BLISS-A10-001-11-001

Permit Modification Application

Fort Bliss, TX

USAADACENFB Fort Bliss Municipal Solid Waste Landfill *Permit 1422*

Department of the Army
Fort Bliss Department of Public Works - Environmental
Building 777
El Paso, TX 79916

Revision 1 - December 21, 2011

This document is released for the purpose of Fort Bliss ED Review under the authority of Francisco Xavier Urueta P.E. #99473 on 12-21-2011. It is not to be used for construction or bidding purposes.

zia engineering & environmental consultants, llc

ARCADIS MALCOLM PIRNIE
Infrastructure · Water · Environment · Buildings

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LICENSED
PROFESSIONAL ENGINEER

12-27-11

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Our Ref.:
Bliss-A10-001 06400003.0000

Date:
December 2011

Appendices

STATE OF TEXAS
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STATE OF TEXAS
FRANCISCO XAVIER URUETA
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12-27-11

1.0 PERMIT MODIFICATION NARRATIVE

1.1 Background and Description of Proposed Change

The Fort Bliss Municipal Solid Waste Landfill is an approximately 106 acre facility consisting of several cells as follows:

- An active 10.5-acre Subtitle D Type I Cell;
- A closed 3-acre Non-Subtitle D Type I Cell (TCEQ closure approval received February 24, 1999);
- An active 5-acre Non-Subtitle D Type IV C&D Cell;
- Approximately 80 acres of 1970's era previously filled and operationally closed areas;
- Approximately 7 acres designated for landfill roads, access areas, and guard shack/scale house, etc.

1.1.1 Currently Permitted Final Cover Design

A March 2009 permit modification (MOD) for vertically extending the height of the Subtitle D cell by 10 feet was approved and issued by the TCEQ effective on March 19, 2009. The permit modification approval included final cover designs for all the landfill cells. For the Subtitle D cell the approved cover design is as follows (from top to bottom):

- Six inches of 1-inch to 4-inch diameter cobbles;
- A 12-inch drainage layer, $k \geq 1 \times 10^{-2}$ cm/sec;
- Geocomposite drainage net;
- 60-mil textured High Density Polyethylene (HDPE) or Linear Low Density Polyethylene (LLDPE) geomembrane; and
- 18-inch clayey material layer, $k \leq 1 \times 10^{-5}$ cm/sec.

For the previously filled and operationally closed areas and the Non-Subtitle D Type IV C&D cell, the approved cover design included an 18-inch thick (minimum) compacted low permeability soil layer (i.e., compacted clay) overlain by six inches of soil capable of sustaining native plant growth.

The Non-Subtitle D Type I cell was closed in 1999 with a non-Subtitle D final cover that complied with the closure plan for that cell and for which TCEQ closure approval was obtained in 1999.

1.1.2 Alternative ET Final Cover Design

Both the active Subtitle D and Non-Subtitle D Type IV C&D cell are nearing capacity and are scheduled to close in 2012. In addition, the facility permit does not allow further placement of waste within the 1970's era inactive areas. According to the March 1995 Final Closure Plan and Cost Estimate, these 80 acres are closed; however, formal TCEQ approval documentation has not been located in the DOE or TCEQ files.

The low permeability soil material required for the approved final cover systems for these cells is not readily available in the area and will need to be imported at considerable expense. Accordingly, Fort Bliss is seeking a permit modification to provide an alternative evapotranspiration (ET) final cover system to replace the final cover systems for those parts of the landfill that have not already received a permitted final cover (i.e. all landfill cells except the non-subtitle D cell that was capped/closed in 1999).

The proposed ET Final Cover System will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,
- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.

The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 of the Texas Administrative Code (TAC) Rule §330.5(b)(1)(D)) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling without calibration.

The alternative ET landfill cover final grading plan doesn't significantly alter the final grades presented in the March 2009 MOD; rather, the ET landfill cover final grading plan adjusts the final grades to generally conform to the grades developed during filling operations to provide more easily constructible ridges, swales, and slopes and a more uniform surface for installation and maintenance of the ET cap. Specifically:

- The final closure grades of the northwest inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 2.2% to a more uniform pyramidal shape with a 3.6% top slope facing to the west and between 6% and 18% side slopes facing to the north, east, and south.
- The final closure grades of the northeast inactive cell were adjusted from inconsistently directed 2% side slopes to a more uniform pyramidal shape with a 2.2% top slope facing to the west and between 5% and 8.3% side slopes facing to the north, east, and south.
- The final closure grades of the southeast inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 3.3% to a more uniform plateau shape with a 2% top slope facing to the south and between 8.3% and 25% slopes facing east and north respectively.
- The final closure grades of the Type IV C&D cell were adjusted from steep 25% plateau side slopes to a more uniform pyramidal shape with 2% side slopes in all directions.
- The final closure grades of the Subtitle D cell were generally kept consistent with the 2008 permit modification grades.

The final grading and drainage plan remains consistent with the previously approved March 2009 MOD. Final drainage patterns at the landfill will consist mostly of overland flow paths and shallow concentrated flow leading off the ET cover landfill side slopes. Swales provide flow paths for internal watersheds to the existing landfill perimeter swales. Surface water runoff flows off the landfill into the existing shallow perimeter drainage swales that discharge to the natural flow patterns of the surrounding area, generally towards the southwest and southeast corners of the landfill.

Conventional landfill covers typically include a gas collection layer and passive gas vents to relieve landfill gas pressures on the overlying impermeable geomembrane and minimize slope stability concerns. The alternative ET landfill cover will only consist of course-grained permeable soil; therefore, no passive gas venting system is proposed as part of the final ET landfill cover design. Rather, the ET cover soils will naturally and effectively vent landfill gas, similar to the existing conditions and the daily/intermediate cover soil at the site. Additionally, the microbes in the ET cover soil will oxidize some of the methane as it vents, creating more environmentally friendly emissions. While the venting of the landfill gas may affect vegetative growth on the landfill cover, the ET cover system was designed to be effective with only 10% vegetative coverage. Based on the operational and regulatory history of the landfill (83 acres of

1970's era waste), significant landfill gas generation is not expected. Should excessive methane concentrations be detected in perimeter landfill gas monitoring probes or ambient landfill air during routine landfill gas monitoring, corrective venting and reporting procedures are outlined in the Fort Bliss Guidance Document titled *Procedures Following a Methane Exceedance*.

1.2 Purpose of Change and Provision Under Which Modification is Sought

The purpose of the proposed ET Final Cover System is to provide a more cost effective closure that offers equivalent environmental protections as those provided by the closure design previously approved. Accordingly, per Title 30 TAC §305.70(k)(10), the purpose of this permit modification application is to request approval of an ET Final Cover System as an alternative final cover system for closure of the Fort Bliss Landfill.

1.3 Permit Modification Application Organization and Structure

In accordance with Title 30 TAC §305.70(e), this permit modification application consists of a new TCEQ Core Data form and Part I form, a description of the proposed permit changes, revisions to existing applicable permit documents (including strikeout and clean copies), and an updated landowners map and landowners list as required under Title 30 TAC §330.59(c)(3).
This application is organized as follows:

- Appendix A – TCEQ Core Data form *[for information only]*
- Appendix B – TCEQ Part I form
- Appendix C - Redline/Strikeout Copy Replacement Pages. This appendix includes redline/strikeout replacement pages to the *Permit Modification Application, Fort Bliss Municipal Solid Waste Landfill, Permit 1422* (March 2008, Malcolm Pirnie, Inc.) document which reflect the inclusion of the ET Final Cover System Design
- Appendix D – Clean Copy Replacement Pages. This appendix includes clean copy replacement pages of the changes reflected in Appendix C
- Appendix E – Adjacent Landowner Information. This appendix includes a list and map of adjacent property owners for notice as required by Title 30 TAC §330.59(c)(3)

APPENDIX A

TCEQ Core Data form

APPENDIX B

TCEQ Part I form

Texas Commission on Environmental Quality

Permit or Registration Application for Municipal Solid Waste Facility

Part I

A. General Information

Facility Name:	USAADACENFB Fort Bliss Municipal Solid Waste Landfill			
Physical or Street Address (if available):	Building 367, Landfill Road			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79913-0058
(Area Code) Telephone Number:	915-568-5919			
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]:	U.S. Army Garrison, Fort Bliss IMWE-BLS-PW			
Mailing Address:	Building 777			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79916
(Area Code) Telephone Number:	915-568-5919			
(Area Code) FAX Number:	915-568-3943			
Charter Number:	N/A			

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

Permittee Name:	Headquarters, U.S. Army Garrison, Fort Bliss IMWE-BLS-PW			
Physical or Street Address (if available):	Same as Operator			
(City) (County)(State)(Zip Code):			TX	
(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)	C&D Debris		☐	Other (Specify)		
☒	Other (Specify)	Mulching		☐	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.

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?

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.):	El Paso Public Library			
Mailing Address:	501 North Oregon Street			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79901-0058
(Area Code) Telephone Number:	915-543-5433			

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.
https://www.bliss.army.mil/DPW/Environmental/EISDocuments2.html

Local Government Jurisdiction:	N/A
Within City Limits of:	N/A
Within Extraterritorial Jurisdiction of City of:	N/A
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.
The landfill is located on Fort Bliss property near the Union Southern Pacific Railroad tracks along Sanitary Rill Road, approximately 4 miles north of the intersection with Fred Wilson Road

Detail the access routes from the nearest United States or state highway to the facility.
The paved landfill access road, referred to as Sanitary Road, is located on Fort Bliss property running south from the landfill site, parallel to the Union Southern Pacific Railroad tracks, to Fred Wilson Road. Fred Wilson Road is located approximately 4 miles south of the landfill site. The Sanitary Fill Road is a two-lane asphalt concrete paved road. The road is 30-ft wide with road shoulder on both sides. The access road is owned and maintained by Fort Bliss.

Provide the latitudinal and longitudinal geographic coordinates of the facility.

Latitude	**N 31° 52.70’**
Longitude	**W 106° 22.60’**
Elevation (above msl)	3930

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

Texas Department of Transportation District Location:

TXDOT District Name & Number:	El Paso District #4			
District Engineer’s Name:	Charles H. Berry, Jr., PE			
Street or P. O. Box:	13301 Gateway East			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79928
(Area Code) Telephone Number:	915-790-4203			
(Area Code) FAX Number:	915-790-4311			

The local governmental authority or agency responsible for road maintenance:

Agency Name	Fort Bliss			
Contact Person’s Name:	John Ghim			
Street or P. O. Box:	IMWE-BLS-PW, Building 777			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79916
(Area Code) Telephone Number:	915-568-5201			
(Area Code) FAX Number:	915-568-3943			

State Representative:

District Number:	79			
State Representative's Name:	Joe Pickett			
District Office Address:	1790 Lee Trevino #307			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79936
(Area Code) Telephone Number:	915-590-4349			
(Area Code) FAX Number:	915-590-4726			

State Senator:

District Number:	29			
State Senator's Name:	The Honorable Jose Rodriquez			
District Office Address:	911 Dallas Street			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-521-3500			
(Area Code) FAX Number:	No fax listed			

Council of Government (COG) Information:

COG Name:	Rio Grande Council of Governments			
COG Representative's Name:	Michael Ada			
COG Representative's Title:	Director, Environmental Services			
Street or P. O. Box:	1100 N. Stanton St. Suite 610			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-533-0998 x 121			
(Area Code) FAX Number:	915-532-9382			

River Basin Information:

River Authority:	International Boundary & Water Commission			
Contact Person's Name:	Gilbert Anaya			
Watershed Sub-Basin Name:	Tularosa Closed Basin			
Street or P. O. Box:	4171 N. Mesa, Suite C-100			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-832-4702			
(Area Code) FAX Number:	915-832-4190			

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
Manuel Talamantes	N/A	Moore Services, Inc.

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
N/A	

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
N/A	

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	582EA000112797

PROPERTY OWNER AFFIDAVIT

"I, Alfredo J. Riera, P.E.,
(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)

1/18/12
(Date)

Signature Page

I, Alfredo J. Riera, P.E., Director of Public Works,
(Operator) (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: [signature] Date: 1/20/12

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

I, ______________________, hereby designate ______________________
(Print or Type Operator Name) (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 Alfredo J Riera

On this 20 day of January, 2012

My commission expires on the 01 day of May, 2013

T. L. CRAYCRAFT NOTARY PUBLIC STATE OF TEXAS EXPIRES 5-1-2013

TL Craycraft
Notary Public in and for

El Paso County, Texas

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

APPENDIX C

Redline/Strikeout Copies

APPENDIX C-1

Replacement Documents Summary Table

INTRODUCTION

The following table identifies the sections of the Evapotranspiration (ET) Final Cover Permit Modification Application dated October 19, 2011 that were revised in order to address the TCEQ Notice of Deficiency (NOD) dated November 22, 2011. The clean copy replacement pages presented in Appendix D of this Permit Modification Application Revision 1 dated December 21, 2011 submittal are meant to be inserted into the Fort Bliss Municipal Solid Waste Landfill Permit No. 1422 and entirely replace the previous documents included in the October 19, 2011 submittal.

The following redline copies of these sections highlight the revisions made to the October 19, 2011 submittal in order to address the TCEQ Notice of Deficiency (NOD) dated November 22, 2011. A response to comment letter titled “Response to Evapotranspiration (ET) Final Cover Notice of Deficiency (NOD)” is also attached to this submittal that formally responds to how each TCEQ comment was addressed in this Revision 1 submittal.

REPLACEMENT SECTIONS
Part I Form
Fort Bliss Municipal Solid Waste Landfill, Permit No. 1422 – Appendices
▪ **Appendix B – Landfill Modification and Closure Design Drawings**
▪ **Appendix I – Slope Stability and Settlement Analysis**
▪ **Appendix L – Facility Surface Water Drainage Report**
▪ **Appendix O - Closure Plan**
▪ **Appendix P – Post-Closure Plan**
▪ **Appendix Q – Evapotranspiration Cover Design Report**

APPENDIX C-2

Appendix O – Closure Plan
[redline]

Department of the Army
Fort Bliss Department of Public Works - Environmental
IMWE-BLS-PW~~U.S. Army Corps of Engineers, Fort Worth District~~

~~819 Taylor Street, Forth Worth, TX 76102~~

Final Closure Plan

USAADACENFB Fort Bliss Municipal Solid Waste Landfill ~~Facility~~ (Permit #1422)

Revised ~~Revised September~~ December 2011

Prepared By:

ARCADIS Malcolm Pirnie~~, Inc.~~

44 South Broadway
15th Floor
White Plains, NY 10601

6400003

Engineering Certification

I attest that this Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 of the Texas Administrative Code (Title 30 TAC) Rule §330. This certification in no way relieves Fort Bliss of its duty to prepare and fully implement this Plan.

Certifying Engineer:	Jeffrey Rusch, P.E.
State:	Texas
Registration Number:	109130

Signature: ______________________________

Certification Date: ______________________________

Engineering Seal:

Contents

List of Tables

~~Attachments~~

1. Introduction

The final closure plan has been prepared to provide a general guidance for the Fort Bliss Municipal Solid Waste Landfill (MSWLF) in meeting the Texas Commission on Environmental Quality (TCEQ) rules listed in Title 30 of the Texas Administrative Code Chapter 330 Rule ~~330.~~457 (Title 30 TAC §330.457) in reference to the closure requirements for MSWLF units.

~~If any questions arise regarding the Fort Bliss MSWLF final closure methods or requirements, he or she should consult with: (1) the Department of Public Works – Environmental (DPW-ENV) of Fort Bliss or (2) the TCEQ.~~

~~The DOE may be contacted at the following address:~~

~~Department of Public Works – Environmental (DPW-ENV)~~
~~Fort Bliss~~
~~IMWE-BLS-PW~~
~~Fort Bliss, TX 79916~~
~~Tel. (915) 568-5724~~

~~The TCEQ Municipal Solid Waste Division is located at the following address:~~

~~Texas Commission on Environmental Quality~~
~~Municipal Solid Waste Division~~
~~MC-124~~
~~P.O. Box 13087~~
~~Austin, Texas 78711-3087~~
~~Tel. (512) 239-6784~~

~~Additionally, the Region 6 TCEQ staff at El Paso can be reached at the following address:~~

~~Texas Commission on Environmental Quality~~
~~Region 6~~
~~401 E. Franklin Ave., Ste. 560~~
~~El Paso, Texas 79901-1212~~
~~Tel. (915) 834-4949~~

2. Final Cover Requirements

2.1. Final Cover Design

Title 30 TAC §330.457(a)

The Fort Bliss MSWLF was permitted on November 1, 1982 for a total area of 106~~.03~~ acres. Currently, approximately 80% of the MSWLF has been operationally closed or is inactive. Three acres of the MSWLF have been closed as a Type I landfill unit. Ten and a half acres of the remaining portion of the landfill are designed to meet both USEPA Subtitle D and the Texas Municipal Solid Waste regulations. The remaining landfill area is classified as a Type IV construction and demolition debris cell.

The currently permitted final cover requirements for the MSWLF are summarized as follows:

Table 2-1
Fort Bliss MSWLF Final Cover Requirements (Title 30 TAC §330.457(e)(2))

Area*	Cover Requirements	Current Status
88~~30~~ Acres	24" Clean Soil	Operationally Closed/Inactive
10.5~~6~~ Acres (Type I)	Subtitle D Cover	Active
3 Acres (Type I)	Non-Subtitle D Cover	Closed 1999
5 Acres (Type IV)	24" Clean Soil	Active
7 Acres **	N/A	N/A

* Acreage is approximate and for estimation purposes only.

** Designed landfill access area.

Pursuant to Title 30 TAC §305~~30~~.70(k)(10), an alternative final cover design may be approved as long as the alternative design achieves an equivalent reduction in infiltration as the clay-rich soil specified in 30 TAC §330.457(a)(~~2~~1) and provides equivalent protection from wind and water erosion as the erosion layer specified in Title 30 TAC §330.457(a)(3). As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell was closed in 1999 with a final cover that complied with the closure plan for that cell and for which TCEQ closure approval was obtained on February 24, 1999. However, the remainder of the facility will be closed with an alternative evapotranspiration (ET) final cover designed to be equivalent with the currently permitted final cover systems. The ET cover will be the only final cover design for those parts of the landfill that have not received a permitted final cover (i.e. all landfill cells except the non-subtitle D cell that was capped/closed in 1999). The ET final cover will also be installed over top of the approved final cover of the Non-Subtitle D Type I cell for site grading and drainage purposes.

The ET f~~F~~inal c~~C~~over s~~S~~ystem will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;~~that serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;~~
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provid~~in~~e~~g~~ storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will ~~which will~~ allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,
- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.

2.2. Final Cover Area

As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell was closed in 1999. However, the remainder of the facility will be closed with an alternative evapotranspiration (ET) landfill cover. The total area to be capped and closed with the ET landfill cover includes the 1970's era inactive cells, the 10.5~~6~~-acre Type I cell, and the 5-acre Type IV C&D cell, and encompasses approximately 98.5~~6~~ acres.

3. Maximum Inventory of Waste

Title 30 TAC §330.457(e)(3)

Based on the approved 1995 final landfill contours, the total permitted waste capacity of the Fort Bliss MSWLF is 5.9 million cubic yards. The ~~2008 permit modification~~March 2009 MOD for the 10-foot height increase in the Subtitle-D cell added an additional 180,000 cubic yards of landfill capacity. The alternative ET landfill cover final grading plan doesn't significantly alter the final grades presented in the ~~2008 permit modification~~March 2009 MOD; however, the ET landfill cover final grading plan generally conforms to the grades developed during filling operations (based on the 2010 topographic survey) to provide more easily constructible ridges, swales, and slopes and a more uniform surface for installation and maintenance of the ET final cover. Specifically:

- The final closure grades of the northwest inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 2.2% to a more uniform pyramidal shape with a 3.6% top slope facing to the west and between 6% and 18% side slopes facing to the north, east, and south.
- The final closure grades of the northeast inactive cell were adjusted from inconsistently directed 2% side slopes to a more uniform pyramidal shape with a 2.2% top slope facing to the west and between 5% and 8.3% side slopes facing to the north, east, and south.
- The final closure grades of the southeast inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 3.3% to a more uniform plateau shape with a 2% top slope facing to the south and between 8.3% and 25% slopes facing east and north respectively.
- The final closure grades of the Type IV C&D cell were adjusted from steep 25% plateau side slopes to a more uniform pyramidal shape with 2% side slopes in all directions.
- The final closure grades of the Subtitle D cell were generally kept consistent with the March 2009 MOD grades.

~~As of 2008, the current volume of in-place waste was about 5.1 million cubic yards.~~ As reported in the March 2009 MOD the current volume of in-place waste at that time was about 5.1 million cubic yards. The Annual Solid Waste Reports from FY 2009 and FY 2010 and the most recent Daily Landfill Log from FY 2011 document an additional

85,000 cubic yards of in-place waste. Based on the existing landfill grades and the ET landfill cover final grading plan, the remaining capacity in the active Type I and Type IV cells is 100,200 cubic yards. Therefore, at the time of closure the maximum in-place waste volume is expected to be 5,285,200 cubic yards.

It should be noted that the landfill will be closed prior to reaching its permitted waste capacity of 5,893,932 CY. As reported in the 21 February 1996 Report on Volume Calculations and Case Studies, exploratory trenches advanced through the 1970's era filled and operationally closed landfill cells discovered an in-place waste depth of 25-feet corresponding to an in-place waste volume of 2,984,467 CY. The permitted waste capacity over this same area, based on the design waste depth of 30-ft, is 3,676,542 CY. Therefore, the disparity between the permitted capacity and the anticipated final volume of in-place waste is primarily related to the shallower waste depth in the historic cells.

~~The Annual Solid Waste Reports from FY 2009 and FY 2010 and the most recent Daily Landfill Log from FY 2011 document an additional 85,000 cubic yards of in-place waste. Based on the existing landfill grades and the ET landfill cover final grading plan, the remaining capacity in the active Type I and Type IV cells is 100,200 cubic yards. Therefore, at the time of closure the maximum in-place waste volume is expected to be 5,285,200 cubic yards.~~

4.1. ET Cover System

As previously discussed in Section 2.1, the Fort Bliss MSWLF will be closed with an alternative evapotranspiration (ET) final cover designed to be equivalent with the currently permitted final cover systems. The ET cover will be the only final cover design for those parts of the landfill that have not received a permitted final cover. The alternative ET cover system was designed to meet the requirements listed in Title 30 TAC §330.457 and will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following components:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,
- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.

It should be noted that the TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling and constructing without model calibration.

4.2. Landfill Cells

Title 30 TAC §330.457(e)(1)

~~The final cover systems of the MSWLF will be designed and constructed to meet the requirements listed in Title 30 TAC §330.457.~~ The Fort Bliss MSWLF is comprised of five distinct areas:

1. 1970's era inactive cells that consist of 30-foot deep trenches with two feet of clean soil cover. These cells cover an ~~83~~ 80 acre area and are unlined and without leachate collection. The permit does not allow further placement of MSW on these cells. According to the March 1995 Final Closure Plan and Cost Estimate these 80 acres are closed; however, formal TCEQ approval documentation has not been located in the DOE or TCEQ files.
2. A three-acre Type 1 cell with final cover in place (non-Subtitle D) that complies with the closure plan and TCEQ closure requirements. TCEQ approval was received on February 24, 1999 ~~(see Attachment 1)~~.
3. A 10.~~6~~5-acre Type I active cell meeting Subtitle D requirements. This cell is lined and has a leachate collection system. This cell is nearing permitted capacity and is anticipated to be full by January 2012.
4. A 5-acre active Type IV construction debris cell. This cell is unlined and without leachate collection. This cell is also anticipated to reach capacity by July 2012.
5. Seven acres designated for landfill roads, access areas, gatehouse, etc.

~~4.1.~~4.3. 1970's Inactive Cells

The 1970's era inactive areas are covered with 24-inch thick clean soil, as indicated in the March 1995 Final Closure Plan and Cost Estimate sealed by Mr. John Karlsruher of Cardenas-Salcedo and Associates, Inc. These landfill areas are also indicated as closed in the May 1999 Final Cover Quality Control Plan for the 3-acre Type 1 cell. However, this area is described as in interim closure by Fort Bliss DPW-ENV and no TCEQ approval or Texas P.E. certification of closure has been found in TCEQ or Fort Bliss DPW-ENV records. Accordingly, ~~an~~ the ET ~~F~~final ~~C~~cover ~~S~~system as described in Section 4.~~3~~ 1 will be installed over these areas. The existing intermediate cover material will require clearing/grubbing and/or tilling, watering and regrading, and compaction as defined in Section 5 to meet the requirements of the intermediate cover component of the ET cover system.~~.~~

The final grades of these ~~Side slopes of the final cover for the~~ 1970's era cells will be adjusted to create uniform pyrimdal shapes as summarized in Section 3. ~~vary between 2% and 25% based on site constraints and drainage features.~~ All cells will be crowned at the top to promote positive drainage off the landfill and preclude ponding of surface water when total fill height and expected subsidence are taken into consideration.

~~4.2.~~4.4. Non-Subtitle D Area (Type I)

The closure of the Non-Subtitle D Type I cell was approved by TCEQ on February 24, 1999. ~~The TCEQ approval letter dated February 24, 1999 of the final cover for this 3-acre unit is provided as Attachment 1~~. However, the ET final cover system will be installed over top of the approved final cover for site grading and drainage purposes.

~~4.3.~~4.5. Subtitle D Area (Type I)

The final cover for the Type I Subtitle D area will be the ET final cover system as described in Section 4.1. Final closure grades will be generally consistent with the March 2009 MOD grades and will form a landfill plateau with 2% top slopes and 25% side slopes.

~~Fort Bliss will install a final cover system for the Subtitle D cell that will be designed and constructed to minimize infiltration and erosion. Fort Bliss shall place a copy of the Final Cover System Evaluation Report in the operating record.~~

~~Fort Bliss will install an ET Final Cover System that consists of a 3.5-foot layered soil cap comprised of (from top to bottom) the following:~~

- ~~12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;~~
- ~~12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density . The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;~~
- ~~6-inch thick Capillary Break Layer consisting of well graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,~~

- ~~12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.~~

~~The final grading of the Subtitle D cell will consist of a landfill crown set at a 2% slope transitioning to 25% side slopes.~~

~~4.4.~~4.6. Non-Subtitle D Area (Type IV)

The final cover for the Type IV Non-Subtitle D area ~~at the MSWLF~~ will be the ET f~~F~~inal c~~C~~over s~~S~~ystem as described in Section 4.~~3~~ 1~~above~~. The final grading of the Non-Subtitle D cell ~~consists of a landfill crown with 2% sideslopes.~~will create a uniform pyramidal shape with 2% side slopes in all directions.

5. Construction Quality Assurance

5.1. Introduction

Title 30 TAC §330.457(e)(1)

Construction of the ~~Subtitle D cell~~ ET final cover system will be performed by using equipment that is suitable for completing the construction ~~in accordance with current standards imposed by TCEQ~~and achieving the desired grading, compaction and vegetative cover requirements.

~~The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling and constructing without model calibration.~~

5.2. Construction Quality Control Plan (CQCP)

This section addresses the construction of the soil components of the alternative ET final cover system and outlines the Construction Quality Control Plan (CQCP) to be implemented with regard to material selection and evaluation, laboratory test requirements, and field test requirements.

The primary soil parameters and construction specifications that will impact the performance of the ET final cover system are soil gradation, saturated hydraulic properties, and degree of compaction. The modeling and design of the ET cover system was based on these material and construction specification requirements. Therefore, the QA testing procedures presented herein will be required during the final closure construction to ensure that the ET final cover is constructed in accordance with the design intent and to maximize ET performance.

5.2.1. Source Material Evaluation

Material evaluations shall be performed on stockpiled or delivered material to ascertain its acceptability for the intended purpose. All material shall be sampled and tested by the Contractor in accordance with the requirements summarized in the following subsections. Stockpile materials shall not be altered in any manner, including adding or taking material, until the results from the material testing laboratory have been received and reviewed. Copies of the laboratory inspection testing results will be submitted to the Engineer of Record and will also be included in the Final Cover System Evaluation Report (FCSER).

Standards referenced in this Section are:

- ASTM D422, Test Method for Particle Size Analysis of Soils
- ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
- ASTM D2216, Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D6836 - Standard Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using a Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, and/or Centrifuge
- ASTM D6938, Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

5.2.2. Intermediate Cover Layer

5.2.2.1. Material Specification

The Intermediate Cover Layer will consist of twelve-inches of existing placed cover material or stock-piled cover material (SM) placed over the waste and compacted to approximately within ±2% of 75% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system.

5.2.2.2. Existing Intermediate Cover Material Construction Requirements

–Across the 1970's era inactive cells, ~~In most instances, this~~the Intermediate Cover Layer ~~material~~ will likely consist of the existing intermediate cover soil placed in accordance with the Site Operating Plan. In general, over 24-inches of compacted intermediate cover material has been placed over these inactive cells. Over time, isolated patches of native vegetation have taken root across these calls. Therefore, ~~T~~the Contractor will be required to clear and grub all existing intermediate cover material of all vegetation, roots, and other deleterious materials using bulldozers, graders, tillers, or other suitable equipment to provide a smooth uniformly graded bare surface.

All existing intermediate cover material will require watering, re-working, and compaction as necessary to create an intermediate cover material subgrade consistent with the final cover requirements. Prior to final grading and compaction, the existing intermediate cover material will be probed at 100-foot intervals to verify that a minimum of 12-inches of cover soil is in place and verify the existing in-place density. Where existing suitable intermediate cover material does not meet or cannot be re-worked to meet the final cover material or compaction requirements or does not measure the minimum of 12-inches in depth, additional stockpiled SM cover material shall be backfilled, graded, and compacted to create a uniform bare surface of suitable intermediate cover material. Intermediate cover material may exceed the minimum 12-inches in thickness, where necessary.

5.2.2.3. Other Construction Requirements

Where existing intermediate cover material has not been installed, stockpiled intermediate cover SM material will be placed as a single lift to achieve a minimum compacted thickness of 12-inches. All intermediate cover material (existing re-worked material and stockpiled backfill) will require static and/or vibratory compaction to meet the project compaction requirements of 75% of the Modified Proctor maximum dry density ±2% through the full 12-inch soil layer. Should in-place density exceed project requirements, intermediate cover material will be tilled to a minimum depth of 12-inchs, watered, and re-compacted with appropriate energy to meet the project requirements. Surveying and grade stakes will be used to verify the final grades of the intermediate cover material

5.2.2.4. Field QA Testing

During construction, the intermediate cover material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor ~~re-work the existing cover soil to provide a smooth uniformly graded surface. The cover soil will be free of rock and debris greater than 2-inches in diameter. Existing intermediate cover material shall be probed to verify that a minimum of 12-inches of cover soil is in place.~~

- ~~A minimum of one moisture/density compaction test (ASTM D1557) and one sieve analysis (ASTM D422)~~ moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed

- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed
- Modified Proctor moisture/density testing (ASTM D1557) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Mositure content testing (ASTM D2216) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- ~~will be performed on a sample collected from each soil type of the existing and/or stockpiled and installed intermediate cover material. The intermediate cover layer will be re-worked, where required, to provide the specified density. The minimum frequency of f~~Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre for ~~the~~ existing and/or ~~re-worked~~backfilled intermediate cover material~~shall be 2 tests per acre.~~

5.2.3. Capillary Break Layer

~~5.2.2.1.~~5.2.3.1. Material Specification

The Capillary Break Layer will be installed over the Intermediate Cover Layer as approved by the Engineer of Record and will consist of 6-inches of well-graded, fine to coarse grained sand (SW). Sand ~~shall~~ will be a fine granular material produced by the crushing of rock, gravel, or naturally produced by disintegration of rock and ~~shall~~ will be free of organic material, mica, loam, clay and other deleterious substances.

5.2.3.2. Construction Requirements

Capillary break layer material will be placed as one lift to achieve a minimum compacted thickness of six inches and compacted to within ±5% of 90% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. Over-compacted material will be tilled and re-compacted. Material installed as part of the capillary break layer will be placed at ±2% of the optimum moisture content at the time of placement and will be covered with the overlying storage layer as soon as practical. Placement of capillary break layer material will not occur during rainfall events to prevent saturation and over-compaction. Surveying will be performed to verify the thickness of the capillary break layer.

~~5.2.2.2.~~5.2.3.3. Field QA Testing

During construction, the capillary break layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of imported capillary break material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of imported capillary break material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of imported capillary break material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

~~A minimum of one moisture/density compaction test (ASTM D1557) and one sieve analysis (ASTM D422) will be performed on a sample collected from each source of capillary break material. Additionally, a minimum of one soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter test (ASTMD5084) will be performed for every source of capillary break material to verify the van Genuchten parameters and saturated hydraulic properties of the material. The minimum frequency of field density testing for the existing and/or re-worked intermediate cover material shall be 2 tests per acre. Over-compacted material will be ripped or tilled and recompacted. Material installed as part of the storage layer will be maintained to avoid overdrying of the material below 2% of the optimum water content. Placement of storage layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the capillary break layer.~~

~~5.2.3.~~5.2.4. Storage Layer

5.2.4.1. Material Specification

The Storage Layer will be installed over the capillary break layer as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM material compacted to within ±2% of 75% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. The soil will be inspected as placed to be free ~~of~~ of vegetation, roots, debris, and rocks greater than 2-inches in diameter.

5.2.4.2. Construction Requirements

The Storage Layer will be placed as ~~a single lift~~a single lift to –achieve a minimum compacted thickness of 12-inches and compacted to within ±2% of 75% of the Modified Proctor maximum dry density~~to the specified density~~. Over-compacted material will be tilled and recompacted. Surveying will be performed to verify the thickness of the storage layer.

5.2.4.3. Field QA Testing

During construction, the storage layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of stockpiled storage layer material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

~~A minimum of one moisture/density compaction test (ASTM D1557) and one sieve analysis (ASTM D422) will be performed for every 10,000 cubic yards of stockpiled and installed storage layer material. Additionally, a minimum of one soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter test (ASTMD5084) will be performed for every 20,000 cubic yards of stockpiled and installed storage layer material to verify the saturated hydraulic properties and van Genuchten parameters of the material. The minimum frequency of field density testing for the existing and/or re-worked intermediate cover material shall be 2 tests per acre. Over-compacted material will be ripped or tilled and recompacted. Material installed as part of the storage layer will be maintained to avoid overdrying of the material below 2% of the optimum water content. Placement of storage layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the storage layer.~~

~~5.2.4.~~5.2.5. Vegetative Surface Layer

5.2.5.1. Material Specification

The vegetative Surface layer will be installed over the storage layer as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM material compacted to within ±2% of 75% of the Modified Proctor maximum dry density. ~~T~~ Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter. Where possible, stockpiled SM material visually observed to contain a higher organic content will be reserved for use in the vegetative surface layer.~~he soil will be inspected as placed to be free of debris and rocks greater than 2-inches in diameter.~~

5.2.5.2. Construction Requirements

The ~~Storage Layer~~Surface Layer will be placed as a single lift to achieve a minimum compacted thickness of 12-inches ~~single lift~~ and compacted to within ±2% of 75% of the Modified Proctor maximum dry density~~the specified density~~. Over-compacted material will be tilled and recompacted. Material installed as part of the vegetative surface layer will be placed at ±2% of the optimum moisture content at the time of placement. Placement of vegetative surface layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the vegetative surface layer.

The top 4-inches of the vegetative surface layer will be tilled perpendicular to the slope of the surface in preparation for seeding in accordance with Section 5.3.

5.2.5.3. Field QA Testing

During construction, the vegetative surface layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of stockpiled surface layer material

- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

~~A minimum of one moisture/density compaction test (ASTM D1557) and one sieve analysis (ASTM D422) will be performed for every 10,000 cubic yards of stockpiled and installed storage layer material. Additionally, a minimum of one soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter test (ASTMD5084) will be performed for every 20,000 cubic yards of stockpiled and installed storage layer material to verify the saturated hydraulic properties and van Genuchten parameters of the material. The minimum frequency of field density testing for the existing and/or re-worked intermediate cover material shall be 2 tests per acre. Over-compacted material will be ripped or tilled and recompacted. Material installed as part of the storage layer will be maintained to avoid overdrying of the material below 2% of the optimum water content. Placement of storage layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the surface layer. The surface of the vegetative surface layer will be tilled parallel to the final grades in preparation for seeding in accordance with Section 5.3.~~

5.3. Vegetation Planting Plan

The purpose of this plan is to detail the procedures to be used for soil preparation and initial planting on the ET Cover. This plan sets forth use a specified native seed mix for permanent cover which includes the two target grass species from the genera~~us~~ *Aristida* and *Sporobolus* for permanent establishment, but also allows for use of non-native and cultivated seed mixes per TxDOT specifications which are designed for temporary cover to achieve soil stabilization in the event final grading is completed outside of the germination period for target species (May 15 – November).

5.3.1. Soil Preparation and Seeding

All seeds must conform to the requirements of the USDA rules and regulations set forth in the Federal Seed Act and Texas seed law. Utilization of local soils stockpiled on-site will constitute the 12-inch thick Vegetative Surface Layer. These soils consist of silty sand (SM) and will be compacted to 75% of the Modified Proctor maximum dry density prior to seedbed preparation as discussed in Section 5.2.5.

Seedbed preparation will start as soon as possible after completion of the Vegetative Surface Layer to the lines and grades specified in the construction plans. The vegetated area will be cultivated to a typical depth of 4-inches before placement of seed or seed mix. If temporary seeding is utilized, the area covered with temporary grass will be cultivated to a typical depth of 4 inches before application of permanent seeds.

Table 5-1 includes the schedule and species for seeding as well as the seed application rate of pure live seed (PLS) per acre. The schedule is subject to potentially change depending on the availability of grass species specified as well as due to unexpected climatic conditions during and immediately after final cover construction are encountered.

Table 5-1
Fort Bliss MSWLF ET Cover Seeding Schedule

Dates	Seed Type to Use	Seed Species to Use (Common Name)	Seed Species to Use (Latin Name)	Rates (lb Pure Live Seed/ac)
February 1 – May 15	Perennial (Native Species Seed Mix)	Green Sprangletop	*Leptochloa dubia*	0.3
		~~Sand Dropseed~~Red threeawn	*~~Sporobolus cryptandrus~~Aristida purpurea Nutt.*	0.4
		~~Alkali Sacaton~~Mesa dropseed	*~~S. airoides~~Sporobolus flexuosus*	0.9
		Blue Grama	*Bouteloua gracilis*	1.0
		Indian Ricegrass	*Oryzopsis hymenoides*	1.6
		Purple Prairieclover	*Dalea purpurea*	0.5
May 16 – August 31	Temporary Warm (Summer) Season (A Native Species and A Cultivated Species)	Buffalo Grass	*Buchloe dactyloides*	50
September 1 – November 30	Temporary Cool (Winter) Season (Introduced Species)	Plains Bristlegrass	*Setaria vulpiseta*	4.0

Plant seeding may utilize one or a combination of the following methods, as suggested by the Texas Department of Transportation *Specifications Book.*

1. Broadcast Seeding. Distribute seed/mixture uniformly over the areas shown on the plans using hand or mechanical distribution or hydro-seeding on top of the soil. When seed and water are to be distributed as a slurry during hydroseeding, apply the mixture to the area to be seeded within 30 minutes of placement of components in the equipment. Roll the planted area with a light roller or other suitable equipment. Roll sloped areas along the contour of the slope.

2. Straw or Hay Mulch Seeding. Use Broadcast Seeding method to plant seed. Immediately after planting the seed/mixture, apply straw or hay mulch uniformly over the seeded area. Apply straw mulch at 2 to 2.5 tons per acre. Apply hay mulch at 1.5 to 2 tons per acre. Use a tacking method over the mulched area.

3. Cellulose Fiber Mulch Seeding. Plant seed using broadcast seeding. Immediately after planting seed/mixture, apply cellulose fiber mulch uniformly over the seeded area at the following rates:
   - Clay soils with slopes of 3:1 or less – 2,000 lbs per acre
   - Clay soils with slopes greater than 3:1 – 2,300 lbs per acre
   - Sandy soils with slopes of 3:1 or less – 2,500 lbs per acre
   - Sandy soils with slopes greater than 3:1 – 3,000 lbs per acre

4. Drill Seeding. Using a pasture or rangeland type drill, plant seed/mixture uniformly over the area at a depth of 1/4 inch to 1/3 inch. Plant seed along the contour of the slopes.

5. Straw or Hay Mulching. Apply straw or hay mulch uniformly over the area as indicated on the plans. Apply hay mulch at 1.5 to 2 tons per acre. Apply straw at 2 to 2.5 tons per acre. Use a tacking method over the mulched area.

5.3.2. Fertilizer Recommendations

The installed vegetation layer will be tested for fertilizer need prior to seeding. Except for broadcast seeding, initial fertilization will occur prior to seeding. Fertilizer needs for the installed vegetation layer will be determined by collecting one soil sample per every 10 acres of installed vegetation layer, (for the purpose of this plan only one vegetation layer is proposed). Soil nutrient needs will be tested by a qualified agronomic testing laboratory (e.g. Texas A&M University Soil, Water and Forage Testing Laboratory). The laboratory testing report will determine macro and micro nutrient needs and may also contain suggestions for soil inoculants, organic matter, etc. for the installed vegetation layer. The nitrogen, phosphoric acid and potash ratio is 2:1:1, and will be applied at a rate of 100 pounds of nitrogen, 50 pounds of phosphoric acid and 50 pounds of potash per acre, unless laboratory testing results mandate higher rates. At a minimum, micronutrients will be applied at a minimum rate of 1 pound per acre of boron, calcium and magnesium.

Seed and fertilizer may be distributed simultaneously during Broadcast Seeding operations, provided each component is applied at the specified rate. When temporary and permanent seeding are both specified for the same area, apply half of the amount of fertilizer during temporary seeding operation and the other half during the permanent seeding operation. Fertilization will occur at intervals of no more than six week after initial seeding and until vegetation is established. To prevent damage to established vegetation, turf type line equipment will be used to apply fertilizer.

Unless otherwise specified on the plans, use a fertilizer containing nitrogen, phosphoric acid and potash nutrients. Similar to urea-based and plastic resin-coated fertilizers, at least 50 percent of the nitrogen component must be of a slow release formulation unless otherwise dictated by the soils laboratory. The vegetation establishment contractor will ensure that fertilizer is in an acceptable condition for distribution in containers labeled with the analysis. Fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service in accordance with the Texas Fertilizer Law.

5.4. Vegetation Establishment Verification Plan

5.4.1. Introduction

The Vegetation Establishment Verification Plan will ensure that the vegetation is established consistent with the parameters used in the ET Alternative Final Cover Demonstration and includes the following subsections:

- Vegetation Establishment Period
- Maintenance Activities to be Completed During the Vegetation Establishment Period
- Vegetation Performance Specification

5.4.2. Vegetation Establishment Period

The maintenance period will start immediately after seeding is conducted and will continue until TCEQ approves the vegetation establishment verification. Vegetation will be considered established when a satisfactory population of mature plants belonging to the *Aristida* and/or *Sporobolus* genera is verified to cover no less than 10% of the ET final ground cover area with no more than 50% bare areas. A bare area is defined as zero plants within a square meter quadrant (~10.76 square feet). ~~The specified vegetative cover will be established allowing for 50% of bare areas during the maintenance period as it~~ It is assumed that re-use of local stockpiled soils containing native plant seed stock will significantly aide in facilitating vegetative growth. ~~A bare area is defined as zero plants within a square meter quadrant (~10.76 square feet). In addition, establishment of vegetative cover will also require that at least 10% of the matured vegetative species belong to the *Sporobolus* genus.~~

The vegetation establishment period begins after the Final Cover System Evaluation Report (see Section 5.5.1) is approved by TCEQ and ends when the Vegetation Establishment Report (see Section 5.5.2) is approved by TCEQ. The standard timeframe is 2 to 3 years. The facility will establish the vegetation consistent with the parameters specified in the Vegetation Planting Plan.

5.4.3. *Maintenance Activities to be Completed during the Vegetation Establishment Period*

The following maintenance activities ensure that the planted vegetation will meet the vegetation performance specification:

- Following application of perennial seed mix, if less than 10% vegetative ground coverage or greater than 50% ~~of~~ bare areas are determined to exist, re-seeding of ~~the percentage of~~ areas that will amount to achieving the 10% ground coverage with no more than 50% bare areas ~~coverage~~ will need to be completed prior to May 15.
- Following application of a temporary seed mix, if less than 10% vegetative ground coverage or greater than 50% ~~of~~ bare areas are determined to exist, re-seeding ~~of the percentage~~ of areas that will amount to achieving the 10% ground coverage with no more than 50% bare areas ~~coverage~~ will need to be completed prior to November 30 to avoid over-winter exposure of said bare areas.
- Temporary erosion protection measures will be installed, as necessary, if greater than 50% bare areas are determined to exist.
- Additional landfill gas extraction wells will be installed in any specific vegetative area where landfill gas poses a detrimental threat.
- Areas of significant differential settlement will be re-graded and re-seeded.
- Depending on the season, vegetation will be maintained and mowed as appropriate. No mowing will be allowed until grasses establish mature seeds.
- The facility will irrigate and fertilize the ET final cover area to stimulate and promote vegetative.
- Erosion and sediment controls will be added to areas that experience erosion.

5.4.4. *Vegetation Performance Specification*

The vegetation layer will be evaluated at the end of the vegetation establishment period by a Texas Licensed Professional Engineer to determine if the vegetation is established in accordance with the Evapotranspiration Cover Design Report. The performance specification for the vegetation layer is summarized herein:

- Vegetative Coverage – The vegetative coverage specification is based upon a demonstration of a satisfactory population of mature plants belonging to the *Aristida* and/or *Sporobolus* genera covering no less than 10% of the ET final ground cover area with no more than 50% bare areas larger than one square meter without a matured vegetative species.

- Root Penetration – The minimum root depth required of 12" is based on achieving 10% vegetative cover entirely comprised of *Aristida* and/or ~~two~~ *Sporobolus* species as an input parameter for completing the UNSAT-H model demonstration. This root depth will ensure that these two grass species are established and will survive drought conditions.
- ~~Percent Vegetation Cover – An 50% vegetative cover will be based on experience of a satisfactory population of mature plants, defined as 50% ground cover with at least 10% of the matured vegetative species belong to the *Sporobolus* genus, and no bare areas larger than one square meter of the established species.~~

5.5. Documentation

5.5.1. Final Cover System Evaluation Report (FCSER)

Following the installation of the ET cover system, a Final Cover System Evaluation Report will be submitted certifying that the ET soils were constructed in accordance with the construction methods and test procedures in the Final Cover Quality Control Program. The FCSER will be signed and sealed by a Professional Engineer in the State of Texas and include, at a minimum:

- Completed report forms required by TCEQ
- Summary of construction activities
- Summary of the initial installation of vegetation
- Summary of all laboratory and field test results
- Drawings showing sample and test locations
- Field and laboratory test results
- As-built drawings
- A description of significant construction problems and the resolution of these problems
- A statement of compliance with the Final Cover Quality Control Program

The Final Cover Evaluation Report will be signed and sealed by the ~~Resident~~ Professional Engineer, signed by the site operator, and submitted to the MSW Permits Section of Waste Permits Division of the TCEQ for acceptance. Upon acceptance of the Final Cover Evaluation Report, the vegetation establishment period will begin as noted in the Vegetation Establishment Verification Plan. After the acceptance of the Final Cover Evaluation Report and during the vegetation establishment period, the applicant will request closure of the site in accordance with this Report. Since the vegetation establishment period timeframe is 2 to 3 years, closure of the site will occur prior to the completion of the vegetation establishment period.

5.5.2. *Vegetation Establishment Verification Report*

At the end of the vegetation establishment period, a Vegetation Establishment Verification Report will be completed as described in the Vegetation Establishment Verification Plan. A quarterly report will be submitted to TCEQ during the vegetation establishment period. The quarterly report will include the status of vegetation establishment activities (fertilizer application, watering, reseeding, etc.) and any other activities that are related to installed final cover or vegetation

The Vegetation Establishment Verification Report will be prepared and submitted to TCEQ for approval at the end of the vegetation establishment period. The report will be prepared by a Texas Licensed Professional Engineer and include the following:

- Documentation of the root penetration performance. A hand auger or drive cylinder will be driven at a frequency of every acre within vegetative cover areas consisting of ~~either~~ *Aristida* and/or *Sporobolus* species to a depth of 12 inches to determine and verify the rooting depth. In addition, each core obtained will be examined by the certifying engineer to observe that the *Aristida* and/or *Sporobolus* roots are denser in the upper portion of the soul profile and extend to 12 inches in depth. Each sample location will be shown on design drawings.
- Documentation that the percent vegetative cover is in accordance with the ground cover and bare area determination procedures included in this plan. This documentation will include the engineers' assessment of the vegetation cover and photographs that document compliance with the performance specification.
- The certifying engineer will also provide a statement indicating that the vegetation layer of the ET final cover system has been maintained consistent with the parameters used in the UNSAT-H analysis.

6. Schedule for Closure Activities

The landfill closure schedule and other closure related activities shall follow the requirements of Title 30 TAC §330.457(f) and (g).

6.1. Closure Schedule

Title 30 TAC §330.457(e)(4)

An overall timetable for the closure of the Fort Bliss MSWLF is presented following this section. This schedule is based on the current BRAC realignment process at Fort Bliss and the regulatory closure requirements described in subsequent sections.

6.2. Final Contour Map

Title 30 TAC §330.457(e)(5)

A final contour map depicting the proposed final contours, top slopes, and side slopes, and proposed surface drainage features is provided as Sheet 3 in Appendix B of the permit modification application. The MSWLF is not within a 100-year flood plain.

6.3. Location of Plan

Title 30 TAC §330.457(f)(1)

Fort Bliss DPW-ENV shall maintain a copy of the closure plan in the operating record.

6.4. Written Notification

Title 30 TAC §330.457(f)(2)

No later than 45 days prior to the initiation of closure activities for any area or final closure of the facility, Fort Bliss shall provide written notification to the Executive Director of the intent to close the unit or facility and place this notice of intent in the operating record.

No later than 90 days prior to the initiation of a final facility closure, Fort Bliss shall, 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 following information:

- Facility Name
- Facility Address
- Physical Location of the Facility
- The Permit Number
- Last Date of Intended Receipt of Waste.

6.5. Start of Final Closure Activities

Title 30 TAC §330.457(f)(3)

Fort Bliss shall begin final closure activities for each unit or facility no later than 30 days after the date on which the unit or facility receives the known final receipt of wastes or, if the unit or facility has remaining capacity and there is a reasonable likelihood that the unit or facility 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 Fort Bliss has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the MSWLF.

6.6. Completion of Final Closure Activities

Title 30 TAC §330.457(f)(4)

Fort Bliss shall complete final closure activities for the unit or facility in accordance with the approved final closure plan within 180 days following the initiation or final closure activities. A request for an extension for the completion of final 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 MSWLF unit.

6.7. Certification

Title 30 TAC §330.457(f)(5)

Following final closure of the MSWLF unit or facility, the owner or operator shall submit to the Executive Director for review and approval a Final Cover System Evaluation Report (FCSER), a Vegetation Establishment Report, signed by an independent licensed professional engineer, verifying that final closure has been completed in accordance with the approved final 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.

6.8. Inspection Report

Title 30 TAC §330.457(f)(6)

Following receipt of the required final closure documents, as applicable, and an inspection report from the commission's district office verifying proper closure of the MSWLF unit or facility according to the approved final closure plan, the executive director may acknowledge the termination of operation and closure of the unit or facility and deem it properly closed.

6.9. Affidavit to the Public

Title 30 TAC §330.457(g)

Upon notification to the executive director, Fort Bliss 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 on closing for specific unit(s) or the entire facility and the prohibition against further receipt of waste materials after the stated date.

Within 10 days after completion of final closure of the MSWLF unit or facility, Fort Bliss shall submit to the executive director a certified copy of an "Affidavit to the Public" in accordance with the requirements of Title 30 TAC §330.19 and place a copy of the affidavit in the operating record. In addition, a certified notation of the deed to the facility property, or on some other instrument that is normally examined during title search, needs to be recorded. This is intended so that in perpetuity any potential purchaser of the property is notified that the land has been used as a landfill facility and use of the land is restricted.

Post-closure care maintenance specified in Title 30 TAC §330.463(b) (relating to Post-Closure Care Requirements) shall begin immediately upon the date of final closure as approved by the executive director.

6.10. Post-Closure Care

Following the professional engineer certification of the completion of closure as accepted by the Executive Director of the TCEQ Waste Permits Division, Fort Bliss DPW-ENV shall commence the 30-year post-closure care period. A Vegetation Establishment Report shall be submitted semi-annually during the cover vegetation start-up period indicating the type and quantity of vegetation established, the percent vegetative cover, and the vegetative root structure. If the type or quantity of vegetation or root structure does not meet specifications, then corrective action shall be taken to improve the vegetation consistent with the ET final cover design. Post-closure care requirements are discussed in the *Post Closure Plan.*

7. Closure Cost Estimate

Title 30 TAC §330.63(j)

As an agency of the Federal Government, Fort Bliss is not required to complete financial assurance mechanism requirements. Therefore, a closure cost estimate is not required per Title 30 TAC §37.8001~~330.5~~.

APPENDIX C-3

Appendix P – Post-Closure Plan

[redline]

Department of the Army

Fort Bliss Department of Public Works - Environmental

IMWE-BLS-PW

Post-Closure Care Plan

USAADACENFB Fort Bliss Municipal Solid Waste Landfill Permit #1422

Revised December 2011

Report Prepared By:

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White Plains, NY 10601

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819 Taylor Street, Fort Worth, TX 76102

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Engineering Certification

I attest that this Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 of the Texas Administrative Code (Title 30 TAC) Chapter §330. This certification in no way relieves Fort Bliss of its duty to prepare and fully implement this Plan.

Certifying Engineer:	Jeffrey Rusch, P.E.
State:	Texas
Registration Number:	109130

Signature: ______________________________

Certification Date: ______________________________

Engineering Seal:

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1. Introduction

This Post–Closure Care Plan has been prepared to provide general guidance for Fort Bliss in meeting the Texas Commission on Environmental Quality (TCEQ) rules listed in Title 30 of the Texas Administrative Code Chapter 330 Rule 463 (Title 30 TAC §330.463) in reference to the post-closure care maintenance requirements for Municipal Solid Waste Landfill (MSWLF) units. A copy of this Post-Closure Care Plan will be maintained in the operating record.

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Deleted: If any questions arise regarding the Fort Bliss MSWLF post-closure care maintenance methods or requirements, he or she should consult with: (1) the Department of Public Works – Environmental (DPW-ENV) of Fort Bliss or (2) the TCEQ.¶
The DPW-ENV may be contacted at the following address:¶
Department of Public Works – Environmental (DPW-ENV)¶
Fort Bliss¶
IMWE-BLS-PW¶
Fort Bliss, TX 79916¶
Tel. (915) 568-5724¶
¶
The TCEQ Municipal Solid Waste Division is located at the following address:¶
Texas Commission on Environmental Quality¶
Municipal Solid Waste Division¶
MC 124¶
P.O. Box 13087¶
Austin, Texas 78711-3087¶
Tel. (512) 239-6784¶
¶
Additionally, the Region 6 TCEQ staff at El Paso can be reached at the following address:¶
Texas Commission on Environmental Quality¶
Region 6¶
401 E. Franklin Ave., Ste. 560¶
El Paso, Texas 79901-1212¶
Tel. (915) 834-4949¶

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2. Maintenance and Monitoring

2.1. Post-Closure Care

Title 30 TAC §330.463(b)(1)

After professional engineer certification of the completion of closure requirements for the MSWLF is accepted by the executive director, Fort Bliss shall begin conducting post-closure care maintenance for 30 years unless the executive director specifies otherwise. Post closure care shall consist, at a minimum, of the following:

2.1.1. General Maintenance

Title 30 TAC §330.463(b)(1)(A)

Fort Bliss (the owner) or operator shall retain the right of entry to the closed unit or facility and shall maintain all rights-of-way and conduct maintenance and/or remediation activities as needed, in order to maintain the integrity and effectiveness of all final cover and drainage control system(s); to correct any effects of settlement, subsidence, ponded water, erosion, or other events or failures detrimental to the integrity of the closed unit or facility; and to prevent surface run-on and run-off from eroding or otherwise damaging the final cover system.

2.1.2. Leachate Collection System Monitoring

Title 30 TAC §330.463(b)(1)(B)

Fort Bliss shall maintain and operate the leachate collection system (LCS) in accordance with the requirements listed in Title 30 TAC §330.331 and §330.333 (relating to Design Criteria and Leachate Collection System, respectively).

Leachate shall be measured at least once a year by a scaled dip stick into the on-site vertical leachate monitoring pipe. The watermark on the stick measures the depth of leachate that collected on the liner. If the leachate is more than 12 inches (30 centimeters) deep in the landfill, it will be pumped out through the leachate transfer pipe and spread on the Subtitle D cell for evaporation.

The leachate measurement shall be kept in the site operating record. These measurements shall also be reported to the TCEQ. The executive director may allow Fort Bliss to stop managing leachate if Fort Bliss demonstrates to the approval of the executive director that leachate no longer poses a threat to human health and the environment.

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<#>Rights of Entry¶
Title 30 TAC §330.463(a)(1)¶
Fort Bliss shall retain the right of entry to and maintain all rights-of-way of the closed municipal solid waste management unit in order to conduct periodic inspections of the closed unit. Fort Bliss shall correct, as needed, the erosion of cover material, lack of vegetative growth, leachate or methane migration, and subsidence or ponding of water on the unit. If any of these problems occur after the end of the five year post-closure period or persist for longer than the first five years of post-closure care, Fort Bliss shall be responsible for their correction until the executive director determines that all problems have been adequately resolved. The executive director may reduce the post-closure period for the unit if all wastes and waste residues have been removed during closure.¶
<#>Monitoring Programs¶
Title 30 TAC §330.463(a)(2)¶
Any monitoring programs (groundwater monitoring, resistivity surveys, methane monitoring, etc.) in effect during the life of the unit shall be continued during the post-closure care period.¶
<#>Evidence of Release¶
Title 30 TAC §330.463(a)(3)¶
If there is any evidence of release from a municipal solid waste unit, the executive director may require an investigation into the nature and extent of the release and an assessment of the measures necessary to correct an impact to groundwater.¶

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General Maintenance

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2.1.3. Groundwater Monitoring

Title 30 TAC §330.463(b)(1)(C)

Ground-water monitoring requirements under Title 30 TAC §330.403 (relating to Ground-Water Monitoring Systems), §330.405 (relating to Groundwater Sampling and Analysis Requirements), §330.407 (relating to Detection Monitoring Program for Type I Landfills), and §330.409 (relating to Assessment Monitoring Program) were suspended by the executive director on May 22, 1996, since Fort Bliss demonstrated that there is no potential for migration of hazardous constituents from the MSWLF unit to the uppermost aquifer as defined in Title 30 TAC §330.3 (relating to Definitions) during the active life and the closure and post-closure care period of the unit. A copy of the May 22, 1996 letter is provided in Appendix F of the permit modification application.

2.1.4. Gas Monitoring

Title 30 TAC §330.463(b)(1)(D)

Fort Bliss shall maintain and operate the gas monitoring system in accordance with the requirements listed in 30 TAC §330 Subchapter I and the current approved Landfill Gas Management Plan.

2.1.5. Electrical Resistivity Surveys

Title 30 TAC §330.463(b)(1)(E)

Fort Bliss is not subject to electrical resistivity surveys.

2.1.6. Vegetation Establishment Monitoring

A Vegetation Establishment Report shall be submitted semi-annually during the cover vegetation start-up period indicating the type and quantity of vegetation established, the percent vegetative cover, and the vegetative root structure. If the type or quantity of vegetation or root structure does not meet specifications, then corrective action shall be taken to improve the vegetation consistent with the ET final cover design in accordance with the Fort Bliss MSWLF Closure Plan.

2.1.7. Schedule

Title 30 TAC §330.463(b)(3)(A)

Post-closure activities required for the MSWLF are described below:

**Table 2-1.
Post-Closure Monitoring and Inspection Activities**

Items	Inspection period	Action	Remark
Erosion	Quarterly and after any major storm	Correct	-----
Methane	Quarterly	Report to TCEQ	Monitoring
Leachate	Annually	Report to TCEQ	Measuring
Vegetation Establishment	Quarterly during establishment period	Report to TCEQ	Monitoring/Measuring

2.1.8. Post Closure Care Period

Title 30 TAC §330.463(b)(2)

Following the professional engineer certification of the completion of closure as accepted by the executive director of the TCEQ Waste Permits Division, Fort Bliss DPW-ENV shall commence the 30-year post-closure care period. The length of the Post-Closure Care maintenance period of the MSWLF may be decreased by the executive director if Fort Bliss submits to the executive director for review and approval a documented certification, signed by an independent registered professional engineer and including all applicable documentation necessary to support the certification that demonstrates that the reduced period is sufficient to protect human health and the environment. The post-closure maintenance period may be increased by the executive director if it is determined that the lengthened period is necessary to protect human health and the environment. If there is evidence of a release from the MSWLF, the executive director may require an investigation into the nature and extent to the release and an assessment of measures necessary to correct an impact to groundwater.

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3. Post - Closure Cost Estimate

Title 30 TAC §330.463(b)(3)(D)

As an agency of the Federal Government, Fort Bliss is not required to complete financial assurance mechanism requirements. Therefore, a post-closure cost estimate is not required per Title 30 TAC §37.8001.

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4. Completion of Post - Closure Care

Title 30 TAC §330.465

Following completion of the post-closure care maintenance period for the MSWLF, Fort Bliss will submit to the executive director for review and approval a documented certification, signed by an independent registered professional engineer verifying that post-closure care maintenance has been completed in accordance with the approved post-closure care plan. The submittal to the executive director shall include all applicable and supporting documentation necessary for the certification of completion of post-closure care maintenance.

Upon completion of the post-closure care period for the MSWLF Fort Bliss shall also submit to the executive director a request for voluntary revocation of the facility permit.

Title 30 TAC §330.463(b)(3)(C)

Fort Bliss has no foreseeable future land use plan for the landfill property at this time. If such a land use plan is needed, all land use and development plans shall comply with the requirements set forth in Title 30 TAC Chapter 330, Subchapter T: Use of Land Over Closed Municipal Solid Waste Landfills.

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¶
¶

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APPENDIX C-4

Permit Modification Application

[redline]

BLISS-A10-001-11-001

Permit Modification Application

Fort Bliss, TX

USAADACENFB Fort Bliss Municipal Solid Waste Landfill ~~Facility~~

Permit 1422

Department of the Army
Fort Bliss Department of Public Works - Environmental
Building 777
El Paso, TX 79916
~~U.S. Army Corps of Engineers~~
~~Fort Worth District~~
~~819 Taylor Street~~
~~Fort worth, TX 76012~~

Revision 1 - ~~September~~ December 21, 2011

zia engineering & environmental consultants, llc

ARCADIS MALCOLM PIRNIE Infrastructure · Water · Environment · Buildings

This document is ... under authority of Franc... 1. It is not to be used for construction or bidding purposes.

Permit Modification Application

Fort Bliss, TX

USAADACENFB Fort Bliss

Municipal Solid Waste Landfill~~l Facility~~

Permit 1422

t of the Army
epartment of Public Works -
ntal
Building 777
El Paso, TX 79916

~~U.S. Army Corps of Engineers~~
~~Fort Worth District~~
~~819 Taylor Street~~
~~Fort worth, TX 76012~~

~~September 2011~~Revision 1 – December 21, 2011

This document is released for the purpose of Fort Bliss ED Review under the authority of Francisco Xavier Urueta P.E. #99473 on ~~5~~12-~~25~~21-2011. It is not to be used for construction or bidding purposes.

Prepared for:
Department of the Army
Fort Bliss Department of Public Works - Environmental
~~U.S. Army Corps of Engineers~~

Francisco X. Urueta, P.E.
Project Engineer
Zia Engineering & Environmental Consultants, LLC
Texas Reg. Num. 11907

Prepared by:
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Tel 575-532-1526
Fax 575-532-1587

Jeffrey Rusch, P.E., LEED AP
Staff Engineer
ARCADIS of New York, Inc.
Texas Reg. Num. 7727

ARCADIS Malcolm Pirnie~~, Inc.~~
44 South Broadway
15th Floor , Box 751
White Plains, NY 10602-0751
Tel 914 694 2100
Fax 914 694 9286

Our Ref.:
Bliss-A10-001 06400003.0000

Date:
~~September~~ December 2011

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

Appendices

A TCEQ Core Data form

B TCEQ Part I form

C Redline/Strikeout Copi~~y~~es ~~Replacement Pages~~
C-1 – Replacement ~~Pages~~ Documents Summary Table
C-2 – *Appendix O* – Closure Plan [redline]
C-3 – *Appendix P* – Post-Closure Plan [redline]
C-~~2~~4 – ~~Appendix O~~Permit Modification Application ~~– Closure Plan~~ [redline]
C-5 – *Appendix B* – Landfill Modification and Closure Design Drawings [redline]
C-6 - *Appendix I* – Slope Stability and Settlement Analysis [redline]
C-7 – *Appendix L* – Facility Surface Water Drainage Report [redline]
C-8 – *Appendix Q* – Evapotranspiration Cover Design Report [redline]

D Clean Copy Replacement ~~Pages~~Documents
D-1 – *Appendix B* – Landfill Modification and Closure Design Drawings

D-2 – *Appendix I* – Slope Stability and Settlement Analysis
D-3 – *Appendix L* – Facility Surface Water Drainage Report
D-4 – *Appendix O* – Closure Plan
D-5 – *Appendix P* – Post-Closure Plan
D-6 – *Appendix Q* – Evapotranspiration Cover Design Report

E Adjacent Landowner Information

~~*(There are no redlines for Appendices B, I, and L because the new documents completely replace the previous documents and Appendix Q will be a new appendix to the permit document)*~~

1.0 PERMIT MODIFICATION NARRATIVE

1.1 Background and Description of Proposed Change

The Fort Bliss Municipal Solid Waste Landfill is an approximately 106 acre facility consisting of several cells as follows:

- An active 10.~~6~~5-acre Subtitle D Type I Cell;
- A closed 3-acre Non-Subtitle D Type I Cell (TCEQ closure approval received February 24, 1999);
- An active 5-acre Non-Subtitle D Type IV C&D Cell;
- Approximately 80~~3~~ acres of 1970's era previously filled and operationally closed areas;
- Approximately 7 acres designated for landfill roads, access areas, and guard shack/scale house, etc.

1.1.1 Currently Permitted Final Cover Design

A March 2009 permit modification (MOD) for vertically extending the height of the Subtitle D cell by 10 feet was approved and issued by the TCEQ effective on March 19, 2009. ~~In March 2008, a permit modification application was submitted to TCEQ for vertically extending the height of the Subtitle D cell by 10 feet. This permit modification was approved, issued, and effective on March 11, 2009.~~ The permit modification approval included final cover designs for all the landfill cells. For the Subtitle D cell the approved cover design is as follows (from top to bottom):

- Six inches of 1-inch to 4-inch diameter cobbles;
- A 12-inch drainage layer, $k \geq 1 \times 10^{-2}$ cm/sec;
- Geocomposite drainage net;
- 60-mil textured High Density Polyethylene (HDPE) or Linear Low Density Polyethylene (LLDPE) geomembrane; and
- 18-inch clayey material layer, $k \leq 1 \times 10^{-5}$ cm/sec.

For the previously filled and operationally closed areas and the Non-Subtitle D Type IV C&D cell, the approved cover design included an 18-inch thick (minimum) compacted low permeability soil layer (i.e., compacted clay) overlain by six inches of soil capable of sustaining native plant growth.

The Non-Subtitle D Type I cell was closed in 1999 with a non-Subtitle D final cover that complied with the closure plan for that cell and for which TCEQ closure approval was obtained in 1999.

1.1.2 Alternative ET Final Cover Design

Both the active Subtitle D and Non-Subtitle D Type IV C&D cell are nearing capacity and are scheduled to close in 2012. In addition, the facility permit does not allow further placement of waste within the 1970's era inactive areas. According to the March 1995 Final Closure Plan and Cost Estimate, these 80 acres are closed; however, formal TCEQ approval documentation has not been located in the DOE or TCEQ files.
~~the 1970's era inactive areas have inadequate low permeability in-place final cover.~~
~~–~~The low permeability soil material required for the approved final cover systems for these cells is not readily available in the area and will need to be imported at considerable expense. Accordingly, Fort Bliss is seeking a permit modification to provide an alternative evapotranspiration (ET) final cover system to ~~closure design that~~ replace~~s~~ the final cover systems for those parts of the landfill that have not already received a permitted final cover (i.e. all landfill cells except the non-subtitle D cell that was capped/closed in 1999).~~described above with an Evapotranspiration (ET) Final Cover System.~~

~~The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 of the Texas Administrative Code (TAC) Rule §330.5(b)(1)(D)) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling without calibration.~~

The proposed ET Final Cover System will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,

- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.
- ~~12-inch thick Vegetative Surface Layer that serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;~~
- ~~12-inch thick Storage Layer providing storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;~~
- ~~6-inch thick Capillary Break Layer which will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,~~
- ~~12-inch thick Intermediate Cover Layer to provide additional water retention storage volume.~~

The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 of the Texas Administrative Code (TAC) Rule §330.5(b)(1)(D)) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling without calibration.

The alternative ET landfill cover final grading plan doesn't significantly alter the final grades presented in the ~~2008 permit modification~~March 2009 MOD; rather, the ET landfill cover final grading plan adjusts the final grades to generally conform to the grades developed during filling operations to provide more easily constructible ridges, swales, and slopes and a more uniform surface for installation and maintenance of the ET cap. Specifically~~.~~:

- The final closure grades of the northwest inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 2.2% to a more uniform pyramidal shape with a 3.6% top slope facing to the west and between 6% and 18% side slopes facing to the north, east, and south.
- The final closure grades of the northeast inactive cell were adjusted from inconsistently directed 2% side slopes to a more uniform pyramidal shape with a 2.2% top slope facing to the west and between 5% and 8.3% side slopes facing to the north, east, and south.
- The final closure grades of the southeast inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 3.3% to a more uniform plateau shape with a 2% top slope facing to the south and between 8.3% and 25% slopes facing east and north respectively.

- The final closure grades of the Type IV C&D cell were adjusted from steep 25% plateau side slopes to a more uniform pyramidal shape with 2% side slopes in all directions.
- The final closure grades of the Subtitle D cell were generally kept consistent with the 2008 permit modification grades.

The final grading and drainage plan remains consistent with the previously approved ~~2008 permit modification~~March 2009 MOD. Final drainage patterns at the landfill will consist mostly of overland flow paths and shallow concentrated flow leading off the ET cover landfill side slopes. Swales provide flow paths for internal watersheds to the existing landfill perimeter swales. Surface water runoff flows off the landfill into the existing shallow perimeter drainage swales that discharge to the natural flow patterns of the surrounding area, generally towards the southwest and southeast corners of the landfill.

Conventional landfill covers typically include a gas collection layer and passive gas vents to relieve landfill gas pressures on the overlying impermeable geomembrane and minimize slope stability concerns. The alternative ET landfill cover will only consist of course-grained permeable soil; therefore, no passive gas venting system is proposed as part of the final ET landfill cover design. Rather, the ET cover soils will naturally and effectively vent landfill gas, similar to the existing conditions and the daily/intermediate cover soil at the site. Additionally, the microbes in the ET cover soil will oxidize some of the methane as it vents, creating more environmentally friendly emissions. While the venting of the landfill gas may affect vegetative growth on the landfill cover, the ET cover system was designed to be effective with only 10% vegetative coverage. Based on the operational and regulatory history of the landfill (83 acres of 1970's era waste), significant landfill gas generation is not expected. Should excessive methane concentrations be detected in perimeter landfill gas monitoring probes or ambient landfill air during routine landfill gas monitoring, corrective venting and reporting procedures are outlined in the Fort Bliss Guidance Document titled *Procedures Following a Methane Exceedance*.

1.2 Purpose of Change and Provision Under Which Modification is Sought

The purpose of the proposed ET Final Cover System is to provide a more cost effective closure that offers equivalent environmental protections as those provided by the closure design previously approved. Accordingly, per Title 30 TAC §305.70(k)(10), the purpose of this permit modification application is to request approval of an ET Final Cover System as an alternative final cover system for closure of the Fort Bliss Landfill.

1.3 Permit Modification Application Organization and Structure

In accordance with Title 30 TAC §305.70(e), this permit modification application consists of a new TCEQ Core Data form and Part I form, a description of the proposed permit changes, revisions to existing applicable permit documents (including strikeout and clean copies), and an updated landowners map and landowners list as required under Title 30 TAC §330.59(c)(3). This application is organized as follows:

- Appendix A – TCEQ Core Data form *[for information only]*
- Appendix B – TCEQ Part I form
- Appendix C - Redline/Strikeout Copy Replacement Pages. This appendix includes redline/strikeout replacement pages to the *Permit Modification Application, Fort Bliss Municipal Solid Waste Landfill, Permit 1422* (March 2008, Malcolm Pirnie, Inc.) document which reflect the inclusion of the ET Final Cover System Design
- Appendix D – Clean Copy Replacement Pages. This appendix includes clean copy replacement pages of the changes reflected in Appendix C
- Appendix E – Adjacent Landowner Information. This appendix includes a list and map of adjacent property owners for notice as required by Title 30 TAC §330.59(c)(3)

APPENDIX A

TCEQ Core Data form

APPENDIX B

TCEQ Part I form

APPENDIX C

Redline/Strikeout Copies~~y~~

~~Replacement Pages~~

APPENDIX C-1

Replacement ~~Pages~~ Documents

Summary Table

APPENDIX C-2

Appendix O – Closure Plan~~Appendix O – Closure Plan~~

[redline]

APPENDIX C-3

Appendix ~~P~~ P – ~~Post-Closure Plan~~Post-Closure Plan [redline]

APPENDIX C-4

Permit Modification Application

[redline]

APPENDIX C-5

Appendix B – Landfill Modification and Closure Design Drawings [redline]

APPENDIX C-6

Appendix I – Slope Stability and Settlement Analysis [redline]

APPENDIX C-7

Appendix L – Facility Surface Water Drainage Report [redline]

APPENDIX C-8

Appendix Q – Evapotranspiration Cover Design Report [redline]

APPENDIX D

Clean Copy Replacement ~~Pages~~Documents

APPENDIX D-1

Appendix B – Landfill Modification and Closure Design Drawings

APPENDIX D-2

Appendix I – Slope Stability and Settlement Analysis

APPENDIX D-3

Appendix L – Facility Surface Water Drainage Report

APPENDIX D-4

Appendix O – Closure Plan

APPENDIX D-5

Appendix P – Post-Closure Plan

APPENDIX D-6

Appendix Q – Evapotranspiration Cover Design Report

APPENDIX E

Adjacent Landowner Information

Texas Commission on Environmental Quality

Permit or Registration Application for Municipal Solid Waste Facility

Part I

A. General Information

Facility Name:	USAADACENFB Fort Bliss Municipal Solid Waste Landfill			
Physical or Street Address (if available):	Building 367, Landfill Road			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79913-0058
(Area Code) Telephone Number:	915-568-5919			
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]:	U.S. Army Garrison, Fort Bliss ~~IMWE-BLS-PW~~			
Mailing Address:	Building 777			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79916
(Area Code) Telephone Number:	915-568-5919			
(Area Code) FAX Number:	915-568-3943			
Charter Number:	N/A			

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

Permittee Name:	Headquarters, U.S. Army Garrison, Fort Bliss IMWE-BLS-PW			
Physical or Street Address (if available):	Same as Operator			
(City) (County)(State)(Zip Code):			TX	
(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)	C&D Debris		☐	Other (Specify)		
☒	Other (Specify)	Mulching		☐	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.

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?

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.):	El Paso Public Library			
Mailing Address:	501 North Oregon Street			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79901-0058
(Area Code) Telephone Number:	915-543-5433			

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.
https://www.bliss.army.mil/DPW/Environmental/EISDocuments2.html

Local Government Jurisdiction:	N/A
Within City Limits of:	N/A
Within Extraterritorial Jurisdiction of City of:	N/A
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.
The landfill is located on Fort Bliss property near the Union Southern Pacific Railroad tracks along Sanitary Rill Road, approximately 4 miles north of the intersection with Fred Wilson Road

Detail the access routes from the nearest United States or state highway to the facility.
The paved landfill access road, referred to as Sanitary Road, is located on Fort Bliss property running south from the landfill site, parallel to the Union Southern Pacific Railroad tracks, to Fred Wilson Road. Fred Wilson Road is located approximately 4 miles south of the landfill site. The Sanitary Fill Road is a two-lane asphalt concrete paved road. The road is 30-ft wide with road shoulder on both sides. The access road is owned and maintained by Fort Bliss.

Provide the latitudinal and longitudinal geographic coordinates of the facility.

Latitude	**N 31° 52.70'**
Longitude	**W 106° 22.60'**
Elevation (above msl)	3930

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

Texas Department of Transportation District Location:

TXDOT District Name & Number:	El Paso District #4			
District Engineer's Name:	Charles H. Berry, Jr., PE			
Street or P. O. Box:	13301 Gateway East			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79928
(Area Code) Telephone Number:	915-790-4203			
(Area Code) FAX Number:	915-790-4311			

The local governmental authority or agency responsible for road maintenance:

Agency Name	Fort Bliss			
Contact Person's Name:	John Ghim			
Street or P. O. Box:	IMWE-BLS-PW, Building 777			
(City) (County)(State)(Zip Code):	Fort Bliss	El Paso	TX	79916
(Area Code) Telephone Number:	915-568-5201			
(Area Code) FAX Number:	915-568-3943			

State Representative:

District Number:	79			
State Representative's Name:	Joe Pickett			
District Office Address:	1790 Lee Trevino #307			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79936
(Area Code) Telephone Number:	915-590-4349			
(Area Code) FAX Number:	915-590-4726			

State Senator:

District Number:	29			
State Senator's Name:	The Honorable Jose Rodriquez			
District Office Address:	911 Dallas Street			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-521-3500			
(Area Code) FAX Number:	No fax listed			

Council of Government (COG) Information:

COG Name:	Rio Grande Council of Governments			
COG Representative's Name:	Michael Ada			
COG Representative's Title:	Director, Environmental Services			
Street or P. O. Box:	1100 N. Stanton St. Suite 610			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-533-0998 x 121			
(Area Code) FAX Number:	915-532-9382			

River Basin Information:

River Authority:	International Boundary & Water Commission			
Contact Person's Name:	Gilbert Anaya			
Watershed Sub-Basin Name:	Tularosa Closed Basin			
Street or P. O. Box:	4171 N. Mesa, Suite C-100			
(City) (County)(State)(Zip Code):	El Paso	El Paso	TX	79902
(Area Code) Telephone Number:	915-832-4702			
(Area Code) FAX Number:	915-832-4190			

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
Manuel Talamantes	N/A	Moore Services, Inc.

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
N/A	

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
N/A	

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	582EA000112797

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, ___________________________________, ________________________________,
(Operator) (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: ________________

- -

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

I, ___________________________________, hereby designate ____________________________
(Print or Type Operator Name) (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 ____________________________________

On this _____________day of ___________________, __________

My commission expires on the ____________________day of ____________________, __________

____
Notary Public in and for

____________________________ County, Texas

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

APPENDIX C-5

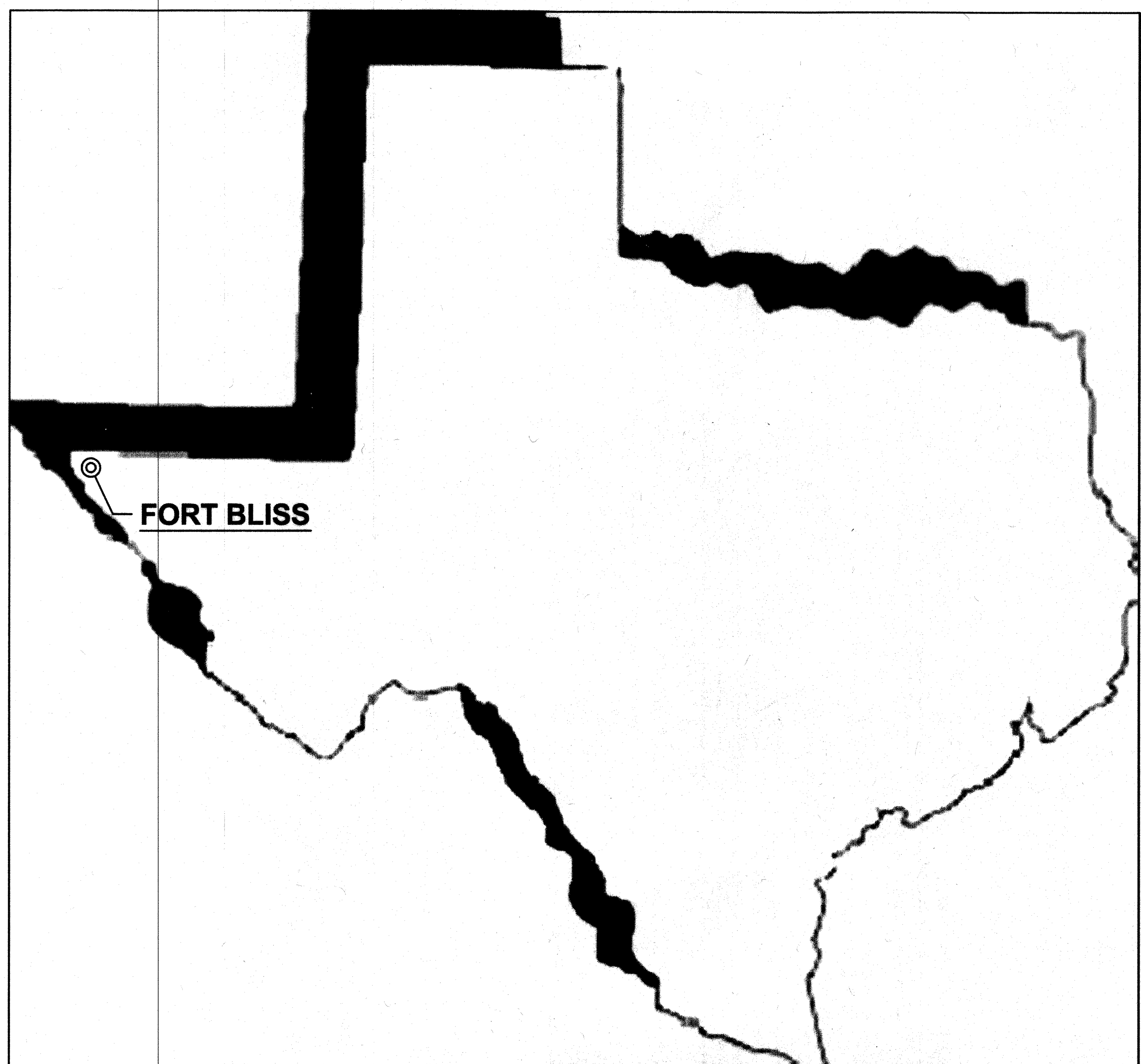
Appendix B – Landfill Modification and Closure Design Drawings [redline]

FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
FOR
FORT BLISS MUNICIPAL SOLID WASTE LANDFILL
BLISS-A10-001

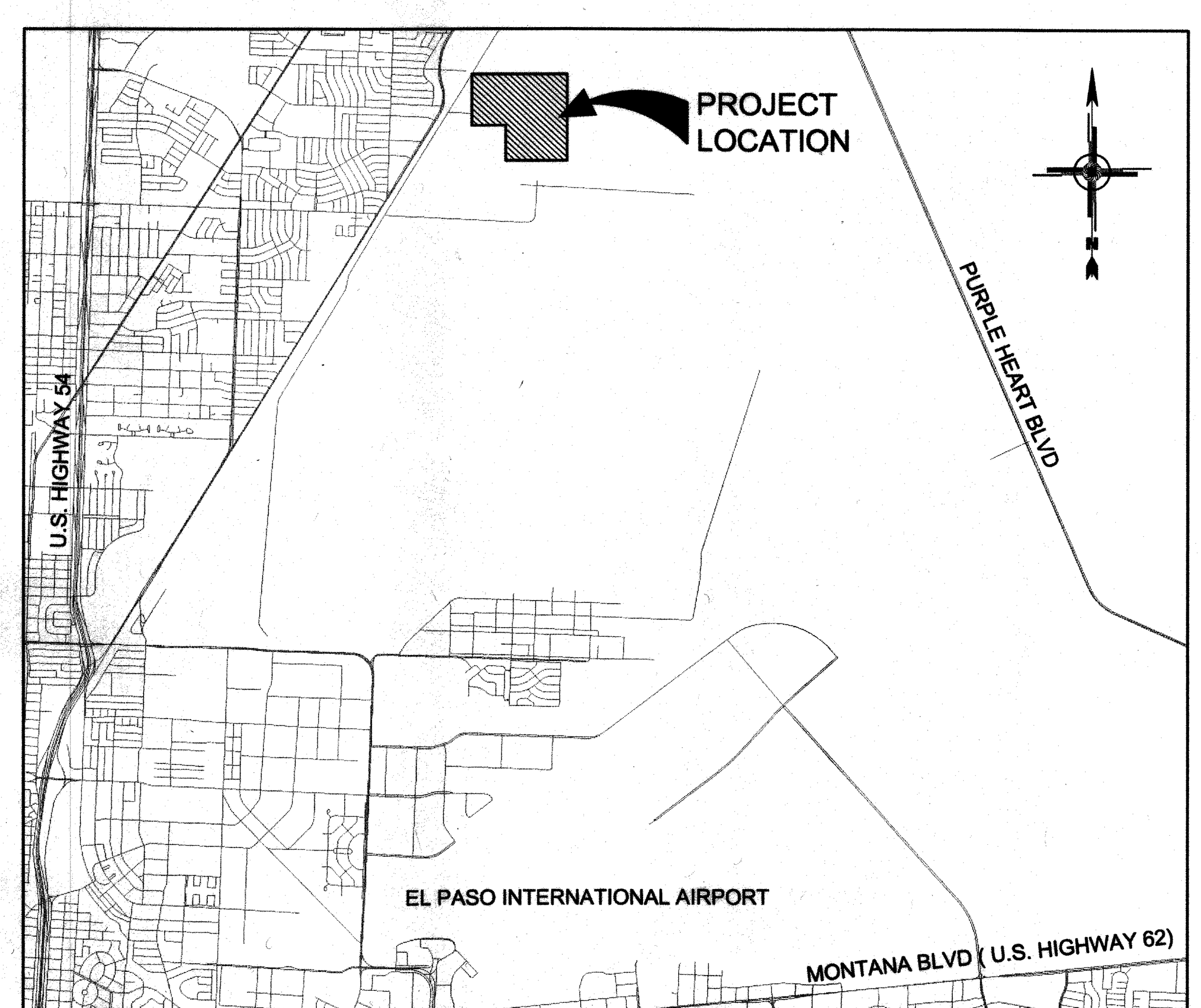
EL PASO , EL PASO COUNTY, TEXAS

DECEMBER, 2011

SHEET INDEX:



VICINITY MAP
N.T.S.



LOCAL VICINITY MAP
N.T.S.

LIST OF ABBREVIATIONS:

@ = AT
A.D. = ALGEBRAIC DIFFERENCE
ASTM = AMERICAN SOCIETY FOR TESTING AND MATERIALS
BM = BENCHMARK
BP = BEGIN POINT
BVCE = BEGINNING OF VERTICAL CURVE ELEVATION
BVCS = BEGINNING OF VERTICAL CURVE STATION
CL = CENTERLINE
DIA = DIAMETER
E = EAST OR EASTING
EG = EXISTING GRADE ELEVATION
ELEV = ELEVATION
EP = END POINT
EVCE = END OF VERTICAL CURVE ELEVATION
EVCS = END OF VERTICAL CURVE STATION
FFE = FINISH FLOOR ELEVATION
FG = FINISH GRADE ELEVATION
FL = FLOW LINE ELEVATION
INV = INVERT ELEVATION
K = VERTICAL CURVE K-VALUE
LF = LINEAL FEET
LT = LEFT
MAX = MAXIMUM
MIN = MINIMUM
MUTCD = MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
N = NORTH OR NORTHING
N.E.C. = NATIONAL ELECTRICAL CODE
NMOC = NEW MEXICO ONE CALL SERVICE
N.T.S. = NOT TO SCALE
O.C. = ON CENTER
PC = POINT OF CURVE
PB = PULL BOX
P.E. = PROFESSIONAL ENGINEER
PI = POINT OF INTERSECTION
PLS = PROFESSIONAL LAND SURVEYOR
PNM = PUBLIC SERVICE COMPANY OF NEW MEXICO
P.S.I = POUNDS PER SQUARE INCH
PT = POINT OF TANGENT
PVC = POLYVINYL CHLORIDE
PVI = POINT OF VERTICAL INTERSECTION
R = RADIUS LENGTH
RE = REFERENCE
RT = RIGHT
SF = SQUARE FEET
STA = STATION
S = SOUTH
TC = TOP OF CURB ELEVATION
TF = TOP OF FOOTING ELEVATION
TW = TOP OF WALL ELEVATION
TYP = TYPICAL
UE = UNDERGROUND ELECTRIC
VC = VERTICAL CURVE LENGTH
VOR = VILLAGE OF RUIDOSO
W = WEST

Texas 811
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CLIENT:

DEPARTMENT OF THE ARMY
FORT BLISS DEPARTMENT OF
PUBLIC WORKS - ENVIRONMENTAL
BUILDING 777
EL PASO, TX 79916

PROFESSIONAL LAND SURVEYOR:

KERY W. GREINER, P.L.S.
ZIA ENGINEERING & ENVIRONMENTAL
CONSULTANTS, LLC
755 S. TELSHOR BLVD., SUITE F-201
LAS CRUCES, NEW MEXICO 88011
PHONE: (575) 532 1526
FAX: (575) 532-1587

ENGINEER OF RECORD:

FRANCISCO XAVIER URUETA P.E. #99473
ZIA ENGINEERING & ENVIRONMENTAL
CONSULTANTS, LLC
755 S. TELSHOR BLVD., SUITE F-201
LAS CRUCES, NEW MEXICO 88011
PHONE: (575) 532-1526
FAX: (575) 532-1587

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PROPERTY LOCATED OUTSIDE CORPORATE LIMITS IN AN UNIDENTIFIED ZONE PER FLOOD INSURANCE RATE MAP NUMBER 4802140025B, EFFECTIVE DATE OF OCTOBER 15, 1982.

PROJECT BENCHMARK BM:
PROJECT BENCHMARK IS SUB D1, ORTEGA, BRASS CAP IN CONCRETE. ELEVATION = 3921.81 NAVD = 88

Field By:		REVISIONS	
Drawn By:	AH	Date:	Comment
Approved By:	AF / FXU	12/21/11	Revision 1
Date:			

Call TEXAS811
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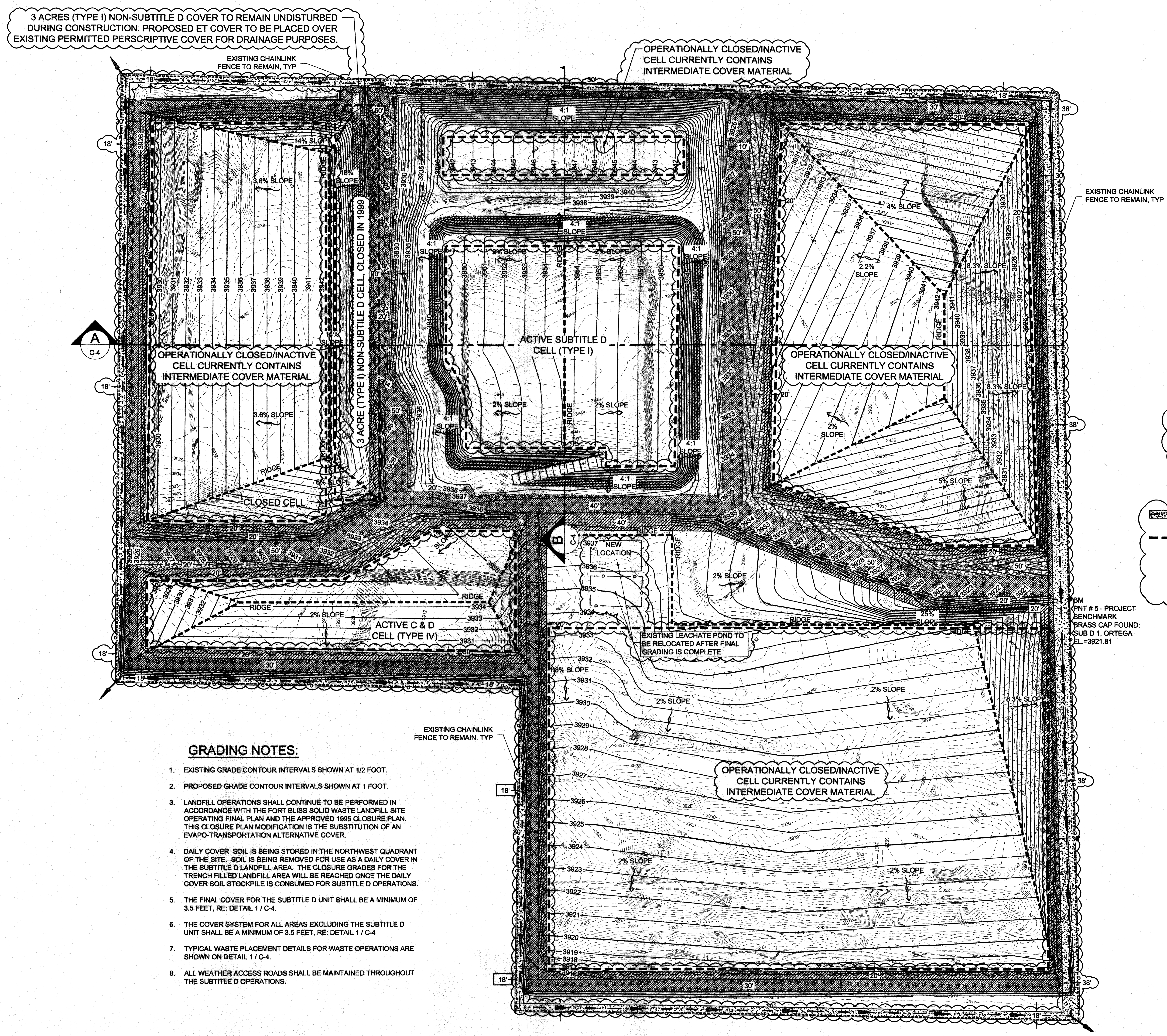
File ID: BLISS-A10-001

Date:

Sheet Title: COVER SHEET
Project Name: FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
Client: U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers
Certificate of Registration # F-11907

DRAWING NO: G-1
SHEET 1 OF 6



LEGEND

- - - -	LIMITS OF CONSTRUCTION
◆	PROJECT BENCHMARK
—o—	EXISTING CHAIN LINK FENCE TO REMAIN
3900	CONTOUR LABEL
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
3900	CONTOUR LABEL
	RIDGE
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	PROPOSED ACCESS ROAD, AREAS WILL NOT RECEIVE PROPOSED ET COVER.
	INTERNAL DRAINAGE SWALE, RE: DETAIL 3 / C-4, AREAS WILL NOT RECEIVE PROPOSED ET COVER.
	OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION AREA, RE: DETAIL 2 / C-4
	PROPOSED PERIMETER DRAINAGE DITCH, RE: DETAIL 4/C-4
	APPROXIMATE LOCATIONS OF THE CELLS/AREAS LISTED IN TABLE 2-1 OF THE FINAL CLOSURE PLAN. ACTUAL LOCATION OF THE CELLS TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION. ALL AREAS WITHIN THIS BOUNDARY TO RECEIVE PROPOSED ET COVER.

GRADING NOTES:

1. EXISTING GRADE CONTOUR INTERVALS SHOWN AT 1/2 FOOT.
2. PROPOSED GRADE CONTOUR INTERVALS SHOWN AT 1 FOOT.
3. LANDFILL OPERATIONS SHALL CONTINUE TO BE PERFORMED IN ACCORDANCE WITH THE FORT BLISS SOLID WASTE LANDFILL SITE OPERATING FINAL PLAN AND THE APPROVED 1995 CLOSURE PLAN. THIS CLOSURE PLAN MODIFICATION IS THE SUBSTITUTION OF AN EVAPO-TRANSPORTATION ALTERNATIVE COVER.
4. DAILY COVER SOIL IS BEING STORED IN THE NORTHWEST QUADRANT OF THE SITE. SOIL IS BEING REMOVED FOR USE AS A DAILY COVER IN THE SUBTITLE D LANDFILL AREA. THE CLOSURE GRADES FOR THE TRENCH FILLED LANDFILL AREA WILL BE REACHED ONCE THE DAILY COVER SOIL STOCKPILE IS CONSUMED FOR SUBTITLE D OPERATIONS.
5. THE FINAL COVER FOR THE SUBTITLE D UNIT SHALL BE A MINIMUM OF 3.5 FEET, RE: DETAIL 1 / C-4.
6. THE COVER SYSTEM FOR ALL AREAS EXCLUDING THE SUBTITLE D UNIT SHALL BE A MINIMUM OF 3.5 FEET, RE: DETAIL 1 / C-4
7. TYPICAL WASTE PLACEMENT DETAILS FOR WASTE OPERATIONS ARE SHOWN ON DETAIL 1 / C-4.
8. ALL WEATHER ACCESS ROADS SHALL BE MAINTAINED THROUGHOUT THE SUBTITLE D OPERATIONS.

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PROJECT BENCHMARK BM:

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REVISIONS		
Date:	Comment	
12/21/11	Revision 1	

Field By:
Drawn By: AH
Approved By: AF/FXU
Date:

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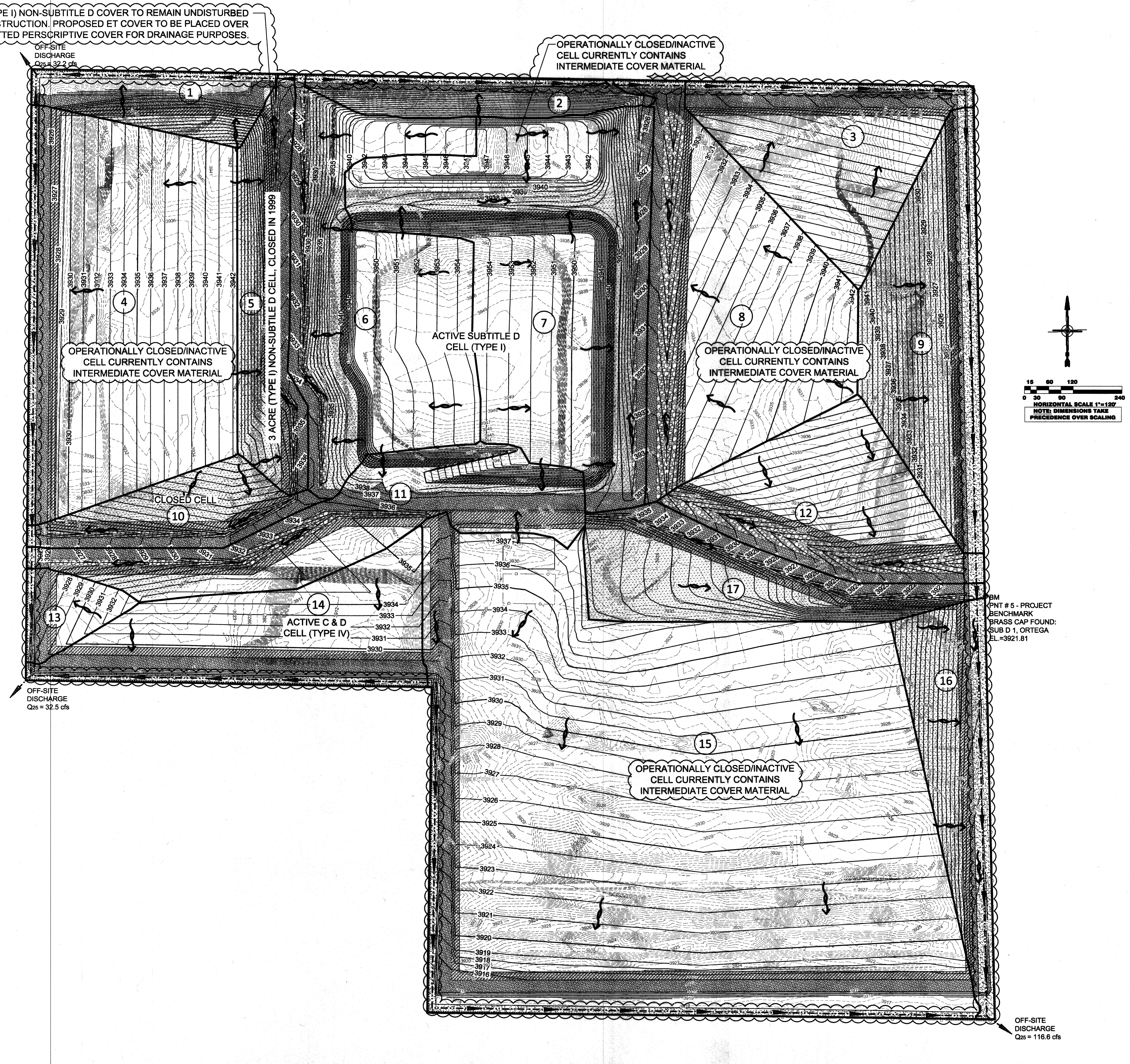
File ID: BLISS-A10-001

Sheet Title:
FORT BLISS MSW LANDFILL FINAL SITE GRADING PLAN
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers Certificate of Registration # F-11907

DRAWING NO: C-2
SHEET 3 OF 6



LEGEND

- BM — PROJECT BENCHMARK
- LIMITS OF CONSTRUCTION
- 3900 — EXISTING CHAIN LINK FENCE / PERMITTED SITE BOUNDARY
- 3900 — CONTOUR LABEL
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 3900 — CONTOUR LABEL
- WATERSHED BOUNDARY
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- ACCESS ROAD
- INTERNAL DRAINAGE SWALE, RE: DETAIL 3 / C-4
- EROSION CONTROL BLANKET, ECOBLANKET, FLEXTERRA, OR EQUAL
- OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION AREA, RE: DETAIL 2 / C-4
- STORM WATER FLOW DIRECTION
- 7 — WATERSHED LABEL
- PROPOSED PERIMETER DRAINAGE DITCH, RE: DETAIL 4/C-4

TOTAL WATERSHED PEAK DISCHARGE RUNOFF AND FLOW VELOCITY AT DRAINAGE INTERCEPTORS*

Watershed No.	Area (Acres)	Time of Concentration (Hours)	Peak Discharge (cfs)	Runoff Volume (ac-ft)	Normal Depth of Flow in Swale (ft)	Velocity in Swale(s) (ft/s)
1	1.8	0.14	3.3	0.3	0.7	2.4
2	1.6	0.10	3.0	0.2	0.9	2.8
3	4.4	0.10	8.0	0.6	0.9	2.8
4	10.6	0.17	19.4	1.6	0.9	2.7
5	3.0	0.17	5.5	0.4	0.6	2.1
6	7.5	0.16	13.7	1.1	0.9	2.6
7	10.1	0.12	18.5	1.5	0.8	3.9
8	7.9	0.14	14.5	1.2	0.8	3.5
9	5.1	0.17	9.3	0.8	0.8	2.8
10	2.1	0.09	3.9	0.3	0.5	2.6
11	5.0	0.21	8.3	0.7	0.7	2.6
12	4.5	0.09	8.3	0.7	0.6	3.6
13	0.9	0.10	1.7	0.1	0.9	2.7
14	4.9	0.10	8.9	0.7	0.4	1.8
15	29.7	0.31	42.2	4.4	0.9	2.7
16	3.2	0.17	5.9	0.5	0.8	2.8
17	3.7	0.13	6.9	0.6	0.5	3.3

*DETAILED CALCULATIONS ARE PROVIDED IN THE FACILITY SURFACE WATER DRAINAGE REPORT

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PROPERTY LOCATED OUTSIDE CORPORATE LIMITS IN AN UNIDENTIFIED ZONE PER FLOOD INSURANCE RATE MAP NUMBER 4802140025B, EFFECTIVE DATE OF OCTOBER 15, 1982.

PROJECT BENCHMARK BM:
PROJECT BENCHMARK IS SUB D1, ORTEGA, BRASS CAP IN CONCRETE. ELEVATION = 3921.81 NAVD = 88

REVISIONS	
Date:	Comment
12/21/11	Revision 1

Designed By: CA
Drawn By: AH
Approved By: FU
Date:

NM One Call Utility Locate-Statewide 1-800-321-2537
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File ID: BLISS-A10-001

Date:

Sheet Title:
FORT BLISS MSW LANDFILL WATERSHED AND STORMWATER FLOW DIRECTION

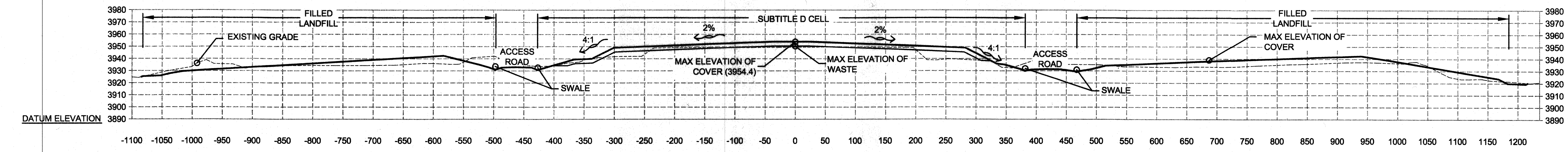
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION

Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers
Certificate of Registration # F-11907

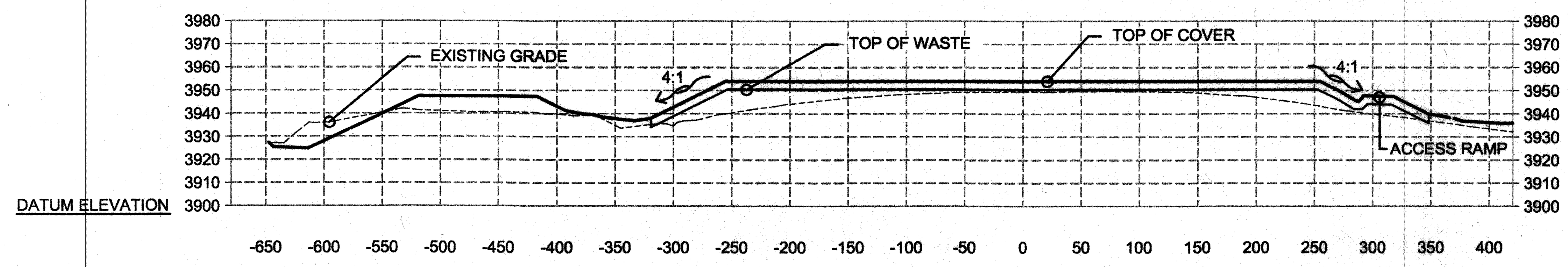
DRAWING NO: C-3

SHEET 4 OF 6



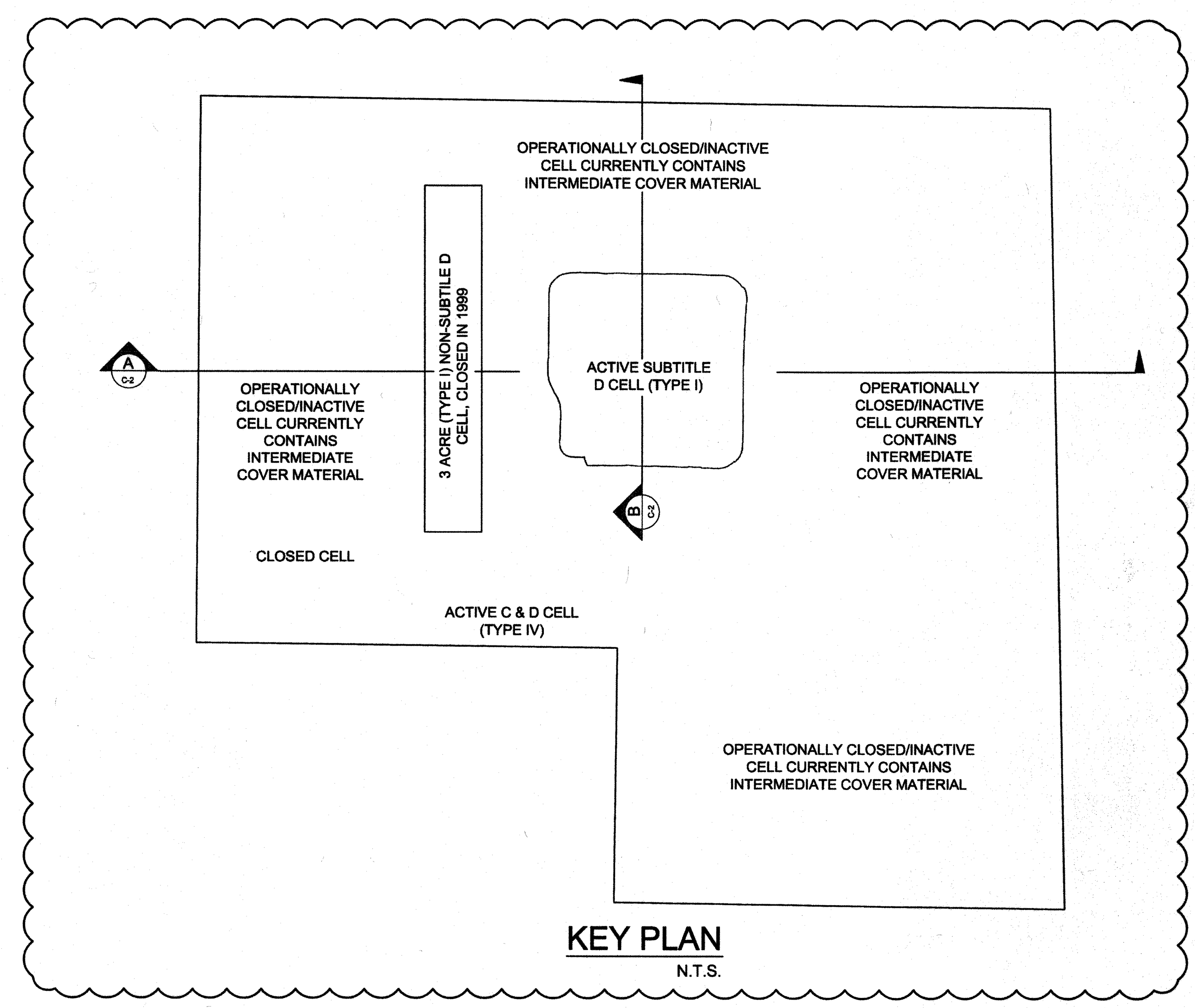
A / C-2 **GRADING CROSS SECTION**

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'



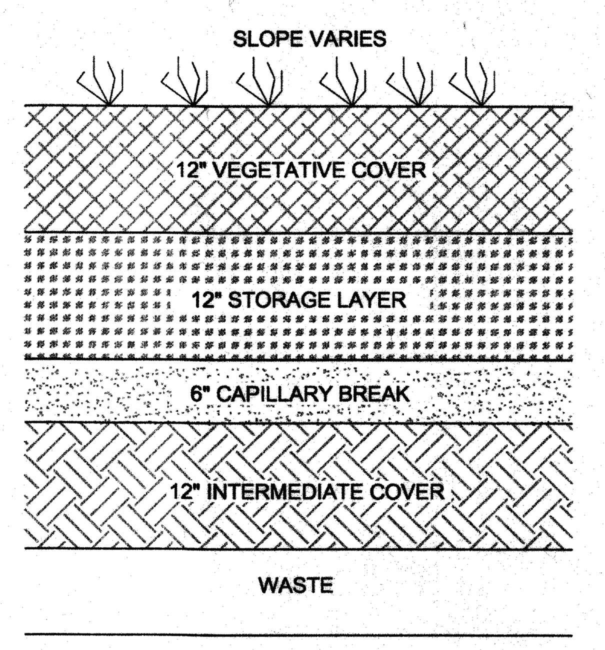
B / C-2 **GRADING CROSS SECTION**

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'



KEY PLAN

N.T.S.

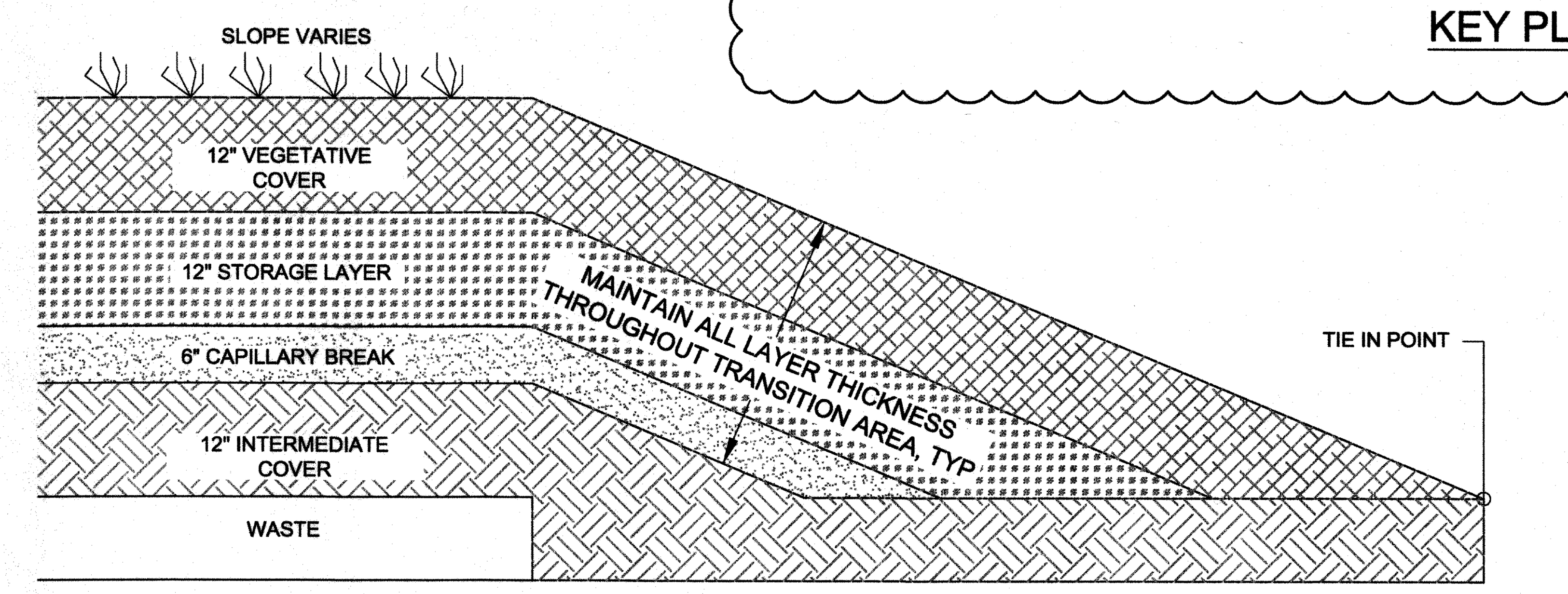


NOTE:

VEGETATIVE COVER FOR THE PROPOSED ET COVER SYSTEM WILL BE ACHIEVED BY SEEDING WITH A BALANCED MIXTURE OF NATIVE HERBACEOUS AND VASCULAR PLANTS THAT ARE INDIGENOUS SPECIES OF THE AREA, SUCH AS ALKALI SACATON AND SAND DROPSEED.

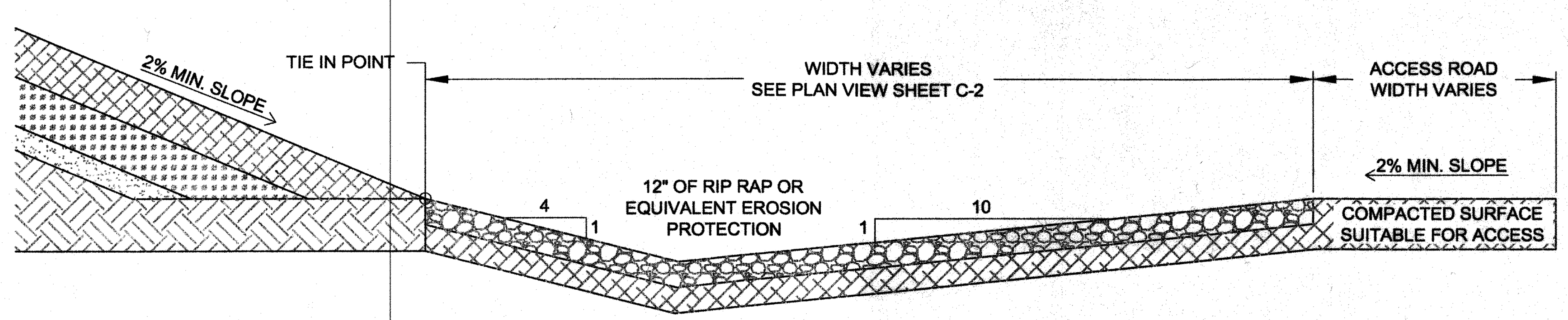
1 / -- **OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM SECTION**

N.T.S.



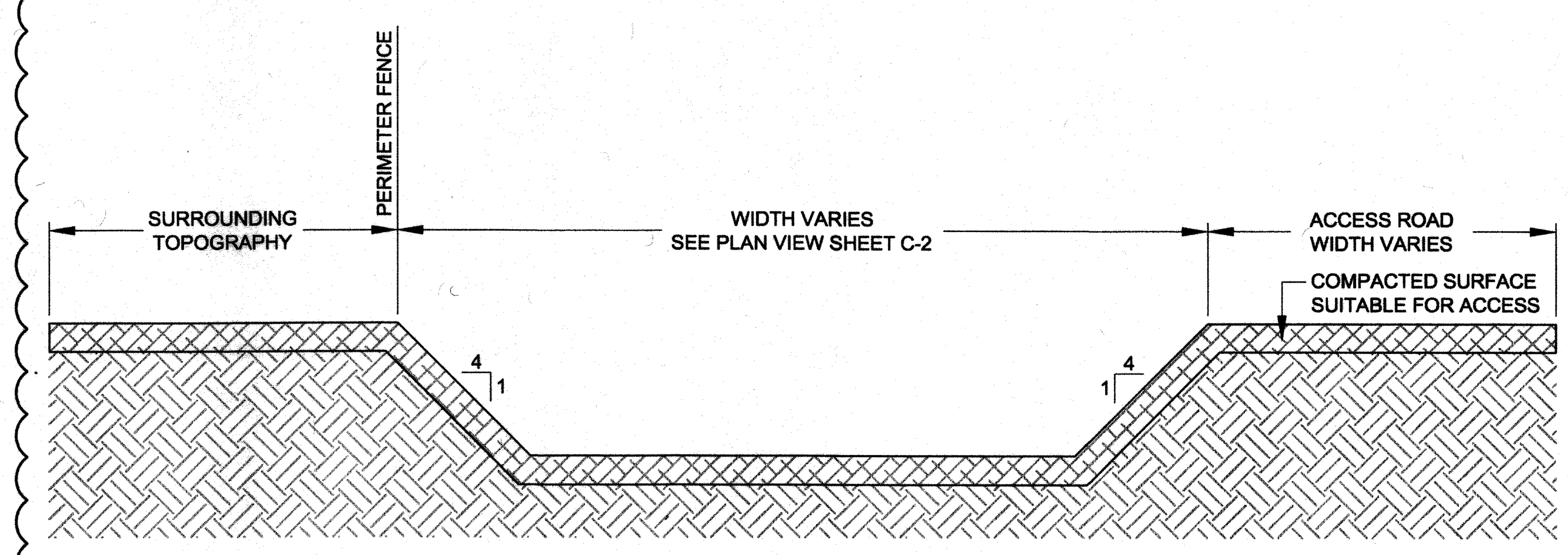
2 / C-2 **OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION DETAIL**

N.T.S.



3 / C-2 **INTERNAL DRAINAGE SWALE DETAIL**

N.T.S.



4 / C-2 **PERIMETER DRAINAGE DITCH DETAIL**

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REVISIONS		
Date:	Comment	
12/21/11	Revision 1	

Field By:
Drawn By: AH
Approved By: AF / FXU
Date:

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File ID: BLISS-A10-001

Date:

Sheet Title:
FORT BLISS MSW LANDFILL CROSS SECTIONS AND DETAILS
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers
Certificate of Registration # F-11907

DRAWING NO: C-4

APPENDIX C-6

Appendix I – Slope Stability and Settlement Analysis [redline]

GENERALIZED SUBSURFACE CONDITIONS			
Description	**Depth of Soil Under Landfill Cell (feet)**	**Material Encountered Based on Review of Existing Geotechnical Information**	**Consistency/Relative Density**
Stratum 1	0 to 5	Silty sand, fine to medium grained.	Medium Dense to Dense
Stratum 2	5 to 16	Silty sand, fine to medium grained	Loose to Medium Dense
Stratum 3	16 to 20	Silty sand, fine to coarse grained, poorly graded	Medium Dense to Dense
Stratum 4	20 to 50	Sand coarse, poorly graded	Dense
Stratum 5	50 to 51.5	Sandy Clay	Very Stiff

4.2 EXISTING/PROPOSED LANDFILL CONDITIONS

Based on our on information provided by Zia for the Type I/Subtitle D landfill cell site, the following generalized landfill characteristics were assumed in our settlement/slope stability analyses:

EXISTING/PROPOSED LANDFILL CONDITIONS				
Landfill Cell Area	**Description**	**Approximate Depth from Top of MSWL (feet)**	**Proposed/Encountered Material**	**Consistency/Density**
Proposed Final Evapo-Transpiration Cover	Vegetative Surface Layer	0 to 1	Loam***	Soft to Medium Stiff***
	Storage Layer	1 to 2	Clayey/Silty Sand ****	Medium Dense***
	Capillary Break Layer	2 to 2.5	Silty Sand/Sand****	Loose to Medium Dense***
	Intermediate Layer	2.5 to 3.5	Clayey/Silty Sand****	Medium Dense***
Solid Waste	Fresh Waste to be filled	3.5 to 17 (Section B)or 4 to 13.5* (Section A)	Municipal Solid Waste	Compacted
	Existing Waste	17 to 51.5**	Municipal Solid Waste	Compacted
Existing Liner	Protective Layer	51.5 to 53.5	Sand+	Compacted
	60-mil HDPE Smooth/Textured	53.5	Geosynthetic	
	Secondary Liner	53.5 to 55.5	Shale or Betonite Treated Caliche+	Compacted

* Fresh waste fill thickness varies within the provided range in each section.
** This value represents the average thickness of the existing solid waste based on Section 1 and 2 of the Malcolm Pirnie Subtitle D Landfill Permit Modification Plans, Sheet 5, revision dated August 6, 2008
***Assumed
****Assumed values based on the Cover Investigation Report by Malcolm Pirnie, dated January 2009.
+Based on details show on sheet 6 of the Modification To Fort Bliss Landfill Plan by Coupland-Moran Consulting Engineers, Inc.

5.0 SLOPE STABILITY AND SETTLEMENT ANALYSES

The settlement and slope stability analyses performed for the proposed closure of the Type I/Subtitle D Cell for Fort Bliss MSWL site have been based upon geotechnical conditions encountered in the existing test borings as previously discussed and on information included in the referenced documentation.

Subsurface conditions on the Type I/Subtitle D landfill cell site were generalized for use in our settlement analyses as previously discussed. For slope stability analyses, silty sand soils were considered as the landfill foundation.

5.1 SLOPE STABILITY ANALYSES

5.1.1 Slope Stability Analyses Description

Slope stability analyses have been performed on one selected cross section in order to determine the global stability factors of safety for the proposed closure configuration of the Type I/Subtitle D cell for this project.

The selection of the cross section analyzed was based on considering slope heights and slope inclination for the proposed final landfill grading plan. The referenced documentation indicates that the groundwater elevation is located 300 feet or more in depth at the site. At this depth, groundwater will not affect the slope stability and it has not been considered in the analyses.

The selected cross section, Cross Section B, runs from east to west across the landfill cell as shown on the site plan, Exhibit A-1 in Appendix A. The slope configurations vary along the length of the cross section. As proposed, the steepest slope cap configuration for the landfill will be 4H:1V (Horizontal:Vertical) with a maximum height above finished grade of approximately 19 feet. The plans indicate that the steepest bottom liner slope for this section is 3H:1V. We have assumed in our analyses that no external loads (i.e., structures, traffic, etc.) will be applied to the cross section after the final grades have been achieved.

Slope-W 2007 program Version 7.17 by Geo-Slope International, Ltd was used to perform our slope stability analyses. The General Limit Equilibrium (GLE) method developed by Fredlund at the University of Saskatchewan in the 1970's (Geo-Slope Manual, 2007) was used in our analyses. The GLE formulations are based on moment and force equilibrium conditions and allows for a range of interslice shear-normal force conditions. The GLE method also allows the analyses of different translational and rotational slip surfaces.

APPENDIX C-7

Appendix L – Facility Surface Water Drainage Report [redline]

This document is released for the purpose of review under the authority of Francisco Xavier Urueta P.E. #99473 on ~~5-6-2011~~ 12-21-2011. It is not to be used for construction or bidding purposes

FACILITY SURFACE WATER DRAINAGE REPORT

FORT BLISS FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION BLISS-A10-001

Revised December 21, 2011 ~~May 6, 2011~~

zia engineering & environmental consultants, llc

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Texas Board of Professional Engineers Certificate of Registration #F-11907

FACILITY SURFACE WATER DRAINAGE REPORT

FORT BLISS MUNICIPAL SOLID WASTE LANDFILL FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION FORT BLISS, TEXAS

Zia Project No. BLISS-A10-001

Prepared for:
U.S. Army Corps of Engineers, Fort Worth District
819 Taylor Street
Fort Worth, Texas 76102

Prepared and Certified by:
I attest that this Report has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 TAC §330.303. This document is released for the purpose of review. It is not to be used for construction or bidding purposes.

Certifying Engineer:	Francisco X. Urueta
State:	Texas
Registration Number:	99473

Signature: ______________________________
Certification Date: ______________________________
Engineers Seal:

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1.0 INTRODUCTION

The Fort Bliss Municipal Solid Waste Landfill (MSWLF) includes active Subtitle D Type I and Type IV landfill cells that are currently in use to serve the United States Army Air Defense Artillery Center and Fort Bliss area. Permitted types of solid wastes disposed of at the Fort Bliss MSWLF are non-hazardous solid waste from military operations, bulky items, grass and tree trimmings, refuse from litter cans, construction debris, classified waste (dry), dead animals, Regulated Asbestos Containing Material (RACM), and empty oil cans (1-quart and 5-gallon sizes). The MSWLF does not receive hazardous waste nor does it recover incoming waste.

The landfill area is comprised of five distinct areas:

- 1970’s-era inactive cells that cover approximately 80-acres that are considered closed.
- An approximately 3-acre Type I cell with final cover in place (non-Subtitle D) that complies with the 1995 closure plan and TCEQ requirements.
- An approximately 10.5-acre Type I active cell meeting Subtitle D requirements (Subtitle D Cell).
- An approximately 5-acre Type IV construction and demolition (C&D) debris cell.
- Approximately 7 acres designated for landfill roads, access areas, guard shack/scale house, etc.

This Facility Surface Water Drainage Report has been completed to meet the requirements of Title 30 of the Texas Administrative Code Chapter 330.63(c) (30 TAC §330.63(c)) as part of the final closure and permit modification application for an alternative cover design and grading plan. This report was developed from the March 2009 Facility Surface Water Drainage Report by updating it to reflect the changes resulting from the alternative cover design and grading plan. This report replaces the March 2009 Facility Surface Water Drainage Report. This report illustrates that the proposed modification does not adversely alter the existing (permitted) drainage patterns and that these drainage patterns can be retained for the modification.

This report also serves as the surface water drainage report required by 30 TAC § Subchapter G. The facility design complies with the requirements of 30 TAC § 330.303 relating to management of run-on and runoff. The surface water drainage analysis for the Fort Bliss MSWLF is presented in Section 2. An Erosion and Sediment Control Plan is included in Section 3. Section 4 presents the maintenance and inspection requirements.

1.1 General Geology and Soils

The Fort Bliss MSWLF is underlain by Hueco Bolson deposits of tertiary age and typically are composed of unconsolidated to slightly consolidated interbedded sands, clay, silt, gravel, and caliche. Individual beds are not well defined and range in thickness from a fraction of an inch to about 100 feet. The general geology and soils details for the MSWLF site are provided in Attachment 6 of this report.

1.2 General Climate and Weather

The MSWLF is located in west Texas where desert conditions exist; therefore, surface water flow near the MSWLF is limited. Maximum daytime summer temperatures range between 90 and 105 degrees Fahrenheit (°F) and winter temperatures range from 55 to 60°F. The surrounding area receives less than 10 inches of rain per year and relative humidity is very low. Depending upon the intensity and duration of each precipitation event, the water delivered by the occurrence may infiltrate into the soil or become surface runoff. The infiltrated water may percolate downward to the water table or return to the atmosphere via evapotranspiration.

1.3 Surface Water Bodies

No surface water bodies exist at or near the MSWLF. Given a large rain event, all surface water runoff may flow downstream to the stormwater retention basin located approximately 2 miles south of the landfill, north of Fred Wilson Boulevard. This storm water retention basin is located on the Fort Bliss Military Reservation and is managed by the Fort Bliss Storm Water Pollution Prevention Team. Structural control measures to reduce sediment are described in the ~~2005~~ 2011 Storm Water Pollution Prevention Plan (Attachment 5). Further discussion on the surface water drainage and erosion and sedimentation controls are given in Sections 2 and 3 respectively.

2.0 FACILITY SURFACE WATER DRAINAGE ANALYSIS

The final grading/drainage plan for the approximately 106 acre landfill was modified to incorporate the reduced cover design and provide more easily constructible ridges, swales and slopes than provided in the previous (~~2008~~ 2009) permit modification. However, the drainage concept remains consistent with the previously approved site plans and consists of mostly overland and shallow concentrated flows leading off the landfill side slopes. Swales provide flow paths for internal watersheds to the perimeter. There are four pairs of drainage swales located along the edges of the access roads entering the site form the north, east, and west. Surface water runoff flows off the landfill into ~~existing~~ shallow perimeter drainage ~~swales~~ ditches that discharge to the natural flow patterns of the surrounding area. In general, the perimeter drainage ditches discharge to the natural surrounding topography ~~flow patterns drain towards the~~ at the northwest, southwest and southeast corners of the landfill as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification. These existing off-site discharge locations and contributing drainage areas will not significantly change as a result of the alternative cover design and grading plan. Therefore, the surrounding drainage patterns will not be adversely altered as a result of this alternative cover design and grading plan.

A hydrologic and hydraulic analysis was conducted on the final grading plan, shown on Sheet C-2 in Appendix D (Design Drawings) of the permit modification. The analysis incorporates the proposed alternative cover design and grading modifications to estimate the peak discharge and run-off volumes associated with the 25-year, 24-hour design storm event as required in 30 TAC §330.305I. The runoff volumes and peak discharges show that the drainage is not adversely affected and that the previously designated storm water control features (i.e. landfill drainage swales down the side slopes) remain adequate.

Appendix D (Design Drawings) of the permit modification application provides the drainage areas, cross-sectional areas, and swale grades used in the analysis.

Per the *TCEQ Guidelines for Preparing a Surface Water Drainage Report for a Municipal Solid Waste Facility* (RG-417), the Rational Method described in Chapter 5, Section 6 of the Texas Department of Transportation's Hydraulic Design Manual (TxDOT 2004) was used to calculate the peak discharge flows. Use of USDA Natural Resources Conservation Service (NRCC) Technical Release 55 (TR-55) method has been approved by the Texas Commission on Environmental Quality (TCEQ) Executive Director for the calculation of the runoff volumes. The values for runoff volume, peak discharge, and flow velocity calculated in this analysis are used to design the erosion and sediment controls and to confirm that the existing drainage patterns for the landfill will not be adversely affected because of these modifications.

2.1 Runoff Volume

The volume of runoff from the landfill cover is dependent on the anticipated amount of precipitation and potential abstractions (principally infiltration) which depend on the soil type, vegetative cover, and the hydraulic conditions of the soil and proposed cover material.

The runoff volume from the landfill is calculated in accordance with 30 TAC §330.63(c)(~~i~~1)(C) and §330.305(a) using the Curve Number (CN) Method, also known as the Soil Conservation Service (SCS Runoff Curve Number Method) method TR-55:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where: Q = runoff (inches over the watershed area)

P = precipitation for the 25-year/24-hour storm event (inches)

S = 1000/CN – 10 = potential maximum retention after runoff begins (inches)

CN = SCS curve number (Table 2-2, Chapter 2, TR-55)

The following assumptions were used to obtain the values above:

P = 3.5 inches (NOAA National Weather Service, Technical Paper 40, 1961)

CN = 82 (weighted average: 95 acres of CN 81 from Table 2.2d, fair herbaceous cover Hydrologic Soil Type C and 11 acres of CN 85 from Table 2.2a, Gravel access roads Hydrologic Soil Type B)

Therefore, the total runoff volume for the landfill during a 25-year, 24-hour storm event is:

S = 1000/82 – 10 = 2.2

$Q = (3.5 – 0.2*2.2)^2 / (3.5 + 0.8*2.2) = 1.78$ inches

Runoff Volume = Q*A = 1.78 inches (106 acres)/12 = 15.7 acre-feet (ac-ft).

A copy of Worksheet 2 from TR-55 is provided as Attachment 1 of this report.

Table 2-1: Summary of Runoff Volumes

Precipitation (P)	Runoff (Q)	Total Runoff Volume (V)
3.5 inches (25-year, 24-hour)	1.78 inches	15.7 ac-ft

The landfill was divided into 17 separate drainage (watershed) areas based on the final grading plan as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification application. The following table summarizes the runoff volume for each watershed.

Table 2-2: Runoff Volumes by Watershed

Watershed No.	Area (acres)	Runoff Volume (ac-ft)
1	1.8	0.3
2	1.6	0.2
3	4.4	0.6
4	10.6	1.6
5	3.0	0.4
6	7.5	1.1
7	10.1	1.5
8	7.9	1.2
9	5.1	0.8
10	2.1	0.3
11	5.0	0.7
12	4.5	0.7
13	0.9	0.1
14	4.9	0.7
15	29.7	4.4
16	3.2	0.5
17	3.7	0.6
Total:	**105.8**	**15.7**

2.2 Peak Discharges

The peak discharge at any storm water control outlet or overland flow from a watershed area is dependent on the time of concentration of that watershed area or drainage swale outfall. The following paragraphs described the rational method and assumptions used to calculate the peak discharge flows for each of the 17 watershed areas shown on the final grading plan on Sheet C-3 of Appendix D (Design Drawings) in the permit modification.

2.2.1 Time of Concentration

The time of concentration (T_c) is the time required for a drop of water to travel from the most hydrological remote point in the watershed to the point of collection.

The time of concentration was calculated according to the procedures specified in TR-55 for each watershed area.

The steps for determining the time of concentration are summarized below:

1. The landfill was divided into 17 separate watershed areas based on the final grading plan as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification application.

2. The area of each watershed was determined as summarized in Table 2-2.

3. The sheet flow, shallow concentrated flow, and channel flow lengths and slopes were determined for each watershed area using Sheet C-3 of Appendix D (Design Drawings) of the permit modification application.

4. The travel time (T_t) for the separate types of flow in each watershed area were calculated (Worksheet 3, Chapter 3, TR-55) using the following equations and then added together to compute the total T_c for the watershed area:

   T_c = Sheet Flow T_t + Shallow Concentrated Flow T_t + Channel Flow T_t

   a. <u>Sheet flow</u> travel time was calculated with a maximum flow length of 300-feet using Overton and Meadow's equation: $T_t = 0.007\ (nL)^{0.8} / (P_2)^{0.5}\ (S)^{0.4}$ (the value for "bare soil", 0.011, was used for the roughness coefficient n).

   b. <u>Shallow concentrated flow</u> travel time was calculated using the equation T_t = L/3600*V where the average flow velocity (V) was obtained from Figure 3.1 in Chapter 3 of TR-55 for unpaved surface at the specified watercourse slope.

   c. <u>Channel flow</u> travel time was also calculated using T_t = L/3600*V where the average flow velocity was calculated by the Manning's equation:

      $V = 1.49*(r^{2/3})\ (s^{½}) / n$. (0.022 was used for Manning's roughness coefficient for the grass swale, n). The following iteration was followed to determine the final T_t:

      i. Depth of flow, "y", is assumed.

      ii. Cross-section area, wetted perimeter, and hydraulic radius are calculated.

      iii. T_t is determined and the peak discharge is computed with TR-55.

      iv. The peak discharge is used in the Manning's equation to determine the depth of flow, "y".

      v. The computed depth of flow is compared with the assumed value. The assumed value is adjusted and the calculation reiterated until the calculated and assumed values are close in value.

2.2.2 Rational Method

The procedure for calculating the Rational Method described in Chapter 5, Section 6 of the Texas Department of Transportation's Hydraulic Design Manual (TxDOT 2004) was used to calculate the maximum rate of runoff. The Rational Method estimates the peak rate of runoff at any location in a watershed as a function of the drainage area, runoff coefficient, and mean rainfall intensity of duration equal to the time of concentration. The rational formula is expressed as:

$Q = CC_fIA$

Q = Maximum rate of runoff (cfs)

C = runoff coefficient (0.38 based on poor vegetative cover and relatively flat land)

C_f = Runoff Coefficient Adjustments (1.1 for the 25 year storm)

I = average rainfall intensity (in/hr) for the 25-year/24 hr and the time of concentration for each area as described in Section 2.2.1 above.

A = drainage area (acres)

Because most of the watersheds are small and had times of concentration less than 10.25 minutes (minimum time of concentration of 10 minutes recommended by 2004 TxDOT Hydraulic Manual), the rainfall intensity for the 25-year storm for most watersheds was 4.4 inches/hour. Watershed No. 11 has a time of concentration of 12.60 minutes and resulted in a rainfall intensity of 4.0 inches/hour. Watershed No. 15 has a time of concentration of 18.45 minutes and resulted in a rainfall intensity of 3.4 inches/hour. The runoff coefficient was calculated as a factor of the relief, soil infiltration characteristics, vegetative cover, and surface type in accordance with the Hydraulic Design Manual (TxDOT 2004). A runoff coefficient factor of 1.1 was used to adjust the runoff coefficient since these calculations are for the 25-year storm event. A sample calculation and the results of the peak discharge calculations for the 17 watersheds are provided in Attachment 1 and Table 2-3, respectively.

Table 2-3: Peak Discharges

Watershed No.	Area (acres)	Time of Concentration (hours)	Peak Discharge (cfs)
1	1.8	0.14	3.3
2	1.6	0.10	3.0
3	4.4	0.10	8.0
4	10.6	0.17	19.4
5	3.0	0.17	5.5
6	7.5	0.16	13.7
7	10.1	0.12	18.5
8	7.9	0.14	14.5
9	5.1	0.17	9.3
10	2.1	0.09	3.9

Watershed No.	Area (acres)	Time of Concentration (hours)	Peak Discharge (cfs)
11	5.0	0.21	8.3
12	4.5	0.09	8.3
13	0.9	0.10	1.7
14	4.9	0.10	8.9
15	29.7	0.31	42.2
16	3.2	0.17	5.9
17	3.7	0.13	6.9

2.3 Peak Runoff Velocities Calculations

The general surface hydrology and stormwater runoff for the final cover grades are shown on Sheet C-3 in Appendix D (Design Drawings) of the permit modification. Stormwater from watersheds 1 through 4, 9, and 13 through 16 drain straight to the ~~existing~~ perimeter drainage ~~swales~~ ditches, where as watersheds 5 though 8, 10 through 12, and 17 drain to erosion control lined swales and then out to the ~~existing~~ perimeter drainage ~~swales~~ ditches. The ~~existing~~ site perimeter drainage ~~swales~~ ditches discharge to the natural surrounding flow patterns and generally flow towards the northwest, southeast and southwest corners of the landfill.

The flow velocities and the flow depths for the eight landfill drainage swales and six perimeter drainage ditches are summarized below in Table 2-4. The typical swale is V-shaped, 1 to 1.5 feet deep with 10 (H): 1 (V) side slopes on side adjacent to access road and 4 (H): 1 (V) side slopes on opposite side. The typical drainage ditch is trapezoidal, 1 to 1.5 feet deep, 10 to 30 foot wide bottom with 4 (H): 1 (V) side slopes. Details of each type of drainage conveyance structure are shown on Sheet C-4 in Appendix D (Design Drawings) of the permit modification were used for the hydraulic analysis of the landfill drainage swales. A sample calculation of the methodology used for determining the velocities and flow depths is provided in Attachment 1. As demonstrated in Table 2-4 flow depths of each swale are less than 1 foot, therefore all swales provide sufficient capacity to convey peak flow from the 25-year, 24-hour storm event.

Table 2-4: Velocities and Depths of Flow in Swales and Ditches

Watershed Associated with Swale or Ditch	Peak Discharge (cfs)	Flow Depth (ft)	Velocity (ft/s)
5	5.5	0.6	2.1
6	13.7	0.9	2.6
7	18.5	0.8	3.9
8	14.5	0.8	3.5
10	3.9	0.5	2.6
11	8.3	0.7	2.6
12	8.3	0.6	3.6

Watershed Associated with Swale or Ditch	Peak Discharge (cfs)	Flow Depth (ft)	Velocity (ft/s)
17	6.9	0.5	3.3
Perimeter North (2, 3, 7, 8)*	44.0	0.9	2.8
Perimeter East (2, 3, 7, 8, 9, 12, 16, 17)*	74.4	0.8	2.8
Perimeter South (15)*	42.2	0.9	2.7
Perimeter South West (14)*	8.9	0.4	1.8
Perimeter West (4, 10, 11, 13)*	33.3	0.9	2.7
Perimeter North West (1, 5, 6)*	22.5	0.7	2.4

* Watersheds draining to the perimeter ditch

2.4 Summary of Drainage Analysis

The 2009 permit modification grading plan was designed to convey drainage from approximately two-thirds of the area to the southeast corner of the site with the drainage from the other one-third of the area evenly divided between the northwest and southwest corners. The proposed alternative cover and grading plan was designed to maintain these drainage areas. Table 2-5 summarizes the ~~results from the pre-developed (~~permitted facility conditions per the approved ~~1995 Closure Plan)~~ 2009 permit modification and ~~post-developed~~ the proposed conditions ~~(final closure~~ with the alternative cover design and grading plan~~)~~, to demonstrate that the proposed modification does not adversely affect the surrounding drainage patterns. The comparison ~~helps to~~ illustrates that the ~~range of~~ peak discharges, ~~and flow characteristics~~ runoff volumes, average flow depths, and average flow velocities discharging off-site ~~of the site drainage have~~ will not ~~been~~ be significantly altered because of the proposed modification. The landfill surface area was not increased and the off-site drainage ~~patterns~~ discharge locations were not altered significantly so as to change the previously permitted drainage conditions of the site.

~~**Table 2-5:**~~
~~**Comparison of Peak Discharges, Flow Depths, and Flow Velocities in Swales**~~

~~Condition and Analysis~~	~~Range of Peak Discharge (cfs)~~	~~Range of Normal Depth of Flow, y (ft)~~	~~Range of Flow Velocities (ft/s)~~
~~Pre-Development (2005 Permitted)~~	~~10.9 – 73.6~~	~~0.7 – 1.1~~	~~1.9 – 3.9~~
~~Post-Development (Alternative Cover and Grading)~~	~~1.7 – 42.2~~	~~0.5 – 0.9~~	~~2.1 – 3.9~~

Table 2-5:
Comparison of Peak Discharges, Volumes, Flow Depths and Flow Velocities at Off-Site Discharge Locations

Location	Peak Discharge (cfs)		Runoff Volume (ac-ft)		Average Flow Depth (ft)		Average Flow Velocity (ft/s)	
	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT
Southeast Corner	126.1	116.6	10.2	10.5	1.0	0.9	2.8	2.8
Southwest Corner	32.3	32.5	2.6	2.6	0.8	0.7	2.2	2.2
Northwest Corner	34.2	32.2	2.9	2.6	0.7	0.7	2.5	2.4

3.0 EROSION AND SEDIMENT CONTROL PLAN

This plan describes the design and operation considerations for erosion and sediment control measures specified and best management practices (BMPs) of the landfill facility in order to minimize erosion and provide effective erosional stability to top dome surfaces and external embankment side slopes during all phases of landfill operations in accordance with 30 TAC §330.305(d).

The plan layouts the erosion and sediment control measures for the three conditions of the Fort Bliss MSWLF: the active Subtitle D disposal areas, intermediate cover areas, and final cover areas. The installation of the proposed erosion and sediment control measures will be on going and include both temporary and permanent controls throughout the remaining duration of the landfill operation until closure is completed when all permanent controls are finally installed.

Landfill cover phases are defined as daily cover, intermediate cover, and final cover. The topography of the landfill changes over time as the landfill is operating and reaching closure grades. In order to comply with 30 TAC §330.305(d), top dome surfaces and external embankment side slopes are defined as areas of above graded slopes that drain to the existing perimeter drainage swale, areas that have received intermediate or final cover, and areas that have received their permitted elevation and will remain inactive for longer than 180 days. Slopes that drain to cells where waste is being placed are not considered external embankment side slopes.

Based on the above definitions, all areas of the Fort Bliss MSWLF will require erosion and sediment controls per 30 TAC §330.305(d) ~~with the exception of active internal slopes within Subtitle D cell where waste and daily cover are being placed~~. In addition, active internal slopes within the Subtitle D cell where waste and daily cover are being placed will require run-on and run-off controls per 30 TAC §330.305(b) and (e).

3.1 General Erosion and Soil Loss Assessment

Areas of the site most prone to erosion and soil loss are areas of soil disturbance for the landfill operations, areas with steep slopes for intermediate and final covers, and intermediate or permanent drainage swales that control stormwater discharges leaving the site. Therefore, the erosion and sediment control plan focuses on these sensitive areas and incorporates structural and non-structural controls to guard ~~again~~ against soil loss from site.

During a rain event, stormwater falls on the top dome and embankment side slopes of the landfill where erosion is more susceptible. In areas of steeper slopes and embankment side slopes, structural BMPs such as temporary soil berms and swales are proposed to control the runoff and minimize erosion. The following sections, accompanied by the Permit Modification Drawings in Appendix D (Design Drawings) describe the design for structural erosion control measures proposed to avoid erosion and off-site discharge of sediments during the phases of landfill operation through final closure. Maintenance and inspections are addressed in Section 3.4 of this report.

3.2 Interim Construction Stages

This sub-section describes temporary and intermediate erosion control measures that will be used during the landfill interim construction stages to minimize erosion of top dome surfaces and external embankment side slopes as required by 30 TAC §330.305(e)(2). The erosion control measures were selected and designed based on velocity and soil erosion analyses. The temporary erosion control measures shall remain in place until the final cover installation is completed and all permanent erosion control measures have been installed.

3.2.1. Description of Phase Development

Interim construction phases include filling of waste and daily cover grading in Subtitle D and placement of intermediate soil cover in Subtitled D. Sections 21 and 22 of the Fort Bliss Solid Waste Landfill Site Operating Plan (March 2008) describes measures to be implemented to comply with 30 TAC §330.305(b) and (e). Contaminated storm water as defined by 30 TAC §330.3(36) shall be managed in accordance with Section 23 of the Site Operating Plan. The phased development for landfill cell construction and solid waste placement will be followed as specified in the typical fill operation cross section detail on Sheet C-4 in Appendix D (Design Drawings) of the permit modification. This sequencing will ensure adequate slope stability and limited erosion and soil loss during cell construction and installation of the intermediate and final cover systems.

During filling operations through installation of the final cover, the top dome of the daily and intermediate cover for Subtitle D shall be sloped at 2.0% and the external embankment side slopes will be 4(H):1(V) as shown on Sheet C-4 in Appendix D (Design Drawings). Stormwater shall be controlled with temporary soil berms, and drainage swales to avoid erosion of the embankment side slopes and maintain flow velocities at or below the permissible non-erodible velocity.

The temporary soil berms will be used near the crest of the external embankment side slope to divert runoff to the swales, located ~~in~~ on the ~~northeastern~~ north and ~~southwestern~~ south ~~corners~~ sides of Subtitle D cell, as shown on Sheet C-5 in Appendix D (Design Drawings). The typical temporary soil berm design will be 2-foot high as measured from the invert of the channel to the top of berm, with the invert sloped at 0.5% minimum and 10% maximum in the direction of flow towards the drainage swales. The slopes of the soil berms will be stabilized with mulch or equal. (see Section 3.2.3 below)

Two swales will run along the existing Subtitle D cell access roads and will be constructed at the termination of the temporary soil berms as shown on Sheet C-4. The recommended minimum dimensions of the discharge swales are V-shaped, 1 to 1.5 feet deep with 10 (H): 1 (V) side slopes on side adjacent to access road and 4 (H): 1 (V) side slopes on opposite side. Stabilization of the swales shall be established using either Reno®Mattress, Armoflex®, riprap or equal.

The drainage swales will convey runoff off-site to the ~~existing~~ perimeter drainage ditches and out to the surrounding topography (not shown in the Appendix D drawings) at existing discharge points. Slopes of the topography surrounding the site are shallow with numerous low lying areas and small dunes topped with vegetation common to the semi-arid southwest. Surrounding topography generally slopes from northeast to southwest. Hydraulic analysis of the drainage swales is included in Attachment 1.

3.2.2. Erosion and Sediment Controls Design

The erosion and sedimentation controls described above where designed based on the following criteria outlined in 30 TAC §330.305(d), to ensure the stability of top dome surface and external embankment side slopes:

- The estimated peak runoff velocity should be less than the permissible non-erodible velocities under similar conditions. Typical permissible non-erodible flow velocities assumed for the design are:
  - Silty-sandy loam 3 ft/sec,
  - Coarse Gravels is 5 ft/sec,
  - 0.5 ft thick Reno®Mattress or Armoflex® 8 ft/sec

- The potential soil erosion loss should not exceed the permissible soil loss for comparable soil slope lengths and soil-cover conditions. The soil erosion loss of 50 tons/acre/year is selected as the permissible soil erosion loss for interim erosion and sediment controls.

Peak Runoff Velocities Calculations

To calculate the flow velocity being conveyed along the temporary soil berm and out the drainage swale as described above and shown on Sheet C-4 in Appendix D (Design Drawings), the interim peak discharge from watershed 7A, as shown on Sheet C-5, was calculated and is presented in Attachment 2. The worst case slope for a berm constructed on the top dome surface is a maximum anticipated slope of 0.5% on the daily and/or intermediate cover, resulting in a flow velocity along the temporary soil berm ~~is~~ of approximately 1.4 ft/sec. ~~on the top dome and~~ The worst case slope for a berm constructed along the external embankment is the maximum allowable berm slope of 10%, resulting in a flow velocity ~~through~~ along the temporary soil berm ~~along the embankment slope is~~ of approximately 6.9 ft/sec. Thereafter, the flow is conveyed through the permanent discharge swale ~~is~~ at its proposed slope of 1%, resulting in a flow velocity of approximately 3.9 ft/sec as calculated in section 3 and presented in Table 2-4 and Attachment 1.

Drainage and conveyance channels were designed and sized to withstand erosive forces of water and not to exceed the permissible non-erodible velocities presented in section 3.2.2 and summarized in Table 3-1.

Table 3-1:
Comparison of Calculated Flow Velocities and Permissible Non-Erodible Velocities

Type	Velocity	Permissible Non-Erodible Velocity
Temp. Soil Berm - Top Dome	1.4 ft/sec	3 ft/sec (silty-loam)
Temp. Soil Berm - off Subtitle D Embankment	6.9 ft/sec	8 ft/s (Reno®Mattress)
Drainage Swale off Landfill	3.9 ft/sec	5 ft/sec (gravel lined swale)

To further reduce flow velocities and allow sediments and other pollutants to settle, organic check dams will be installed at the discharge points from the drainage swales adjacent to Subtitle D as shown on Sheet C-5 in Appendix D (Design Drawings).

The hydraulic calculation supporting this design of the temporary soil berm and discharge swale is included in Attachment 2. The hydraulic calculation supporting the design of the permanent drainage swale is included in Attachment 1.

Soil Loss Calculations
Soil erosion loss was estimated utilizing the Revised Universal Soil Loss Equation Version 2 (RUSLE2). RUSLE2 uses factors that represent the effects of climate (erosivity, precipitation, and temperature), soil erodibility, topography, cover management, and support practices to compute soil loss and erosion.

RUSLE2 is a mathematical model that uses a system of equations implemented in a computer program to estimate erosion rates. The other major component of RUSLE2 is a database containing an extensive array of site/county specific values (precipitation, R, EL, etc.) that are used by the RUSLE2 user to describe a site-specific condition so RUSLE2 can compute erosion values that directly reflect conditions at a particular site. The RUSLE2 computer program and its extensive database information were developed by the USDA-Agricultural Research Service (ARS), USDA-Natural Resources Conservation Service (NRCS) and the University of Tennessee. The horizontal length of 1,000 feet at an average slope of 2.7% was calculated using the following flow segments from Sheet C-5: 250 feet at 0.5% (top dome); 205 feet at 10% (embankment); and 545 feet at 1% (swale).

Results show soil losses of 5.0 tons/acre/year. With the organic check dam installed at the discharge point of the drainage swale as a best management practice (BMP) for pollution prevention, the soil losses would be reduced to 2.4 tons/acre/year. The soil loss analyses demonstrate that proposed erosion and sedimentation controls can achieve effective erosional stability. Soil loss calculations are included in Attachment 2.

3.2.3 Soil Surface Stabilization – Interim Measures

The selected BMPs to be implemented during landfill operations, for soil stabilization and stormwater control, are ones that are proven and commonly used as described below.

Temporary stabilization of intermediate cover on top dome and external slopes will be completed within 180 days after installation and maintained until the final cover is placed and permanent stabilization controls implemented. Types of soil surface stabilization BMPs that will be implemented at the site are listed below:

The specific cover practices that will be implemented prior to installation of final closure:

- Mulch - Mulching is the application of a layer of organic, biodegradable material which is spread over areas where vegetation is not yet established. Types of mulch include compost, straw, wood chips, or manufactured products. Mulch application can be in dry or hydraulic forms. When applied dry, the thickness of the mulch will vary depending on the type of mulch applied. Primary-grind mulch (e.g. wood shreds that form a mass of intermixed fragments), which will be used primarily for erosion control, will be applied using spreading equipment, such as a bulldozer, at a minimum thickness of 2-inches. Compost material, which will consist of more finely ground mulch, will be applied using mechanical spreaders or sprayers. A tackifier or binder can be used to increase the strength and durability of the mulch. Hydraulic mulch applications consist of the use of hydromulch, bonded fiber matrix, Flexible Growth Medium (FGM), Flexterra®, as well as other commercially available products. Hydraulic mulch typically includes a tackifier or binder. Seeds can be applied to the soil first or mixed into the hydraulic mulch.

  The application method and application rate of hydraulic mulch will be based on manufacturers' recommendations to ensure a uniform and complete coverage. A specification of the Flexterra® product and Ecoblanket is included in Attachment 4. Any mulch (dry or hydraulic) that is used shall be evaluated by site personnel to ensure it remains in place on the slopes during rain events or windy conditions.

For erosion control in drainage swales as shown on Sheet C-5 in Appendix D (Design Drawings), rolled-erosion control products (RECPs) can be used and are specified herein. The standard specification for rolled erosion control products published by the Erosion Control Technology Council is provided in Attachment 4.

For pollution prevention, organic/biodegradable check dams (organic check dam) are specified. These types of silt control structures are alternatives of traditional silt fences and straw bales. Organic check dams may be Organic Filter Tube Check Dams or Organic Filter Berm Check Dams. A typical biodegradable tube consists of mulch contained in a synthetic mesh sock or tube. The tubes are installed on the slope with stake anchors. Organic berms are typically constructed of compost/mulch. A specification for the organic check dam, published by the TCEQ, is included in Attachment 4.

For on-site stockpiles, some combination of silt fences, rock berms or soil berms will be required around the stockpiles to prevent the discharge of sediment-laden runoff from the stockpile area(s) unless vegetation is used to stabilize the stockpiles.

3.3 Final Cover Stage

Permanent erosion and sediment controls measures will be installed during the final cover phase, detailed on Sheet C-5 in Appendix D (Design Drawings) of the permit modification. These permanent erosion and sedimentation control measures include an erosion control layer (e.g topsoil and 1"-4" cobbles and drainage. Details of the measures are shown on Sheet C-5 in Appendix D (Design Drawings).

3.3.1 Erosion and Sedimentation Controls Design

The permanent erosion and sediment control measures were designed based on the peak flow velocities presented in Table 2-4 and soil loss analysis discussed below for the final cover design.

Peak Runoff Velocities Calculations
The flow velocity through the drainage swales where calculated in Section 2.3 and presented in Table 2-4. The drainage swales will have erosion control lining as specified on the drawings and therefore was compared to the permissible non-erodible velocity of 5 ft/sec. All the velocities presented in Table 2-4 compared to the permissible erodible velocities presented in Table 3-1 illustrate that the drainage and conveyance channels were designed and sized to withstand erosive forces of water and not to exceed the permissible non-erodible velocity of 3 ft/sec in the drainage ditch and 5 ft/sec in the drainage swales.

Soil Loss Calculations
RUSLE2 is a mathematical model was exercised to compute the soil loss analysis for the final cover surfaces. The Subtitle D area final cover slopes were analyzed: 250 feet at 2% (top dome); 95 feet at 25% (embankment); and 655 feet at 1% (swale). The input data for management operations have been changed: riprap fill on the top surfaces of Subtitle D area added, etc. The results show soil losses of 4.9 tons/acre/year and reduction to 2.2, because of erosion control measures for Subtitle D cell. The soil loss analysis demonstrates that the landfill surfaces with proposed erosion and sedimentation controls can achieve recommended soil loss rate. (According to *Guidance for Addressing Erosional Stability During all Phases of Landfill Operation*, 30 TAC §330.63(c), §330.305(c), (d) and (e), 02/14/07, the soil erosion loss of 50 tons/acre/year is a permissible soil erosion loss rate and 2 to 3 tons/acre/year is a recommended rate for final cover phase).

Erosion calculations report is included in Attachment 3.

Based on velocity and soil erosion analyses, selections of BMPs are identified and general installation guidance is provided on Sheet C-3 and C-5 in Appendix D (Design Drawings) of the permit modification.

3.3.2 Soil Surface Stabilization – Permanent Measures

The selected BMPs that will be implemented for final cover and post closure landfill operations, to meet the soil stabilization and stormwater control requirements, are ones that are proven and commonly used as described below.

- Vegetation - Vegetative cover reduces erosion potential by shielding the soil surface from the direct erosive impact of raindrops, improving the soil's water storage porosity and capacity, so more water can infiltrate, slowing the runoff and allowing the sediment to drop out, and physically holding the soil in place with plant roots. Vegetative cover will consist of a balanced mixture of native herbaceous and vascular plants. Dr. Rafael Corral of the Fort Bliss Environmental Division and Leah Markiewitz with Zia provided an optimum vegetative design to utilize indigenous species of the area such as alkali sacaton and sand dropseed. This type of vegetation more suitable for the area and was selected in accordance with guidelines published by the state and other similar sources. The standard seeding specification published by the Texas Department of Transportation (TxDOT) is provided in Attachment 4.

- Erosion control protection such as rip rap or geosynthetic erosion control material will be installed in the swales as determined by Fort Bliss at the time of closure.

4.0 MAINTENANCE AND INSPECTIONS

In addition to the design and operational considerations as previously described in the Erosion and Sedimentation Control Plan, inspection and maintenance of the stormwater management system and erosion control measures are necessary to maintain the required effectiveness of the system components. The inspection, maintenance, and repair guidelines discussed in the following sections will be implemented into the employee training program as outlined in Site Operating Plan and Stormwater Pollution Prevention Plan ~~2005~~ 2011.

4.1 Stormwater Management System

The facility will be monitored to ensure the integrity and adequate operation of the stormwater collection and conveyance structures. On a weekly basis, and following major storm events, all temporary and permanent drainage facilities will be inspected. In the event of a washout or failure, the drainage system will be restored and repaired pursuant to 30 TAC §330.305(e) (1). Plans and actions will be developed to address and remediate the problem, to ensure protection to ground and surface waters.

Erosion of intermediate and final cover will be repaired pursuant to 30 TAC §330.165(g). Sediment and debris will be removed from ditches as needed to maintain the effectiveness of the stormwater management system. Minor maintenance requirements, such as the removal of excessive sediment and vegetation, will be undertaken as required.

In accordance with 30 TAC §330.305(g), Stormwater Pollution Prevention Plan ~~2005~~ 2011, describes inspections, maintenance, and record keeping frequencies and techniques for the phased development of the landfill. The plan discusses how the owner or operator will handle, store, treat, and dispose of surface or groundwater that has become contaminated by contact with the working face of the landfill or with leachate pursuant to §330.207 of this title (relating to Contaminated Water Management); and how storage areas for this contaminated water will be designed with regard to size, locations, and methods.

A Storm Water Pollution Prevention Plan was prepared for the site in ~~2005~~ 2011. The plan satisfies the control of erosion and sedimentation using interim controls for the phased development of the landfill as required by 30 TAC §330.63(c) (1) and §330.305(c), (d), and (e) until the landfill is closed per the regulations.

4.2 Landfill Cover Materials

Landfill cover soils are inspected on a regular basis. Daily cover soils are inspected and applied as part of the Site Operating Plan requirements. In addition, pursuant to the facility's SWPPP, during the active life of the site, daily, intermediate and final cover will be inspected weekly and after a significant rainfall event for areas of erosion, exposed waste, or other damage. During the post-closure maintenance period of the site, the final cover will be inspected quarterly. The inspections will include any temporary or permanent erosion measures that are in place at the time of the inspection.

Reports of these inspections will be documented in the Cover Application Log and will be maintained as part of the site operating record, in accordance with the Site Operating Plan. Damage to the cover system noted during these inspections will be repaired, as set forth below, and documented in the Cover Application Log. Any runoff from damaged or eroded areas that has met waste will be handled as contaminated water in accordance with site operating plan until the repairs are completed.

In accordance with 30 TAC §330.165(g), erosion gullies or washed-out areas deep enough to jeopardize the intermediate or final cover must be repaired within five days of detection. An eroded area is considered deep enough to jeopardize the intermediate or final cover if it exceeds four inches in depth as measured from the vertical plane from the erosion feature and the 90-degree intersection of this plane with the horizontal slope face or surface. Damage to any temporary or permanent erosion measures that are noted during the inspections, will be repaired or replaced within 14 days of detection. The repair schedule as outlined for the cover or the erosion measures may be extended due to inclement weather conditions or the severity of the condition requiring an extended repair schedule.

5.0 ATTACHMENTS

ATTACHMENT 1 – Peak Discharge Flow Sample Calculations Using Rational Method and Drainage Swale Design

ATTACHMENT 2 – Intermediate Erosion and Soil Control Design Calculations (Peak Runoff Velocity, Channel Design, and Soil Loss)

ATTACHMENT 3 – Final Erosion and Soil Control Design Calculations (Soil Loss)

ATTACHMENT 4 – Erosion and Soil Control Measures Specifications Information

ATTACHMENT 5 – ~~2005~~ 2011 Stormwater Pollution Prevention Plan (For Reference Only. Prepared by ~~U.S. Army Center for Health Promotion and Preventive Medicine.~~ Fort Bliss Directorate of Public Works, Environmental Division, Storm Water Compliance)

ATTACHMENT 6 – Geohydrologic Site Characterization of the Municipal Solid Waste Landfill Facility, U.S. Army Air Defense Artillery Center and Fort Bliss, El Paso County, Texas

Insert Page Into Attachment 2

Perimeter Ditch Hydraulic Analysis
25-Year Storm Event

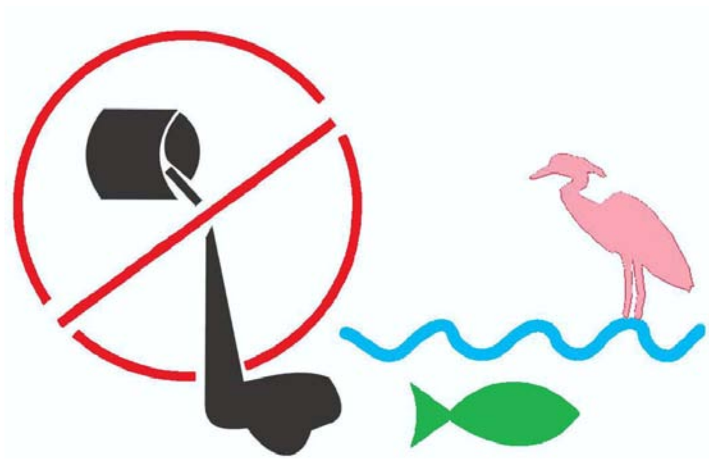
Ditch	Contributing Watersheds	Slope (ft/ft)	Manning Roughness, n	Side Slope 1 (z1:1)	Side Slope 2 (z2:1)	Bottom Width (ft)	Depth (ft)	Area (ft2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Avg Velocity (ft/s)	Flow (cfs)
North	2, 3, 7, 8	0.0025	0.022	4	4	14.00	0.90	15.87	21.43	0.74	2.77	44.00
East	2, 3, 7, 8, 9, 12, 16, 17	0.0025	0.022	4	4	30.00	0.81	26.97	36.69	0.74	2.76	74.40
South	15	0.0025	0.022	4	4	14.00	0.88	15.43	21.26	0.73	2.73	42.20
South West	14	0.0025	0.022	4	4	10.00	0.43	5.07	13.56	0.37	1.76	8.90
West	4, 10, 11, 13	0.0025	0.022	4	4	10.00	0.91	12.38	17.49	0.71	2.69	33.30
North West	1, 5, 6	0.0025	0.022	4	4	10.00	0.73	9.45	16.03	0.59	2.38	22.50

ATTACHMENT 5

~~2005~~ 2011 Stormwater Pollution Prevention Plan

(For Reference Only. Prepared by ~~U.S. Army Center for Health Promotion and Preventive Medicine.~~ Fort Bliss Directorate of Public Works, Environmental Division, Storm Water Compliance)

STORM WATER POLLUTION PREVENTION PLAN CALENDAR YEAR 2011 FORT BLISS, TEXAS



Directorate of Public Works
Environmental Division
Storm Water Compliance
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FINAL
January 2011

APPENDIX C-8

Appendix Q – Evapotranspiration Cover Design Report [redline]

EVAPOTRANSPIRATION COVER DESIGN REPORT

FORT BLISS DESIGN AND PERMIT MODIFICATION APPLICATION BLISS-A10-001

~~May, 2011~~ Revised December 2011

zia engineering & environmental consultants, llc

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Texas Board of Professional Engineers Certificate of Registration #F-11907

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INTRODUCTION

The purpose of report is to present the approach and methodologies used during the design of the proposed evapotranspiration (ET) final cover system for the Fort Bliss Municipal Solid Waste Landfill (MSWLF). The MSWLF consists of the following distinct areas:

- An active ~~10.6~~ 10.5-acre Type Subtitle D Cell
- A closed 3-acre Type 1 Non-Subtitle D cell (TCEQ closure approval received February 24, 1999)
- An active 5-acre Type IV C&D cell
- Approximately ~~83~~ 80 acres of previously filled and closed areas
- Approximately 7 acres designated for landfill roads, access areas, and guard shack / scale house, etc.

Based on capacity estimations performed by Zia Engineering and Environmental Consultants (Zia) and current disposal rates provided by the Fort Bliss Environmental Division, the Subtitle D cell is expected to reach its capacity in the second quarter of FY 2012. At that time, the Subtitle D cell will be closed, followed shortly thereafter by the Type IV C&D cell. The permitted closure design for the Subtitle D Cell, the C&D Cell, and the previously filled and closed areas includes an 18 inch thick prescriptive layer with low permeability soil (i.e. clay) that is not readily available in the area and would need to be imported at a considerable expense.

The purpose of the proposed ET final cover system is to create a more cost-effective and sustainable landfill cover alternative that is equally protective of human health and the environment as the prescriptive closure design. The proposed ET cover system will utilize readily available fill material located on-site to create a layered soil cover designed to optimize water storage and evapotranspiration. This report discusses the feasibility and preliminary design requirements of an ET cover system at Fort Bliss and presents a demonstration of its performance.

The proposed ET cover system was designed in accordance with the draft Texas Commission on Environmental Quality (TCEQ) document Guidance for Requesting a Water Balance Alternative Final Cover for a Municipal Solid Waste Landfill (guidance document), revised November 17, 2010.

FEASIBILITY

According to the United States Environmental Protection Agency Fact Sheet on Evapotranspiration Cover Systems for Waste Containment, evapotranspiration cover systems are increasingly being considered for use at waste disposal sites in arid regions when equivalent performance to conventional final cover systems can be demonstrated. The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for considering alternative landfill designs. Additionally, over 60% of the precipitation in the El Paso region is received during the growing season, between March and August.

Numerous species of indigenous herbaceous and vascular vegetation inhabit the native soils at Fort Bliss. As such, the utilization of local soils stockpiled on-site and native plant species bodes well for the successful performance of an ET cap. Additionally, a balanced seed design of both herbaceous and vascular native plants has been chosen in an effort to promote and sustain evapotranspiration throughout the year.

During preliminary research, Malcolm Pirnie (MP) found that the Interstate Technology and Regulatory Council (ITRC) document titled Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers (December 2003) states that a range of 75%-85% compaction is best for ET cover systems. Hydraulic laboratory testing of the native material stockpiled on-site at 75% and 80% compaction was performed in December of 2008 by AMEC and indicates adequate water retention and saturated hydraulic conductivity parameters for use in an ET cover system, with a plant-available water content (difference between water content at field capacity and at wilting point) of 0.3. Additionally, a substantial portion of the landfill area currently contains in excess of 1.5-feet of interim cover material that will be incorporated into the ET cover system as supplemental intermediate cover material.

DESCRIPTION OF PROPOSED DESIGN

The proposed ET cover system, shown in **Figure 2**, will consist of a 3.5-foot layered soil cap and include the following components (from top of cover to top of waste):

- 12-inch thick Vegetative Surface Layer, consisting of stock-piled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer will serve as a medium for seed germination and plant growth as well as provide protection against erosion and desiccation.
- 12-inch thick Storage Layer, consisting of stock-piled SM material also compacted to 75% of the Modified Proctor maximum dry density (ASTM D 1557). The Storage Layer will provide approximately 11.3 cm of storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials.
- 6-inch thick Capillary Break Layer, consisting of well-graded, fine to coarse grained sand. Installation of the Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break due to the difference in the hydraulic conductivities of the two layers. The additional water stored within the Storage Layer will help promote the establishment and development of the surface vegetation. The increased vegetative cover will contribute to greater ET and reduce surface erosion from both wind and rain.
- 12-inch thick Intermediate Cover Layer, consisting of existing cover material and/or additional stock-piled SM material compacted to approximately 75% of the Modified Proctor maximum dry density (ASTM D 1557). The Intermediate Cover Layer will provide approximately 11.3 cm of additional water retention storage volume.

COMPUTER MODELING

The performance of the proposed ET cover system was predicatively modeled using UNSAT-H version 3.01 software, which is managed by the Hydrology Group at the Pacific Northwest National Laboratory. UNSAT-H is a one-dimensional model that simulates soil water infiltration, redistribution, evaporation, plant transpiration, and deep drainage. UNSAT-H is commonly used to evaluate and optimize performance of barrier designs. The following sections summarize input parameters, the source of those parameters, and major assumptions made in modeling the proposed ET cover system.

Options, Constants, and Limits

The input parameters noted below define the modeling period, the components of groundwater flow to be modeled, and the solution methods.

- IPLANT: The plant option was selected to include plants, as transpiration will be a critical component of the performance of the proposed ET cap system.
- NGRAV: The model was given a vertical orientation to model vertical infiltration through the proposed ET cap system
- IFDEND, IDTBEG, and IDTEND: The ending day of the simulation and the number of days that weather data was provided annually was set at 365.
- IYS and NYEARS: The model was set to run for a 30-year period. The first year of the simulation was set as 1981.
- ISTEAD: The model was set to solve in transient mode, utilizing variable historical weather data.
- NPRINT: The level of output was set for end of day and end of simulation summaries.
- ISMETH: The Crank-Nicholson solution method was specified based on guidance from the Pacific Northwest National Laboratory.
- KOPT: Soil hydraulic properties were defined by the van Genuchten parameters.
- KEST: The arithmetic mean was selected to calculate liquid conductivity at the midpoint between nodes.
- ITOPBC and LOWER: A flux surface boundary and unit gradient lower boundary condition was specified.
- IEVOPT and NFHOUR: The evaporation option was selected as evaporation will be a critical component of the performance of the proposed ET cap system. The option to generate hourly factors from a sine wave function for distribution of daily potential evapotranspiration was selected to calculate the surface boundary condition.
- HIRRI and HDRY: Minimum and maximum heads to which the soil can wet up and dry out were defined as 1 and 1 x 10^6 cm, respectively.
- RHA, IETOPT, ICLOUD, and IRAIN: Daily meteorological data from the National Oceanic and Atmospheric Administration (NOAA) was provided for the model.

Daily solar radiation values were synthetically generated using the Hydrologic Evaluation of Landfill Performance (HELP) model. Average relative humidity was also obtained from the HELP model for the El Paso, Texas region.

- IHYS and IHEAT: Hysteresis and heat flow were not simulated.
- IVAPOR: The option to model vapor flow was selected. Fayer and Gee (2004) have documented that vapor flow is a necessary process to be included in simulations of drainage in sandy soil in arid and semiarid climates.
- MATN: Four soil layers were modeled, as previously described in the Description of Proposed Design section.

Soil Property Information

Composite soil samples were collected in December of 2008 by AMEC from the stockpiled material on-site for hydraulic laboratory testing by TRI Environmental Inc. in order to evaluate its water retention and saturated hydraulic conductivity parameters. The ITRC states that a range of 75%-85% compaction is best for ET cover systems. As such, the soil was prepared at 75% of the Modified Proctor (MP) maximum dry density (ASTM D 1557) for laboratory testing. The 75% compaction material was specified for the surficial Vegetative Surface Layer to promote vegetative growth, for the Storage Layer to increase water retention capacity, and the Intermediate Cover Layer to conservatively estimate the existing conditions of the interim cover material. Compaction requirements were based on the Modified Proctor maximum dry density to more accurately simulate compaction of the landfill area by modern construction equipment and methods. It should be noted that, due to the low fines content of the available fill on-site, minimal variance (i.e. 5%) between the Standard and Modified Proctor maximum dry densities is expected. As such, estimated equivalent compaction requirements based on the Standard Proctor maximum dry density (i.e. 80%) can be specified as well. Hydraulic properties of the Capillary Break Layer were estimated using typical parameter values of van Genuchten models for sand from Leij, Alves, and van Genuchten (1996).

The Mualem-van Genuchten conductivity model was used with an exponent of the pore interaction term of 2, as recommended in the UNSAT-H User's Manual. The hydraulic properties of the proposed ET cover system materials are summarized below. Laboratory data is included in Appendix A.

Layers 1 and 2 – Stockpiled SM Material at 75% MP Compaction Density

- THET - Saturated water content: 0.372
- THTR – Residual water content: 0.1025
- VGA – Van Genuchten α coefficient: 0.020
- VGN - Van Genuchten n coefficient: 1.560
- SK – Saturated hydraulic conductivity: 0.504 cm/hr (1.4 x 10^{-4} cm/sec)

Layer 3 – Capillary Break Layer of Well-Graded Clean Sand

- THET - Saturated water content: 0.43
- THTR – Residual water content: 0.045
- VGA – Van Genuchten α coefficient: 0.145

- VGN - Van Genuchten n coefficient: 2.68
- SK – Saturated hydraulic conductivity: 29.7 cm/hr (8.25 x 10^{-3} cm/sec)

Layer 4 – Stockpiled SM Material and Regraded Intermediate Cover Material at 75% MP Compaction Density

- THET - Saturated water content: 0.372
- THTR – Residual water content: 0.1025
- VGA – Van Genuchten α coefficient: 0.020
- VGN - Van Genuchten n coefficient: 1.560
- SK – Saturated hydraulic conductivity: 0.504 cm/hr (1.4 x 10^{-4} cm/sec)

Initial Conditions

Initial suction head values were estimated using the soil water characteristic curves generated during hydraulic laboratory testing. The suction head values, summarized below, assume that the soil will be placed with ±2% of the optimum water content for the given compaction requirements.

- Layer 1 and 2: 1.0 x 10^4 cm
- Layer 3: 1.0 x 10^2 cm
- Layers 4: 1.0 x 10^4 cm

Plant Information

Transpiration will be a contributing component of the performance of the proposed ET cover system. For the purposes of this preliminary ET model, a conservative 10% coverage of vegetative growth over the area was assumed. Vegetative growth of the final design of the proposed ET cover system will consist of a balanced mixture of native herbaceous and vascular plants. Dr. Rafael Corral of the Fort Bliss Environmental Division and Leah Markiewitz with Zia provided an optimum vegetative design to utilize indigenous species of the area such as ~~alkali sacaton~~ mesa dropseed and ~~sand dropseed~~ red threeawn.

~~For the purposes of this preliminary ET model, a conservative 10% coverage of vegetative growth over the area was assumed.~~ The plant information for mesa dropseed and red threeawn required for UNSAT-H simulations was not readily available through our research efforts. Due to the difficulty in finding root data, the rooting depth of the indigenous species in our vegetative design was estimated using seasonal cheatgrass data published by Harris (1967). Cheatgrass contains very shallow, fibrous roots which makes it an ideal plant choice for plant growth with a shallow soil depth requirement. The indigenous species mentioned above were chosen due to their similar fibrous roots and fairly shallow growth patterns described through the studies of Robert P. Gibbens and James M. Lenz (2001) at the Jornada Experimental Range in Las Cruces, New Mexico (**Figure 1**). Additionally, these plants extend out horizontally which will allow for additional erosion control (Gibbens & Lenz, 2001) (**Figure 2**). Due to the rooting similarities, our vegetative experts felt using cheatgrass plant information for the purposes of modeling transpiration was a reasonable choice considering the limited plant information available.

~~The rooting depth of cheatgrass is very similar to the native species of grass found at Fort Bliss as shown in **Figure 1**.~~

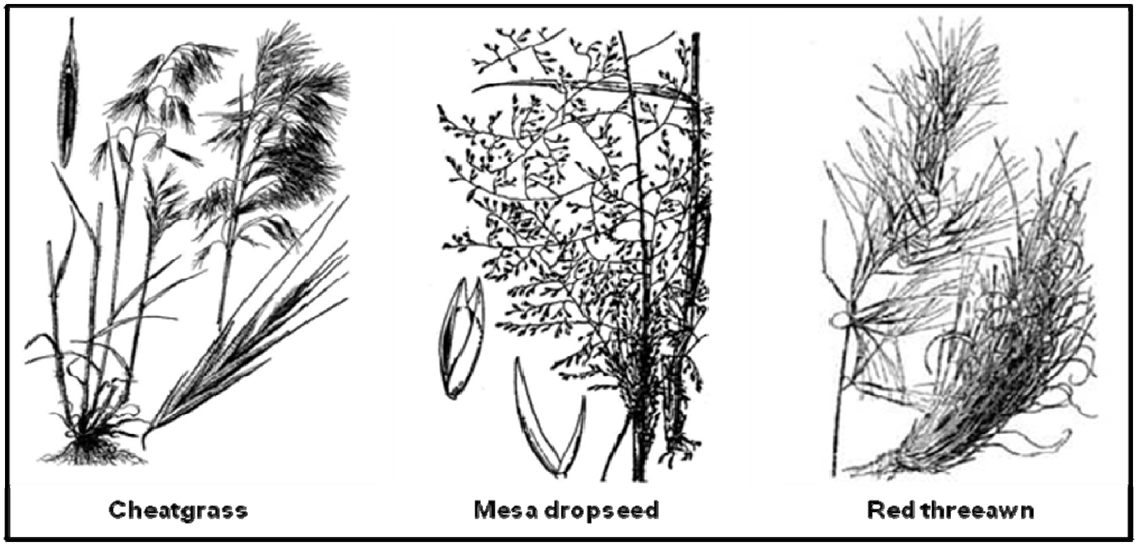


Figure 1: Rooting Depth Comparison

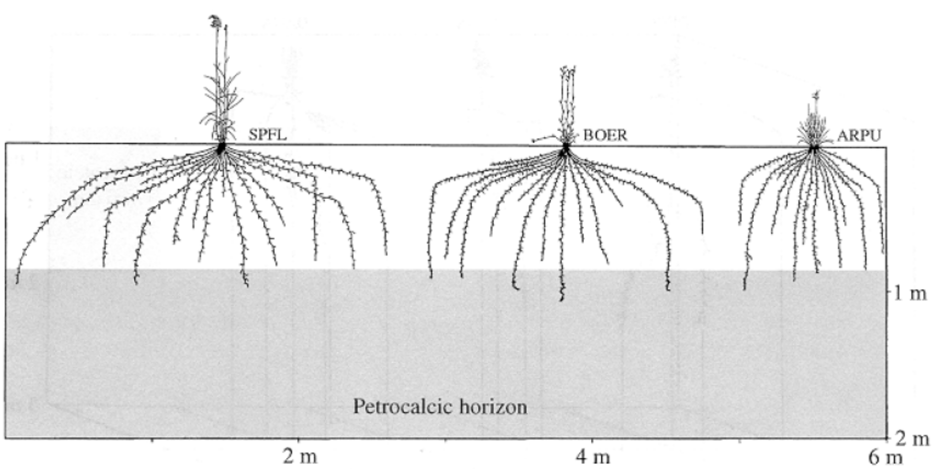


Figure 1. Mesa dropseed and red threeawn rooting system

Potential transpiration and evaporation were generated from empirical cheatgrass data published by Hinds (1975). The HELP model was consulted to define the growing season of the El Paso region, between March and August. The HELP model was also consulted to define the plant water uptake parameters. The influence of landfill gas on vegetative growth was modeled by limiting maximum root growth to within the top 12-inches of the Vegetative Support Layer only.

Boundary Conditions

The boundary conditions required for the model include general site-specific data and daily meteorological data. Daily meteorological input data includes maximum and minimum temperature, dew point, solar radiation, average wind speed, cloud cover, and daily precipitation. Data was obtained for the El Paso International Airport weather station from the National Oceanic and Atmospheric Administration (NOAA). The El Paso International Airport weather station is located approximately 4.4 nautical miles south of the landfill.

DEMONSTRATION OF PERFORMANCE

The TCEQ set two performance criteria for the demonstration of performance of an ET cover system, as summarized below:

- Less than 4 millimeters per year of drainage from the base of the ET cover system
- Modeled runoff less than 10% of the annual water applied.

Table 1 summarizes annual results of the 30-year simulation of the proposed ET cover system. It should be noted that the model is conservative in that transpiration was modeled based on 10% coverage of vegetative growth and incorporates influences of landfill gas. The data presented in **Table 1** demonstrates that the proposed ET cover system meets the TCEQ drainage performance criteria over the 30-year modeling period. Furthermore, the model's performance over years 24 through 28, which on average received 40% more precipitation than the annual average, demonstrate the ability of the proposed cover system to perform under variable weather conditions. The runoff ratio exceeds the TCEQ Performance Criteria of 10% by 1% during the floods of 2006, but it should be noted that 2006 was the wettest year on record in the El Paso region.

Figure 3 shows the annual storage requirement of the proposed ET cover system compared to the available storage capacity of the cover system design. It can be seen that the annual storage requirement never exceeds 53% of the overall storage capacity.

The sensitivity of the model was evaluated by varying ~~various~~ input parameters, including time-stop factors; initial suction head conditions, and solution types. Layer thicknesses were also varied in order to develop the proposed cover system design. Once the optimum layer thickness and compaction requirements were determined, additional simulations were run at varying compactions to identify a range of acceptance during construction (Additional simulations are a). Parameter values of native soil were interpolated using known data for 75% and 80% compaction and simulations were run at 73% and 77% compaction (Interpolation results are attached). Results for 73% compaction consistently meet drainage Performance Criteria and meet the runoff Performance Criteria in 26 of the 30 years. Results for 77% compaction meet drainage Performance Criteria in 28 of the 30 years and meet the runoff Performance Criteria in 29 of the 30 years. These results provide significant confidence in the performance of the cap over a ±2% compaction range. QA/QC procedures requiring the evaluation of material prior to use and compaction testing after placement on the cap will ensure native soil used in the construction of the ET Cap meets the requirements set forth in this document. The performance of the cover system design presented in this Preliminary Design Report was determined to be stable with respect to variable non-boundary condition and/or initial condition input parameters. The design-specific input parameters were conservatively developed to accurately portray the anticipated conditions during the construction and performance of the cover system.

ATTACHMENTS

Table 1 – Proposed ET Cover System Performance Demonstration Summary

Figure 2 – Schematic of Proposed ET Cover System
Figure 3 - Storage Requirement / Capacity Comparison

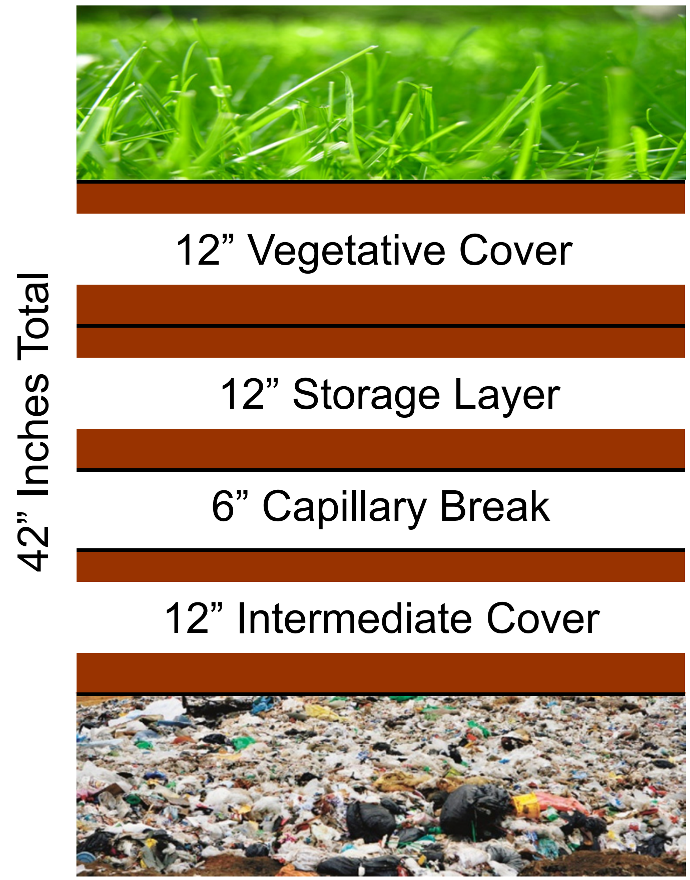
Appendix A - UNSAT-H Input File
Appendix B - UNSAT-H Output Data
Appendix C - Hydraulic Parameter Lab Testing Data
Appendix D - Meteorological Data
Appendix E –Additional UNSAT-H Simulations

Table 1 - Proposed ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	13.62					
1	32.08	239.94	0.13	27.34	2.16	0.80	0.02	38.39	15.36	40%	0.00	19846.00	0.05	0.05
2	27.86	236.06	0.12	21.79	1.53	1.69	0.06	38.39	18.19	47%	0.00	18506.00	0.03	0.03
3	20.30	230.27	0.09	21.55	1.98	0.00	0.00	38.39	14.93	39%	0.00	18549.00	0.02	0.02
4	41.07	218.38	0.19	34.92	1.73	1.56	0.04	38.39	17.75	46%	0.00	18898.00	0.03	0.03
5	20.73	189.15	0.11	21.45	1.59	0.00	0.00	38.39	15.43	40%	0.00	18520.00	0.01	0.01
6	30.91	196.27	0.16	27.33	1.52	0.29	0.01	38.39	17.19	45%	0.00	19594.00	0.02	0.02
7	27.79	207.25	0.13	23.57	2.07	0.35	0.01	38.39	18.96	49%	0.00	19035.00	0.03	0.03
8	28.09	211.76	0.13	29.72	1.74	0.00	0.00	38.39	15.57	41%	0.00	19033.00	0.02	0.02
9	18.44	224.97	0.08	17.47	1.86	0.07	0.00	38.39	14.59	38%	0.00	18256.00	0.03	0.03
10	32.64	226.79	0.14	29.02	1.30	0.14	0.00	38.39	16.74	44%	0.00	18876.00	0.03	0.03
11	31.45	224.82	0.14	26.77	1.75	0.54	0.02	38.39	19.10	50%	0.00	19668.00	0.03	0.03
12	28.96	225.83	0.13	28.60	2.07	0.84	0.03	38.39	16.54	43%	0.00	19736.00	0.00	0.00
13	24.46	239.48	0.10	23.36	1.94	0.00	0.00	38.39	15.68	41%	0.00	18990.00	0.02	0.02
14	13.92	251.76	0.06	12.19	2.13	0.00	0.00	38.39	15.24	40%	0.00	17218.00	0.04	0.04
15	15.39	248.49	0.06	14.60	1.22	0.01	0.00	38.39	14.78	38%	0.00	17676.00	0.02	0.02
16	21.31	260.54	0.08	19.60	1.51	0.06	0.00	38.39	14.90	39%	0.00	17986.00	0.02	0.02
17	24.46	226.38	0.11	21.28	2.22	0.00	0.00	38.39	15.82	41%	0.00	19257.00	0.05	0.05
18	17.20	236.93	0.07	16.02	1.60	0.01	0.00	38.39	15.35	40%	0.00	17984.00	0.03	0.03
19	20.73	238.02	0.09	18.66	1.45	0.00	0.00	38.39	15.94	42%	0.00	17395.00	0.03	0.03
20	18.82	240.07	0.08	17.55	1.84	0.15	0.01	38.39	15.20	40%	0.00	17900.00	0.03	0.03
21	10.90	240.84	0.05	10.79	1.43	0.00	0.00	38.39	13.85	36%	0.00	17090.00	0.03	0.03
22	17.50	241.24	0.07	15.00	1.38	0.00	0.00	38.39	14.93	39%	0.00	17989.00	0.04	0.04
23	10.69	251.67	0.04	10.47	1.65	0.00	0.00	38.39	13.48	35%	0.00	16736.00	0.02	0.02
24	30.99	236.19	0.13	24.93	2.17	0.16	0.01	38.39	17.15	45%	0.00	17776.00	0.07	0.07
25	32.69	238.22	0.14	29.67	2.27	1.83	0.06	38.39	16.05	42%	0.00	18639.00	0.03	0.03
26	44.48	260.38	0.17	35.82	1.92	5.08	0.11[3]	38.39	17.62	46%	0.05	18698.00	0.03	0.09
27	25.71	241.12	0.11	23.59	2.33	0.08	0.00	38.39	17.12	45%	0.16	18651.00	0.04	0.20
28	25.02	255.25	0.10	23.36	1.32	0.53	0.02	38.39	16.81	44%	0.11	18361.00	0.01	0.12
29	22.05	244.94	0.09	18.77	1.76	0.14	0.01	38.39	18.09	47%	0.08	17683.00	0.03	0.11
30	16.94	240.72	0.07	17.16	1.94	0.00	0.00	38.39	15.86	41%	0.06	18245.00	0.02	0.08
SUM=	733.55	7023.70		662.31	53.35	14.33					0.45		0.88	

Notes:
1. TCEQ Performance Criteria Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria Runoff less than or equal to 10% total water applied
3. This value excceeds the TCEQ Performance Criteria of 10%, but it should be noted that 2006 was the wettest year on record in the El Paso region.

Figure 2 - Optimized Evapotranspiration Cover System Cross-section



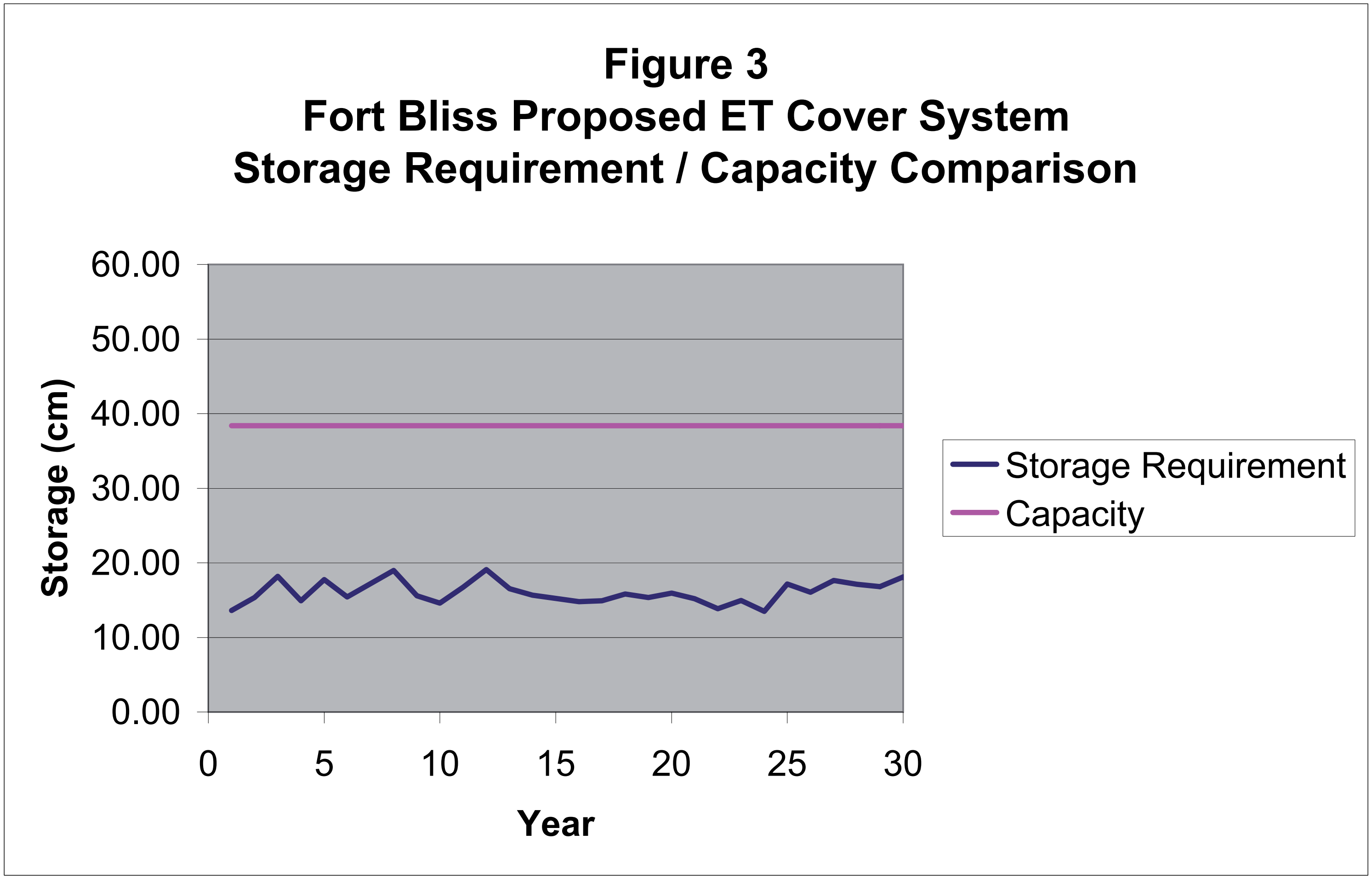


Figure 3
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Storage (cm)
0
5
10
15
20
25
30
Year
Storage Requirement
Capacity

APPENDIX A

UNSAT-H INPUT FILE

```
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1.0,1.0E-8,0.0,                 DELMAX,DELMIN,OUTTIM
1.5,1.00E-05,0,0,0,             RFACT,RAINIF,DHTOL,DHMAX,DHFACT
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0,1,2,1,                        ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,          HIRRI,HDRY,HTOP,RHA
1,1,1,                          IETOPT,ICLOUD,ISHOPT
1,1.0,                          IRAIN,HPR
0,0,0,0,0,                      IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                          IHEAT,CONVH,DMAXHE
0,0,0,0,                        UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                          LOWERH,QHLEAK,TGRAD
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3,91.44,3,96.52,3,101.6,3,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 2 80 compaction of silty sand SM water retention parameters
0.329,0.163,0.010,2.180,                  THET, THTR, vGA, vGN
Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
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Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
0.430,0.045,0.145,2.68,                   THET, THTR, vGA, vGN
Layer 4 clean sand hydraulic conductivity parameters
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220.0,                          BIOMAS
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```

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APPENDIX E

ADDITIONAL UNSAT-H SIMULATIONS

UNSAT-H Variable	Compaction % Modified Proctor			
	73%	75%	77%	80%
THET	0.381	0.372	0.3548	0.329
THTR	0.783	0.1025	0.1267	0.163
VGA	0.024	0.02	0.016	0.01
VGN	1.312	1.56	1.808	2.18
RKMOD	2	2	2	2
SK	0.67	0.504	0.338	0.036
VGA	0.24	0.02	0.016	0.01
VGN	1.312	1.56	1.808	2.18
EPIT	0.5	0.5	0.5	0.5

```
FTBLISS
1,1,                          IPLANT,NGRAV
365,1,365,                    IFDEND,IDTBEG,IDTEND
1981,30,0,2,30,               IYS,NYEARS,ISTEAD,IFLIST,NFLIST
0,0,                          NPRINT,STOPHR
0,3,1,1.00E-4,                ISMETH,INMAX,ISWDIF,DMAXBA
1.0,1.0E-8,0.0,               DELMAX,DELMIN,OUTTIM
1.5,1.00E-05,0,0,0,           RFACT,RAINIF,DHTOL,DHMAX,DHFACT
4,1,0.5,                      KOPT,KEST,WTF
0,1,2,1,                      ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,        HIRRI,HDRY,HTOP,RHA
1,1,1,                        IETOPT,ICLOUD,ISHOPT
1,1.0,                        IRAIN,HPR
0,0,0,0,0,                    IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                        IHEAT,CONVH,DMAXHE
0,0,0,0,                      UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                        LOWERH,QHLEAK,TGRAD
1,0.66,291.0,0.239,           IVAPOR,TORT,TSOIL,VAPDIF
4,24,                         MATN,NPT
2,0.00,2,1.00,2,2.00,2,3.00,  MAT,Z
2,4.00,2,5.08,2,10.16,2,20.32,
2,30.48,2,35.56,2,40.64,2,45.72,
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4,71.12,4,76.20,2,81.28,2,83.36,
2,91.44,2,96.52,2,101.6,2,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 2 73 compaction of silty sand SM water retention parameters
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Layer 2 73 compaction of silty sand SM hydraulic conductivity parameters
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Layer 3 75 compaction of silty sand SM water retention parameters
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Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
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Layer 4 clean sand hydraulic conductivity parameters
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0.90,                   BARE
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Created using BSUM Version 3.01; all units are cm
First file in series is 73%COM1981.res

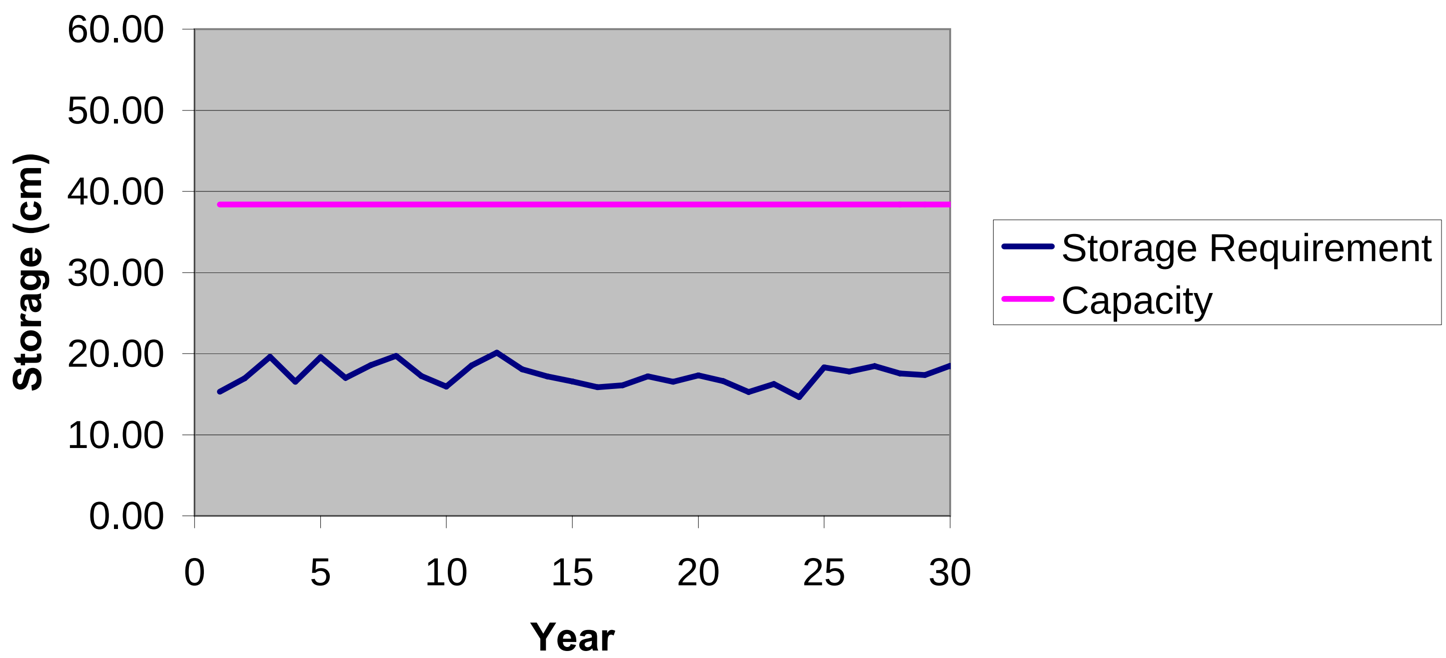
Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							15.305		
1	32.080	239.938	1.920	26.246	2.216	0.000	16.951	20337	0.05147
2	27.864	236.062	1.340	20.268	3.574	0.000	19.596	18874	0.03648
3	20.295	230.265	1.910	21.280	0.141	0.000	16.533	18907	0.02677
4	41.072	218.383	1.616	31.993	4.377	0.000	19.568	19533	0.05009
5	20.726	189.147	1.502	21.357	0.418	0.000	17.001	18807	0.01610
6	30.912	196.269	1.573	25.882	1.826	0.000	18.596	20040	0.03565
7	27.788	207.251	1.946	22.991	1.679	0.000	19.726	19313	0.04172
8	28.092	211.756	1.638	28.193	0.710	0.000	17.242	19515	0.03573
9	18.440	224.974	1.726	17.454	0.537	0.000	15.933	18566	0.03164
10	32.639	226.790	1.085	26.531	2.386	0.000	18.528	19222	0.04270
11	31.445	224.820	1.639	26.542	1.651	0.000	20.099	20022	0.04113
12	28.956	225.833	2.171	26.246	2.550	0.000	18.070	20176	0.01723
13	24.460	239.475	1.802	23.068	0.418	0.000	17.212	19374	0.02999
14	13.919	251.763	2.000	12.395	0.120	0.000	16.575	17397	0.04012
15	15.392	248.486	1.107	14.329	0.629	0.000	15.877	17862	0.02467
16	21.311	260.543	1.412	18.930	0.708	0.000	16.110	18240	0.02758
17	24.460	226.377	1.921	21.254	0.147	0.000	17.192	19764	0.05538
18	17.196	236.926	1.346	16.006	0.462	0.000	16.538	18182	0.03431
19	20.726	238.020	1.316	18.106	0.491	0.000	17.320	17673	0.03125
20	18.821	240.065	1.760	16.974	0.763	0.000	16.607	18165	0.03862
21	10.897	240.838	1.134	11.080	0.000	0.000	15.266	17221	0.02225
22	17.501	241.242	1.229	15.237	0.009	0.000	16.251	18223	0.04013
23	10.693	251.668	1.391	10.758	0.124	0.000	14.647	16860	0.02348
24	30.988	236.192	2.058	23.467	1.732	0.000	18.309	18343	0.06885
25	32.690	238.215	2.062	27.148	3.949	0.000	17.803	19088	0.03709
26	44.475	260.375	1.768	32.520	9.475	0.000	18.471	19068	0.04346
27	25.705	241.122	2.197	23.620	0.749	0.000	17.563	18949	0.04743
28	25.019	255.251	1.255	21.966	1.970	0.001	17.360	18569	0.03040
29	22.047	244.936	1.619	17.870	1.367	0.001	18.510	17933	0.03993
30	16.942	240.720	1.709	16.697	0.524	0.001	16.499	18416	0.02314
SUM=	733.552	7023.701	49.152	636.411	45.704	0.007			1.08480

Table 1b - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	15.31					
1	32.08	239.94	0.13	26.25	1.92	2.22	0.07	38.39	16.95	44%	0.00	20337.00	0.05	0.05
2	27.86	236.06	0.12	20.27	1.34	3.57	0.13	38.39	19.60	51%	0.00	18874.00	0.04	0.04
3	20.30	230.27	0.09	21.28	1.91	0.14	0.01	38.39	16.53	43%	0.00	18907.00	0.03	0.03
4	41.07	218.38	0.19	31.99	1.62	4.38	0.11	38.39	19.57	51%	0.00	19533.00	0.05	0.05
5	20.73	189.15	0.11	21.36	1.50	0.42	0.02	38.39	17.00	44%	0.00	18807.00	0.02	0.02
6	30.91	196.27	0.16	25.88	1.57	1.83	0.06	38.39	18.60	48%	0.00	20040.00	0.04	0.04
7	27.79	207.25	0.13	22.99	1.95	1.68	0.06	38.39	19.73	51%	0.00	19313.00	0.04	0.04
8	28.09	211.76	0.13	28.19	1.64	0.71	0.03	38.39	17.24	45%	0.00	19515.00	0.04	0.04
9	18.44	224.97	0.08	17.45	1.73	0.54	0.03	38.39	15.93	42%	0.00	18566.00	0.03	0.03
10	32.64	226.79	0.14	26.53	1.09	2.39	0.07	38.39	18.53	48%	0.00	19222.00	0.04	0.04
11	31.45	224.82	0.14	26.54	1.64	1.65	0.05	38.39	20.10	52%	0.00	20022.00	0.04	0.04
12	28.96	225.83	0.13	26.25	2.17	2.55	0.09	38.39	18.07	47%	0.00	20176.00	0.02	0.02
13	24.46	239.48	0.10	23.07	1.80	0.42	0.02	38.39	17.21	45%	0.00	19374.00	0.03	0.03
14	13.92	251.76	0.06	12.40	2.00	0.12	0.01	38.39	16.58	43%	0.00	17397.00	0.04	0.04
15	15.39	248.49	0.06	14.33	1.11	0.63	0.04	38.39	15.88	41%	0.00	17862.00	0.02	0.02
16	21.31	260.54	0.08	18.93	1.41	0.71	0.03	38.39	16.11	42%	0.00	18240.00	0.03	0.03
17	24.46	226.38	0.11	21.25	1.92	0.15	0.01	38.39	17.19	45%	0.00	19764.00	0.06	0.06
18	17.20	236.93	0.07	16.01	1.35	0.46	0.03	38.39	16.54	43%	0.00	18182.00	0.03	0.03
19	20.73	238.02	0.09	18.11	1.32	0.49	0.02	38.39	17.32	45%	0.00	17673.00	0.03	0.03
20	18.82	240.07	0.08	16.97	1.76	0.76	0.04	38.39	16.61	43%	0.00	18165.00	0.04	0.04
21	10.90	240.84	0.05	11.08	1.13	0.00	0.00	38.39	15.27	40%	0.00	17221.00	0.02	0.02
22	17.50	241.24	0.07	15.24	1.23	0.01	0.00	38.39	16.25	42%	0.00	18223.00	0.04	0.04
23	10.69	251.67	0.04	10.76	1.39	0.12	0.01	38.39	14.65	38%	0.00	16860.00	0.02	0.02
24	30.99	236.19	0.13	23.47	2.06	1.73	0.06	38.39	18.31	48%	0.00	18343.00	0.07	0.07
25	32.69	238.22	0.14	27.15	2.06	3.95	0.12	38.39	17.80	46%	0.00	19088.00	0.04	0.04
26	44.48	260.38	0.17	32.52	1.77	9.48	0.21	38.39	18.47	48%	0.00	19068.00	0.04	0.04
27	25.71	241.12	0.11	23.62	2.20	0.75	0.03	38.39	17.56	46%	0.00	18949.00	0.05	0.05
28	25.02	255.25	0.10	21.97	1.26	1.97	0.08	38.39	17.36	45%	0.00	18569.00	0.03	0.03
29	22.05	244.94	0.09	17.87	1.62	1.37	0.06	38.39	18.51	48%	0.00	17933.00	0.04	0.04
30	16.94	240.72	0.07	16.70	1.71	0.52	0.03	38.39	16.50	43%	0.00	18416.00	0.02	0.02
SUM=	733.55	7023.70		636.41	49.15	45.70					0.00		1.08	1.09

Notes:
1. TCEQ Performance Criteria Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria Runoff less than or equal to 10% total water applied

Figure 3b
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison



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0,0,                          NPRINT,STOPHR
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1.0,1.0E-8,0.0,               DELMAX,DELMIN,OUTTIM
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1,1,1,                        IETOPT,ICLOUD,ISHOPT
1,1.0,                        IRAIN,HPR
0,0,0,0,0,                    IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                        IHEAT,CONVH,DMAXHE
0,0,0,0,                      UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                        LOWERH,QHLEAK,TGRAD
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Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
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Layer 2 77 compaction of silty sand SM water retention parameters
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Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.338,0.016,1.808,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
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Layer 4 clean sand hydraulic conductivity parameters
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2009.txt
2010.txt

Created using BSUM Version 3.01; all units are cm
First file in series is 77%COM1981.res

Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							14.614		
1	32.080	239.938	2.208	27.633	0.894	0.000	15.918	19479	0.04075
2	27.864	236.062	1.591	21.501	1.945	0.000	18.721	18349	0.02317
3	20.295	230.265	1.938	21.264	0.000	0.000	15.797	18234	0.01622
4	41.072	218.383	1.681	35.388	1.624	0.000	18.153	18728	0.02240
5	20.726	189.147	1.515	21.016	0.000	0.000	16.340	18296	0.00859
6	30.912	196.269	1.450	27.441	0.375	0.000	17.972	19275	0.01261
7	27.788	207.251	1.914	23.613	0.413	0.000	19.796	18744	0.02410
8	28.092	211.756	1.649	29.854	0.008	0.000	16.358	18783	0.01849
9	18.440	224.974	1.907	17.112	0.109	0.000	15.647	17946	0.02236
10	32.639	226.790	1.383	29.429	0.195	0.000	17.258	18623	0.02000
11	31.445	224.820	1.682	26.393	0.584	0.001	20.013	19344	0.03064
12	28.956	225.833	1.835	28.795	0.982	0.001	17.356	19454	-0.00038
13	24.460	239.475	1.923	23.231	0.001	0.001	16.642	18725	0.01777
14	13.919	251.763	2.177	11.926	0.000	0.001	16.435	17072	0.02199
15	15.392	248.486	1.341	14.505	0.015	0.001	15.946	17484	0.01831
16	21.311	260.543	1.500	19.737	0.104	0.001	15.900	17774	0.01387
17	24.460	226.377	2.283	21.083	0.000	0.001	16.951	19015	0.04199
18	17.196	236.926	1.729	15.879	0.036	0.001	16.481	17755	0.02062
19	20.726	238.020	1.477	18.826	0.000	0.001	16.884	17195	0.01992
20	18.821	240.065	1.760	17.565	0.184	0.001	16.168	17654	0.02726
21	10.897	240.838	1.618	10.444	0.000	0.001	14.987	16966	0.01507
22	17.501	241.242	1.518	14.750	0.000	0.001	16.188	17755	0.03122
23	10.693	251.668	1.828	10.296	0.000	0.001	14.742	16608	0.01485
24	30.988	236.192	2.164	25.548	0.249	0.001	17.716	17532	0.05233
25	32.690	238.215	2.217	29.516	2.090	0.001	16.563	18394	0.02015
26	44.475	260.375	1.922	35.376	5.303	0.507	17.909	18598	0.01971
27	25.705	241.122	2.268	23.108	0.122	0.432	17.652	18427	0.03028
28	25.019	255.251	1.294	23.546	0.634	0.156	17.029	18120	0.01151
29	22.047	244.936	1.701	18.552	0.222	0.091	18.487	17479	0.02295
30	16.942	240.720	1.894	17.043	0.000	0.063	16.420	18118	0.00901
SUM=	733.552	7023.701	53.369	660.371	16.091	1.268			0.64773

Table 1c - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	14.61					
1	32.08	239.94	0.13	27.63	2.21	0.89	0.03	38.39	15.92	41%	0.00	19479.00	0.04	0.04
2	27.86	236.06	0.12	21.50	1.59	1.95	0.07	38.39	18.72	49%	0.00	18349.00	0.02	0.02
3	20.30	230.27	0.09	21.26	1.94	0.00	0.00	38.39	15.80	41%	0.00	18234.00	0.02	0.02
4	41.07	218.38	0.19	35.39	1.68	1.62	0.04	38.39	18.15	47%	0.00	18728.00	0.02	0.02
5	20.73	189.15	0.11	21.02	1.52	0.00	0.00	38.39	16.34	43%	0.00	18296.00	0.01	0.01
6	30.91	196.27	0.16	27.44	1.45	0.38	0.01	38.39	17.97	47%	0.00	19275.00	0.01	0.01
7	27.79	207.25	0.13	23.61	1.91	0.41	0.01	38.39	19.80	52%	0.00	18744.00	0.02	0.02
8	28.09	211.76	0.13	29.85	1.65	0.01	0.00	38.39	16.36	43%	0.00	18783.00	0.02	0.02
9	18.44	224.97	0.08	17.11	1.91	0.11	0.01	38.39	15.65	41%	0.00	17946.00	0.02	0.02
10	32.64	226.79	0.14	29.43	1.38	0.20	0.01	38.39	17.26	45%	0.00	18623.00	0.02	0.02
11	31.45	224.82	0.14	26.39	1.68	0.58	0.02	38.39	20.01	52%	0.00	19344.00	0.03	0.03
12	28.96	225.83	0.13	28.80	1.84	0.98	0.03	38.39	17.36	45%	0.00	19454.00	0.00	0.00
13	24.46	239.48	0.10	23.23	1.92	0.00	0.00	38.39	16.64	43%	0.00	18725.00	0.02	0.02
14	13.92	251.76	0.06	11.93	2.18	0.00	0.00	38.39	16.44	43%	0.00	17072.00	0.02	0.02
15	15.39	248.49	0.06	14.51	1.34	0.02	0.00	38.39	15.95	42%	0.00	17484.00	0.02	0.02
16	21.31	260.54	0.08	19.74	1.50	0.10	0.00	38.39	15.90	41%	0.00	17774.00	0.01	0.01
17	24.46	226.38	0.11	21.08	2.28	0.00	0.00	38.39	16.95	44%	0.00	19015.00	0.04	0.04
18	17.20	236.93	0.07	15.88	1.73	0.04	0.00	38.39	16.48	43%	0.00	17755.00	0.02	0.02
19	20.73	238.02	0.09	18.83	1.48	0.00	0.00	38.39	16.88	44%	0.00	17195.00	0.02	0.02
20	18.82	240.07	0.08	17.57	1.76	0.18	0.01	38.39	16.17	42%	0.00	17654.00	0.03	0.03
21	10.90	240.84	0.05	10.44	1.62	0.00	0.00	38.39	14.99	39%	0.00	16966.00	0.02	0.02
22	17.50	241.24	0.07	14.75	1.52	0.00	0.00	38.39	16.19	42%	0.00	17755.00	0.03	0.03
23	10.69	251.67	0.04	10.30	1.83	0.00	0.00	38.39	14.74	38%	0.00	16608.00	0.01	0.02
24	30.99	236.19	0.13	25.55	2.16	0.25	0.01	38.39	17.72	46%	0.00	17532.00	0.05	0.05
25	32.69	238.22	0.14	29.52	2.22	2.09	0.06	38.39	16.56	43%	0.00	18394.00	0.02	0.02
26	44.48	260.38	0.17	35.38	1.92	5.30	0.12	38.39	17.91	47%	0.51	18598.00	0.02	0.53
27	25.71	241.12	0.11	23.11	2.27	0.12	0.00	38.39	17.65	46%	0.43	18427.00	0.03	0.46
28	25.02	255.25	0.10	23.55	1.29	0.63	0.03	38.39	17.03	44%	0.16	18120.00	0.01	0.17
29	22.05	244.94	0.09	18.55	1.70	0.22	0.01	38.39	18.49	48%	0.09	17479.00	0.02	0.11
30	16.94	240.72	0.07	17.04	1.89	0.00	0.00	38.39	16.42	43%	0.06	18118.00	0.01	0.07
SUM=	733.55	7023.70		660.37	53.37	16.09					1.26		0.65	1.91

Notes:
1. TCEQ Performance Criteria Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria Runoff less than or equal to 10% total water applied

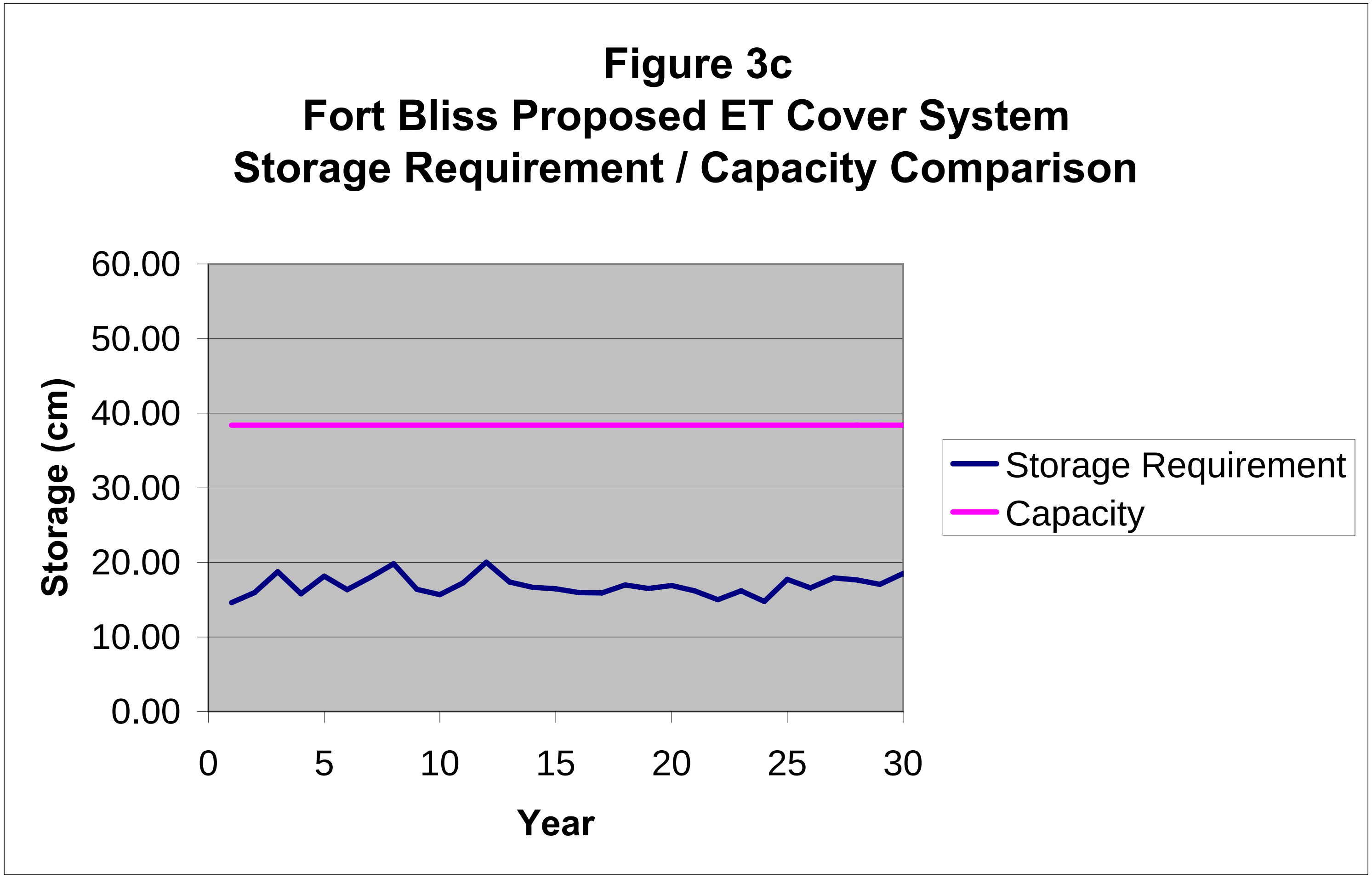


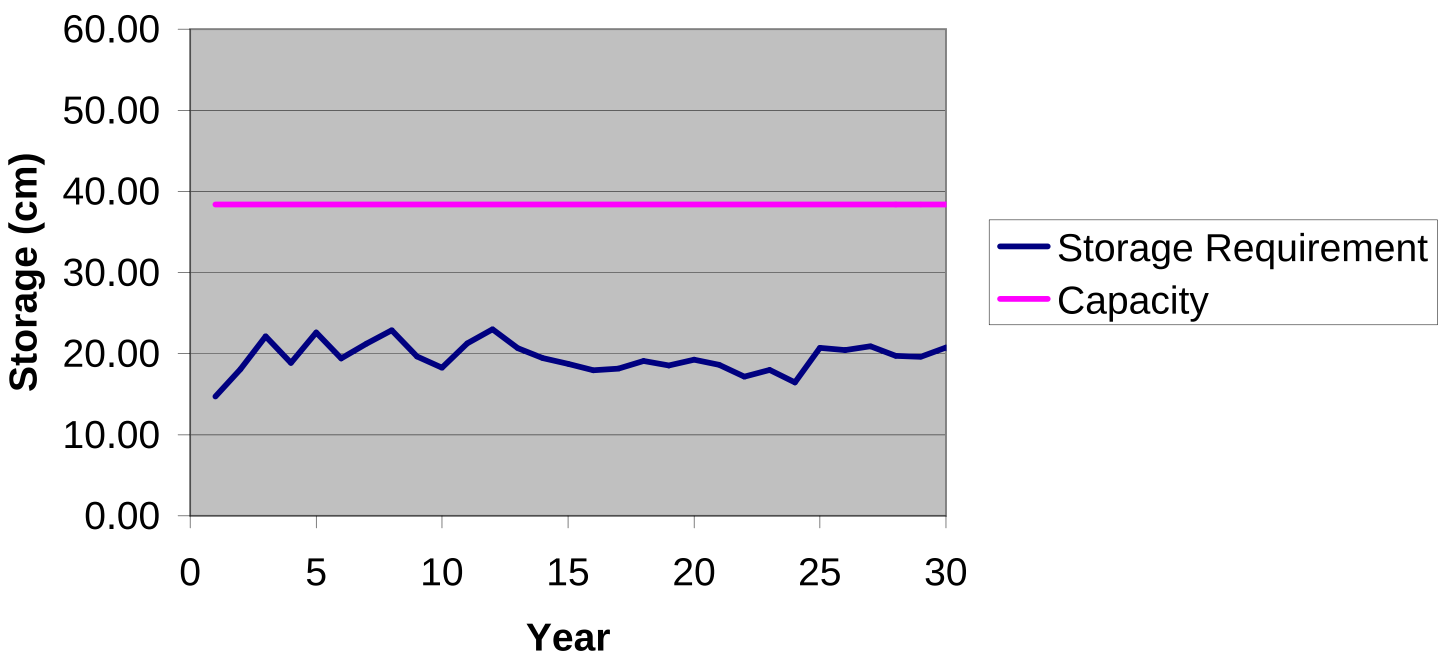
Figure 3c
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison
Storage (cm)
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
5
10
15
20
25
30
Year
Storage Requirement
Capacity

Table 1b - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	14.71					
1	32.08	239.94	0.13	27.34	2.16	0.78	0.02	38.39	18.06	47%	0.01	19846.00	0.05	0.07
2	27.86	236.06	0.12	21.79	1.53	1.68	0.06	38.39	22.15	58%	0.34	18506.00	0.04	0.37
3	20.30	230.27	0.09	21.55	1.98	0.00	0.00	38.39	18.87	49%	0.91	18549.00	0.03	0.94
4	41.07	218.38	0.19	34.92	1.73	1.51	0.04	38.39	22.61	59%	2.40	18898.00	0.04	2.44
5	20.73	189.15	0.11	21.45	1.59	0.00	0.00	38.39	19.43	51%	1.49	18520.00	0.01	1.50
6	30.91	196.27	0.16	27.33	1.52	0.28	0.01	38.39	21.23	55%	0.74	19594.00	0.02	0.76
7	27.79	207.25	0.13	23.57	2.07	0.34	0.01	38.39	22.87	60%	0.81	19035.00	0.04	0.85
8	28.09	211.76	0.13	29.72	1.74	0.00	0.00	38.39	19.65	51%	1.43	19033.00	0.03	1.46
9	18.44	224.97	0.08	17.47	1.86	0.07	0.00	38.39	18.27	48%	0.52	18256.00	0.03	0.54
10	32.64	226.79	0.14	29.02	1.30	0.13	0.00	38.39	21.26	55%	1.28	18876.00	0.04	1.32
11	31.45	224.82	0.14	26.77	1.75	0.53	0.02	38.39	23.00	60%	1.06	19668.00	0.04	1.09
12	28.96	225.83	0.13	28.60	2.07	0.78	0.03	38.39	20.69	54%	1.80	19736.00	0.01	1.81
13	24.46	239.48	0.10	23.36	1.94	0.00	0.00	38.39	19.45	51%	0.72	18990.00	0.02	0.74
14	13.92	251.76	0.06	12.19	2.13	0.00	0.00	38.39	18.73	49%	0.33	17218.00	0.03	0.36
15	15.39	248.49	0.06	14.60	1.22	0.01	0.00	38.39	17.97	47%	0.14	17676.00	0.03	0.17
16	21.31	260.54	0.08	19.60	1.51	0.06	0.00	38.39	18.15	47%	0.20	17986.00	0.01	0.21
17	24.46	226.38	0.11	21.28	2.22	0.00	0.00	38.39	19.07	50%	0.22	19257.00	0.05	0.27
18	17.20	236.93	0.07	16.02	1.60	0.01	0.00	38.39	18.56	48%	0.18	17984.00	0.03	0.21
19	20.73	238.02	0.09	18.66	1.45	0.00	0.00	38.39	19.25	50%	0.21	17395.00	0.03	0.24
20	18.82	240.07	0.08	17.55	1.84	0.14	0.01	38.39	18.62	49%	0.31	17900.00	0.04	0.35
21	10.90	240.84	0.05	10.79	1.43	0.00	0.00	38.39	17.15	45%	0.23	17090.00	0.03	0.25
22	17.50	241.24	0.07	15.00	1.38	0.00	0.00	38.39	17.99	47%	0.11	17989.00	0.04	0.14
23	10.69	251.67	0.04	10.47	1.65	0.00	0.00	38.39	16.43	43%	0.09	16736.00	0.02	0.11
24	30.99	236.19	0.13	24.93	2.17	0.15	0.00	38.39	20.70	54%	0.18	17776.00	0.07	0.24
25	32.69	238.22	0.14	29.67	2.27	1.77	0.05	38.39	20.42	53%	1.87	18639.00	0.03	1.90
26	44.48	260.38	0.17	35.82	1.92	4.92	0.11	38.39	20.91	54%	5.62	18698.00	0.03	5.65
27	25.71	241.12	0.11	23.59	2.33	0.08	0.00	38.39	19.71	51%	1.07	18651.00	0.04	1.11
28	25.02	255.25	0.10	23.36	1.32	0.52	0.02	38.39	19.62	51%	0.75	18361.00	0.02	0.77
29	22.05	244.94	0.09	18.77	1.76	0.14	0.01	38.39	20.76	54%	0.59	17683.00	0.03	0.63
30	16.94	240.72	0.07	17.16	1.94	0.00	0.00	38.39	18.55	48%	0.70	18245.00	0.02	0.72
SUM=	733.55	7023.70		662.31	53.35	13.90					26.31		0.93	27.23

Notes:
1. TCEQ Performance Criteria Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria Runoff less than or equal to 10% total water applied

Figure 3
TCEQ Requested ET Cover System
Storage Requirement / Capacity Comparison



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FTBLISS
1,1,                          IPLANT,NGRAV
365,1,365,                    IFDEND,IDTBEG,IDTEND
1981,30,0,2,30,               IYS,NYEARS,ISTEAD,IFLIST,NFLIST
0,0,                          NPRINT,STOPHR
0,3,1,1.00E-4,                ISMETH,INMAX,ISWDIF,DMAXBA
1.0,1.0E-8,0.0,               DELMAX,DELMIN,OUTTIM
1.5,1.00E-05,0,0,0,           RFACT,RAINIF,DHTOL,DHMAX,DHFACT
4,1,0.5,                      KOPT,KEST,WTF
0,1,2,1,                      ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,        HIRRI,HDRY,HTOP,RHA
1,1,1,                        IETOPT,ICLOUD,ISHOPT
1,1.0,                        IRAIN,HPR
0,0,0,0,0,                    IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                        IHEAT,CONVH,DMAXHE
0,0,0,0,                      UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                        LOWERH,QHLEAK,TGRAD
1,0.66,291.0,0.239,           IVAPOR,TORT,TSOIL,VAPDIF
4,24,                         MATN,NPT
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1,4.00,1,5.08,1,10.16,1,20.32,
1,30.48,3,35.56,3,40.64,3,45.72,
3,50.80,3,55.88,3,60.96,3,66.04,
3,71.12,3,76.20,3,81.28,3,83.36,
3,91.44,3,96.52,3,101.6,3,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 2 80 compaction of silty sand SM water retention parameters
0.329,0.163,0.010,2.180,                  THET, THTR, vGA, vGN
Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.036,0.010,2.180,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
0.430,0.045,0.145,2.68,                   THET, THTR, vGA, vGN
Layer 4 clean sand hydraulic conductivity parameters
2.000,29.7,0.145,2.68,0.500,              RKMOD, SK, VGA, VGN, EPIT
0,    NDAY
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0.90,                   BARE
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15000.0,3000.0,300.0,   HW, HD, HN
220.0,                        BIOMAS
2.0E-01,1206.4,10.0,1000.0,   ALBEDO,ALT,ZU,PMB
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2005.txt
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2007.txt
2008.txt
2009.txt
2010.txt

12-18-12 10%.out
Created using BSUM Version 3.01; all units are cm
First file in series is TCEQCHECK1981.res

Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							14.712		
1	32.080	239.938	2.104	25.780	0.779	0.013	18.063	19871	0.05298
2	27.864	236.062	1.355	20.375	1.676	0.336	22.147	18563	0.03735
3	20.295	230.265	1.952	20.688	0.000	0.911	18.866	18589	0.02528
4	41.072	218.383	1.736	31.643	1.510	2.401	22.605	19148	0.04186
5	20.726	189.147	1.544	20.864	0.000	1.487	19.428	18616	0.00951
6	30.912	196.269	1.506	26.569	0.280	0.736	21.227	19740	0.02270
7	27.788	207.251	2.033	22.923	0.336	0.811	22.873	19033	0.03716
8	28.092	211.756	1.637	28.220	0.001	1.432	19.649	19157	0.02680
9	18.440	224.974	1.851	17.357	0.071	0.518	18.267	18284	0.02633
10	32.639	226.790	1.310	26.879	0.130	1.283	21.264	18912	0.03916
11	31.445	224.820	1.701	26.389	0.528	1.058	22.996	19681	0.03651
12	28.956	225.833	2.080	26.594	0.782	1.799	20.687	19937	0.00879
13	24.460	239.475	1.873	23.092	0.000	0.715	19.446	19010	0.02258
14	13.919	251.763	2.137	12.137	0.000	0.332	18.727	17240	0.03211
15	15.392	248.486	1.263	14.714	0.007	0.141	17.967	17663	0.02593
16	21.311	260.543	1.479	19.374	0.061	0.196	18.153	18027	0.01436
17	24.460	226.377	2.187	21.080	0.000	0.224	19.073	19261	0.04944
18	17.196	236.926	1.547	15.941	0.014	0.180	18.558	17991	0.02842
19	20.726	238.020	1.397	18.395	0.000	0.209	19.252	17380	0.03140
20	18.821	240.065	1.776	17.187	0.144	0.312	18.620	17903	0.03505
21	10.897	240.838	1.400	10.713	0.000	0.226	17.152	17107	0.02518
22	17.501	241.242	1.417	15.098	0.000	0.105	17.994	17999	0.03802
23	10.693	251.668	1.658	10.489	0.000	0.089	16.431	16744	0.02056
24	30.988	236.192	2.181	24.146	0.149	0.178	20.699	17855	0.06659
25	32.690	238.215	2.173	27.125	1.774	1.867	20.415	18776	0.03444
26	44.475	260.375	1.919	31.494	4.917	5.623	20.905	18817	0.03194
27	25.705	241.122	2.316	23.391	0.084	1.073	19.707	18676	0.03824
28	25.019	255.251	1.267	22.539	0.523	0.754	19.623	18327	0.01877
29	22.047	244.936	1.705	18.440	0.136	0.594	20.762	17677	0.03454
30	16.942	240.720	1.778	16.662	0.000	0.703	18.545	18298	0.01575
SUM=	733.552	7023.701	52.283	636.298	13.902	26.307			0.92778

APPENDIX D

Clean Copy Replacement Documents

APPENDIX D-1

Appendix B – Landfill Modification and Closure Design Drawings

FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION

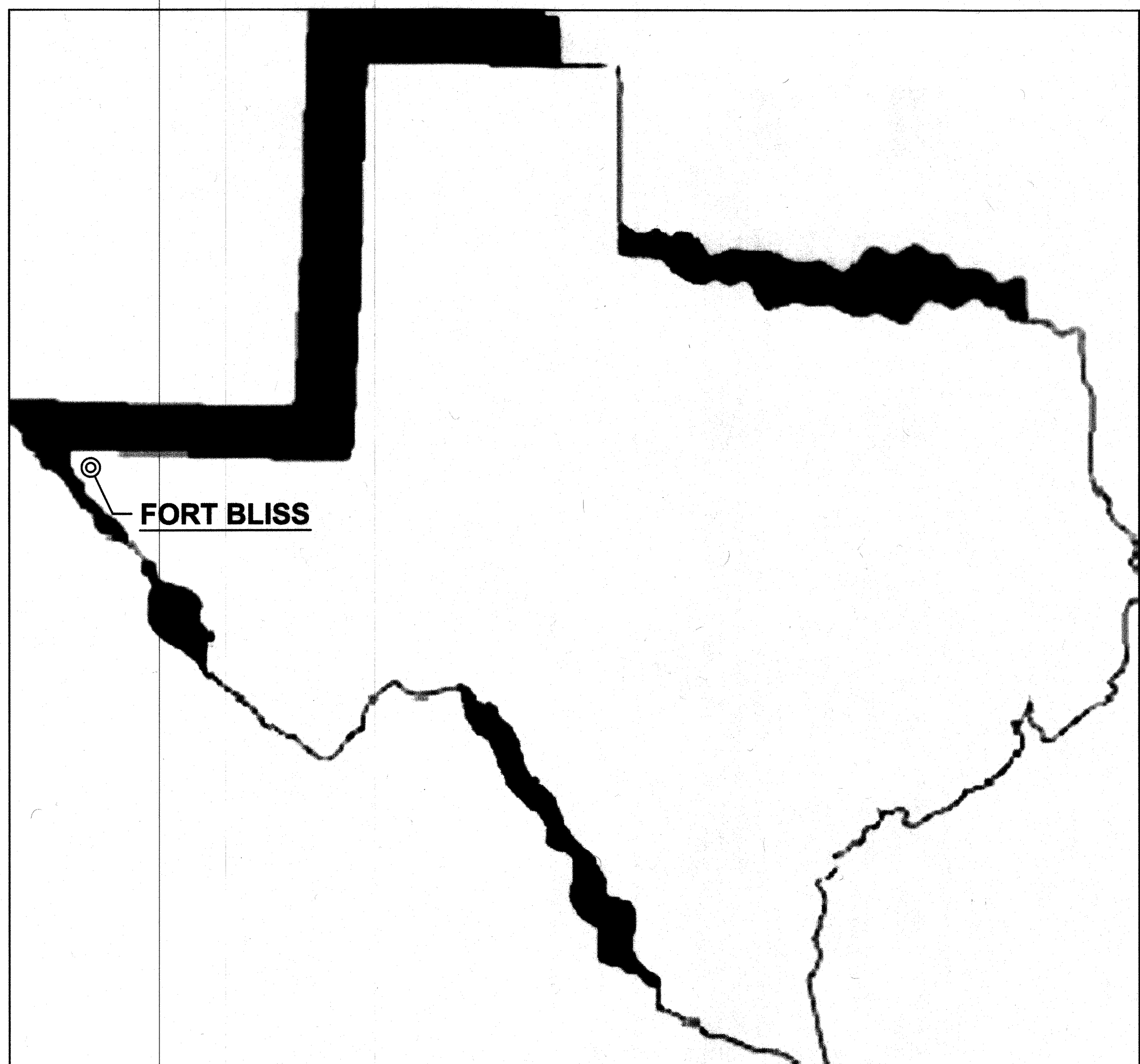
FOR

FORT BLISS MUNICIPAL SOLID WASTE LANDFILL

BLISS-A10-001

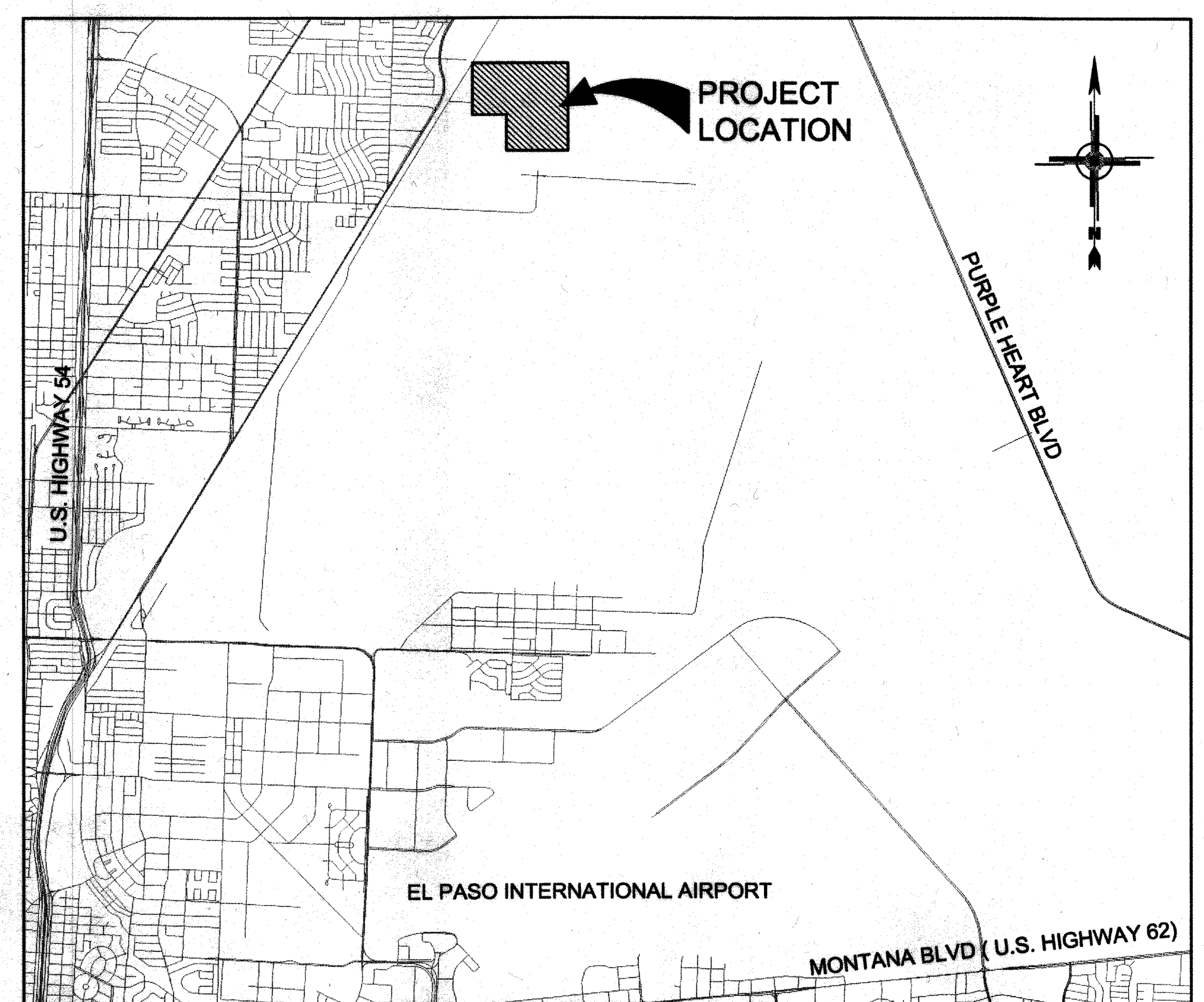
EL PASO , EL PASO COUNTY, TEXAS

DECEMBER, 2011



VICINITY MAP

N.T.S.



LOCAL VICINITY MAP

N.T.S.

SHEET INDEX:

LIST OF ABBREVIATIONS:

@ = AT
A.D. = ALGEBRAIC DIFFERENCE
ASTM = AMERICAN SOCIETY FOR TESTING AND MATERIALS
BM = BENCHMARK
BP = BEGIN POINT
BVCE = BEGINNING OF VERTICAL CURVE ELEVATION
BVCS = BEGINNING OF VERTICAL CURVE STATION
CL = CENTERLINE
DIA = DIAMETER
E = EAST OR EASTING
EG = EXISTING GRADE ELEVATION
ELEV = ELEVATION
EP = END POINT
EVCE = END OF VERTICAL CURVE ELEVATION
EVCS = END OF VERTICAL CURVE STATION
FFE = FINISH FLOOR ELEVATION
FG = FINISH GRADE ELEVATION
FL = FLOW LINE ELEVATION
INV = INVERT ELEVATION
K = VERTICAL CURVE K-VALUE
LF = LINEAL FEET
LT = LEFT
MAX = MAXIMUM
MIN = MINIMUM
MUTCD = MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
N = NORTH OR NORTHING
N.E.C. = NATIONAL ELECTRICAL CODE
NMOC = NEW MEXICO ONE CALL SERVICE
N.T.S. = NOT TO SCALE
O.C. = ON CENTER
PC = POINT OF CURVE
PB = PULL BOX
P.E. = PROFESSIONAL ENGINEER
PI = POINT OF INTERSECTION
PLS = PROFESSIONAL LAND SURVEYOR
PNM = PUBLIC SERVICE COMPANY OF NEW MEXICO
P.S.I = POUNDS PER SQUARE INCH
PT = POINT OF TANGENT
PVC = POLYVINYL CHLORIDE
PVI = POINT OF VERTICAL INTERSECTION
R = RADIUS LENGTH
RE = REFERENCE
RT = RIGHT
SF = SQUARE FEET
STA = STATION
S = SOUTH
TC = TOP OF CURB ELEVATION
TF = TOP OF FOOTING ELEVATION
TW = TOP OF WALL ELEVATION
TYP = TYPICAL
UE = UNDERGROUND ELECTRIC
VC = VERTICAL CURVE LENGTH
VOR = VILLAGE OF RUIDOSO
W = WEST

CLIENT:

DEPARTMENT OF THE ARMY
FORT BLISS DEPARTMENT OF
PUBLIC WORKS - ENVIRONMENTAL
BUILDING 777
EL PASO, TX 79916

PROFESSIONAL LAND SURVEYOR:

KERY W. GREINER, P.L.S.
ZIA ENGINEERING & ENVIRONMENTAL
CONSULTANTS, LLC
755 S. TELSHOR BLVD., SUITE F-201
LAS CRUCES, NEW MEXICO 88011
PHONE: (575) 532 1526
FAX: (575) 532-1587

ENGINEER OF RECORD:

FRANCISCO XAVIER URUETA P.E. #99473
ZIA ENGINEERING & ENVIRONMENTAL
CONSULTANTS, LLC
755 S. TELSHOR BLVD., SUITE F-201
LAS CRUCES, NEW MEXICO 88011
PHONE: (575) 532-1526
FAX: (575) 532-1587

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STIPULATION FOR REUSE OR ALTERATION

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PROPERTY LOCATED OUTSIDE CORPORATE LIMITS IN AN UNIDENTIFIED ZONE PER FLOOD INSURANCE RATE MAP NUMBER 4802140025B, EFFECTIVE DATE OF OCTOBER 15, 1982.

PROJECT BENCHMARK BM:

PROJECT BENCHMARK IS SUB D1, ORTEGA, BRASS CAP IN CONCRETE. ELEVATION = 3921.81 NAVD = 88

Field By:		REVISIONS	
Drawn By:	AH	Date:	Comment
Approved By:	AF / FXU	12/21/11	Revision 1
Date:			

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Call 48 hours before you dig.

File ID: BLISS-A10-001

STATE OF TEXAS
FRANCISCO XAVIER URUETA
99473
LICENSED
PROFESSIONAL ENGINEER

1-11-12

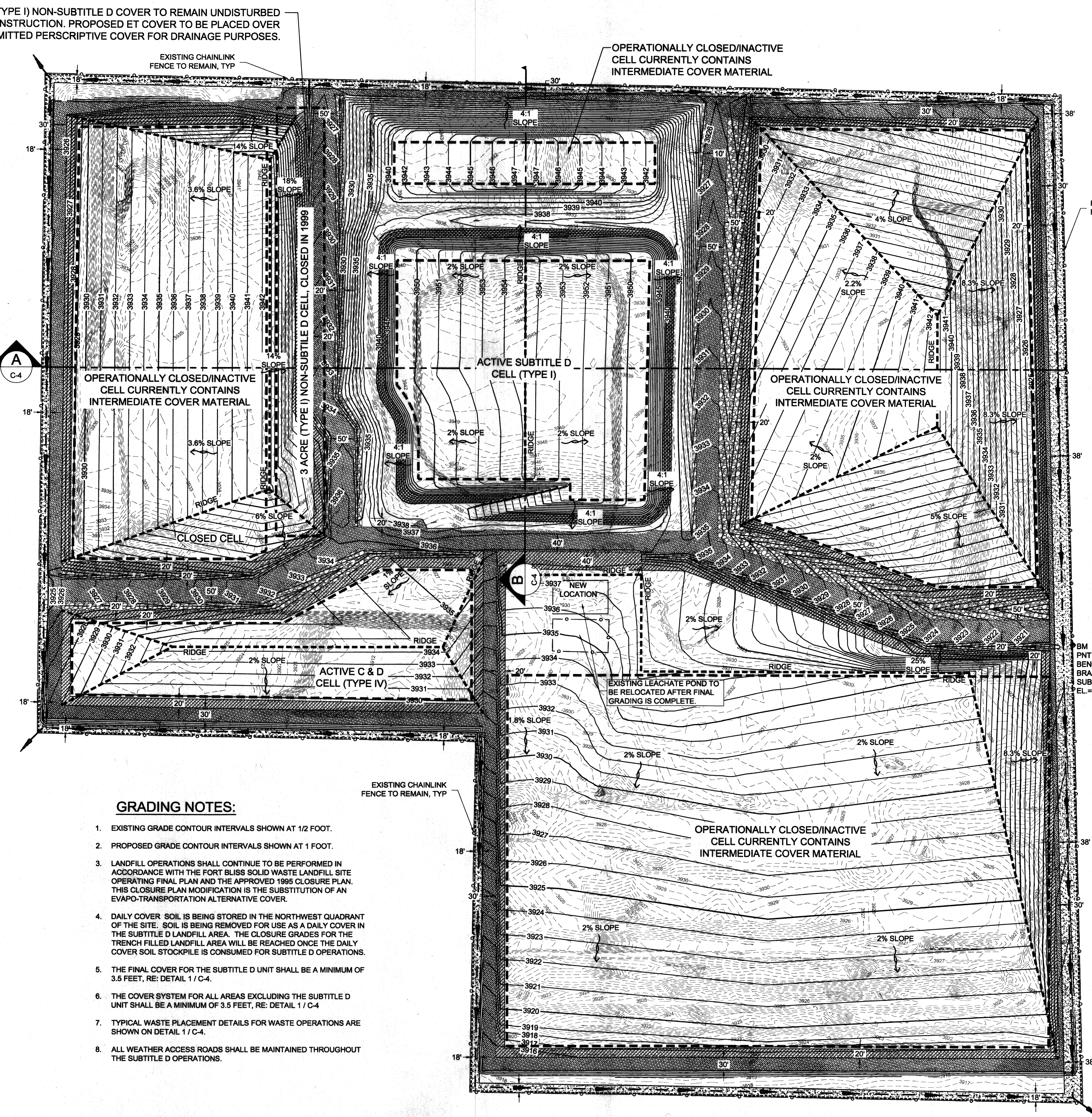
Date:

Sheet Title:
COVER SHEET
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers
Certificate of Registration # F-11907

DRAWING NO:
G-1

SHEET 1 OF 6



LEGEND

- LIMITS OF CONSTRUCTION
- PROJECT BENCHMARK
- EXISTING CHAIN LINK FENCE TO REMAIN
- 3900 CONTOUR LABEL
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 3900 CONTOUR LABEL
- RIDGE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED ACCESS ROAD, AREAS WILL NOT RECEIVE PROPOSED ET COVER.
- INTERNAL DRAINAGE SWALE, RE: DETAIL 3 / C-4, AREAS WILL NOT RECEIVE PROPOSED ET COVER.
- OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION AREA, RE: DETAIL 2 / C-4
- PROPOSED PERIMETER DRAINAGE DITCH, RE: DETAIL 4/C-4
- APPROXIMATE LOCATIONS OF THE CELLS/AREAS LISTED IN TABLE 2-1 OF THE FINAL CLOSURE PLAN. ACTUAL LOCATION OF THE CELLS TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION. ALL AREAS WITHIN THIS BOUNDARY TO RECEIVE PROPOSED ET COVER.

15 60 120
0 30 90 240
HORIZONTAL SCALE 1"=120'
NOTE: DIMENSIONS TAKE PRECEDENCE OVER SCALING

GRADING NOTES:

1. EXISTING GRADE CONTOUR INTERVALS SHOWN AT 1/2 FOOT.
2. PROPOSED GRADE CONTOUR INTERVALS SHOWN AT 1 FOOT.
3. LANDFILL OPERATIONS SHALL CONTINUE TO BE PERFORMED IN ACCORDANCE WITH THE FORT BLISS SOLID WASTE LANDFILL SITE OPERATING FINAL PLAN AND THE APPROVED 1995 CLOSURE PLAN. THIS CLOSURE PLAN MODIFICATION IS THE SUBSTITUTION OF AN EVAPO-TRANSPORTATION ALTERNATIVE COVER.
4. DAILY COVER SOIL IS BEING STORED IN THE NORTHWEST QUADRANT OF THE SITE. SOIL IS BEING REMOVED FOR USE AS A DAILY COVER IN THE SUBTITLE D LANDFILL AREA. THE CLOSURE GRADES FOR THE TRENCH FILLED LANDFILL AREA WILL BE REACHED ONCE THE DAILY COVER SOIL STOCKPILE IS CONSUMED FOR SUBTITLE D OPERATIONS.
5. THE FINAL COVER FOR THE SUBTITLE D UNIT SHALL BE A MINIMUM OF 3.5 FEET, RE: DETAIL 1 / C-4.
6. THE COVER SYSTEM FOR ALL AREAS EXCLUDING THE SUBTITLE D UNIT SHALL BE A MINIMUM OF 3.5 FEET, RE: DETAIL 1 / C-4
7. TYPICAL WASTE PLACEMENT DETAILS FOR WASTE OPERATIONS ARE SHOWN ON DETAIL 1 / C-4.
8. ALL WEATHER ACCESS ROADS SHALL BE MAINTAINED THROUGHOUT THE SUBTITLE D OPERATIONS.

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PROJECT BENCHMARK BM:
PROJECT BENCHMARK IS SUB D1, ORTEGA, BRASS CAP IN CONCRETE. ELEVATION = 3921.81 NAVD = 88

REVISIONS		
Date:	Comment	
12/21/11	Revision 1	

Field By:
Drawn By: AH
Approved By: AF/FXU
Date:

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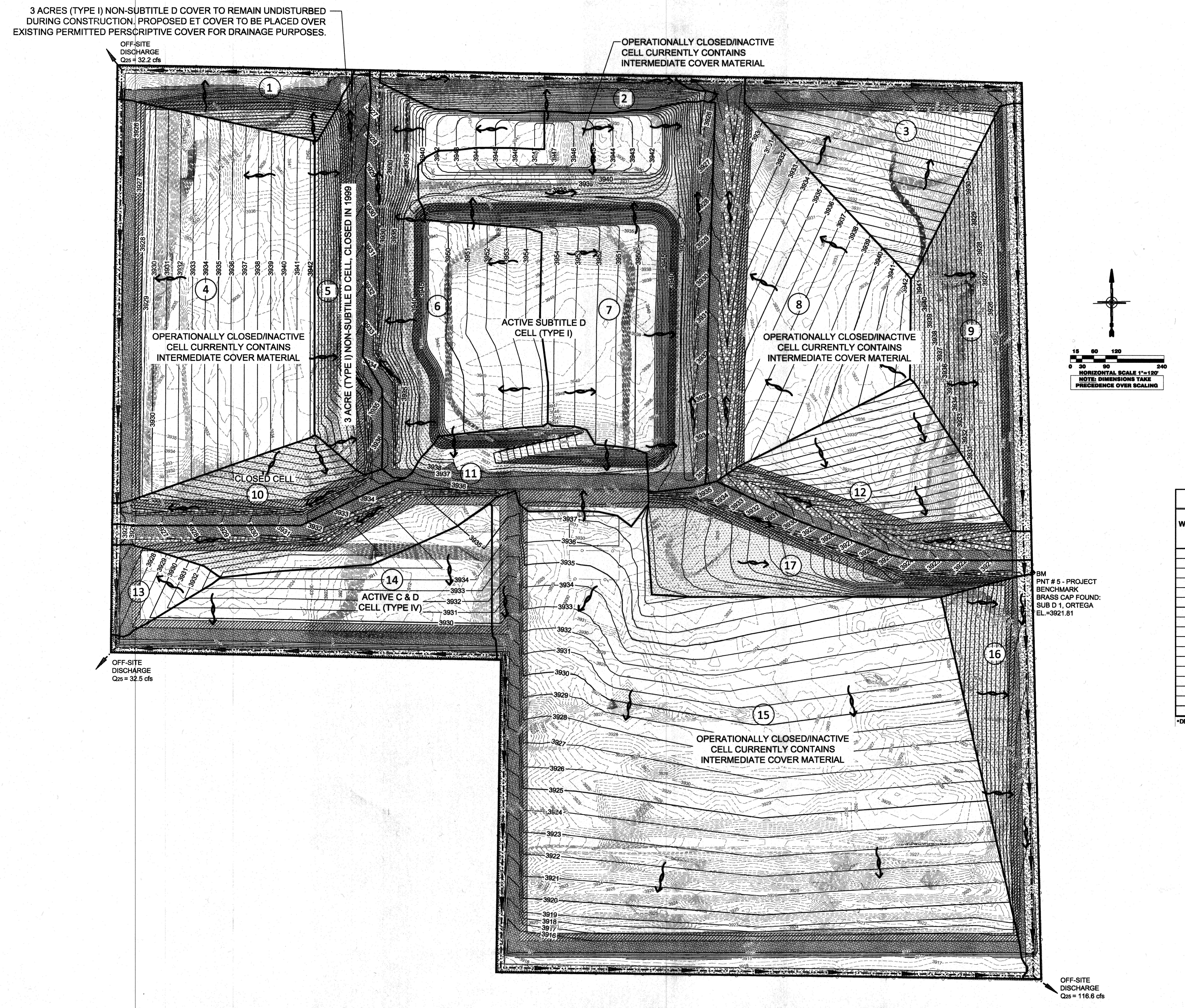
File ID: BLISS-A10-001

STATE OF TEXAS
FRANCISCO XAVIER URUETA
99473
LICENSED
PROFESSIONAL ENGINEER
1-11-12

Sheet Title:
FORT BLISS MSW LANDFILL FINAL SITE GRADING PLAN
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers Certificate of Registration # F-11907

DRAWING NO: C-2
SHEET 3 OF 6



LEGEND

- BM PROJECT BENCHMARK
- LIMITS OF CONSTRUCTION
- 3900 EXISTING CHAIN LINK FENCE / PERMITTED SITE BOUNDARY
- 3900 CONTOUR LABEL
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 3900 CONTOUR LABEL
- WATERSHED BOUNDARY
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- ACCESS ROAD
- INTERNAL DRAINAGE SWALE, RE: DETAIL 3 / C-4
- EROSION CONTROL BLANKET, ECOBLANKET, FLEXTERRA, OR EQUAL
- OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION AREA, RE: DETAIL 2 / C-4
- STORM WATER FLOW DIRECTION
- 7 WATERSHED LABEL
- PROPOSED PERIMETER DRAINAGE DITCH, RE: DETAIL 4/C-4

TOTAL WATERSHED PEAK DISCHARGE RUNOFF AND FLOW VELOCITY AT DRAINAGE INTERCEPTORS*

Watershed No.	Area (Acres)	Time of Concentration (Hours)	Peak Discharge (cfs)	Runoff Volume (ac-ft)	Normal Depth of Flow in Swale (ft)	Velocity in Swale(s) (ft/s)
1	1.8	0.14	3.3	0.3	0.7	2.4
2	1.6	0.10	3.0	0.2	0.9	2.8
3	4.4	0.10	8.0	0.6	0.9	2.8
4	10.6	0.17	19.4	1.6	0.9	2.7
5	3.0	0.17	5.5	0.4	0.6	2.1
6	7.5	0.16	13.7	1.1	0.9	2.6
7	10.1	0.12	18.5	1.5	0.8	3.9
8	7.9	0.14	14.5	1.2	0.8	3.5
9	5.1	0.17	9.3	0.8	0.8	2.8
10	2.1	0.09	3.9	0.3	0.5	2.6
11	5.0	0.21	8.3	0.7	0.7	2.6
12	4.5	0.09	8.3	0.7	0.6	3.6
13	0.9	0.10	1.7	0.1	0.9	2.7
14	4.9	0.10	8.9	0.7	0.4	1.8
15	29.7	0.31	42.2	4.4	0.9	2.7
16	3.2	0.17	5.9	0.5	0.8	2.8
17	3.7	0.13	6.9	0.6	0.5	3.3

*DETAILED CALCULATIONS ARE PROVIDED IN THE FACILITY SURFACE WATER DRAINAGE REPORT

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PROPERTY LOCATED OUTSIDE CORPORATE LIMITS IN AN UNIDENTIFIED ZONE PER FLOOD INSURANCE RATE MAP NUMBER 480214002SB, EFFECTIVE DATE OF OCTOBER 15, 1982.

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PROJECT BENCHMARK BM:

PROJECT BENCHMARK IS SUB D1, ORTEGA, BRASS CAP IN CONCRETE. ELEVATION = 3921.81 NAVD = 88

REVISIONS		
Date:	Comment	
12/21/11	Revision 1	

Designed By:	CA
Drawn By:	AH
Approved By:	FU
Date:	

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File ID: BLISS-A10-001

STATE OF TEXAS FRANCISCO XAVIER URUETA 99473 LICENSED PROFESSIONAL ENGINEER

1-11-12

Date:

Sheet Title:
FORT BLISS MSW LANDFILL WATERSHED AND STORMWATER FLOW DIRECTION

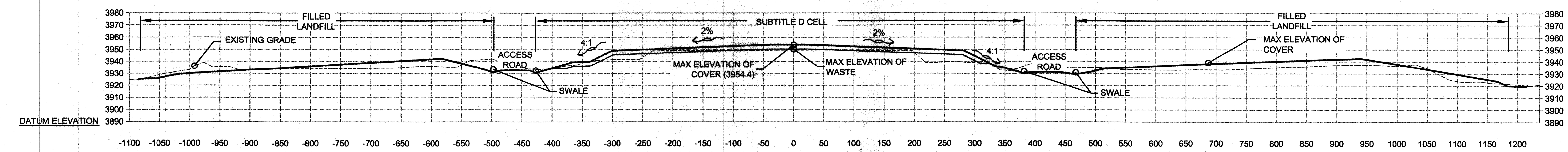
Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION

Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
Phone: (575) 532-1526
Fax: (575) 532-1587
Texas Board of Professional Engineers Certificate of Registration # F-11907

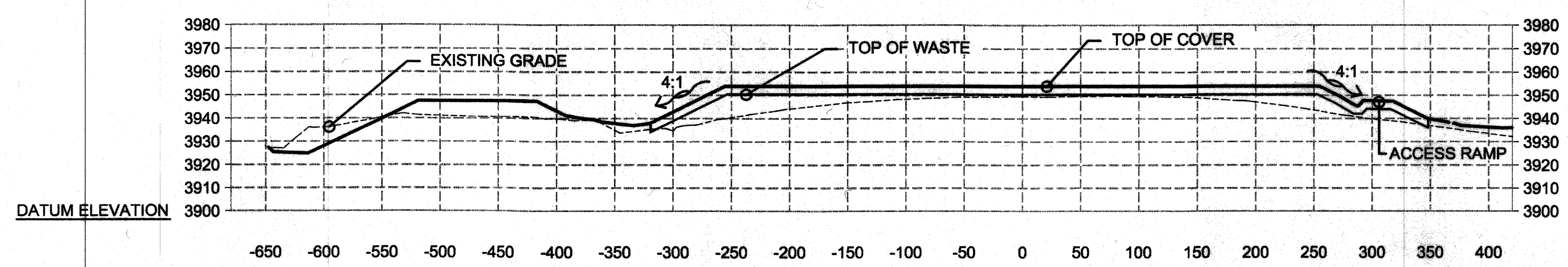
DRAWING NO: C-3

SHEET 4 OF 6



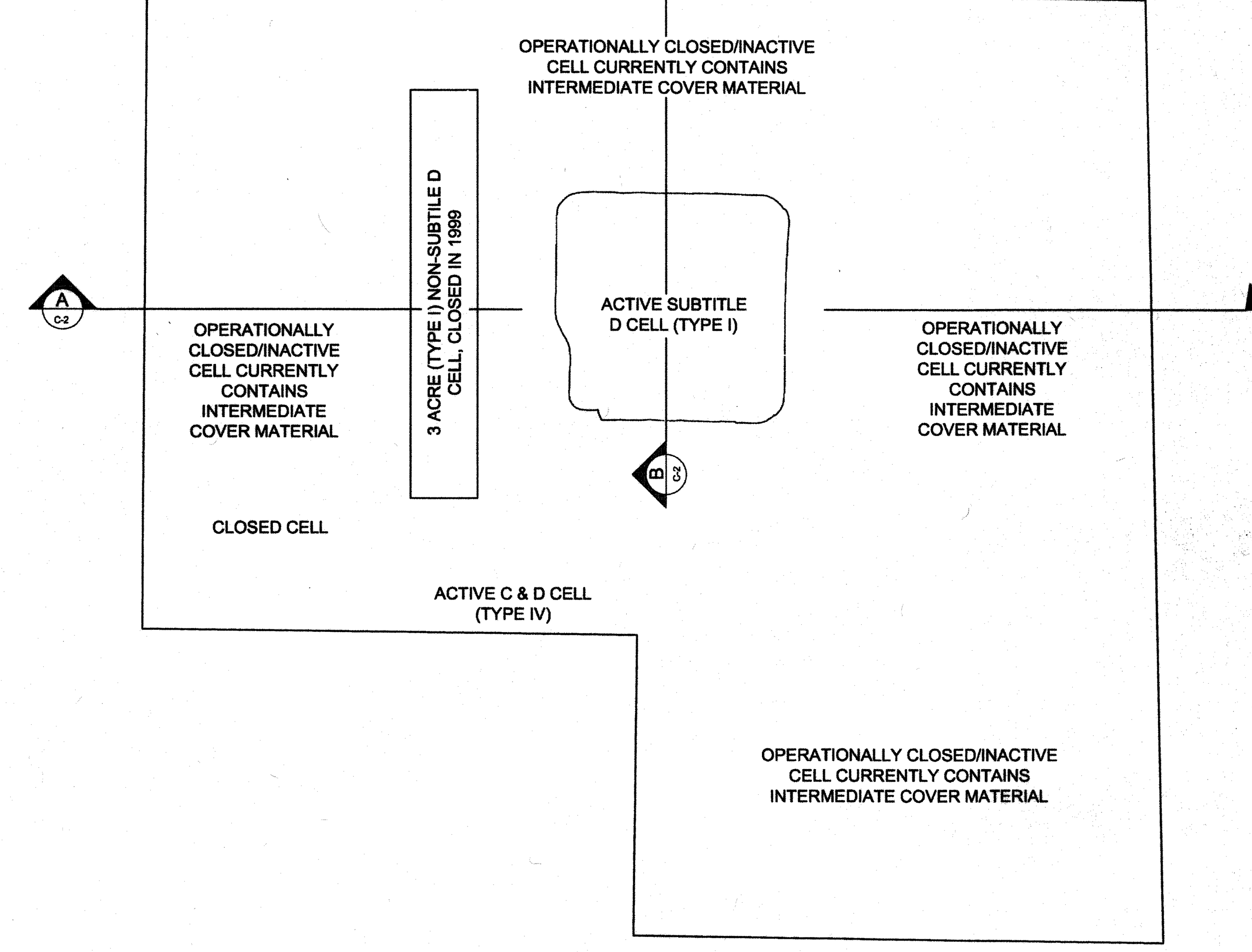
A / C-2 GRADING CROSS SECTION

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'



B / C-2 GRADING CROSS SECTION

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'



KEY PLAN

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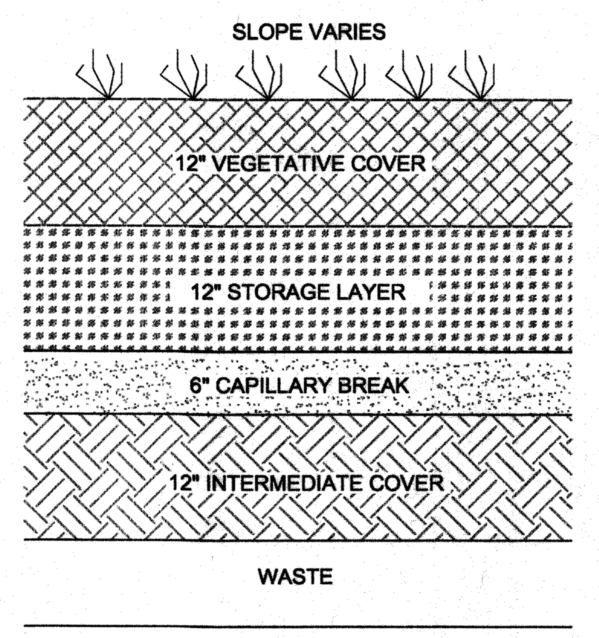
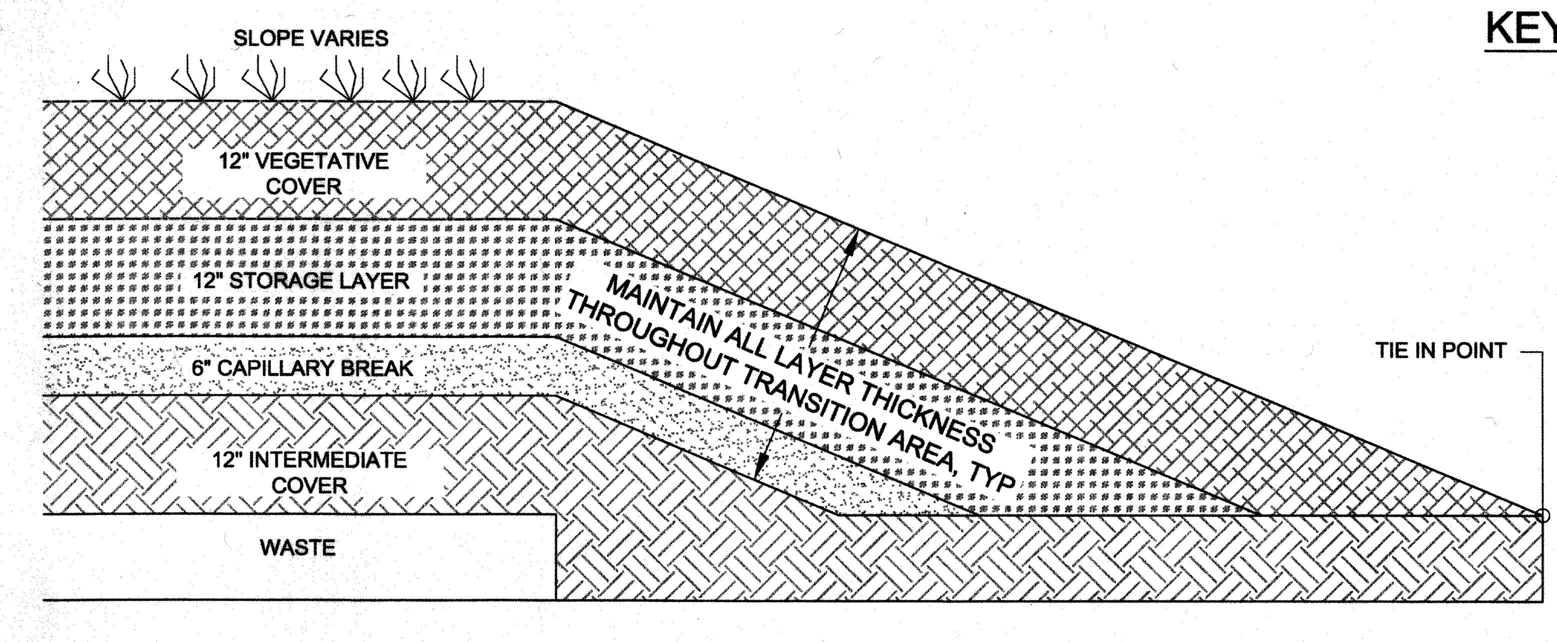


NOTE:

VEGETATIVE COVER FOR THE PROPOSED ET COVER SYSTEM WILL BE ACHIEVED BY SEEDING WITH A BALANCED MIXTURE OF NATIVE HERBACEOUS AND VASCULAR PLANTS THAT ARE INDIGENOUS SPECIES OF THE AREA, SUCH AS ALKALI SACATON AND SAND DROPSEED.

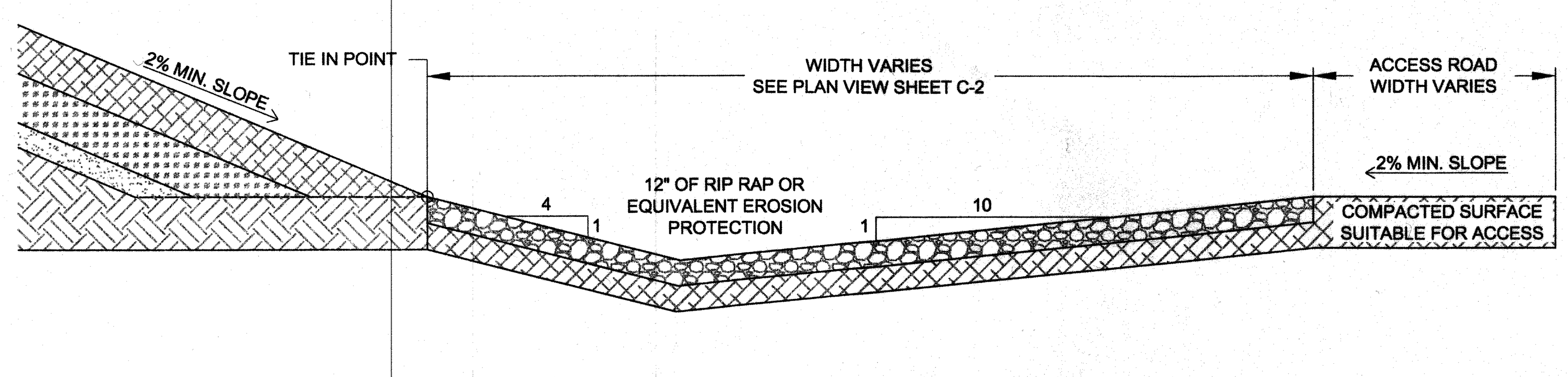
1 / -- OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM SECTION

N.T.S.



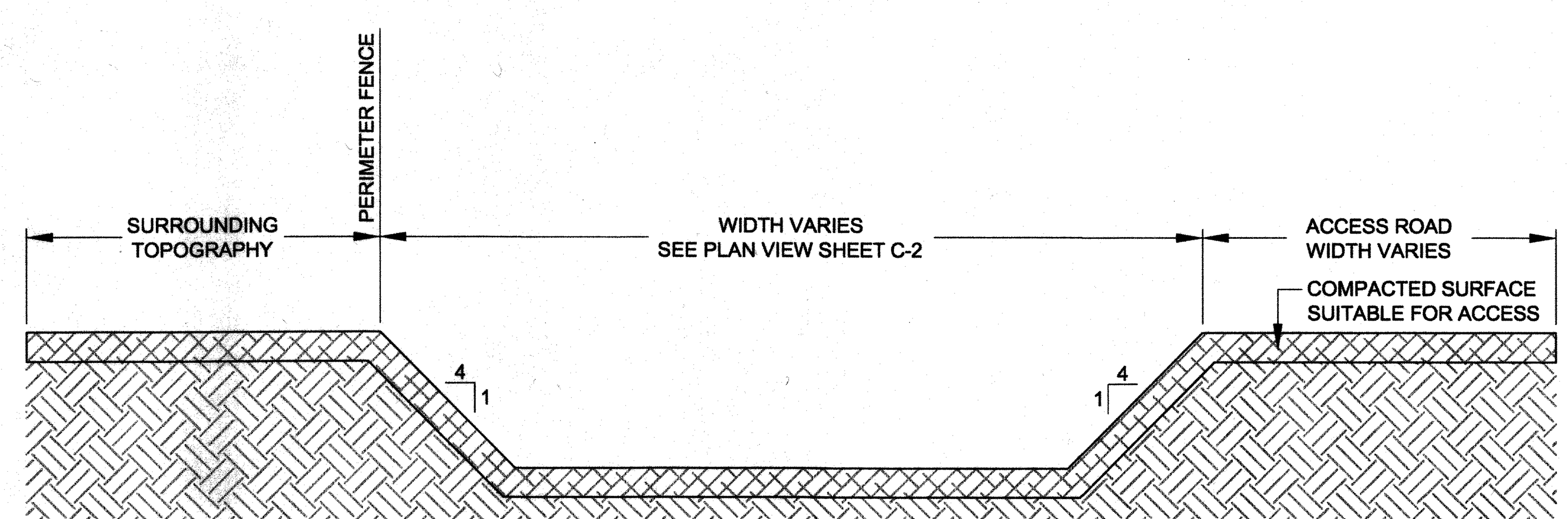
2 / C-2 OPTIMIZED EVAPOTRANSPIRATION COVER SYSTEM TRANSITION DETAIL

N.T.S.



3 / C-2 INTERNAL DRAINAGE SWALE DETAIL

N.T.S.



4 / C-2 PERIMETER DRAINAGE DITCH DETAIL

N.T.S.

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REVISIONS	
Date:	Comment
12/21/11	Revision 1

File ID: BLISS-A10-001

Field By:
Drawn By: AH
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Date:

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STATE OF TEXAS
FRANCISCO XAVIER URUETA
99473
LICENSED
PROFESSIONAL ENGINEER

1-11-12

Sheet Title:
FORT BLISS MSW LANDFILL CROSS SECTIONS AND DETAILS

Project Name:
FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION

Client:
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

Zia Engineering & Environmental Consultants, Inc.
755 S. Telshor Blvd., Suite F-201
Las Cruces, New Mexico 88011
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Texas Board of Professional Engineers
Certificate of Registration # F-11907

DRAWING NO: C-4

SHEET 5 OF 6

APPENDIX D-2

Appendix I – Slope Stability and Settlement Analysis

GENERALIZED SUBSURFACE CONDITIONS			
Description	**Depth of Soil Under Landfill Cell (feet)**	**Material Encountered Based on Review of Existing Geotechnical Information**	**Consistency/Relative Density**
Stratum 1	0 to 5	Silty sand, fine to medium grained.	Medium Dense to Dense
Stratum 2	5 to 16	Silty sand, fine to medium grained	Loose to Medium Dense
Stratum 3	16 to 20	Silty sand, fine to coarse grained, poorly graded	Medium Dense to Dense
Stratum 4	20 to 50	Sand coarse, poorly graded	Dense
Stratum 5	50 to 51.5	Sandy Clay	Very Stiff

4.2 EXISTING/PROPOSED LANDFILL CONDITIONS

Based on our on information provided by Zia for the Type I/Subtitle D landfill cell site, the following generalized landfill characteristics were assumed in our settlement/slope stability analyses:

EXISTING/PROPOSED LANDFILL CONDITIONS				
Landfill Cell Area	**Description**	**Approximate Depth from Top of MSWL (feet)**	**Proposed/Encountered Material**	**Consistency/Density**
Proposed Final Evapo-Transpiration Cover	Vegetative Surface Layer	0 to 1	Loam***	Soft to Medium Stiff***
	Storage Layer	1 to 2	Clayey/Silty Sand****	Medium Dense***
	Capillary Break Layer	2 to 2.5	Silty Sand/Sand****	Loose to Medium Dense***
	Intermediate Layer	2.5 to 3.5	Clayey/Silty Sand****	Medium Dense***
Solid Waste	Fresh Waste to be filled	3.5 to 17 (Section B)or 4 to 13.5* (Section A)	Municipal Solid Waste	Compacted
	Existing Waste	17 to 51.5**	Municipal Solid Waste	Compacted
Existing Liner	Protective Layer	51.5 to 53.5	Sand+	Compacted
	60-mil HDPE Smooth/Textured	53.5	Geosynthetic	
	Secondary Liner	53.5 to 55.5	Shale or Betonite Treated Caliche+	Compacted

* Fresh waste fill thickness varies within the provided range in each section.
** This value represents the average thickness of the existing solid waste based on Section 1 and 2 of the Malcolm Pirnie Subtitle D Landfill Permit Modification Plans, Sheet 5, revision dated August 6, 2008
***Assumed
****Assumed values based on the Cover Investigation Report by Malcolm Pirnie, dated January 2009.
+Based on details show on sheet 6 of the Modification To Fort Bliss Landfill Plan by Coupland-Moran Consulting Engineers, Inc.

5.0 SLOPE STABILITY AND SETTLEMENT ANALYSES

The settlement and slope stability analyses performed for the proposed closure of the Type I/Subtitle D Cell for Fort Bliss MSWL site have been based upon geotechnical conditions encountered in the existing test borings as previously discussed and on information included in the referenced documentation.

Subsurface conditions on the Type I/Subtitle D landfill cell site were generalized for use in our settlement analyses as previously discussed. For slope stability analyses, silty sand soils were considered as the landfill foundation.

5.1 SLOPE STABILITY ANALYSES

5.1.1 Slope Stability Analyses Description

Slope stability analyses have been performed on one selected cross section in order to determine the global stability factors of safety for the proposed closure configuration of the Type I/Subtitle D cell for this project.

The selection of the cross section analyzed was based on considering slope heights and slope inclination for the proposed final landfill grading plan. The referenced documentation indicates that the groundwater elevation is located 300 feet or more in depth at the site. At this depth, groundwater will not affect the slope stability and it has not been considered in the analyses.

The selected cross section, Cross Section B, runs from east to west across the landfill cell as shown on the site plan, Exhibit A-1 in Appendix A. The slope configurations vary along the length of the cross section. As proposed, the steepest slope cap configuration for the landfill will be 4H:1V (Horizontal:Vertical) with a maximum height above finished grade of approximately 19 feet. The plans indicate that the steepest bottom liner slope for this section is 3H:1V. We have assumed in our analyses that no external loads (i.e., structures, traffic, etc.) will be applied to the cross section after the final grades have been achieved.

Slope-W 2007 program Version 7.17 by Geo-Slope International, Ltd was used to perform our slope stability analyses. The General Limit Equilibrium (GLE) method developed by Fredlund at the University of Saskatchewan in the 1970’s (Geo-Slope Manual, 2007) was used in our analyses. The GLE formulations are based on moment and force equilibrium conditions and allows for a range of interslice shear-normal force conditions. The GLE method also allows the analyses of different translational and rotational slip surfaces.

APPENDIX D-3

Appendix L – Facility Surface Water Drainage Report

FACILITY SURFACE WATER DRAINAGE REPORT

FORT BLISS FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION
BLISS-A10-001

Revised December 21, 2011

zia engineering & environmental consultants, llc

755 South Telshor Blvd, Suite F-201 ● Las Cruces, New Mexico 88011 ● phone (575) 532-1526 ● fax (575) 532-1587
Texas Board of Professional Engineers Certificate of Registration #F-11907

FACILITY SURFACE WATER DRAINAGE REPORT

FORT BLISS MUNICIPAL SOLID WASTE LANDFILL FINAL CLOSURE DESIGN AND PERMIT MODIFICATION APPLICATION FORT BLISS, TEXAS

Zia Project No. BLISS-A10-001

Prepared for:
U.S. Army Corps of Engineers, Fort Worth District
819 Taylor Street
Fort Worth, Texas 76102

Prepared and Certified by:
I attest that this Report has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 TAC §330.303. This document is released for the purpose of review. It is not to be used for construction or bidding purposes.

Certifying Engineer:	Francisco X. Urueta
State:	Texas
Registration Number:	99473

Signature: ______________________________
Certification Date: ______________________________
Engineers Seal:

zia engineering & environmental consultants, llc
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Las Cruces, New Mexico 88011
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TABLE OF CONTENTS

1.0 INTRODUCTION

The Fort Bliss Municipal Solid Waste Landfill (MSWLF) includes active Subtitle D Type I and Type IV landfill cells that are currently in use to serve the United States Army Air Defense Artillery Center and Fort Bliss area. Permitted types of solid wastes disposed of at the Fort Bliss MSWLF are non-hazardous solid waste from military operations, bulky items, grass and tree trimmings, refuse from litter cans, construction debris, classified waste (dry), dead animals, Regulated Asbestos Containing Material (RACM), and empty oil cans (1-quart and 5-gallon sizes). The MSWLF does not receive hazardous waste nor does it recover incoming waste.

The landfill area is comprised of five distinct areas:

- 1970's-era inactive cells that cover approximately 80-acres that are considered closed.
- An approximately 3-acre Type I cell with final cover in place (non-Subtitle D) that complies with the 1995 closure plan and TCEQ requirements.
- An approximately 10.5-acre Type I active cell meeting Subtitle D requirements (Subtitle D Cell).
- An approximately 5-acre Type IV construction and demolition (C&D) debris cell.
- Approximately 7 acres designated for landfill roads, access areas, guard shack/scale house, etc.

This Facility Surface Water Drainage Report has been completed to meet the requirements of Title 30 of the Texas Administrative Code Chapter 330.63(c) (30 TAC §330.63(c)) as part of the final closure and permit modification application for an alternative cover design and grading plan. This report was developed from the March 2009 Facility Surface Water Drainage Report by updating it to reflect the changes resulting from the alternative cover design and grading plan. This report replaces the March 2009 Facility Surface Water Drainage Report. This report illustrates that the proposed modification does not adversely alter the existing (permitted) drainage patterns and that these drainage patterns can be retained for the modification.

This report also serves as the surface water drainage report required by 30 TAC § Subchapter G. The facility design complies with the requirements of 30 TAC § 330.303 relating to management of run-on and runoff. The surface water drainage analysis for the Fort Bliss MSWLF is presented in Section 2. An Erosion and Sediment Control Plan is included in Section 3. Section 4 presents the maintenance and inspection requirements.

1.1 General Geology and Soils

The Fort Bliss MSWLF is underlain by Hueco Bolson deposits of tertiary age and typically are composed of unconsolidated to slightly consolidated interbedded sands, clay, silt, gravel, and caliche. Individual beds are not well defined and range in thickness from a fraction of an inch to about 100 feet. The general geology and soils details for the MSWLF site are provided in Attachment 6 of this report.

1.2 General Climate and Weather

The MSWLF is located in west Texas where desert conditions exist; therefore, surface water flow near the MSWLF is limited. Maximum daytime summer temperatures range between 90 and 105 degrees Fahrenheit (°F) and winter temperatures range from 55 to 60°F. The surrounding area receives less than 10 inches of rain per year and relative humidity is very low. Depending upon the intensity and duration of each precipitation event, the water delivered by the occurrence may infiltrate into the soil or become surface runoff. The infiltrated water may percolate downward to the water table or return to the atmosphere via evapotranspiration.

1.3 Surface Water Bodies

No surface water bodies exist at or near the MSWLF. Given a large rain event, all surface water runoff may flow downstream to the stormwater retention basin located approximately 2 miles south of the landfill, north of Fred Wilson Boulevard. This storm water retention basin is located on the Fort Bliss Military Reservation and is managed by the Fort Bliss Storm Water Pollution Prevention Team. Structural control measures to reduce sediment are described in the 2011 Storm Water Pollution Prevention Plan (Attachment 5). Further discussion on the surface water drainage and erosion and sedimentation controls are given in Sections 2 and 3 respectively.

2.0 FACILITY SURFACE WATER DRAINAGE ANALYSIS

The final grading/drainage plan for the approximately 106 acre landfill was modified to incorporate the reduced cover design and provide more easily constructible ridges, swales and slopes than provided in the previous (2009) permit modification. However, the drainage concept remains consistent with the previously approved site plans and consists of mostly overland and shallow concentrated flows leading off the landfill side slopes. Swales provide flow paths for internal watersheds to the perimeter. There are four pairs of drainage swales located along the edges of the access roads entering the site form the north, east, and west. Surface water runoff flows off the landfill into shallow perimeter drainage ditches that discharge to the natural flow patterns of the surrounding area. In general, the perimeter drainage ditches discharge to the natural surrounding topography at the northwest, southwest and southeast corners of the landfill as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification. These existing off-site discharge locations and contributing drainage areas will not significantly change as a result of the alternative cover design and grading plan. Therefore, the surrounding drainage patterns will not be adversely altered as a result of this alternative cover design and grading plan.

A hydrologic and hydraulic analysis was conducted on the final grading plan, shown on Sheet C-2 in Appendix D (Design Drawings) of the permit modification. The analysis incorporates the proposed alternative cover design and grading modifications to estimate the peak discharge and run-off volumes associated with the 25-year, 24-hour design storm event as required in 30 TAC §330.305I. The runoff volumes and peak discharges show that the drainage is not adversely affected and that the previously designated storm water control features (i.e. landfill drainage swales down the side slopes) remain adequate.

Appendix D (Design Drawings) of the permit modification application provides the drainage areas, cross-sectional areas, and swale grades used in the analysis.

Per the *TCEQ Guidelines for Preparing a Surface Water Drainage Report for a Municipal Solid Waste Facility* (RG-417), the Rational Method described in Chapter 5, Section 6 of the Texas Department of Transportation's Hydraulic Design Manual (TxDOT 2004) was used to calculate the peak discharge flows. Use of USDA Natural Resources Conservation Service (NRCC) Technical Release 55 (TR-55) method has been approved by the Texas Commission on Environmental Quality (TCEQ) Executive Director for the calculation of the runoff volumes. The values for runoff volume, peak discharge, and flow velocity calculated in this analysis are used to design the erosion and sediment controls and to confirm that the existing drainage patterns for the landfill will not be adversely affected because of these modifications.

2.1 Runoff Volume

The volume of runoff from the landfill cover is dependent on the anticipated amount of precipitation and potential abstractions (principally infiltration) which depend on the soil type, vegetative cover, and the hydraulic conditions of the soil and proposed cover material.

The runoff volume from the landfill is calculated in accordance with 30 TAC §330.63(c)(1)(C) and §330.305(a) using the Curve Number (CN) Method, also known as the Soil Conservation Service (SCS Runoff Curve Number Method) method TR-55:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where: Q = runoff (inches over the watershed area)

P = precipitation for the 25-year/24-hour storm event (inches)

S = 1000/CN – 10 = potential maximum retention after runoff begins (inches)

CN = SCS curve number (Table 2-2, Chapter 2, TR-55)

The following assumptions were used to obtain the values above:

P = 3.5 inches (NOAA National Weather Service, Technical Paper 40, 1961)

CN = 82 (weighted average: 95 acres of CN 81 from Table 2.2d, fair herbaceous cover Hydrologic Soil Type C and 11 acres of CN 85 from Table 2.2a, Gravel access roads Hydrologic Soil Type B)

Therefore, the total runoff volume for the landfill during a 25-year, 24-hour storm event is:

S = 1000/82 – 10 = 2.2

Q = (3.5 – 0.2*2.2)^2 / (3.5 + 0.8*2.2) = 1.78 inches

Runoff Volume = Q*A = 1.78 inches (106 acres)/12 = 15.7 acre-feet (ac-ft).

A copy of Worksheet 2 from TR-55 is provided as Attachment 1 of this report.

Table 2-1: Summary of Runoff Volumes

Precipitation (P)	Runoff (Q)	Total Runoff Volume (V)
3.5 inches (25-year, 24-hour)	1.78 inches	15.7 ac-ft

The landfill was divided into 17 separate drainage (watershed) areas based on the final grading plan as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification application. The following table summarizes the runoff volume for each watershed.

Table 2-2: Runoff Volumes by Watershed

Watershed No.	Area (acres)	Runoff Volume (ac-ft)
1	1.8	0.3
2	1.6	0.2
3	4.4	0.6
4	10.6	1.6
5	3.0	0.4
6	7.5	1.1
7	10.1	1.5
8	7.9	1.2
9	5.1	0.8
10	2.1	0.3
11	5.0	0.7
12	4.5	0.7
13	0.9	0.1
14	4.9	0.7
15	29.7	4.4
16	3.2	0.5
17	3.7	0.6
Total:	**105.8**	**15.7**

2.2 Peak Discharges

The peak discharge at any storm water control outlet or overland flow from a watershed area is dependent on the time of concentration of that watershed area or drainage swale outfall. The following paragraphs described the rational method and assumptions used to calculate the peak discharge flows for each of the 17 watershed areas shown on the final grading plan on Sheet C-3 of Appendix D (Design Drawings) in the permit modification.

2.2.1 Time of Concentration

The time of concentration (T_c) is the time required for a drop of water to travel from the most hydrological remote point in the watershed to the point of collection.

The time of concentration was calculated according to the procedures specified in TR-55 for each watershed area.

The steps for determining the time of concentration are summarized below:

1. The landfill was divided into 17 separate watershed areas based on the final grading plan as shown on Sheet C-3 of Appendix D (Design Drawings) of the permit modification application.

2. The area of each watershed was determined as summarized in Table 2-2.

3. The sheet flow, shallow concentrated flow, and channel flow lengths and slopes were determined for each watershed area using Sheet C-3 of Appendix D (Design Drawings) of the permit modification application.

4. The travel time (T_t) for the separate types of flow in each watershed area were calculated (Worksheet 3, Chapter 3, TR-55) using the following equations and then added together to compute the total T_c for the watershed area:

   T_c = Sheet Flow T_t + Shallow Concentrated Flow T_t + Channel Flow T_t

   a. Sheet flow travel time was calculated with a maximum flow length of 300-feet using Overton and Meadow's equation: $T_t = 0.007\ (nL)^{0.8} / (P_2)^{0.5}\ (S)^{0.4}$ (the value for "bare soil", 0.011, was used for the roughness coefficient n).

   b. Shallow concentrated flow travel time was calculated using the equation T_t = L/3600*V where the average flow velocity (V) was obtained from Figure 3.1 in Chapter 3 of TR-55 for unpaved surface at the specified watercourse slope.

   c. Channel flow travel time was also calculated using T_t = L/3600*V where the average flow velocity was calculated by the Manning's equation:

      $V = 1.49*(r^{2/3})\ (s^{½}) / n$. (0.022 was used for Manning's roughness coefficient for the grass swale, n). The following iteration was followed to determine the final T_t:

      i. Depth of flow, "y", is assumed.

      ii. Cross-section area, wetted perimeter, and hydraulic radius are calculated.

      iii. T_t is determined and the peak discharge is computed with TR-55.

      iv. The peak discharge is used in the Manning's equation to determine the depth of flow, "y".

      v. The computed depth of flow is compared with the assumed value. The assumed value is adjusted and the calculation reiterated until the calculated and assumed values are close in value.

2.2.2 Rational Method

The procedure for calculating the Rational Method described in Chapter 5, Section 6 of the Texas Department of Transportation's Hydraulic Design Manual (TxDOT 2004) was used to calculate the maximum rate of runoff. The Rational Method estimates the peak rate of runoff at any location in a watershed as a function of the drainage area, runoff coefficient, and mean rainfall intensity of duration equal to the time of concentration. The rational formula is expressed as:

$Q = CC_fIA$

Q = Maximum rate of runoff (cfs)

C = runoff coefficient (0.38 based on poor vegetative cover and relatively flat land)

C_f = Runoff Coefficient Adjustments (1.1 for the 25 year storm)

I = average rainfall intensity (in/hr) for the 25-year/24 hr and the time of concentration for each area as described in Section 2.2.1 above.

A = drainage area (acres)

Because most of the watersheds are small and had times of concentration less than 10.25 minutes (minimum time of concentration of 10 minutes recommended by 2004 TxDOT Hydraulic Manual), the rainfall intensity for the 25-year storm for most watersheds was 4.4 inches/hour. Watershed No. 11 has a time of concentration of 12.60 minutes and resulted in a rainfall intensity of 4.0 inches/hour. Watershed No. 15 has a time of concentration of 18.45 minutes and resulted in a rainfall intensity of 3.4 inches/hour. The runoff coefficient was calculated as a factor of the relief, soil infiltration characteristics, vegetative cover, and surface type in accordance with the Hydraulic Design Manual (TxDOT 2004). A runoff coefficient factor of 1.1 was used to adjust the runoff coefficient since these calculations are for the 25-year storm event. A sample calculation and the results of the peak discharge calculations for the 17 watersheds are provided in Attachment 1 and Table 2-3, respectively.

Table 2-3: Peak Discharges

Watershed No.	Area (acres)	Time of Concentration (hours)	Peak Discharge (cfs)
1	1.8	0.14	3.3
2	1.6	0.10	3.0
3	4.4	0.10	8.0
4	10.6	0.17	19.4
5	3.0	0.17	5.5
6	7.5	0.16	13.7
7	10.1	0.12	18.5
8	7.9	0.14	14.5
9	5.1	0.17	9.3
10	2.1	0.09	3.9

Watershed No.	Area (acres)	Time of Concentration (hours)	Peak Discharge (cfs)
11	5.0	0.21	8.3
12	4.5	0.09	8.3
13	0.9	0.10	1.7
14	4.9	0.10	8.9
15	29.7	0.31	42.2
16	3.2	0.17	5.9
17	3.7	0.13	6.9

2.3 Peak Runoff Velocities Calculations

The general surface hydrology and stormwater runoff for the final cover grades are shown on Sheet C-3 in Appendix D (Design Drawings) of the permit modification. Stormwater from watersheds 1 through 4, 9, and 13 through 16 drain straight to the perimeter drainage ditches, where as watersheds 5 though 8, 10 through 12, and 17 drain to erosion control lined swales and then out to the perimeter drainage ditches. The site perimeter drainage ditches discharge to the natural surrounding flow patterns and generally flow towards the northwest, southeast and southwest corners of the landfill.

The flow velocities and the flow depths for the eight landfill drainage swales and six perimeter drainage ditches are summarized below in Table 2-4. The typical swale is V-shaped, 1 to 1.5 feet deep with 10 (H): 1 (V) side slopes on side adjacent to access road and 4 (H): 1 (V) side slopes on opposite side. The typical drainage ditch is trapezoidal, 1 to 1.5 feet deep, 10 to 30 foot wide bottom with 4 (H): 1 (V) side slopes. Details of each type of drainage conveyance structure are shown on Sheet C-4 in Appendix D (Design Drawings) of the permit modification were used for the hydraulic analysis of the landfill drainage swales. A sample calculation of the methodology used for determining the velocities and flow depths is provided in Attachment 1. As demonstrated in Table 2-4 flow depths of each swale are less than 1 foot, therefore all swales provide sufficient capacity to convey peak flow from the 25-year, 24-hour storm event.

Table 2-4: Velocities and Depths of Flow in Swales and Ditches

Watershed Associated with Swale or Ditch	Peak Discharge (cfs)	Flow Depth (ft)	Velocity (ft/s)
5	5.5	0.6	2.1
6	13.7	0.9	2.6
7	18.5	0.8	3.9
8	14.5	0.8	3.5
10	3.9	0.5	2.6
11	8.3	0.7	2.6
12	8.3	0.6	3.6

Watershed Associated with Swale or Ditch	Peak Discharge (cfs)	Flow Depth (ft)	Velocity (ft/s)
17	6.9	0.5	3.3
Perimeter North (2, 3, 7, 8)*	44.0	0.9	2.8
Perimeter East (2, 3, 7, 8, 9, 12, 16, 17)*	74.4	0.8	2.8
Perimeter South (15)*	42.2	0.9	2.7
Perimeter South West (14)*	8.9	0.4	1.8
Perimeter West (4, 10, 11, 13)*	33.3	0.9	2.7
Perimeter North West (1, 5, 6)*	22.5	0.7	2.4

* Watersheds draining to the perimeter ditch

2.4 Summary of Drainage Analysis

The 2009 permit modification grading plan was designed to convey drainage from approximately two-thirds of the area to the southeast corner of the site with the drainage from the other one-third of the area evenly divided between the northwest and southwest corners. The proposed alternative cover and grading plan was designed to maintain these drainage areas. Table 2-5 summarizes the permitted facility conditions per the approved 2009 permit modification and the proposed conditions with the alternative cover design and grading plan, to demonstrate that the proposed modification does not adversely affect the surrounding drainage patterns. The comparison illustrates that the peak discharges, runoff volumes, average flow depths, and average flow velocities discharging off-site will not be significantly altered because of the proposed modification. The landfill surface area was not increased and the off-site drainage discharge locations were not altered significantly so as to change the previously permitted drainage conditions of the site.

Table 2-5:
Comparison of Peak Discharges, Volumes, Flow Depths and Flow Velocities at Off-Site Discharge Locations

Location	Peak Discharge (cfs)		Runoff Volume (ac-ft)		Average Flow Depth (ft)		Average Flow Velocity (ft/s)	
	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT	2009 Permit MOD	Proposed ALT
Southeast Corner	126.1	116.6	10.2	10.5	1.0	0.9	2.8	2.8
Southwest Corner	32.3	32.5	2.6	2.6	0.8	0.7	2.2	2.2
Northwest Corner	34.2	32.2	2.9	2.6	0.7	0.7	2.5	2.4

3.0 EROSION AND SEDIMENT CONTROL PLAN

This plan describes the design and operation considerations for erosion and sediment control measures specified and best management practices (BMPs) of the landfill facility in order to minimize erosion and provide effective erosional stability to top dome surfaces and external embankment side slopes during all phases of landfill operations in accordance with 30 TAC §330.305(d).

The plan layouts the erosion and sediment control measures for the three conditions of the Fort Bliss MSWLF: the active Subtitle D disposal areas, intermediate cover areas, and final cover areas. The installation of the proposed erosion and sediment control measures will be on going and include both temporary and permanent controls throughout the remaining duration of the landfill operation until closure is completed when all permanent controls are finally installed.

Landfill cover phases are defined as daily cover, intermediate cover, and final cover. The topography of the landfill changes over time as the landfill is operating and reaching closure grades. In order to comply with 30 TAC §330.305(d), top dome surfaces and external embankment side slopes are defined as areas of above graded slopes that drain to the existing perimeter drainage swale, areas that have received intermediate or final cover, and areas that have received their permitted elevation and will remain inactive for longer than 180 days. Slopes that drain to cells where waste is being placed are not considered external embankment side slopes.

Based on the above definitions, all areas of the Fort Bliss MSWLF will require erosion and sediment controls per 30 TAC §330.305(d). In addition, active internal slopes within the Subtitle D cell where waste and daily cover are being placed will require run-on and run-off controls per 30 TAC §330.305(b) and (e).

3.1 General Erosion and Soil Loss Assessment

Areas of the site most prone to erosion and soil loss are areas of soil disturbance for the landfill operations, areas with steep slopes for intermediate and final covers, and intermediate or permanent drainage swales that control stormwater discharges leaving the site. Therefore, the erosion and sediment control plan focuses on these sensitive areas and incorporates structural and non-structural controls to guard against soil loss from site.

During a rain event, stormwater falls on the top dome and embankment side slopes of the landfill where erosion is more susceptible. In areas of steeper slopes and embankment side slopes, structural BMPs such as temporary soil berms and swales are proposed to control the runoff and minimize erosion. The following sections, accompanied by the Permit Modification Drawings in Appendix D (Design Drawings) describe the design for structural erosion control measures proposed to avoid erosion and off-site discharge of sediments during the phases of landfill operation through final closure. Maintenance and inspections are addressed in Section 3.4 of this report.

3.2 Interim Construction Stages

This sub-section describes temporary and intermediate erosion control measures that will be used during the landfill interim construction stages to minimize erosion of top dome surfaces and external embankment side slopes as required by 30 TAC §330.305(e)(2). The erosion control measures were selected and designed based on velocity and soil erosion analyses. The temporary erosion control measures shall remain in place until the final cover installation is completed and all permanent erosion control measures have been installed.

3.2.1. Description of Phase Development

Interim construction phases include filling of waste and daily cover grading in Subtitle D and placement of intermediate soil cover in Subtitled D. Sections 21 and 22 of the Fort Bliss Solid Waste Landfill Site Operating Plan (March 2008) describes measures to be implemented to comply with 30 TAC §330.305(b) and (e). Contaminated storm water as defined by 30 TAC §330.3(36) shall be managed in accordance with Section 23 of the Site Operating Plan. The phased development for landfill cell construction and solid waste placement will be followed as specified in the typical fill operation cross section detail on Sheet C-4 in Appendix D (Design Drawings) of the permit modification. This sequencing will ensure adequate slope stability and limited erosion and soil loss during cell construction and installation of the intermediate and final cover systems.

During filling operations through installation of the final cover, the top dome of the daily and intermediate cover for Subtitle D shall be sloped at 2.0% and the external embankment side slopes will be 4(H):1(V) as shown on Sheet C-4 in Appendix D (Design Drawings). Stormwater shall be controlled with temporary soil berms, and drainage swales to avoid erosion of the embankment side slopes and maintain flow velocities at or below the permissible non-erodible velocity.

The temporary soil berms will be used near the crest of the external embankment side slope to divert runoff to the swales, located on the north and south sides of Subtitle D cell, as shown on Sheet C-5 in Appendix D (Design Drawings). The typical temporary soil berm design will be 2-foot high as measured from the invert of the channel to the top of berm, with the invert sloped at 0.5% minimum and 10% maximum in the direction of flow towards the drainage swales. The slopes of the soil berms will be stabilized with mulch or equal. (see Section 3.2.3 below)

Two swales will run along the existing Subtitle D cell access roads and will be constructed at the termination of the temporary soil berms as shown on Sheet C-4. The recommended minimum dimensions of the discharge swales are V-shaped, 1 to 1.5 feet deep with 10 (H): 1 (V) side slopes on side adjacent to access road and 4 (H): 1 (V) side slopes on opposite side. Stabilization of the swales shall be established using either Reno®Mattress, Armoflex®, riprap or equal.

The drainage swales will convey runoff off-site to the perimeter drainage ditches and out to the surrounding topography (not shown in the Appendix D drawings) at existing discharge points. Slopes of the topography surrounding the site are shallow with numerous low lying areas and small dunes topped with vegetation common to the semi-arid southwest. Surrounding topography generally slopes from northeast to southwest. Hydraulic analysis of the drainage swales is included in Attachment 1.

3.2.2. Erosion and Sediment Controls Design

The erosion and sedimentation controls described above where designed based on the following criteria outlined in 30 TAC §330.305(d), to ensure the stability of top dome surface and external embankment side slopes:

- The estimated peak runoff velocity should be less than the permissible non-erodible velocities under similar conditions. Typical permissible non-erodible flow velocities assumed for the design are:
  - Silty-sandy loam 3 ft/sec,
  - Coarse Gravels is 5 ft/sec,
  - 0.5 ft thick Reno®Mattress or Armoflex® 8 ft/sec

- The potential soil erosion loss should not exceed the permissible soil loss for comparable soil slope lengths and soil-cover conditions. The soil erosion loss of 50 tons/acre/year is selected as the permissible soil erosion loss for interim erosion and sediment controls.

Peak Runoff Velocities Calculations

To calculate the flow velocity being conveyed along the temporary soil berm and out the drainage swale as described above and shown on Sheet C-4 in Appendix D (Design Drawings), the interim peak discharge from watershed 7A, as shown on Sheet C-5, was calculated and is presented in Attachment 2. The worst case slope for a berm constructed on the top dome surface is a maximum anticipated slope of 0.5% on the daily and/or intermediate cover, resulting in a flow velocity along the temporary soil berm of approximately 1.4 ft/sec. The worst case slope for a berm constructed along the external embankment is the maximum allowable berm slope of 10%, resulting in a flow velocity along the temporary soil berm of approximately 6.9 ft/sec. Thereafter, the flow is conveyed through the permanent discharge swale at its proposed slope of 1%, resulting in a flow velocity of approximately 3.9 ft/sec as calculated in section 3 and presented in Table 2-4 and Attachment 1.

Drainage and conveyance channels were designed and sized to withstand erosive forces of water and not to exceed the permissible non-erodible velocities presented in section 3.2.2 and summarized in Table 3-1.

Table 3-1:
Comparison of Calculated Flow Velocities and Permissible Non-Erodible Velocities

Type	Velocity	Permissible Non-Erodible Velocity
Temp. Soil Berm - Top Dome	1.4 ft/sec	3 ft/sec (silty-loam)
Temp. Soil Berm - off Subtitle D Embankment	6.9 ft/sec	8 ft/s (Reno®Mattress)
Drainage Swale off Landfill	3.9 ft/sec	5 ft/sec (gravel lined swale)

To further reduce flow velocities and allow sediments and other pollutants to settle, organic check dams will be installed at the discharge points from the drainage swales adjacent to Subtitle D as shown on Sheet C-5 in Appendix D (Design Drawings).

The hydraulic calculation supporting this design of the temporary soil berm and discharge swale is included in Attachment 2. The hydraulic calculation supporting the design of the permanent drainage swale is included in Attachment 1.

Soil Loss Calculations
Soil erosion loss was estimated utilizing the Revised Universal Soil Loss Equation Version 2 (RUSLE2). RUSLE2 uses factors that represent the effects of climate (erosivity, precipitation, and temperature), soil erodibility, topography, cover management, and support practices to compute soil loss and erosion.

RUSLE2 is a mathematical model that uses a system of equations implemented in a computer program to estimate erosion rates. The other major component of RUSLE2 is a database containing an extensive array of site/county specific values (precipitation, R, EL, etc.) that are used by the RUSLE2 user to describe a site-specific condition so RUSLE2 can compute erosion values that directly reflect conditions at a particular site. The RUSLE2 computer program and its extensive database information were developed by the USDA-Agricultural Research Service (ARS), USDA-Natural Resources Conservation Service (NRCS) and the University of Tennessee. The horizontal length of 1,000 feet at an average slope of 2.7% was calculated using the following flow segments from Sheet C-5: 250 feet at 0.5% (top dome); 205 feet at 10% (embankment); and 545 feet at 1% (swale).

Results show soil losses of 5.0 tons/acre/year. With the organic check dam installed at the discharge point of the drainage swale as a best management practice (BMP) for pollution prevention, the soil losses would be reduced to 2.4 tons/acre/year. The soil loss analyses demonstrate that proposed erosion and sedimentation controls can achieve effective erosional stability. Soil loss calculations are included in Attachment 2.

3.2.3 Soil Surface Stabilization – Interim Measures

The selected BMPs to be implemented during landfill operations, for soil stabilization and stormwater control, are ones that are proven and commonly used as described below.

Temporary stabilization of intermediate cover on top dome and external slopes will be completed within 180 days after installation and maintained until the final cover is placed and permanent stabilization controls implemented. Types of soil surface stabilization BMPs that will be implemented at the site are listed below:

The specific cover practices that will be implemented prior to installation of final closure:

- Mulch - Mulching is the application of a layer of organic, biodegradable material which is spread over areas where vegetation is not yet established. Types of mulch include compost, straw, wood chips, or manufactured products. Mulch application can be in dry or hydraulic forms. When applied dry, the thickness of the mulch will vary depending on the type of mulch applied. Primary-grind mulch (e.g. wood shreds that form a mass of intermixed fragments), which will be used primarily for erosion control, will be applied using spreading equipment, such as a bulldozer, at a minimum thickness of 2-inches. Compost material, which will consist of more finely ground mulch, will be applied using mechanical spreaders or sprayers. A tackifier or binder can be used to increase the strength and durability of the mulch. Hydraulic mulch applications consist of the use of hydromulch, bonded fiber matrix, Flexible Growth Medium (FGM), Flexterra®, as well as other commercially available products. Hydraulic mulch typically includes a tackifier or binder. Seeds can be applied to the soil first or mixed into the hydraulic mulch.

  The application method and application rate of hydraulic mulch will be based on manufacturers' recommendations to ensure a uniform and complete coverage. A specification of the Flexterra® product and Ecoblanket is included in Attachment 4. Any mulch (dry or hydraulic) that is used shall be evaluated by site personnel to ensure it remains in place on the slopes during rain events or windy conditions.

For erosion control in drainage swales as shown on Sheet C-5 in Appendix D (Design Drawings), rolled-erosion control products (RECPs) can be used and are specified herein. The standard specification for rolled erosion control products published by the Erosion Control Technology Council is provided in Attachment 4.

For pollution prevention, organic/biodegradable check dams (organic check dam) are specified. These types of silt control structures are alternatives of traditional silt fences and straw bales. Organic check dams may be Organic Filter Tube Check Dams or Organic Filter Berm Check Dams. A typical biodegradable tube consists of mulch contained in a synthetic mesh sock or tube. The tubes are installed on the slope with stake anchors. Organic berms are typically constructed of compost/mulch. A specification for the organic check dam, published by the TCEQ, is included in Attachment 4.

For on-site stockpiles, some combination of silt fences, rock berms or soil berms will be required around the stockpiles to prevent the discharge of sediment-laden runoff from the stockpile area(s) unless vegetation is used to stabilize the stockpiles.

3.3 Final Cover Stage

Permanent erosion and sediment controls measures will be installed during the final cover phase, detailed on Sheet C-5 in Appendix D (Design Drawings) of the permit modification. These permanent erosion and sedimentation control measures include an erosion control layer (e.g topsoil and 1"-4" cobbles and drainage. Details of the measures are shown on Sheet C-5 in Appendix D (Design Drawings).

3.3.1 Erosion and Sedimentation Controls Design

The permanent erosion and sediment control measures were designed based on the peak flow velocities presented in Table 2-4 and soil loss analysis discussed below for the final cover design.

Peak Runoff Velocities Calculations

The flow velocity through the drainage swales where calculated in Section 2.3 and presented in Table 2-4. The drainage swales will have erosion control lining as specified on the drawings and therefore was compared to the permissible non-erodible velocity of 5 ft/sec. All the velocities presented in Table 2-4 compared to the permissible erodible velocities presented in Table 3-1 illustrate that the drainage and conveyance channels were designed and sized to withstand erosive forces of water and not to exceed the permissible non-erodible velocity of 3 ft/sec in the drainage ditch and 5 ft/sec in the drainage swales.

Soil Loss Calculations

RUSLE2 is a mathematical model was exercised to compute the soil loss analysis for the final cover surfaces. The Subtitle D area final cover slopes were analyzed: 250 feet at 2% (top dome); 95 feet at 25% (embankment); and 655 feet at 1% (swale). The input data for management operations have been changed: riprap fill on the top surfaces of Subtitle D area added, etc. The results show soil losses of 4.9 tons/acre/year and reduction to 2.2, because of erosion control measures for Subtitle D cell. The soil loss analysis demonstrates that the landfill surfaces with proposed erosion and sedimentation controls can achieve recommended soil loss rate. (According to *Guidance for Addressing Erosional Stability During all Phases of Landfill Operation*, 30 TAC §330.63(c), §330.305(c), (d) and (e), 02/14/07, the soil erosion loss of 50 tons/acre/year is a permissible soil erosion loss rate and 2 to 3 tons/acre/year is a recommended rate for final cover phase).

Erosion calculations report is included in Attachment 3.

Based on velocity and soil erosion analyses, selections of BMPs are identified and general installation guidance is provided on Sheet C-3 and C-5 in Appendix D (Design Drawings) of the permit modification.

3.3.2 Soil Surface Stabilization – Permanent Measures

The selected BMPs that will be implemented for final cover and post closure landfill operations, to meet the soil stabilization and stormwater control requirements, are ones that are proven and commonly used as described below.

- Vegetation - Vegetative cover reduces erosion potential by shielding the soil surface from the direct erosive impact of raindrops, improving the soil's water storage porosity and capacity, so more water can infiltrate, slowing the runoff and allowing the sediment to drop out, and physically holding the soil in place with plant roots. Vegetative cover will consist of a balanced mixture of native herbaceous and vascular plants. Dr. Rafael Corral of the Fort Bliss Environmental Division and Leah Markiewitz with Zia provided an optimum vegetative design to utilize indigenous species of the area such as alkali sacaton and sand dropseed. This type of vegetation more suitable for the area and was selected in accordance with guidelines published by the state and other similar sources. The standard seeding specification published by the Texas Department of Transportation (TxDOT) is provided in Attachment 4.

- Erosion control protection such as rip rap or geosynthetic erosion control material will be installed in the swales as determined by Fort Bliss at the time of closure.

4.0 MAINTENANCE AND INSPECTIONS

In addition to the design and operational considerations as previously described in the Erosion and Sedimentation Control Plan, inspection and maintenance of the stormwater management system and erosion control measures are necessary to maintain the required effectiveness of the system components. The inspection, maintenance, and repair guidelines discussed in the following sections will be implemented into the employee training program as outlined in Site Operating Plan and Stormwater Pollution Prevention Plan 2011.

4.1 Stormwater Management System

The facility will be monitored to ensure the integrity and adequate operation of the stormwater collection and conveyance structures. On a weekly basis, and following major storm events, all temporary and permanent drainage facilities will be inspected. In the event of a washout or failure, the drainage system will be restored and repaired pursuant to 30 TAC §330.305(e) (1). Plans and actions will be developed to address and remediate the problem, to ensure protection to ground and surface waters.

Erosion of intermediate and final cover will be repaired pursuant to 30 TAC §330.165(g). Sediment and debris will be removed from ditches as needed to maintain the effectiveness of the stormwater management system. Minor maintenance requirements, such as the removal of excessive sediment and vegetation, will be undertaken as required.

In accordance with 30 TAC §330.305(g), Stormwater Pollution Prevention Plan 2011, describes inspections, maintenance, and record keeping frequencies and techniques for the phased development of the landfill. The plan discusses how the owner or operator will handle, store, treat, and dispose of surface or groundwater that has become contaminated by contact with the working face of the landfill or with leachate pursuant to §330.207 of this title (relating to Contaminated Water Management); and how storage areas for this contaminated water will be designed with regard to size, locations, and methods.

A Storm Water Pollution Prevention Plan was prepared for the site in 2011. The plan satisfies the control of erosion and sedimentation using interim controls for the phased development of the landfill as required by 30 TAC §330.63(c) (1) and §330.305(c), (d), and (e) until the landfill is closed per the regulations.

4.2 Landfill Cover Materials

Landfill cover soils are inspected on a regular basis. Daily cover soils are inspected and applied as part of the Site Operating Plan requirements. In addition, pursuant to the facility's SWPPP, during the active life of the site, daily, intermediate and final cover will be inspected weekly and after a significant rainfall event for areas of erosion, exposed waste, or other damage. During the post-closure maintenance period of the site, the final cover will be inspected quarterly. The inspections will include any temporary or permanent erosion measures that are in place at the time of the inspection.

Reports of these inspections will be documented in the Cover Application Log and will be maintained as part of the site operating record, in accordance with the Site Operating Plan. Damage to the cover system noted during these inspections will be repaired, as set forth below, and documented in the Cover Application Log. Any runoff from damaged or eroded areas that has met waste will be handled as contaminated water in accordance with site operating plan until the repairs are completed.

In accordance with 30 TAC §330.165(g), erosion gullies or washed-out areas deep enough to jeopardize the intermediate or final cover must be repaired within five days of detection. An eroded area is considered deep enough to jeopardize the intermediate or final cover if it exceeds four inches in depth as measured from the vertical plane from the erosion feature and the 90-degree intersection of this plane with the horizontal slope face or surface. Damage to any temporary or permanent erosion measures that are noted during the inspections, will be repaired or replaced within 14 days of detection. The repair schedule as outlined for the cover or the erosion measures may be extended due to inclement weather conditions or the severity of the condition requiring an extended repair schedule.

5.0 ATTACHMENTS

ATTACHMENT 1 – Peak Discharge Flow Sample Calculations Using Rational Method and Drainage Swale Design

ATTACHMENT 2 – Intermediate Erosion and Soil Control Design Calculations (Peak Runoff Velocity, Channel Design, and Soil Loss)

ATTACHMENT 3 – Final Erosion and Soil Control Design Calculations (Soil Loss)

ATTACHMENT 4 – Erosion and Soil Control Measures Specifications Information

ATTACHMENT 5 – 2011 Stormwater Pollution Prevention Plan (For Reference Only. Prepared by Fort Bliss Directorate of Public Works, Environmental Division, Storm Water Compliance)

ATTACHMENT 6 – Geohydrologic Site Characterization of the Municipal Solid Waste Landfill Facility, U.S. Army Air Defense Artillery Center and Fort Bliss, El Paso County, Texas

Insert Page Into Attachment 2

Perimeter Ditch Hydraulic Analysis
25-Year Storm Event

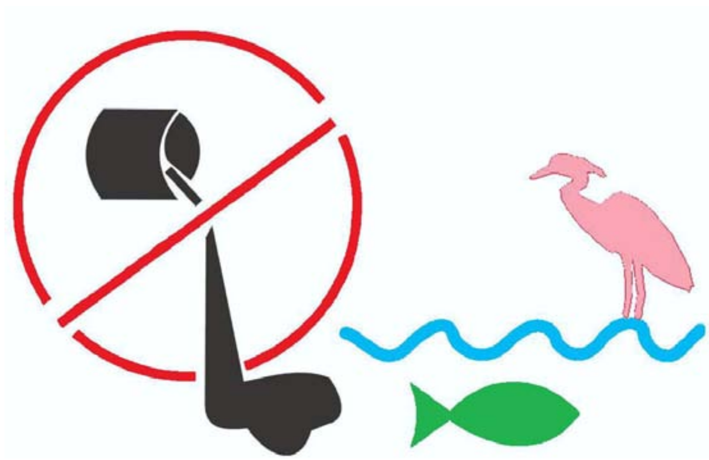
Ditch	Contributing Watersheds	Slope (ft/ft)	Manning Roughness, n	Side Slope 1 (z_1:1)	Side Slope 2 (z_2:1)	Bottom Width (ft)	Depth (ft)	Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Avg Velocity (ft/s)	Flow (cfs)
North	2, 3, 7, 8	0.0025	0.022	4	4	14.00	0.90	15.87	21.43	0.74	2.77	44.00
East	2, 3, 7, 8, 9, 12, 16, 17	0.0025	0.022	4	4	30.00	0.81	26.97	36.69	0.74	2.76	74.40
South	15	0.0025	0.022	4	4	14.00	0.88	15.43	21.26	0.73	2.73	42.20
South West	14	0.0025	0.022	4	4	10.00	0.43	5.07	13.56	0.37	1.76	8.90
West	4, 10, 11, 13	0.0025	0.022	4	4	10.00	0.91	12.38	17.49	0.71	2.69	33.30
North West	1, 5, 6	0.0025	0.022	4	4	10.00	0.73	9.45	16.03	0.59	2.38	22.50

ATTACHMENT 5

2011 Stormwater Pollution Prevention Plan

(For Reference Only. Prepared by Fort Bliss Directorate of Public Works, Environmental Division, Storm Water Compliance)

STORM WATER POLLUTION PREVENTION PLAN CALENDAR YEAR 2011 FORT BLISS, TEXAS



Directorate of Public Works
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FINAL
January 2011

This document is organized in an identical format to Texas Commission on Environmental Quality Multi Sector General Permit TXR050000 in order to provide section by section correspondence for future compliance reviews.

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LIST OF APPENDICES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AR	Army Regulations
AST	Aboveground Storage Tank
BAAF	Biggs Army Air Field
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CAB	Combat Aviation Brigade
COD	Chemical Oxygen Demand
COR	Contracting Officer
DPW-E	Department of Public Work – Environmental Division
DRMO	Defense Reutilization and Marketing Office
DRMS	Defense Reutilization and Marketing Service
EMS	Environmental Management System
GSA	General Services Administration
HWSF	Hazardous Waste Storage Facility
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
NEPA	National Environmental Policy Act
OWS	Oil Water Separator
POC	Point of Contact
POD	Point of Discharge
POL	Petroleum/Oil/Lubricant
SAP	Satellite Accumulation Point
SIC	Standard Industrial Classification
SPCCP	Spill Prevention Control and Countermeasure Plan
SWMP	Storm Water Management Plan
SWP3	Storm Water Pollution Prevention Plan
SWPPT	Storm Water Pollution Prevention Team
SWMU	Solid Waste Management Unit
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TSS	Total Suspended Solids
USGS	U.S. Geological Survey
UST	Underground Storage Tank

PART III. PERMIT REQUIREMENTAND CONDITIONS

Section A. Storm Water Pollution Prevention Plan Requirements

1. Implementation of SWP3 and Consistency with Other Plans

(a) The Fort Bliss SWP3 is maintained onsite and readily available for review by authorized TCEQ personnel upon request. The master copy under control of the installation Directorate of Public Works, Environmental Division Storm Water Compliance Manager is located in Building 622, room 110 (915) 568-0794. Copies are also maintained at each industrial activity site listed in the SWP3 under the control of the site POC. Storm Water discharge from industrial activities and the Fort Bliss MS4 could contribute storm water discharges to the adjacent and interconnected City of El Paso municipal separate storm sewer system (MS4) and a copy of the Fort Bliss SWP3 will be furnished to the City of El Paso if requested. The Fort Bliss SWP3 has been developed according to the requirements of TXR050000 and specifically includes:

(1) The most wide spread potential pollutant is POL. The appendices to this SWP3 identify the sites of actual or potential sources of pollution that are anticipated to affect the quality of storm water discharges from the facility. A figure showing the locations and distribution of MSGP sites is located in Appendix A. Certifications and signature pages are located in Appendix B

(2) Installation wide practices to effectively reduce storm water pollution and to maintain consistency with other plans include implementation of the installation EMS, designation and training of an Environmental Officer for every organizational entity operating at Fort Bliss, installation internal EPAS annual audit system, and installation requirement for secondary containment for any stored liquids, These are the primary installation wide practices and controls that prevent or effectively reduce pollution in storm water discharges from the facility and that ensure compliance with the terms and conditions of this general permit.

(3) The above described installation wide practices and controls in combination with site and process specific training are appropriate for the facility due to the very large, transient installation population and large geographic distribution of industrial activities.

(4) Installation controls and practices are a combination of training, inspection, and correction applied both at an installation wide level and application of storm water pollution prevention practices focused at site and process specific activities by on-site training, recurring formal and informal site inspections, and consideration of the Annual Comprehensive Site Compliance Evaluation results by the Storm Water Pollution Prevention Team.

(b) The installation Spill Prevention Control Countermeasures Plan (SPCCP) [USACE, 2010] is readily available for review by authorized TCEQ personnel upon request. The master copy under control of the installation Directorate of Public Works, Environmental Division Pollution Prevention Manager (Mr. Danny Duran) is located in Building 622, room 107 (915) 568-6989.

2. Pollution Prevention Team

A storm water Pollution Prevention Team has been established. The SWP3document in PDF form is available to the members of the team, as well as all employees via the Fort Bliss intranet Environmental Division storm water web site under “Links”. (https://imcom.bliss.army.mil/DPWE/stormwater/default.aspx).

(a) Members of the Team, contact information and responsibilities are shown in Table 1.

TABLE 1 STORM WATER POLLUTION PREVENTION TEAM

Member	Responsibilities
Kelly Blough, Storm Water Compliance Manger	Clean Water Act Storm Water compliance execution including regulatory review and budget and NEPA planning.
Bob Lenhart, Storage Tanks and Fuels	Storage tanks and fuel compliance oversight particularly with respect to secondary containment.
Danny Duran, Pollution Prevention	Spill response and SPCC plan preparation and execution.
Hector Flores, Contractor, MSGP Technician	MSGP SWP3 training, inspections and equipment distribution.
George Galvan, Contractor, MS4 Technician	Small MS4 outreach and support.

(b) The team completes annual review of storm water compliance program statistics prepared by storm water compliance manager including inspections results and analytical results and makes recommendations for emphasis in training, inspections, processes or best management practices.

3. Investigation and Certification of Non-Storm Water Discharges

(a) Allowable Non-storm water discharges permitted under the MSGP are described below.

(1) discharges from fire fighting activities and uncontaminated fire hydrant flushings (excluding discharges of hyperchlorinated water, unless the water is first dechlorinated (< 4ppm) and discharges are not expected to adversely affect aquatic life);
(2) potable water sources (excluding discharges of hyperchlorinated water, unless the water is first dechlorinated and discharges are not expected to adversely affect aquatic life);
(3) lawn watering and similar irrigation drainage;
(4) water from the routine external washing of buildings, conducted without the use of detergents or other chemicals;

(5) water from the routine washing of pavement conducted without the use of detergents or other chemicals and where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed);
(6) uncontaminated air conditioner condensate, compressor condensate, and steam condensate;
(7) water from foundation or footing drains where flows are not contaminated with pollutants (e.g., process materials, solvents, and other pollutants);
(8) uncontaminated water used for dust suppression;
(9) springs and other uncontaminated ground water.

The SWP3 shall describe the discharge points and appropriate best management practices (BMPs) for these non-storm water discharges (see appendix C Site Specific Data Tables).

(b) Investigation for Non-Storm Water Discharges: A survey of potential non-storm water sources has been conducted. In addition, installation wide internal Environmental Performance Assessment System (EPAS) inspections are conducted of all industrial facilities at least once per year. In addition, many facilities that are occupied by deployable military units (e.g. motor pools) are inspected via a separate process when military units and their equipment deploy. Due to the arid climate, significant open channel conveyance, and limited natural vegetation, the municipal separate storm sewer system is screened for the presence of non-storm water flows by direct observation of potential dry weather flows by SWMT members during course of normal work activities. The procedures for correcting dry weather flows when observed, is by environmental compliance site visit if the flow is the result of management practice, or submission of an installation work order for infrastructure repairs or improvements.

(c) Certification: The SWP3 must include a certification, signed according to Part III.E.3.(g) of this general permit, relating to Signatory Requirements, that states that the facility's separate storm sewer system has been evaluated for the presence of non-storm water discharges and that the discharge of non-permitted, non-storm water does not occur. The certification signature page is located in Appendix B.

4. Description of Potential Pollutants and Sources

See Appendix C - Site Specific Data Tables.

5. Pollution Prevention Measures and Controls

See Appendix C - Site Specific Data Tables.

6. Management of Runoff with Structural Controls

See Appendix C - Site Specific Data Tables.

7. Annual Comprehensive Site Compliance Evaluation

See Appendix C - Site Specific Data Tables by Sector. This annual evaluation is completed using the internal Environmental Performance Assessment System (EPAS) process.

8. Copy of Multi-Sector General Permit (MSGP)

A full copy of the Multi Sector General Permit TXR050000 is located in Appendix D.

Section B. Inspection of the Storm Water Pollution Prevention Plan (SWP3) or Site

Site inspections are performed annually. The SWP3 is updated annually. Inspection records are maintained in SWP3 master copy located in building 622, room 110.

Section C. General Monitoring and Records Requirements

1. Representative Storm Events

(a) Monitoring, sampling, examinations, and inspections of storm water discharges that are required as a provision of TXR050000 shall be conducted on discharges of runoff from a representative storm event. For the purposes of this general permit, a representative storm event is an event with at least 0.1 inch of measured precipitation that occurs with a minimum interval of at least 72 hours from the preceding measurable storm event. The 72-hour interval requirement does not apply if the preceding storm event did not yield a discharge that was sufficient for obtaining a sample, or if it is documented in the SWP3 that an interval of fewer than 72 hours is representative for local storm events for the sampling period.

(b) Samplers serving all of the sites described in this SWP3 are located and reflect drainage originating from the actual sites prior to discharge to retention (no outlet) storm water basins.

(c) The gauge of record for execution of this SWP3 is an on-site, real time precipitation gauge operated and maintained by Fort Bliss via the US Geological Survey (USGS) and the data is viewable over the internet at http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08365702&PARAmeter_cd=00045. The USGS identity of this rain gauge station is USGS 08365702 Ft Bliss Sump at El Paso, TX. The El Paso office of the USGS is responsible for the operation and maintenance of this gauge and the point of contact is Hector Garza ((915) 534-6308, cell (915) 345-0239 or email at hhgarza@usgs.gov).

2. Representative Discharges from Substantially Similar Outfalls

(a) If discharges of storm water through two or more outfalls are substantially the same, then sampling and monitoring may be conducted at one of the outfalls, and the results may be reported as representative of the discharge from the substantially similar outfall. Before results may be submitted as representative of discharges from substantially similar outfalls, the SWP3 must include a description of outfall locations and provide a detailed justification of why the discharge qualities from the outfalls are substantially similar. To determine if outfalls are substantially similar, the following characteristics of each outfall must be compared:

(1) the industrial activities that occur in the drainage area to each outfall;
(2) significant materials stored or handled within the drainage area to each outfall; and
(3) the management practices and pollution control structures that occur within the drainage area of each outfall.

(b) Substantially similar outfalls may be established for the following monitoring requirements described in this general permit:

(1) Quarterly Visual Monitoring
(2) Hazardous Metals Monitoring
(3) Benchmark Monitoring

(c) Substantially similar outfalls may not be established for non-storm water discharges.

3. Representative Discharge Samples

All samples are collected in a manner to be as representative of the discharge as possible. Sampling should be conducted within the first 30 minutes of discharge using a grab sample using. If it is not practicable to collect the sample or to complete the sampling within the first 30 minutes, then sampling must be completed within the first hour of discharge. If sampling is not completed within the first 30 minutes of discharge, the reason must be documented and attached to all required reports and records of the sampling activity. Analytical test procedures comply with the standards specified in 30 TAC §§ 319.11 - 319.12. http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=319&sch=A&rl=Y

4. Monitoring Periods

The implementation of this plan (monitoring, inspection, training, and reporting) will occur on the calendar year cycle consistent with TXR050000 Part III, Section C, number 4.

5. Temporary Suspension and Waivers from Monitoring Requirements

See Appendix E – Visual Monitoring and Analytical Schedule.

6. Records Retention

Records of inspection and training maintained and available at each of the storm water sites listed in this SWP3 and in Building 622, room 110 along with the master copy of the current and past SPW3's and analytical data.

Section D. Numeric Effluent Limitations

1. Discharges of Storm Water Run-off

See Appendix E **–** Visual Monitoring and Analytical Schedule.

Section E. Standard Permit Conditions

See Appendix D - MSGP TXR050000 Part III, Section E.

PART IV. BENCHMARK MONITORING REQUIREMENTS COMMON TO MANY INDUSTRIAL ACTIVITIES

Benchmark monitoring requirements are included as a provision of this general permit for industrial activities. The following table defines the sectors and sub-sectors that are required to monitor and also identifies specific pollutants that must be monitored. The specific benchmark values are identified in Part IV of the permit with the other requirements that are specific to each sector or sub-sector of industrial activities.

Section A. Use of Benchmark Data

The permittee must compare the results of analyses to the benchmark values, and must include this comparison in the overall assessment of the SWP3s effectiveness. Analytical results that exceed a benchmark value are not a violation of this permit, as these values are not numeric effluent limitations, however, if a permittee is required to sample for any of the hazardous metals listed in Part III.D.1. of this general permit as part of the benchmark requirements in Part V of this permit, then the permittee is subject to the effluent limitations in Part III.D.1. for those samples that are collected at a final outfall. Results of analyses are indicators that modifications of the SWP3 may be necessary. The Pollution Prevention Team must investigate the cause for each exceedance and must document the results of this investigation in the SWP3 within 90 days following the sampling event.

The Pollution Prevention Team investigation must identify the following:

1) any additional potential sources of pollution, such as spills that might have occurred,
2) necessary revisions to the Good Housekeeping Measures section of the SWP3,
3) additional BMPs, including a schedule to install or implement the BMPs,
4) other parts of the SWP3 for which revisions are appropriate.

Background concentrations of specific pollutants may also be considered during the investigation. If the Pollution Prevention Team is able to relate the cause of the exceedance to background concentrations, then subsequent exceedances of benchmark values for that pollutant may be resolved by referencing the earlier finding in the SWP3. Background concentrations may be identified by laboratory analyses of samples of storm water run-on to the permitted facility, by laboratory analyses of samples of storm water run-off from adjacent non-industrial areas, or by identifying the pollutant is a naturally occurring material in soils at the site.

Section B. Sectors Subject to Benchmark Monitoring

Fort Bliss, Texas monitors Sectors K, L, N, P and S. (See Appendix E - Analytical Schedule)

Section C. Benchmark Monitoring Requirements

Benchmark monitoring must be conducted once every six months following permit issuance. Monitoring must be continued throughout the permit term for all facilities subject to benchmark sampling. See Appendix E site – analytical schedule.

1. Monitoring Periods

Semi-annual sampling must be conducted at least once during the first full monitoring period (January through June or July through December) following permit issuance, and then once during each monitoring period for the term of the general permit. See Appendix E site – analytical schedule.

2. Reporting Requirements

Results of analyses for sampling shall be submitted to the TCEQ before March 31st of each year. The reported values shall be the average yearly result of analysis for each specific pollutant discharged under a specific SIC code, rather than an outfall-by-outfall, basis. Substantially similar outfalls may be established for benchmark monitoring, in accordance with Part III.C.2. of the general permit. The report must be completed on a form provided by the executive director and mailed to the TCEQ's Wastewater Permitting Section (MC-148).

If sampling during any six month period is not conducted for a pollutant due to adverse weather conditions or drought in accordance with Part III.C.5.(a) of this general permit, then the reported average annual result shall be based on data collected for that year.

REFERENCES.

Bohannan-Huston, Inc. *Comprehensive Engineering Analysis and General Storm Drainage Plan for Future Development*. Albuquerque, New Mexico. 1982.

Tetrahedron, Inc. *Storm Water Pollution Prevention Plan for Fort Bliss, Texas for 2008.* Contract Number: W912BV-07-D-2050. Baltimore, Maryland, March 2009.

Texas Commission on Environmental Quality. *Notice of Intent (TCEQ 10382).* Texas Pollution Discharge Elimination System. P.O. Box 13087, Austin, Texas. Submitted on December 5, 2006.

Texas Commission on Environmental Quality. *TPDES General Permit No. TXR050000. Relating to Storm Water Discharges Associated with Industrial Activity*. P.O. Box 13087, Austin, Texas. Updated 14 August 14 2006. http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr050000.pdf

Texas Commission on Environmental Quality. *TPDES MSGP permit number TXR05U377*, issued to Fort Bliss by TCEQ on January 8, 2007.

Texas Commission on Environmental Quality. *Sampling and Laboratory Methods*, as specified in 30 TAC §§ 319.11 - 319.12. http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=319&sch=A&rl=Y

USACE, Southwestern Division, Tulsa District. *Spill Prevention, Control, and Countermeasures Plan (SPCCP) for USAADAC and Fort Bliss, Fort Bliss, Texas*. September 2004.

US Geological Survey (USGS), data is viewable over the internet at http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08365702&PARAmeter_cd=00045.

Appendix A

Figure for
Fort Bliss Main Cantonment and Biggs Army Airfield
With Industrial Site Locations and Sampler Locations

Site	Location	UTM	Sector
L-1	Hazardous waste storage area (B11607) West of Biggs Army Air Field	E 370263 N 3524135	K, N
L-2	Aviation Hanger (B11304) Biggs Army Air Field (Currently Vacant)	E 367974 N 3523440	S
L-3	Aviation Hanger (B11304) Biggs Army Air Field	E 367947 N 3523354	S
L-7	Aviation Fuel Transfer Facility (B11337)	E 369689 N 3523354	S
L-8	Fuel Distribution Facility (B11027) -Outside Main Cantonment Area	E 367446 N 3522215	P
L-9	Rail Deployment Facility (B3636) Outside Main Cantonment Area	E 366415 N 3523575	P
L-10	Sanitary Landfill -Outside the Main Cantonment Area	E 368174 N 3527709	L
L-11	Central Wash Facility (B2653) -Main Cantonment Area	E 366293 N 3521703	P
L-12	Recycling Center (B1334/B1336) -Main Cantonment Area	E 364518 N 3520700	N
L-13	GSA Fleet Fueling Point (B1326) -Main Cantonment Area	E 364407 N 3520707	P
L-14	DRMS Scrap Metal Contractor (B1336) -Main Cantonment Area	E 364518 N 3520804	N
L-15	DRMS Excess Vehicle Yard 5 -Main Cantonment Area	E 366128 N 3521486	N
L-16	Central Warehouse (B2527) -Main Cantonment Area	E 365659 N 3521486	N
L-17	Bio-Cell, south of Sanitary Landfill – Outside Main Cantonment Area	E368176 N 3527579	L
L-18 & L-19	CAB Aviation 1 & 2 (Future sites) -Outside Main Cantonment Area	(future sites)	S
L-20	New Central Wash Facility (B23001) -Outside Main Cantonment Area	E 374770 N 352499	P
L-21	HazMart (B2515) -Main Cantonment Area	E 365547 N 3521569	K


N
Operating
Sanitary Landfill
(SWMU 1)
L-10
L-17
Bio-Cell
New Central
Vehicle Wash
Facility
L-20
L-1
Hazardous Waste
Storage Facility
(B11607)
Rail Deployment
Facility (B3636)
L-9
L-2
L-3
Aviation Hangar
(B11108)
Aviation Hangar
(B11304)
Aviation Fuel
Transfer Facility
(B11377)
L-7
L-6
L-4
L-8
Fuel Distribution
Facility (B11027)
L-5
Haz Mart
(B2515)
L-11
Central Wash
Facility (B2653)
L-21
L-16
DRMS Excess
Vehicle Yard 5
Central
Warehouse
(B2527)
L-15
DRMS Scrap Metal
Contractor (B1336)
L-13
L-14
L-12
GSA Fuel Point
(B1326)
Recycle Center
(B1334)
SCALE 1:24000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

Appendix B

Certifications and Signatures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BLISS
1 PERSHING ROAD
FORT BLISS, TX 79916-3803

REPLY TO
ATTENTION OF:

Office of Garrison Commander

Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78753

Dear Sir or Madam:

The U.S. Army, Fort Bliss is submitting the Change of Responsible Official (OP-CRO2) to change the responsible official to Colonel Joseph A. Simonelli as required by the Federal Operating (Title V) Permit O-2865. In addition, Fort Bliss is submitting the Delegation of Authority as required by the Clean Water Act.

Copies will be furnished to Mrs. Lorinda Gardner at the TCEQ Region 6 El Paso Office and Mr. John Garza at the City of El Paso, Environmental Services Department.

If you have any questions or concerns regarding the submission, please feel free to contact Mr. Jesus D. Moncada, Air Program Manager at (915) 568-1838 or jesus.d.moncada@us.army.mil.

Respectfully,

Joseph A. Simonelli, Jr.
Colonel, US Army
Commanding

Enclosure

Form OP-CRO2
Change of Responsible Official Information
Federal Operating Permit Program

The Texas Commission on Environmental Quality (TCEQ) shall be notified of a new appointment or administrative information change (e.g., address, phone number, title) for a Responsible Official (RO), Designated Representative (DR), or Alternate Designated Representative (ADR) in the next submittal. This form satisfies the requirements for notification (a revised Certificate of Representation must also be submitted to the U.S. Environmental Protection Agency for changes in the DR and ADR). *After the initial submittal, if there is a change of Duly Authorized Representative (DAR) appointment or an administrative information change for the DAR, include a revised Form OP-DEL (Delegation of Responsible Official) with the next submittal to the TCEQ.*

I. IDENTIFYING INFORMATION		
A. Account No.: EE-0024-G	B. RN: 100210095	C. CN: 600126262
D. Permit No.: O-2865	E. Area Name: U.S. Army, Fort Bliss	
F. Company Name: U.S. Army		

II. CHANGE TYPES		
A. Action Type:	New Appointment: ☑	Administrative Information Change: ☐
B. Contact Type *(only one response can be accepted per form)*		
Responsible Official: ☑	Designated Representative: ☐	Alternate Designated Representative: ☐

III. RESPONSIBLE OFFICIAL/DESIGNATED REPRESENTATIVE/ALTERNATE DESIGNATED REPRESENTATIVE INFORMATION		
A. Name: (__Mr. __Mrs. __Ms. __Dr.) COL Joseph A. Simonelli		
B. Title: Garrison Commander	C. Appointment Effective Date: 04/01/2010	
D. Telephone: (915) 568-2833	E. Fax: (915) 568-5473	
F. Company Name: U.S. Army		
G. Mailing Address: Building 1, Pershing Road		
City: Fort Bliss	State: TX	Zip Code: 79916
H. Delivery Address: Building 1, Pershing Road		
City: Fort Bliss	State: TX	Zip Code: 79916

IV. CERTIFICATION OF TRUTH, ACCURACY, AND COMPLETENESS

This certification does not extend to information which is designated by the TCEQ as information for reference only.

I, Joseph A. Simonelli, Jr. *(Name printed or typed)*, certify that, based on information and belief formed after reasonable inquiry, the statements and information stated above are true, accurate, and complete.

Signature: ______________ Signature Date: 6 APRIL 2010

Title: Garrison Commander

DELEGATION OF AUTHORITY

The Chief or the Acting Chief of the Environmental Division, Directorate of Public Works, is the duly authorized representative of the undersigned and is empowered to sign Resource Conservation and Recovery Act, Clean Water Act, and Safe Drinking Water Act permit documentation and to make any certification required by Federal or state statue or regulation. This certification and signatory authority includes: notices of intent to obtain permit coverage, plans reports, and other records requiring signature of certification of an authorized representative. The individual occupying the indicated position will ensure that qualified personnel gather and evaluate the information submitted. They will also certify that the information presented is, to the best of their knowledge and belief, accurate and complete.

JOSEPH A. SIMONELLI, JR.
COL, AD
Garrison Commander

Date

SUMMARY SHEET

	ROUTING						ROUTING				
	OFFICE	DATE	CONCUR	NON-CONCUR	SEE TAB.		OFFICE	DATE	CONCUR	NON- CONCUR	SEE TAB.
1	SJA	3-18-10	[initials]			11	G-1	4/2/10	✓✓		
2	Deputy, DPW					12					
3	Deputy, GC	4-5-10	[initials]			13					
4	GC	4-5-10	[initials]		A,B,C,D,E	14					
5						15					
6						16					
7						17					
8						18					
9						19					
10						20					

ACTION OFFICE: Environmental Division
OFFICER/PHONE: Jesus Moncada, 568-1838

SUBJECT: Environmental Policies and Responsible Official

DATE: 19 MAR 2010

SUMMARY

1. PURPOSE. To obtain the Garrison Commander's authorization and signature for various environmental permits and programs.

2. RECOMMENDATION. Environmental Division recommends that the Garrison Commander sign the enclosed correspondance letter (TAB A), Change of Responsible Official form (TAB B), Delegation of Authority (TAB C), Sustainability Policy (TAB D), and EMS Memorandum of Instructuion (TAB E).

3. FACTS.

a. Fort Bliss maintains a dynamic Environmental Management System (EMS) program and requires the Garrison Commander re-certify the EMS Policy (TAB E). In addition, the MOI (TAB E) is included requesting the Garrison Commander to re-certify these policies.

b. Fort Bliss maintains environmental permits for air quality, clean and potable water, and hazarous waste. These permits require a change of responsible official each time there is a change in facility manager or garrison commander. The RO is responsible for signing all permit-requirement reports, certifications and documents that are submitted to the Texas Commission on Environmental Quality and U.S. EPA.

c. The air quality permit (Title V) requires the Change of Responsible Official (TAB B) and other environmental permits require the Delegation of Authority (TAB C) be signed by Colonel Simonelli.

d. The forms for change of delegation will be effective 1 APRIL 2010.

[signature]
ALFREDO J. RIERA, P.E.
Director of Public Works

DECISION OFFICE
GC
- [x] APPROVED
- [ ] APPROVED AS MODIFIED
- [ ] DISAPPROVED
- [ ] NOTED
- [ ] SEE ME

INITIALS [initials] DATE 4.5.10

FB Form 801 (DOIM) 1 Nov 94

Previous editions of this form are obsolete.

STORM WATER POLLUTION PREVENTION PLAN CERTIFICATION

"I 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 that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

____

Ms. Vicki Hamilton
Acting Division Chief
Directorate of Public Works,
Environmental Division
Fort Bliss, Texas

Certification of Non-Storm Water Discharges

Date:
05 October 2009

Method Used:
Dry weather visual observation by SWMT during the course of normal work.

Result:
None observed.

Authorized Non-Storm Water Discharges:
Ice machine discharge (B11607)
Groundwater discharge at Pershing Dam Basin

Unauthorized Non-Storm Water Discharges:
None

Assessment Performed By:

____
Kelly Blough, Storm Water Compliance Manager
Directorate of Public Works, Environmental Division
Fort Bliss, Texas

Appendix C

Site Specific Data Tables by Sector (K, L, N, P, S)

Sector K

Hazardous Waste Treatment Storage or Disposal Facilities

(Hazardous Waste Storage Facility, B11607 [Sample Site L1])

(Haz Mart, B2515 [Sample Site L-21]

Sector L

Landfills and Land Application Sites

(Operating Sanitary Landfill [Sample Site L10])

(Bio-Cell [Sample Site L-17])

Sector N

Scrap Recycling Facilities

(Hazardous Waste Storage Facility, B11607 [L-1])
(Recycle Center, B1334 [L-12])
(DRMS Scrap Metal Contractor, B1336 [L-14])
(DRMS Excess Vehicle Yard 5, [L-15])
(Central Receiving, B2527 [L-16])

Sector P

Land Transportation

(Fuel Distribution Facility, B11027 [L-8])

(Rail Deployment Facility, B3636 [L-9])

(Central Wash Facility, B2653 [L-11])

(GSA Fuel Point, B1326 [L-13])

(New Central Vehicle Wash Facility, [L-20])

Sector P

Land Transportation

(Fuel Distribution Facility, B11027 [L-8])

(Rail Deployment Facility, B3636 [L-9])

(Central Wash Facility, B2653 [L-11])

(GSA Fuel Point, B1326 [L-13])

(New Central Vehicle Wash Facility, [L-20])

Sector S

Air Transportation

(Aviation Hangar, B11304 [L-2])

(Aviation Hangar, B11108 [L-3])

(Aviation Fuel Transfer, Facility B11377 [L-7])

(CAB Aviation 1, [L-18])

(CAB Aviation 2, [L-19])

Hazardous Waste Storage Facility (B11607) Sector K, N, Sampler L-1	Sustainability Center Coordinator-DPW-E: Michelle Bayer, Off 915 744- 9331, Cell 915 526-2003 email: patricia.bayer@us.army.mil HW Storage Facility Coordinator-DRMS: Beth Pouncy, Off 915 744-9336, Cell 915 497-6372 elizabeth.pouncy@dla.mil	DPW-E Alt./COTR: Stan Green Off 915 568-7041, Cell 915 637-7054, email: stanley.green4@us.army.mil DRMS Alt./COTR: Gilbert Vargas-Ortiz Off 915 744-9336, Cell 915 497-6372, email: gilbert.vargas-ortiz@dla.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
HW permitted facility receives hazardous waste for consolidation, packaging and off-site disposal.	Outdoor packaged waste staging areas, loading and unloading operations. Processed and packaged materials may be staged outdoors pending pick up.		None in previous year	Sampler L-1.
Sustainability materials such as antifreeze, expended spray cans, fluorescent tubes, parts cleaner solvent, fire extinguishers, oil filters, empty drums.	Materials are processed, consolidated and packaged indoors or under roofed areas. Processed and packaged materials may be staged outdoors pending pick up.		None in previous year	Sampler L-1.
POL - Hydraulically operated equipment such as lift trucks are in daily operation throughout facility.	Hydraulically operated equipment is stored indoors or under cover during non duty hours.		Visual evidence of past drips, leaks on paved and unpaved areas.	Sampler L-1.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
Implement good housekeeping practices. a) Keep area in clean and orderly manner. b) Label all containers even if empty. c) Store liquids on secondary containment d) Cover dirty (exterior) containers if stored outdoors.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Prevent vehicles from entering storm water basin at NW corner of yard.	a) Funding has been requested for concrete containment to surround outdoor HW packaging/processing area, enlarge basin, and install storm water treatment device at inlet to basin.	a) Use drip pans as needed under hydraulically operated equipment. b) Regularly use VacStar to clean heavily trafficked outdoor surfaces.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	L-1 quarterly visual monitoring and semi-annual analytical sampling.	Site copy SWP3 records retained on-site (Sustainability Center Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Funding has been requested (POM BLS10SW006) for concrete containment to surround outdoor HW packaging/processing area, enlarge basin, and install storm water treatment device at inlet into basin.	Not applicable at this site.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Haz Mart (B2515) Sector K, Sampler L-21	Site Coordinator-: Linda Jones, Off 915 568-0680, Cell 915 203-2401, email: linda.jones10@us.army.mil	Alt./COTR: Michael Armstead, off: 915 568-3407, email: michael.armstead1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Materials stored at site include paints, motor oil, consumer solvents, pesticides, batteries and household cleaners.	HazMart receives, stores, re-issues, and disposes of household hazardous waste. Materials are stored in both permanent and portable buildings and are exposed only during loading and unloading.		There were no significant spills in the 5 years prior to Oct. 2009.	Sampler L-21 implemented 2nd qtr FY10.
POL - Hydraulically operated equipment such as lift trucks are in daily operation throughout facility.	Hydraulically operated equipment is stored indoors or under cover during non duty hours.		Visual evidence of past small drips leaks on paved areas.	Sampler L-21 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Implement good housekeeping practices. b) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and waste. b) Maintain spill prevention and response signage.	Entire site is paved.	Maintain pavement and buildings.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-21: Quarterly visual monitoring and semi-annual analytical sampling.	Site copy SWP3 records retained on-site (Bldg 2515) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Operating Sanitary Landfill (SWMU 1) B3791 Sector L, Sampler L-10	Site Coordinator: Manny Telemantes (Moore Services, Inc.), Off 915 592-5558, Cel 915 490-5860, email: rasmithmsi@sbcglobal.net	Alt./COTR: Oscar Perales, Off 915 569-8730, email: oscar.perales@us.army.mil. Lilia Lenhart, Off 915 568-5724, email: lilia.lenhart@us.army.mil

Description of Potential Pollutants and Sources

<table>
<tr><th>Inventory of Exposed Materials</th><th>Narrative Description</th><th>Site Map</th><th>Spills and Leaks</th><th>Sampling Data</th></tr>
<tr><td>Municipal solid waste</td><td>Municipal solid waste in active cell is covered daily. Inert construction and demolition waste in active C&D cell is covered as needed.</td><td rowspan="2">
</td><td>None</td><td>Sampler L-10 implemented 2nd qtr FY10.</td></tr>
<tr><td>Diesel fuel (750 gal. AST) and in-use POL for operation of earth moving equipment.</td><td>AST has secondary containment. POLs are stored in a labeled flammable storage locker on secondary containment. Spill kits are kept on site to clean-up spills.</td><td>Visual evidence of past POL drips and leaks on bare soil areas near to AST.</td><td>Sampler L-10 implemented 2nd qtr FY10.</td></tr>
</table>

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on reclaimed soil or vegetated areas.	Maintain earthen berms along perimeter fencing as needed.	a) Implement good housekeeping practices. b) In-use and waste materials are containerized and stored at the SAP	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-10: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (Sanitary Landfill Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

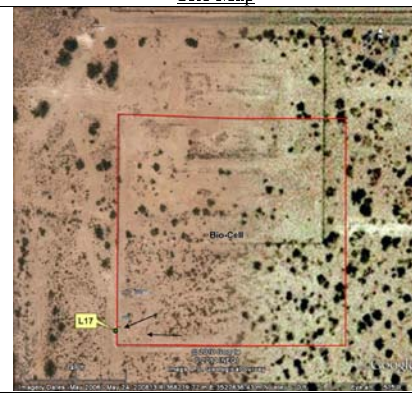
Structural Controls	Velocity Dissipation Devices
Not applicable.	Not applicable.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Bio-Cell Sector L, Sampler L-17	Site Coordinator: Zack Telemantes, (Tetrahedron, Inc.) Off 410 837-0512 , Cel 915 422-1973, Email: zackoleum@yahoo.com	Alt./COTR: Danny Duran, Off 915 568-6989, Cel 915 256-9971, Email: danny.duran@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
POL contaminated soil to be remediated, fertilizers, manure.	Contaminated soil is places in lined cell is treated with water and fertilizer.		none	Sampler L-17 implemented 2nd qtr FY10.
Hydraulically operated equipment and associated POL.	Equipment is stored under shelter or covered during non duty hours.		none	Sampler L-17 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Repair/replace fencing and earthen berms as needed.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-17: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (Biocell Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable.	Not applicable.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Hazardous Waste Storage Facility (B11607) Sector K,N, Sampler L-1	Sustainability Center Coordinator-DPW-E: Michelle Bayer, Off 915 744- 9331, Cell 915 526-2003 email: patricia.bayer@us.army.mil HW Storage Facility Coordinator-DRMS: Beth Pouncy, Off 915 744-9336, Cell 915 497-6372 elizabeth.pouncy@dla.mil	DPW-E Alt./COTR: Stan Green Off 915 568-7041, Cell 915 637-7054, email: stanley.green4@us.army.mil DRMS Alt./COTR: Gilbert Vargas-Ortiz Off 915 744-9336, Cell 915 497-6372, email: gilbert.vargas-ortiz@dla.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
HW permitted facility receives hazardous waste for consolidation, packaging and off-site disposal.	Outdoor packaged waste staging areas, loading and unloading operations. Processed and packaged materials may be staged outdoors pending pick up.		None in previous year	Sampler L-1.
Sustainability materials such as antifreeze, expended spray cans, fluorescent tubes, parts cleaner solvent, fire extinguishers, oil filters, empty drums.	Materials are processed, consolidated and packaged indoors or under roofed areas. Processed and packaged materials may be staged outdoors pending pick up.		None in previous year	Sampler L-1.
POL - Hydraulically operated equipment such as lift trucks are in daily operation throughout facility.	Hydraulically operated equipment is stored indoors or under cover during non duty hours.		Visual evidence of past drips, leaks on paved and unpaved areas.	Sampler L-1.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
Implement good housekeeping practices. a) Keep area in clean and orderly manner. b) Label all containers even if empty. c) Store liquids on secondary containment d) Cover dirty (exterior) containers if stored outdoors.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Prevent vehicles from entering storm water basin at NW corner of yard.	a) Funding has been requested for concrete containment to surround outdoor HW packaging/processing area, enlarge basin, and install storm water treatment device at inlet to basin.	a) Use drip pans as needed under hydraulically operated equipment. b) Regularly use VacStar to clean heavily trafficked outdoor surfaces.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	L-1 quarterly visual monitoring and semi-annual analytical sampling.	Site copy SWP3 records retained on-site (Sustainability Center Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Funding has been requested (POM BLS10SW006) for concrete containment to surround outdoor HW packaging/processing area, enlarge basin, and install storm water treatment device at inlet into basin.	Not applicable at this site.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Recycle Center (B1334) Sector N, Sampler L-12	Site Coordinator: Gilbert Garcia, Off 915 568-1537, Cell 915 487-6366 Email: gilberto.garcia8@us.army.mil	Alt./COTR: Lilia Lenhart, Off 915 568-5724, Email: lilia.lenhart@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Potential for overnight exposure of household recyclables at outdoor public drop off site.	Public drop off area is open 24/7. Covered bins emptied as needed by single stream contractor for processing off-site. All other recycled materials are stored indoors.		Chain link fencing is used to capture any windblown floatables from the public drop off.	Sampler L-12 implemented 2nd qtr FY10.
POL - Potential drips and leaks from truck hydraulic fittings and occasional outdoor use of forklifts.	Hydraulically operated equipment is stored indoors during non duty hours.		Visual evidence of past drips leaks on paved areas.	Sampler L-12 implemented 2nd qtr FY10.
Unused hoppers (painted metal) stored in paved yard.	Spare hoppers and recycling containers are stored clean and tipped to prevent collecting rain water.		None	Sampler L-12 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Collect and properly dispose of any abandoned waste. b) Prevent/ recover loose recyclables or other floatable materials.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Repair/replace fences and drop-off bins lids as needed.	Implement good housekeeping practices especially closing container covers.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-12: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B1334) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Funding has been requested (POM BLS10SW001) for connector tunnel between buildings 1334 and 1336 to permit vehicle movement between buildings reducing outside operations and potential storm water impacts.	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

DRMS Scrap Metal Contractor (B1336) Sector N, Sampler L-14	Site Coordinator: Tom Armstrong, (Gov't Liquidators) Off 602 321-5645	Alt./COTR: Courtney Aubry Off 915 744-2412, Cell 915 497-6481 email: courtney.aubrey@dla.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Scrap Metal is dropped off at the site for sorting and recycling.	This is not covered to prevent leaching.		Visual evidence of piles of metal uncovered at the site.	Sampler L-14 implemented 2nd qtr FY10.
POL - Potential drips and leaks from parked truck hydraulic fittings and occasional outdoor use of forklifts.	Minimal component and equipment is stored indoors when not in use, or a drip pan can be placed under the vehicle.		Visual evidence of past drips leaks on paved areas.	Sampler L-14 implemented 2nd qtr FY10.
Trash roll-off.	This was uncovered.		Some evidence of leakage around roll-off.	Sampler L-14 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner. b) Cover exposed trash.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Repair/replace fences as needed.	Implement good housekeeping practices. a) Cover or move uncovered scrap inside when possible.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-14: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B1336) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
This operation is expected to be relocated to DRMS Excess Vehicle Yard 5 during 3rd qtr FY10.	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

DRMS Excess Vehicle Yard 5 Sector N, Sampler L-15	Site Coordinator: Joe Shaw Off 915 568-3812, Cell 915 497-6481 email: joe.g.shaw@us.army.mil	Alt./COTR: Michael Armstead, off: 915 568-3407, email: michael.armstead1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Painted and unpainted metal, vehicles, and associated POL.	Staging area for DRMS excessing of trailers, carts, trucks and other various types of wheeled tactical and non tactical equipment.		There was no visual evidence of past drips leaks on unpaved areas.	Sampler L-15 implemented 2nd qtr FY10.
POL - Potential drips and leaks from parked truck hydraulic fittings and occasional outdoor use of lift trucks.	Fluids are drained out of some vehicles.		There was no visual evidence of past drips leaks on unpaved areas.	Sampler L-15 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner. b) Check stored vehicles and equipment for POL leaks.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Repair/replace fences as needed.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-15: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained B2527) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
The DRMS Scrap Metal contractor operation is expected to be relocated from the Recycle Center (Building 1336) to DRMS Excess Vehicle Yard 5 during 3rd qtr FY10.	Not applicable.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Central Warehouse (B2527) Sector N, Sampler L-16	Site Coordinator: Joe Shaw Off 915 568-3812, Cell 915 497-6481 email: joe.g.shaw@us.army.mil	Alt./COTR: Brad McNair off: 915 568-4802, email: bradley.mcnair@us.army.mil

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
New and used painted and unpainted metal parts, tactical industrial and aviation vehicle parts, batteries, tires, kitchen equipment and shop and warehouse furniture.	Outdoor shipping and receiving storage of new and used parts. Policy for used items is that they must be clean and drained for turn in acceptance.		Visual evidence of past drips leaks on paved areas.	Sampler L-16 implemented 2^{nd} qtr FY10.
POL - Potential drips and leaks from parked truck hydraulic fittings and outdoor use of lift and delivery trucks.	Yard is very intensively used with little to no undercover storage capability.		Visual evidence of past drips leaks on paved areas.	Sampler L-16 implemented 2^{nd} qtr FY10.
Soft goods such as military tents, netting.	Most but not all hard and soft materials are stored uncovered on wooden pallets.		21 Jan 2010 15 gallons of diesel fuel.	Sampler L-16 implemented 2^{nd} qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Batteries and liquids to be stored on containment pallets b) POL coated materials should be rejected or kept under cover.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Area paved.	Maintain pavement.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-16: Quarterly visual monitoring and semi-annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B2527) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Funding has been requested (POM BLS10SW007) for concrete containments and ramada style rain shelters for stored materials.	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Fuel Distribution Facility (B11027) Sector P, Sampler L-8	Site Coordinator: Orlando Rivera, Off 915 744-8586, Cell 915 346-6604, Email: Orlando.rivera2@us.army.mil Alternate Joe Hernandez, Off 915 744-5444, Email: jose.a.hernandez3@us.army.mil	Alt./COTR: Michael Armstead, off: 915 568-3407, email: michael.armstead1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
JP-8 and mogas are received, stored in bulk and distributed via military tanker trucks.	The 250,000-gallon JP-8 AST, two smaller 25K gallon JP-8 ASTs and one 25k gallon unleaded gasoline AST. Entire system has secondary containment except some sections of above ground piping.		Releases have occurred from pipe fittings present outside of the secondary containment area. Drip pans have been placed under the leaks. Past soil remediation has occurred as a result of past piping failures.	Sampler L-8 implemented 2nd qtr FY10.
Potential spills or leaks from transfer points.	Fuel transfer points have secondary containment with open top vault for storage of accumulated rain water.		There were no significant spills in the 5 years prior to Oct. 2009, except for 1) 160 gal leak Aug 2006 and 2) overflow of oil/ water from the waste sump Jan. 2009 from unusual 4" rain.	Sampler L-8 implemented 2nd qtr FY10.
POL- Potential releases from parked tank trucks and vehicles.	Trucks are parked in roll-over curbing containment.		Visual evidence of small drips within vehicle containment.	Sampler L-8 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Quarterly Visual Monitoring	Records
a) Remove, drum and properly dispose of accumulated rain water from vault after rains. b) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Monitor open top containment vault for accumulated rain water.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Daily site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Quarterly L-8 visual monitoring only. (See Appendix E)	Site copy SWP3 records retained on-site (B11027 Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
A project (P-001368-08) to fund containment of remaining single wall above ground piping has been submitted to DESC by R. Lenhart.	

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Rail Deployment Facility (B3636) Sector P, Sampler L-9	Site Coordinator: Robert Cleary Off 915 744-6088, Email: Robert.w.cleary@bliss.army.mil	Alt./COTR: Enrique Nater, Off 915 744-8166, Email: enrique.nater@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
POL from potential drips and leaks from parked locomotives.	Locomotive routine service is performed inside. Major annual maintenance may be performed outside with appropriate containment.		Visual evidence of past drips leaks on gravel and paved areas.	Sampler L-9 implemented 2nd qtr FY10.
Four 1000-gallon ASTs for used oil, used anti-freeze, used mixed fluids and oil are located on the west side of the building.	All have secondary containment.		There were no significant spills in the 5 years prior to Oct. 2009, except for 1) overflow of minimal oil from an overfill May of 2008.	Sampler L-9 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Apply drip pans or fasten absorbents to leaking locomotive fittings. b) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	None	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-9: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B3636 Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable.	Not applicable.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Central Wash Facility (B2653) Sector P, Sampler L-11	Site Coordinator: Gilbert Saenz , Off 915 568-1344, Chuy Garcia Off 915 568-5985, Cel 915 726-4049, Email: jgarciaaquirre@prideindustries.com	Alt./COTR: Bill Rucker (DPW), Off 915 568-3304, Email: william.rucker1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
POL	Closed loop facility for washing of tactical vehicles, mobile kitchens, and oily water and sludge derived from cleaning of other installation oil water separators.		Over spray to ground surface off of concrete wash area from high pressure guns is possible. Operator supervises soldiers and disciplines as needed. Concrete wash area is not curbed creating condition where wash water runoff can occur.	Sampler L-11 implemented 2nd qtr FY10.
POL contaminated wash water	Facility is composed of lined source water pond, concrete wash areas with high pressure sprayers, drains to very large oil water separators, collection pond and elevated water tank for dosing sand filters. Filtered water is returned to source water pond. The two oil water separators have AST's with rope skimmers.		Potential for small POL release to ground surface via windblown oil droplets from wave action in large OWS's and windblown POL droplets entrained from rope skimmers. 11 Feb 2009 10 gallons of motor oil.	Sampler L-11 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Operate rope skimmers to maximum extent before forecast high wind events. b) Minimize operation of rope skimmers during high wind events.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	a) Minimize foot or vehicle travel on soil or vegetated surfaces.	a) Repair/replace fences as needed. b) Mow slopes as needed, restore and re-vegetate earthen berms to reduce erosion.	a) Implement good housekeeping practices. b) **Operator shall refuse loads with free oil during or 24 hours before a forecast high wind event.**	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-11: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B2653 Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

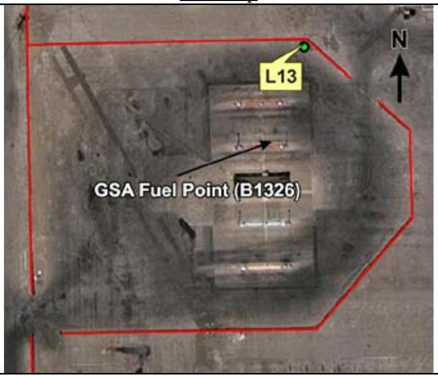
Structural Controls	Velocity Dissipation Devices
Project (POM BLS10SW0003) for adding concrete curbing to wash pad area has been programmed. **High wind events are when official (www.noaa.gov) forecasts are for sustained winds greater than 25 mph.**	Not applicable.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

GSA Fuel Point (B1326) Sector P, Sampler L-13	Site Coordinator: Orlando Rivera, Off 915 744-8586, Cell 915 346-6604, Alternate Joe Hernandez, Off 915 744-5444, Email: jose.a.hernandez3@us.army.mil	Alt./COTR: Michael Armstead, off: 915 568-3407, email: michael.armstead1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
JP-8 and mogas	Refueling station for primarily non tactical government owned vehicles. Station is configured same as commercial civilian gas station.		No evidence of released products.	Sampler L-13 implemented 2nd qtr FY10.
POL	Minor drips typical of motor vehicle traffic area.		Visual evidence of past drips leaks on paved areas.	Sampler L-13 implemented 2nd qtr FY10.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Quarterly Visual Monitoring	Records
a) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	Not applicable, site is completely paved.	Maintain pavement.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Daily site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-13: Quarterly visual monitoring only (See Appendix E)	Site copy SWP3 records retained on-site (B1326 Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

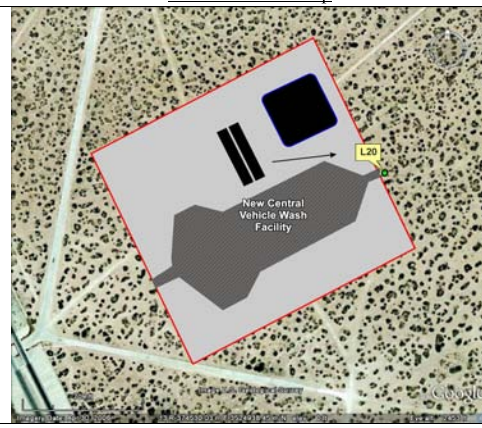
Structural Controls	Velocity Dissipation Devices
Not applicable.	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

New Central Vehicle Wash Facility Sector P, Sampler L-20	Site Coordinator: Javier Zarate, Off 915 568-1344, Chuy Garcia Off 915 568-5985, Cel 915 726-4049, Email: jgarciaaquirre@prideindustries.com	Alt./COTR: Bill Rucker (DPW), Off 915 568-3304, Email: william.rucker1@us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Tentative Site Map	Spills and Leaks	Sampling Data
POL	Closed loop facility for washing of tactical vehicles, mobile kitchens, and oily water and sludge derived from cleaning of other installation oil water separators.		Not in operation yet.	Sampler L-20 implemented 2nd qtr FY10.
POL contaminated wash water	Facility is composed of lined source water pond, concrete wash areas with high pressure sprayers, drains to very large oil water separators, separated water is returned to source water pond. The two oil water separators have AST's with rope skimmers.		Not in operation yet.	Sampler L-20 implemented 2nd qtr FY10

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner.	a) Maintain spill kits for vehicles and equipment. b) Maintain spill prevention and response signage.	a) Minimize foot or vehicle travel on soil or vegetated surfaces. b) Mow slopes as needed	a) Repair/replace fences as needed. b) Regrade slopes as needed, compact earthen berms to reduce erosion.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-20: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (New Central Vehicle Wash Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

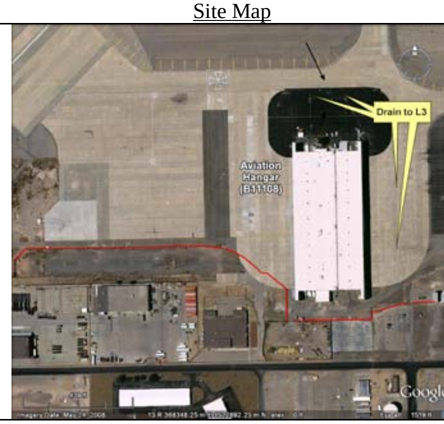
Structural Controls	Velocity Dissipation Devices
Not applicable.	Any allowable discharge per TPDES TXR050000 Part II, Section A(6)(b), must be directed and controlled to minimize erosion.

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Aviation Hangar (B11108) Sector S, Sampler L-3	Site Coordinator: Carlos Sandoval, Off 915 568-8621, Email: dosshazmat@elp.rr.com	Alt./COTR: Ann Saucedo, Off 915 568-7714

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
POL	Aircraft maintenance is conducted in hangar. Aircraft are washed on aircraft wash rack.		None	Sampler L-3
JP-8	Aircraft fuel may occur on flight line. Refueling trucks are equipped with spill kits. Secondary containment at point of fuel transfer is not required on flight line.		None	Sampler L-3

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
a) Keep area in clean and orderly manner.	a) Maintain spill kits for aircraft, vehicles, spilled materials, and equipment. b) Maintain spill prevention and response signage.	Site is totally paved.	Maintain pavement.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-3: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B11108 Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable.	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Aviation Fuel Transfer Facility (B11377) Sector S, Sampler L-7	Site Coordinator: Steven P. Marruffo, OM Atlantic Aviation, Off 915 779-2831, Cell 915 861-2390, Email: steven.marruffo@atlanticaviation.com	Alt./COR: Rebecca Toney, Contract Specialist, Defense Energy Support Center, Mobility Fuels Division, Direct Delivery Fuels off 703 767-0193, email: rebecca.toney@dla.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
JP-8 Drips and leaks from above surface piping, hoses, and connections including fuel additive.	UST loading – unloading racks (secondary containment)		Small container used for capture small amount of fuel remaining in hose at each use.	Sampler L-7 damaged by utility contractor, has been replaced 2nd qtr FY10.
JP-8, POL Drips and leaks from parked tank truck fittings and dispensers.	Tank truck parking area (secondary containment)		Visual evidence of drips leaks within parking containment. Visual evidence of potentially contaminated rainwater from parking containment being pumped onto ground surface.	Sampler L-7 damaged by utility contractor, has been replaced 2nd qtr FY10.
JP-8, POL Drips and leaks from tank truck fittings and dispensers and/or aircraft during refueling.	Secondary containment not required for this aircraft refueling process due to flight line safety concerns.		Aircraft refueling takes place at disbursed flight line locations not reflected by this site analysis.	Disbursed aircraft refueling on flight line is up gradient of sample locations L-2 and L-3.

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Quarterly Visual Monitoring	Records
a) Empty or seal any open containers. b) Absorb and remove any leaks and drips daily	a) Ensure filled containers on functional secondary containment b) Maintains spill prevention and response signage.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Inspect and record fuel handling equipment condition daily.	Observe, correct, record daily a) Drips or leaks. b) Replenish spill kits. c) Seal or cover containers.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Daily site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site L-3: Quarterly visual monitoring only. (See Appendix E)	Site copy SWP3 records retained on-site (B11377) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Drainage of accumulated rain water from secondary containments follow installation Environmental Officer (EO) Guidebook Secondary Containment procedure. Discharge of potentially (sheen visible) POL contaminated water is forbidden without valid analytical data indicating concentrations below TPDES General Permit TXG830000 Part III, Section A Effluent Limitations.	Any allowable discharge per TPDES TXR050000 Part II, Section A(6)(b), must be directed and controlled to minimize erosion.
Excessive run-on into the fuel truck parking containment from up gradient apron contributes to excessive containment drainage effort and expense and results in unnecessary contamination of rainwater. Site operator intends to design and implement corrective action.	

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

CAB Aviation 1 (B_____) Sector S, Future Sampler L-18	Site Coordinator: _______________________; Off 915 568-____ Email: ___________	Alt./COTR: Email: ___________

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Future Site		Future Site Pending		Future Sampler L-18
General	Spills in the last five years.			

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
Implement good housekeeping practices. Keep area in clean and orderly manner.	Maintain spill kits for aircraft, vehicles and equipment.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Maintain pavement.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site Future L-18: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B_____ Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

CAB Aviation 2 (B_____) Sector S, Future Sampler L-19	Site Coordinator: ________________________; Off 915 568-____ Email: ___________.us.army.mil	Alt./COTR: Email: ___________.us.army.mil

Description of Potential Pollutants and Sources

Inventory of Exposed Materials	Narrative Description	Site Map	Spills and Leaks	Sampling Data
Future Site		Future Site Pending		Future Sampler L-19

Pollution Prevention Measures and Controls

Good Housekeeping Measures	Spill Prevention and Response Measures	Erosion Control Measures	Maintenance Program for Structural Controls	Best Management Practices (BMP's)	Employee Training Education Program	Periodic Inspections	Visual Monitoring and Analytical Sampling	Records
Implement good housekeeping practices. Keep area in clean and orderly manner.	Maintain spill kits for aircraft, vehicles and equipment.	Minimize foot or vehicle travel on soil or vegetated surfaces.	Maintain pavement.	Implement good housekeeping practices.	a) Annual storm water pollution prevention training provided to all site personnel. b) Annual Environmental Officer course required for Site Operator POC.	a) Weekly site operator inspections. b) Random storm water compliance inspection. c) Annual Storm Water and Comprehensive Site Compliance Evaluation.	Sample Site Future L-19: Quarterly visual monitoring and annual analytical sampling. (See Appendix E)	Site copy SWP3 records retained on-site (B_____ Office) and in SWP3 Master Copy room 110, Bldg. 622.

Management of Runoff with Structural Controls

Structural Controls	Velocity Dissipation Devices
Not applicable	Not applicable

Annual Comprehensive Site Evaluation

Description	General Requirements	Annual Site Compliance Evaluation Report	Revision of SWP3
Site and operations are subject to formal inspection under the installation Environmental Performance Assessment System (EPAS).	Inspection is referenced to AR-201, EO 13148, AR 1-201, Installation Environmental Compliance Memo DACS-ZB 25 Feb 2002, and installation SWP3.	EPAS procedure includes standardized reporting to Site POC, COR, Director, or Unit Commander, Storm Water Compliance Manager and EMS Coordinator.	Annual revision by K. Blough DPW-E 915 568-0794, kelly.blough@us.army.mil.

Appendix D

Multi Sector General Permit TXR050000

The following link is provided for electronic copies of this Plan. Hard copies of this plan are required to include the actual 111 page hard copy of the permit in order to be considered administratively complete.

http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr050000.pdf

Appendix E

Visual Monitoring and Analytical Schedule

Appendix E
Visual Monitoring and Analytical Schedule

MSGP Sector	Name of Activity	Sample Location	Visual Monitoring (four times per year)	Benchmark Monitoring (twice per year)	Numeric Effluent Limitations Inland Waters (once per year)
SECTOR K. Hazardous Waste Treatment Storage or Disposal Facilities	Hazardous Waste Storage Facility (B11607)	L-1	Quarterly	Ammonia-Nitrogen, Total Magnesium, COD, Total Arsenic, Total Cadmium, Total Cyanide, Total Lead, Total Mercury, Total Selenium, Total Silver	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Haz Mart (B2515)	L-21	Quarterly	Ammonia-Nitrogen, Total Magnesium, COD, Total Arsenic, Total Cadmium, Total Cyanide, Total Lead, Total Mercury, Total Selenium, Total Silver	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
SECTOR L. Landfills and Land Application Sites	Operating Sanitary Landfill	L-10	Quarterly	Total Iron, TSS	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Bio-Cell	L-17	Quarterly	Total Iron, TSS	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)

Appendix E
Visual Monitoring and Analytical Schedule (Continued)

MSGP Sector	Name of Activity	Sample Location	Visual Monitoring (four times per year)	Benchmark Monitoring (twice per year)	Numeric Effluent Limitations Inland Waters (once per year)
SECTOR N. Scrap Recycling Facilities	Hazardous Waste Storage Facility (B11607)	L-1	Quarterly	Total Copper, Total Aluminum, Total Iron, Total Lead, Total Zinc, TSS, COD	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Recycle Center (B1334)	L-12	Quarterly	Total Copper, Total Aluminum, Total Iron, Total Lead, Total Zinc, TSS, COD	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	DRMS Scrap Metal Contractor (B1336)	L-14	Quarterly	Total Copper, Total Aluminum, Total Iron, Total Lead, Total Zinc, TSS, COD	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	DRMS Excess Vehicle Yard 5	L-15	Quarterly	Total Copper, Total Aluminum, Total Iron, Total Lead, Total Zinc, TSS, COD	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Central Receiving (B2527)	L-16	Quarterly	Total Copper, Total Aluminum, Total Iron, Total Lead, Total Zinc, TSS, COD	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)

Appendix E

Visual Monitoring and Analytical Schedule (Continued)

MSGP Sector	Name of Activity	Sample Location	Visual Monitoring (four times per year)	Benchmark Monitoring (twice per year)	Numeric Effluent Limitations Inland Waters (once per year)
SECTOR P. Land Transportation	Fuel Distribution Facility (B11027)	L-8	Quarterly	Benchmark Monitoring Not Required	Waiver from Numeric Effluent Limitation per TXR050000 D,1,(e)(i)(ii).
	Rail Deployment Facility (B3636)	L-9	Quarterly	Benchmark Monitoring Not Required	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Central Wash Facility (B2653)	L-11	Quarterly	Benchmark Monitoring Not Required	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	GSA Fuel Point (B1326)	L-13	Quarterly	Benchmark Monitoring Not Required	Waiver from Numeric Effluent Limitation per TXR050000 D,1,(e)(i)(ii).
	New Central Vehicle Wash Facility	L-20	Quarterly	Benchmark Monitoring Not Required	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
SECTOR S. Air Transportation	Aviation Hangar (B11304)	L-2	**None**	**None**	**Discontinued as this site is no longer in use.**
	Aviation Hangar (B11108)	L-3	Quarterly	Lack of De-icing activity precludes need for Sector S Benchmark Monitoring.	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	Aviation Fuel Transfer Facility (B11377)	L-7	Quarterly	Benchmark Monitoring Not Required	Waiver from Numeric Effluent Limitation per TXR050000 D,1,(e)(i)(ii).
	CAB Aviation 1	L-18	Quarterly	Lack of De-icing activity precludes need for Sector S Benchmark Monitoring.	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)
	CAB Aviation 2	L-19	Quarterly	Lack of De-icing activity precludes need for Sector S Benchmark Monitoring.	Hazardous Metals (Total Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc)

Note: Sampling and analysis from locations designated as L2, L4, L5, and L6 were discontinued as of December 2009.

Calendar Year Implementation

Quarterly = Jan-Mar (1^{st} qtr), Apr–Jun (2^{nd} qtr), Jul-Sep (3^{rd} qtr), Oct–Dec (4^{th} qtr).

Semiannual = Jan-Jun (1^{st} period), Jul-Dec (2^{nd} period).

Annual = Year end is December 31^{s}

APPENDIX D-4

Appendix O – Closure Plan

Department of the Army
Fort Bliss Department of Public Works - Environmental
IMWE-BLS-PW

Final Closure Plan

USAADACENFB Fort Bliss Municipal Solid Waste Landfill Permit #1422

Revised December 2011

Prepared By:

ARCADIS Malcolm Pirnie

44 South Broadway
15th Floor
White Plains, NY 10601

6400003

Infrastructure · Water · Environment · Buildings

Engineering Certification

I attest that this Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 of the Texas Administrative Code (Title 30 TAC) Rule §330. This certification in no way relieves Fort Bliss of its duty to prepare and fully implement this Plan.

Certifying Engineer:	Jeffrey Rusch, P.E.
State:	Texas
Registration Number:	109130

Signature: ______________________

Certification Date: 1/10/12

Engineering Seal:

STATE OF TEXAS
JEFFREY A. RUSCH
109130
LICENSED
PROFESSIONAL ENGINEER

JEFFREY A. RUSCH
109130
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

JAR 1/10/12

Contents

List of Tables

STATE OF TEXAS
JEFFREY A. RUSCH
109130
LICENSED
PROFESSIONAL ENGINEER

1/10/12

1. Introduction

The final closure plan has been prepared to provide a general guidance for the Fort Bliss Municipal Solid Waste Landfill (MSWLF) in meeting the Texas Commission on Environmental Quality (TCEQ) rules listed in Title 30 of the Texas Administrative Code Chapter 330 Rule 457 (Title 30 TAC §330.457) in reference to the closure requirements for MSWLF units.

2. Final Cover Requirements

2.1. Final Cover Design

Title 30 TAC §330.457(a)

The Fort Bliss MSWLF was permitted on November 1, 1982 for a total area of 106 acres. Currently, approximately 80% of the MSWLF has been operationally closed or is inactive. Three acres of the MSWLF have been closed as a Type I landfill unit. Ten and a half acres of the remaining portion of the landfill are designed to meet both USEPA Subtitle D and the Texas Municipal Solid Waste regulations. The remaining landfill area is classified as a Type IV construction and demolition debris cell.

The currently permitted final cover requirements for the MSWLF are summarized as follows:

Table 2-1
Fort Bliss MSWLF Final Cover Requirements (Title 30 TAC §330.457(e)(2))

Area*	Cover Requirements	Current Status
80 Acres	24" Clean Soil	Operationally Closed/Inactive
10.5 Acres (Type I)	Subtitle D Cover	Active
3 Acres (Type I)	Non-Subtitle D Cover	Closed 1999
5 Acres (Type IV)	24" Clean Soil	Active
7 Acres **	N/A	N/A

* Acreage is approximate and for estimation purposes only.
** Designed landfill access area.

Pursuant to Title 30 TAC §305.70(k)(10), an alternative final cover design may be approved as long as the alternative design achieves an equivalent reduction in infiltration as the clay-rich soil specified in 30 TAC §330.457(a)(1) and provides equivalent protection from wind and water erosion as the erosion layer specified in Title 30 TAC §330.457(a)(3). As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell was closed in 1999 with a final cover that complied with the closure plan for that cell and for which TCEQ closure approval was obtained on February 24, 1999. However, the remainder of the facility will be closed with an alternative evapotranspiration (ET) final cover designed to be equivalent with the currently permitted final cover systems. The ET cover will be the only final cover design for those parts of the landfill that have not received a permitted final cover (i.e. all landfill cells except the non-subtitle D cell that was capped/closed in 1999). The ET final cover will also be installed over top of the approved final cover of the Non-Subtitle D Type I cell for site grading and drainage purposes.

The ET final cover system will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,
- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.

2.2. Final Cover Area

As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell was closed in 1999. However, the remainder of the facility will be closed with an alternative evapotranspiration (ET) landfill cover. The total area to be capped and closed with the ET landfill cover includes the 1970's era inactive cells, the 10.5-acre Type I cell, and the 5-acre Type IV C&D cell, and encompasses approximately 98.5 acres.

3. Maximum Inventory of Waste

Title 30 TAC §330.457(e)(3)

Based on the approved 1995 final landfill contours, the total permitted waste capacity of the Fort Bliss MSWLF is 5.9 million cubic yards. The March 2009 MOD for the 10-foot height increase in the Subtitle-D cell added an additional 180,000 cubic yards of landfill capacity. The alternative ET landfill cover final grading plan doesn't significantly alter the final grades presented in the March 2009 MOD; however, the ET landfill cover final grading plan generally conforms to the grades developed during filling operations (based on the 2010 topographic survey) to provide more easily constructible ridges, swales, and slopes and a more uniform surface for installation and maintenance of the ET final cover. Specifically:

- The final closure grades of the northwest inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 2.2% to a more uniform pyramidal shape with a 3.6% top slope facing to the west and between 6% and 18% side slopes facing to the north, east, and south.
- The final closure grades of the northeast inactive cell were adjusted from inconsistently directed 2% side slopes to a more uniform pyramidal shape with a 2.2% top slope facing to the west and between 5% and 8.3% side slopes facing to the north, east, and south.
- The final closure grades of the southeast inactive cell were adjusted from inconsistently directed and varying top and side slopes generally ranging between 2% and 3.3% to a more uniform plateau shape with a 2% top slope facing to the south and between 8.3% and 25% slopes facing east and north respectively.
- The final closure grades of the Type IV C&D cell were adjusted from steep 25% plateau side slopes to a more uniform pyramidal shape with 2% side slopes in all directions.
- The final closure grades of the Subtitle D cell were generally kept consistent with the March 2009 MOD grades.

As reported in the March 2009 MOD the current volume of in-place waste at that time was about 5.1 million cubic yards. The Annual Solid Waste Reports from FY 2009 and FY 2010 and the most recent Daily Landfill Log from FY 2011 document an additional 85,000 cubic yards of in-place waste. Based on the existing landfill grades and the ET landfill cover final grading plan, the remaining capacity in the active Type I and Type IV cells is 100,200 cubic yards. Therefore, at the time of closure the maximum in-place waste volume is expected to be 5,285,200 cubic yards.

It should be noted that the landfill will be closed prior to reaching its permitted waste capacity of 5,893,932 CY. As reported in the 21 February 1996 Report on Volume Calculations and Case Studies, exploratory trenches advanced through the 1970's era filled and operationally closed landfill cells discovered an in-place waste depth of 25-feet corresponding to an in-place waste volume of 2,984,467 CY. The permitted waste capacity over this same area, based on the design waste depth of 30-ft, is 3,676,542 CY. Therefore, the disparity between the permitted capacity and the anticipated final volume of in-place waste is primarily related to the shallower waste depth in the historic cells.

4. Final Cover Design

4.1. ET Cover System

As previously discussed in Section 2.1, the Fort Bliss MSWLF will be closed with an alternative evapotranspiration (ET) final cover designed to be equivalent with the currently permitted final cover systems. The ET cover will be the only final cover design for those parts of the landfill that have not received a permitted final cover. The alternative ET cover system was designed to meet the requirements listed in Title 30 TAC §330.457 and will consist of a 3.5-foot layered soil cap comprised of (from top to bottom) the following components:

- 12-inch thick Vegetative Surface Layer consisting of stockpiled Silty Sand (United Soil Classification System (USCS) SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer serves as a medium for seed germination and plant growth, and provides protection against erosion and desiccation;
- 12-inch thick Storage Layer consisting of stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density. The Storage Layer will provide storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials;
- 6-inch thick Capillary Break Layer consisting of well-graded, fine to coarse grained sand. The Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break layer. The additional water stored within the Storage Layer will help promote the establishment and development of surface vegetation, contribute to greater evapotranspiration, and reduce surface erosion; and,
- 12-inch thick Intermediate Cover Layer consisting of existing cover material and/or additional stockpiled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density to provide additional water retention storage volume.

It should be noted that the TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling and constructing without model calibration.

4.2. Landfill Cells

Title 30 TAC §330.457(e)(1)

The Fort Bliss MSWLF is comprised of five distinct areas:

1. 1970's era inactive cells that consist of 30-foot deep trenches with two feet of clean soil cover. These cells cover an 80 acre area and are unlined and without leachate collection. The permit does not allow further placement of MSW on these cells. According to the March 1995 Final Closure Plan and Cost Estimate these 80 acres are closed; however, formal TCEQ approval documentation has not been located in the DOE or TCEQ files.
2. A three-acre Type 1 cell with final cover in place (non-Subtitle D) that complies with the closure plan and TCEQ closure requirements. TCEQ approval was received on February 24, 1999.
3. A 10.5-acre Type I active cell meeting Subtitle D requirements. This cell is lined and has a leachate collection system. This cell is nearing permitted capacity and is anticipated to be full by January 2012.
4. A 5-acre active Type IV construction debris cell. This cell is unlined and without leachate collection. This cell is also anticipated to reach capacity by July 2012.
5. Seven acres designated for landfill roads, access areas, gatehouse, etc.

4.3. 1970's Inactive Cells

The 1970's era inactive areas are covered with 24-inch thick clean soil, as indicated in the March 1995 Final Closure Plan and Cost Estimate sealed by Mr. John Karlsruher of Cardenas-Salcedo and Associates, Inc. These landfill areas are also indicated as closed in the May 1999 Final Cover Quality Control Plan for the 3-acre Type 1 cell. However, this area is described as in interim closure by Fort Bliss DPW-ENV and no TCEQ approval or Texas P.E. certification of closure has been found in TCEQ or Fort Bliss DPW-ENV records. Accordingly, the ET final cover system as described in Section 4.1 will be installed over these areas. The existing intermediate cover material will require clearing/grubbing and/or tilling, watering and regrading, and compaction as defined in Section 5 to meet the requirements of the intermediate cover component of the ET cover system.

The final grades of these 1970's era cells will be adjusted to create uniform pyrimdal shapes as summarized in Section 3. All cells will be crowned at the top to promote positive drainage off the landfill and preclude ponding of surface water when total fill height and expected subsidence are taken into consideration.

4.4. Non-Subtitle D Area (Type I)

The closure of the Non-Subtitle D Type I cell was approved by TCEQ on February 24, 1999. However, the ET final cover system will be installed over top of the approved final cover for site grading and drainage purposes.

4.5. Subtitle D Area (Type I)

The final cover for the Type I Subtitle D area will be the ET final cover system as described in Section 4.1. Final closure grades will be generally consistent with the March 2009 MOD grades and will form a landfill plateau with 2% top slopes and 25% side slopes.

4.6. Non-Subtitle D Area (Type IV)

The final cover for the Type IV Non-Subtitle D area will be the ET final cover system as described in Section 4.1. The final grading of the Non-Subtitle D cell will create a uniform pyramidal shape with 2% side slopes in all directions.

5. Construction Quality Assurance

5.1. Introduction

Title 30 TAC §330.457(e)(1)

Construction of the ET final cover system will be performed by using equipment that is suitable for completing the construction and achieving the desired grading, compaction and vegetative cover requirements.

5.2. Construction Quality Control Plan (CQCP)

This section addresses the construction of the soil components of the alternative ET final cover system and outlines the Construction Quality Control Plan (CQCP) to be implemented with regard to material selection and evaluation, laboratory test requirements, and field test requirements.

The primary soil parameters and construction specifications that will impact the performance of the ET final cover system are soil gradation, saturated hydraulic properties, and degree of compaction. The modeling and design of the ET cover system was based on these material and construction specification requirements. Therefore, the QA testing procedures presented herein will be required during the final closure construction to ensure that the ET final cover is constructed in accordance with the design intent and to maximize ET performance.

5.2.1. Source Material Evaluation

Material evaluations shall be performed on stockpiled or delivered material to ascertain its acceptability for the intended purpose. All material shall be sampled and tested by the Contractor in accordance with the requirements summarized in the following subsections. Stockpile materials shall not be altered in any manner, including adding or taking material, until the results from the material testing laboratory have been received and reviewed. Copies of the laboratory inspection testing results will be submitted to the Engineer of Record and will also be included in the Final Cover System Evaluation Report (FCSER).

Standards referenced in this Section are:

- ASTM D422, Test Method for Particle Size Analysis of Soils

- ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
- ASTM D2216, Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D6836 - Standard Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using a Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, and/or Centrifuge
- ASTM D6938, Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

5.2.2. Intermediate Cover Layer

5.2.2.1. Material Specification

The Intermediate Cover Layer will consist of twelve-inches of existing placed cover material or stock-piled cover material (SM) placed over the waste and compacted to approximately within ±2% of 75% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system.

5.2.2.2. Existing Intermediate Cover Material Construction Requirements

Across the 1970’s era inactive cells, the Intermediate Cover Layer will likely consist of the existing intermediate cover soil placed in accordance with the Site Operating Plan. In general, over 24-inches of compacted intermediate cover material has been placed over these inactive cells. Over time, isolated patches of native vegetation have taken root across these calls. Therefore, the Contractor will be required to clear and grub all existing intermediate cover material of all vegetation, roots, and other deleterious materials using bulldozers, graders, tillers, or other suitable equipment to provide a smooth uniformly graded bare surface.

All existing intermediate cover material will require watering, re-working, and compaction as necessary to create an intermediate cover material subgrade consistent with the final cover requirements. Prior to final grading and compaction, the existing intermediate cover material will be probed at 100-foot intervals to verify that a minimum of 12-inches of cover soil is in place and verify the existing in-place density. Where existing suitable intermediate cover material does not meet or cannot be re-worked to meet the final cover material or compaction requirements or does not measure the minimum of 12-inches in depth, additional stockpiled SM cover material shall be backfilled, graded, and compacted to create a uniform bare surface of suitable intermediate cover material. Intermediate cover material may exceed the minimum 12-inches in thickness, where necessary.

5.2.2.3. Other Construction Requirements

Where existing intermediate cover material has not been installed, stockpiled intermediate cover SM material will be placed as a single lift to achieve a minimum compacted thickness of 12-inches. All intermediate cover material (existing re-worked material and stockpiled backfill) will require static and/or vibratory compaction to meet the project compaction requirements of within ±2% of 75% of the Modified Proctor maximum dry density through the full 12-inch soil layer. Should in-place density exceed project requirements, intermediate cover material will be tilled to a minimum depth of 12-inches, watered, and re-compacted with appropriate energy to meet the project requirements. Surveying and grade stakes will be used to verify the final grades of the intermediate cover material.

5.2.2.4. Field QA Testing

During construction, the intermediate cover material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10 acres of existing intermediate cover material installed
- Modified Proctor moisture/density testing (ASTM D1557) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Mositure content testing (ASTM D2216) - Minimum frequency of 1 test per 10,000 CY stockpiled intermediate cover material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre for existing and/or backfilled intermediate cover material

5.2.3. Capillary Break Layer

5.2.3.1. Material Specification

The Capillary Break Layer will be installed over the Intermediate Cover Layer as approved by the Engineer of Record and will consist of 6-inches of well-graded, fine to coarse grained sand (SW). Sand will be a fine granular material produced by the crushing of rock, gravel, or naturally produced by disintegration of rock and will be free of organic material, mica, loam, clay and other deleterious substances.

5.2.3.2. Construction Requirements

Capillary break layer material will be placed as one lift to achieve a minimum compacted thickness of six inches and compacted to within ±5% of 90% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. Over-compacted material will be tilled and re-compacted. Material installed as part of the capillary break layer will be placed at ±2% of the optimum moisture content at the time of placement and will be covered with the overlying storage layer as soon as practical. Placement of capillary break layer material will not occur during rainfall events to prevent saturation and over-compaction. Surveying will be performed to verify the thickness of the capillary break layer.

5.2.3.3. Field QA Testing

During construction, the capillary break layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of imported capillary break material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of imported capillary break material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of imported capillary break material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

5.2.4. Storage Layer

5.2.4.1. Material Specification

The Storage Layer will be installed over the capillary break layer as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM material compacted to within ±2% of 75% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter.

5.2.4.2. Construction Requirements

The Storage Layer will be placed as a single lift to achieve a minimum compacted thickness of 12-inches and compacted to within ±2% of 75% of the Modified Proctor maximum dry density. Over-compacted material will be tilled and recompacted. Surveying will be performed to verify the thickness of the storage layer.

5.2.4.3. Field QA Testing

During construction, the storage layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY of stockpiled storage layer material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of stockpiled storage layer material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

5.2.5. Vegetative Surface Layer

5.2.5.1. Material Specification

The vegetative Surface layer will be installed over the storage layer as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM material compacted to within ±2% of 75% of the Modified Proctor maximum dry density. Sensitivity simulations confirmed that compaction within ±2% of the desired compaction specification achieves sufficient performance of the ET final cover system. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter. Where possible, stockpiled SM material visually observed to contain a higher organic content will be reserved for use in the vegetative surface layer.

5.2.5.2. Construction Requirements

The Surface Layer will be placed as a single lift to achieve a minimum compacted thickness of 12-inches and compacted to within ±2% of 75% of the Modified Proctor maximum dry density. Over-compacted material will be tilled and recompacted. Material installed as part of the vegetative surface layer will be placed at ±2% of the optimum moisture content at the time of placement. Placement of vegetative surface layer layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the vegetative surface layer.

The top 4-inches of the vegetative surface layer will be tilled perpendicular to the slope of the surface in preparation for seeding in accordance with Section 5.3.

5.2.5.3. Field QA Testing

During construction, the vegetative surface layer material will be sampled and tested at the minimum frequencies presented below:

- Modified Proctor moisture/density testing (ASTM D1557) – Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Sieve analysis testing (ASTM D422) - Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Atterberg limits testing (ASTM D4318) - Minimum frequency of 1 test per 10,000 CY of stockpiled surface layer material
- Soil water characteristic curve (ASTM D6836) and saturated hydraulic permeameter testing (ASTMD5084) - Minimum frequency of 1 test per 20,000 CY of stockpiled surface layer material
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 2 tests per acre

5.3. Vegetation Planting Plan

The purpose of this plan is to detail the procedures to be used for soil preparation and initial planting on the ET Cover. This plan sets forth use a specified native seed mix for permanent cover which includes the two target grass species from the genera *Aristida* and *Sporobolus* for permanent establishment, but also allows for use of non-native and cultivated seed mixes per TxDOT specifications which are designed for temporary cover to achieve soil stabilization in the event final grading is completed outside of the germination period for target species (May 15 – November).

5.3.1. Soil Preparation and Seeding

All seeds must conform to the requirements of the USDA rules and regulations set forth in the Federal Seed Act and Texas seed law. Utilization of local soils stockpiled on-site will constitute the 12-inch thick Vegetative Surface Layer. These soils consist of silty sand (SM) and will be compacted to 75% of the Modified Proctor maximum dry density prior to seedbed preparation as discussed in Section 5.2.5.

Seedbed preparation will start as soon as possible after completion of the Vegetative Surface Layer to the lines and grades specified in the construction plans. The vegetated area will be cultivated to a typical depth of 4-inches before placement of seed or seed mix. If temporary seeding is utilized, the area covered with temporary grass will be cultivated to a typical depth of 4 inches before application of permanent seeds.

Table 5-1 includes the schedule and species for seeding as well as the seed application rate of pure live seed (PLS) per acre. The schedule is subject to potentially change depending on the availability of grass species specified as well as due to unexpected climatic conditions during and immediately after final cover construction are encountered.

Table 5-1
Fort Bliss MSWLF ET Cover Seeding Schedule

Dates	Seed Type to Use	Seed Species to Use (Common Name)	Seed Species to Use (Latin Name)	Rates (lb Pure Live Seed/ac)
February 1 – May 15	Perennial (Native Species Seed Mix)	Green Sprangletop	*Leptochloa dubia*	0.3
		Red threeawn	***Aristida purpurea Nutt.***	0.4
		Mesa dropseed	***Sporobolus flexuosus***	0.9
		Blue Grama	*Bouteloua gracilis*	1.0
		Indian Ricegrass	*Oryzopsis hymenoides*	1.6
		Purple Prairieclover	*Dalea purpurea*	0.5
May 16 – August 31	Temporary Warm (Summer) Season (A Native Species and A Cultivated Species)	Buffalo Grass	*Buchloe dactyloides*	50
September 1 – November 30	Temporary Cool (Winter) Season (Introduced Species)	Plains Bristlegrass	*Setaria vulpiseta*	4.0

Plant seeding may utilize one or a combination of the following methods, as suggested by the Texas Department of Transportation *Specifications Book.*

1. Broadcast Seeding. Distribute seed/mixture uniformly over the areas shown on the plans using hand or mechanical distribution or hydro-seeding on top of the soil. When seed and water are to be distributed as a slurry during hydroseeding, apply the mixture to the area to be seeded within 30 minutes of placement of components in the equipment. Roll the planted area with a light roller or other suitable equipment. Roll sloped areas along the contour of the slope.

2. Straw or Hay Mulch Seeding. Use Broadcast Seeding method to plant seed. Immediately after planting the seed/mixture, apply straw or hay mulch uniformly

over the seeded area. Apply straw mulch at 2 to 2.5 tons per acre. Apply hay mulch at 1.5 to 2 tons per acre. Use a tacking method over the mulched area.

3. Cellulose Fiber Mulch Seeding. Plant seed using broadcast seeding. Immediately after planting seed/mixture, apply cellulose fiber mulch uniformly over the seeded area at the following rates:
   - Clay soils with slopes of 3:1 or less – 2,000 lbs per acre
   - Clay soils with slopes greater than 3:1 – 2,300 lbs per acre
   - Sandy soils with slopes of 3:1 or less – 2,500 lbs per acre
   - Sandy soils with slopes greater than 3:1 – 3,000 lbs per acre
4. Drill Seeding. Using a pasture or rangeland type drill, plant seed/mixture uniformly over the area at a depth of 1/4 inch to 1/3 inch. Plant seed along the contour of the slopes.
5. Straw or Hay Mulching. Apply straw or hay mulch uniformly over the area as indicated on the plans. Apply hay mulch at 1.5 to 2 tons per acre. Apply straw at 2 to 2.5 tons per acre. Use a tacking method over the mulched area.

5.3.2. Fertilizer Recommendations

The installed vegetation layer will be tested for fertilizer need prior to seeding. Except for broadcast seeding, initial fertilization will occur prior to seeding. Fertilizer needs for the installed vegetation layer will be determined by collecting one soil sample per every 10 acres of installed vegetation layer, (for the purpose of this plan only one vegetation layer is proposed). Soil nutrient needs will be tested by a qualified agronomic testing laboratory (e.g. Texas A&M University Soil, Water and Forage Testing Laboratory). The laboratory testing report will determine macro and micro nutrient needs and may also contain suggestions for soil inoculants, organic matter, etc. for the installed vegetation layer. The nitrogen, phosphoric acid and potash ratio is 2:1:1, and will be applied at a rate of 100 pounds of nitrogen, 50 pounds of phosphoric acid and 50 pounds of potash per acre, unless laboratory testing results mandate higher rates. At a minimum, micronutrients will be applied at a minimum rate of 1 pound per acre of boron, calcium and magnesium.

Seed and fertilizer may be distributed simultaneously during Broadcast Seeding operations, provided each component is applied at the specified rate. When temporary and permanent seeding are both specified for the same area, apply half of the amount of fertilizer during temporary seeding operation and the other half during the permanent seeding operation. Fertilization will occur at intervals of no more than six week after initial seeding and until vegetation is established. To prevent damage to established vegetation, turf type line equipment will be used to apply fertilizer.

Unless otherwise specified on the plans, use a fertilizer containing nitrogen, phosphoric acid and potash nutrients. Similar to urea-based and plastic resin-coated fertilizers, at least 50 percent of the nitrogen component must be of a slow release formulation unless otherwise dictated by the soils laboratory. The vegetation establishment contractor will ensure that fertilizer is in an acceptable condition for distribution in containers labeled with the analysis. Fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service in accordance with the Texas Fertilizer Law.

5.4. Vegetation Establishment Verification Plan

5.4.1. Introduction

The Vegetation Establishment Verification Plan will ensure that the vegetation is established consistent with the parameters used in the ET Alternative Final Cover Demonstration and includes the following subsections:

- Vegetation Establishment Period
- Maintenance Activities to be Completed During the Vegetation Establishment Period
- Vegetation Performance Specification

5.4.2. Vegetation Establishment Period

The maintenance period will start immediately after seeding is conducted and will continue until TCEQ approves the vegetation establishment verification. Vegetation will be considered established when a satisfactory population of mature plants belonging to the *Aristida* and/or *Sporobolus* genera is verified to cover no less than 10% of the ET final ground cover area with no more than 50% bare areas. A bare area is defined as zero plants within a square meter quadrant (~10.76 square feet). It is assumed that re-use of local stockpiled soils containing native plant seed stock will significantly aide in facilitating vegetative growth.

The vegetation establishment period begins after the Final Cover System Evaluation Report (see Section 5.5.1) is approved by TCEQ and ends when the Vegetation Establishment Report (see Section 5.5.2) is approved by TCEQ. The standard timeframe is 2 to 3 years. The facility will establish the vegetation consistent with the parameters specified in the Vegetation Planting Plan.

5.4.3. Maintenance Activities to be Completed during the Vegetation Establishment Period

The following maintenance activities ensure that the planted vegetation will meet the vegetation performance specification:

- Following application of perennial seed mix, if less than 10% vegetative ground coverage or greater than 50% bare areas are determined to exist, re-seeding of areas that will amount to achieving the 10% ground coverage with no more than 50% bare areas will need to be completed prior to May 15.
- Following application of a temporary seed mix, if less than 10% vegetative ground coverage or greater than 50% bare areas are determined to exist, re-seeding of areas that will amount to achieving the 10% ground coverage with no more than 50% bare areas will need to be completed prior to November 30 to avoid over-winter exposure of said bare areas.
- Temporary erosion protection measures will be installed, as necessary, if greater than 50% bare areas are determined to exist.
- Additional landfill gas extraction wells will be installed in any specific vegetative area where landfill gas poses a detrimental threat.
- Areas of significant differential settlement will be re-graded and re-seeded.
- Depending on the season, vegetation will be maintained and mowed as appropriate. No mowing will be allowed until grasses establish mature seeds.
- The facility will irrigate and fertilize the ET final cover area to stimulate and promote vegetative.
- Erosion and sediment controls will be added to areas that experience erosion.

5.4.4. Vegetation Performance Specification

The vegetation layer will be evaluated at the end of the vegetation establishment period by a Texas Licensed Professional Engineer to determine if the vegetation is established in accordance with the Evapotranspiration Cover Design Report. The performance specification for the vegetation layer is summarized herein:

- Vegetative Coverage – The vegetative coverage specification is based upon a demonstration of a satisfactory population of mature plants belonging to the *Aristida* and/or *Sporobolus* genera covering no less than 10% of the ET final ground cover area with no more than 50% bare areas larger than one square meter without a matured vegetative species.
- Root Penetration – The minimum root depth required of 12" is based on achieving 10% vegetative cover entirely comprised of *Aristida* and/or *Sporobolus* species as an input parameter for completing the UNSAT-H model demonstration. This root

depth will ensure that these two grass species are established and will survive drought conditions.

5.5. Documentation

5.5.1. Final Cover System Evaluation Report (FCSER)

Following the installation of the ET cover system, a Final Cover System Evaluation Report will be submitted certifying that the ET soils were constructed in accordance with the construction methods and test procedures in the Final Cover Quality Control Program. The FCSER will be signed and sealed by a Professional Engineer in the State of Texas and include, at a minimum:

- Completed report forms required by TCEQ
- Summary of construction activities
- Summary of the initial installation of vegetation
- Summary of all laboratory and field test results
- Drawings showing sample and test locations
- Field and laboratory test results
- As-built drawings
- A description of significant construction problems and the resolution of these problems
- A statement of compliance with the Final Cover Quality Control Program

The Final Cover Evaluation Report will be signed and sealed by the Professional Engineer, signed by the site operator, and submitted to the MSW Permits Section of Waste Permits Division of the TCEQ for acceptance. Upon acceptance of the Final Cover Evaluation Report, the vegetation establishment period will begin as noted in the Vegetation Establishment Verification Plan. After the acceptance of the Final Cover Evaluation Report and during the vegetation establishment period, the applicant will request closure of the site in accordance with this Report. Since the vegetation establishment period timeframe is 2 to 3 years, closure of the site will occur prior to the completion of the vegetation establishment period.

5.5.2. *Vegetation Establishment Verification Report*

At the end of the vegetation establishment period, a Vegetation Establishment Verification Report will be completed as described in the Vegetation Establishment Verification Plan. A quarterly report will be submitted to TCEQ during the vegetation establishment period. The quarterly report will include the status of vegetation establishment activities (fertilizer application, watering, reseeding, etc.) and any other activities that are related to installed final cover or vegetation

The Vegetation Establishment Verification Report will be prepared and submitted to TCEQ for approval at the end of the vegetation establishment period. The report will be prepared by a Texas Licensed Professional Engineer and include the following:

- Documentation of the root penetration performance. A hand auger or drive cylinder will be driven at a frequency of every acre within vegetative cover areas consisting of *Aristida* and/or *Sporobolus* species to a depth of 12 inches to determine and verify the rooting depth. In addition, each core obtained will be examined by the certifying engineer to observe that the *Aristida* and/or *Sporobolus* roots are denser in the upper portion of the soul profile and extend to 12 inches in depth. Each sample location will be shown on design drawings.
- Documentation that the percent vegetative cover is in accordance with the ground cover and bare area determination procedures included in this plan. This documentation will include the engineers' assessment of the vegetation cover and photographs that document compliance with the performance specification.
- The certifying engineer will also provide a statement indicating that the vegetation layer of the ET final cover system has been maintained consistent with the parameters used in the UNSAT-H analysis.

6. Schedule for Closure Activities

The landfill closure schedule and other closure related activities shall follow the requirements of Title 30 TAC §330.457(f) and (g).

6.1. Closure Schedule

Title 30 TAC §330.457(e)(4)

An overall timetable for the closure of the Fort Bliss MSWLF is presented following this section. This schedule is based on the current BRAC realignment process at Fort Bliss and the regulatory closure requirements described in subsequent sections.

6.2. Final Contour Map

Title 30 TAC §330.457(e)(5)

A final contour map depicting the proposed final contours, top slopes, and side slopes, and proposed surface drainage features is provided as Sheet 3 in Appendix B of the permit modification application. The MSWLF is not within a 100-year flood plain.

6.3. Location of Plan

Title 30 TAC §330.457(f)(1)

Fort Bliss DPW-ENV shall maintain a copy of the closure plan in the operating record.

6.4. Written Notification

Title 30 TAC §330.457(f)(2)

No later than 45 days prior to the initiation of closure activities for any area or final closure of the facility, Fort Bliss shall provide written notification to the Executive Director of the intent to close the unit or facility and place this notice of intent in the operating record.

No later than 90 days prior to the initiation of a final facility closure, Fort Bliss shall, 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 following information:

- Facility Name
- Facility Address
- Physical Location of the Facility
- The Permit Number
- Last Date of Intended Receipt of Waste.

6.5. Start of Final Closure Activities

Title 30 TAC §330.457(f)(3)

Fort Bliss shall begin final closure activities for each unit or facility no later than 30 days after the date on which the unit or facility receives the known final receipt of wastes or, if the unit or facility has remaining capacity and there is a reasonable likelihood that the unit or facility 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 Fort Bliss has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the MSWLF.

6.6. Completion of Final Closure Activities

Title 30 TAC §330.457(f)(4)

Fort Bliss shall complete final closure activities for the unit or facility in accordance with the approved final closure plan within 180 days following the initiation or final closure activities. A request for an extension for the completion of final 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 MSWLF unit.

6.7. Certification

Title 30 TAC §330.457(f)(5)

Following final closure of the MSWLF unit or facility, the owner or operator shall submit to the Executive Director for review and approval a Final Cover System Evaluation Report (FCSER), a Vegetation Establishment Report, signed by an independent licensed professional engineer, verifying that final closure has been completed in accordance with the approved final 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.

6.8. Inspection Report

Title 30 TAC §330.457(f)(6)

Following receipt of the required final closure documents, as applicable, and an inspection report from the commission's district office verifying proper closure of the MSWLF unit or facility according to the approved final closure plan, the executive director may acknowledge the termination of operation and closure of the unit or facility and deem it properly closed.

6.9. Affidavit to the Public

Title 30 TAC §330.457(g)

Upon notification to the executive director, Fort Bliss 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 on closing for specific unit(s) or the entire facility and the prohibition against further receipt of waste materials after the stated date.

Within 10 days after completion of final closure of the MSWLF unit or facility, Fort Bliss shall submit to the executive director a certified copy of an "Affidavit to the Public" in accordance with the requirements of Title 30 TAC §330.19 and place a copy of the affidavit in the operating record. In addition, a certified notation of the deed to the facility property, or on some other instrument that is normally examined during title search, needs to be recorded. This is intended so that in perpetuity any potential purchaser of the property is notified that the land has been used as a landfill facility and use of the land is restricted.

Post-closure care maintenance specified in Title 30 TAC §330.463(b) (relating to Post-Closure Care Requirements) shall begin immediately upon the date of final closure as approved by the executive director.

6.10. Post-Closure Care

Following the professional engineer certification of the completion of closure as accepted by the Executive Director of the TCEQ Waste Permits Division, Fort Bliss DPW-ENV shall commence the 30-year post-closure care period. A Vegetation Establishment Report shall be submitted semi-annually during the cover vegetation start-up period indicating the type and quantity of vegetation established, the percent vegetative cover, and the vegetative root structure. If the type or quantity of vegetation or root structure does not meet specifications, then corrective action shall be taken to improve the vegetation consistent with the ET final cover design. Post-closure care requirements are discussed in the *Post Closure Plan.*

7. Closure Cost Estimate

Title 30 TAC §330.63(j)

As an agency of the Federal Government, Fort Bliss is not required to complete financial assurance mechanism requirements. Therefore, a closure cost estimate is not required per Title 30 TAC §37.8001.

APPENDIX D-5

Appendix P – Post-Closure Plan

Department of the Army

Fort Bliss Department of Public Works - Environmental

IMWE-BLS-PW

Post-Closure Care Plan

USAADACENFB Fort Bliss Municipal Solid Waste Landfill Permit #1422

Revised December 2011

Report Prepared By:

ARCADIS Malcolm Pirnie

44 South Broadway
15th Floor
White Plains, NY 10601

6400003

Engineering Certification

I attest that this Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 of the Texas Administrative Code (Title 30 TAC) Rule §330. This certification in no way relieves Fort Bliss of its duty to prepare and fully implement this Plan.

Certifying Engineer: Jeffrey Rusch, P.E.

State: Texas

Registration Number: 109130

Signature: ____________________

Certification Date: 1/10/12

Engineering Seal:

STATE OF TEXAS
JEFFREY A. RUSCH
109130
LICENSED
PROFESSIONAL ENGINEER

List of Tables

STATE OF TEXAS
JEFFREY A. RUSCH
109130
LICENSED
PROFESSIONAL ENGINEER

1/10/12

1. Introduction

This Post–Closure Care Plan has been prepared to provide general guidance for Fort Bliss in meeting the Texas Commission on Environmental Quality (TCEQ) rules listed in Title 30 of the Texas Administrative Code Chapter 330 Rule 463 (Title 30 TAC §330.463) in reference to the post-closure care maintenance requirements for Municipal Solid Waste Landfill (MSWLF) units. A copy of this Post-Closure Care Plan will be maintained in the operating record.

2. Maintenance and Monitoring

2.1. Post-Closure Care

Title 30 TAC §330.463(b)(1)

After professional engineer certification of the completion of closure requirements for the MSWLF is accepted by the executive director, Fort Bliss shall begin conducting post-closure care maintenance for 30 years unless the executive director specifies otherwise. Post closure care shall consist, at a minimum, of the following:

2.1.1. General Maintenance

Title 30 TAC §330.463(b)(1)(A)

Fort Bliss (the owner) or operator shall retain the right of entry to the closed unit or facility and shall maintain all rights-of-way and conduct maintenance and/or remediation activities as needed, in order to maintain the integrity and effectiveness of all final cover and drainage control system(s); to correct any effects of settlement, subsidence, ponded water, erosion, or other events or failures detrimental to the integrity of the closed unit or facility; and to prevent surface run-on and run-off from eroding or otherwise damaging the final cover system.

2.1.2. Leachate Collection System Monitoring

Title 30 TAC §330.463(b)(1)(B)

Fort Bliss shall maintain and operate the leachate collection system (LCS) in accordance with the requirements listed in Title 30 TAC §330.331 and §330.333 (relating to Design Criteria and Leachate Collection System, respectively).

Leachate shall be measured at least once a year by a scaled dip stick into the on-site vertical leachate monitoring pipe. The watermark on the stick measures the depth of leachate that collected on the liner. If the leachate is more than 12 inches (30 centimeters) deep in the landfill, it will be pumped out through the leachate transfer pipe and spread on the Subtitle D cell for evaporation.

The leachate measurement shall be kept in the site operating record. These measurements shall also be reported to the TCEQ. The executive director may allow Fort Bliss to stop managing leachate if Fort Bliss demonstrates to the approval of the executive director that leachate no longer poses a threat to human health and the environment.

2.1.3. Groundwater Monitoring

Title 30 TAC §330.463(b)(1)(C)

Ground-water monitoring requirements under Title 30 TAC §330.403 (relating to Ground-Water Monitoring Systems), §330.405 (relating to Groundwater Sampling and Analysis Requirements), §330.407 (relating to Detection Monitoring Program for Type I Landfills), and §330.409 (relating to Assessment Monitoring Program) were suspended by the executive director on May 22, 1996, since Fort Bliss demonstrated that there is no potential for migration of hazardous constituents from the MSWLF unit to the uppermost aquifer as defined in Title 30 TAC §330.3 (relating to Definitions) during the active life and the closure and post-closure care period of the unit. A copy of the May 22, 1996 letter is provided in Appendix F of the permit modification application.

2.1.4. Gas Monitoring

Title 30 TAC §330.463(b)(1)(D)

Fort Bliss shall maintain and operate the gas monitoring system in accordance with the requirements listed in 30 TAC §330 Subchapter I and the current approved Landfill Gas Management Plan.

2.1.5. Electrical Resistivity Surveys

Title 30 TAC §330.463(b)(1)(E)

Fort Bliss is not subject to electrical resistivity surveys.

2.1.6. Vegetation Establishment Monitoring

A Vegetation Establishment Report shall be submitted semi-annually during the cover vegetation start-up period indicating the type and quantity of vegetation established, the percent vegetative cover, and the vegetative root structure. If the type or quantity of vegetation or root structure does not meet specifications, then corrective action shall be taken to improve the vegetation consistent with the ET final cover design in accordance with the Fort Bliss MSWLF Closure Plan.

2.1.7. Schedule

Title 30 TAC §330.463(b)(3)(A)

Post-closure activities required for the MSWLF are described below:

Table 2-1.
Post-Closure Monitoring and Inspection Activities

Items	Inspection period	Action	Remark
Erosion	Quarterly and after any major storm	Correct	-----
Methane	Quarterly	Report to TCEQ	Monitoring
Leachate	Annually	Report to TCEQ	Measuring
Vegetation Establishment	Quarterly during establishment period	Report to TCEQ	Monitoring/Measuring

2.1.8. Post Closure Care Period

Title 30 TAC §330.463(b)(2)

Following the professional engineer certification of the completion of closure as accepted by the executive director of the TCEQ Waste Permits Division, Fort Bliss DPW-ENV shall commence the 30-year post-closure care period. The length of the Post-Closure Care maintenance period of the MSWLF may be decreased by the executive director if Fort Bliss submits to the executive director for review and approval a documented certification, signed by an independent registered professional engineer and including all applicable documentation necessary to support the certification that demonstrates that the reduced period is sufficient to protect human health and the environment. The post-closure maintenance period may be increased by the executive director if it is determined that the lengthened period is necessary to protect human health and the environment. If there is evidence of a release from the MSWLF, the executive director may require an investigation into the nature and extent to the release and an assessment of measures necessary to correct an impact to groundwater.

3. Post - Closure Cost Estimate

Title 30 TAC §330.463(b)(3)(D)

As an agency of the Federal Government, Fort Bliss is not required to complete financial assurance mechanism requirements. Therefore, a post-closure cost estimate is not required per Title 30 TAC §37.8001.

4. Completion of Post - Closure Care

Title 30 TAC §330.465

Following completion of the post-closure care maintenance period for the MSWLF, Fort Bliss will submit to the executive director for review and approval a documented certification, signed by an independent registered professional engineer verifying that post-closure care maintenance has been completed in accordance with the approved post-closure care plan. The submittal to the executive director shall include all applicable and supporting documentation necessary for the certification of completion of post-closure care maintenance.

Upon completion of the post-closure care period for the MSWLF Fort Bliss shall also submit to the executive director a request for voluntary revocation of the facility permit.

Title 30 TAC §330.463(b)(3)(C)

Fort Bliss has no foreseeable future land use plan for the landfill property at this time. If such a land use plan is needed, all land use and development plans shall comply with the requirements set forth in Title 30 TAC Chapter 330, Subchapter T: Use of Land Over Closed Municipal Solid Waste Landfills.

APPENDIX D-6

Appendix Q – Evapotranspiration Cover Design Report

EVAPOTRANSPIRATION COVER DESIGN REPORT

FORT BLISS DESIGN AND PERMIT MODIFICATION APPLICATION BLISS-A10-001

Revised December 2011

zia engineering & environmental consultants, llc

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Texas Board of Professional Engineers Certificate of Registration #F-11907

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INTRODUCTION

The purpose of report is to present the approach and methodologies used during the design of the proposed evapotranspiration (ET) final cover system for the Fort Bliss Municipal Solid Waste Landfill (MSWLF). The MSWLF consists of the following distinct areas:

- An active 10.5-acre Type Subtitle D Cell
- A closed 3-acre Type 1 Non-Subtitle D cell (TCEQ closure approval received February 24, 1999)
- An active 5-acre Type IV C&D cell
- Approximately 80 acres of previously filled and closed areas
- Approximately 7 acres designated for landfill roads, access areas, and guard shack / scale house, etc.

Based on capacity estimations performed by Zia Engineering and Environmental Consultants (Zia) and current disposal rates provided by the Fort Bliss Environmental Division, the Subtitle D cell is expected to reach its capacity in the second quarter of FY 2012. At that time, the Subtitle D cell will be closed, followed shortly thereafter by the Type IV C&D cell. The permitted closure design for the Subtitle D Cell, the C&D Cell, and the previously filled and closed areas includes an 18 inch thick prescriptive layer with low permeability soil (i.e. clay) that is not readily available in the area and would need to be imported at a considerable expense.

The purpose of the proposed ET final cover system is to create a more cost-effective and sustainable landfill cover alternative that is equally protective of human health and the environment as the prescriptive closure design. The proposed ET cover system will utilize readily available fill material located on-site to create a layered soil cover designed to optimize water storage and evapotranspiration. This report discusses the feasibility and preliminary design requirements of an ET cover system at Fort Bliss and presents a demonstration of its performance.

The proposed ET cover system was designed in accordance with the draft Texas Commission on Environmental Quality (TCEQ) document Guidance for Requesting a Water Balance Alternative Final Cover for a Municipal Solid Waste Landfill (guidance document), revised November 17, 2010.

FEASIBILITY

According to the United States Environmental Protection Agency Fact Sheet on Evapotranspiration Cover Systems for Waste Containment, evapotranspiration cover systems are increasingly being considered for use at waste disposal sites in arid regions when equivalent performance to conventional final cover systems can be demonstrated. The TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for considering alternative landfill designs. Additionally, over 60% of the precipitation in the El Paso region is received during the growing season, between March and August.

Numerous species of indigenous herbaceous and vascular vegetation inhabit the native soils at Fort Bliss. As such, the utilization of local soils stockpiled on-site and native plant species bodes well for the successful performance of an ET cap. Additionally, a balanced seed design of both herbaceous and vascular native plants has been chosen in an effort to promote and sustain evapotranspiration throughout the year.

During preliminary research, Malcolm Pirnie (MP) found that the Interstate Technology and Regulatory Council (ITRC) document titled Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers (December 2003) states that a range of 75%-85% compaction is best for ET cover systems. Hydraulic laboratory testing of the native material stockpiled on-site at 75% and 80% compaction was performed in December of 2008 by AMEC and indicates adequate water retention and saturated hydraulic conductivity parameters for use in an ET cover system, with a plant-available water content (difference between water content at field capacity and at wilting point) of 0.3. Additionally, a substantial portion of the landfill area currently contains in excess of 1.5-feet of interim cover material that will be incorporated into the ET cover system as supplemental intermediate cover material.

DESCRIPTION OF PROPOSED DESIGN

The proposed ET cover system, shown in **Figure 2**, will consist of a 3.5-foot layered soil cap and include the following components (from top of cover to top of waste):

- 12-inch thick Vegetative Surface Layer, consisting of stock-piled Silty Sand (SM) material compacted to 75% of the Modified Proctor maximum dry density and seeded. The Vegetative Surface Layer will serve as a medium for seed germination and plant growth as well as provide protection against erosion and desiccation.
- 12-inch thick Storage Layer, consisting of stock-piled SM material also compacted to 75% of the Modified Proctor maximum dry density (ASTM D 1557). The Storage Layer will provide approximately 11.3 cm of storage volume during wet weather periods to promote deep root growth while limiting infiltration to the underlying Capillary Break and Intermediate Cover materials.
- 6-inch thick Capillary Break Layer, consisting of well-graded, fine to coarse grained sand. Installation of the Capillary Break Layer will allow the fine-textured soil of the Storage Layer to store more water than a comparable layer without the capillary break due to the difference in the hydraulic conductivities of the two layers. The additional water stored within the Storage Layer will help promote the establishment and development of the surface vegetation. The increased vegetative cover will contribute to greater ET and reduce surface erosion from both wind and rain.
- 12-inch thick Intermediate Cover Layer, consisting of existing cover material and/or additional stock-piled SM material compacted to approximately 75% of the Modified Proctor maximum dry density (ASTM D 1557). The Intermediate Cover Layer will provide approximately 11.3 cm of additional water retention storage volume.

COMPUTER MODELING

The performance of the proposed ET cover system was predicatively modeled using UNSAT-H version 3.01 software, which is managed by the Hydrology Group at the Pacific Northwest National Laboratory. UNSAT-H is a one-dimensional model that simulates soil water infiltration, redistribution, evaporation, plant transpiration, and deep drainage. UNSAT-H is commonly used to evaluate and optimize performance of barrier designs. The following sections summarize input parameters, the source of those parameters, and major assumptions made in modeling the proposed ET cover system.

Options, Constants, and Limits

The input parameters noted below define the modeling period, the components of groundwater flow to be modeled, and the solution methods.

- IPLANT: The plant option was selected to include plants, as transpiration will be a critical component of the performance of the proposed ET cap system.
- NGRAV: The model was given a vertical orientation to model vertical infiltration through the proposed ET cap system
- IFDEND, IDTBEG, and IDTEND: The ending day of the simulation and the number of days that weather data was provided annually was set at 365.
- IYS and NYEARS: The model was set to run for a 30-year period. The first year of the simulation was set as 1981.
- ISTEAD: The model was set to solve in transient mode, utilizing variable historical weather data.
- NPRINT: The level of output was set for end of day and end of simulation summaries.
- ISMETH: The Crank-Nicholson solution method was specified based on guidance from the Pacific Northwest National Laboratory.
- KOPT: Soil hydraulic properties were defined by the van Genuchten parameters.
- KEST: The arithmetic mean was selected to calculate liquid conductivity at the midpoint between nodes.
- ITOPBC and LOWER: A flux surface boundary and unit gradient lower boundary condition was specified.
- IEVOPT and NFHOUR: The evaporation option was selected as evaporation will be a critical component of the performance of the proposed ET cap system. The option to generate hourly factors from a sine wave function for distribution of daily potential evapotranspiration was selected to calculate the surface boundary condition.
- HIRRI and HDRY: Minimum and maximum heads to which the soil can wet up and dry out were defined as 1 and 1 x 10^6 cm, respectively.
- RHA, IETOPT, ICLOUD, and IRAIN: Daily meteorological data from the National Oceanic and Atmospheric Administration (NOAA) was provided for the model.

Daily solar radiation values were synthetically generated using the Hydrologic Evaluation of Landfill Performance (HELP) model. Average relative humidity was also obtained from the HELP model for the El Paso, Texas region.

- IHYS and IHEAT: Hysteresis and heat flow were not simulated.
- IVAPOR: The option to model vapor flow was selected. Fayer and Gee (2004) have documented that vapor flow is a necessary process to be included in simulations of drainage in sandy soil in arid and semiarid climates.
- MATN: Four soil layers were modeled, as previously described in the Description of Proposed Design section.

Soil Property Information

Composite soil samples were collected in December of 2008 by AMEC from the stockpiled material on-site for hydraulic laboratory testing by TRI Environmental Inc. in order to evaluate its water retention and saturated hydraulic conductivity parameters. The ITRC states that a range of 75%-85% compaction is best for ET cover systems. As such, the soil was prepared at 75% of the Modified Proctor (MP) maximum dry density (ASTM D 1557) for laboratory testing. The 75% compaction material was specified for the surficial Vegetative Surface Layer to promote vegetative growth, for the Storage Layer to increase water retention capacity, and the Intermediate Cover Layer to conservatively estimate the existing conditions of the interim cover material. Compaction requirements were based on the Modified Proctor maximum dry density to more accurately simulate compaction of the landfill area by modern construction equipment and methods. It should be noted that, due to the low fines content of the available fill on-site, minimal variance (i.e. 5%) between the Standard and Modified Proctor maximum dry densities is expected. As such, estimated equivalent compaction requirements based on the Standard Proctor maximum dry density (i.e. 80%) can be specified as well. Hydraulic properties of the Capillary Break Layer were estimated using typical parameter values of van Genuchten models for sand from Leij, Alves, and van Genuchten (1996).

The Mualem-van Genuchten conductivity model was used with an exponent of the pore interaction term of 2, as recommended in the UNSAT-H User's Manual. The hydraulic properties of the proposed ET cover system materials are summarized below. Laboratory data is included in Appendix A.

Layers 1 and 2 – Stockpiled SM Material at 75% MP Compaction Density

- THET - Saturated water content: 0.372
- THTR – Residual water content: 0.1025
- VGA – Van Genuchten α coefficient: 0.020
- VGN - Van Genuchten n coefficient: 1.560
- SK – Saturated hydraulic conductivity: 0.504 cm/hr (1.4 x 10^{-4} cm/sec)

Layer 3 – Capillary Break Layer of Well-Graded Clean Sand

- THET - Saturated water content: 0.43
- THTR – Residual water content: 0.045
- VGA – Van Genuchten α coefficient: 0.145

- VGN - Van Genuchten n coefficient: 2.68
- SK – Saturated hydraulic conductivity: 29.7 cm/hr (8.25 x 10^{-3} cm/sec)

Layer 4 – Stockpiled SM Material and Regraded Intermediate Cover Material at 75% MP Compaction Density

- THET - Saturated water content: 0.372
- THTR – Residual water content: 0.1025
- VGA – Van Genuchten α coefficient: 0.020
- VGN - Van Genuchten n coefficient: 1.560
- SK – Saturated hydraulic conductivity: 0.504 cm/hr (1.4 x 10^{-4} cm/sec)

Initial Conditions

Initial suction head values were estimated using the soil water characteristic curves generated during hydraulic laboratory testing. The suction head values, summarized below, assume that the soil will be placed with ±2% of the optimum water content for the given compaction requirements.

- Layer 1 and 2: 1.0 x 10^4 cm
- Layer 3: 1.0 x 10^2 cm
- Layers 4: 1.0 x 10^4 cm

Plant Information

Transpiration will be a contributing component of the performance of the proposed ET cover system. For the purposes of this preliminary ET model, a conservative 10% coverage of vegetative growth over the area was assumed. Vegetative growth of the final design of the proposed ET cover system will consist of a balanced mixture of native herbaceous and vascular plants. Dr. Rafael Corral of the Fort Bliss Environmental Division and Leah Markiewitz with Zia provided an optimum vegetative design to utilize indigenous species of the area such as mesa dropseed and red threeawn.

The plant information for mesa dropseed and red threeawn required for UNSAT-H simulations was not readily available through our research efforts. Due to the difficulty in finding root data, the rooting depth of the indigenous species in our vegetative design was estimated using seasonal cheatgrass data published by Harris (1967). Cheatgrass contains very shallow, fibrous roots which makes it an ideal plant choice for plant growth with a shallow soil depth requirement. The indigenous species mentioned above were chosen due to their similar fibrous roots and fairly shallow growth patterns described through the studies of Robert P. Gibbens and James M. Lenz (2001) at the Jornada Experimental Range in Las Cruces, New Mexico (**Figure 1**). Additionally, these plants extend out horizontally which will allow for additional erosion control (Gibbens & Lenz, 2001) (**Figure 2**). Due to the rooting similarities, our vegetative experts felt using cheatgrass plant information for the purposes of modeling transpiration was a reasonable choice considering the limited plant information available.

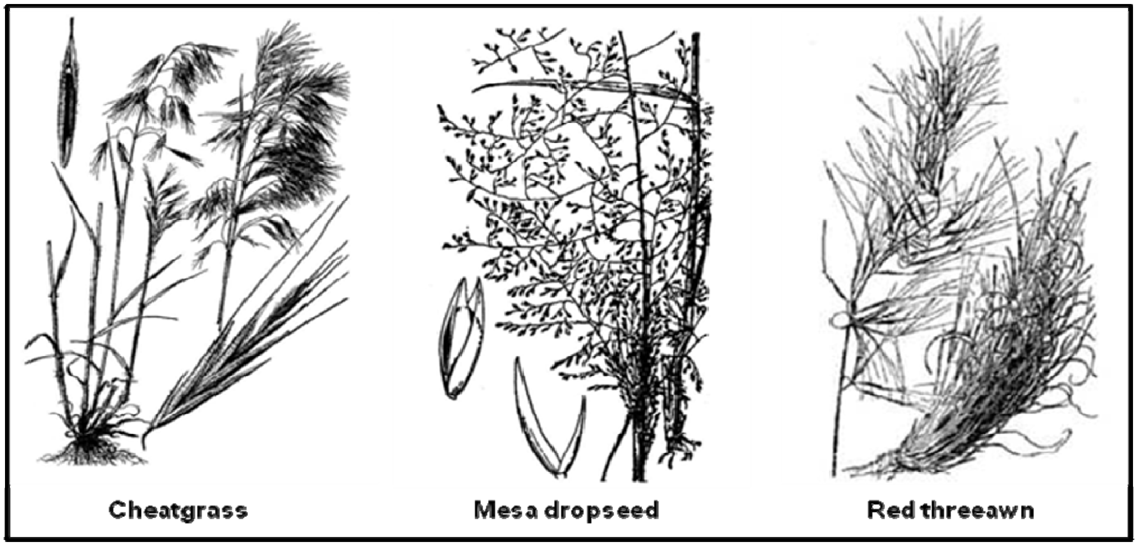


Figure 1: Rooting Depth Comparison

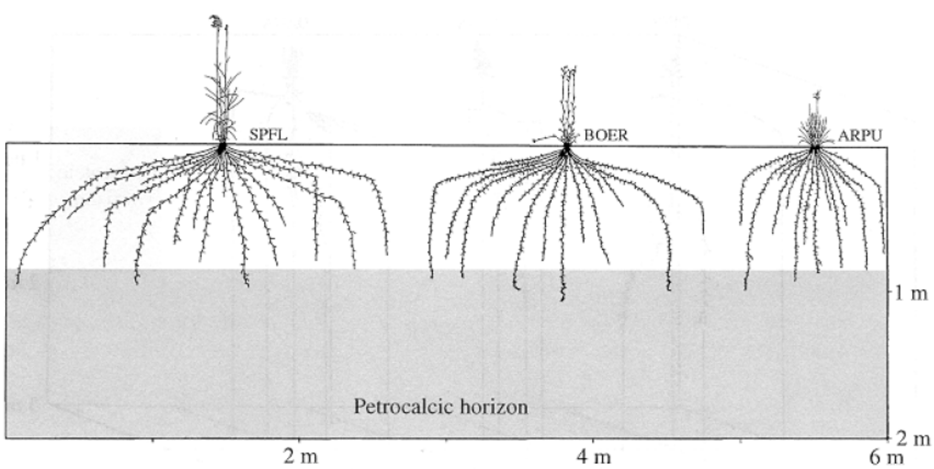


Figure 1. Mesa dropseed and red threeawn rooting system

Potential transpiration and evaporation were generated from empirical cheatgrass data published by Hinds (1975). The HELP model was consulted to define the growing season of the El Paso region, between March and August. The HELP model was also consulted to define the plant water uptake parameters. The influence of landfill gas on vegetative growth was modeled by limiting maximum root growth to within the top 12-inches of the Vegetative Support Layer only.

Boundary Conditions

The boundary conditions required for the model include general site-specific data and daily meteorological data. Daily meteorological input data includes maximum and minimum temperature, dew point, solar radiation, average wind speed, cloud cover, and daily precipitation. Data was obtained for the El Paso International Airport weather station from the National Oceanic and Atmospheric Administration (NOAA). The El Paso International Airport weather station is located approximately 4.4 nautical miles south of the landfill.

DEMONSTRATION OF PERFORMANCE

The TCEQ set two performance criteria for the demonstration of performance of an ET cover system, as summarized below:

- Less than 4 millimeters per year of drainage from the base of the ET cover system
- Modeled runoff less than 10% of the annual water applied.

Table 1 summarizes annual results of the 30-year simulation of the proposed ET cover system. It should be noted that the model is conservative in that transpiration was modeled based on 10% coverage of vegetative growth and incorporates influences of landfill gas. The data presented in **Table 1** demonstrates that the proposed ET cover system meets the TCEQ drainage performance criteria over the 30-year modeling period. Furthermore, the model's performance over years 24 through 28, which on average received 40% more precipitation than the annual average, demonstrate the ability of the proposed cover system to perform under variable weather conditions. The runoff ratio exceeds the TCEQ Performance Criteria of 10% by 1% during the floods of 2006, but it should be noted that 2006 was the wettest year on record in the El Paso region.

Figure 3 shows the annual storage requirement of the proposed ET cover system compared to the available storage capacity of the cover system design. It can be seen that the annual storage requirement never exceeds 53% of the overall storage capacity.

The sensitivity of the model was evaluated by varying input parameters, including time-stop factors; initial suction head conditions, and solution types. Layer thicknesses were also varied in order to develop the proposed cover system design. Once the optimum layer thickness and compaction requirements were determined, additional simulations were run at varying compactions to identify a range of acceptance during construction (Additional simulations are a). Parameter values of native soil were interpolated using known data for 75% and 80% compaction and simulations were run at 73% and 77% compaction (Interpolation results are attached). Results for 73% compaction consistently meet drainage Performance Criteria and meet the runoff Performance Criteria in 26 of the 30 years. Results for 77% compaction meet drainage Performance Criteria in 28 of the 30 years and meet the runoff Performance Criteria in 29 of the 30 years. These results provide significant confidence in the performance of the cap over a ±2% compaction range. QA/QC procedures requiring the evaluation of material prior to use and compaction testing after placement on the cap will ensure native soil used in the construction of the ET Cap meets the requirements set forth in this document. The performance of the cover system design presented in this Preliminary Design Report was determined to be stable with respect to variable non-boundary condition and/or initial condition input parameters. The design-specific input parameters were conservatively developed to accurately portray the anticipated conditions during the construction and performance of the cover system.

ATTACHMENTS

Table 1 – Proposed ET Cover System Performance Demonstration Summary

Figure 2 – Schematic of Proposed ET Cover System
Figure 3 - Storage Requirement / Capacity Comparison

Appendix A - UNSAT-H Input File
Appendix B - UNSAT-H Output Data
Appendix C - Hydraulic Parameter Lab Testing Data
Appendix D - Meteorological Data
Appendix E –Additional UNSAT-H Simulations

Table 1 - Proposed ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	13.62					
1	32.08	239.94	0.13	27.34	2.16	0.80	0.02	38.39	15.36	40%	0.00	19846.00	0.05	0.05
2	27.86	236.06	0.12	21.79	1.53	1.69	0.06	38.39	18.19	47%	0.00	18506.00	0.03	0.03
3	20.30	230.27	0.09	21.55	1.98	0.00	0.00	38.39	14.93	39%	0.00	18549.00	0.02	0.02
4	41.07	218.38	0.19	34.92	1.73	1.56	0.04	38.39	17.75	46%	0.00	18898.00	0.03	0.03
5	20.73	189.15	0.11	21.45	1.59	0.00	0.00	38.39	15.43	40%	0.00	18520.00	0.01	0.01
6	30.91	196.27	0.16	27.33	1.52	0.29	0.01	38.39	17.19	45%	0.00	19594.00	0.02	0.02
7	27.79	207.25	0.13	23.57	2.07	0.35	0.01	38.39	18.96	49%	0.00	19035.00	0.03	0.03
8	28.09	211.76	0.13	29.72	1.74	0.00	0.00	38.39	15.57	41%	0.00	19033.00	0.02	0.02
9	18.44	224.97	0.08	17.47	1.86	0.07	0.00	38.39	14.59	38%	0.00	18256.00	0.03	0.03
10	32.64	226.79	0.14	29.02	1.30	0.14	0.00	38.39	16.74	44%	0.00	18876.00	0.03	0.03
11	31.45	224.82	0.14	26.77	1.75	0.54	0.02	38.39	19.10	50%	0.00	19668.00	0.03	0.03
12	28.96	225.83	0.13	28.60	2.07	0.84	0.03	38.39	16.54	43%	0.00	19736.00	0.00	0.00
13	24.46	239.48	0.10	23.36	1.94	0.00	0.00	38.39	15.68	41%	0.00	18990.00	0.02	0.02
14	13.92	251.76	0.06	12.19	2.13	0.00	0.00	38.39	15.24	40%	0.00	17218.00	0.04	0.04
15	15.39	248.49	0.06	14.60	1.22	0.01	0.00	38.39	14.78	38%	0.00	17676.00	0.02	0.02
16	21.31	260.54	0.08	19.60	1.51	0.06	0.00	38.39	14.90	39%	0.00	17986.00	0.02	0.02
17	24.46	226.38	0.11	21.28	2.22	0.00	0.00	38.39	15.82	41%	0.00	19257.00	0.05	0.05
18	17.20	236.93	0.07	16.02	1.60	0.01	0.00	38.39	15.35	40%	0.00	17984.00	0.03	0.03
19	20.73	238.02	0.09	18.66	1.45	0.00	0.00	38.39	15.94	42%	0.00	17395.00	0.03	0.03
20	18.82	240.07	0.08	17.55	1.84	0.15	0.01	38.39	15.20	40%	0.00	17900.00	0.03	0.03
21	10.90	240.84	0.05	10.79	1.43	0.00	0.00	38.39	13.85	36%	0.00	17090.00	0.03	0.03
22	17.50	241.24	0.07	15.00	1.38	0.00	0.00	38.39	14.93	39%	0.00	17989.00	0.04	0.04
23	10.69	251.67	0.04	10.47	1.65	0.00	0.00	38.39	13.48	35%	0.00	16736.00	0.02	0.02
24	30.99	236.19	0.13	24.93	2.17	0.16	0.01	38.39	17.15	45%	0.00	17776.00	0.07	0.07
25	32.69	238.22	0.14	29.67	2.27	1.83	0.06	38.39	16.05	42%	0.00	18639.00	0.03	0.03
26	44.48	260.38	0.17	35.82	1.92	5.08	0.11[3]	38.39	17.62	46%	0.05	18698.00	0.03	0.09
27	25.71	241.12	0.11	23.59	2.33	0.08	0.00	38.39	17.12	45%	0.16	18651.00	0.04	0.20
28	25.02	255.25	0.10	23.36	1.32	0.53	0.02	38.39	16.81	44%	0.11	18361.00	0.01	0.12
29	22.05	244.94	0.09	18.77	1.76	0.14	0.01	38.39	18.09	47%	0.08	17683.00	0.03	0.11
30	16.94	240.72	0.07	17.16	1.94	0.00	0.00	38.39	15.86	41%	0.06	18245.00	0.02	0.08
SUM=	733.55	7023.70		662.31	53.35	14.33					0.45		0.88	

Notes:
1. TCEQ Performance Criteria   Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria   Runoff less than or equal to 10% total water applied
3. This value excceeds the TCEQ Performance Criteria of 10%, but it should be noted that 2006 was the wettest year on record in the El Paso region.

Figure 2 - Optimized Evapotranspiration Cover System Cross-section

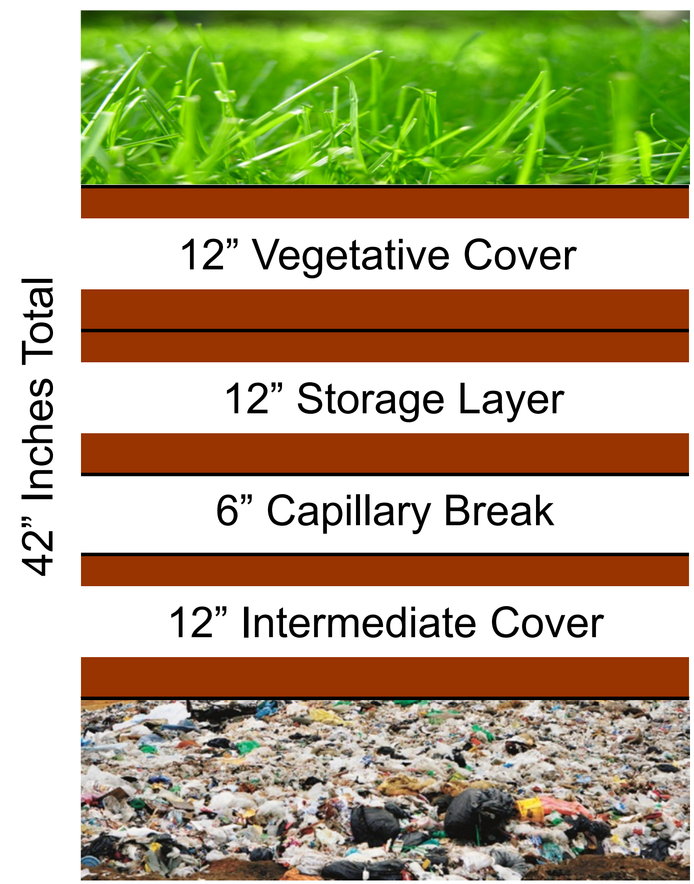
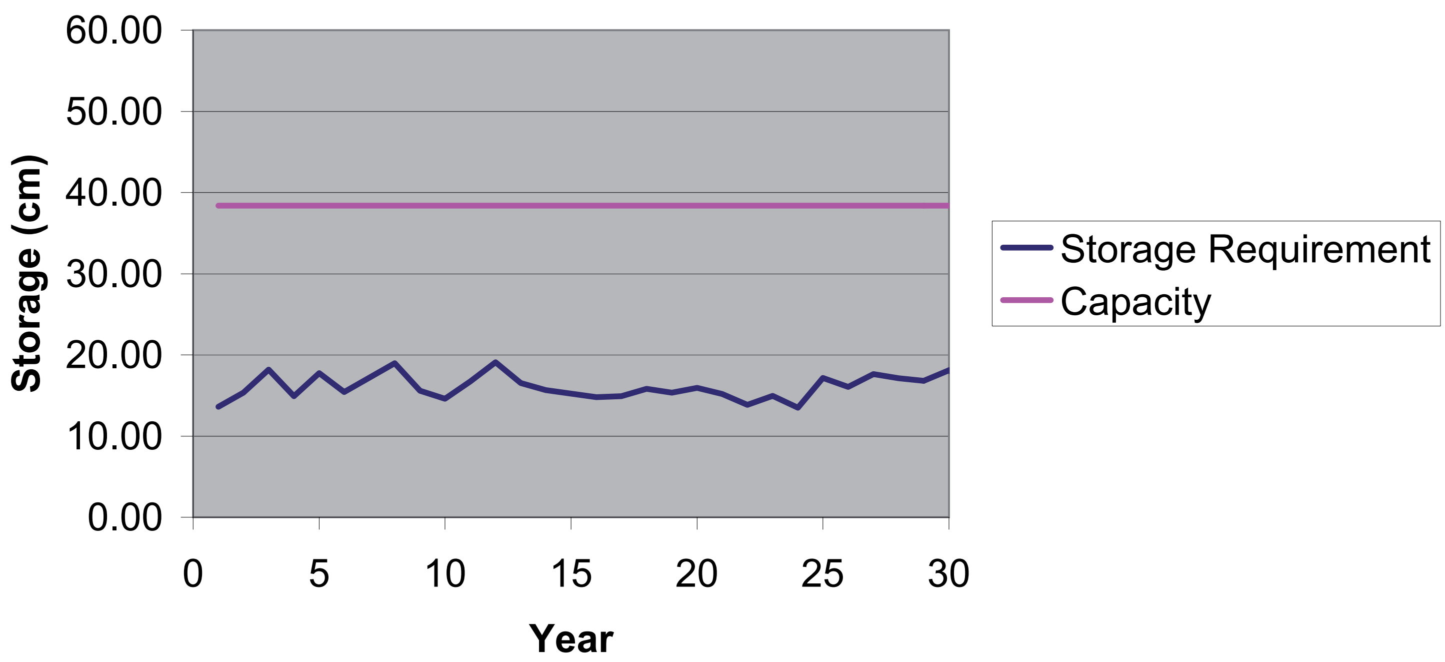


Figure 3
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison



APPENDIX A

UNSAT-H INPUT FILE

```
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1981,30,0,2,30,                   IYS,NYEARS,ISTEAD,IFLIST,NFLIST
0,0,                              NPRINT,STOPHR
0,3,1,1.00E-4,                    ISMETH,INMAX,ISWDIF,DMAXBA
1.0,1.0E-8,0.0,                   DELMAX,DELMIN,OUTTIM
1.5,1.00E-05,0,0,0,               RFACT,RAINIF,DHTOL,DHMAX,DHFACT
4,1,0.5,                          KOPT,KEST,WTF
0,1,2,1,                          ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,            HIRRI,HDRY,HTOP,RHA
1,1,1,                            IETOPT,ICLOUD,ISHOPT
1,1.0,                            IRAIN,HPR
0,0,0,0,0,                        IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                            IHEAT,CONVH,DMAXHE
0,0,0,0,                          UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                            LOWERH,QHLEAK,TGRAD
1,0.66,291.0,0.239,               IVAPOR,TORT,TSOIL,VAPDIF
4,24,                             MATN,NPT
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1,4.00,1,5.08,1,10.16,1,20.32,
1,30.48,3,35.56,3,40.64,3,45.72,
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4,71.12,4,76.20,3,81.28,3,83.36,
3,91.44,3,96.52,3,101.6,3,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                     THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,                RKMOD, SK, VGA, VGN, EPIT
Layer 2 80 compaction of silty sand SM water retention parameters
0.329,0.163,0.010,2.180,                      THET, THTR, vGA, vGN
Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.036,0.010,2.180,0.500,                RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                     THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,                RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
0.430,0.045,0.145,2.68,                       THET, THTR, vGA, vGN
Layer 4 clean sand hydraulic conductivity parameters
2.000,29.7,0.145,2.68,0.500,                  RKMOD, SK, VGA, VGN, EPIT
0,    NDAY
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15000.0,3000.0,300.0,   HW, HD, HN
15000.0,3000.0,300.0,   HW, HD, HN
15000.0,3000.0,300.0,   HW, HD, HN
220.0,                            BIOMAS
2.0E-01,1206.4,10.0,1000.0,       ALBEDO,ALT,ZU,PMB
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APPENDIX E

ADDITIONAL UNSAT-H SIMULATIONS

UNSAT-H Variable	Compaction % Modified Proctor			
	73%	75%	77%	80%
THET	0.381	0.372	0.3548	0.329
THTR	0.783	0.1025	0.1267	0.163
VGA	0.024	0.02	0.016	0.01
VGN	1.312	1.56	1.808	2.18
RKMOD	2	2	2	2
SK	0.67	0.504	0.338	0.036
VGA	0.24	0.02	0.016	0.01
VGN	1.312	1.56	1.808	2.18
EPIT	0.5	0.5	0.5	0.5

```
FTBLISS
1,1,                          IPLANT,NGRAV
365,1,365,                    IFDEND,IDTBEG,IDTEND
1981,30,0,2,30,               IYS,NYEARS,ISTEAD,IFLIST,NFLIST
0,0,                          NPRINT,STOPHR
0,3,1,1.00E-4,                ISMETH,INMAX,ISWDIF,DMAXBA
1.0,1.0E-8,0.0,               DELMAX,DELMIN,OUTTIM
1.5,1.00E-05,0,0,0,           RFACT,RAINIF,DHTOL,DHMAX,DHFACT
4,1,0.5,                      KOPT,KEST,WTF
0,1,2,1,                      ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,        HIRRI,HDRY,HTOP,RHA
1,1,1,                        IETOPT,ICLOUD,ISHOPT
1,1.0,                        IRAIN,HPR
0,0,0,0,0,                    IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                        IHEAT,CONVH,DMAXHE
0,0,0,0,                      UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                        LOWERH,QHLEAK,TGRAD
1,0.66,291.0,0.239,           IVAPOR,TORT,TSOIL,VAPDIF
4,24,                         MATN,NPT
2,0.00,2,1.00,2,2.00,2,3.00,  MAT,Z
2,4.00,2,5.08,2,10.16,2,20.32,
2,30.48,2,35.56,2,40.64,2,45.72,
2,50.80,2,55.88,2,60.96,4,66.04,
4,71.12,4,76.20,2,81.28,2,83.36,
2,91.44,2,96.52,2,101.6,2,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 2 73 compaction of silty sand SM water retention parameters
0.381,0.0783,0.024,1.312,                 THET, THTR, vGA, vGN
Layer 2 73 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.670,0.024,1.312,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
0.430,0.045,0.145,2.68,                   THET, THTR, vGA, vGN
Layer 4 clean sand hydraulic conductivity parameters
2.000,29.7,0.145,2.68,0.500,              RKMOD, SK, VGA, VGN, EPIT
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0,1,1,2,66,243,         LEAF,NFROOT,NUPTAK,NFPET,NSOW,NHRVST
0.90,                   BARE
1.2,0.13,0.02,          A,B1,B2
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15000.0,3000.0,300.0,   HW, HD, HN
220.0,                        BIOMAS
2.0E-01,1206.4,10.0,1000.0,   ALBEDO,ALT,ZU,PMB
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Created using BSUM Version 3.01; all units are cm
First file in series is 73%COM1981.res

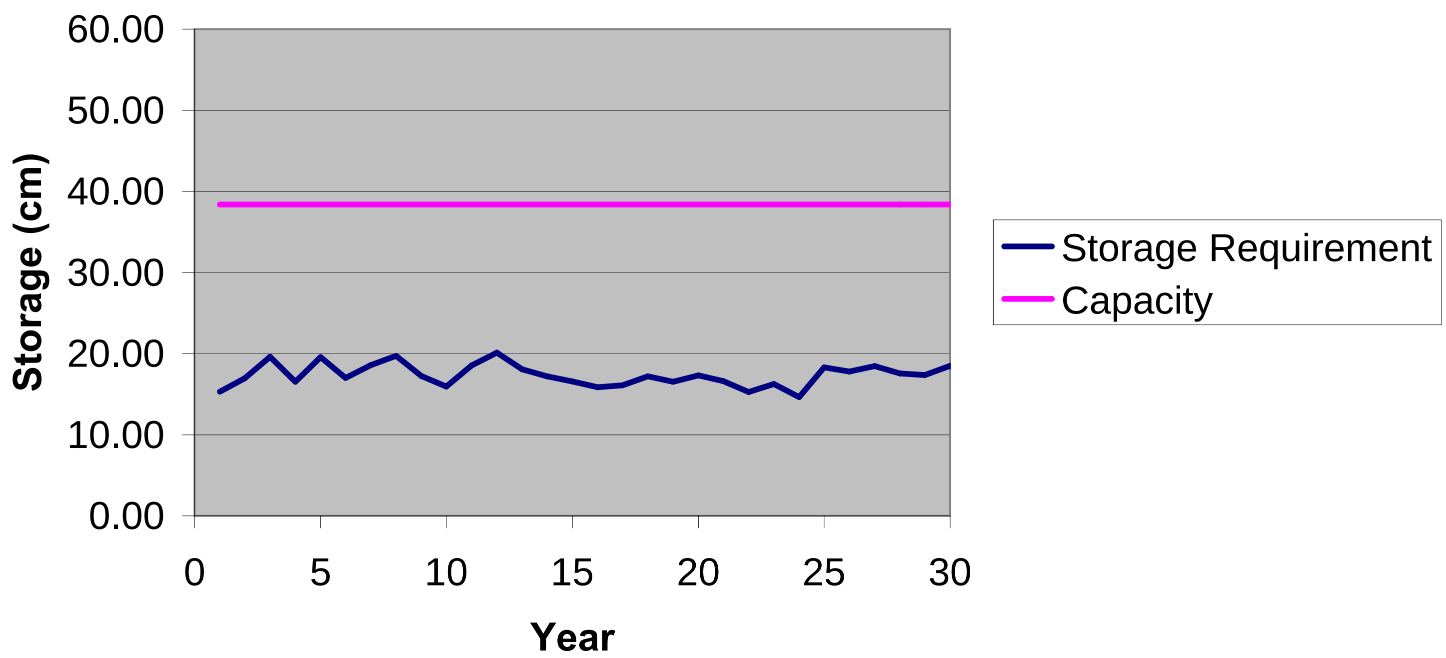
Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							15.305		
1	32.080	239.938	1.920	26.246	2.216	0.000	16.951	20337	0.05147
2	27.864	236.062	1.340	20.268	3.574	0.000	19.596	18874	0.03648
3	20.295	230.265	1.910	21.280	0.141	0.000	16.533	18907	0.02677
4	41.072	218.383	1.616	31.993	4.377	0.000	19.568	19533	0.05009
5	20.726	189.147	1.502	21.357	0.418	0.000	17.001	18807	0.01610
6	30.912	196.269	1.573	25.882	1.826	0.000	18.596	20040	0.03565
7	27.788	207.251	1.946	22.991	1.679	0.000	19.726	19313	0.04172
8	28.092	211.756	1.638	28.193	0.710	0.000	17.242	19515	0.03573
9	18.440	224.974	1.726	17.454	0.537	0.000	15.933	18566	0.03164
10	32.639	226.790	1.085	26.531	2.386	0.000	18.528	19222	0.04270
11	31.445	224.820	1.639	26.542	1.651	0.000	20.099	20022	0.04113
12	28.956	225.833	2.171	26.246	2.550	0.000	18.070	20176	0.01723
13	24.460	239.475	1.802	23.068	0.418	0.000	17.212	19374	0.02999
14	13.919	251.763	2.000	12.395	0.120	0.000	16.575	17397	0.04012
15	15.392	248.486	1.107	14.329	0.629	0.000	15.877	17862	0.02467
16	21.311	260.543	1.412	18.930	0.708	0.000	16.110	18240	0.02758
17	24.460	226.377	1.921	21.254	0.147	0.000	17.192	19764	0.05538
18	17.196	236.926	1.346	16.006	0.462	0.000	16.538	18182	0.03431
19	20.726	238.020	1.316	18.106	0.491	0.000	17.320	17673	0.03125
20	18.821	240.065	1.760	16.974	0.763	0.000	16.607	18165	0.03862
21	10.897	240.838	1.134	11.080	0.000	0.000	15.266	17221	0.02225
22	17.501	241.242	1.229	15.237	0.009	0.000	16.251	18223	0.04013
23	10.693	251.668	1.391	10.758	0.124	0.000	14.647	16860	0.02348
24	30.988	236.192	2.058	23.467	1.732	0.000	18.309	18343	0.06885
25	32.690	238.215	2.062	27.148	3.949	0.000	17.803	19088	0.03709
26	44.475	260.375	1.768	32.520	9.475	0.000	18.471	19068	0.04346
27	25.705	241.122	2.197	23.620	0.749	0.000	17.563	18949	0.04743
28	25.019	255.251	1.255	21.966	1.970	0.001	17.360	18569	0.03040
29	22.047	244.936	1.619	17.870	1.367	0.001	18.510	17933	0.03993
30	16.942	240.720	1.709	16.697	0.524	0.001	16.499	18416	0.02314
SUM=	733.552	7023.701	49.152	636.411	45.704	0.007			1.08480

Table 1b - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	15.31					
1	32.08	239.94	0.13	26.25	1.92	2.22	0.07	38.39	16.95	44%	0.00	20337.00	0.05	0.05
2	27.86	236.06	0.12	20.27	1.34	3.57	0.13	38.39	19.60	51%	0.00	18874.00	0.04	0.04
3	20.30	230.27	0.09	21.28	1.91	0.14	0.01	38.39	16.53	43%	0.00	18907.00	0.03	0.03
4	41.07	218.38	0.19	31.99	1.62	4.38	0.11	38.39	19.57	51%	0.00	19533.00	0.05	0.05
5	20.73	189.15	0.11	21.36	1.50	0.42	0.02	38.39	17.00	44%	0.00	18807.00	0.02	0.02
6	30.91	196.27	0.16	25.88	1.57	1.83	0.06	38.39	18.60	48%	0.00	20040.00	0.04	0.04
7	27.79	207.25	0.13	22.99	1.95	1.68	0.06	38.39	19.73	51%	0.00	19313.00	0.04	0.04
8	28.09	211.76	0.13	28.19	1.64	0.71	0.03	38.39	17.24	45%	0.00	19515.00	0.04	0.04
9	18.44	224.97	0.08	17.45	1.73	0.54	0.03	38.39	15.93	42%	0.00	18566.00	0.03	0.03
10	32.64	226.79	0.14	26.53	1.09	2.39	0.07	38.39	18.53	48%	0.00	19222.00	0.04	0.04
11	31.45	224.82	0.14	26.54	1.64	1.65	0.05	38.39	20.10	52%	0.00	20022.00	0.04	0.04
12	28.96	225.83	0.13	26.25	2.17	2.55	0.09	38.39	18.07	47%	0.00	20176.00	0.02	0.02
13	24.46	239.48	0.10	23.07	1.80	0.42	0.02	38.39	17.21	45%	0.00	19374.00	0.03	0.03
14	13.92	251.76	0.06	12.40	2.00	0.12	0.01	38.39	16.58	43%	0.00	17397.00	0.04	0.04
15	15.39	248.49	0.06	14.33	1.11	0.63	0.04	38.39	15.88	41%	0.00	17862.00	0.02	0.02
16	21.31	260.54	0.08	18.93	1.41	0.71	0.03	38.39	16.11	42%	0.00	18240.00	0.03	0.03
17	24.46	226.38	0.11	21.25	1.92	0.15	0.01	38.39	17.19	45%	0.00	19764.00	0.06	0.06
18	17.20	236.93	0.07	16.01	1.35	0.46	0.03	38.39	16.54	43%	0.00	18182.00	0.03	0.03
19	20.73	238.02	0.09	18.11	1.32	0.49	0.02	38.39	17.32	45%	0.00	17673.00	0.03	0.03
20	18.82	240.07	0.08	16.97	1.76	0.76	0.04	38.39	16.61	43%	0.00	18165.00	0.04	0.04
21	10.90	240.84	0.05	11.08	1.13	0.00	0.00	38.39	15.27	40%	0.00	17221.00	0.02	0.02
22	17.50	241.24	0.07	15.24	1.23	0.01	0.00	38.39	16.25	42%	0.00	18223.00	0.04	0.04
23	10.69	251.67	0.04	10.76	1.39	0.12	0.01	38.39	14.65	38%	0.00	16860.00	0.02	0.02
24	30.99	236.19	0.13	23.47	2.06	1.73	0.06	38.39	18.31	48%	0.00	18343.00	0.07	0.07
25	32.69	238.22	0.14	27.15	2.06	3.95	0.12	38.39	17.80	46%	0.00	19088.00	0.04	0.04
26	44.48	260.38	0.17	32.52	1.77	9.48	0.21	38.39	18.47	48%	0.00	19068.00	0.04	0.04
27	25.71	241.12	0.11	23.62	2.20	0.75	0.03	38.39	17.56	46%	0.00	18949.00	0.05	0.05
28	25.02	255.25	0.10	21.97	1.26	1.97	0.08	38.39	17.36	45%	0.00	18569.00	0.03	0.03
29	22.05	244.94	0.09	17.87	1.62	1.37	0.06	38.39	18.51	48%	0.00	17933.00	0.04	0.04
30	16.94	240.72	0.07	16.70	1.71	0.52	0.03	38.39	16.50	43%	0.00	18416.00	0.02	0.02
SUM=	733.55	7023.70		636.41	49.15	45.70					0.00		1.08	1.09

Notes:
1. TCEQ Performance Criteria   Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria   Runoff less than or equal to 10% total water applied

Figure 3b
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison



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Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
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Layer 2 77 compaction of silty sand SM water retention parameters
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Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.338,0.016,1.808,0.500,          RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
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Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
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Created using BSUM Version 3.01; all units are cm
First file in series is 77%COM1981.res

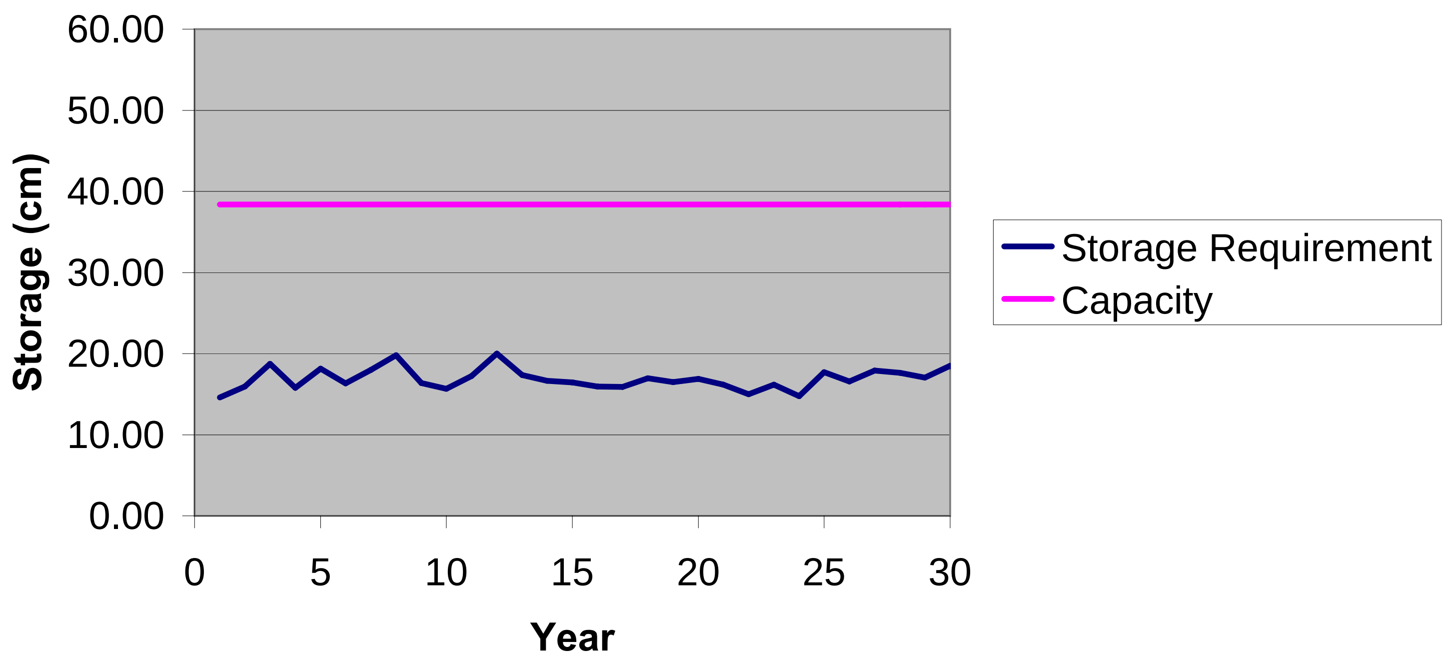
Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							14.614		
1	32.080	239.938	2.208	27.633	0.894	0.000	15.918	19479	0.04075
2	27.864	236.062	1.591	21.501	1.945	0.000	18.721	18349	0.02317
3	20.295	230.265	1.938	21.264	0.000	0.000	15.797	18234	0.01622
4	41.072	218.383	1.681	35.388	1.624	0.000	18.153	18728	0.02240
5	20.726	189.147	1.515	21.016	0.000	0.000	16.340	18296	0.00859
6	30.912	196.269	1.450	27.441	0.375	0.000	17.972	19275	0.01261
7	27.788	207.251	1.914	23.613	0.413	0.000	19.796	18744	0.02410
8	28.092	211.756	1.649	29.854	0.008	0.000	16.358	18783	0.01849
9	18.440	224.974	1.907	17.112	0.109	0.000	15.647	17946	0.02236
10	32.639	226.790	1.383	29.429	0.195	0.000	17.258	18623	0.02000
11	31.445	224.820	1.682	26.393	0.584	0.001	20.013	19344	0.03064
12	28.956	225.833	1.835	28.795	0.982	0.001	17.356	19454	-0.00038
13	24.460	239.475	1.923	23.231	0.001	0.001	16.642	18725	0.01777
14	13.919	251.763	2.177	11.926	0.000	0.001	16.435	17072	0.02199
15	15.392	248.486	1.341	14.505	0.015	0.001	15.946	17484	0.01831
16	21.311	260.543	1.500	19.737	0.104	0.001	15.900	17774	0.01387
17	24.460	226.377	2.283	21.083	0.000	0.001	16.951	19015	0.04199
18	17.196	236.926	1.729	15.879	0.036	0.001	16.481	17755	0.02062
19	20.726	238.020	1.477	18.826	0.000	0.001	16.884	17195	0.01992
20	18.821	240.065	1.760	17.565	0.184	0.001	16.168	17654	0.02726
21	10.897	240.838	1.618	10.444	0.000	0.001	14.987	16966	0.01507
22	17.501	241.242	1.518	14.750	0.000	0.001	16.188	17755	0.03122
23	10.693	251.668	1.828	10.296	0.000	0.001	14.742	16608	0.01485
24	30.988	236.192	2.164	25.548	0.249	0.001	17.716	17532	0.05233
25	32.690	238.215	2.217	29.516	2.090	0.001	16.563	18394	0.02015
26	44.475	260.375	1.922	35.376	5.303	0.507	17.909	18598	0.01971
27	25.705	241.122	2.268	23.108	0.122	0.432	17.652	18427	0.03028
28	25.019	255.251	1.294	23.546	0.634	0.156	17.029	18120	0.01151
29	22.047	244.936	1.701	18.552	0.222	0.091	18.487	17479	0.02295
30	16.942	240.720	1.894	17.043	0.000	0.063	16.420	18118	0.00901
SUM=	733.552	7023.701	53.369	660.371	16.091	1.268			0.64773

Table 1c - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	14.61					
1	32.08	239.94	0.13	27.63	2.21	0.89	0.03	38.39	15.92	41%	0.00	19479.00	0.04	0.04
2	27.86	236.06	0.12	21.50	1.59	1.95	0.07	38.39	18.72	49%	0.00	18349.00	0.02	0.02
3	20.30	230.27	0.09	21.26	1.94	0.00	0.00	38.39	15.80	41%	0.00	18234.00	0.02	0.02
4	41.07	218.38	0.19	35.39	1.68	1.62	0.04	38.39	18.15	47%	0.00	18728.00	0.02	0.02
5	20.73	189.15	0.11	21.02	1.52	0.00	0.00	38.39	16.34	43%	0.00	18296.00	0.01	0.01
6	30.91	196.27	0.16	27.44	1.45	0.38	0.01	38.39	17.97	47%	0.00	19275.00	0.01	0.01
7	27.79	207.25	0.13	23.61	1.91	0.41	0.01	38.39	19.80	52%	0.00	18744.00	0.02	0.02
8	28.09	211.76	0.13	29.85	1.65	0.01	0.00	38.39	16.36	43%	0.00	18783.00	0.02	0.02
9	18.44	224.97	0.08	17.11	1.91	0.11	0.01	38.39	15.65	41%	0.00	17946.00	0.02	0.02
10	32.64	226.79	0.14	29.43	1.38	0.20	0.01	38.39	17.26	45%	0.00	18623.00	0.02	0.02
11	31.45	224.82	0.14	26.39	1.68	0.58	0.02	38.39	20.01	52%	0.00	19344.00	0.03	0.03
12	28.96	225.83	0.13	28.80	1.84	0.98	0.03	38.39	17.36	45%	0.00	19454.00	0.00	0.00
13	24.46	239.48	0.10	23.23	1.92	0.00	0.00	38.39	16.64	43%	0.00	18725.00	0.02	0.02
14	13.92	251.76	0.06	11.93	2.18	0.00	0.00	38.39	16.44	43%	0.00	17072.00	0.02	0.02
15	15.39	248.49	0.06	14.51	1.34	0.02	0.00	38.39	15.95	42%	0.00	17484.00	0.02	0.02
16	21.31	260.54	0.08	19.74	1.50	0.10	0.00	38.39	15.90	41%	0.00	17774.00	0.01	0.01
17	24.46	226.38	0.11	21.08	2.28	0.00	0.00	38.39	16.95	44%	0.00	19015.00	0.04	0.04
18	17.20	236.93	0.07	15.88	1.73	0.04	0.00	38.39	16.48	43%	0.00	17755.00	0.02	0.02
19	20.73	238.02	0.09	18.83	1.48	0.00	0.00	38.39	16.88	44%	0.00	17195.00	0.02	0.02
20	18.82	240.07	0.08	17.57	1.76	0.18	0.01	38.39	16.17	42%	0.00	17654.00	0.03	0.03
21	10.90	240.84	0.05	10.44	1.62	0.00	0.00	38.39	14.99	39%	0.00	16966.00	0.02	0.02
22	17.50	241.24	0.07	14.75	1.52	0.00	0.00	38.39	16.19	42%	0.00	17755.00	0.03	0.03
23	10.69	251.67	0.04	10.30	1.83	0.00	0.00	38.39	14.74	38%	0.00	16608.00	0.01	0.02
24	30.99	236.19	0.13	25.55	2.16	0.25	0.01	38.39	17.72	46%	0.00	17532.00	0.05	0.05
25	32.69	238.22	0.14	29.52	2.22	2.09	0.06	38.39	16.56	43%	0.00	18394.00	0.02	0.02
26	44.48	260.38	0.17	35.38	1.92	5.30	0.12	38.39	17.91	47%	0.51	18598.00	0.02	0.53
27	25.71	241.12	0.11	23.11	2.27	0.12	0.00	38.39	17.65	46%	0.43	18427.00	0.03	0.46
28	25.02	255.25	0.10	23.55	1.29	0.63	0.03	38.39	17.03	44%	0.16	18120.00	0.01	0.17
29	22.05	244.94	0.09	18.55	1.70	0.22	0.01	38.39	18.49	48%	0.09	17479.00	0.02	0.11
30	16.94	240.72	0.07	17.04	1.89	0.00	0.00	38.39	16.42	43%	0.06	18118.00	0.01	0.07
SUM=	733.55	7023.70		660.37	53.37	16.09					1.26		0.65	1.91

Notes:
1. TCEQ Performance Criteria   Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria   Runoff less than or equal to 10% total water applied

Figure 3c
Fort Bliss Proposed ET Cover System
Storage Requirement / Capacity Comparison



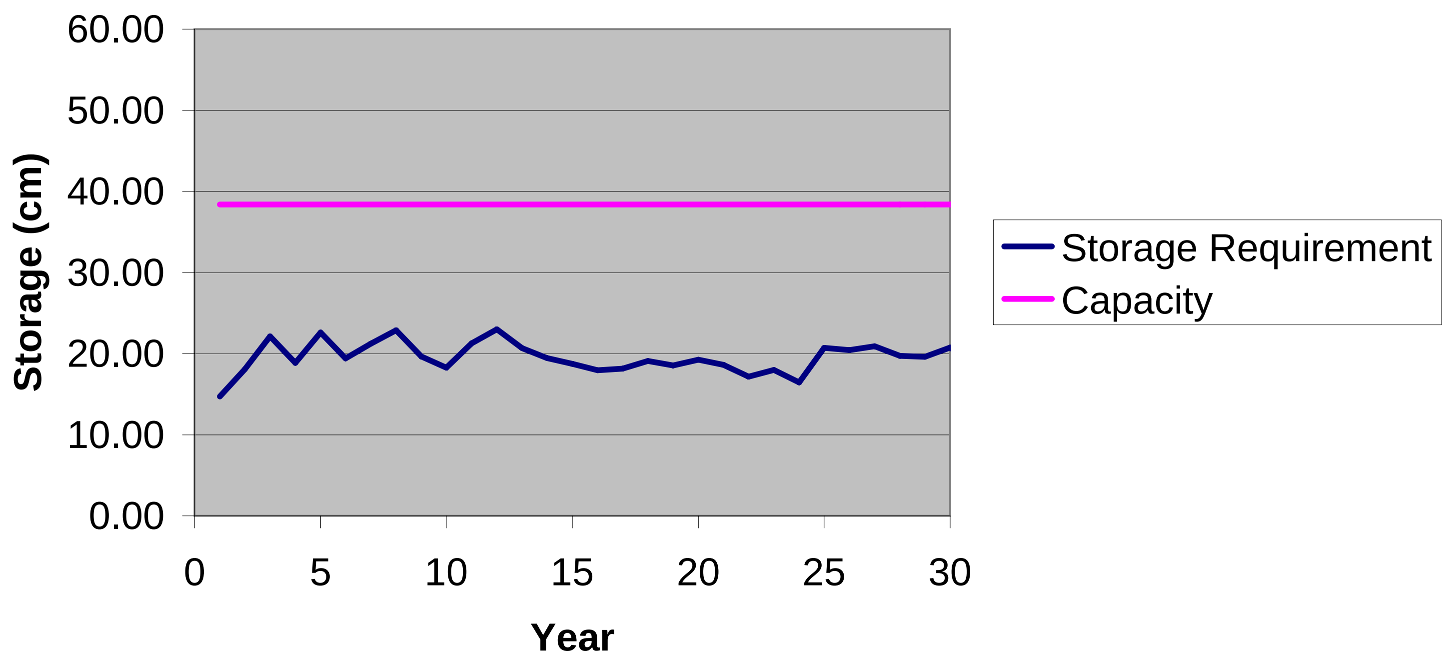
No Capillary Break Layer

Table 1b - TCEQ Requested ET Cover System Performance Demonstration Summary

Year	Precipitation (cm)	PET (cm)	P/PET	Evaporation (cm)	Transpiration (cm)	Runoff (cm)	R/P[2]	Capacity (cm)	Storage (cm)	%	Drainage (cm)	TimeStp	MasBalErr (cm)	Drainage + Error (cm) [1]
0	Initial storage =							38.39	14.71					
1	32.08	239.94	0.13	27.34	2.16	0.78	0.02	38.39	18.06	47%	0.01	19846.00	0.05	0.07
2	27.86	236.06	0.12	21.79	1.53	1.68	0.06	38.39	22.15	58%	0.34	18506.00	0.04	0.37
3	20.30	230.27	0.09	21.55	1.98	0.00	0.00	38.39	18.87	49%	0.91	18549.00	0.03	0.94
4	41.07	218.38	0.19	34.92	1.73	1.51	0.04	38.39	22.61	59%	2.40	18898.00	0.04	2.44
5	20.73	189.15	0.11	21.45	1.59	0.00	0.00	38.39	19.43	51%	1.49	18520.00	0.01	1.50
6	30.91	196.27	0.16	27.33	1.52	0.28	0.01	38.39	21.23	55%	0.74	19594.00	0.02	0.76
7	27.79	207.25	0.13	23.57	2.07	0.34	0.01	38.39	22.87	60%	0.81	19035.00	0.04	0.85
8	28.09	211.76	0.13	29.72	1.74	0.00	0.00	38.39	19.65	51%	1.43	19033.00	0.03	1.46
9	18.44	224.97	0.08	17.47	1.86	0.07	0.00	38.39	18.27	48%	0.52	18256.00	0.03	0.54
10	32.64	226.79	0.14	29.02	1.30	0.13	0.00	38.39	21.26	55%	1.28	18876.00	0.04	1.32
11	31.45	224.82	0.14	26.77	1.75	0.53	0.02	38.39	23.00	60%	1.06	19668.00	0.04	1.09
12	28.96	225.83	0.13	28.60	2.07	0.78	0.03	38.39	20.69	54%	1.80	19736.00	0.01	1.81
13	24.46	239.48	0.10	23.36	1.94	0.00	0.00	38.39	19.45	51%	0.72	18990.00	0.02	0.74
14	13.92	251.76	0.06	12.19	2.13	0.00	0.00	38.39	18.73	49%	0.33	17218.00	0.03	0.36
15	15.39	248.49	0.06	14.60	1.22	0.01	0.00	38.39	17.97	47%	0.14	17676.00	0.03	0.17
16	21.31	260.54	0.08	19.60	1.51	0.06	0.00	38.39	18.15	47%	0.20	17986.00	0.01	0.21
17	24.46	226.38	0.11	21.28	2.22	0.00	0.00	38.39	19.07	50%	0.22	19257.00	0.05	0.27
18	17.20	236.93	0.07	16.02	1.60	0.01	0.00	38.39	18.56	48%	0.18	17984.00	0.03	0.21
19	20.73	238.02	0.09	18.66	1.45	0.00	0.00	38.39	19.25	50%	0.21	17395.00	0.03	0.24
20	18.82	240.07	0.08	17.55	1.84	0.14	0.01	38.39	18.62	49%	0.31	17900.00	0.04	0.35
21	10.90	240.84	0.05	10.79	1.43	0.00	0.00	38.39	17.15	45%	0.23	17090.00	0.03	0.25
22	17.50	241.24	0.07	15.00	1.38	0.00	0.00	38.39	17.99	47%	0.11	17989.00	0.04	0.14
23	10.69	251.67	0.04	10.47	1.65	0.00	0.00	38.39	16.43	43%	0.09	16736.00	0.02	0.11
24	30.99	236.19	0.13	24.93	2.17	0.15	0.00	38.39	20.70	54%	0.18	17776.00	0.07	0.24
25	32.69	238.22	0.14	29.67	2.27	1.77	0.05	38.39	20.42	53%	1.87	18639.00	0.03	1.90
26	44.48	260.38	0.17	35.82	1.92	4.92	0.11	38.39	20.91	54%	5.62	18698.00	0.03	5.65
27	25.71	241.12	0.11	23.59	2.33	0.08	0.00	38.39	19.71	51%	1.07	18651.00	0.04	1.11
28	25.02	255.25	0.10	23.36	1.32	0.52	0.02	38.39	19.62	51%	0.75	18361.00	0.02	0.77
29	22.05	244.94	0.09	18.77	1.76	0.14	0.01	38.39	20.76	54%	0.59	17683.00	0.03	0.63
30	16.94	240.72	0.07	17.16	1.94	0.00	0.00	38.39	18.55	48%	0.70	18245.00	0.02	0.72
SUM=	733.55	7023.70		662.31	53.35	13.90					26.31		0.93	27.23

Notes:
1. TCEQ Performance Criteria — Annual drainage less than or equal to 4 mm/yr
2. TCEQ Performance Criteria — Runoff less than or equal to 10% total water applied

Figure 3
TCEQ Requested ET Cover System
Storage Requirement / Capacity Comparison



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0,0,                          NPRINT,STOPHR
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4,1,0.5,                      KOPT,KEST,WTF
0,1,2,1,                      ITOPBC,IEVOPT,NFHOUR,LOWER
1.0,1.00E6,5.0,0.4025,        HIRRI,HDRY,HTOP,RHA
1,1,1,                        IETOPT,ICLOUD,ISHOPT
1,1.0,                        IRAIN,HPR
0,0,0,0,0,                    IHYS,AIRTO,HYSTOL,HYSMXH,HYFILE
0,0,0,                        IHEAT,CONVH,DMAXHE
0,0,0,0,                      UPPERH,TSMEAN,TSAMP,QHCTOP
0,0,0,                        LOWERH,QHLEAK,TGRAD
1,0.66,291.0,0.239,           IVAPOR,TORT,TSOIL,VAPDIF
4,24,                         MATN,NPT
1,0.00,1,1.00,1,2.00,1,3.00,  MAT,Z
1,4.00,1,5.08,1,10.16,1,20.32,
1,30.48,3,35.56,3,40.64,3,45.72,
3,50.80,3,55.88,3,60.96,3,66.04,
3,71.12,3,76.20,3,81.28,3,83.36,
3,91.44,3,96.52,3,101.6,3,106.68,
Layer 1 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 1 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 2 80 compaction of silty sand SM water retention parameters
0.329,0.163,0.010,2.180,                  THET, THTR, vGA, vGN
Layer 2 80 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.036,0.010,2.180,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 3 75 compaction of silty sand SM water retention parameters
0.372,0.1025,0.020,1.560,                 THET, THTR, vGA, vGN
Layer 3 75 compaction of silty sand SM hydraulic conductivity parameters
2.000,0.504,0.020,1.560,0.500,            RKMOD, SK, VGA, VGN, EPIT
Layer 4 clean sand water retention parameters
0.430,0.045,0.145,2.68,                   THET, THTR, vGA, vGN
Layer 4 clean sand hydraulic conductivity parameters
2.000,29.7,0.145,2.68,0.500,              RKMOD, SK, VGA, VGN, EPIT
0,    NDAY
1.00E4,1.00E4,1.00E4,1.00E4,
1.00E4,1.00E4,1.00E4,1.00E4,
1.00E4,1.00E4,1.00E4,1.00E2,
1.00E2,1.00E2,1.00E4,1.00E4,
1.00E4,1.00E4,1.00E4,1.00E4,
1.00E4,1.00E4,1.00E4,1.00E4,
0,1,1,2,66,243,         LEAF,NFROOT,NUPTAK,NFPET,NSOW,NHRVST
0.90,                   BARE
1.2,0.13,0.02,          A,B1,B2
1,1,2,3,4,6,11,17,23,28,
34,40,45,51,56,85,125,166,365,365,
365,365,365,365,
15000.0,3000.0,300.0,   HW, HD, HN
15000.0,3000.0,300.0,   HW, HD, HN
15000.0,3000.0,300.0,   HW, HD, HN
15000.0,3000.0,300.0,   HW, HD, HN
220.0,                        BIOMAS
2.0E-01,1206.4,10.0,1000.0,   ALBEDO,ALT,ZU,PMB
```

1981.txt
1982.txt
1983.txt
1984.txt
1985.txt
1986.txt
1987.txt
1988.txt
1989.txt
1990.txt
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2002.txt
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2004.txt
2005.txt
2006.txt
2007.txt
2008.txt
2009.txt
2010.txt

12-18-12 10%.out
Created using BSUM Version 3.01; all units are cm
First file in series is TCEQCHECK1981.res

Year	Precip	PET	Transp	Evap	Runoff	Drain	Store	TimeStp	MasBalErr
Initial storage =							14.712		
1	32.080	239.938	2.104	25.780	0.779	0.013	18.063	19871	0.05298
2	27.864	236.062	1.355	20.375	1.676	0.336	22.147	18563	0.03735
3	20.295	230.265	1.952	20.688	0.000	0.911	18.866	18589	0.02528
4	41.072	218.383	1.736	31.643	1.510	2.401	22.605	19148	0.04186
5	20.726	189.147	1.544	20.864	0.000	1.487	19.428	18616	0.00951
6	30.912	196.269	1.506	26.569	0.280	0.736	21.227	19740	0.02270
7	27.788	207.251	2.033	22.923	0.336	0.811	22.873	19033	0.03716
8	28.092	211.756	1.637	28.220	0.001	1.432	19.649	19157	0.02680
9	18.440	224.974	1.851	17.357	0.071	0.518	18.267	18284	0.02633
10	32.639	226.790	1.310	26.879	0.130	1.283	21.264	18912	0.03916
11	31.445	224.820	1.701	26.389	0.528	1.058	22.996	19681	0.03651
12	28.956	225.833	2.080	26.594	0.782	1.799	20.687	19937	0.00879
13	24.460	239.475	1.873	23.092	0.000	0.715	19.446	19010	0.02258
14	13.919	251.763	2.137	12.137	0.000	0.332	18.727	17240	0.03211
15	15.392	248.486	1.263	14.714	0.007	0.141	17.967	17663	0.02593
16	21.311	260.543	1.479	19.374	0.061	0.196	18.153	18027	0.01436
17	24.460	226.377	2.187	21.080	0.000	0.224	19.073	19261	0.04944
18	17.196	236.926	1.547	15.941	0.014	0.180	18.558	17991	0.02842
19	20.726	238.020	1.397	18.395	0.000	0.209	19.252	17380	0.03140
20	18.821	240.065	1.776	17.187	0.144	0.312	18.620	17903	0.03505
21	10.897	240.838	1.400	10.713	0.000	0.226	17.152	17107	0.02518
22	17.501	241.242	1.417	15.098	0.000	0.105	17.994	17999	0.03802
23	10.693	251.668	1.658	10.489	0.000	0.089	16.431	16744	0.02056
24	30.988	236.192	2.181	24.146	0.149	0.178	20.699	17855	0.06659
25	32.690	238.215	2.173	27.125	1.774	1.867	20.415	18776	0.03444
26	44.475	260.375	1.919	31.494	4.917	5.623	20.905	18817	0.03194
27	25.705	241.122	2.316	23.391	0.084	1.073	19.707	18676	0.03824
28	25.019	255.251	1.267	22.539	0.523	0.754	19.623	18327	0.01877
29	22.047	244.936	1.705	18.440	0.136	0.594	20.762	17677	0.03454
30	16.942	240.720	1.778	16.662	0.000	0.703	18.545	18298	0.01575
SUM=	733.552	7023.701	52.283	636.298	13.902	26.307			0.92778