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UTAH DIVISION OF
SOLID & HAZARDOUS WASTE
08.02145

GREEN RIVER LANDFILL, L.L.C.

SOLITUDE LANDFILL

APPLICATION
FOR CLASS V
PERMIT RENEWAL

PROFESSIONAL ENGINEER
6-30-08
No. 169141-2202
KENT C.
STAHELI
STATE OF UTAH

Prepared by:

HANSEN, ALLEN & LUCE, INC.
Consulting Engineers
6771 South 900 East
Midvale, Utah 84047
(801) 566-5599

June 2008

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EXHIBIT C - NOTICE OF INTENT LETTER TO SURROUNDING PROPERTY OWNERS

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SECTION I

INTRODUCTION

Green River Landfill, L.L.C. (GRL) is proposing to renew the Class V permit to construct and operate a commercial solid waste landfill, the "Solitude Landfill", to be located within the boundaries of the City of Green River, Emery County, Utah. Solitude received a Class V permit from Utah Solid and Hazardous Waste on July 15, 2003. Since issuance of the Class V permit, the landfill was sold as Green River Landfill, L.L.C. which entity is applying for renewal of the Class V permit. This application for Class V permit renewal is submitted in accordance with the requirements of Rules R315-302, R315-303, R315-308, R315-309, and R315-315 of the Utah Solid Waste Permitting and Management Rules and the Utah Solid and Hazardous Waste Act (UCA 19-6-101 through 123).

Exhibit A of this permit renewal application contains the original permit application entitled "Class V Landfill Application" prepared for Green River Landfill, LLC, a Utah limited liability company, prepared by Infill Companies of Salt Lake City, Utah, dated April 2003. The original permit application will be referenced extensively to provide much of the information required by the Utah Solid Waste Rules. Only the information referenced Is considered a part of this application and information presented in the text of this permit application will take precedence and will be considered an update to the information presented in the original (April 2003) permit application.

SECTION II

PART I
UTAH CLASS I AND V LANDFILL PERMIT APPLICATION FORM

The following pages consist of the completed Utah Class I and V Landfill Permit Application Form.

Utah Division of Solid and Hazardous Waste
Solid Waste Management Program

Mailing Address
P O Box 144880
Salt Lake City, Utah 84114-4880

Office Location
288 North 1460 West
Salt Lake City, Utah 84116

Phone (801) 538-6170
Fax (801) 538-6715
www.deq.utah.gov

APPLICATION FOR A PERMIT TO OPERATE A CLASS I OR CLASS V LANDFILL

Please read the instructions that are found in the document, INSTRUCTIONS FOR APPLICATION FOR A PERMIT TO OPERATE A CLASS I OR CLASS V LANDFILL. This application form shall be used for all Class I or V solid waste disposal facility permits and modifications. Part I GENERAL INFORMATION must accompany a permit application. Part II, APPLICATION CHECKLIST, is provided to assist applicants and, if included with the application, will assist review. Part II is provided to assist in preparation and review of a permit application, *it is not rule*. The text of the rule governs all permit application contents and should be consulted when questions arise.

Please note the version date of this form found on the lower right of the page; if you have received this form more than six months after this date it is recommended you contact our office at (801) 538-6170 to determine if this form is still current. When completed, please return this form and support documents, forms, drawings, and maps to:

Dennis R. Downs, Director
Division of Solid and Hazardous Waste
Utah Department of Environmental Quality
PO Box 144880
Salt Lake City, Utah 84114-4880

(Note: When the application is determined to be complete, submittal of two copies of the complete application will be required.)

Utah Class I and V Landfill Permit Application Form

Part I **General Information** APPLICANT: PLEASE COMPLETE ALL SECTIONS.

***I.* Landfill Type**	☐ Class I ☒ Class V	***II.* Application Type**	☐ New Application ☒ Renewal Application	☐ Facility Expansion ☐ Modification

For Renewal Applications, Facility Expansion Applications and Modifications Enter Current Permit Number 0301

III. Facility Name and Location

Legal Name of Facility Solitude Landfill					
Site Address (street or directions to site) Approximately 9 miles east of downtown in the City of Green River				County Emery	
City Green River	State Utah	Zip Code	Telephone		
Township 21 S	Range 17 E	Section(s) 22	Quarter/Quarter Section	Quarter Section	
Main Gate Latitude degrees 38 minutes 58 seconds 20			Longitude degrees 110 minutes 01 seconds 42		

IV. Facility Owner(s) Information

Legal Name of Facility Owner Green River Landfill, L.L.C.			
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060

V. Facility Operator(s) Information

Legal Name of Facility Operator Green River Landfill, L.L.C.			
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060

VI. Property Owner(s) Information

Legal Name of Property Owner Green River Landfill, L.L.C.			
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060

VII. Contact Information

Owner Contact Marlene P. Wheaton		Title Corporate Controller/Treasurer	
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060
Email Address mwheaton@transloadamerica.com		Alternative Telephone (cell or other)	
Operator Contact Marlene P. Wheaton		Title Corporate Controller/Treasurer	
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060
Email Address mwheaton@transloadamerica.com		Alternative Telephone (cell or other)	
Property Owner Contact Marlene P. Wheaton		Title Corporate Controller/Treasurer	
Address (mailing) 76 South Orange Ave, Suite 208			
City South Orange	State NJ	Zip Code 07079	Telephone (973) 762-6060
Email Address mwheaton@transloadamerica.com		Alternative Telephone (cell or other)	

Utah Class I and V Landfill Permit Application Form

Part I General Information (Continued)

VIII. Waste Types (check all that apply)

☒ All non-hazardous solid waste (see R315-315-7(3) for PCB special requirements) **OR** the following specific waste types: **(As Limited by Permit)**

Waste Type	Combined Disposal Unit	Monofill Unit
☐ Municipal Waste	☐	☐
☐ Construction & Demolition	☐	☐
☐ Industrial	☐	☐
☐ Incinerator Ash	☐	☐
☐ Animals	☐	☐
☐ Asbestos	☐	☐
☐ PCB's (R315-315-7(3) only)	☐	☐
☐ Other ________	☐	☐

IX. Facility Area

Facility Area .... 320 acres

Disposal Area .... 320 acres

Design Capacity

Years 24.5

Cubic Yards .... 22 M

Tons .... 12 M

X. Fee and Application Documents

Indicate Documents Attached To This Application

☒ Application Fee: Amount $ 100

☒ Facility Map or Maps	☒ Facility Legal Description	☒ Plan of Operation	☒ Waste Description
☒ Ground Water Report	☒ Closure Design	☒ Cost Estimates	☒ Financial Assurance

Class V Special Requirements

☐ Documents required by UCA 19-6-108(9) and (10)

I HEREBY CERTIFY THAT THIS INFORMATION AND ALL ATTACHED PAGES ARE CORRECT AND COMPLETE.

Signature of Authorized Owner Representative

By: Marlene P. Wheaton

Marlene P. Wheaton By: TLA-Bale Tech LLC, its managing member

Name typed or printed By: Transload America Inc., its managing member

Title Corporate Controller/Treasurer

Date

Address 76 South Orange Ave, Suite 208
South Orange, NJ 07079

Signature of Authorized Land Owner Representative (if applicable)

Name typed or printed

Title

Date

Address

Signature of Authorized Operator Representative (if applicable)

Name typed or printed

Title

Date

Address

SECTION III

PART II
UTAH CLASS I AND V
PERMIT APPLICATION CHECKLIST

The following pages include the completed Utah Class I and V Permit Application Checklist as obtained from Utah Division of Solid and Hazardous Waste. The checklist includes reference to the locations in this permit application where each item required on the checklist is provided.

Utah Class I and V Permit Application Checklist

Important Note: The following checklist is for the permit application and addresses only the requirements of the Division of Solid and Hazardous Waste. Other federal, state, or local agencies may have requirements that the facility must meet. The applicant is responsible to be informed of, and meet, any applicable requirements. Examples of these requirements may include obtaining a conditional use permit, a business license, or a storm water permit. The applicant is reminded that obtaining a permit under the *Solid Waste Permitting and Management Rules* does not exempt the facility from these other requirements.

An application for a permit to construct and operate a landfill is the documentation that the landfill will be located, designed, constructed, operated, and closed in compliance with the requirements of Rules R315-302, R315-303, R315-308, R315-309, and R315-315 of the *Utah Solid Waste Permitting and Management Rules* and the *Utah Solid and Hazardous Waste Act* (UCA 19-6-101 through 123). The application should be written to be understandable by regulatory agencies, landfill operators, and the general public. The application should also be written so that the landfill operator, after reading it, will be able to operate the landfill according to the requirements with a minimum of additional training.

Copies of the *Solid Waste Permitting and Management Rules*, the *Utah Solid and Hazardous Waste Act*, along with many other useful guidance documents can be obtained by contacting the Division of Solid and Hazardous Waste at 801-538-6170. Most of these documents are available on the Division's web page at www.hazardouswaste.utah.gov. Guidance documents can be found at the solid waste section portion of the web page.

When the application is determined to be complete, the original complete application and one copy of the complete application are required along with an electronic copy.

Part II **Application Checklist**

I. **Facility General Information**	
Description of Item	Location In Document
Ia. Information Required - All Class I and V Landfills	
Completed Part I General information Form (See form above)	II-2
General description of the facility (R315-310-3(1)(b))	IV-1
Legal description of property (R315-310-3(1)(c))	IV-1
Proof of ownership, lease agreement, or other mechanism (R315-310-3(1)(c))	IV-1
Area served by the facility including population (R315-310-3(1)(d))	IV-2
If the permit application is for a class I landfill a demonstration that the landfill is not a commercial facility	IV-2
Waste type and anticipated daily volume (R315-310-3(1)(d))	IV-2
Ib. Information Required - All New Or Laterally Expanding Class I and V Landfills	
Intended schedule of construction (R315-302-2(2)(a))	IV-2
Name and address of all property owners within 1000 feet of the facility boundary (R315-310-3(2)(i))	IV-3
Documentation that a notice of intent to apply for a permit has been sent to all property owners listed above (R315-310-3(2)(ii))	IV-3
Name of the local government with jurisdiction over the facility site (R315-310-3(2)(iii))	IV-3

***I.* Facility General Information**	
Description of Item	Location In Document
***Ic.* Location Standards - All New Or Laterally Expanding Class I and V Landfills (R315-302-1)**	
Documentation that the facility has meet the historical survey requirement of R315-302-1(2)(f)	V-1
Land use compatibility	
Maps showing the existing land use, topography, residences, parks, monuments, recreation areas or wilderness areas within 1000 feet of the site boundary	V-1 and EXHIBIT A FIGURES
Certifications that no ecologically or scientifically significant areas or endangered species are present in site area	V-1
List of airports within five miles of facility and distance to each	V-1
Geology	V-2
Geologic maps showing significant geologic features, faults, and unstable areas	V-2 through V-4
Maps showing site soils	V-4
Surface water	V-4
Magnitude of 24 hour 25 year and 100 year storm events	V-6
Average annual rainfall	V-6
Maximum elevation of flood waters proximate to the facility	V-6
Maximum elevation of flood water from 100 year flood for waters proximate to the facility	V-6
Wetlands	V-6
Ground water	V-6
***Id.* Plan of Operations Requirements - All Class I And V Landfills (R315-310-3(1)(e) and R315-302-2(2))**	
Forms and other information as required in R3315-302-2(3) including a description of on-site waste handling procedures and an example of the form that will be used to record the weights or volumes of waste received (R315-302-2(2)(b) And R315-310-3(1)(f))	VI-1, VI-2
Schedule for conducting inspections and monitoring, and examples of the forms that will be used to record the results of the inspections and monitoring (R315-302-2(2)(c), R315-302-2(5)(a), and R315-310-3(1)(g))	VI-2
Contingency plans in the event of a fire or explosion (R315-302-2(2)(d))	VI-4
Corrective action programs to be initiated if ground water is contaminated (R315-302-2(2)(e))	VI-4
Contingency plans for other releases, e.g. explosive gases or failure of run-off collection system (R315-302-2(2)(f))	VI-4
Plan to control fugitive dust generated from roads, construction, general operations, and covering the waste (R315-302-2(2)(g))	VI-5

I. **Facility General Information**	
Description of Item	Location In Document
Plan for letter control and collection (R315-302-2(2)(h))	VI-5
Description of maintenance of installed equipment (R315-302-2(2)(i))	VI-6
Procedures for excluding the receipt of prohibited hazardous or PCB containing wastes (R315-302-2(2)(j))	VI-6
Procedures for controlling disease vectors (R315-302-2(2)(k))	VI-6
A plan for alternative waste handling (R315-302-2(2)(l))	VI-7
A general training and safety plan for site operations (R315-302-2(2)(o))	VI-7
Any recycling programs planned at the facility (R315-303-4(6))	VI-8
Closure and post-closure care Plan (R315-302-2(2)(m))	VI-8
Procedures for the handling of special wastes (R315-315)	VI-8
Plans and operation procedures to minimize liquids (R315-303-3(1)(a) and (b))	VI-9
Plans and procedures to address the requirements of R315-303-3(7)(c) through (i) and R315-303-4	VI-9
Any other site specific information pertaining to the plan of operation required by the Executive Secretary (R315-302-2(2)(p))	VI-10
Ie. Special Requirements - New Or Laterally Expanding Class V Landfill (R315-310-3(2))	
Submit information required by the *Utah Solid and Hazardous Waste Act* Subsections 19-6-108(9) and 19-6-108(10) (R315-310-3(2)(a))	VII-1
Approval from the local government within which the solid waste facility sits	VII-1

II **Facility Technical Information**	
Description of Item	Location In Document
IIa. Maps - All Class I and V Landfills	
Topographic map drawn to the required scale with contours showing the boundaries of the landfill unit, ground water monitoring well locations, gas monitoring points, and the borrow and fill areas (R315-310-4(2)(a)(i))	VIII-1
Most recent U.S. Geological Survey topographic map, 7-1/2 minute series, showing the waste facility boundary; the property boundary; surface drainage channels; any existing utilities and structures within one-fourth mile of the site; and the direction of the prevailing winds (R315-310-4(2)(a)(ii))	VIII-1
IIb. Geohydrological Assessment - All Class I and V Landfills (R315-310-4(2)(b))	
Local and regional geology and hydrology including faults, unstable slopes and subsidence areas on site (R315-310-4(2)(b)(i))	IX-1
Evaluation of bedrock and soil types and properties including permeability rates (R315-310-4(2)(b)(ii))	IX-2

***II* Facility Technical Information**	
Description of Item	Location In Document
Depth to ground water (R315-310-4(2)(b)(iii))	IX-2
Direction and flow rate of ground water (R315-310-4(2)(b)(iv))	IX-2
Quantity, location, and construction of any private or public wells on-site or within 2,000 feet of the facility boundary (R315-310-4(2)(b)(v))	IX-2
Tabulation of all water rights for ground water and surface water on-site and within 2,000 feet of the facility boundary (R315-310-4(2)(b)(vi))	IX-2
Identification and description of all surface waters on-site and within one mile of the facility boundary (R315-310-4(2)(b)(vii))	IX-2
Background ground water and surface water quality assessment and, for an existing facility, identification of impacts upon the ground water and surface water from leachate discharges (R315-310-4(2)(b)(viii))	IX-3
Ground Water Monitoring (R315-303-3(7)(b) and R315-308)	IX-3
Statistical method to be used (R315-308-2(7))	IX-3
Calculation of site water balance (R315-310-4(2)(b)(ix))	IX-3
IIc. Engineering Report - Plans, Specifications, And Calculations - All Class I and V Landfills	
Documentation that the facility will meet all of the performance standards of R315-303-2	X-1
Engineering reports required to meet the location standards of R315-302-1 including documentation of any demonstration or exemption made for any location standard (R315-310-4(2)(c)(i))	X-1
Anticipated facility life and the basis for calculating the facility's life (R315-310-4(2)(c)(ii))	X-1
Cell design to include liner design, cover design, fill methods, elevation of final cover including plans and drawings signed and sealed by a professional engineer registered in the State of Utah (R315-303-3(3), R315-303-3(6) and (7)(a), R315-310-3(1)(b) and R315-310-4(2)(c)(iii))	X-1
Leachate collection system design and calculations showing system meets the requirements of R315-303-3(2)	X-1
Equipment requirements and availability (R315-310-4(2)(c)(iii))	X-1
Identification of borrow sources for daily and final cover and for soil liners (R315-310-4(2)(c)(iv))	X-2
Run-On and run-off diversion designs (R315-303-3(1)(c), (d) and (e))	X-2
Leachate collection, treatment, and disposal and documentation to show that any treatment system is being or has been reviewed by the Division of Water Quality (R315-310-4(2)(c)(v) and R315-310-3(1)(i))	X-2

***II* Facility Technical Information**	
Description of Item	Location In Document
Ground water monitoring plan that meets the requirements of Rule R315-308 including well locations, design, and construction (R315-310-4(2)(b)(x) and R315-310-4(2)(c)(vi))	X-2
Landfill gas monitoring and control plan that meets the requirements of Subsection R315-303-3(5) (R315-310-4(2)(c)(vii))	X-2
Slope stability analysis for static and under the anticipated seismic event for the facility (R315-310-4(2)(b)(i) and R315-302-1(2)(b)(ii))	X-3
Design and location of run-on and run-off control systems (R315-310-4(2)(c)(viii))	X-3
IId. **Closure Plan - All Class I and V Landfills (R315-310-3(1)(h))**	
Closure Plan (R315-302-3(2) and (3))	XI-1
Closure schedule (R315-310-4(2)(d)(i))	XI-1
Design of final cover (R315-303-3(4) and R315-310-4(2)(c)(iii))	XI-1
Capacity of site in volume and tonnage (R315-310-4(2)(d)(ii))	XI-1
Final inspection by regulatory agencies (R315-310-4(2)(d)(iii))	XI-1
IIe. **Post-Closure Care Plan - All Class I and V Landfills (R315-310-3(1)(h))**	
Post-Closure Plan (R315-302-3(5) and (6))	XII-1
Site monitoring of landfill gases, ground water, and surface water, if required (R315-310-4(2)(e)(i))	XII-1
Changes to record of title, land use, and zoning restrictions (R315-310-4(2)(e)(ii))	XII-1
Maintenance activities to maintain cover and run-on/run-off control systems (R315-310-4(2)(e)(iii))	XII-1
List the name, address, and telephone number of the person or office to contact about the facility during the post-closure care period (R315-310-4(2)(e)(vi))	XII-1
IIf. **Financial Assurance - All Class I and V Landfills (R315-310-3(1)(j))**	
Identification of closure costs including cost calculations (R315-310-4(2)(d)(iv)) and (R315-302-2(2)(n))	XIII-1
Identification of post-closure care costs including cost calculations (R315-310-4(2)(e)(iv))	XIII-1
Identification of the financial assurance mechanism that meets the requirements of Rule R315-309 and the date that the mechanism will become effective (R315-309-1(1))	XIII-3

SECTION IV

PART II
I. FACILITY GENERAL INFORMATION - INFORMATION REQUIRED

Completed Part I General Information Form

The part I general information form is completed and is provided in Section II of this document.

General description of the Facility (R315-310-3(1)(b))

The Solitude Landfill will be located on approximately 320 acres of privately owned land located in Section 22, Township 21 South, Range 17 East, Salt Lake Base and Meridian. It is bordered on all sides by undeveloped land. Figure 1, Exhibit A shows the general location of the site. Within the site boundaries are three proposed disposal areas and associated access roads.

Land use zoning of the site and of the properties adjacent to the landfill boundary are designated industrial. The landfill site will be surrounded by at least a 4-strand barbed wire security fence, phased in place as landfill expansion occurs. Access to the facility will be gated to inhibit unauthorized entrance when the landfill operator is not present.

Legal description of property (R315-310-3(1)(c)

The legal description of the property as provided on the Quit-Claim Deed is as follows:

The North half of the Northwest quarter, the Southeast quarter of the Northwest quarter, the South half of the Northeast quarter, the Northeast quarter of the Southwest quarter, and the North half of the Southeast quarter of Section 22, Township 21 South, Range 17 East, Salt Lake Base and Meridian, together with all mineral, oil and gas rights, said rights and reservations not being subject to the following:

> Subject to City and/or County taxes and Assessments, not delinquent, Easements, Rights-Of-Way, Covenants, Conditions, and Restrictions now of record.

The facility is not yet constructed with a perimeter fence and entry gate. The current approved location of the proposed access road, however, will provide for an entry gate at about Latitude N 38°58.517' and Longitude W 110°02.194'. A map of the proposed facility site is provided as Figure 1 in Exhibit A. A land use and zoning map of the surrounding areas, as provided by the City of Green River, is located in Exhibit B. The facility is located in an area zoned as I-3, heavy industrial, which includes state permitted waste dumps and landfills under the permitted and conditional uses.

Proof of ownership, lease agreement, or other mechanism (R315-310-3(1)(c)

The proof of ownership is provided in Exhibit A, Appendix A - Proof of Ownership W/Legal Description in the original permit application document.

Area served by the facility including population (R315-310-3(1)(d))

The area served is expected to include municipal and non-municipal entities within and outside the State of Utah generating non-hazarsous waste meeting the restrictions defined for class V landfills. Entities outside the State of Utah are expected to include most of the western states.

Since this facility is owned and operated as a commercial landfill, the population served will vary depending on the municipal and non-municipal entities served.

If the permit application is for a class I landfill a demonstration that the landfill is not a commercial facility

The permit application is for a class V landfill, therefore, no demonstration is provided.

Waste type and anticipated daily volume (R315-310-3(1)(d))

The facility will be a commercial non-hazardous solid waste disposal facility used for disposal of municipal solid waste and other non-hazardous solid waste as defined by R315-301-2(11), not otherwise limited by rule or by the solid waste permit for disposal. It is anticipated that the facility will initially dispose of approximately 130,000 tons per year and may increase to approximately 300,000 to 750,000 tons per year depending on potential waste sources. Assuming approximately 286 days of operation per year (5.5 days per week average and 52 weeks per year), daily volumes are estimated to be about 450 tons per day initially with a potential of 1,050 to 2,620 tons per day.

Intended schedule of construction (R315-302-2(2)(a))

Table IV-1 presents the proposed schedule of general site construction, and construction of the first landfill area. Rail access is not expected to be constructed until such time as waste volumes makes rail construction feasible or becomes necessary to meet the demands of waste clients.

TABLE IV-1
SCHEDULE OF CONSTRUCTION

Anticipated Start	Construction Activity	Anticipated Completion
Notice + 60 days	Construction Staking	Notice + 80 days
Notice + 90 days	Construction of Initial Disposal Area	Notice + 130 days
Notice + 90 days	Access Road Construction	Notice + 130 days
Notice + 90 days	Security Fences and Gates	Notice + 130 days
Notice + 150 days	Begin Facility Operations	na
Notice + 130 days	Operations Building	na

Landfill construction will be phased to meet disposal volume needs based on contractual obligations with municipal and other clients. It is expected that baled waste and compacted waste will be placed in separate landfill areas for better management of wastes and to better utilize the advantages of the baling technology.

Name and address of all property owners within 1000 feet of the facility boundary (R315-310-3(2)(l))

Property owners within 1000 feet of the facility boundary include the following:

U.S. Department of the Interior
Bureau of Land Management (BLM)
Utah State Office
440 West 200 South
Suite 500
Salt Lake City, Utah 84101

U.S. Department of the Interior
Bureau of Land Management
Canyon Country District Office
(Moab Field Office)
82 East Dogwood
Moab, Utah 84532

State of Utah
School and Institutional Trust Lands Administration (SITLA)
675 East 500 South
Suite 500
Salt Lake City, Utah 84102

Documentation that a notice of intent to apply for a permit has been sent to all property owners listed above (R315-310-3(2)(ii))

Notice of intent is provided in Exhibit C.

Name of the local government with jurisdiction over the facility site (R315-310-3(2)(iii))

Local government with jurisdiction over the facility is:

The City of Green River
460 East Main Street
P.O. Box 620
Green River, Utah 84525

SECTION V

PART II
I. FACILITY GENERAL INFORMATION - LOCATION STANDARDS (R315-302-1)

Documentation that the facility has met the historical survey requirement of R315-302-1(2)(f)

A historical survey was completed by Montgomery Archeological Consultants in March 2008. The report providing the results of the survey as submitted to the State Historic Preservation Officer is provided Exhibit D of this permit application. The historical survey was sent to the state historic preservation officer at the Utah State Historical Society on March 20, 2008. According to the report submitted, there were three new sites identified and "All three historic sites are recommended ineligible for inclusion in the National Register of Historic Places (NRHP). These include a historic oil well with associated trash scatter, a trash scatter associates with oil and gas exploration, and another trash scatter associated with cattle ranching. These sites are not associated with persons or events that are significant within history, nor do they retain structural integrity or possess the capacity to yield additional information that would be important to the history of the area."

Land use compatibility

The site is particularly suited for a landfill due to its remote location, small amount of annual precipitation of 6.34 inches and estimated annual evapotranspiration of 60.2 inches (Exhibit E), low-permeable bedrock immediately below the site, the considerable depth to groundwater and the poor quality of groundwater. The site, and the area surrounding the site, are not used for agriculture due to the lack of water and the poor soil and vegetative conditions.

Site compliance with the location standards set forth in R315-302-1(2) are as follows:

- The site is not located within 1000 feet of any of the following:
  - national, state, county, or city park, monument, or recreation area;
  - designated wilderness or wilderness study area;
  - wild and scenic river areas;
  - lakes or reservoirs;
  - ecologically and scientifically significant natural areas, including wildlife management areas and habitat for threatened or endangered species;
  - farmland which is classified as "prime," "unique," or of "statewide importance." All land within 1000 feet of the site boundary is owned by the U.S. Department of Interior - Bureau of Land Management (BLM) and the Utah State School and Institutional Trust Lands Administration (SITLA). Land uses primarily consist of grazing of livestock. A map showing existing topography within 1000 feet of the facility is provided as Figure 1 in the April 2003 permit application included in Exhibit A. The map provided was obtained from the Green River NE Quadrangle, Utah - Grand County, 7.5 Minute Series (Topographic) Map.

- The site is not located within one-fourth mile of any of the following:
    - permanent dwellings
    - historic structures or properties listed as eligible to be listed in the State or National Register of Historic Places.

- The site is not located within 10,000 feet of any airport runway end used by turbojet aircraft.
- the site is not located within 5,000 feet of any airport runway end used by only piston type aircraft.
- There are no eligible archeological sites at the facility.
- The site is not located in a subsidence area, a dam failure flood area, above an underground mine, or above a salt dome or salt bed.
- The site is not located within 200 feet of a Holocene fault, nor is it located withink a seismic impact zone.
- The local geology of the site, confirmed by field study (Exhibit A), does not indicate that it is an unstable area subject to differential settlement.
- The site is not located in any public land used by a public water system for watershed control for municipal drinking water purposes, or in a location that could cause contamination to a lake, reservoir, or and.
- The site is not located in a 100-year flood plain or wetland area.
- Based on hydrogeologic studies in the area, the aquifer below the site is 200 feet to over 1000 feet below the surface. There are some isolated perched areas where water is located 25 feet to 40 feet below the surface along the ephemeral streams. The water quality of these perched water areas was found to have a TDS content generally greater than 10,000 mg/L.
- There area no threatened or endangered species at the site. Certification regarding the absence of endangered, threatened, and sensitive species is provided in a letter from the State of Utah Department of Natural Resources, Division of Wildlife Resources, dated January 10, 2002 (Exhibit A, end of Appendix F). This letter states that "The Utah Division of Wildlife Resources (UDWR) does not have records of the occurrence for any threatened, endangered, or sensitive species in the area of the proposed landfill site."

Geology

A geologic map and a cross section of the geologic formations in the area of the facility are provided as Figures 2 and 3 in Exhibit A, a description of the local geology is provided on pages 12 through 14 in Exhibit A, and a description of the regional geology is provided on pages 14 and 15 in Exhibit A. For ease of review, much of the geologic information provided in the April 2003 permit application included in Exhibit A is presented herein.

The site generally lies on a gently northwest-sloping pediment that has developed on the Mancos shale formation. The site is typical of Badlands topography which include arroyos and ephemeral streams. Brown's wash is a large ephemeral stream which crosses the northeast corner of the site and flows toward the west. Brown's wash has several tributaries that either cross or originate on the site and join with Brown's wash outside the west boundary of the site.

Site stratigraphy consists of a thin layer of alluvium or weathered shale above the Mancos shale layer. The northern and some of the central portions of the site are covered with alluvium and/or terrace deposits from the ephemeral stream channels in those areas (Exhibit A, Figure 2). Generally, alluvial deposits exist near the base of the plateaus and near the larger stream channels where they contain a wide range of grain sizes, varying from boulders to clay. Subsurface logs from test pits and exploratory borings at the site show that the depth of alluvium generally ranges from 0 to 22 feet with the greater thicknesses near the stream channels. The remaining areas of the site are covered with an overburden that consists of silty clay material, weathered from the Mancos Shale bedrock. Test pits and exploratory borings indicate that the depths of silty clay overburden range from 0 to 5 feet. Test pit and boring logs are presented in Exhibit A, Attachment 1.

Bedrock consists of outcrops of Mancos Shale formation, which is a dark-gray marine shale. Drilling logs from water and oil wells in the vicinity incicate that the Mancos Shale has a minimum thickness of about 1100 feet in the area of the site. Projecting the dip angle of the lower contact of the Mancos outcropping southwest of the site, the shale would be approximately 1420 feet thick below the site (Exhibit A, Figure 2, Geologic Map). The Mancos Shale formation has two distinguishable members in the lower part of the section in the area of the site. In decending order, these members consist of Ferron Sandstone and Tununk Shale. These members both outcrop approximately 2 miles southwest of the site. Projecting the dip angle of these beds indicates that the Ferron Sandstone would be approximately 1300 feet below the site.

Directly below the Mancos Shale formation lies the Dakota Sandstone with a maximum thickness of 200 feet. The Dakota Sandstone comprises the top layer of the Mesozoic Sandstone Aquifer, and aquifer composed fo a thick sequence of 11 bedrock units that are mostly sandstones. The maximum thickness of the Mesozoic Sandstone Aquifer is about 3000 feet. Underlying the Mesozoic Aquifer is the Lower Mesozoic and Upper Paleozoic confining beds, which are comprised of inter-bedded layers of siltstone, shale, sandstone, and a highly impermeable layer of evaporites with a maximum thickness of 12,000 feet. Under the confining beds is the Lower Paleozoic Aquifer which is comprised of siltstones, sandstones, and limestones. A conceptual geologic cross section (Exhibit A, Figure 3) shows a profile of general sub-surface conditions.

Structural Geology was determined by a site investigation conducted in 1994 which included coring into the Mancos Shale to characterize the bedrock. The bedrock was determined to be highly weathered in the top 0 to 10 feet of the shale, rapidly grading to a competent shale to the maximum depth of the coring (140 feet). The Rock Quality Designation (RQD) of the bedrock ranged from 0 near the surface to 100% at about 30 feet deep and deeper. Joint spacing ranged from 0-1 inches near the surface to over 5 feet at the bottom of the corings. Some vertical fracturing was observed in the upper 20 feet of the corings, but at depths over 20 feet the joints were relatively clean and largely horizontal with some evaporite material (gypsum) found along the joints.

The nearest Holocene fault, the Little Grand Fault is located 1-1/4 miles south of the site. The Little Grand Fault runs generally east-west and is a normal fault that is approximately 12 miles in length (Rush, 1982 as referenced in Exhibit A). Although some smaller faults are located approximately 5 miles to the east and about 3 miles to the southwest, seismic activity at the site is probably governed by the larger and closer Little Grand Fault. Seismic activity at the site is considered minimal based on USGS National Seismic Hazard Mapping Project (http://geohazards.cr.usgs.gov/eq/index.php). According to the probabilistic ground motion values given for the site's coordinates, there is a 90% probability of not exceeding a horizontal acceleration of 0.05 g in 50 years.

Regional Geology of the facility is in the northern portion of the Paradox Basin, which is in the Canyonlands section of the Colorado Plateau. The region is characterized by young-to-mature plateaus and large topographic relief. Paradox basin is not a definable physiographic feature but consists of the portion of the Colorado Plateau that is underlain by a thick sequence of evaporite (salt) beds.

Rock units in the area dip gently to the northwest. Identifiable rock outcroppings in the region include the Mesaverde Group, which is a sandstone unit with seams of shale and coal; the Book Cliffs and higher elevation plateaus are formed from Mesaverde Group. Below the Mesaverde Group lies the Mancos Shale formation which is a dark-grey marine slale; the proposed site lies on an outcropping of the Mancos Shale Formation. Beneath the Mancos Shale formation lies the Dakota Sandstone which comprises the top layer of the Mesozoic Sandstone Aquifer, and aquifer composed of a thick sequence of 11 rock unts that are mostly sandstones. The Dakota Sandstone outcrops about six miles south of the site. Further south of the site is a large outcropping of the Lower Mesozoic confining beds which consist of interbedded layers of siltstone, shale, sandstone, and evaportite beds. The Canyonlands area, approximately 30 miles south fo the site, is formed from the Lower Mesozoic Confining beds. Under the confining beds is the Lower Plaleozoic Aquifer which is comprised of siltstones, sandstones, and limestones.

Maps showing site soils

Mapping of site soils was obtained from the US Department of Agriculture - National Resources Conservation Service web site (http://websoilsurvey.nrcs.usda.gov/app/). The mapping is provided in Exhibit F along with descriptions associated with the different soil types.

Surface water

Two large streams, the Colorado and Green Rivers, flow through the region in the southerly direction. The Colorado River is located approximately 45 miles east of the site and the Green River is located about 6 miles west of the site. Two smaller perennial streams, the Price and San Rafael Rivers, enter the Green River from the northwest at a distance of 12 miles north and 16 miles south of the site, respectively. Most of the drainages in the area have ephemeral streams that flow in response to snowmelt or precipitation runoff.

Brown's Wash, a large ephemeral stream, crosses the northeast corner of the northern portion of the site and flows toward the west. Tributaries to Brown's Wash also cross the site flowing in a northwest direction and join Brown's Wash outside of the north and west boundaries of the site. Brown's Wash joins with the Green River approximately 6 miles west of the site.

The drainage area of Brown's Wash located up-gradient from the site consists of approximately 27,930 acres (Exhibit A, Figure 4 and Exhibit G). An estimated peak flow rate of 1020 cfs resulting from the 100-year storm event was estimated in Brown's Wash in the original permit application (Exhibit A, page 13). The report indicates that the TR-20 SCS methodology was used to determine this flow rate. A flow depth of 3.46 feet at a peak velocity of 8.3 feet per second was calculated within Brown's Wash based on the peak flow rate. A conclusion was then made that there would be no flooding from the channel during the 100-year storm event since the depth of the channel is 5 feet.

A separate evaluation was conducted by Hansen, Allen & Luce, Inc. regarding the Brown's Wash hydrology which is included in Exhibit G. During this evaluation a review of soil types and hydrologic soils groups were obtained from soil surveys conducted in the area of the site and of Brown's Wash. Estimates of the condition of the vegetative cover were determined from a site visit and aerial photographs, and the precipitation depths for the 100-year and the 25-year precipitation events were obtained from "Point Precipitation Frequency Estimates From NOAA Atlas 14 using the latitude and longitude of the center of the site and the center of the Brown's Wash drainage basin. The evaluation was also conducted using the TR-20 SCS software and using the HEC-HMS software from the Army Corps of Engineers.

The Brown's Wash drainage area above the Solitude property is about 27,800 acres or 43.4 square miles (which is basically the same area presented in the original permit application). Brown's Wash drainage area consists of 39%, 33%, and 28% hydrologic soil group B, C, and D soils, respectively. A weighted curve number of 80 was determined using poor vegetative cover over 85% of the drainage area and fair vegetative cover over 15% of the drainage area (the fair cover being in the highest elevation areas of the drainage). This curve number is much higher than the curve number of 65 used in the original permit application which will predict higher flows for Brown's Wash.

The point precipitation depth obtained from NOAA Atlas 14 for the 100-year 24-hour event is 2.81 inches using a latitude and longitude located in the center of the Brown's Wash drainage area. An aerial reduction factor is applied to the precipitation characteristics to simulate the aerial variations that are expected to occur in a large drainage area from any one precipitation event. Information provided in NOAA Atlas 2 resulted in an aerial reduction factor of 95.5% for the 43.4 acre area of the Brown's Wash drainage.

The hydrologic computer model HEC-HMS developed by the US Army Corps of Engineers was used with the information provided above to estimate runoff from the Brown's Wash drainage, The resulting estimated runoff is 2502 cfs which is a little more than double the 1020 cfs estimated in the original permit application. The differences are primarily a result of the difference in the curve number estimated for the drainage area.

Cross-sections were measured at two locations through Brown's Wash as it crosses through the northeast corner of the facility property. The two cross-sections, as measured, are presented on the last page of the calculations for Brown's Wash hydrology. Calculations show that the estimated peak runoff of 2502 cfs for the 100-year 24-hour precipitation event will be contained within Brown's Wash.

All storm water that comes in contact with waste material disposed in the open operating areas of the landfill will be contained within the landfill footprint so that there is no discharge into receiving streams. Precipitation on areas of the waste mound that have been covered with native soil as daily and intermediate cover will be allowed to discharge as clean storm water.

Magnitude of 24 hour 25 year and 100 year storm events

Magnitudes of the 100-year 24-hour and the 25-year 24-hour precipitation events at the facility are 2.25 inches and 1.77 inches, respectively based on the Point Precipitation Frequency Estimates from NOAA Atlas 14 (Exhibit G).

Average annual rainfall

The average annual rainfall for the site is approximately 6.34 inches based on the Utah Climate Center climate summary table for the Green River Aviation weather station. The average annual evaporation and evapo-transpiration are estimated to be about 39.63 inches and 60.15 inches respectively based on Utah Agriculture Experiment Station Research Report 145 (applicable pages of the report are included in Exhibit E).

Maximum elevation of flood waters proximate to the facility

As provided above, Brown's Wash provides the main source of potential flood waters in the proximity of the facility. Runoff that currently enters Brown's Wash, from Tributaries and from overland flow through and across the facility, will be diverted around the facility and discharged into Brown's Wash near the northeast and northwest corners of the facility boundary. The drainage channels used to divert runoff around the facility are designed to completely contain the 100-year, 24-hour precipitation event with 2 feet of freeboard as provided in the original permit application (Exhibit A).

Maximum elevation of flood water from 100 year flood for waters proximate to the facility

Maximum elevation of flood water from the 100-year precipitation event will be contained completely within Brown's wash. The flood stage is about 2 feet above the defined "washed-out" portion of the channel, however, it remains within a narrow width of the depressed area adjacenet to and sloping toward the channel.

Wetlands

A search was competed on the national wetlands inventory web site (www.fws.gov/nwi/) and no wetlands were delineated at the site. All streams and tributaries at the site are ephemeral and ground water is too great a depth to provide for wetland conditions.

Ground water

Drill holes completed in areas surrounding the site show ground water to be at significant depths and generally of low quality. Ground water flow is generally toward the west and southwest from book cliff areas of recharge to the Green River drainage. Analyses of wells drilled in the area indicate the minimum depth to ground water to be on the order of 200 feet with a maximum depth of over 1000 feet. Information obtained form the from the US Department of Agriculture - National Resources Conservation Service web site (http://websoilsurvey.nrcs.usda.gov/app/), as provided in Exhibit F, also describes the water table in the area of the site to be greater than 200 feet.

Ground water is present in primarily two separate aquifers: the upper Mesozoic sandstone aquifer and the lower Paleozoic aquifer. The upper and lower aquifers are hydraulically separated by thick beds of evaporites which effectively delineate the two aquifers and cause the aquifers to act independently. All ground water recharge to the aquifer systems from the ground surface is limited to the upper aquifer, as the lower system is hydraulically isolated from the surface. Potential leakage between the aquifers is in an upward direction under the site.

Upper Aquifer Characteristics (upper Mesozoic aquifer) consist of a thick sequence of 11 northwesterly-dipping rock units that are mostly sandstone. The aquifer has a maximum thickness of 3,000 feet and is confined in the areas of the site by the impermeable Mancos shale formation. Generally, water occurs in the rocks of the unsaturated part of the upper ground water system as a result of recharge from local precipitation. The precipitation vertically percolates downward toward the underlying zone of saturation where it begins to move horizontally. Regionally much of the upper aquifer is unsaturated, although perched water is common.

Water in the upper aquifer is generally found at depths greater than 200 feet. The potentiometric surface of the upper aquifer is the lowest near the Green River and rises away from the river. The elevation of the potentiometric surface is at least 200 feet below the ground surface at the location of the site according to a potentiometric map developed by Rush (1982) included in the Exhibit A references.

Upper Aquifer Recharge from precipitation in the area of the site is probably minimal due to the outcropping of the impermeable Mancos Shale at the site. The majority of recharge to the upper aquifer system is greatest near the Book Cliffs, where the precipitation is relatively larger, and along the ephemeral streams, where infiltration is most likely.

No recharge to the upper aquifer occurs due to inflows from the Green River. The potentiometric maps of the aquifer suggest instead that the river acts as a drain for the area. Recharge to the upper aquifer also occurs from subsurface inflows from the adjacent areas. Potentiometric maps of the area indicate that most of the ground water inflow is from the San Rafael Swell to the west and the Book Cliff area to the north and east.

Upper Aquifer Outflows are limited to discharge into streams such as the Green River and the Colorado River. Several studies have been performed to determine the amount of outflow from the upper aquifer system into the Green River. Potentiometric maps and mass balance equations for the Green River indicate that regionally, there is flow from the upper aquifer into the Green River, although there appears to be very little local subsurface flow from the area based on potentiometric maps of the region. Regionally, subsurface flow from the area appears to flow from the area near the Green River and the Colorado River confluence to the south of the stie. Discharge from wells and springs is believed to be minimal as there area no large diameter wells in the vicinity of the site, and there are few springs, and these springs generall flow from perched water tables.

Perched Water was initially found at five locations during a 1994 subsurface field investigation associated with the geotechnical evaluation of the site. Perched water was found in DH-2, MW-2, MW-5, MW-7 and DH-10. No additional water was found to be present in MW-7 after installation of the casing. All other drill holes and MW's at the site were dry although many of the drill holes and MW's extended to elevations well below the elevations where the perched water was observed at the other locations. The perched water does not extend across the entire site and it appears to be associated with isolated pockets of water that are found near the ephemeral streams. Recharge of the perched water appears to be caused by of runoff within in the streams infiltrating into the ground through the gravels and sands that appear to be present within the channels.

Additional observations were conducted associated with the perched water conditions in 2008 by checking for water levels in MW-2, MW-4, MW-5, MW-7, MW-7A, MW-13, MW-14, and DH-10 (a PVC pipe was installed in DH-10 that allowed for additional checking for water levels). In January and again in February of 2008 there was water present in MW-2, MW-4, MW-5, and DH-10. The MW's are near ephemeral streams and BH-10 is in a drainage collection area upstream from the confluence of some streams. During the 2007 - 2008 winter the Green River area experienced wetter than normal conditions which included snow that melted slowly.

Water Quality

Existing data indicate that the ground water from the upper confining bed (Mancos Shale) and the upper aquifer (Mesozoic Sandstone) is brackish with dissolved solid levels from 500 to 14,000 mg/l. This would classify the water as Class II (drinking water) to Class IV (saline gournd water) according to the *Administrative Rules for Ground Water Quality Protection*, (DWQ, 2007).

Perched water samples were obtained on July 29, 1994 from DH-2, DH-10, MW-2, and MW-5. Laboratory results indicate that the quality of the perched water below the site is of poor quality with TDS values ranging from 9,400 to 30,000 mg/l (Exhibit A, Appendix D). These TDS values would generally classify the perched water as Class IV (Saline Groundwater), for TDS values above 10,000 mg/l. This is based on the groundwater aquifer classification system established in the Utah Groundwater Quality Protection Regulations.

Well Inventory

A search of water rights on file with the Utah Division of Water Rights was completed with the original permit application. That original search indicated that no wells are located within 5 miles of the site (Exhibit A, Appendix C). A recent search of water rights completed in April 2008 confirms again the findings associated with the original application.

Water Rights

The only water rights within a radius of 5 miles of the site include livestock watering ponds, springs, and diversions along the ephemeral streams in the area. All water used form the ponds, springs and diversions are associated with livestock and wildlife watering. The City of Green River procures potable water from the Green River and does not utilize the well water due to the poor quality of the ground water.

SECTION VI

PART II
I. FACILITY GENERAL INFORMATION - PLAN OF OPERATIONS
(R315-310-3 (1)(E) AND R315-302-2(2))

Forms and Other Information Required in R315-302-2(3)

Example forms to meet requirements of R315-302-2(2)(c) and R315-310-3(1)(g) are provided in Exhibit A, Appendix B.

Description of On-Site Waste Handling

The landfill will be operated by Green River Landfill, L.L.C. and daily operational management will be conducted out of their operations office. Daily operations will be under the direction of the landfill operator as designated by Green River Landfill, L.L.C.

Construction will be completed and approval to operate each completed area will be provided by the Utah Division of Solid and Hazardous Waste prior to beginning disposal in the newly constructed areas. Disposal operations will begin in the initial constructed landfill phase or phases and will expand during the operational life of the facility. It is expected that excavation for the landfill expansion will be ongoing to meet soil needs for daily, intermediate, and final covers.

Handling procedures for baled waste will include delivery to the landfill facility by either rail or truck and then transported to the landfill operational area for disposal. Railed waste will be transferred to trucks and then to the operational landfill area, or transported to the operational landfill area in the rail transport containers as appropriate. Baled waste delivered by truck will be either transferred to site trucks and transported to the landfill operation area, or transported directly to the landfill operational area on the delivery trucks. Bales will be off-loaded and placed in the landfill operational area as directed by the facility operator. The bales will be placed in a configuration to minimize air space between the bales and to provide stability to the waste mound. Baled waste will be loaded, transferred, offloaded, and transported using equipment that is suitable for safe handling of the baled waste.

A daily operational record will be kept on a form to track the disposal of baled waste by the number of bales and/or the weight of baled waste placed per day. The volume of baled waste placed will be estimated based on the volume per bale times the number of bales placed or based on the average volume in cubic yards per ton times the number of tons placed per day. Copies of daily operation records will be kept on file at the site.

Daily cover materials will be placed as needed to control vectors, blowing debris, and to reduce the potential of fire hazards. The leading faces of the baled waste provide the receiving faces for continued placement. Since most leading faces are only exposed for less than a 24-hour period, no daily cover is anticipated over the leading faces. Leading faces exposed for more than a 24-hour period will receive a cover in the form a soil cover (sloped appropriately for stability), an alternative cover, or a temporary or permanent synthetic cover as approved by the Utah Division of Solid and Hazardous Waste. Synthetic wrapping placed around waste bales are expected to satisfy the requirements of a daily cover. Synthetic wrapping that is damaged during loading, offloading, transport, and/or disposal such that the waste material is exposed for more than a day will be either repaired or covered with an approved daily cover material.

When soil is used for daily cover, the soil will be placed a minimum of 6 inches thick. Areas where the working faces do not receive waste for a period longer than 30 days will receive a minimum soil cover thickness of 12 inches.

Intermediate soil cover is intended to provide the base for the final closure cover of the landfill areas. The intermediate soil will be placed to a thickness of 12 inches when the waste pile has reached its final design grade and will provide a temporary cover until final closure activities occur.

Handling procedures for loose (non-baled) waste will include delivery to the landfill facility by rail or truck and then transported to the operational landfill area for disposal. Railed waste will be transferred to trucks and then to the operational landfill area, or transported to the operational landfill area in the rail transport containers as appropriate. Waste delivered by truck will be either transferred to site trucks and transported to the landfill operation area, or transported directly to the landfill operational area by the delivery trucks. Loose waste will be placed and compacted in the landfill operational area using appropriate placement and compaction equipment as directed by the facility operator.

A daily operational record will be kept on a form to track the number of loads, weights, estimated volumes, and types of wastes received. The volume of waste placed will be estimated based on the average density achieved after placement and compaction as determined by annual topographic surveys of the waste pile. Annual density calculations will be completed and included in the annual reports provided to the Utah Division of Solid and Hazardous Waste. The goal of the facility is to achieve in-place densities between 1,100 and 1,400 pounds per cubic yard or higher. Copies of daily operation records will be kept on file at the site.

A 6-inch thick of daily soil cover will be placed over the operational areas to control vectors, blowing debris, and to reduce the potential of fire hazard. Daily cover over the leading waste faces that are exposed for less than 24 hours may include approved alternative covers such as spray-on covers, auto fluff, etc as approved by the Utah Division of Solid and Hazardous Waste. Leading faces exposed for more than 24 hours will receive a 6-inch thick soil cover. Areas where the working faces do not receive waste for a period longer than 30 days will receive a minimum soil cover thickness of 12 inches.

Intermediate soil cover is intended to provide the base for the final closure cover of the landfill areas. The intermediate soil will be placed a minimum of 12 inches thick when the waste pile has reached its final design grade and will provide a temporary cover until final closure activities occur.

Inspections and Monitoring Schedule

Waste will be inspected visually, except for wastes that have previously been inspected at transfer stations, to verify that no wastes other than those allowed by the permit are disposed in the landfill. A complete inspection will be ocnducted at a minimum frequency of one load per week, or, if more than 100 loads per week are received, 1% of the incoming loads. Loads to be inspected will be chosen on a random basis.

All containers capable of holding more than five gallons of liquid will be inspected to determine if the waste is acceptable for disposal.

All loads that the operator suspects may contain a waste not allowed for disposal at the landfill will be inspected.

Complete random inspections will be conducted as follows:

- The operator will conduct the random waste inspections at the working face or an area designated by the operator;
- The loads to be inspected will be selected on a random basis;
- Loads subjected to complete inspections will be unloaded at the designated areas;
- Loads will be spread by equipment or by hand tools;
- A visual inspection of the waste will be conducted by personnel trained in hazardous waste recognition and recognition of other unacceptable waste; and
- The inspection will be recorded on a waste inspection form to be placed in the operating record at the end of the day.

The schedule of inspections and monitoring associated with the landfill facility to provide for proper operation and maintenance are provided in Table VI-1 and Table VI-2. Since there is no required ground water monitoring, and there is no leachate collection and removal system, there is no dedicated equipment installed at the landfill for ground water monitoring, and leachate monitoring and collection. There are also no current plans for dedicated landfill gas monitoring equipment or an active landfill gas collection system. Therefore, there is no required maintenance as specified in UAC R315-302-2(2)(h).

TABLE VI-1
INSPECTION SCHEDULE

Inspection Activity	Frequency
Access Road and Gate	Monthly
Security Fences	Monthly
Landfill Construction	As Specified in Construction CQC/CQA Plans
Landfill Equipment	As recommended by Manufacturers
Final Closure Cover	Quarterly
Post Closure	Quarterly

TABLE VI-2
MONITORING SCHEDULE

Monitoring Activity	Frequency
Explosive Landfill Gases	Quarterly

Fire or Explosion Contingency

Fire hazard is reduced by soil cover materials placed on the waste during waste handling and placement. In the event that fires do occur during operating hours, the burning material will first be covered with soil material using on-site soils and earth moving equipment to remove or minimize the presence of oxygen. Small fires may be extinguished with fire extinguishers provided in the site vehicles, by using on-site water available from designated water sources, and/or by covering the fires with on-site soils.

Upon notification of a fire that can not be controlled using on-site equipment, a long blase (greater than 30 seconds) on a vehicle horn or on permanent site alarm equipment will be sounded and nonessential equipment will be shut down. All site personnel will assemble outside the landfill entrance and the City of Green River Fire Department will be notified. All site presonnel will be moved a safe distance from the area involved until the fire is safely controlled or extinguished. The telephone number and location of the nearest fire station will be displayed near telephones located in the site office and in site vehicles.

Fires that occur during times that the landfill is closed will have additional time to spread and will, therefore, be more difficult to get controlled. The landfill operator or manager may utilize site equipment to cover fires with soil and/or separate burning materials from the other waste materials and bury the burning materials with soil. Otherwise, the local fire department will be notified to assist in the efforts to control fires.

Explosive gases are expected to be minimal due to the dry nature of the waste (especially the baled waste) entering the landfill and due to the dry climate and limited availability of moisture that can leach into the landfilled waste. The contingency plan for mitigating explosive gases is included in "Other Releases Contingency Plan."

Ground Water Contamination Corrective Action Program

Groundwater monitoring will not be performed due to the hydrogeologic conditions at the facility. Therefore, no corrective action programse are included.

Other Releases Contingency Plan

Additional releases that maybe of concern include the release of explosive gases and the release of contaminated storm water from the waste disposal area. Each of these items are discussed herein.

Explosive gas releases at dangerous levels are not expected due to the low moisture content expected in most of the waste received and the dry climate of the area resulting in low levels of gas generation. If quarterly gas monitoring indicates that explosive gas levels exceed 25% of the LEL in any of the facility structures, the structures will be evacuated until the structures are sufficiently ventilated to safe levels. If quarterly gas monitoring indicates that gas levels exceed the LEL at the property boundary corrective measures will be implemented within 10 days. The contingency plan for implementing corrective measures will include notification to the City of Green River, Division of Solid and Hazardous Waste, and the Division of Air Quality. Corrective measures will also include increasing the monitoring frequency to monthly until the explosive gas levels are lowered to acceptable levels and installation of a passive ventilation system or an active gas system if needed.

Contaminated storm water releases will be controlled within the open operational areas of the landfill by complete containment when waste levels are below ground levels and by placement of clean soil over the waste materials in areas of the landfill where waste has been placed above grade. Storm water that runs off clean soil surfaces will be considered clean and will be allowed to discharge into natural drainage channels after passing through detention basins or flowing overland through vegetated areas where sediments picked up from disturbed areas can be settled out of the storm water.

A storm water pollution prevention plan (SWPP Plan) will be developed for implementation of best management practices (BMP's) from all disturbed areas during construction, operation, and closure activities associated with landfill operations. A spill prevention, control, and countermeasure plan (SPCC Plan) will be developed to ensure containment and clean-up of spills associated with petroleum products and chemicals stored and used on site. Both the SWPP Plan and the SPCC Plan will provide safegards against illicit discharges in compliance with the NPDES program.

Fugitive Dust Control Plan

Fugitive dust will be controlled by applying water, or by use of other dust treatment and control procedures, to roads and other exposed surfaces where fugitive dust generation becomes a nuisance. Fugitive dust will be and the control of fugitive dust will be routinely reviewed for compliance with Division of Air Quality regulations.

Litter Control and Collection Plan

Litter will be controlled by synthetic wrap material placed around baled waste, by placement of daily cover materials, and by installation of debris fencing as needed. Although measures intended to control litter dispersal are effective, it is inevitable that litter collection will still be required.

There will be periods of time when wind conditions are very calm and litter will not be problematic. However, there will be occasions when winds will occur that will scatter litter around the property and onto surrounding properties. When litter collection is necessary, the facility will hire laborers to pick up scattered litter around the facility property and surrounding properties. The collected litter will be placed in garbage bags and disposed of in the loose waste area of the landfill and covered with proper cover materials for litter control.

Contractors will be required to place litter in trash recepticals where the litter will be contained and controlled. Recepticals will be emptied as needed into the loose waste disposal areas of the landfill and covered with proper cover materials for litter control.

Maintenance of Installed Equipment

No equipment is installed, or is planned to be installed, at the landfill, including groundwater monitoring equipment, leachate monitoring and collection equipment, and gas monitoring and collection equipment.

Prohibited Hazardous or PCB Containing Waste

The landfill will be operated as a commercial, nonhazardous solid waste facility and will accept only waste defined in for Class V landfill disposal. It is anticipated that most of the waste delivered for disposal will pass through transfer stations designed and operated to remove materials defined by regulation as hazardous or PCB containing wastes. These procedures will include, at a minimum, formal training of transfer station operators and waste handling personnel in identification and removal of hazardous and PCB containing wastes.

Local wastes delivered to the landfill will most likely not pass through a transfer station and, therefore, will not have been monitored for hazardous or PCB containing wastes. Landfill operators and waste handling personnel will also be trained in identification and removal of hazardous and PCB containing wastes. If hazardous and PCB containing wastes are observed during delivery or disposal, these materials will be removed and arrangements will be made for their proper handling and disposal. The landfill manager will have ultimate authority and responsibility for decisions regarding acceptance or rejection of waste materials.

No hazardous waste as defined by R315-1 and R315-2, except waste specified by R315-303-4(7)(a)(i)(B); or PCB's as defined by R315-301-2(53), except those specified by R315-315-7(2) will be accepted for treatment, storage, or disposal at the landfill. No industrial waste will be received directly from an industrial waste generator. No industrial waste will be received for disposal other than as part of a contract for municipal waste disposal. No waste generated as part of a site cleanup under CERCLA or other contaminated waste from a site remediation will be received for disposal. No waste as described by R315-315-3 will be received for disposal from an incinerator that has a design capacity of more than 10 tons per day.

Disease Vector Control

Both baled and loose waste materials will be received at the landfill that will provide for several methods for controlling vectors. The requirements for baled waste will be slightly different than those for loose waste.

It is anticipated that some of the baled waste will be received with a synthetic wrap around each of the bales. The synthetic wrap provides a barrier around the waste that provides for effective vector control and is expected to satisfy the requirements of a daily cover. Synthetic wrapping that is damaged during loading, offloading, transport, and/or disposal such that the waste material is exposed for more than a day will be either repaired or covered with an approved daily cover material.

Bales received without a synthetic wrap will receive a 6-inch thick daily soil cover or an approved alternative cover on the top surface of each lift and either a 6-inch thick daily soil cover or an approved alternative cover on the perimeter surfaces, other than the leading work face. Waste placement against the leading work faces is a continuous process where these faces are typically exposed for a period of less than 24 hours. When waste placement activities are scheduled such that a working face will be exposed for more than 24 hours (typically on weekends and possibly holidays) without placement of additional waste, an approved cover will be placed for vector control. The cover may consist of a daily soil cover (sloped appropriately for stability), or an alternative cover as provided in R315-303-4 or otherwise approved by the Utah Division of Solid and Hazardous Waste.

Loose waste placed in the landfill will receive a 6-inch thick of daily soil cover, or some type of approved alternative cover on working faces exposed for less than a 24-hour period, for vector control. Alternative cover materials placed on the leading waste faces that are exposed for less than 24 hours may include alternative covers as provided in R315-303-4 or otherwise approved by the Utah Division of Solid and Hazardous Waste. Leading faces exposed for more than 24 hours will receive a 6-inch thick soil cover.

Alternative Waste Handling Plan

If the facility is closed for any reason, waste that is in transit may be stored in the transport containers (e.g. rail car on a siding, truck trailer at the site). Although the site consists of 320 acres which is mostly designed waste disposal facilities, the disposal areas will be constructed in phases as needed. In the event of an emergency, areas of the facility other than the active disposal areas may be used to receive waste (for disposal or temporary storage), but only if such areas are constructed and available. If no such areas are available during an emergency, waste receipt will be temporarily halted until such areas can be made available for disposal or storage and waste in transit will be stored as described.

Training and Safety Plan

Employee health an safety, and maintaining environmental quality are important to Transload America in the operation of the facility. Each person employed at the landfill will be trained to have a working knowledge of basic health, safety, and emergency response procedures for the facility. Those employed to handle waste materials will be trained with basic maintenance and operational procedures to avoid endangerment of human health and safety, and to protect the quality of the environmental. Those employed to operate equipment will receive training for the proper operation, care, and maintenance of the equipment to which they are assigned.

A facility training program will be implement through on-the-job supervision and training and through formal classroom training by individuals qualified to provide the training. The facility training program will be directed by the facility manager, or a designated trainer. Initial training will be completed within the first two months of employment followed by annual reviews and by regular and special training meetings scheduled as needed.

Recycling Program

Recycling activities will occur either at the transfer stations or at the waste source within municipalities and industries. No provisions for recycling will be made at the landfill and the general public will not have access to the landfill.

Closure and Post-Closure Care Plan

Closure and post-closure care plans will be in accordance with the state requirements for closure plans provided in R315-310-3(1)(h) and the state requirements for post-closure care plans provided in R315-310-3(1)(h) and as provided in Sections XI and XII of this permit renewal application, respectively.

Special Waste Handling Plan

Special wastes consist of asbestos, ash, bulk wastes, sludge, dead animals, PCB containing wastes meeting the criterial of R315-315-7, petroleum contaminated soils, and waste asphalt. Special wastes shall be handled and disposed of in a manner that will minimize exposure. All special wastes shall be disposed only on areas designated and assigned to receive special wastes and shall only be disposed by those properly trained to handle the special wastes.

Asbestos wastes shall be handled, transported, and disposed in a manner that will not permit releas of asbestos fibers into the air and must comply with CFR Title 40, Part 61, Section 154. Asbestos packaging shall be inspected to ensure of proper labeling including the waste generator, location where the waste was generated, and provided with a warning label indicating that the container contains asbestos. All vehicles transporting asbestos to the landfill shall also be properly labeled with warning signs as specified in 40 CFR Part 61.149(d)(1)(iii). No asbestos waste shall be accepted from vehicles that are not appropriately labeled and where packaging is not appropriately labeled.

Asbestos waste shall not be accepted without being properly wetted and containerized. Disposal of properly wetted and containerized asbestos waste shall be accomplished by trenching or otherwise providing a depressed area where the asbestos will be disposed, placing the containerized asbestos in the trench or depressed area in such a manner that will avoid causing damage to the packaging, and covering the asbestos with a minimum of 6 inches of soil, or soil type waste that will prevent dispersal of the asbestos fibers. Compaction of materials shall only be allowed after adequate cover thickness has been placed to ensure that the asbestos fibers are not disbursed into the air.

Public access within the facility will not be allowed, therefore, access to areas where asbestos is disposed shall be limited to facility personnel and those contracted by the facility to survey or provide other tasks at the facility requiring access.

Bulky Waste consisting of automobile bodies, furniture, and appliances shall be crushed prior to final disposal. Disposal will only be allowed in areas that are below existing ground surface grade or within the central portion of the waste pile so as to not be under the perimeter slopes of the waste pile.

Ash wastes shall be transported and disposed in a manner that will prevent fugitive dust emissions. No waste as described by R3125-315-3 will be received for disposal from an incinerator that has a design capacity of more than 10 tons per day.

Sludge wastes from water treatment plants, digested waste water treatment processes, or septage shall not be allowed to contain free liquids. All sludges meeting the requirements of R315-303-3(1) for disposal in a Class V landfill shall be disposed near the bottom of the working face and covered with other solid waste or suitable daily cover materials.

Dead Animals shall be managed and disposed to minimize odors and attraction, harborage, or propagation or insects, rodents, birds, or other animals. Dead animals will be disposed near the bottom of the working face or in a trench prepared for the receipt of dead animals and immediately covered with a minimum of 2 feet of other waste. Dead animals placed in trenches will be covered with 6 inches of soil cover material at the end of each working day that carcasses are received.

PCB Containing Waste will only be accepted for disposal that meet the requirements of R315-315-7.

Petroleum Contaminated Soils that are within constituent levels provided in R315-315-8 and that are not classified as a hazardous waste will be accepted for disposal. Waste Asphalt that has been ground and that is not recycled may used for facility roads, accesses, staging areas.

Liquids Minimization Plan

The facility is in an arid climate where precipitation is very low and evaporation is very high which will result in minimizing the precipitation type liquids in the landfill. Liquids resulting from precipitation will also be minimized by placement of daily and intermediate cover materials. No non-containerized liquid waste, containerized liquid waste in containers larger than household size, and sludge waste containing free liquids will be accepted for disposal.

Plans and procedures to address the requirements of R315-303-3(7)(c) through (i) and R315-303-4

The facility will keep a record of the weight of waste received and disposed at the facility. Waste delivered to the facility will either be weighed at transfer stations prior to shipment or weighed at the facility when received for disposal. Weight tickets will accompany all waste shipments when relying upon waste weighed at transfer stations.

A sign will be erected at the access to the facility entrance providing the facility name, an emergency telephone number, that the facility is not open for public access, and other pertinent information regarding facility operations and restrictions.

Fire prevention and control will be accomplished primarily by on-site equipment and by arrangement with the Green River fire department should there be incidents of uncontrollable fires.

Buildings, facilities, and active areas of the facility will be inspected regularly for vectors such as rats, insects, birds , and burrowing animals. Measures will be implemented to minimize vectors should vectors become a nuisance.

Unloading areas and areas of working faces will be minimized as much as possible while providing adequate and safe access for traffic and equipment necessary for facility operations. The facility will be closed to public access, therefore, road maintenance will be adequate to provide for safe access and operations for facility traffic and equipment.

Telephone and/or radio equipment will be provided at a minimum between management offices and those supervising field operations for timely emergency response.

At least two people will be on site during landfill operating hours.

Any other site specific information pertaining to the plan of operation required by the Executive Secretary (R315-302-2(2)(p))

The Executive Secretary may issue by permit additional site specific requirements that will become a part of the facility operating plan.

SECTION VII

PART II

I. FACILITY GENERAL INFORMATION - SPECIAL REQUIREMENTS (R315-310-3(2))

Submit information required by the Utah Solid and Hazardous Waste Act Subsections 19-6 108-(9) and 19-6 108(10) (R315-310-3(2)(a))

Public participation requirements were met as provided under Section IV of this permit renewal application.

Approval from the local government within which the solid waste facility sits

An agreement for the Solitude Landfill entered into between the City of Green River and Landfill Investors, LLC., which entity sold the solitude landfill to Green River Landfill, L.L.C., is included in Exhibit A, Appendix F.

SECTION VIII

PART II

II. FACILITY TECHNICAL INFORMATION - MAPS

Topographic map drawn to the required scale with contours showing the boundaries of the landfill unit (R315-310-4(2)(a)(I))

Topographic mapping is provided in Appendix A,

Ground water monitoring well locations (R315-310-4(2)(a)(I))

A request was made and granted in the original permit application to waive the requirements for ground water monitoring in accordance with R315-308-1(3). Demonstration was provided and accepted by the Division of Solid and Hazardous Waste that there is no potential for migration of hazardous constituents from the facility to ground water during the active life of the facility and the post-closure care period.

Gas monitoring points (R315-310-4(2)(a)(I))

Gas monitoring points will include extreme corners of facility buildings and on each of the eight corners fo the facility property shown on Figure 1 of Exhibit A.

Borrow and fill areas (R315-310-4(2)(a)(I))

Borrow materials will all be obtained from the excavation within the landfill footprint, drainage channels, and other facilities located within the property boundary requiring excavation. The borrow materials will be obtained during construction and operation of the landfills and support facilities. Fill areas are associated with landfill perimeter embankments, berms, roads, and support facilities located within the facility boundary. All these construction areas are presented on the permit design drawings provided with the figures of the original permit application provided in Exhibit A.

Most recent U.S. Geological Survey topographic map, 7-1/2 minute series, showing the waste facility boundary; the property boundary; surface drainage channels; any existing utilities and structures within one-fourth mile of the site; and the direction of the prevailing winds (R315-310-4(2)(a)(ii))

The U.S. Geological Survey topographic map is provided as Figure 1 within Exhibit A. The map shows the direction of the prevailing winds.

SECTION IX

PART II
II. FACILITY TECHNICAL INFORMATION - GEOHYDROLOGICAL ASSESSMENT (R315-310-4(2)(b))

Local and regional geology and hydrology including faults, unstable slopes and subsidence areas on site (R315-310-4(2)(b)(I))

This information is presented in the original permit application included in Exhibit A. Local geology begins with Paragraph 4.1 (page 12) and regional geology begins with paragraph 4.2 (page 14). The discussion provided in Exhibit A includes hydrology and local faults. The property is gently sloping and is built upon the Manco's formation which eliminated concerns of unstable slopes and subsidence areas.

There was an additional evaluation resulting in a modification to the runoff projection within Brown's Wash which is included in Exhibit G. During this evaluation a review of soil types and hydrologic soils groups were obtained from soil surveys conducted in the area of the site and of Brown's Wash. Estimates of the condition of the vegetative cover were determined from a site visit and aerial photographs, and the precipitation depths for the 100-year and the 25-year precipitation events were obtained from "Point Precipitation Frequency Estimates From NOAA Atlas 14" using the latitude and longitude of the center of the site and the center of the Brown's Wash drainage basin. The evaluation was also conducted using the TR-20 SCS software and using the HEC-HMS software from the Army Corps of Engineers.

The Brown's Wash drainage area above the Solitude property is about 27,800 acres or 43.4 square miles (which is basically the same area presented in the original permit application). Brown's Wash drainage area consists of 39%, 33%, and 28% hydrologic soil group B, C, and D soils, respectively. A weighted curve number of 80 was determined using poor vegetative cover over 85% of the drainage area and fair vegetative cover over 15% of the drainage area (the fair cover being in the highest elevation areas of the drainage). This curve number is much higher than the curve number of 65 used in the original permit application which will predict higher flows for Brown's Wash.

The point precipitation depth obtained from NOAA Atlas 14 for the 100-year 24-hour event is 2.81 inches using a latitude and longitude located in the center of the Brown's Wash drainage area. An aerial reduction factor is applied to the precipitation characteristics to simulate the aerial variations that are expected to occur in a large drainage area from any one precipitation event. Information provided in NOAA Atlas 2 resulted in an aerial reduction factor of 95.5% for the 43.4 acre area of the Brown's Wash drainage.

The hydrologic computer model HEC-HMS developed by the US Army Corps of Engineers was used with the information provided above to estimate runoff from the Brown's Wash drainage, The resulting estimated runoff is 2502 cfs which is a little more than double the 1020 cfs estimated in the original permit application. The differences are primarily a result of the difference in the curve number estimated for the drainage area.

Cross-sections were measured at two locations through Brown's Wash as it crosses through the northeast corner of the facility property. The two cross-sections, as measured, are presented on the last page of the calculations for Brown's Wash hydrology. Calculations show that the estimated peak runoff of 2502 cfs for the 100-year 24-hour precipitation event will be contained within Brown's Wash.

Evaluation of bedrock and soil types and properties including permeability rates (R315-310-4(2)(b)(ii))

This evaluation is included with the local and regional geology presented on pages 12 through 15 of the original permit application included in Exhibit A.

Depth to ground water (R315-310-4(2)(b)(iii))

The depth of the regional groundwater table is between 200 and 1000 feet (Exhibit A, paragraph 4.3, page 15) and the depth of the water table in the vicinity of the facility is documented to be at least 200 feet (Exhibit A, paragraph 4.3.1, page 15). There is also locally perched water in the northern part of the facility near Brown's Wash and near the confluences of the drainage channels that pass through the facility with Brown's Wash (Exhibit A, paragraph 4.3.4, page 16).

Direction and flow rate of ground water (R315-310-4(2)(b)(iv))

Regional ground water flow direction is toward the west-southwest as presented in paragraph 4.3 (page 15) of the original permit application included in Exhibit A

Quantity, location, and construction of any private or public wells on-site or within 2,000 feet of the facility boundary (R315-310-4(2)(b)(v))

There are no private or public wells on site or within 2,000 feet of the facility boundary.

Tabulation of all water rights for ground water and surface water on-site and within 2,000 feet of the facility boundary (R315-310-4(2)(b)(vi))

A search of water rights shows only one water right within 2,000 of the facility boundary. This is a surface water right that belongs to the Bureau of Land Management and is used in conjunction with a pond for wildlife and stock watering.

Identification and description of all surface waters on-site and within one mile of the facility boundary (R315-310-4(2)(b)(vii))

There are no surface water bodies within one mile of the facility. Brown's Wash is an ephemeral stream located near the northeast and northwest corners of the facility and is the only identifiable stream located within one mile of the facility. There are three smaller washes that tributaries to

Brown's Wash. One wash is located east of the facility, one is located north of the facility and develops within the facility.

Background ground water and surface water quality assessment and, for an existing facility, identification of impacts upon the ground water and surface water from leachate discharges (315-310-4(2)(b)(viii))

Background water quality indicates that water in the upper aquifer consists of total dissolved solids between 500 and 14,000 mg/l. Water sampled from the perched water below the north area of the facility resulted in a TDS ranging from 9,400 to 30,000 mg/l (Exhibit A, paragraph 4.7, page 17).

Ground Water Monitoring (R315-303-3(7)(b) and R315-308)

A variance was granted with the original permit eliminating the ground water monitoring requirements because of the depth to ground water, quality of the ground water, and the extent of the Mancos shale and the natural barrier it provides.

Statistical method to be used (R315-308-2(7))

No statistical methods are proposed because of the variance in performing ground water monitoring.

Calculation of site water balance (R315-310-4(2)(b)(ix))

A calculation of site water balance is provided in Exhibit A, paragraph 4.8, page 17.

SECTION X

PART II

II. FACILITY TECHNICAL INFORMATION - ENGINEERING REPORT - PLANS, SPECIFICATIONS, AND CALCULATIONS

Documentation that the facility will meet all of the performance standards of R315-303-2

Compliance with the performance standards of R315-303-2 is demonstrated in the April 2003 permit application included in Exhibit A.

Engineering reports required to meet the location standards of R315-302-1 including documentation of any demonstration or exemption made for any location standard (R315-310-4(2)(c)(i))

Compliance with the location standards is presented in Section V and starting on page V-1 of this permit application and in Section 4 of the April 2003 permit application in Exhibit A.

Anticipated facility life and the basis for calculating the facility's life (R315-310-4(2)(c)(ii))

The anticipated facility life and supporting calculations are provided in Section 5, paragraph 5.2, page 20 of the April 2003 permit application in Exhibit A.

Cell design to include liner design, cover design, fill methods, elevation of final cover including plans and drawings signed and sealed by a professional engineer registered in the State of Utah (R315-303-3(3), R315-303-3(6) and (7)(a), R315-310-3(1)(b) and R315-310-4(2)(c)(iii))

Cell design documentation is provided in Section 5, paragraph 5.3, starting on page 20 of the April 2003 permit application included in Exhibit A. Plans and drawings are provided as drawing 2 through 10 of the April 2003 permit application in Exhibit A.

Leachate collection system design and calculations showing system meets the requirements of R315-303-3(2)

A variance was requested and granted in the April 2003 permit application which eliminates the requirements for lining and leachate collection systems due to the soils, geological and ground water conditions at the site.

Equipment requirements and availability (R315-310-4(2)(c)(iii))

Equipment requirements and availability is presented in Section 5, paragraph 5.4, starting on page 22 of the April 2003 permit application included in Exhibit A.

Identification of borrow sources for daily and final cover and for soil liners (R315-310-4(2)(c)(iv))

Description of borrow sources is included in Section 5, paragraph 5.5, page 23 of the April 2003 permit application in Exhibit A.

Run-On and run-off diversion designs (R315-303-3(1)(c), (d) and (e)

Designs associated with of run-off collection and the run-off control system are presented in Section 5, paragraphs 5.6 and 5.8, page 23 of the April 2008 permit application in Exhibit A.

Leachate collection, treatment, and disposal and documentation to show that any treatment system is being or has been reviewed by the Division of Water Quality (R315-310-4(2)(c)(v) and R315-310-3(1)(i))

There will be no lining or leachate collection systems as presented in Section 5, paragraph 5.3, page 20 of the April 2003 permit Application in Exhibit A. Therefore, collection, treatment, and disposal of leachate and its associated documentation are not required.

Ground water monitoring plan that meets the requirements of Rule R315-308 including well locations, design, and construction (R315-310-4(2)(b)(x) and R315-310-4(2)(c)(vi))

A waiver from ground water monitoring was granted in the 2003 permit based the waiver request and demonstration that there is no potential for migration of hazardous constituents from the facility to the ground water during the active live of the facility and the post-closure care period as provided in Section 5, paragraph 5.7, page 23 of the April 2003 permit application in Exhibit A.

Landfill gas monitoring and control plan that meets the requirements of Subsection R315-303-3(5) (R315-310-4(2)(c)(vii))

Landfill gas monitoring of explosive gases will occur quarterly during the active life and post-closure care period of the facility. Monitoring will occur within facility structures and at least each of the eight corners around the perimeter of the facility property. Each monitoring event will be documented and the documentation will include a record of any detections levels that are encountered.

Explosive gas concentrations will not be allowed to exceed 25% of the lower explosive limit (LEL) within facility structures nor 100% of the LEL around the perimeter of the facility property. In addition, the landfill will obtain required air quality permits and conform to ambient air quality standards at the facility boundary or emission standards from any emission of landfill gases, combustion, or any other emission associated with the facility.

Any detection of explosive gas concentrations meeting or exceeding 25% of the LEL within facility structures and 100% of the LEL at the facility boundary or beyond will automatically require implementation of a safety plan that requires:

- Immediate steps to ensure protection of human health.
- Notification to the Executive Secretary within 24 hours of the detection.
- Document in the operating record the explosive gas levels detected and a description of the steps taken to protect human health within 7 days of the detection.
- Implementation of a remediation plan, approved by the Executive Secretary and included in the operating record, for the explosive gas release within 60 days of the detection with a notification to the Executive Secretary that the plan has been implemented.

Slope stability analysis for static and under the anticipated seismic event for the facility (R315-310-4(2)(b)(i) and R315-302-1(2)(b)(ii))

Slope stability is presented in Section 5, paragraph 5.3.1, page 21 and in the geotechnical evaluations provided in Appendix D, Division 4 of the April 2003 permit application in Exhibit A.

Design and location of run-on and run-off control systems (R315-310-4(2)(c)(viii))

Run-on and run-ff control systems are presented in the permit design drawings and in section 5, paragraph 5.8, page 23 of the April 2003 permit application in Exhibit A.

SECTION XI

PART II
II. FACILITY TECHNICAL INFORMATION - CLOSURE PLAN (R315-310-3(1)(h))

Closure Plan (R315-302-3(2) and (3))

A closure plan is provided in Section 6, paragraph 6.0, page 24 of the April 2003 permit application in Exhibit A.

Closure Schedule (R315-310-4(2)(d)(i))

A closure schedule is provided in Section 6, paragraph 6.1, page 24 of the April 2003 permit application in Exhibit A.

Design of Final Cover (R315-303-3(4) and R315-310-4(2)(c)(iii))

Design of the final cover system is provided in the permit design drawings and in Section 6, paragraph 6.2, page 24 of the April 2003 permit application in Exhibit A.

Capacity of Site in Volume and Tonnage (R315-310-4(2)(d)(ii))

Site capacity is provided in Section 6, paragraph 6.3, page 24 of the April 2003 permit application in Exhibit A.

Final Inspection by Regulatory Agencies (R315-310-4(2)(d)(iii))

Final Inspection criteria are provided in Section 6, paragraph 6.4, page 24 of the April 2003 permit application in Exhibit A.

SECTION XII

PART II
II. FACILITY TECHNICAL INFORMATION - POST-CLOSURE CARE PLAN (R315-310-3(1)(h)

Post-Closure Plan (R315-302-3(5) and (6))

A post-closure plan is provided in Section 7, paragraph 7.0, page 25 of the April 2003 permit application in Exhibit A.

Site Monitoring of Landfill Gases, Ground Water, and Surface Water, if Required (R315-310-4(2)(e)(i))

Site monitoring is provided in Section 7, paragraph 7.1, page 25 of the April 2003 permit application in Exhibit A.

Changes to Record of Title, Land Use, and Zoning Restrictions (R315-310-4(2)(e)(ii))

Criteria is provided in Section 7, paragraph 7.2, page 25 of the April 2003 permit application in Exhibit A.

Maintenance Activities to Maintain Cover and Run-on/Run-off Control Systems (R315-310-4(2)(e)(iii))

Maintenance activities are provided in Section 7, paragraph 7.3, 7.4 and 7.5 on page 25 of the April 2003 permit application in Exhibit A.

List the Name, Address, and Telephone Number of the Person or Office to Contact About the Facility During the Post-Closure Care Period (R315-310-4(2)(e)(vi))

Contact information is provided below:

Ms. Marlene Wheaton
76 South Orange Ave., Suite 208
South Orange, New Jersey 07079
(973) 630-7721

SECTION XIII

PART II
II. FACILITY TECHNICAL INFORMATION - FINANCIAL ASSURANCE
(R315-310-3(1)(j))

Identification of closure costs including cost calculations (R315-310-4(2)(d)(iv) and (R315-302-2(2)(n))

Closure cost calculations completed with the April 2003 permit application are presented in Section 8, paragraph 8.0, Table 4 - Summary of Estimated Closure Costs for Cell 1, 2, or 3, page 26, Exhibit A. The following is a revision of Table 4 adjusting the unit and task costs by an inflationary rate of 2.8% per year.

Table 4 Modified
Summary of Estimated Closure Costs for Cell 1, 2, or 3
(Section 8, Paragraph 8.0, Page 26, April 2003 Permit Application, Exhibit A)

Task/Service	Quantity	Units	April 2003 Unit Cost	2008 Adjusted Unit Cost	2008 Task Cost
Conduct Site Evaluation	1	LS	$2,750	$3,160	$3,160
Remove Buildings & Equipment	1	LS	$2,450	$2,815	$2,815
Final Grading	2	Acres	$1,122	$1,290	$2,580
Move & Compact On-Site Clay	4,840	CY	$3.20	$3.70	$17,908
Move & Place Erosion Control Cover	1,613	CY	$12.00	$13.80	$22,259
Subtotal					**$50,730**
Technical & Professional Services	1	LS	7%	7%	$3,551
Contingency	1	LS	10%	10%	$5,073
Total					**$59,355**

Identification of post-closure care costs including cost calculations (R315-310-4(2)(e)(iv))

Post-closure cost calculations completed with the April 2003 permit application are presented in Section 8, paragraph 8.0, Table 5 - Summary of Estimated Post-Closure Costs for Cell 1 or 3, and Table 6 - Summary of Estimated Post-Closure Costs for Cell 2, both on page 26, Exhibit A. The following are revisions of Tables 5 and 6 adjusting the unit and task costs by an inflationary rate of 2.8% per year.

Table 5 Modified
Summary of Estimated Post-Closure Costs for Cell 1 or 3
(Section 8, Paragraph 8.0, Page 26, April 2003 Permit Application, Exhibit A)

Task/Service	Quantity	Units	April 2003 Unit Cost	2008 Adjusted Unit Cost	2008 Task Cost
Post Closure Inspections[1]	120	LS	$500	$575	$69,000
Methane Gas Monitoring[2]	120	LS	$140	$161	$19,320
Repair/Maintain Cover[3]	4,260	Acres	$12	$14	$58,788
Subtotal					**$147,108**
Technical & Professional Services	1	LS	7%	7%	$10,298
Contingency	1	LS	10%	10%	$14,711
Total					**$172,116**

Table 6 Modified
Summary of Estimated Post-Closure Costs for Cell 2
(Section 8, Paragraph 8.0, Page 26, April 2003 Permit Application, Exhibit A)

Task/Service	Quantity	Units	April 2003 Unit Cost	2008 Adjusted Unit Cost	2008 Task Cost
Post Closure Inspections[1]	120	LS	$500	$575	$69,000
Methane Gas Monitoring[2]	120	LS	$140	$161	$19,320
Repair/Maintain Cover[3]	7,200	Acres	$12	$14	$99,360
Subtotal					**$187,680**
Technical & Professional Services	1	LS	7%	7%	$13,138
Contingency	1	LS	10%	10%	$18,768
Total					**$219,586**

Notes to tables included in Section 8, paragraph 8.0, page 27 include:

1. May be reduced to annual inspections upon site stabilization, with DEQ approval.
2. May be discontinued upon site stabilization, with DEQ approval.
3. Calculated at 2 cy/acre x 120 acres x 30 years

Identification of the financial assurance mechanism that meets the requirements of Rule R-315-309 and the date that the mechanism will become effective (R315-309-1(1)

The Owners propose to use a bond as the financial assurance mechanism. Each Cell will have its own bond as an individual funding mechanism. A stand-by trust fund will be established if bonds that do not allow partial-payments are used.

The financial assurance mechanism may be re-established as approved by the Utah Division of Solid and Hazardous Waste at the time of each annual financial assurance re-evaluation during the operational life and post closure care period of the facility.

EXHIBIT A

CLASS V
LANDFILL APPLICATION

Prepared for:
Green River Landfill, LLC
A Utah Limited Liability Company

Prepared by:

Infill Companies
2825 East Cottonwood Parkway
Suite 500
Salt Lake City, Utah 84121

April 2003

HAND DELIVERED

APR 29 2003

03.01555

Utah Division of Solid and Hazardous Waste

CLASS V LANDFILL APPLICATION

Prepared for

Green River Landfill, LLC
A Utah Limited Liability Company

Prepared by

Infill Companies
2825 East Cottonwood Parkway, Suite 500
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1.0 GENERAL INFORMATION

Landfill Investors, LLC proposes to permit a Class V commercial solid waste landfill, the "Solitude Landfill", within the boundaries of the City of Green River, Emery County, Utah. The landfill will be a commercial nonhazardous solid waste disposal facility used for the disposal of municipal solid waste and any other nonhazardous solid waste, not otherwise limited by rule or solid waste permit for disposal. It is intended that the landfill will be operated in accordance with all Federal and State laws and regulations applicable to the management and operation of landfill sites. This includes, but is not limited to, the Rules of the Utah Solid Waste Disposal Act and Subtitle D of the Resource Conservation and Recovery Act.

1.1 NAME OF FACILITY

Solitude Landfill

1.2 SITE LOCATION

The landfill property is an irregularly shaped 320 acre parcel in Section 22, Township 21 South, Range 17 East, Salt Lake Base and Meridian (see Figure 1). The site is located approximately nine miles east of the Green River in the City of Green River. The latitude and longitude coordinates of the entry gate are:

Latitude:	N 38° 58' 20"
Longitude:	W 110°1' 42"

1.3 FACILITY OWNER

Green River Landfill, LLC
4570 Westgrove Drive, Suite 240
Addison, Texas 75001
972-407-0550

1.4 FACILITY OPERATOR

Landfill Investors, LLC
4570 Westgrove Drive, Suite 240
Addison, TX 75001
(972) 407-0701

1.5 LOCAL CONTACT PERSON

Pete Fote
2825 East Cottonwood Parkway, Suite 500
Salt Lake City, UT 84121
801-990-3456

1.6 TYPE OF FACILITY

Class V Commercial Landfill

1.7 TYPE OF APPLICATION

Initial Application

1.8 PROPERTY OWNERSHIP

Green River Landfill, LLC, a Utah Limited Liability Corporation, owns the property; proof of ownership is included in Appendix A.

1.9 CERTIFICATION OF SUBMITTED INFORMATION

The certification of submitted information is included below:

CERTIFICATION OF SUBMITTED INFORMATION

_________________________, President
(Name of Official) (Title)

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 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.

Signature:_________________________, Date 4/28/2003

SUBSCRIBED AND SWORN to before this 28th day of April, 2003.

My commission expires on the 5th day of February, 2005.

Roxie Hebert
Notary Public in and for

(SEAL) Dallas County, Texas.

ROXIE HEBERT
Notary Public, State of Texas
My Commission Expires
February 05, 2005

SECTION TWO INTRODUCTION

2.1 PROJECT SUMMARY

Green River Landfill, LLC (Owner), a Utah Limited Liability Corporation, and Landfill Investors, LLC (Operator) are a partnership of commercial landfill development firms with local offices in Salt Lake City, Utah. The Owner and Operator are making this application for the purpose of disposing of municipal solid waste and any other nonhazardous solid waste, not otherwise limited by rule or solid waste permit for disposal. The site for the new Class V Municipal Sold Waste (MSW) landfill is approximately nine miles east of the Green River in the City of Green River. The landfill will accept only waste delivered by truck and/or rail from municipal clients in Utah and throughout the United States under contract with Landfill Investors.

2.2 GENERAL DESCRIPTION OF THE FACILITY

The Solitude Landfill (Landfill) will be located on 320 acres of privately owned land located in Section 22, Township 21 South, Range 17 East, Salt Lake Base and Meridian. It is bordered on all sides by undeveloped land. Figure 1 shows the location of the site. Proof of ownership is included in Appendix A. Within the site boundaries are located three disposal cells and associated access roads.

The land use zoning of the site and the properties adjacent to the Landfill boundary is designated Industrial. The Landfill site will be surrounded by a chain-link security fence, phased in place as each cell is constructed. Other fencing may be placed between cells, as may be appropriate to or directed by various municipal clients. Access to the landfill will be gated to prevent unauthorized entrance when the landfill operator is not present. The locked gate will be located approximately 800 feet south of the northwest property corner. Entrance to the Landfill will be from the west along an improved all-weather road.

2.3 LEGAL DESCRIPTION OF FACILITY

The property was surveyed in June 1994 and the topography was mapped. The topographic map is provided here as Figure 2, Site Map.

2.4 TYPES OF WASTE AND AREA SERVED

The Landfill will accept waste as defined by R315-301-2 (11): The landfill will be a commercial nonhazardous solid waste disposal facility used for the disposal of municipal solid waste and any other nonhazardous solid waste, not otherwise limited by rule or solid waste permit for disposal. This waste will be delivered to the Landfill by truck and/or rail. The potential area served is the State of Utah and municipalities outside of the State of Utah. No hazardous waste will be accepted (see Section 3).

3.0. PLAN OF OPERATION

The purpose of the Plan of Operation is to provide an accurate description of the daily operation of the Landfill.

3.1 SCHEDULE OF CONSTRUCTION

The Owner will begin construction within 60 days following 1) approval by the Utah Department of Environmental Quality to operate the Landfill, 2) approval by the City of Green River to operate the Landfill, and 3) approval of the Governor and the Legislature. Table 1 presents the proposed schedule of general site construction, and construction of the first cell; however, rail access will be not be constructed until such time as the volume of waste makes it feasible or the demand of contracted municipalities requires it.

Table 1
Schedule of Construction

Start Date	Construction Activity	Completion Date
Notice + 60 days	Stake Disposal Cells for Excavation	Notice + 70 days
Notice + 72 days	Excavate First Disposal Cell & Stockpile Dirt	Notice + 102 days
Notice + 72 days	Grade and surface access road to site	Notice + 93 days
Notice + 102 days	Construct 1000 sf Operations Building	Notice + 144 days
Notice + 102 days	Fence & Gate Property	Notice + 137 days
Notice + 147 days	Facility Open for Disposal Operations	NA

Notice = Notice of Approvals and Contract Completion

The Landfill will be constructed with three disposal cells. One, two or all three cells may be constructed at once, depending on contractual arrangements with municipal clients. For example, two municipalities may allow co-mingling of their waste in one cell, while a third may demand a separate cell. Additionally, while it is intended to operate the Landfill as a bale-fill, a municipality that does not utilize baling technology will need a separate cell. The result of this potential variability is that the Schedule of Construction may be modified.

3.2 DESCRIPTION OF ON-SITE WASTE HANDLING PROCEDURES

The Landfill will be operated by Landfill Investors, LLC. Management of the Landfill will be conducted out of the operations office at the Landfill. The local contact at the site will be designated by the Owner's Utah Manager, Pete Fote. Daily operation of the landfill will be under the direction of his designated Landfill Operator (Operator) on site.

The landfill design will incorporate an excavated cut-and-fill method, excavating three disposal areas below the natural ground surface to an approximate maximum depth of between 30 to 35 feet (see Drawings 6 and 7). The bottom will be graded at approximately 2 percent slope, south to north, to follow the general topography of ground surface. The below-grade disposal area will be excavated and constructed prior to acceptance of waste. Disposal of waste will continue until the entire area has been filled to ground surface, then from ground surface up to a height of approximately 35 feet.
The gate to the landfill will be kept locked at all times that the landfill is not in operation. It is the responsibility of the operator to unlock the gate each morning and lock the gate at the

end of the day. The operator is responsible for directing vehicles to the proper location for disposal of waste. Direction of vehicles also may be accomplished through the placement of directional signs. An operator will attend the landfill at all times that the landfill is open.

3.2.1 Bale-Fill Operation.

The Operator will direct trucks with bales to the working face of the landfill cell designated for bales, where he will direct unloading and placement of the bales. Bales will be placed in such a manner as to reduce or eliminate air space between bales and to create the effect of an interlocking wall of bales. The number of bales accepted for disposal will be maintained on a daily basis. The Operator will take a photograph of the bale-fill working face at the end of each working day and prior to placement of required daily cover.

A Daily Operating Record form shall be completed during each day of operation at the landfill. An example of the Daily Operating Record is included in Appendix B. For the bale-fill cell, information shall include number and type/size of bales, inspection log, and any deviations from the approved Plan of Operation, along with the reason for the deviation. Completed forms shall be kept on file at the site.

3.2.2 Compacted Fill Operation

Non-baled waste may be delivered to the Landfill by either truck or rail car. In either event, the vehicles will be unloaded at the site and the waste moved to the working face of the compacted fill disposal cell. The operator will perform load counts on a daily basis, making a record of the number, type, maximum volume and tare weight of each delivery vehicle arriving at the site. A Daily Operating Record form shall be completed during each day of operation at the landfill. An example of the Daily Operating Record is included in Appendix B. Information shall include accurate load counts, type of waste, inspection log, and any deviations from the approved Plan of Operation, along with the reason for the deviation. Completed forms shall be kept on file at the site.

Incoming waste will be deposited at the working face under the direction of the operator. Refuse will be compacted across the working face with a compactor to achieve maximum practicable in-place density. The working goal for in-place density will be the range of 1100 to 1400 pounds per cubic yard. In-place density will be determined by calculation using disposal records (weight and volume) and a topographic survey. Density calculation will be performed on an annual basis so that the information will be complete in time for the annual report to the DEQ.

The working face of the compacted disposal cell will be covered daily with a minimum of six inches of soil over the surface of all exposed waste.

3.3 INSPECTIONS AND MONITORING

The schedule for inspections and monitoring of landfill facilities to ensure proper operation and maintenance is provided in Table 2.

TABLE 2
INSPECTION AND MONITORING SCHEDULE

Inspection/Monitoring Activity	Frequency
Access road and gate	Monthly
Fence inspection	Monthly
Landfill equipment maintenance	Per manufacturers recommendations
Closure final cover inspection	During closure activities
Post Closure Inspection/Maintenance	Quarterly
Post Closure Monitoring	Quarterly

There is no installed equipment at the landfill such as monitoring wells, leachate collection or gas collection systems, therefore there is no required maintenance as specified in UAC R315-302-2(2)(h).

3.4 CONTINGENCY PLANS FOR FIRE OR EXPLOSION

As a precaution to avoid a fire hazard, all waste shall be covered with soil on a daily basis (Section 3.2). In the event that fires do occur during operating hours, the burning material will be separated from other material and covered with soil, using on-site earth-moving equipment.

Small fires may be extinguished with the fire extinguishers provided in the site vehicles or by using on-site water, available from the water storage tank and/or the water trailer. Upon notification of an on-site fire, which is not controllable with on-site fire protection equipment, a long blast (greater than 30 seconds) on a vehicle horn will be sounded, and nonessential equipment will be shut down. All site personnel will assemble outside the landfill entrance, the City of Green River Fire Department will be alerted and all personnel will move to a safe distance from the involved area until the fire is extinguished. The telephone number and location of the nearest fire station will be displayed in the site office and in all site vehicles.

Fires that occur during times that the landfill is closed will be more difficult to control due to the time available for the fire to spread. If a fire is reported after hours, the Operator or Landfill Manager may utilize site equipment to segregate the burning portion and bury the fire with soil. Otherwise, the local fire department will be summoned to control the fire.

The contingency plan for dealing with explosive gasses is provided in Section 3.6.1. Such gases, however, are not expected to be generated within this Class V landfill due to the dry nature of the waste and the extremely limited availability of moisture to be entrained within the landfilled waste.

3.5 CORRECTIVE ACTION PROGRAMS FOR GROUNDWATER CONTAMINATION

Groundwater monitoring will not be performed at the Solitude Landfill; therefore no corrective action programs are included with this application.

3.6 CONTINGENCY PLANS FOR OTHER RELEASES

3.6.1 Explosive Gas

Due to the types of waste received and the dry climate of Utah, this landfill should generate little, if any, explosive gas. If quarterly gas monitoring indicates that methane gas exceeds the LEL at the property boundary; however, corrective measures will be implemented within ten (10) days. The contingency plan for implementing corrective measures will include 1) notification to The City of Green River and DEQ, 2) increasing quarterly monitoring frequency to monthly, and 3) installation of a passive venting system.

3.6.2 Run-Off Control System

During operation of the below-grade disposal operations, there will be no potential for failure of the run-off control system. During operation of the above-grade disposal operations, however, the perimeter berms that constitute the run-off control system could be compromised by such incidents as an excessively heavy rainfall or accidental breach by equipment. The contingency plan for dealing with such failure is first to re-direct surface flow (if any) back into the perimeter, and second to reconstruct the berm sufficiently to function as designed. All aspects of this contingency plan can and will be implemented using on-site equipment.

3.7 FUGITIVE DUST

Fugitive dust is not expected to be a nuisance; there are no residences within one-half mile of the facility. If, at any point in the operation of the facility, fugitive dust is determined to be a problem, measures will be taken to control it, which may include watering the road. Fugitive dust will be addressed routinely as necessary to comply with Division of Air Quality regulations.

3.8 MAINTENANCE OF INSTALLED EQUIPMENT

No equipment is installed, or is planned to be installed, at the Landfill, including groundwater monitoring equipment, leachate collection equipment, and gas collection and monitoring equipment.

3.9 PROCEDURES FOR EXCLUDING HAZARDOUS WASTE

The landfill will be a commercial, nonhazardous solid waste disposal facility and will accept waste as defined in R 15-301-2 (11). The landfill will accept municipal solid waste and any other nonhazardous solid waste, not otherwise limited by rule or solid waste permit for disposal; the landfill will not accept hazardous waste.

By contractual agreement, waste delivered to the Solitude Landfill that has originated from a Transfer Station will be required to design and implement procedures for excluding hazardous waste. These procedures will include, at a minimum, formal training of Transfer Station operators and / or collection personnel in the identification and removal of hazardous waste and hazardous materials.

Although procedures initiated at the respective Transfer Stations should preclude the delivery of hazardous waste to the Landfill, the Landfill Operator will also be responsible for identification and prohibition of unacceptable wastes that may be discovered in un-baled waste or loose waste delivered by a local or regional municipality that does not have access to a Transfer Station.

Loads will be inspected as they arrive and any suspicious waste will be refused access to the landfill. The dozer operator also will become aware of unacceptable waste in any waste material as he is working and compacting the load. Any suspicious waste discovered on the working face will be segregated from the other waste pending alternative disposal. The Landfill Manager will have the ultimate authority and responsibility for decisions regarding acceptance or rejection of any waste.

3.10 PROCEDURES FOR CONTROLLING VECTORS

The waste accepted at the Solitude Landfill will be either baled or loose. In either event, the waste will originate from a Transfer Station and as a result will be relatively dry. This type of waste does not lend itself to attracting or generating disease vectors; however, all waste shall be covered on a daily basis to prevent scattering of waste or attracting disease vectors. Standing water shall be allowed to drain to the extent possible to preclude the harboring of mosquito larvae.

3.11 PLAN FOR ALTERNATIVE WASTE HANDLING

If the site is closed for any reason, waste that is in transit may be stored in the transport containers (e.g., rail car on siding, truck trailer at site). Although the Solitude site comprises 320 acres, the entire facility (three cells and associated roadways, etc.) may not be constructed initially. In the event of an emergency, another area of the facility may be used to receive waste (whether for disposal or temporary storage), but only if such areas are constructed and available. If no such areas are available during an emergency, waste flows will be halted and waste in transit will be stored as described above.

3.12 GENERAL TRAINING AND SAFETY PLAN

Each employee who works with solid waste at the Landfill will be trained and have a working knowledge of basic maintenance and operational techniques necessary to operate and maintain the facility in a manner which does not endanger human health and safety or environmental quality, including emergency response and contingency plan implementation. Training will be accomplished through both on-the-job training and classroom training sessions (e.g. SWANA training classes).

The facility-training program will be directed by the Landfill Manager, or a designated professional trainer. Initial training will be completed within two months of employment followed by an annual review of basic waste management skills or formal annual training.

3.13 RECYCLING

Recycling activities will be performed by the contracted municipalities prior to any waste being delivered to the Landfill. No provisions for recycling will be made at the Landfill and the general public will not have access to the Landfill.

3.14 COMMERCIAL DISPOSAL FACILITY REQUIREMENTS, R315-310-3(2)

After receiving a permit from the Executive Secretary, Solitude will gain approval from the City of Green River, the Governor and the Legislature of the State of Utah.

SECTION FOUR GEOHYDROLOGICAL REPORT

4.0 GEOHYDROLOGICAL REPORT

The site is particularly suited for a landfill due to its remote location, small amount of annual precipitation (6.5 inches), high evapotranspiration (55.9 inches), low-permeable bedrock immediately below the site, the considerable depth to groundwater and the poor quality groundwater. The site, and the area surrounding the site, is not used for agriculture due to the lack of water and the poor soil and vegetative conditions.

The site conforms to the following location standards set forth in R315-302-1 (2):

- The site is not located within one thousand feet of any national, state, or county park, monument, or recreation area; designated wilderness or wilderness study area; or wild and scenic river area; ecologically and scientifically significant natural areas; or farmland which is classified as "prime," "unique," or of "statewide importance."
- No permanent dwellings or historic structures or properties exist within one-forth mile of the site.
- The site is not located within five miles of any airport runway.
- No archeological sites are nearby.
- The site is not located in a subsidence area, a dam failure flood area, above an underground mine, or above a salt dome or salt bed.
- The site is not located within 200 feet of a Holocene fault, nor is it located within a seismic impact zone.
- The local geology of the site, confirmed by field study, does not indicate that it is an unstable area subject to differential settling.
- The site is not located in any public land used by a public water system for watershed control for municipal drinking water purposes, or in a location that could cause contamination to a lake, reservoir, or pond.
- The site is not located in a flood plain or wetland area.
- Based on hydrogeologic studies in the area, the aquifer below the site is 200 to over 1000 feet below the surface. Although some isolated perched water pockets 25 to 40 feet below the surface were found along the ephemeral streams, the water quality of this water was found to be contain generally greater than 10,000 mg/L TDS.
- There are no threatened or endangered species at the site. (See letter from Utah Division of Wildlife Resources, Appendix F)

4.1 LOCAL GEOLOGY

The proposed landfill site lies on a gently northwest-sloping pediment that has developed on the Mancos Shale (see Figure 2, Geologic Map, and Figure 3, Geologic Cross Section). The site is typical of Badlands topography and is dissected with arroyos and ephemeral streams. Brown's Wash, a large ephemeral stream, crosses the northern portion of the site flowing west. A tributary of Brown's Wash also crosses the site flowing in a northwest direction and joins Brown's Wash outside of the West boundary of site. Brown's Wash flows into the Green River approximately 6 miles west of the site.

The drainage area of Brown's Wash located upgradient from the Solitude Landfill site encompasses 27,930 acres (see attached map, Figure 4). The estimated flow in Brown's Wash originating from a 100-year storm event was calculated using the TR-20 SCS method. The attached sheets present the assumptions, input parameters, resulting hydrograph, and conclusions. Based on the input parameters used, the estimated peak flow from this storm event is 1020 cfs.

The calculated depth of flow of 3.46 ft will remain within the confines of the channel, which is approximately 5 ft deep. The peak velocity of 8.3 fps necessitates that some rip rap be placed on the banks of the channel, near the northeast corner of Cell 1, extending approximately 30 to 50 feet on either side of the point of closest approach of the channel to the site boundary. The riprap will serve to protect the corner of Cell 1 from undercutting. No other effects are anticipated from runoff in Browns Wash.

There is no runoff from open cells. All runoff in contact with waste is maintained within the open cell (see Figure 8 of the Permit Application). During construction and waste filling of the above-grade portion of the cells, a berm will be maintained around the perimeter of the open portion of the cell to prevent runoff.

Ground elevations at the site range from approximately 4300 to 4400 feet above mean sea level; the Green River, located six miles west of the site, is at about 4050 feet above sea level. The south edge of the site is bounded by low barren hills. The eroded flank of the East Tavuputs Plateau (Book Cliffs) is about 5 miles to the north and east of the site.

The climate of the site is semi-arid and generally has little vegetation, consisting of clumps of shad scale, occasional salt grasses, and isolated cactus plants (Hepwirth, 1963).

4.1.1 Stratigraphy

Soil cover over the site is generally very thin and consists of either a thin layer of alluvium or weathered shale. The northern and some of the central portions of the site are covered with alluvium and/or terrace deposits from the ephemeral stream channels in those areas (see Figure 2). Generally, alluvial deposits are near the base of the plateaus and near the larger stream channels where they contain a wide range of grain sizes, varying from boulders to clay. Subsurface logs from test pits and drill holes from the site show that the depth of alluvium generally ranges from 0 to 22 feet with the thicker depths near the stream channels. The remaining areas of the site are covered with an overburden that consists of silty clay material, weathered from the Mancos Shale bedrock. Test pits and borings indicate that the depths of silty clay overburden ranges from 0 to 5 feet. Test pit and drill hole logs are presented in Attachment 1.

Bedrock at the site consists of outcrops of the Mancos Shale formation, which is a dark-gray marine shale. Drilling logs from water and oil wells in the vicinity indicate that the Mancos Shale has a minimum thickness of about 1100 feet in the area of the site. Projecting the dip angle of the lower contact of the Mancos outcropping southwest of the site (see Figure 2, Geologic Map), the shale would be approximately 1420 feet thick below the site. The Mancos Shale formation has two distinguishable members in the lower part of the section in the area of the site. In descending order these are the Ferron Sandstone and Tununk Shale. These both outcrop approximately 2 miles southwest of the site. Projecting the dip angle of these beds indicates that the Ferron Sandstone would be approximately 1300 feet below the site.

Directly below the Mancos Shale formation lies the Dakota Sandstone with a maximum thickness of 200 feet. The Dakota Sandstone comprises the top layer of the Mesozoic Sandstone Aquifer, an aquifer composed of a thick sequence of 11 bedrock units that are mostly sandstones. The maximum thickness of the Mesozoic Sandstone Aquifer is about 3000 feet. Underlying the Mesozoic Aquifer is the Lower Mesozoic and Upper Paleozoic confining beds, which are comprised of interbedded layers of siltstone, shale, sandstone and a highly impermeable layer of evaporites with a maximum thickness of 12,000 feet. Under the confining beds is the Lower Paleozoic Aquifer which is comprised of siltstones, sandstones, and limestones. A conceptual geologic cross section has been prepared as Figure 3 and shows a profile of general subsurface conditions

4.1.2 Structural Geology

A site investigation performed in 1994 included coring into the Mancos Shale to characterize the bedrock. The bedrock was determined to be highly weathered in the top 0 to 10 feet of the shale, rapidly grading to a competent shale to the maximum depth of the coring (140 feet). The Rock Quality Designation (RQD) of the bedrock ranged from 0 near the surface to 100% at about 30 feet deep and deeper. Joint spacing ranged from 0-1 inches near the surface to over 5 feet at the bottom of the corings. Some vertical fracturing was observed in the upper 20 feet of the corings, but at depths over 20 feet the joints were relatively clean and largely horizontal with some evaporite material (gypsum) found along the joints.

The nearest Holocene fault, the Little Grand Fault is located 1¼ miles south of the site. The Little Grand Fault runs generally east-west and is a normal fault that is approximately 12 miles in length (Rush, 1982). Although some smaller faults are located approximately 5 miles to the east and about 3 miles to the southwest, seismic activity at the site is probably governed by the larger and closer Little Grand Fault. Seismic activity at the site is considered minimal based on USGS National Seismic Hazard Mapping Project (http://geohazards.cr.usgs.gov/eq/index.html). According to the probabilistic ground motion values given for the site's coordinates, there is a 90% probability of not exceeding a horizontal acceleration of 0.05 g in 50 years.

4.2 REGIONAL GEOLOGY

The proposed facility is located in the northern portion of the Paradox Basin, which is in the Canyonlands section of the Colorado Plateau. The region is characterized by young-to-mature plateaus and large topographic relief. Paradox basin is not a definable physiographic feature but consists of the portion of the Colorado Plateau that is underlain by a thick sequence of evaporite (salt) beds.

Rock units in the area dip gently to the northwest. Identifiable rock outcroppings in the region include the Mesaverde Group, which is a sandstone unit with seams of shale and coal; the Book Cliffs and higher elevation plateaus are formed from Mesaverde Group. Below the Mesaverde Group lies the Mancos Shale formation which is a dark-grey marine shale; the proposed site lies on an outcropping of the Mancos Shale Formation. Beneath the Mancos Shale formation lies the Dakota Sandstone which comprises the top layer of the Mesozoic Sandstone Aquifer, an aquifer composed of a thick sequence of 11 rock units that are mostly sandstones. The Dakota Sandstone outcrops about six miles south of the site. Further south of the site is a large outcropping of the Lower Mesozoic confining beds which consists of interbedded layers of siltstone, shale, sandstone, and evaporite beds. The Canyonlands area, approximately 30 miles south of the site, is formed from the Lower Mesozoic Confining beds. Under the confining beds is the Lower Paleozoic Aquifer which is comprised of siltstones, sandstones, and limestones.

4.3 GROUNDWATER

Based on drill holes from the surrounding area, the groundwater is at significant depths and is of generally low quality. Groundwater flow is generally to the west-southwest from areas of recharge (Book Cliffs) toward areas of discharge (Green River). Analysis of wells drilled in the area indicated minimum depth of water is 200 feet and maximum is over 1,000 feet.

Groundwater in the area occurs primarily in two separate aquifers: the upper Mesozoic sandstone aquifer and the lower Paleozoic aquifer. The upper and lower aquifers are hydraulically separated by thick beds of evaporates which effectively delineates the two aquifers and cause the aquifers to act independently. All ground water recharge to the aquifer system from the ground surface is limited to the upper aquifer, as the lower system is hydraulically isolated from the surface. Potential leakage between the aquifers is in an upward direction under the site (Rush, 1982).

4.3.1 Upper Aquifer Characteristics

The upper Mesozoic aquifer consists of a thick sequence of 11 northwesterly-dipping rock units that are mostly sandstones. The aquifer has a maximum thickness of 3,000 feet and is confined in the area of the site by the impermeable Mancos shale formation. Generally, water occurs in the rocks of the unsaturated part of the upper ground water system as a result of recharge from local precipitation. The precipitation vertically percolates downward toward the underlying zone of saturation where it begins to move horizontally. Regionally much of the upper aquifer is unsaturated, although perched water is common.

Water in the upper aquifer is generally found at depths greater than 200 feet. The potentiometric surface of the upper aquifer is the lowest near the Green River and rises away from the river: the elevation of the potentiometric surface is at least 200 feet below the ground surface of the site according to a potentiometric map developed by Rush (1982).

4.3.2 Upper Aquifer Recharge

Recharge from precipitation in the area of the site is probably minimal due to the outcropping of the impermeable Mancos Shale at the site. The majority of recharge to the upper aquifer system is greatest near the Book Cliffs, where the precipitation is relatively large, and along the ephemeral streams, where infiltration is most likely (Rush, 1982).

No recharge to the upper aquifer occurs due to inflows from the Green River. The potentiometric maps of the aquifer suggest instead that the river acts as a drain for the area. Recharge to the upper aquifer also occurs from subsurface inflows from the adjacent areas.

Potentiometric maps of the area indicate that most of the ground water inflow is from the San Raphael Swell to the west and the Book Cliff area to the north and east (Rush, 1982).

4.3.3 Upper Aquifer Outflows

Groundwater in the upper aquifer is too deep to be subject to evapotranspiration although the shale forms soils with minimal permeability and large porosity that retains temporarily stored water near the ground surface. Here it is easily discharged from perched water areas by transpiration due to plants and evaporation from the soil. Most of the evapotranspiration occurs along the larger ephemeral streams where there is perched water.

Several studies have been performed to determine the amount of outflow from the upper aquifer system into the Green River. Potentiometric maps and mass balance equations for the Green River indicate that regionally, there is flow from the upper aquifer into the Green River, although there appears to be very little local subsurface flow from the area based on potentiometric maps of the region. Regionally, subsurface flow from the area appears to flow from the area near the Green and Colorado River confluence to the south of the site. Discharge from wells and springs is believed to be minimal as there are no large diameter wells in the vicinity of the site, and there are few springs, and these springs generally flow from the perched water table (Rush, 1982)

4.3.4 Perched Water

During the 1994 field investigation, perched water was initially found in four locations at the site, in exploratory drill holes and monitor wells DH-2, MW-2, MW-5, MW-7 and DH-10. MW-7 was later discovered to be dry after completion of the monitor well. The only drill holes that produced perched water are found near the ephemeral streams. The perched water is believed to be isolated pockets of water that have been recharged from runoff from the ephemeral channels and does not extend across the site.

4.4 WELL INVENTORY

A search of water rights on file with the Utah Division of Water Rights indicated that no wells were located within 5 miles of the site (Appendix C).

4.5 WATER RIGHTS

The only water rights within a radius of 5 miles of the site include seven livestock watering ponds, five springs, and eight diversions along the ephemeral streams in the area. The City of Green River procures potable water from the Green River and does not utilize wells because of the significant depth to, and poor quality of, the ground water.

4.6 SURFACE WATER

Two large streams, the Colorado and Green Rivers, flow through the region in a southerly direction. The Colorado River is located approximately 45 miles east of the site and the Green River is located about 6 miles west of the proposed site. Two smaller perennial streams, the Price and San Rafael Rivers, enter the Green River from the northwest at a distance of 12 miles north and 16 miles south of the site, respectively. Most of the drainages in the area have ephemeral streams that flow in response to snowmelt or runoff from precipitation events.

4.7 WATER QUALITY

Existing data from Rush (1982) indicate that the ground water from the upper confining bed (Mancos Shale) and the upper aquifer (Mesozoic Sandstone) is brackish with dissolved solids levels from 500 to 14,000 mg/l. This would classify the water as Class II (drinking water) to Class IV (saline ground water) according to the *Administrative Rules For Ground Water Quality Protection*, (DWQ, 1993).

Perched water samples were obtained on July 29, 1994 from DH-2, DH-10, MW-2 and MW-5. Laboratory results, which are provided in Appendix D, indicate that the quality of the perched water below the site is of poor quality with TDS values ranging from 9,400 to 30,000 mg/l. These TDS values would generally classify the perched water as Class IV (Saline Groundwater), for TDS above 10,000 mg/l. This is based on the groundwater aquifer classification system established in the Utah Groundwater Quality Protection Regulations.

4.8 CALCULATION OF SITE WATER BALANCE

The site is semi-arid with annual precipitation at the site estimated to average 6.5 inches a year (*Utah Climate*, 1992). Annual evapotranspiration is significantly higher (55.9 inches) than the average precipitation at the Site. The site is characterized by a thin layer of soil that overlies the Mancos Shale bedrock. The soil consists of permeable silty gravel alluvium near the larger ephemeral streams with a thinner layer of silty clay soils over the rest of the site.

The upper ten feet of bedrock is highly weathered and permeable but grades rapidly to a non-weathered impermeable shale (permeability values range from 10^{-7} cm/sec to 10^{-13} cm/sec). The site is dissected with small arroyos that have developed in the largely silty clay overburden.

The range of ground water depths in the area, based on available well logs and references, ranges from 200 to over 1,000 feet below ground surface (Rush, 1982). Subsurface investigation of the site indicates that there is perched water near the larger ephemeral streams that ranges in depth from 27 to 39 feet.

Test results indicate that the minus 200 fraction of the soils (silt and clay portion) ranges between 5% and 44% in the alluvial areas of the site and between 20% and 90% in other areas of the site. The majority of the site soil would be generally classified as silty or sandy clay. Soils in the alluvial areas would be classified as either silty gravels or silty sand with gravel. A permeability test conducted on an uncompacted sample had a result of 2.2×10^{-4} cm/sec; tests conducted on compacted samples (95% Proctor maximum dry density) had results of 3.2 to 5.4×10^{-8} cm/sec.

4.8.1 HELP MODELING

Site conditions and the proposed design of the landfill were used to predict the site water balance and the hydrologic characteristics of the landfill using the computer program Hydrologic Evaluation of Landfill Performance (HELP). HELP calculates runoff, infiltration, evapotranspiration, and flux through the potential landfill. HELP has the option to synthetically produce rainfall based on data from one of 139 default cities in the program database. Grand Junction, Colorado is the closest city to the site which is in the database

(85 miles), and which has elevation and climate characteristics similar to Green River. The Grand Junction temperature and precipitation values were modified by entering temperature and precipitation values for Green River, Utah taken from *Utah Climate* (Ashcroft, 1992).

4.8.1.1 HELP Sensitivity Analysis

Two landfill hydrologic performance sensitivity cases were analyzed utilizing the HELP model, which included an active (open cell) case and a post-closure case. Both scenarios were modeled for a period of 20 years. The active period of the landfill is the worst-case scenario because there is significantly less evaporation and runoff than during post-closure conditions. Post-closure conditions were also modeled to predict long-term infiltration through the final cover, and infiltration through the landfill profile into the underlying bedrock.

The active (short-term) case conditions simulate the open waste cell during the commencement of disposal of waste material. The assumed exposed layer for the active case is a waste layer. Runoff in the model is allowed from the surface of the daily cover material. The maximum depth at which evaporation could occur (evaporative zone depth) was set to 30 inches. Because of the proposed phased construction it was assumed that the maximum area that will be exposed at a time is 2 acres. The rest of the cell area either would have been filled and the final cover constructed, or construction would not have started and the existing ground surface would be undisturbed.

The other case models post-closure conditions, simulating the cell after the final cover has been constructed. Runoff was allowed from 100 percent of the area in this case and the evaporative zone depth was set to 30 inches. Soil profiles for the cases are as follows:

OPEN (ACTIVE) CASE - CASE 1

- 6 inch silty clay daily cover material, permeability of 2.5E-5 cm/sec
- 10 ft layer of waste material
- 12-inch ripped and compacted shale layer, permeability of 6.8E-7 cm/sec
- Natural shale material

POST-CLOSURE - CASE 2

- 6-inch erosion resistant gravelly sand, permeability of 1E-2 cm/sec
- 24-inch evaporative layer / frost protection of silty sand, permeability of 1.2E-4 cm/sec
- 18-inch compacted shale layer, permeability of 6.8E-7 cm/sec
- 60-feet municipal waste
- 12-inch ripped and compacted shale layer, permeability of 6.8E-7 cm/sec
- Natural shale material

4.8.1.2 Results

HELP results indicate that during the open case, minimal infiltration into the underlying shale material took place. The model predicted approximately 0.03130 inches of infiltration per year during the active filling stage of the landfill.

During the closed period of the model, predicting the landfill after the final cover has been placed; HELP predicted no infiltration through the bottom layer of the landfill. In both cases the majority of precipitation evaporates before infiltrating.

TABLE 1
HELP MODELLING RESULTS

WATER PROFILE (average annual totals)	OPEN CASE (In/yr)	CLOSED CASE (In/yr)
Precipitation	6.26	6.26
Runoff	0.304	0.00
Evaporation	5.981	6.256
Infiltration through cover liner	NA	0.00812
Infiltration through bottom liner	0.03130	0.00812

The worst-case scenario of the HELP model predicts a minimal amount of percolation into the underlying soil. Given the characteristics and thickness of the underlying Mancos shale formation at the site, and the great depth and poor quality of the groundwater in the area of the site, this percolation should be considered negligible.

SECTION FIVE ENGINEERING REPORT

5.0 ENGINEERING REPORT

The landfill will receive only municipal solid waste generated within Utah municipalities. Figure 2 presents a detailed topographic map of the facility. The property is relatively flat, sloping approximately 75 feet across approximately 6600 feet from the southeast corner to the northwest corner of the site.

Construction of the landfill will be completed using heavy equipment such as crawler-dozers, excavators, and scrapers. Soil that is removed during construction will be stockpiled on site to be used for daily cover and final cover. Other borrow areas will not be used. No blasting will be required to excavate the landfill cells. The site engineer will specify that the construction areas will be ripped using a crawler-dozer followed by excavation and removal of the ripped soils.

The landfill may receive clean fill material for disposal. Such materials will be used for cover and general grading, as needed. It is estimated that no more than 10% of the final cover material will need to be acquired from off-site at time of closure.

5.1 LOCATION STANDARDS

The proposed site for the Landfill meets the location standards of R315-302-1 (see Section 4.0).

5.2 FACILITY LIFE

Based on the facility design (see following Section 5.3), the total capacity of the site is 22 million cubic yards (Mcy). Accounting for 10% soil cover, the waste capacity of the site is 19.8 Mcy. The total designed capacity of each cell is, Cell 1 = 5 Mcy, Cell 2 = 11 Mcy, and Cell 3 = 6 Mcy

The Solitude Landfill expects to receive approximately 130,000 tons per year for disposal in Cell 1. At present, this waste is projected to arrive in compacted bales, each measuring approximately 2 cy and weighing approximately 1,400 pounds. Based on these assumptions, Cell 1 would have an approximate life of 12.12 years.

$$\frac{130{,}000 \text{ tons} \times 2{,}000}{1{,}400 \text{ lbs} / 2 \text{ cy}} = \frac{260{,}000{,}000 \text{ lbs}}{700 \text{ lbs/cy}}$$

$$\frac{260{,}000{,}000 \text{ lbs}}{700 \text{ lbs/cy}} = 371{,}428.57 \text{ cy}$$

$$\frac{5{,}000{,}000 \text{ cy} \times 0.9}{371{,}428.57 \text{ cy / year}} = 12.12 \text{ years}$$

Cells 2 and 3 are not currently planned for a specific user; however, potential users have been identified that could generate from 300,000 to 750,000 tons per year (tpy) for disposal. The following assumptions for calculating facility life are based on a maximum usage scenario.

- Cell 2 is filled and closed prior to Cell 3
- The maximum annual volume of waste (750,000 tpy) is received
- All waste in Cells 2 and 3 is co-mingled
- All waste in Cells 2 and 3 is delivered loosely compacted (400 – 800 lbs/cy)
- All waste is compacted on-site to an average density of 1,200 lbs/cy
- Daily cover soil will equal 10% of total volume

Based on those assumptions, the facility will dispose of 1,250,000 cubic yards of waste per year plus 125,000 cubic yards of soil for a total volume of 1,375,000 cubic yards per year. Since Cells 2 and 3 have a combined total designed capacity of 17 Mcy, the calculated facility life is approximately 12.36 years.

5.3 CELL DESIGN – R315-303-3 (3)(c) EQUIVALENT DESIGN

The Owner requests approval by the Executive Secretary for an Equivalent Design, incorporating no liners or leachate collection systems, based on operating practices and location characteristics which minimize the migration of solid waste constituents or leachate into the ground or surface water and which are at least as effective as the liners of R315-303-3 (3)(a) or (b). This standard, as well as the standard of R315-303-2 (1), is demonstrated in Section Four, Geohydrological Report, and is based on 1) the hydrogeologic characteristics of the facility and the surrounding land, 2) the climatic factors of the area, 3) the volume and physical and chemical characteristics of the leachate and 4) predictions (HELP model) that maximize leachate generation. Additionally, operating procedures at each landfill cell minimize the working face and, consequently, minimize potential surface area for leachate generation from precipitation.

5.3.1 General Description

Each cell will be constructed for a designated municipality or group of municipalities, and may be operated as a bale-fill or as a traditional compacted loose-waste fill. No cell will be constructed prior to completion of a contract with a municipality to dispose of MSW generated within that municipality.

Each of the three disposal cells will be constructed below ground surface in the initial phase (see Drawings 1 through 10, attached) with 3:1 slopes to the bottom of the excavation. No blasting will be required to excavate the landfill cells. The cell will be ripped using a crawler-dozer followed by excavation and removal of the ripped soils.

Excavated soil will be used to construct berms around each cell (Drawings 4 and 6) to provide support for above-grade waste disposal. Cell depth ranges between 30 and 35 feet below the natural ground surface. The depth decreases towards the south end to facilitate stormwater collection.

The side-slopes of the excavation are proposed to be 3 horizontal to 1 vertical. An extensive field investigation included exploratory drill holes on the property and data collected indicated a silty clay zone of soil to depths of at least 20 feet below the surface. Silty clay soil should provide the slope stability necessary for any temporary 3:1 side-slopes. The side-slopes may be flattened at the discretion of the landfill operator, to maintain stability of the slopes. Berms will be located adjacent to the top of the vertical slopes (Drawings 4 and 6) to maintain an adequate safe distance of personnel and vehicular traffic from the top of the slope and to provide stormwater diversion. The berms will be constructed of stockpiled material from the excavated cell. Berms will be located an adequate distance away from the edge of the cell to avoid any stability problems.

5.3.2 Phasing

Cells 1 and 3 will be constructed in an orderly sequence, generally from north to south, while Cell 2 will be constructed generally from west to east (Drawings 8, 9 and 10). The natural ground surface elevation at the site varies approximately 100 feet as the topography slopes downward from the southeast to the northwest. Natural grade at the center of the cells is approximately 4335 feet (Cell 1), 4353 (Cell 2), and 4380 (Cell 3). The final elevation of the maximum cover section of each cell will be approximately 64 feet above these elevations. The final cover will be graded to a minimum 3 percent slope extending across the crown of a cell.

The working face in a traditional-fill cell will be constructed to a maximum slope of 4 horizontal to 1 vertical; for a bale-fill, the working face will be constructed to a maximum slope of 2 horizontal to 1 vertical based on slope stability of stacked bales. Cover material will be soil from the excavation of cells. Unloading of waste will be restricted to one area of the working face to limit the amount of waste exposed and the amount requiring cover. The working face will be covered on a daily basis.

5.3.3. Daily, Intermediate and Final Cover.

Daily cover will consist of six (6) inches of soil spread over the compacted waste to protect against both wind-dispersion of waste and propagation of vectors. When an active area of a cell is to be left unused for any length of time, such as construction phasing across a cell, the cell will be covered with a material capable of meeting the performance criteria of daily cover as well as the operational criteria of disposal operations.

An intermediate cover will be placed over the completed areas of a cell. The intermediate cover will consist of a minimum thickness of 12-inches of native soil stockpiled from the excavation. The intermediate cover will be compacted by a crawler-dozer to facilitate trafficability over the completed cells. Gravel may be placed over the intermediate cover in the unloading areas at the top of the working face to improve trafficability. The maximum duration is one year that intermediate cover would remain exposed prior to re-use or closure

Following the complete filling of an excavation cell to the top of the side berms, MSW will be disposed above grade across the surface of the cell. This disposal area will rise to a height of approximately 35 feet above natural grade and sloped to the center crown of the cell at a 3:1 slope. The final phase of disposal operations will be the commencement of closure operations by placement of final cover.

The final cover will consist of 24 inches of frost protection cover placed over 18 inches of compacted native clay with an in-place permeability of no greater than 1 x 10^{-7} cm/sec. Six inches of coarse aggregate will be placed over the cell for erosion control. The cover requirements are also discussed in detail in the following subsections covering final closure.

5.4 EQUIPMENT REQUIREMENTS AND AVAILABILITY

Equipment will be maintained and stored in one of two maintenance buildings, one located on site and one located off site. Landfill operating equipment may be shared between landfill cells, but will be specific to the type of disposal, i.e. bale-fill or traditional-fill. The Landfill Operator/Manager will have a utility truck capable of moving around the site during inclement weather and powerful enough to pull smaller trailer-mounted equipment that may be needed at the site. This vehicle will carry whatever tools are necessary for routine maintenance of the heavy equipment.

5.4.1 Bale-Fill Equipment

A bale-fill cell will require one or more fork-trucks capable of lifting the bales from a flatbed truck and placing them into the working face. Additionally, the flatbed trucks may be equipped with a crane capable of moving the bales from the truck to the working face. The only other piece of equipment necessary for operation of the bale-fill will be a crawler-dozer capable of moving cover material to the working face and then spreading it across the working face.

5.4.2 Traditional-Fill Equipment

Traditional landfilling operations will require at least two pieces of equipment, one compactor and one crawler-dozer. The compactor will be designed for landfill operations, and will be equipped with compactor wheels. The crawler-dozer will be capable of moving and spreading cover material as well as loose MSW.

5.5 BORROW SOURCES

The construction of the landfill will necessarily require excavation and stockpiling of soil. As the excavation of the below-grade phases continue, soil will be stockpiled on site and, when possible, within the boundary of the cell being excavated. The Landfill will provide sufficient cover materials from on-site excavation, and no additional borrow areas should be required.

5.6 RUN-OFF COLLECTION

Potential stormwater run-off has been identified from two sources. First is the run-off that may contact waste in the excavation phase of disposal and would subsequently collect within the excavation. This run-off water may be allowed to evaporate or may be pumped to the top of the working face. No treatment is anticipated or proposed.

The second type of run-off is that which will move from the above grade disposal area to ground level. This may be stormwater that has contacted waste or it may be stormwater that sheets off the intermediate or final cover. In either event, this run-off water will be collected in the stormwater detention areas shown on Drawings 8, 9, and 10. This water will not be permitted to exit the property.

5.7 GROUNDWATER MONITORING – WAIVER REQUEST

In accordance with R315-308-1(3), the owner requests a waiver of groundwater monitoring requirements by the Executive Secretary based on the demonstration that there is no potential for migration of hazardous constituents from the facility to the groundwater during the active life of the facility and the post-closure care period. This demonstration is provided in Section Four, Geohydrological Report.

5.8 RUN-ON / RUN-OFF CONTROL SYSTEMS

Stormwater diversion ditches will be constructed using berms and designed to prevent stormwater from running on to the landfill site. These same diversion ditches will also serve to prevent stormwater run-off from leaving the site. These stormwater controls are shown in detail on Drawing 7.

6.0 CLOSURE PLAN

Final closure activities will be implemented when the final phase of the landfill has been completed and the design dimensions have bee reached, projected during the first quarter of 2014. Closure of the landfill will begin, however, as each cell completes the final phases of construction and design elevations are reached. These activities will eliminate the need to complete final closure on the entire 320 acres above grade. Closure of the site is to be performed in such a manner as to minimize potential effects of the landfill on the surrounding environment.

6.1 CLOSURE SCHEDULE

Final closure activities at the landfill will commence within 30 days after final placement of waste and shall be completed within 180 days. It has been estimated that the last cell to close will cease accepting waste in 2014.

6.2 DESIGN OF FINAL COVER

The closure of the landfill operations at the Solitude Landfill will minimize the need for further maintenance and will minimize any potential threat to human health and the environment. As a cell is constructed and filled above grade, the side slopes will be covered with 18 inches of compacted clay (Mancos shale), 24 inches of native soil comprising a frost protection layer, and six inches of coarse aggregate. This design will also provide 30 inches of frost protection for the clay layer. This process will be used so that only the uppermost 2-acre portion of a cell requires closure at any one time. After the final waste has been placed in a cell, the upper surface will be covered in a manner identical to the side slopes described above.

The final grades will be maintained at the designed slope of 4:1. The final contour plan of the cell closure is presented as Drawing 5. All run-off will be directed off and around the disposal cell.

6.3 SITE CAPACITY

The estimated total capacity of the landfill is approximately 19.8M cubic yards of waste.

6.4 FINAL INSPECTION

A final inspection will be performed at the Solitude Landfill at the termination of all landfill activities, including closure. The final inspection will determine if the landfill meets the closure requirements as outlined in the permit and closure plans. Inspection may include cell cover design requirements and maintenance of proper final grade on the cell to promote run-off.

7.0 POST-CLOSURE CARE

During the post-closure period, the landfill shall be inspected quarterly to determine the integrity of the cover and condition of the access road. Post-closure maintenance will consist of quarterly inspection of the cover; run-on/run-off control structures, and the monitoring structures, and making any necessary repairs.

7.1 SITE MONITORING

In addition to the annual inspections, post-closure monitoring of the landfill will include quarterly sampling for methane gas. Methane gas will be monitored at the perimeter of the landfill and within any buildings at the landfill during the post-closure period.

7.2 CHANGES TO TITLE, LAND USE AND ZONING

Plats and a statement of fact concerning the location of the disposal site shall be recorded as part of the record of title with the county recorder within 60 days after certification of closure.

7.3 MAINTENANCE ACTIVITIES

Post-closure maintenance will consist of quarterly inspections of the cover; run-on/run-off control structures, and the monitoring structures, and making any necessary repairs.

7.4 FINAL COVER

The final cover will be constructed on the uppermost surface of the cell after the waste placement has reached the designed elevation. The side slopes will have been closed, as the cell height increases, with 18 inches of compacted clay (Mancos shale), 24 inches of native soil comprising a frost protection layer, and six inches of coarse aggregate. The final cover material on the uppermost surface of the Solitude Landfill will be identical to the side slopes. The side slopes will be constructed with a maximum 4:1 slope and the upper surface will be constructed with a minimum 3% slope toward the crest of the side slopes.

Precipitation on the landfill cells will drain across the cell cover, through the run-off control berms, and off site.

7.5 RUN-ON / RUN-OFF CONTROL SYSTEMS

Run-on and run-off control systems are described elsewhere in Section 3.6.2 and Section 5.8.

7.6 CONTACT PERSONS

Local Contact: Pete Fote
2825 East Cottonwood Parkway, Suite 500
Salt Lake City, UT 84121
801-990-3456

8.0 FINANCIAL ASSURANCE

An estimate for the closure and post-closure care of the Solitude landfill is summarized in Tables 4, 5, 6 and 7. The estimate is based on the total area for final closure of 2 acres, and an entire cell area of 71 acres each for Cells 1 and 3, and 120 acres for Cell 2. All soil will come from on-site. These tables reflect the maximum area requiring closure at any one time, and has been compiled from information developed by the Oklahoma Department of Environmental Quality for estimating closure and post-closure care costs (see Section Nine)

Table 4

Summary of Estimated Closure Costs for Cell 1, 2, or 3

Task / Service	Quantity	Units	Unit Cost	Task Cost
Conduct Site Evaluation	1	Lump Sum	$2,750	$2,750
Remove Buildings & Equipment	1	Lump Sum	$2,450	$2,450
Final Grading	2	Acres	$1,122	$2,244
Move & Compact On-Site Clay	4,840	Cubic Yds	$3.20	$15,488
Move & Place Erosion Control Cover	1,613	Cubic Yds	$12.00	$19,356
Subtotal				**$42,288**
Technical & Professional Services	1	Lump Sum	7%	$2,960
Contingency	1	Lump Sum	10%	$4,229
Total				**$49,477**

Table 5

Summary of Estimated Post-Closure Costs for Cell 1 or 3

Task / Service	Quantity	Units	Unit Cost	Task Cost
Post-Closure Inspections[1]	120	Events	$500	$60,000
Methane Gas Monitoring[2]	120	Events	$140	$16,800
Repair / Maintain Cover[3]	4,260	Cubic Yds	$12	$51,120
Subtotal				**$127,920**
Technical & Professional Services	1	Lump Sum	7%	$8,954
Contingency	1	Lump Sum	10%	$12,792
Total				**$149,666**

Table 6

Summary of Estimated Post-Closure Costs for Cell 2

Task / Service	Quantity	Units	Unit Cost	Task Cost
Post-Closure Inspections[1]	120	Events	$500	$60,000
Methane Gas Monitoring[2]	120	Events	$140	$16,800
Repair / Maintain Cover[3]	7,200	Cubic Yds	$12	$86,400
Subtotal				**$163,200**
Technical & Professional Services	1	Lump Sum	7%	$11,424
Contingency	1	Lump Sum	10%	$16,320
Total				**$190,944**

NOTES TO TABLES:

[1] May be reduced to annual inspections upon site stabilization, with DEQ approval

[2] May be discontinued upon site stabilization, with DEQ approval

[3] Calculated at 2 cy/acre x 120 acres x 30 years

8.1 FINANCIAL ASSURANCE MECHANISM

The Owners propose to use a bond as the financial assurance mechanism. Each Cell will have its own bond as an individual funding mechanism. A stand-by trust fund will be established if bonds that do not allow partial-payments are used.

9.0 REFERENCES

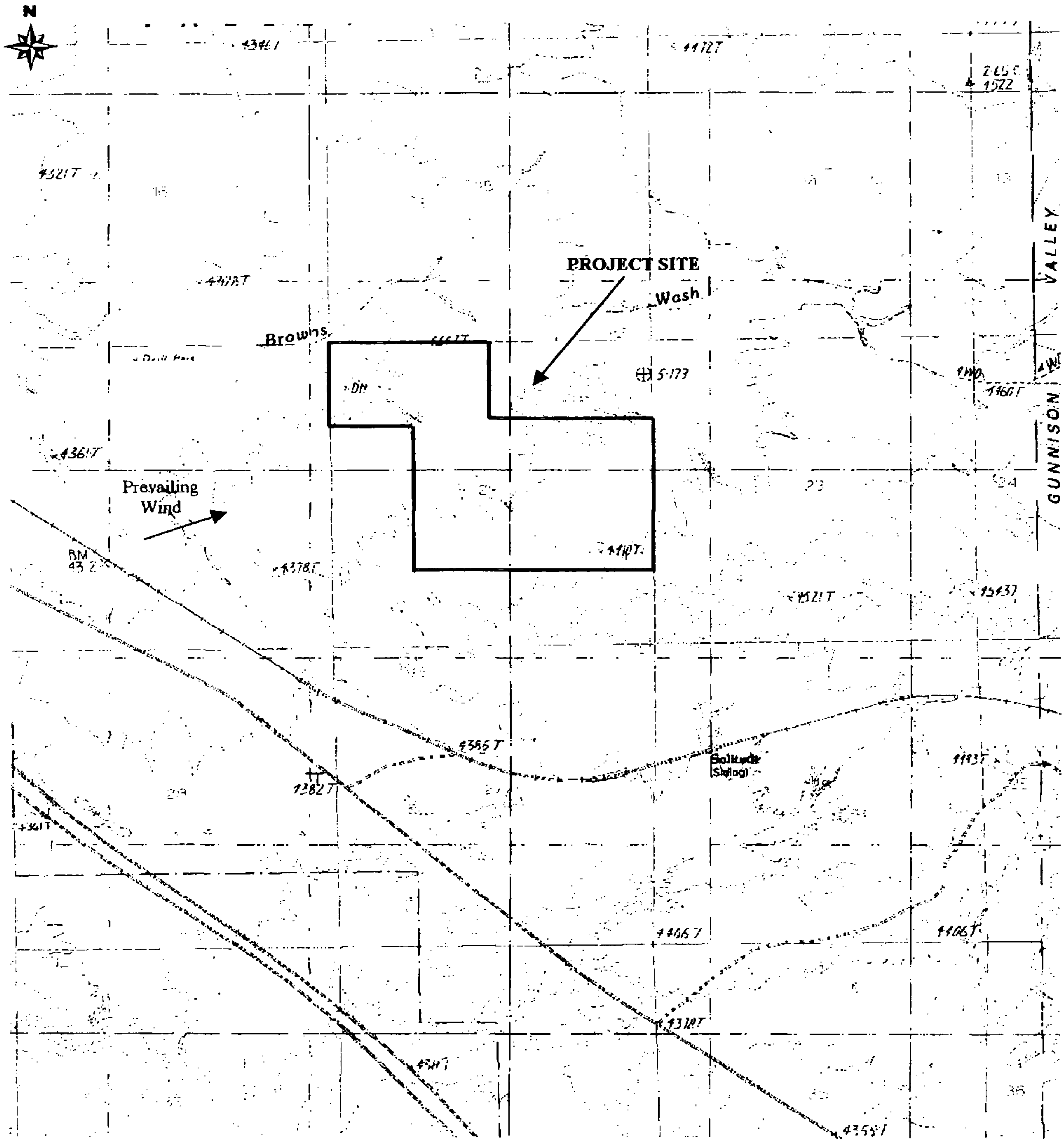
Ashcroft, G.L., Jensen, D.T., Brown, J.L., 1992, *Utah Climate*, Utah Climate Center, Utah State University.

Rush, F.E., 1982, *Regional Hydrology of the Green River – Moab Area, Northwestern Paradox Basin, Utah,* USGS, Denver CO.

Thiros, S.A. and W. C. Brothers, *USGS Technical Publication 102* - Ground-water hydrology of the upper Sevier River basin, south-central Utah, and simulation of ground-water flow in the valley-fill aquifer in Panguitch Valley, 1993.

State of Oklahoma, Department of Environmental Quality, Waste Management Division, *Solid Waste Financial Assurance Program Report*, December 22, 2000.

State of Utah, 2001, *Administrative Rules, Solid Waste Permitting and Management Rules R315-301 through 320*, Department of Environmental Quality, Division of Solid and Hazardous Waste.

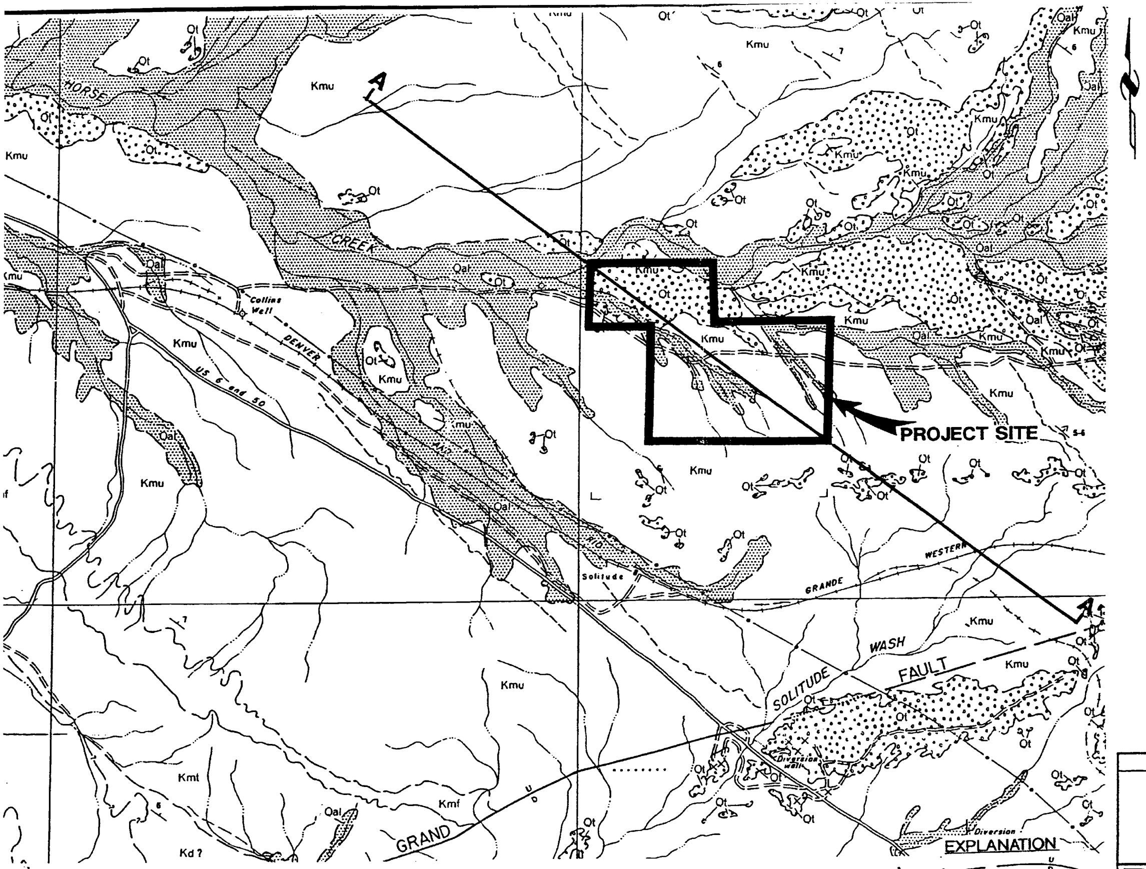


2681 Parleys Way, Suite 106
Salt Lake City, Utah 84109
(801) 412-0003

SCALE: 1:24,000
CONTOUR INTERVAL: 40 FEET

FIGURE 1

Green River NE Quadrangle
Utah – Grand County
7.5 Minute Series (Topographic) Map



EXPLANATION

Fault
Dashed where approximately located
U, upthrown side; D, downthrown side
Questioned where probable.

1 1/2 0 1
Scale in Miles

erence:
togeologic Map of the Tidwell – 1 Quadrangle
nd County, Utah by V.H. Sable, 1955, Map I-87

EXPLANATION

QUATERNARY

- Qal — Alluvium
- Qt — Terrace deposits (?)
- Qu — Undifferentiated sand, residual mantle, and slope wash

CRETACEOUS

Upper Cretaceous

- Kmu / Kmf / Kmt — Mancos shale
  Upper part, undifferentiated, Kmu; Ferron sandstone member, Kmf; Tununk shale member, Kmt

Lower and Upper Cretaceous

- Kd — Dakota sandstone

Lower Cretaceous

- Kbu / Kbl — Probable equivalent of Burro Canyon formation
  Upper unit, Kbu; lower unit, Kbl

JURASSIC

Upper Jurassic

- Jmb / Jms — Morrison formation
  Brushy Basin shale member, Jmb; Salt Wash sandstone member, Jms
- Js — Summerville formation
- Jcu — Curtis formation

GREEN RIVER LANDFILL L.L.C.

GREEN RIVER LANDFILL

GEOLOGIC MAP

BINGHAM ENVIRONMENTAL
SALT LAKE CITY – (801) 532-2230

FIGURE 2

Date NOV. 1994 | Proj. # 2106-006 | Sht of

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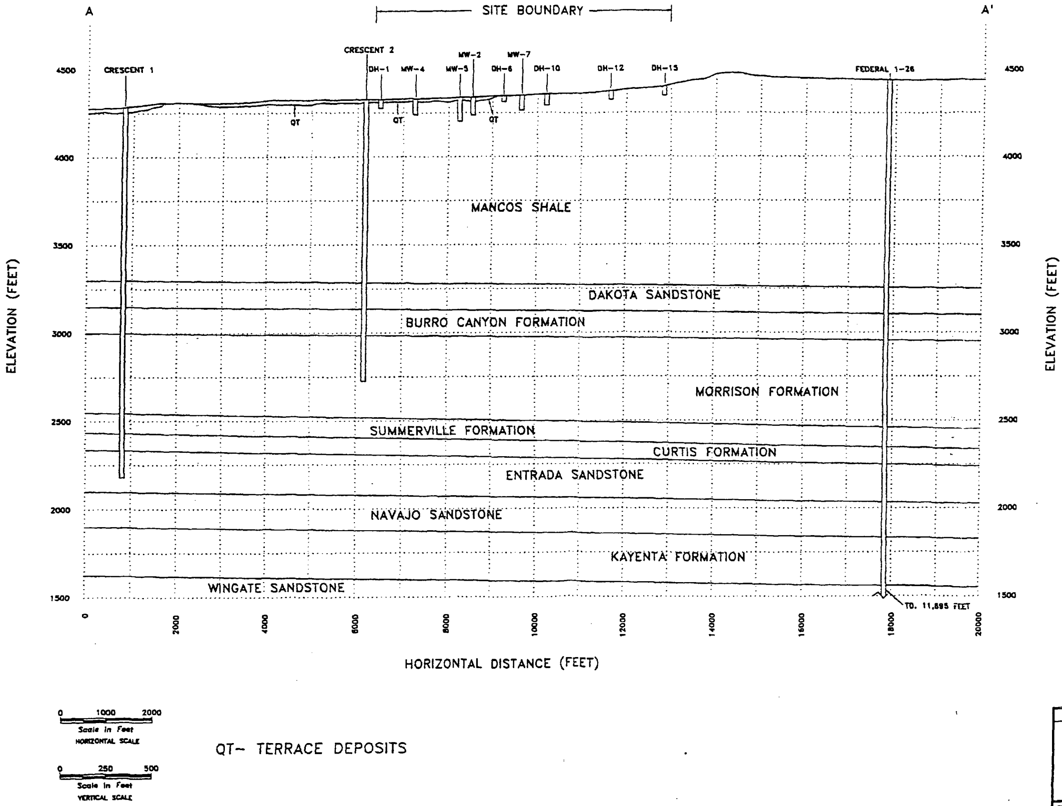

QT- TERRACE DEPOSITS

GREEN RIVER LANDFILL L.L.C.

GREEN RIVER LANDFILL

CONCEPTUAL GEOLOGICAL
CROSS SECTION A-A'

BINGHAM ENVIRONMENTAL
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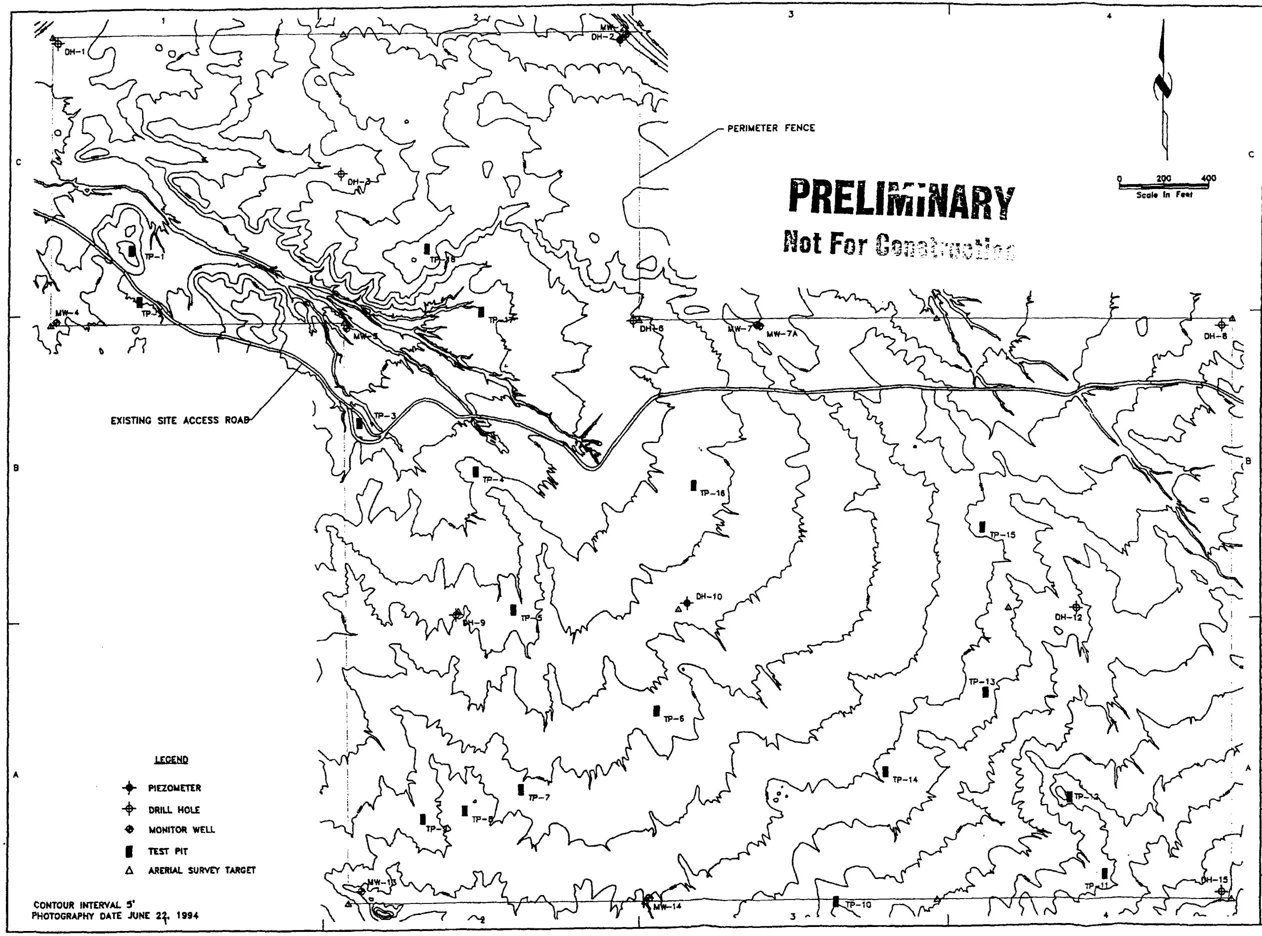
FIGURE 3

Rev.	By	Date	Remarks	Date NOV 1994	Proj. #	JSR



ATC
ASSOCIATES INC

ATC Associates, Inc.
2681 Parleys Way
Suite 106
Salt Lake City, Ut 84109
(801) 412-0003

CONSULTANTS

THIS DRAWING HAS BEEN REVIEWED BY A PROFESSIONAL ENGINEER AND HAS BEEN DETERMINED TO REPRESENT CONSTRUCTIBLE STRUCTURES AND/OR PROJECT. REVISION OF THIS DRAWING MAY BE NECESSARY PRIOR TO CONSTRUCTION.

NOTICE
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ORIGINAL DRAWINGS AND ENGINEERING
BY BINGHAM ENVIRONMENTAL.
PROJECT 2106-006, NOV. 1994

No. 186632
KEVIN B. COSPER

MARK	DATE	DESCRIPTION
	8/29/02	FINAL PERMIT SUB.
	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

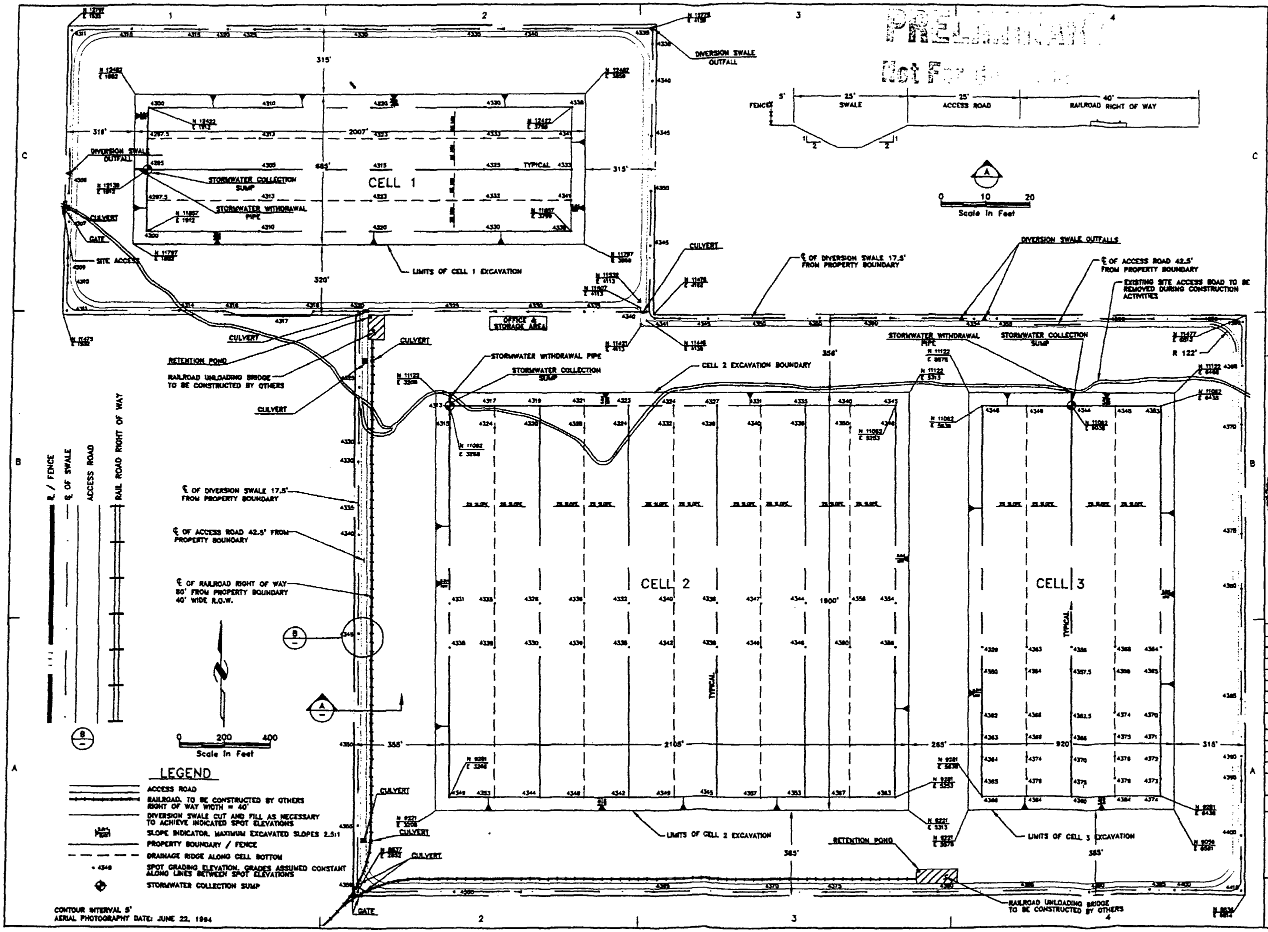
ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE
SOLITUDE LANDFILL

GENERAL
SITE PLAN

FOR PERMIT PURPOSES ONLY NOT FOR CONSTRUCTION

2



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NOTICE

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No. 186632
KEVIN B. COSPER

MARK	DATE	DESCRIPTION
	8/29/02	FINAL PERMIT SUB.
	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE

SOLITUDE LANDFILL

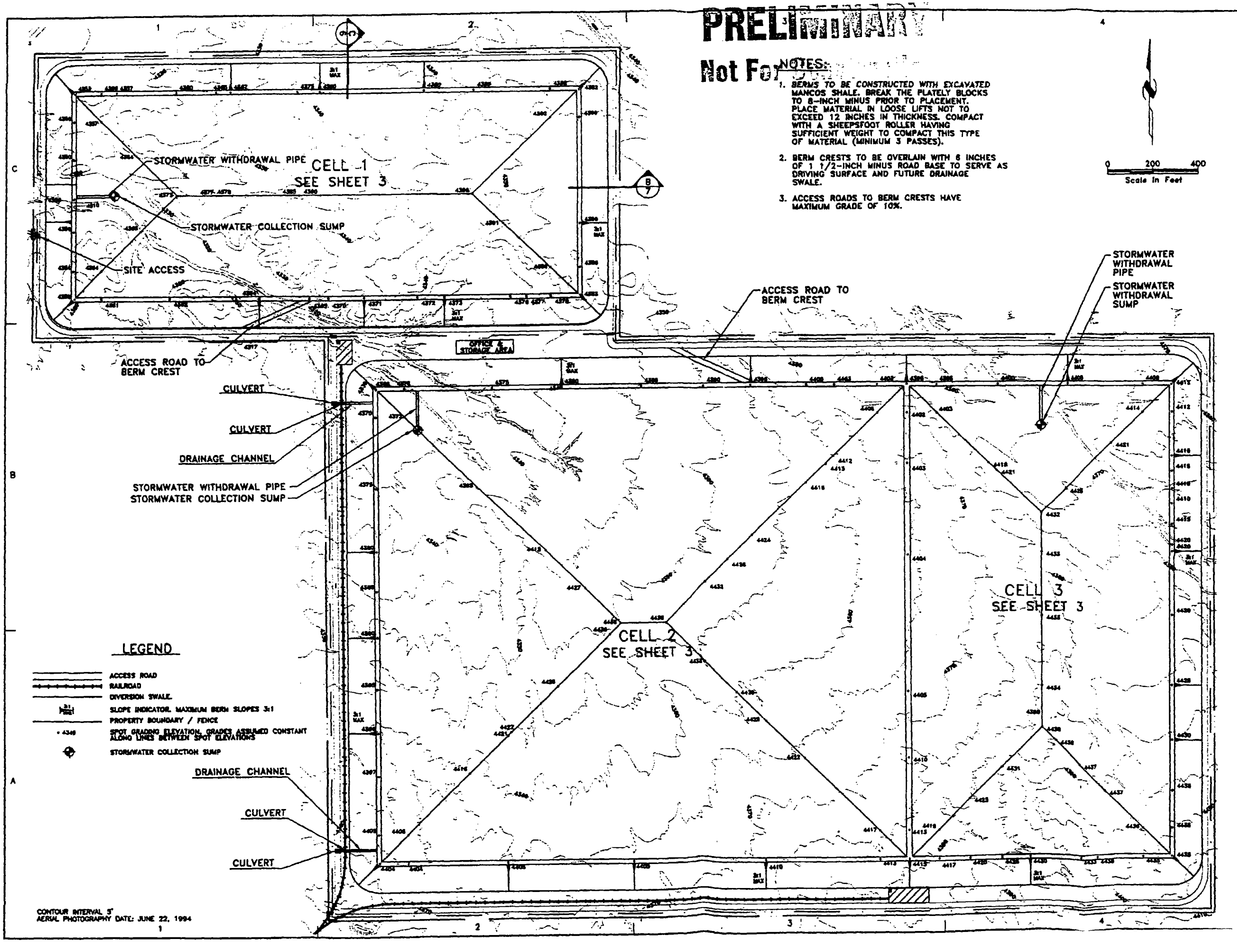
SITE PREPARATION GRADING PLAN

FOR PERMIT PURPOSES ONLY NOT FOR CONSTRUCTION

3

PRELIMINARY

Not For



NOTES:

1. BERMS TO BE CONSTRUCTED WITH EXCAVATED MANCOS SHALE. BREAK THE PLATELY BLOCKS TO 8-INCH MINUS PRIOR TO PLACEMENT. PLACE MATERIAL IN LOOSE LIFTS NOT TO EXCEED 12 INCHES IN THICKNESS. COMPACT WITH A SHEEPSFOOT ROLLER HAVING SUFFICIENT WEIGHT TO COMPACT THIS TYPE OF MATERIAL (MINIMUM 3 PASSES).
2. BERM CRESTS TO BE OVERLAIN WITH 6 INCHES OF 1 1/2-INCH MINUS ROAD BASE TO SERVE AS DRIVING SURFACE AND FUTURE DRAINAGE SWALE.
3. ACCESS ROADS TO BERM CRESTS HAVE MAXIMUM GRADE OF 10%.

LEGEND

ACCESS ROAD
RAILROAD
DIVERSION SWALE
SLOPE INDICATOR. MAXIMUM BERM SLOPES 3:1
PROPERTY BOUNDARY / FENCE
• 4349 SPOT GRADING ELEVATION. GRADES ASSUMED CONSTANT ALONG LINES BETWEEN SPOT ELEVATIONS
⊕ STORMWATER COLLECTION SUMP

CONTOUR INTERVAL 5'
AERIAL PHOTOGRAPHY DATE: JUNE 22, 1994

ATC

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Salt Lake City, Ut 84109
(801) 412-0003

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BY BINGHAM ENVIRONMENTAL,
PROJECT 2106-006, NOV. 1994

No. 186632
KEVIN B. COSPER

MARK	DATE	DESCRIPTION
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	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE

SOLITUDE LANDFILL
BERM CONSTRUCTION PLAN

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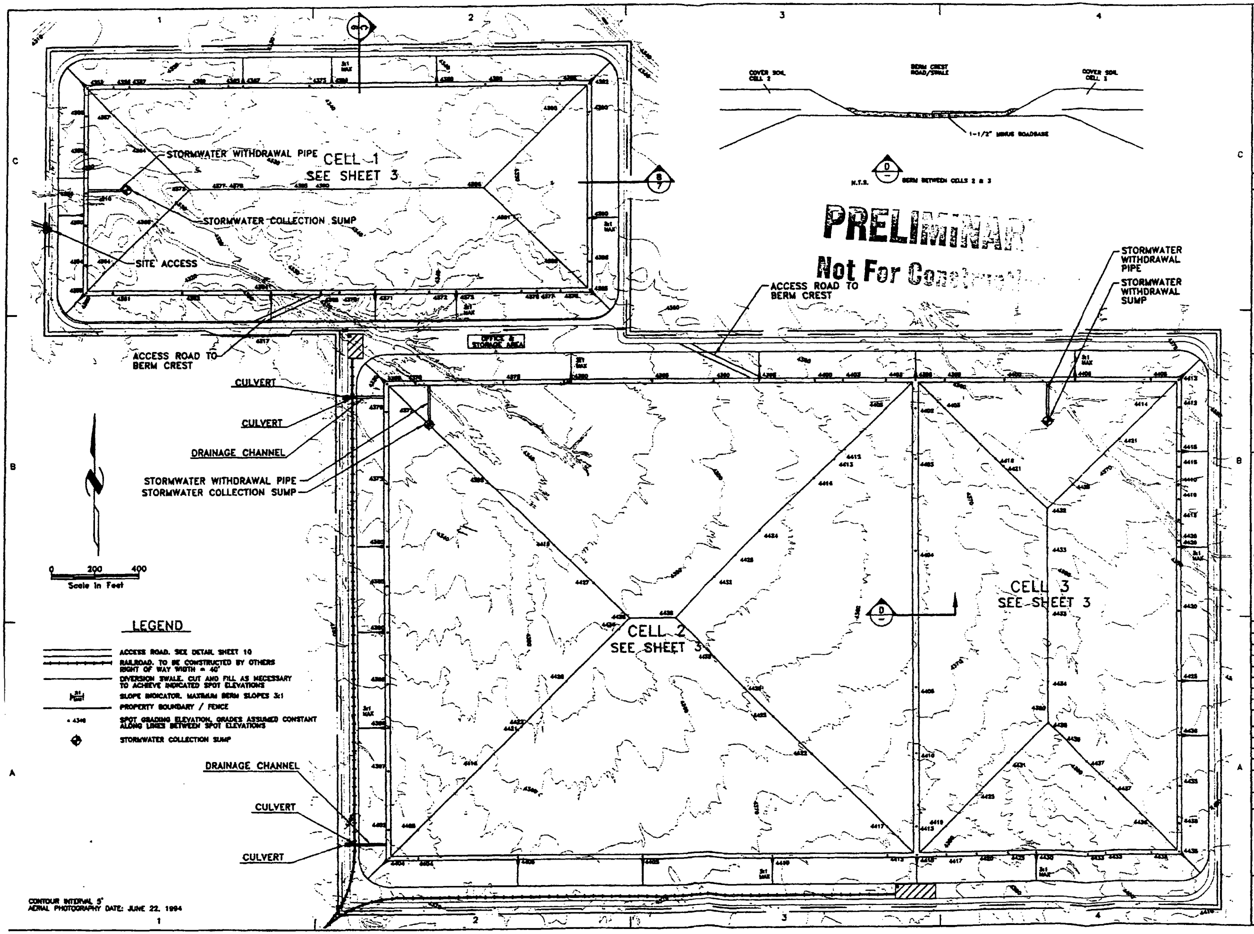
4



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TO IGES FOR MODIFICATION
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BY BINGHAM ENVIRONMENTAL
PROJECT 2106-006, NOV. 1994

NOTES:
1. SPOT ELEVATIONS ON COVER REPRESENT FINAL GRADE OF ROCK MULCH LAYER.

LICENSED PROFESSIONAL ENGINEER
No. 186632
KEVIN B.
COSPER
STATE OF UTAH

MARK	DATE	DESCRIPTION
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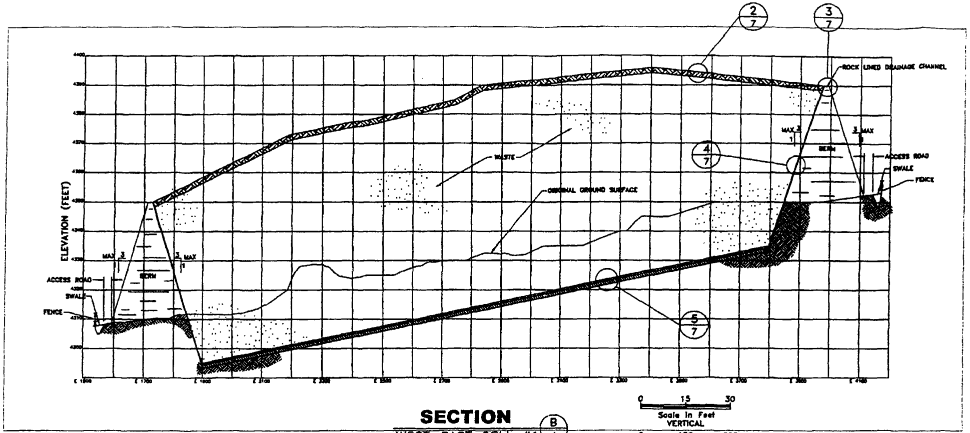
	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE
SOLITUDE LANDFILL
CELL COVER
PLAN

FOR PERMIT PURPOSES ONLY
NOT FOR CONSTRUCTION

5



SECTION
WEST-EAST CELL #1 (B/4)

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ORIGINAL DRAWINGS AND ENGINEERING
BY BINGHAM ENVIRONMENTAL,
PROJECT 2108-008, NOV. 1994

LICENSED PROFESSIONAL ENGINEER
No. 186632
KEVIN B. COSPER
STATE OF UTAH

MARK	DATE	DESCRIPTION
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	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE
SOLITUDE LANDFILL

SECTION

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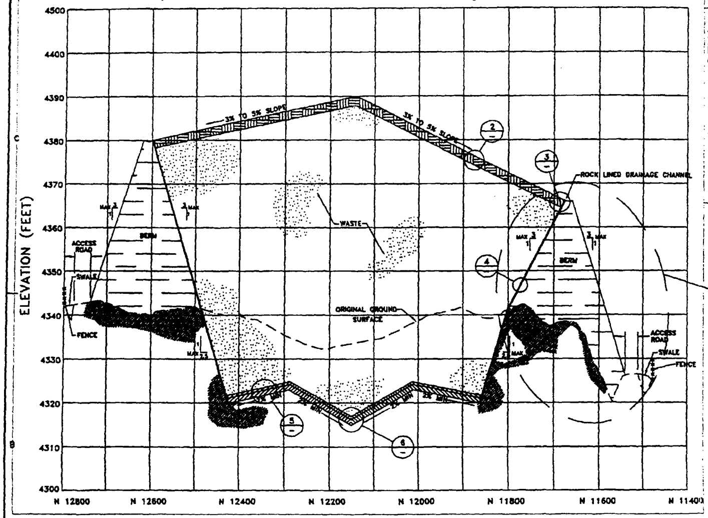
NOT FOR CONSTRUCTION

6



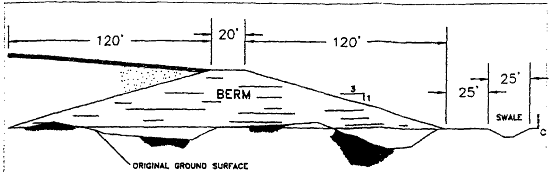
0 10 20
Scale in Feet VERTICAL

0 100 200
Scale in Feet HORIZONTAL

SECTION
C/4 NORTH-SOUTH CELL#1

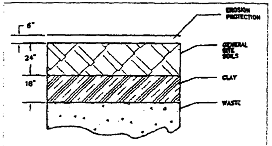
PRELIMINARY

Not For ...



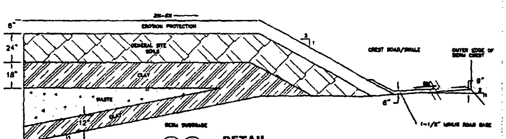
SECTION
E BERM

0 30 60
Scale in Feet

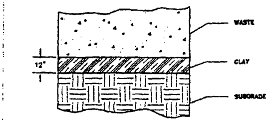


2/6 2 **DETAIL** CELL COVER

N.T.S.

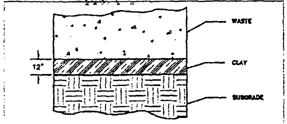


3/6 3 **DETAIL** COVER/TOE



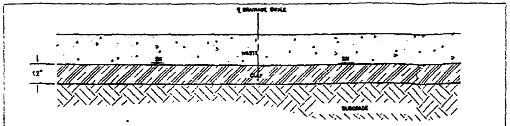
4/6 4 **DETAIL** CELL LINER (CELL SIDE SLOPES)

N.T.S.



5/6 5 **DETAIL** CELL LINER

N.T.S.



6 **DETAIL** CELL DRAINAGE

N.T.S.

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Suite 106
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(801) 412-0003
ROAD

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No. 186632
KEVIN B. COSPER

MARK	DATE	DESCRIPTION
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	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE
SOLITUDE LANDFILL
SECTIONS AND DETAILS

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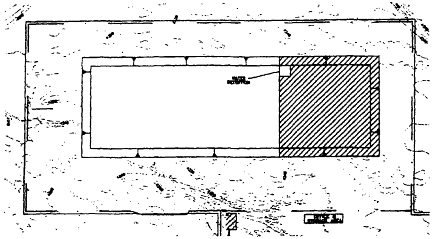
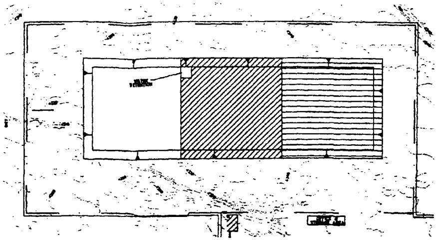
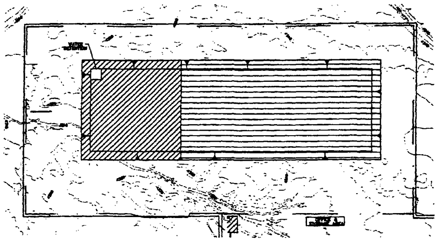
7



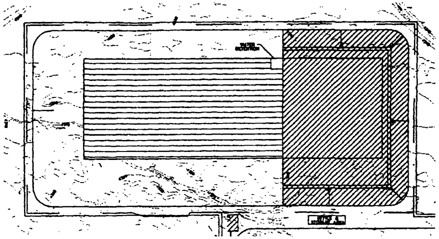
PHASE I



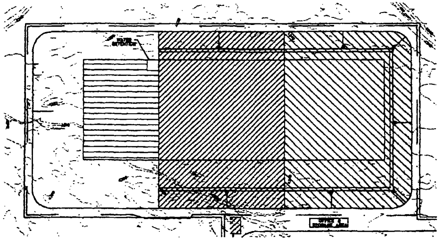
PHASE II



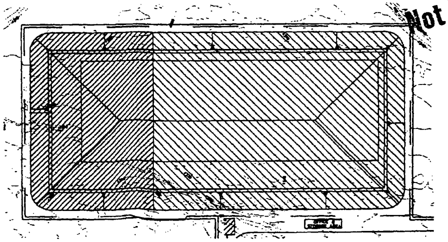
PHASE III



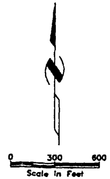
PHASE IV



PHASE V



PHASE VI



▨ ACTIVE CELL

☰ FILL TO GROUND SURFACE

⟍ FILL TO FINAL COVER

PRELIMINARY
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PROJECT 2106-006, NOV. 1994

NOTES:
1.

LICENSED PROFESSIONAL ENGINEER
No. 186632
KEVIN B. COSPER
STATE OF UTAH

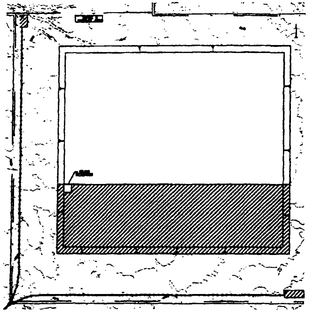
MARK	DATE	DESCRIPTION
	8/29/02	FINAL PERMIT SUB.
	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

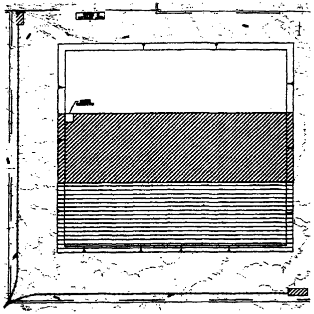
SHEET TITLE
SOLITUDE LANDFILL
CELL #1
FILLING SEQUENCE

FOR PERMIT PURPOSES ONLY NOT FOR CONSTRUCTION

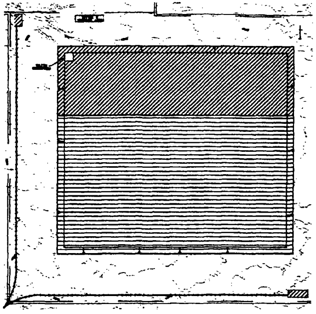
8



PHASE I



PHASE II



PHASE III

▨ ACTIVE CELL

☰ FILL TO GROUND SURFACE

╲ FILL TO FINAL COVER

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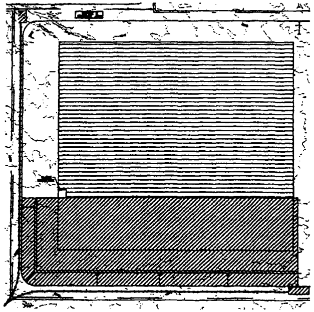
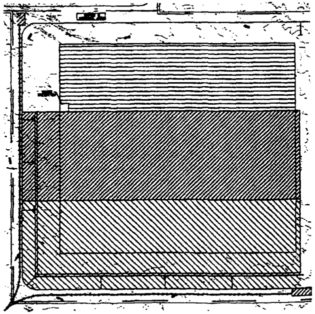
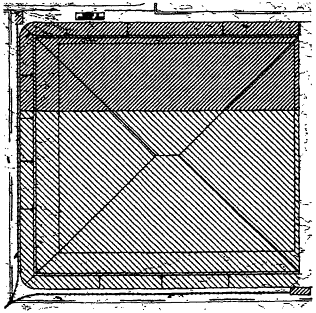
Not For Co



PHASE IV



PHASE V



PHASE VI

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PROJECT 2106-006, NOV. 1994

NOTES:
1.

No. 186632
KEVIN B. COSPER

MARK	DATE	DESCRIPTION
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	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

ISSUE:
PROJECT NO:
CAD DWG FILE:
DRAWN BY:
CHECKED BY:

SHEET TITLE

SOLITUDE LANDFILL
CELL #2
FILLING SEQUENCE

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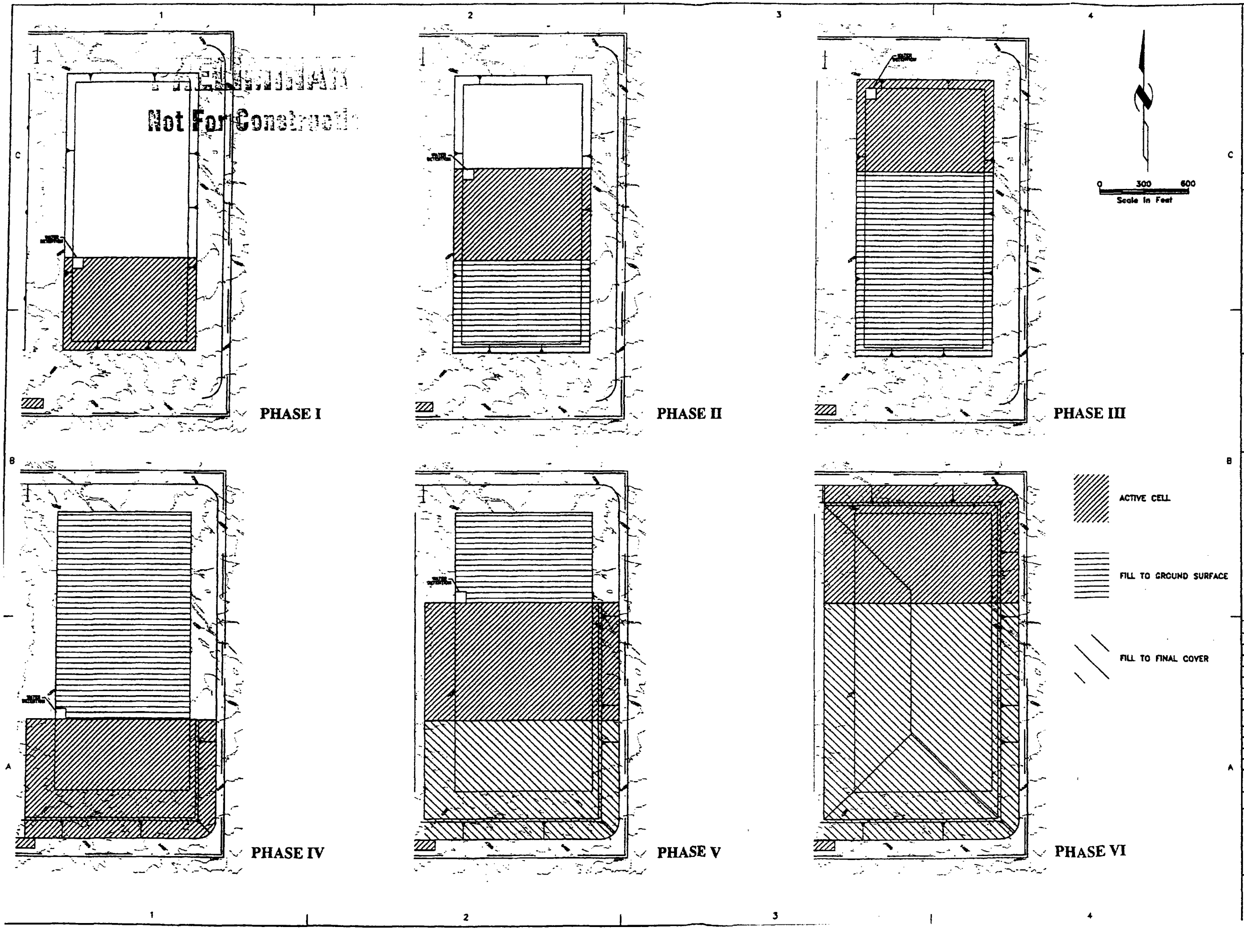
9



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PROJECT 2106-006, NOV. 1994

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No. 186632
KEVIN B. COSPER

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	02/11/02	PERMIT SUBMITTAL
	01/11/02	DRAFT

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PROJECT NO:
CAD DWG FILE:
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CHECKED BY:

SHEET TITLE

SOLITUDE LANDFILL
CELL #3
FILLING SEQUENCE

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10

APPENDIX A PROOF OF OWNERSHIP W/ LEGAL DESCRIPTION

Send Recorded Deed To:
Law Office of Travis L. Bowen, P.C.
P. O. Box 11637
Salt Lake City, UT 84147-0637

E 456032 B 0574 P 330
331
Date 7-JAN-2002 16:19pm
Fee: 12.00 Check
MERLENE MOSHER, Recorder
Filed By VAR
For TRAVIS BOWEN
GRAND COUNTY CORPORATION

Accommodation Recording
Not Examined

Mail Tax Notice To:
Green River Landfill, L.L.C.
4570 Westgrove Suite 240
Addison, Texas 75001

Property Identified As: 320 Acres unimproved property located within Grand County, Utah

---

QUIT-CLAIM DEED

For Value Received, Green River Ltd., a chartered Corporation of the Commonwealth of the Bahamas, hereinafter called the Grantor, hereby quitclaims unto Green River Landfill, L.L.C., a Utah limited liability company, hereinafter called the Grantee, the following premises, in the County of Grand, State of Utah to-wit:

The North half of the Northwest quarter, the Southeast quarter of the Northwest quarter, the South half of the Northeast quarter, the Northeast quarter of the Southwest quarter, and the North half of the Southeast quarter of Section 22, Township 21 South, Range 17 East, Salt Lake Base and Meridian, together with all mineral, oil and gas rights, said rights and reservations not being subject to the following:

Subject to City and/or County taxes and Assessments, not delinquent, Easements, Rights-Of-Way, Covenants, Conditions and Restrictions now of record.

To have and to hold the said premises, with their appurtenances, unto said Grantee and the Grantee's assigns forever.

Dated this 10th day of April, 1998.

GREEN RIVER LTD.

Rick Redle
Rick Redle, Trustee

011300

STATE OF Texas)
: ss.
COUNTY OF Dallas)

On this 30th day of November, 20 01, before me, a Notary Public in and for said State, personally appeared, Rick Redle, Trustee, known to me to be the person whose name is subscribed to the within instrument, and acknowledged to me that the same was executed.

ROXIE HEBERT
Notary Public, State of Texas
My Commission Expires
February 08, 2005

Roxie Hebert
Notary

APPENDIX B INSPECTION FORM

SOLITUDE LANDFILL
GENERAL INSPECTION FORM

Date: ____________________

Time: ____________________

Inspector: ______________________________ ______________________________
Printed Name Signature

Condition of Roadway: ____

____

Condition of Gate & Entry: ____

____

Condition of Fence: ____

____

Condition of Run-on / Run-off Controls: _________________________________

____

Other Items: ____

____

Recommended Actions: ____

____

____

____

WASTE INSPECTION REPORT

Operator: ______________________ Date: ______________ Time. ________

Generator: ______________________ Vehicle Type & ID: ______________________

Net Wt or Volume: ______________ tons ☐ cubic yards ☐

Driver Name: ____________________

Load Description: ____

____

____

Types of Waste:

Household ☐ Commercial ☐ Industrial ☐

Ash ☐ Soil ☐ C&D ☐

Asbestos ☐ Tires ☐ Animals ☐

Sealed containers ☐ Free Liquid ☐

Contained gas ☐

RCRA Hazwaste ☐ Describe: ______________________________________

____

____

INSPECTION RESULTS: LOAD ACCEPTED ☐

LOAD REJECTED ☐

IF REJECTED, NOTIFY DEQ AND GENERATOR.

Date and time DEQ notified: ____

Date and time Generator notified: ______________________________________

INSPECTOR'S SIGNATURE: ____

MUNICIPAL WASTE FLOW RECORD

CELL NO. __________

DATE:______________

TIME	GENERATOR	MSW ☑	OTHER (describe)	VEHICLE TYPE	WEIGHT

DAILY OPERATING RECORD

DEVIATIONS FROM PLAN OF OPERATION

DATE: ____________

This Record is to be used to note operations and operational systems that deviate from the Plan of Operation. Note time, condition that required deviation from Plan of Operation, and action taken. Sign or initial all entries.

RECORD OF PERSONNEL TRAINING

Name: ______________________________

Title / Position: ______________________________

Hire Date: ______________ Supervisor: ______________

Initial Training Date: ____________ Trainer: ______________

Material Covered: ______________________________

____

____

Type of Training: ☐ OJT ☐ Classroom ☐ Seminar

☐ Other: ______________________________

Verification / Certificate / Record in File? ☐ YES ☐ NO

☐ ANNUAL TRAINING ☐ OTHER: ______________

Date: ______________ Trainer: ______________

Material Covered: ______________________________

____

Type of Training: ☐ OJT ☐ Classroom ☐ Seminar

☐ Other: ______________________________

Verification / Certificate / Record in File? ☐ YES ☐ NO

☐ ANNUAL TRAINING ☐ OTHER: ____________________

Date: ____________ Trainer: ______________________

Material Covered: ____________________________________

____

Type of Training: ☐ OJT ☐ Classroom ☐ Seminar

☐ Other: ______________________________

Verification / Certificate / Record in File? ☐ YES ☐ NO

☐ ANNUAL TRAINING ☐ OTHER: ____________________

Date: ____________ Trainer: ______________________

Material Covered: ____________________________________

____

Type of Training: ☐ OJT ☐ Classroom ☐ Seminar

☐ Other: ______________________________

Verification / Certificate / Record in File? ☐ YES ☐ NO

☐ ANNUAL TRAINING ☐ OTHER: ____________________

Date: ____________ Trainer: ______________________

Material Covered: ____________________________________

____

Type of Training: ☐ OJT ☐ Classroom ☐ Seminar

☐ Other: ______________________________

Verification / Certificate / Record in File? ☐ YES ☐ NO

APPENDIX C WELL INVENTORY

1. POINT OF DIVERSION SEARCH

```
                                                  UTAH DIVISION OF WATER RIGHTS
                             WATER RIGHT POINT OF DIVERSION PLOT CREATED TUE, FEB 12, 2002,
                                        PLOT SHOWS LOCATION OF      0 POINTS OF DIVERSION

                                   PLOT OF AN AREA WITH A RADIUS OF 11000     FEET FROM A PO
                                   S 2640 FEET,  E 2640 FEET OF THE NW CORNER,
                                   SECTION 22 TOWNSHIP 21S   RANGE 17E     SL BASE AND MERID

                                   PLOT SCALE IS APPROXIMATELY  1 INCH =    4000 FEET


                                     N O R T H
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```

2. PLACE OF USE SEARCH

utah gov | State Online Services | Agency List | Search Utah.gov go

UTAH DIVISION OF WATER RIGHTS

POUINFO Place of Use Listing

Version: 2001.06.28.00 **Rundate: 02/12/2002 10:44 AM**

WATER RIGHTS (PLACE OF USE) in: Township 21S Range 17E SL Base & Meridian

```
         | (The Division of Water Rights makes NO claims regarding the accuracy of this data
         
         |  POD:     Point of Diversion ----S=Surface, U=Underground, P=Point to Point
         |  ST/TOR:  Status/Type of Right
         |  TYPE:    Type of Place of Use---I=Irrigated Acreage, P=Other Place of Use
         |  USES:     I=Irrigation, S=Stockwatering, D=Domestic, Mu=Municipal, Mi=Mining, P=P

                                                  | N W 4 |*| N E 4 |*| S W 4 |*| S E 4 |
                                                  |N N S S|*|N N S S|*|N N S S|*|N N S S|
WR-CH-EX#  POD ST/TOR TYPE WATER USES             |W E W E|*|W E W E|*|W E W E|*|W E W E|
```

APPENDIX D FIELD AND LABORATORY PROGRAMS - 1994

FIELD PROGRAM

INTRODUCTION

Green River Landfill, L.L.C. (GRL) has investigated an area for a proposed landfill located approximately 7 miles east of Green River, Utah. The landfill area consists of 320 acres located in Section 22, Township 21 South, Range 17 East in Grand County, Utah.

Bingham Environmental, Inc. (Bingham) was retained by GRL to conduct a field investigation at the site to determine the physical and hydrogeological characteristics at the site. Field work was conducted during June and July, 1994. Bingham geologists and/or engineers supervised all field activities. The investigation consisted of the following tasks:

- Aerial Photography to produce a detailed topographic map
- Excavate 18 test pits with a track-mounted backhoe
- Drill 11 exploratory drill holes
- Install 2 piezometers
- Install 7 monitor wells
- Sample 2 monitor wells and 2 piezometers where perched water was encountered
- Perform slug tests on 2 wells

AERIAL PHOTOGRAPHY

Aerial targets were set up and surveyed by Bingham Engineering, Inc. on June 17, 1994, based on limited existing control points. Target locations are shown on the topographic site map (Figure 1). Olympus (Olympus) Aerial Surveys flew over and photographed the site on June 22, 1994. Olympus then produced the detailed topographic map from the aerial photography. The topographic map in Figure 1 is based on 5-foot contours and identified the access road across the site and the existing drainage across the site.

TEST PITS

A Bantam 266 track-mounted backhoe was used to excavate 18 test pits (TP-1 through TP-18) at the locations shown on Figure 1. The test pits were excavated to depths ranging from 8 to 17 feet below the ground surface and logs are included in Attachment 1. In general, the test pits encountered 1 to 3 feet of soil, generally consisting of silt or sandy silt, underlain by weathered shale. One notable exception to this lithology was encountered in TP-18, which had sand, gravel and cobbles to a depth of 12 feet, where the shale bedrock was then encountered. The shale became more competent with depth, with excavation unable to extend below 8 and 17 feet. Bedding thickness ranged from less than 1 inch to about 4 inches. Grab samples, as indicated on the logs, were collected for laboratory testing from each of the test pits.

EXPLORATORY BORINGS

A CME 75 truck-mounted drill rig was used to drill 15 exploratory borings between June 20 and July 22, 1994. A Bingham hydrogeologist and/or engineer supervised the drilling operations during the duration of the drilling program. They located the holes, logged the subsurface soil and bedrock encountered and obtained relatively undisturbed and disturbed soil and bedrock samples. The majority of the soil samples were obtained by driving a standard penetration sampler (SPT) 18 inches. Relatively undisturbed soil samples were obtained using thin walled steel samplers (Shelby tubes) or a 24 inch long California split barrel sampler with 1.5-inch diameter by 4 inch long brass liners. All of the soil samples are recorded on the drill hole logs included in this attachment.

The holes were drilled with 8.25-inch diameter hollow stem augers from the surface generally to a depth of 14 to 19 feet, where they met refusal within the shale bedrock. The borings were then continued by coring to the desired depth (35 to 140 feet) using a carbide coring bit. Cores were recovered and logged from each hole. Competent bedrock (defined for this site as unbroken core lengths at least 12 inches or greater) was generally encountered at a depth of about 26 feet in the borings.

Perched water was encountered in four of the thirteen borings (DH-2, DH-5, DH-7, and DH-10) at depths ranging from 26 to 38 feet below the ground surface. Temporary piezometers were installed in DH-2, DH-7, and DH-10 using 2-inch hand-slotted and blank PVC pipe. DH-7 was later converted into a monitor well, but DH-2 and DH-10 remain as piezometers.

PERCHED WATER MONITOR WELLS

Seven of the fifteen borings were converted into groundwater monitor wells, completed to depths of between 50 and 100 feet. These include MW-2, MW-4, MW-5, MW-7, MW-7A, MW-13, and MW-14. Monitor well completion was accomplished with the installation of 2-inch diameter flush-coupled schedule 40 PVC pipe with 0.020-inch machine slotted screen in the bottom 60 to 80 feet, with the exception of MW-7A, which was screened in the bottom 27 feet. The annulus was backfilled with #10-20 Colorado silica sand to a minimum height of 2 feet above the screened interval. A bentonite pellet plug a minimum of two (2) feet thick was placed over the sand filter. The remaining annulus was backfilled with a cement-bentonite slurry. A protective concrete pad and locking steel casing were constructed at the surface of the monitor wells. Well completion details are included on the boring logs in this attachment.

Only two of the fifteen wells (MW-2 and MW-5) and the two piezometers currently have water. MW-7, when drilled and completed as a piezometer (DH-7) at a depth of 50 feet, contained water at a static level of 32 feet. The water disappeared after a monitor well was completed in the same hole to a depth of 85 feet. Another well (MW-7A) was installed 15 feet away to a depth of 45 feet; to date, no water has collected in this well either. This is indicative of the localized nature of the perched water.

Water levels have been measured in the existing monitor wells and piezometers throughout the field program. Water level measurements were determined using an electronic well probe. Each measurement is referenced to the top of the PVC casing (TOC) which was surveyed so that perched water elevations could be determined. The monitor well and piezometer water level elevations are tabulated in a table in this attachment. (Based on our investigation and analysis of water samples, we believe the water encounter in the wells is perched water which percolates from ? streams, which is not considered a consistent or viable aquifer.)

PERCHED WATER SAMPLING

The monitor wells were developed immediately after installation and then allowed to stabilize for several days before sampling, which was performed on July 29, 1994. Prior to sampling the water level was measured, and a minimum of three casing volumes of water were removed from each well using disposable polyethylene bailers. Specific conductance, temperature and pH were monitored during the bailing and a final reading was obtained prior to the sample collection. After the purging was completed the water level was allowed to return to approximately its original level and samples were obtained using polyethylene bailers.

Sample labels were filled out and attached to the sample bottles and the samples were stored on ice in coolers until the samples were delivered to the analytical laboratory. The samples were sent to the laboratory under chain of custody.

SLUG TESTS

Slug injection tests were performed on two (2) monitor wells identified as MW-2 and MW-5, on July 29, 1994 to estimate horizontal hydraulic conductivity values for the fractured bedrock. Each test consisted of injecting a known volume of previously bailed water back into the monitor well as rapidly as possible, and then measuring the depth to water as the water level dropped back to its original static level.

The tests were performed using automatic water level monitoring and logging equipment which provided accurate water level measurements during the recovery phase. The data was analyzed using methods developed by Hvorslev (1951). Results of the tests have been tabulated and plotted and are included along with a summary of the estimated hydraulic conductivity values in this attachment.

SURVEYING

Bingham performed surveying of all monitor well, piezometer, exploratory drill hole, and test pit locations at the site, as part of the field program. The surveying included determining the horizontal coordinates and vertical elevations of these points. All vertical control was based on the USGS benchmark A-16 located approximately 1 mile from the site. The horizontal control was based on the USGS Utah Green River NE 7½ minute topographic quadrangle. The survey data is summarized in a table in this attachment.

LABORATORY TESTING AND ANALYSIS

GEOTECHNICAL LABORATORY TESTING

Selected samples were submitted to Bingham Engineering's materials testing laboratory for the following tests: moisture content, unit weight, grain size analysis, hydrometer, Atterberg limits, and permeability. The results of the tests are included within this attachment.

Atterberg Limits

Atterberg limits (which include the liquid and plastic limits) determinations were performed as an index to soil behavior, to aid in correlating various other test data and to aid in classifying samples.

Grain Size Analysis and Hydrometer

Standard mechanical grain size analysis was performed on selected soil samples obtained in conjunction with the field investigations. The test procedures consisted of washing a representative portion of each sample through a No. 200 sieve and recording the percent dry weight of the material passing the No. 200 sieve. Then the remaining sample, retained above the No. 200 sieve, was evaluated by a mechanical method to determine the percent by dry weight retained on selected sieve sizes. The material passing the 200 sieve was then further analyzed using a hydrometer for some of the samples.

Moisture Content and Unit Weight Determinations

Moisture content and density determinations were performed in order to aid in classifying materials and to correlate with other hydrogeologic properties.

Compaction Testing

Compaction tests were performed on two representative composite samples to determine the maximum dry density and optimum moisture content. The tests were performed in accordance with the ASTM D-698 Method of Compaction.

Permeability

Permeability testing was performed on three separate samples collected from overburden material at the site. The first test was performed on an uncompacted soil sample (TP-1, CA-2) to determine natural infiltration rates of precipitation into the underlying shale bedrock. The other two tests were performed on compacted soil samples which were compacted to 98% of maximum dry density as determined by the standard Proctor. Information regarding the specific soil samples comprising Composite #1 and Composite #2 is given in the Permeability Test Results table presented in Attachment 1.

Triaxial Testing

Two composite samples (Composite #1 and Composite #2) were submitted for triaxial consolidated undrained with pore pressure testing. The results are included in this section.

Swelling Potential

Because the embankments of the landfill cells are to be constructed with excavated Mancos Shale material, laboratory testing was performed on soil and gravel size shale samples from the Green River Landfill site to determine the swelling potential the material would exhibit when wetted. The procedure used is as follows:

1) Specimens of gravel sized shale particles and weathered shale (soil) are placed in the consolidometer at natural moisture content, loaded in the normal manner to some preselected load, and allowed to come to equilibrium;

2) immerse the sample and observe the height increase until equilibrium is reached;

3) reduce the vertical pressure by a factor of two and observe the associated swell;

4) repeat step (3) until loading is removed;

5) plot the curve representing swelling pressure versus percent expansion.

The results of the testing are included on the attached graphs. The testing indicates that only slight to moderate swell characteristics were observed; a maximum of 1.12% under a loading of 130 pounds per square foot. Given a density of 110 pounds per cubic foot (pcf) for the shale at the site, this loading corresponds to a shallow depth of confinement of 0.12 feet. A swell of 1.12% would be equivalent to 0.02 inches.

The results indicate that the gravel sized shale and the soil are very similar in their swelling potential. Weathering of the shale is not expected to have an adverse effect on the stability of the embankments or the cover system.

CHEMICAL LABORATORY ANALYSIS

Perched water samples were submitted to American West Analytical Laboratory for chemical analysis. The results are included in this attachment and are summarized in Table 1 located after the text of the Hydrogeologic Report.

Field Quality Assurance/Quality Control

Sample Preservation - All samples were placed in Class A environmental containers provided by American West Analytical Laboratory (AWAL) with proper preservatives. The samples were stored in a cooler at 4°C until hand delivered to AWAL for analysis.

Chain of Custody - Samples selected to be sent to AWAL for analysis were hand delivered under strict chain of custody protocol.

Field Analysis Validation - Field analysis for the indicator parameters of conductivity and pH were compared to a certified laboratory analysis and the results compared very well.

Laboratory Quality Assurance/Quality Control

Field Duplicate - A field duplicate was collected from MW-5 and submitted to AWAL under the blind sample identification of MW-1.

1. SUMMARY OF WELL, EXPLORATORY HOLE AND TEST PIT LOCATION AND ELEVATIONS

SUMMARY OF WELL, EXPLORATORY HOLE AND TEST PIT LOCATION AND ELEVATIONS GREEN RIVER LANDFILL

DRILL HOLE ID	PROJECT COORDINATES		ELEV. GROUND SURFACE (feet)	ELEV. TOP PROTECTIVE CASING WITH LID (feet)	ELEV. TO OF PVC W/O CAP (feet)	TEMP BENCH MARK (feet)
	Northing (feet)	Easting (feet)				
DH-1	12768.8	1557.1	4313.1	NA	NA	NA
DH-2	12753.5	4082.5	4340.5	NA	4345.28	NA
DH-3	12159.5	2840.0	4333.4	NA	NA	NA
DH-6	11474.3	4140.6	4343.5	NA	NA	NA
DH-8	11445.7	6765.2	4371.6	NA	NA	NA
DH-9	10142.4	3343.0	4348.6	NA	NA	NA
DH-10	10183.3	4374.3	4352.5	NA	4353.83	NA
DH-12	10155.9	6113.2	4377.5	NA	NA	NA
DH-15	8865.9	6768.1	4406.8	NA	NA	NA
MW-2	12778.4	4110.8	NA	4341.39	4341.30	4338.96
MW-4	11489.8	1557.5	4318.5	4321.51	4321.46	NA
MW-5	11452.7	2865.2	NA	4328.51	4328.29	4326.85
MW-7	11447.3	4701.7	4355.8	4358.71	4358.65	NA
MW-7A	11443.7	4716.4	4355.8	4358.75	4358.67	NA
MW-13	8891.7	2912.2	4372.2	4375.22	4375.10	NA
MW-14	8849.3	4187.8	4369.9	4372.81	4372.77	NA
TP-1	11811.7	1900.4	4327.0	NA	NA	NA
TP-2	11577.2	1937.8	4319.9	NA	NA	NA
TP-3	11018.8	2920.4	4331.3	NA	NA	NA
TP-4	10793.8	3437.4	4342.8	NA	NA	NA
TP-5	10161.2	3599.7	4347.8	NA	NA	NA
TP-6	9695.2	4226.9	4356.6	NA	NA	NA
TP-7	9345.4	3623.7	4361.0	NA	NA	NA
TP-8	9250.6	3372.0	4368.4	NA	NA	NA
TP-9	9216.7	3185.1	4361.9	NA	NA	NA
TP-10	8824.3	5039.5	4384.8	NA	NA	NA
TP-11	8945.1	6244.1	4392.6	NA	NA	NA
TP-12	9291.1	6081.2	4398.4	NA	NA	NA
TP-13	9769.4	5711.6	4372.1	NA	NA	NA
TP-14	9411.9	5261.0	4367.5	NA	NA	NA
TP-15	10522.3	5700.1	4372.5	NA	NA	NA
TP-16	10720.2	4411.7	4347.9	NA	NA	NA
TP-17	11520.7	3466.5	4332.7	NA	NA	NA
TP-18	11809.8	3223.7	4347.4	NA	NA	NA

NA - Not Available or Applicable

11/21/94

2. PERCHED WATER LEVEL MEASUREMENTS

PERCHED WATER LEVEL MEASUREMENTS
GREEN RIVER LANDFILL

WELL ID #	Depth to water from top of PVC casing (feet)	GRDWTR SURFACE ELEVATION (feet)	Depth to water from top of PVC casing (feet)	GRDWTR SURFACE ELEVATION (feet)	Depth to water from top of PVC casing (feet)	GRDWTR SURFACE ELEVATION (feet)	Depth to water from top of PVC casing (feet)	GRDWTR SURFACE ELEVATION (feet)	Depth to water from top of PVC casing (feet)	GRDWTR SURFACE ELEVATION (feet)
	July 14, 1994		July 19, 1994		July 22, 1994		July 28, 1994		November 18, 1994	
DH-2	29.97	4315.31	28.06	4317.22	27.46	4317.82	26.72	4318.56	29.48	4315.80
MW-2	27.98	4313.32	26.20	4315.10	25.75	4315.55	25.04	4316.26	25.50	4315.80
MW-4	NA	NA	NA	NA	DRY	DRY	DRY	DRY	DRY	DRY
MW-5	29.96	4298.33	30.68	4297.61	31.05	4297.24	31.67	4296.62	32.21	4296.08
MW-7	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MW-7A	NA	NA	NA	NA	NA	NA	DRY	DRY	DRY	DRY
DH-10	37.68	4316.15	37.52	4316.31	37.42	4316.41	37.57	4316.26	39.05	4314.78
MW-13	DRY	DRY	NA	NA	DRY	DRY	DRY	DRY	DRY	DRY
MW-14	NA	NA	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY

11/21/94

NA Not measured

3. SUMMARY OF SLUG INJECTION TESTS

SUMMARY OF SLUG INJECTION TESTS
GREEN RIVER LANDFILL

Well I.D.	Screen Length (feet)	Effective Aquifer Length (feet)	Volume of Water Injected (gallons)	Calculated Ho (feet)	Hydraulic Conductivity (cm/sec)	Analysis Method
MW-2	75.0	75.0	2.6	15.93	7.6E-05	1
MW-5	60.0	60.0	0.84	5.15	2.1E-05	1

10/14/94

Analysis Methods:

1. Hvorslev
2. Cooper-Bredehoeft-Papadopulos
3. Ferris-Knowles
4. Bouwer

4. GEOTECHNICAL LABORATORY TEST RESULTS

SECTION SIX

SHALE SWELLING POTENTIAL

The embankments of the landfill cells are to be constructed with excavated Mancos Shale material. Laboratory testing was performed on shale samples from the Green River Landfill site to determine the swelling potential the shale and soil would exhibit when wetted. The procedure used is as follows:

1) Specimens of shale and weathered shale (soil) are placed in the consolidometer at natural moisture content, loaded in the normal manner to some preselected load, and allowed to come to equilibrium;

2) immerse the sample and observe the height increase until equilibrium is reached;

3) reduce the vertical pressure by a factor of two and observe the associated swell;

4) repeat step (3) until loading is removed;

5) plot the curve representing swelling pressure versus percent expansion.

The results of the testing are included on the graphs included in Attachment 3. The testing indicates that the largest swell observed was a 1.12% under a loading of 0.013 ksf (thousand pounds/square foot). Given a density of 110 pounds per cubic foot (pcf) for the shale at the site, this loading corresponds to a depth of 0.12 feet. A swell of 1.12% would be equivalent to 0.02 inches.

The results indicate that the shale and the weathered shale are very similar in their swelling potential. Weathering of the shale is not expected to have an adverse effect on the stability of the embankments.

Purpose: Calculate factor of safety for the outer surface of the waste cell embankment.

Assume: Use PC-STABL5M to predict stability
Embankment material is excavated shale
4 cases: 1) Static case
2) Static with vehicle loading (top and mid-point of embankment)
3) Pseudo-static (earthquake)
Earthquake acceleration is less than 0.10 g (use 0.10 g for analysis)
*Use acceleration with 90% of not being exceeded in 250 years
* S.T. Algermissen, et al.; 1982; "Probabilistic Estimates of Maximum Acceleration And Velocity In Rock In The Contiguous United States"; U.S.G.S Open File Report, 82-1033

Soil Parameters

Mancos Shale

Shale material is a blocky angular rockfill typically well graded with a maximum dimension of 18" and very little fines

Strength of the shale is determined from the following:
* Yong R.M., 1980, "Laboratory Shear Strength of Soil", An ASTM symposium in Chicago Ill., June 25, 1980, ASTM 740
* Winterkorn H.F., Fang H., 1975, "Foundation Engineering Handbook"

	Rockfill (1)	In-Situ (2)
Ø	30°	15°
C	0	5000 psf
γ_d	120	130
γ_{sat}	145	155

(1) From Winterkorn → Ø well graded shale = 35°
Ø poorly graded shale = 33°
From ASTM 740 → Ø = 36° from Fig 6.
Conservatively assume Ø = 30°

(2) From Winterkorn → C for unfavorable shale ranges 5-100 psi (720-14,400 psf)
C for favorable shale ranges 100 to >1000 psi
Ø for unfavorable shale ranges 10-20°
Ø for favorable shale ranges 20-65°
Conservatively assume Ø = 15°
C = 35 psi (5000 psf)

Green River Landfill STABL Modeling DEW 10/25/94 2106-006

Assume: No phreatic surface

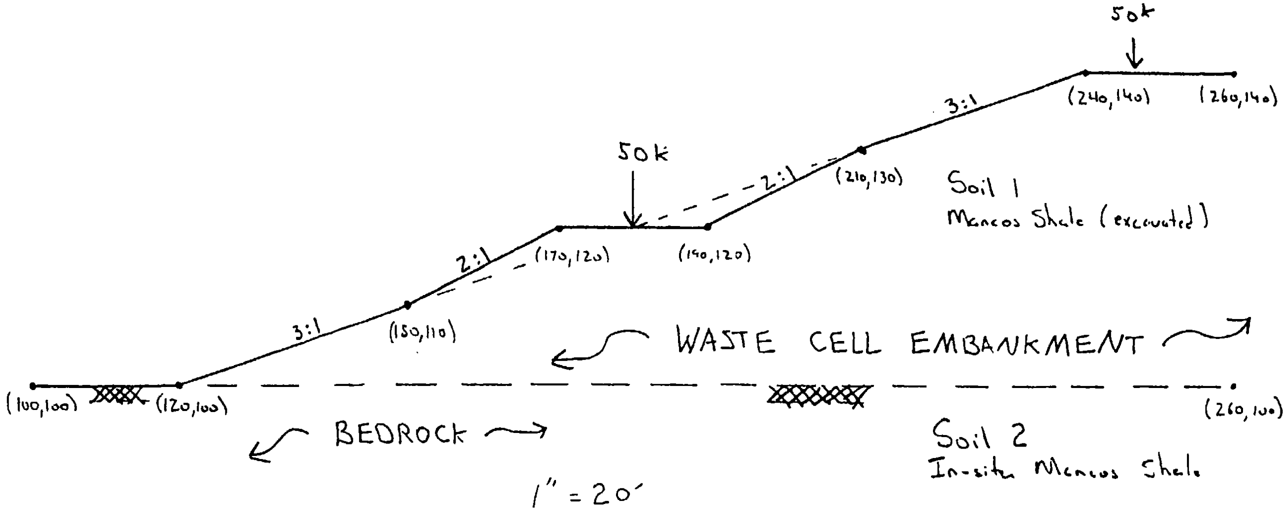
Cases → 1) static (with applied vehicle load (50k))

2) Pseudo-Static without applied vehicle load (earthquake)

Soil parameters given below →

Horizontal acceleration = 0.10g

	Soil 1	Soil 2
γ	120	130
γ_{sat}	145	155
C	0	5000 psf
Ø	30°	15°



Results of STABL Runs

	Factor of safety	Required
Static	1.8	1.5
Static - load at top embank.	1.5	1.5
Static - load at mid-point	1.9	1.5
Pseudo-Static (E quake)	1.3	1.0

Because calculated F.S. ≥ Required, landfill is stable.

```
                    ** PCSTABL5M **

                          by
                    Purdue University

                --Slope Stability Analysis--
              Simplified Janbu, Simplified Bishop
                or Spencer`s Method of Slices

Run Date:                       11/25/94
Time of Run:                    16:20
Run By:                         DEW
Input Data Filename:            RUN1NOL
Output Filename:                RUN1NOL.OUT

PROBLEM DESCRIPTION:
 ITEX Green River Landfill - Run1 (Static case with no vehicle loading)

BOUNDARY COORDINATES

   7 Top   Boundaries
   8 Total Boundaries

Boundary   X-Left   Y-Left   X-Right   Y-Right   Soil Type
  No.       (ft)     (ft)     (ft)      (ft)     Below Bnd

   1       100.00   100.00   120.00    100.00       2
   2       120.00   100.00   150.00    110.00       1
   3       150.00   110.00   170.00    120.00       1
   4       170.00   120.00   190.00    120.00       1
   5       190.00   120.00   210.00    130.00       1
   6       210.00   130.00   240.00    140.00       1
   7       240.00   140.00   260.00    140.00       1
   8       120.00   100.00   260.00    100.00       2


ISOTROPIC SOIL PARAMETERS


 2 Type(s) of Soil


Soil Total  Saturated  Cohesion Friction  Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept  Angle  Pressure Constant Surface
 No.  (pcf)   (pcf)     (psf)     (deg)   Param.   (psf)    No.

  1   120.0   145.0        .0     30.0     .00       .0     1
  2   130.0   155.0    5000.0     15.0     .00       .0     1
```

```
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

300 Trial Surfaces Have Been Generated.

 15 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between  X = 105.00 ft.
                              and  X = 164.00 ft.

Each Surface Terminates Between   X = 240.00 ft.
                             and   X = 260.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y  = 80.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.


Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined.  They Are Ordered - Most Critical
First.


* * Safety Factors Are Calculated By The Modified Bishop Method * *


Failure Surface Specified By 13 Coordinate Points

  Point     X-Surf     Y-Surf
   No.       (ft)       (ft)

    1       132.95     104.32
    2       142.76     106.22
    3       152.53     108.36
    4       162.25     110.72
    5       171.91     113.30
    6       181.51     116.11
    7       191.04     119.14
    8       200.50     122.39
    9       209.88     125.86
   10       219.17     129.54
   11       228.38     133.44
   12       237.50     137.55
   13       242.61     140.00

Circle Center At X =    55.5 ; Y =  529.0  and Radius,  431.7

       ***     1.813   ***
```

```
                Individual data on the   17  slices

                         Water  Water    Tie     Tie    Earthquake
                         Force  Force   Force   Force     Force  Surcharge
Slice  Width   Weight     Top    Bot     Norm    Tan     Hor     Ver     Load
 No.   Ft(m)  Lbs(kg)  Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg)
  1     9.8    803.4     .0      .0      .0      .0      .0      .0      .0
  2     7.2   1545.0     .0      .0      .0      .0      .0      .0      .0
  3     2.5    775.7     .0      .0      .0      .0      .0      .0      .0
  4     9.7   4847.3     .0      .0      .0      .0      .0      .0      .0
  5     7.7   5864.2     .0      .0      .0      .0      .0      .0      .0
  6     1.9   1594.1     .0      .0      .0      .0      .0      .0      .0
  7     9.6   6094.1     .0      .0      .0      .0      .0      .0      .0
  8     8.5   2585.7     .0      .0      .0      .0      .0      .0      .0
  9     1.0    159.9     .0      .0      .0      .0      .0      .0      .0
 10     9.5   2402.1     .0      .0      .0      .0      .0      .0      .0
 11     9.4   3902.5     .0      .0      .0      .0      .0      .0      .0
 12      .1     61.0     .0      .0      .0      .0      .0      .0      .0
 13     9.2   4185.3     .0      .0      .0      .0      .0      .0      .0
 14     9.2   3425.2     .0      .0      .0      .0      .0      .0      .0
 15     9.1   2351.1     .0      .0      .0      .0      .0      .0      .0
 16     2.5    429.8     .0      .0      .0      .0      .0      .0      .0
 17     2.6    195.2     .0      .0      .0      .0      .0      .0      .0

        Failure Surface Specified By 15 Coordinate Points


          Point    X-Surf    Y-Surf
           No.      (ft)      (ft)

            1      120.53    100.18
            2      130.39    101.82
            3      140.21    103.69
            4      149.99    105.78
            5      159.72    108.11
            6      169.39    110.65
            7      179.00    113.43
            8      188.54    116.42
            9      198.01    119.64
           10      207.40    123.07
           11      216.71    126.72
           12      225.93    130.58
           13      235.06    134.66
           14      244.10    138.95
           15      246.18    140.00

        Circle Center At X =   54.7 ; Y =  526.2  and Radius,  431.1

             ***    1.816   ***
```

```
Failure Surface Specified By 13 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)      (ft)

    1      132.95    104.32
    2      142.88    105.52
    3      152.75    107.07
    4      162.57    108.98
    5      172.31    111.24
    6      181.96    113.85
    7      191.52    116.81
    8      200.96    120.10
    9      210.28    123.74
   10      219.46    127.70
   11      228.49    132.00
   12      237.36    136.61
   13      243.34    140.00

Circle Center At X =  104.6 ; Y =  381.0  and Radius,  278.2

     ***    1.838   ***

Failure Surface Specified By 15 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)      (ft)

    1      120.53    100.18
    2      130.37    101.94
    3      140.18    103.88
    4      149.95    106.01
    5      159.68    108.33
    6      169.36    110.83
    7      178.99    113.51
    8      188.57    116.38
    9      198.10    119.42
   10      207.56    122.65
   11      216.97    126.05
   12      226.30    129.64
   13      235.57    133.39
   14      244.77    137.33
   15      250.70    140.00

Circle Center At X =   32.5 ; Y =  620.8  and Radius,  528.0

     ***    1.850   ***
```

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	132.95	104.32
2	142.91	105.20
3	152.82	106.50
4	162.68	108.21
5	172.45	110.34
6	182.12	112.87
7	191.68	115.80
8	201.11	119.13
9	210.39	122.85
10	219.51	126.96
11	228.45	131.44
12	237.19	136.29
13	243.26	140.00

Circle Center At X = 116.8 ; Y = 343.0 and Radius, 239.2

*** 1.852 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	123.63	101.21
2	133.62	101.72
3	143.58	102.65
4	153.48	104.00
5	163.33	105.77
6	173.08	107.95
7	182.74	110.55
8	192.28	113.55
9	201.68	116.96
10	210.93	120.76
11	220.01	124.95
12	228.91	129.52
13	237.60	134.46
14	246.08	139.77
15	246.41	140.00

Circle Center At X = 116.7 ; Y = 337.0 and Radius, 235.9

*** 1.865 ***

```
Failure Surface Specified By 15 Coordinate Points

  Point     X-Surf     Y-Surf
   No.       (ft)      (ft)

    1      123.63     101.21
    2      133.57     102.33
    3      143.47     103.75
    4      153.32     105.46
    5      163.12     107.46
    6      172.85     109.75
    7      182.51     112.33
    8      192.09     115.20
    9      201.58     118.35
   10       210.98     121.79
   11       220.26     125.50
   12       229.43     129.48
   13       238.48     133.74
   14       247.40     138.27
   15       250.58     140.00

 Circle Center At X =    91.0 ; Y =   435.5  and Radius,  335.9

      ***     1.867   ***

 Failure Surface Specified By 13 Coordinate Points

  Point     X-Surf     Y-Surf
   No.       (ft)      (ft)

    1      136.05     105.35
    2      146.03     105.99
    3      155.97     107.11
    4      165.84     108.72
    5      175.62     110.80
    6      185.29     113.36
    7      194.82     116.38
    8      204.19     119.86
    9      213.39     123.80
   10       222.38     128.18
   11       231.14     132.99
   12       239.67     138.22
   13       242.27     140.00

 Circle Center At X =   127.9 ; Y =   310.7  and Radius,  205.5

      ***     1.870   ***
```

```
Failure Surface Specified By 13 Coordinate Points


 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1      136.05    105.35
   2      145.79    107.63
   3      155.50    110.03
   4      165.18    112.54
   5      174.83    115.17
   6      184.44    117.91
   7      194.03    120.76
   8      203.58    123.72
   9      213.09    126.80
  10      222.57    129.99
  11      232.01    133.29
  12      241.41    136.69
  13      250.20    140.00

Circle Center At X =  -53.3 ; Y =  934.7  and Radius,  850.7


    ***    1.873   ***


Failure Surface Specified By 10 Coordinate Points


 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1      160.90    115.45
   2      170.85    116.45
   3      180.73    117.97
   4      190.51    120.03
   5      200.18    122.60
   6      209.69    125.69
   7      219.02    129.29
   8      228.15    133.37
   9      237.04    137.94
  10      240.58    140.00

Circle Center At X =  147.4 ; Y =  300.7  and Radius,  185.7


    ***    1.878   ***
```

```
              Y         A     X    I    S          F     T

              .00      32.50     65.00     97.50    130.00    162.50

X          .00 +---------+---------+---------+---------+---------+---------+
                -
                -
                -
                -
                -
         32.50 +
                -
                -
                -
                -
                -
A        65.00 +
                -
                -
                -
                -
                -
X        97.50 +                         *
                -                    .
                -                    .
                -                   ...
                -                 . ..*
                -                 ....6
I       130.00 +                     .....2.
                -                .....61
                -               .......21
                -               .......68.
                -               .......61*
                -               ........29.
S       162.50 +                     ........5190
                -               ........82. *
                -               ........6310
                -               ..........20
                -               .........631
                -               ..........62*
        195.00 +                    ...........89
                -               ...........621
                -                ...........82
                -                ...........631*
                -                 ............21
                -                 ..........639
F       227.50 +                       ...........21
                -                   ...........2.
                -                    ..........61*
                -                    ..........41
                -                       ........4
                -                        .......
T       260.00 +                         *      ...*
```

```
                    ** PCSTABL5M **

                         by
                   Purdue University

               --Slope Stability Analysis--
           Simplified Janbu, Simplified Bishop
             or Spencer`s Method of Slices

Run Date:                    11/25/94
Time of Run:                 16:45
Run By:                      DEW
Input Data Filename:         RUN1TOP
Output Filename:             RUN1TOP.OUT


PROBLEM DESCRIPTION:
 ITEX Green River Landfill - Run1 (Static case with vehicle loading at top)


BOUNDARY COORDINATES

   7 Top   Boundaries
   8 Total Boundaries


Boundary    X-Left    Y-Left    X-Right    Y-Right    Soil Type
  No.        (ft)      (ft)      (ft)       (ft)     Below Bnd

   1        100.00    100.00    120.00     100.00        2
   2        120.00    100.00    150.00     110.00        1
   3        150.00    110.00    170.00     120.00        1
   4        170.00    120.00    190.00     120.00        1
   5        190.00    120.00    210.00     130.00        1
   6        210.00    130.00    240.00     140.00        1
   7        240.00    140.00    260.00     140.00        1
   8        120.00    100.00    260.00     100.00        2

ISOTROPIC SOIL PARAMETERS

 2 Type(s) of Soil

Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)     (psf)     (deg)   Param.    (psf)    No.

  1   120.0    145.0       .0      30.0     .00        .0      1
  2   130.0    155.0    5000.0     15.0     .00        .0      1
```

```
        BOUNDARY LOAD(S)

           1 Load(s) Specified


         Load      X-Left     X-Right    Intensity    Deflection
          No.       (ft)        (ft)    (lb/sqft)       (deg)


           1       245.00     255.00     5000.0           .0


         NOTE - Intensity Is Specified As A Uniformly Distributed
                Force Acting On A Horizontally Projected Surface.
   1


         A Critical Failure Surface Searching Method, Using A Random
         Technique For Generating Circular Surfaces, Has Been Specified.


         300 Trial Surfaces Have Been Generated.


          15 Surfaces Initiate From Each Of 20 Points Equally Spaced
         Along The Ground Surface Between  X = 110.00 ft.
                                     and  X = 164.00 ft.


         Each Surface Terminates Between   X = 240.00 ft.
                                    and   X = 260.00 ft.


         Unless Further Limitations Were Imposed, The Minimum Elevation
         At Which A Surface Extends Is  Y = 80.00 ft.


         10.00 ft. Line Segments Define Each Trial Failure Surface.


   1


         Following Are Displayed The Ten Most Critical Of The Trial
         Failure Surfaces Examined.  They Are Ordered - Most Critical
         First.


         * * Safety Factors Are Calculated By The Modified Bishop Method * *
```

```
Failure Surface Specified By 12 Coordinate Points

  Point      X-Surf     Y-Surf
   No.        (ft)      (ft)

    1       161.16     115.58
    2       171.07     114.29
    3       181.06     113.84
    4       191.06     114.24
    5       200.98     115.48
    6       210.76     117.56
    7       220.33     120.46
    8       229.62     124.16
    9       238.57     128.63
   10       247.10     133.84
   11       255.16     139.76
   12       255.44     140.00

Circle Center At X =   181.3 ; Y =  231.8  and Radius,  118.0


       ***     1.482   ***

     Individual data on the     17  slices


                   Water  Water     Tie     Tie    Earthquake
                   Force  Force   Force   Force       Force   Surcharge
Slice  Width   Weight   Top     Bot     Norm     Tan     Hor      Ver     Load
 No.   Ft(m)  Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg)
  1     8.8   2955.8     .0      .0      .0      .0      .0      .0      .0
  2     1.1    727.6     .0      .0      .0      .0      .0      .0      .0
  3    10.0   7115.3     .0      .0      .0      .0      .0      .0      .0
  4     8.9   6412.3     .0      .0      .0      .0      .0      .0      .0
  5     1.1    766.5     .0      .0      .0      .0      .0      .0      .0
  6     9.9   9699.8     .0      .0      .0      .0      .0      .0      .0
  7     9.0  12234.5     .0      .0      .0      .0      .0      .0      .0
  8      .8   1154.1     .0      .0      .0      .0      .0      .0      .0
  9     9.6  14742.1     .0      .0      .0      .0      .0      .0      .0
 10     9.3  14138.7     .0      .0      .0      .0      .0      .0      .0
 11     8.9  12489.8     .0      .0      .0      .0      .0      .0      .0
 12     1.4   1838.6     .0      .0      .0      .0      .0      .0      .0
 13     5.0   5380.3     .0      .0      .0      .0      .0      .0      .0
 14     2.1   1714.5     .0      .0      .0      .0      .0      .0 10507.5
 15     7.9   3089.6     .0      .0      .0      .0      .0      .0 39492.5
 16      .2      6.0     .0      .0      .0      .0      .0      .0      .0
 17      .3      4.0     .0      .0      .0      .0      .0      .0      .0
```

```
Failure Surface Specified By 12 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1      158.32    114.16
   2      168.27    113.22
   3      178.27    113.05
   4      188.25    113.64
   5      198.16    115.00
   6      207.93    117.11
   7      217.52    119.96
   8      226.86    123.55
   9      235.89    127.83
  10       244.57    132.80
  11       252.84    138.42
  12       254.83    140.00

Circle Center At X =  175.6 ; Y =  242.9  and Radius,  129.9

      ***    1.485   ***
```

```
Failure Surface Specified By 12 Coordinate Points


 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1      161.16    115.58
   2      170.90    113.31
   3      180.82    112.10
   4      190.82    111.97
   5      200.78    112.92
   6      210.57    114.93
   7      220.10    117.99
   8      229.23    122.06
   9      237.88    127.08
  10       245.93    133.01
  11       253.30    139.77
  12       253.50    140.00

Circle Center At X =  187.0 ; Y =  204.6  and Radius,   92.7

      ***    1.514   ***
```

```
Failure Surface Specified By 11 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)      (ft)

   1      161.16    115.58
   2      170.86    113.15
   3      180.77    111.84
   4      190.77    111.64
   5      200.73    112.57
   6      210.52    114.61
   7      220.01    117.74
   8      229.10    121.91
   9      237.66    127.08
  10      245.58    133.18
  11      252.63    140.00

Circle Center At X =  187.5 ; Y =  200.4  and Radius,   88.8

    ***    1.541   ***

Failure Surface Specified By 13 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)      (ft)

   1      152.63    111.32
   2      162.48    109.60
   3      172.45    108.76
   4      182.45    108.83
   5      192.40    109.78
   6      202.23    111.62
   7      211.86    114.34
   8      221.20    117.90
   9      230.19    122.28
  10      238.75    127.45
  11      246.81    133.37
  12      254.31    139.98
  13      254.33    140.00

Circle Center At X =  176.8 ; Y =  220.4  and Radius,  111.7

    ***    1.557   ***
```

```
Failure Surface Specified By 11 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1     164.00    117.00
   2     173.99    116.53
   3     183.99    116.71
   4     193.95    117.52
   5     203.85    118.98
   6     213.63    121.07
   7     223.25    123.78
   8     232.68    127.10
   9     241.88    131.03
  10      250.81    135.54
  11      258.39    140.00

Circle Center At X =  176.3 ; Y =  272.0  and Radius,  155.5

     ***    1.566   ***


Failure Surface Specified By 14 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)     (ft)

   1     132.74    104.25
   2     142.74    104.31
   3     152.72    104.84
   4     162.67    105.83
   5     172.57    107.28
   6     182.38    109.19
   7     192.10    111.55
   8     201.70    114.36
   9     211.15    117.61
  10      220.45    121.30
  11      229.56    125.42
  12      238.47    129.96
  13      247.17    134.90
  14      255.23    140.00

Circle Center At X =  136.4 ; Y =  319.4  and Radius,  215.2

     ***    1.570   ***
```

```
Failure Surface Specified By 15 Coordinate Points

 Point     X-Surf     Y-Surf
  No.       (ft)       (ft)

   1      129.90     103.30
   2      139.87     102.61
   3      149.87     102.50
   4      159.86     102.97
   5      169.80     104.03
   6      179.67     105.66
   7      189.42     107.86
   8      199.03     110.63
   9      208.47     113.95
  10      217.69     117.81
  11      226.67     122.21
  12      235.39     127.11
  13      243.80     132.52
  14      251.88     138.41
  15      253.81     140.00

Circle Center At X =  146.7 ; Y =  274.3  and Radius,  171.8

      ***    1.589   ***

Failure Surface Specified By 15 Coordinate Points

 Point     X-Surf     Y-Surf
  No.       (ft)       (ft)

   1      129.90     103.30
   2      139.84     102.27
   3      149.83     101.87
   4      159.83     102.10
   5      169.79     102.96
   6      179.68     104.44
   7      189.46     106.54
   8      199.09     109.25
   9      208.52     112.56
  10      217.73     116.46
  11      226.68     120.93
  12      235.32     125.95
  13      243.64     131.51
  14      251.59     137.58
  15      254.38     140.00

Circle Center At X =  151.2 ; Y =  260.8  and Radius,  159.0

      ***    1.593   ***
```

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.26	107.09
2	151.17	105.74
3	161.15	105.14
4	171.15	105.30
5	181.11	106.23
6	190.97	107.90
7	200.67	110.31
8	210.17	113.46
9	219.39	117.31
10	228.30	121.86
11	236.84	127.06
12	244.96	132.90
13	252.61	139.34
14	253.29	140.00

Circle Center At X = 164.0 ; Y = 236.8 and Radius, 131.7

*** 1.594 ***

```
          Y          A     X     I    S          F     T

           .00      32.50     65.00     97.50    130.00    162.50

X       .00  +---------+---------+---------+---------+---------+
          -
          -
          -
          -
          -
       32.50 +
          -
          -
          -
          -
          -
A      65.00 +
          -
          -
          -
          -
          -
X      97.50 +                          *
          -
          -                        .
          -                        .
          -                      ..*
          -                    .....
I     130.00 +                      .....8
          -                    ......7
          -                    .....970
          -                   ..........
          -                   ......970*
          -                   ..........2
S     162.50 +                     ......9875.1
          -                   .......8..2 *
          -                   .......05.16
          -                   .......9831.
          -                   ........57.6
          -                   ........831.*
      195.00 +                    .........5.6.
          -                   .........521..
          -                   .........826.
          -                   .........316..*
          -                    .........82...
          -                     ........316..
F     227.50 +                       .........917..
          -                      .........6..
          -                        .......21..*
          -                        ........62../1
          -                         .......16.
          -                            ......11/
T     260.00 +                          *       .*
```

```
                    ** PCSTABL5M **

                          by
                    Purdue University

                --Slope Stability Analysis--
             Simplified Janbu, Simplified Bishop
               or Spencer`s Method of Slices

Run Date:                 11/25/94
Time of Run:              16:45
Run By:                   DEW
Input Data Filename:      RUN1
Output Filename:          RUN1.OUT


PROBLEM DESCRIPTION:
 ITEX Green River Landfill - Run1 (Static case with vehicle loading)


BOUNDARY COORDINATES

   7 Top   Boundaries
   8 Total Boundaries


Boundary   X-Left   Y-Left   X-Right   Y-Right   Soil Type
  No.       (ft)     (ft)     (ft)      (ft)     Below Bnd

   1       100.00   100.00   120.00    100.00       2
   2       120.00   100.00   150.00    110.00       1
   3       150.00   110.00   170.00    120.00       1
   4       170.00   120.00   190.00    120.00       1
   5       190.00   120.00   210.00    130.00       1
   6       210.00   130.00   240.00    140.00       1
   7       240.00   140.00   260.00    140.00       1
   8       120.00   100.00   260.00    100.00       2

ISOTROPIC SOIL PARAMETERS

 2 Type(s) of Soil

Soil  Total  Saturated  Cohesion Friction  Pore   Pressure  Piez.
Type Unit Wt. Unit Wt. Intercept  Angle  Pressure Constant Surface
 No.  (pcf)   (pcf)     (psf)     (deg)   Param.   (psf)    No.

  1   120.0   145.0       .0      30.0    .00       .0      1
  2   130.0   155.0    5000.0     15.0    .00       .0      1
```

```
BOUNDARY LOAD(S)

   1 Load(s) Specified


 Load      X-Left     X-Right    Intensity    Deflection
  No.        (ft)        (ft)     (lb/sqft)       (deg)


   1       180.00      190.00      2500.0           .0


 NOTE - Intensity Is Specified As A Uniformly Distributed
      Force Acting On A Horizontally Projected Surface.
1


 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.


 300 Trial Surfaces Have Been Generated.


  15 Surfaces Initiate From Each Of 20 Points Equally Spaced
 Along The Ground Surface Between  X = 110.00 ft.
                              and  X = 164.00 ft.


 Each Surface Terminates Between   X = 240.00 ft.
                             and   X = 260.00 ft.


 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y = 80.00 ft.


 10.00 ft. Line Segments Define Each Trial Failure Surface.


1


 Following Are Displayed The Ten Most Critical Of The Trial
 Failure Surfaces Examined.  They Are Ordered - Most Critical
 First.


 * * Safety Factors Are Calculated By The Modified Bishop Method * *
```

```
Failure Surface Specified By 12 Coordinate Points


  Point     X-Surf     Y-Surf
   No.       (ft)       (ft)

    1       141.26     107.09
    2       151.08     109.00
    3       160.85     111.15
    4       170.55     113.55
    5       180.20     116.19
    6       189.77     119.08
    7       199.27     122.21
    8       208.69     125.57
    9       218.02     129.17
   10       227.25     133.00
   11       236.39     137.07
   12       242.56     140.00

Circle Center At X =   70.7 ; Y =  496.5  and Radius,  395.7

    ***    1.864   ***

    Individual data on the    17  slices

                    Water  Water    Tie     Tie    Earthquake
                    Force  Force   Force   Force      Force  Surcharge
Slice Width  Weight   Top    Bot    Norm    Tan     Hor     Ver    Load
 No.  Ft(m) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg) Lbs(kg)
  1    8.7   636.3    .0      .0      .0      .0      .0      .0      .0
  2    1.1   178.7    .0      .0      .0      .0      .0      .0      .0
  3    9.8  3407.6    .0      .0      .0      .0      .0      .0      .0
  4    9.2  5964.4    .0      .0      .0      .0      .0      .0      .0
  5     .6   432.4    .0      .0      .0      .0      .0      .0      .0
  6    9.4  5843.9    .0      .0      .0      .0      .0      .0      .0
  7     .2    90.6    .0      .0      .0      .0      .0      .0   492.6
  8    9.6  2715.4    .0      .0      .0      .0      .0      .0 23936.6
  9     .2    24.2    .0      .0      .0      .0      .0      .0   570.8
 10    9.3  1822.1    .0      .0      .0      .0      .0      .0      .0
 11    9.4  3506.2    .0      .0      .0      .0      .0      .0      .0
 12    1.3   606.2    .0      .0      .0      .0      .0      .0      .0
 13    8.0  3573.4    .0      .0      .0      .0      .0      .0      .0
 14    9.2  3464.7    .0      .0      .0      .0      .0      .0      .0
 15    9.1  2454.6    .0      .0      .0      .0      .0      .0      .0
 16    3.6   637.9    .0      .0      .0      .0      .0      .0      .0
 17    2.6   186.6    .0      .0      .0      .0      .0      .0      .0
```

```
Failure Surface Specified By 15 Coordinate Points


 Point    X-Surf     Y-Surf
  No.      (ft)       (ft)

   1      121.37     100.46
   2      131.35     101.14
   3      141.29     102.21
   4      151.19     103.64
   5      161.02     105.45
   6      170.78     107.62
   7      180.45     110.16
   8      190.02     113.06
   9      199.48     116.32
  10      208.80     119.93
  11      217.99     123.89
  12      227.02     128.19
  13      235.88     132.82
  14      244.56     137.79
  15      248.10     140.00

Circle Center At X =  108.0 ; Y =  366.3  and Radius,  266.2


     ***    1.872   ***


1

Failure Surface Specified By 12 Coordinate Points


 Point    X-Surf     Y-Surf
  No.      (ft)       (ft)

   1      141.26     107.09
   2      151.19     108.29
   3      161.06     109.87
   4      170.87     111.84
   5      180.59     114.20
   6      190.21     116.93
   7      199.71     120.03
   8      209.09     123.51
   9      218.33     127.34
  10      227.40     131.54
  11      236.31     136.08
  12      243.29     140.00

Circle Center At X =  115.7 ; Y =  361.0  and Radius,  255.2


     ***    1.914   ***
```

```
     Failure Surface Specified By 14 Coordinate Points

       Point      X-Surf     Y-Surf
        No.        (ft)       (ft)

         1        129.90     103.30
         2        139.83     104.42
         3        149.73     105.85
         4        159.58     107.59
         5        169.37     109.64
         6        179.08     111.99
         7        188.73     114.64
         8        198.28     117.60
         9        207.74     120.85
        10        217.09     124.39
        11        226.32     128.23
        12        235.43     132.36
        13        244.41     136.76
        14        250.51     140.00

     Circle Center At X =   99.2 ; Y =  420.7  and Radius,  318.9

           ***    1.918   ***


 1

     Failure Surface Specified By 14 Coordinate Points

       Point      X-Surf     Y-Surf
        No.        (ft)       (ft)

         1        132.74     104.25
         2        142.72     104.75
         3        152.68     105.72
         4        162.58     107.14
         5        172.40     109.01
         6        182.13     111.34
         7        191.73     114.11
         8        201.21     117.31
         9        210.52     120.95
        10        219.66     125.01
        11        228.60     129.49
        12        237.33     134.37
        13        245.82     139.65
        14        246.32     140.00

     Circle Center At X =  126.7 ; Y =  321.7  and Radius,  217.5

           ***    1.920   ***
```

```
Failure Surface Specified By 12 Coordinate Points

  Point     X-Surf     Y-Surf
   No.       (ft)       (ft)

    1       141.26     107.09
    2       151.22     107.97
    3       161.13     109.31
    4       170.97     111.10
    5       180.72     113.33
    6       190.36     116.00
    7       199.86     119.11
    8       209.22     122.64
    9       218.40     126.60
   10        227.39     130.97
   11        236.18     135.75
   12        243.23     140.00

Circle Center At X =  126.9 ; Y =  326.0  and Radius,  219.4

     ***     1.933    ***


1

Failure Surface Specified By 13 Coordinate Points

  Point     X-Surf     Y-Surf
   No.       (ft)       (ft)

    1       144.11     108.04
    2       153.84     110.32
    3       163.55     112.72
    4       173.22     115.25
    5       182.87     117.89
    6       192.48     120.66
    7       202.05     123.54
    8       211.59     126.54
    9       221.09     129.66
   10        230.56     132.90
   11        239.98     136.25
   12        249.35     139.72
   13        250.07     140.00

Circle Center At X =  -35.0 ; Y =  893.4  and Radius,  805.6

     ***     1.947    ***
```

```
        Failure Surface Specified By 12 Coordinate Points


          Point     X-Surf      Y-Surf
           No.       (ft)        (ft)

            1       144.11      108.04
            2       154.09      108.67
            3       164.02      109.84
            4       173.87      111.53
            5       183.63      113.74
            6       193.25      116.47
            7       202.71      119.70
            8       211.99      123.42
            9       221.06      127.64
           10        229.89      132.32
           11        238.47      137.47
           12        242.21      140.00

        Circle Center At X =  137.2 ; Y =  295.8  and Radius,  187.9


              ***    1.971    ***

   1

        Failure Surface Specified By 15 Coordinate Points


          Point     X-Surf      Y-Surf
           No.       (ft)        (ft)

            1       127.05      102.35
            2       137.05      102.36
            3       147.04      102.84
            4       157.00      103.79
            5       166.90      105.21
            6       176.72      107.09
            7       186.44      109.43
            8       196.04      112.23
            9       205.50      115.47
           10        214.79      119.16
           11        223.91      123.28
           12        232.81      127.82
           13        241.50      132.78
           14        249.94      138.14
           15        252.58      140.00

        Circle Center At X =  131.8 ; Y =  314.8  and Radius,  212.5

              ***    1.980    ***
```

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	121.37	100.46
2	131.26	101.92
3	141.12	103.58
4	150.95	105.43
5	160.74	107.47
6	170.49	109.71
7	180.19	112.13
8	189.84	114.74
9	199.44	117.53
10	208.99	120.52
11	218.47	123.69
12	227.89	127.04
13	237.25	130.58
14	246.53	134.29
15	255.74	138.19
16	259.79	140.00

Circle Center At X = 51.3 ; Y = 607.8 and Radius, 512.2

*** 1.987 ***

1

```
          Y     A    X    I    S       F    T

           .00      32.50     65.00     97.50    130.00    162.50
X       .00 +---------+---------+---------+---------+---------+
           -
           -
           -
           -
           -
      32.50 +
           -
           -
           -
           -
           -
A     65.00 +
           -
           -
           -
           -
           -
X     97.50 +                         *
           -
           -                     .
           -                     .
           -                    ..*
           -                  ....9
I    130.00 +                     ....24
           -                 .....95
           -                 .....241
           -                .......97.
           -                .......23*
           -                .......94..
S    162.50 +                    .......2517.
           -                .......9.41 *
           -                ........237.
           -                ........9231 /1
           -                .........587
           -                ..........23*1/
     195.00 +                   ..........987
           -                ...........231
           -                 ..........94.
           -                 ...........231*
           -                  ..........9231
           -                   ..........587
F    227.50 +                      ...........231
           -                    .........9.4
           -                     ........021*
           -                     .........921
           -                       .......0.2
           -                         ......9
T    260.00 +                         *        .*
```

```
                        ** PCSTABL5M **

                              by
                        Purdue University

                    --Slope Stability Analysis--
                 Simplified Janbu, Simplified Bishop
                   or Spencer`s Method of Slices

     Run Date:                      11/25/94
     Time of Run:                   16:20
     Run By:                        DEW
     Input Data Filename:           RUN1EQ
     Output Filename:               RUN1EQ.OUT

     PROBLEM DESCRIPTION:
      ITEX Green River Landfill - Run1 (Psuedo-static case)

     BOUNDARY COORDINATES

        7 Top    Boundaries
        8 Total Boundaries


     Boundary     X-Left    Y-Left    X-Right    Y-Right   Soil Type
        No.        (ft)      (ft)      (ft)       (ft)     Below Bnd

         1       100.00    100.00    120.00     100.00        2
         2       120.00    100.00    150.00     110.00        1
         3       150.00    110.00    170.00     120.00        1
         4       170.00    120.00    190.00     120.00        1
         5       190.00    120.00    210.00     130.00        1
         6       210.00    130.00    240.00     140.00        1
         7       240.00    140.00    260.00     140.00        1
         8       120.00    100.00    260.00     100.00        2

    ISOTROPIC SOIL PARAMETERS

      2 Type(s) of Soil

     Soil  Total  Saturated  Cohesion Friction  Pore   Pressure  Piez.
     Type Unit Wt. Unit Wt. Intercept  Angle  Pressure Constant Surface
      No.  (pcf)    (pcf)     (psf)    (deg)   Param.    (psf)    No.

       1   120.0    145.0       .0     30.0     .00        .0     1
       2   130.0    155.0    5000.0    15.0     .00        .0     1
```

```
A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure =      .0 psf


A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.


300 Trial Surfaces Have Been Generated.


 15 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between  X = 105.00 ft.
                                and  X = 164.00 ft.


Each Surface Terminates Between   X = 240.00 ft.
                               and   X = 260.00 ft.


Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y = 80.00 ft.


10.00 ft. Line Segments Define Each Trial Failure Surface.


1


Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined.  They Are Ordered - Most Critical
First.


* * Safety Factors Are Calculated By The Modified Bishop Method * *
```

```
Failure Surface Specified By 13 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)      (ft)

    1      132.95    104.32
    2      142.76    106.22
    3      152.53    108.36
    4      162.25    110.72
    5      171.91    113.30
    6      181.51    116.11
    7      191.04    119.14
    8      200.50    122.39
    9      209.88    125.86
   10      219.17    129.54
   11      228.38    133.44
   12      237.50    137.55
   13      242.61    140.00

Circle Center At X =   55.5 ; Y =  529.0  and Radius,  431.7

      ***    1.339   ***

    Individual data on the    17  slices


                   Water   Water    Tie      Tie    Earthquake
                   Force   Force    Force    Force     Force   Surcharge
Slice  Width   Weight   Top      Bot      Norm     Tan      Hor      Ver     Load
 No.   Ft(m)  Lbs(kg)  Lbs(kg)  Lbs(kg)  Lbs(kg)  Lbs(kg)  Lbs(kg)  Lbs(kg)  Lbs(kg)
  1     9.8    803.4     .0       .0       .0       .0     80.3      .0       .0
  2     7.2   1545.0     .0       .0       .0       .0    154.5      .0       .0
  3     2.5    775.7     .0       .0       .0       .0     77.6      .0       .0
  4     9.7   4847.3     .0       .0       .0       .0    484.7      .0       .0
  5     7.7   5864.2     .0       .0       .0       .0    586.4      .0       .0
  6     1.9   1594.1     .0       .0       .0       .0    159.4      .0       .0
  7     9.6   6094.1     .0       .0       .0       .0    609.4      .0       .0
  8     8.5   2585.7     .0       .0       .0       .0    258.6      .0       .0
  9     1.0    159.9     .0       .0       .0       .0     16.0      .0       .0
 10     9.5   2402.1     .0       .0       .0       .0    240.2      .0       .0
 11     9.4   3902.5     .0       .0       .0       .0    390.3      .0       .0
 12      .1     61.0     .0       .0       .0       .0      6.1      .0       .0
 13     9.2   4185.3     .0       .0       .0       .0    418.5      .0       .0
 14     9.2   3425.2     .0       .0       .0       .0    342.5      .0       .0
 15     9.1   2351.1     .0       .0       .0       .0    235.1      .0       .0
 16     2.5    429.8     .0       .0       .0       .0     43.0      .0       .0
 17     2.6    195.2     .0       .0       .0       .0     19.5      .0       .0
```

```
Failure Surface Specified By 15 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)     (ft)

    1      120.53    100.18
    2      130.39    101.82
    3      140.21    103.69
    4      149.99    105.78
    5      159.72    108.11
    6      169.39    110.65
    7      179.00    113.43
    8      188.54    116.42
    9      198.01    119.64
   10      207.40    123.07
   11      216.71    126.72
   12      225.93    130.58
   13      235.06    134.66
   14      244.10    138.95
   15      246.18    140.00

Circle Center At X =   54.7 ; Y =  526.2  and Radius,  431.1

      ***    1.343   ***

Failure Surface Specified By 13 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)     (ft)

    1      132.95    104.32
    2      142.88    105.52
    3      152.75    107.07
    4      162.57    108.98
    5      172.31    111.24
    6      181.96    113.85
    7      191.52    116.81
    8      200.96    120.10
    9      210.28    123.74
   10      219.46    127.70
   11      228.49    132.00
   12      237.36    136.61
   13      243.34    140.00

Circle Center At X =  104.6 ; Y =  381.0  and Radius,  278.2

      ***    1.359   ***
```

```
Failure Surface Specified By 15 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)      (ft)

   1     120.53    100.18
   2     130.37    101.94
   3     140.18    103.88
   4     149.95    106.01
   5     159.68    108.33
   6     169.36    110.83
   7     178.99    113.51
   8     188.57    116.38
   9     198.10    119.42
  10     207.56    122.65
  11     216.97    126.05
  12     226.30    129.64
  13     235.57    133.39
  14     244.77    137.33
  15     250.70    140.00

Circle Center At X =   32.5 ; Y =  620.8  and Radius,  528.0

      ***    1.361   ***

Failure Surface Specified By 13 Coordinate Points

 Point    X-Surf    Y-Surf
  No.      (ft)      (ft)

   1     132.95    104.32
   2     142.91    105.20
   3     152.82    106.50
   4     162.68    108.21
   5     172.45    110.34
   6     182.12    112.87
   7     191.68    115.80
   8     201.11    119.13
   9     210.39    122.85
  10     219.51    126.96
  11     228.45    131.44
  12     237.19    136.29
  13     243.26    140.00

Circle Center At X =  116.8 ; Y =  343.0  and Radius,  239.2

      ***    1.369   ***
```

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	136.05	105.35
2	145.79	107.63
3	155.50	110.03
4	165.18	112.54
5	174.83	115.17
6	184.44	117.91
7	194.03	120.76
8	203.58	123.72
9	213.09	126.80
10	222.57	129.99
11	232.01	133.29
12	241.41	136.69
13	250.20	140.00

Circle Center At X = -53.3 ; Y = 934.7 and Radius, 850.7

*** 1.372 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	123.63	101.21
2	133.57	102.33
3	143.47	103.75
4	153.32	105.46
5	163.12	107.46
6	172.85	109.75
7	182.51	112.33
8	192.09	115.20
9	201.58	118.35
10	210.98	121.79
11	220.26	125.50
12	229.43	129.48
13	238.48	133.74
14	247.40	138.27
15	250.58	140.00

Circle Center At X = 91.0 ; Y = 435.5 and Radius, 335.9

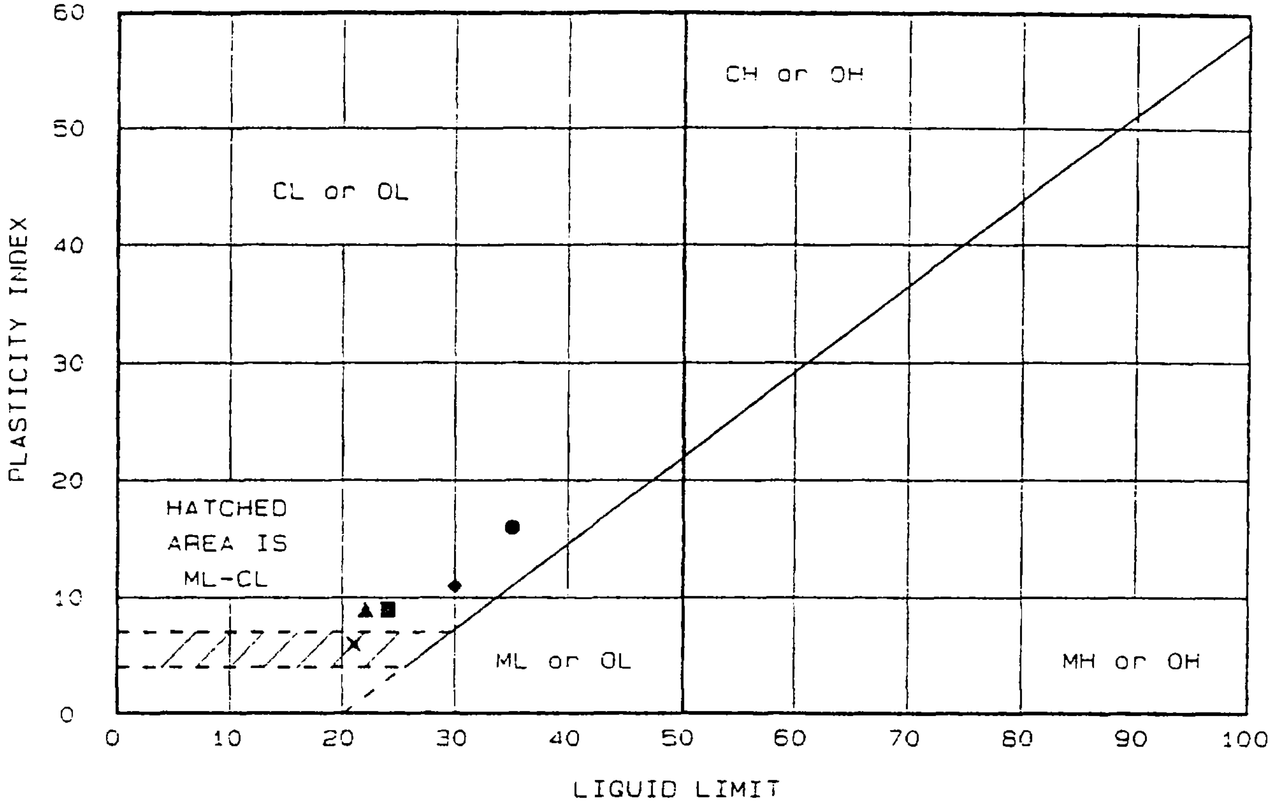
*** 1.375 ***

```
Failure Surface Specified By 15 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)      (ft)

    1      123.63    101.21
    2      133.62    101.72
    3      143.58    102.65
    4      153.48    104.00
    5      163.33    105.77
    6      173.08    107.95
    7      182.74    110.55
    8      192.28    113.55
    9      201.68    116.96
   10      210.93    120.76
   11      220.01    124.95
   12      228.91    129.52
   13      237.60    134.46
   14      246.08    139.77
   15      246.41    140.00

Circle Center At X =  116.7 ; Y =  337.0  and Radius,  235.9


      ***    1.380   ***

Failure Surface Specified By 13 Coordinate Points

  Point    X-Surf    Y-Surf
   No.      (ft)      (ft)

    1      136.05    105.35
    2      146.03    105.99
    3      155.97    107.11
    4      165.84    108.72
    5      175.62    110.80
    6      185.29    113.36
    7      194.82    116.38
    8      204.19    119.86
    9      213.39    123.80
   10      222.38    128.18
   11      231.14    132.99
   12      239.67    138.22
   13      242.27    140.00

Circle Center At X =  127.9 ; Y =  310.7  and Radius,  205.5


      ***    1.382   ***
```

```
Failure Surface Specified By 10 Coordinate Points

 Point     X-Surf     Y-Surf
  No.       (ft)       (ft)

   1       160.90     115.45
   2       170.85     116.45
   3       180.73     117.97
   4       190.51     120.03
   5       200.18     122.60
   6       209.69     125.69
   7       219.02     129.29
   8       228.15     133.37
   9       237.04     137.94
  10       240.58     140.00

Circle Center At X =  147.4 ; Y =  300.7  and Radius,  185.7

      ***    1.383   ***
```

```
          Y          A     X    I    S          F     T

          .00     32.50     65.00     97.50    130.00     162.50

X        .00 +---------+---------+---------+---------+---------+---------+
          -
          -
          -
          -
          -
       32.50 +
          -
          -
          -
          -
          -
A      65.00 +
          -
          -
          -
          -
          -
X      97.50 +                         *
          -                       .
          -                       .
          -                     ...
          -                    . ..*
          -                    ....7
I     130.00 +                    .....2.
          -                   .....71
          -                  .......21
          -                  .......86.
          -                  .......71*
          -                  ........26.
S     162.50 +                    ........5160
          -                  ........92. *
          -                  ........8310
          -                  ..........20
          -                  .........831
          -                  ..........72*
      195.00 +                   ...........96
          -                  ...........721
          -                   ...........92
          -                   ...........731*
          -                   ............21
          -                    ..........836
F     227.50 +                       ...........21
          -                      ...........2.
          -                      ..........71*
          -                       ..........41
          -                          ........4
          -                           .......
T     260.00 +                         *      ...*
```

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description	LL	PL	PI	-200	ASTM D 2487-85
● DH-3, CA-1	35	19	16		
▲ MW-5 S-1	22	13	9		
■ MW-5, CA-2	24	15	9		
◆ DH-6, S-1	30	19	11		
× DH-8, S-1	21	15	6		

Project No.: 2106-004
Project: Subsurface Investigation

Client: Green River Landfill
Location: Green River

Date: 08-17-94

Remarks:

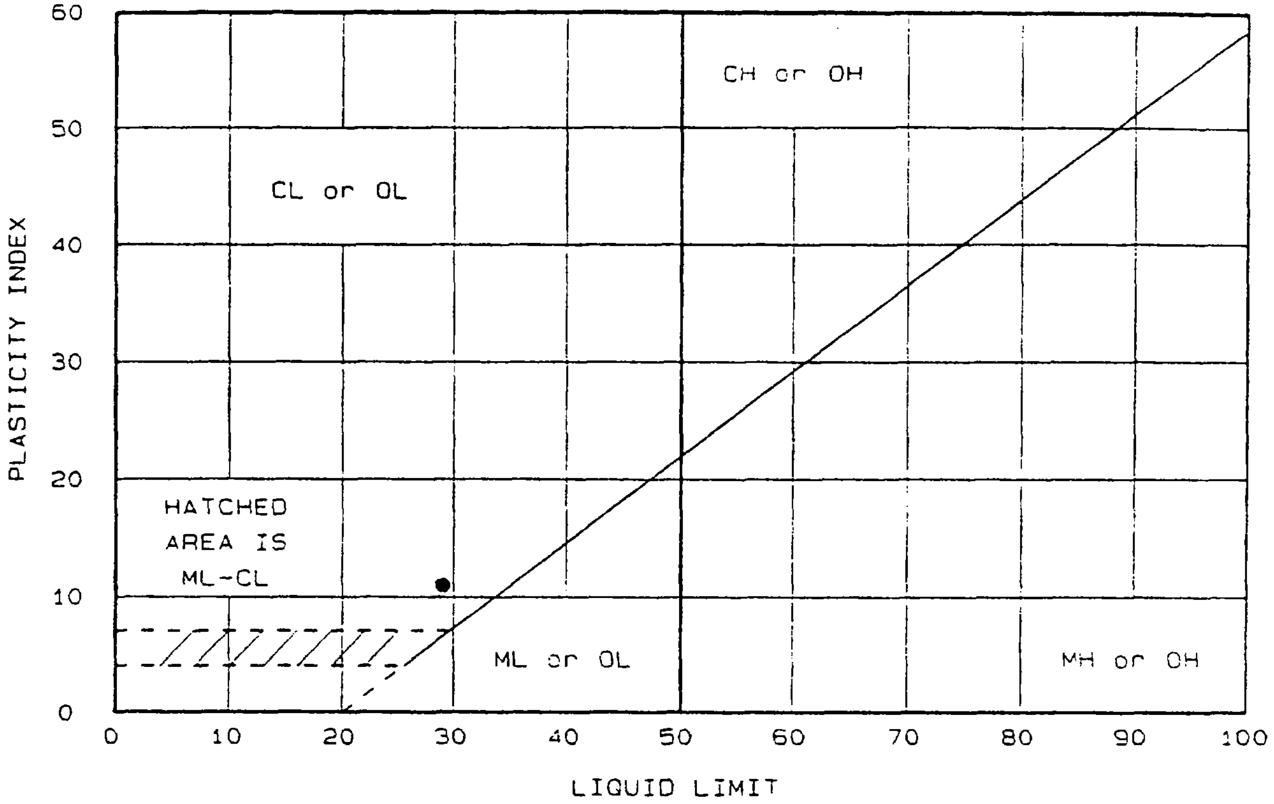
Tested By: BB

LIQUID AND PLASTIC LIMITS TEST REPORT

Bingham Engineering

Fig. No ______

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	ASTM D 2487-85
●	TP-3, B-1	29	18	11		

Project No.: 2106-004
Project: Subsurface Investigation

Client: Green River Landfill
Location: Green River

Date: 08-17-94

Remarks:

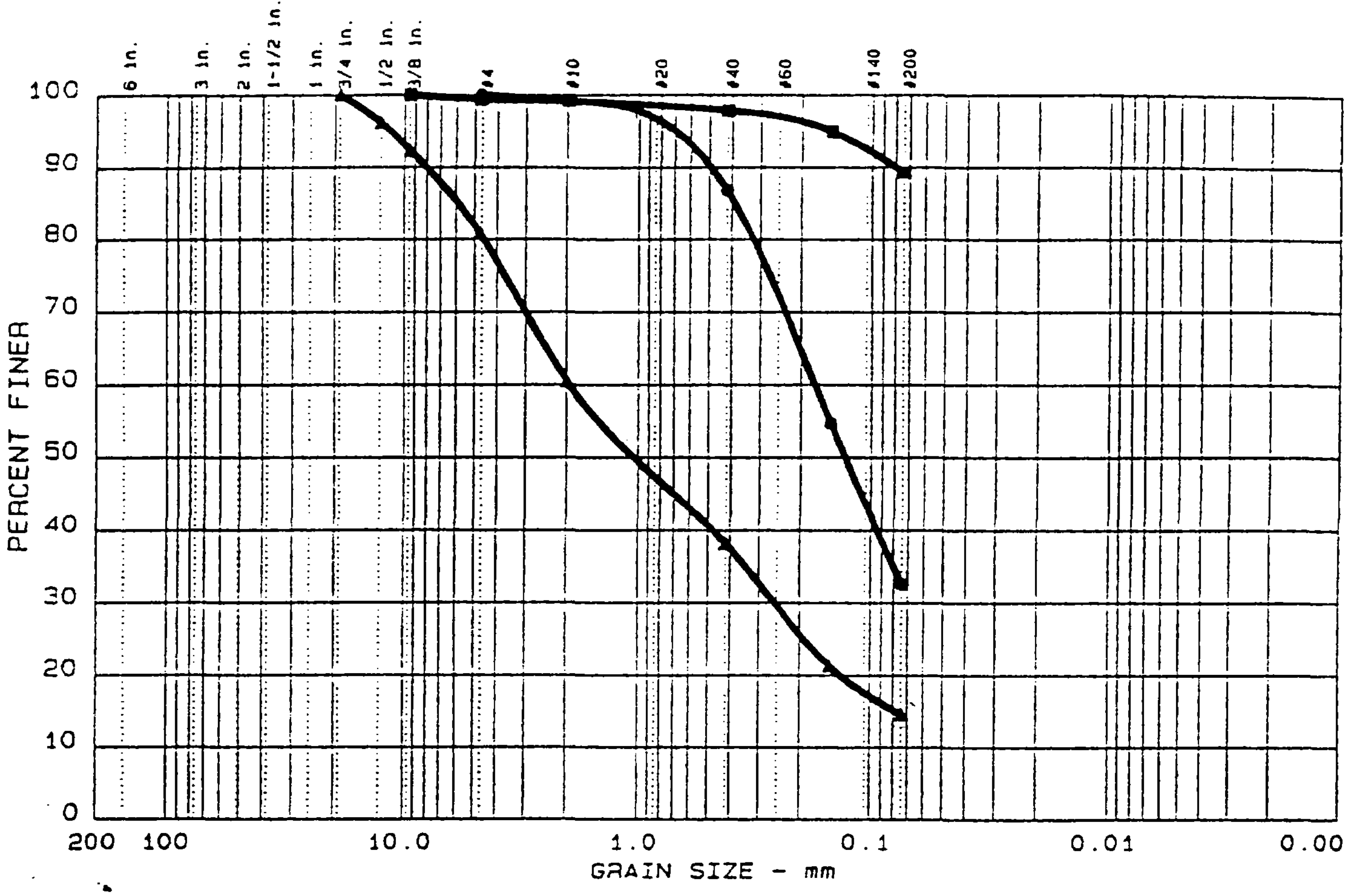
Tested By: BB

LIQUID AND PLASTIC LIMITS TEST REPORT

Bingham Engineering

Fig. No. ______

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	67.4	32.6	
▲	0.0	19.2	66.2	14.6	
■	0.0	0.6	10.1	89.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.39	0.17	0.13					
▲			5.89	1.95	1.05	0.257	0.0776			
■										

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Clayey Sand	SC	A-2-4
▲ Brown Gravely Clayey Sand	SC	A-1-b
■ Brown Fine Sandy Clay	CL	A-4

Project No.: 2106-004
Project: Green River Landfill
● Location: DH-1, CA-2
▲ Location: DH-1, B-3
■ Location: DH-9, CA-1 Depth 8.0' to 12.0'
Date: 08-17-94

Remarks:

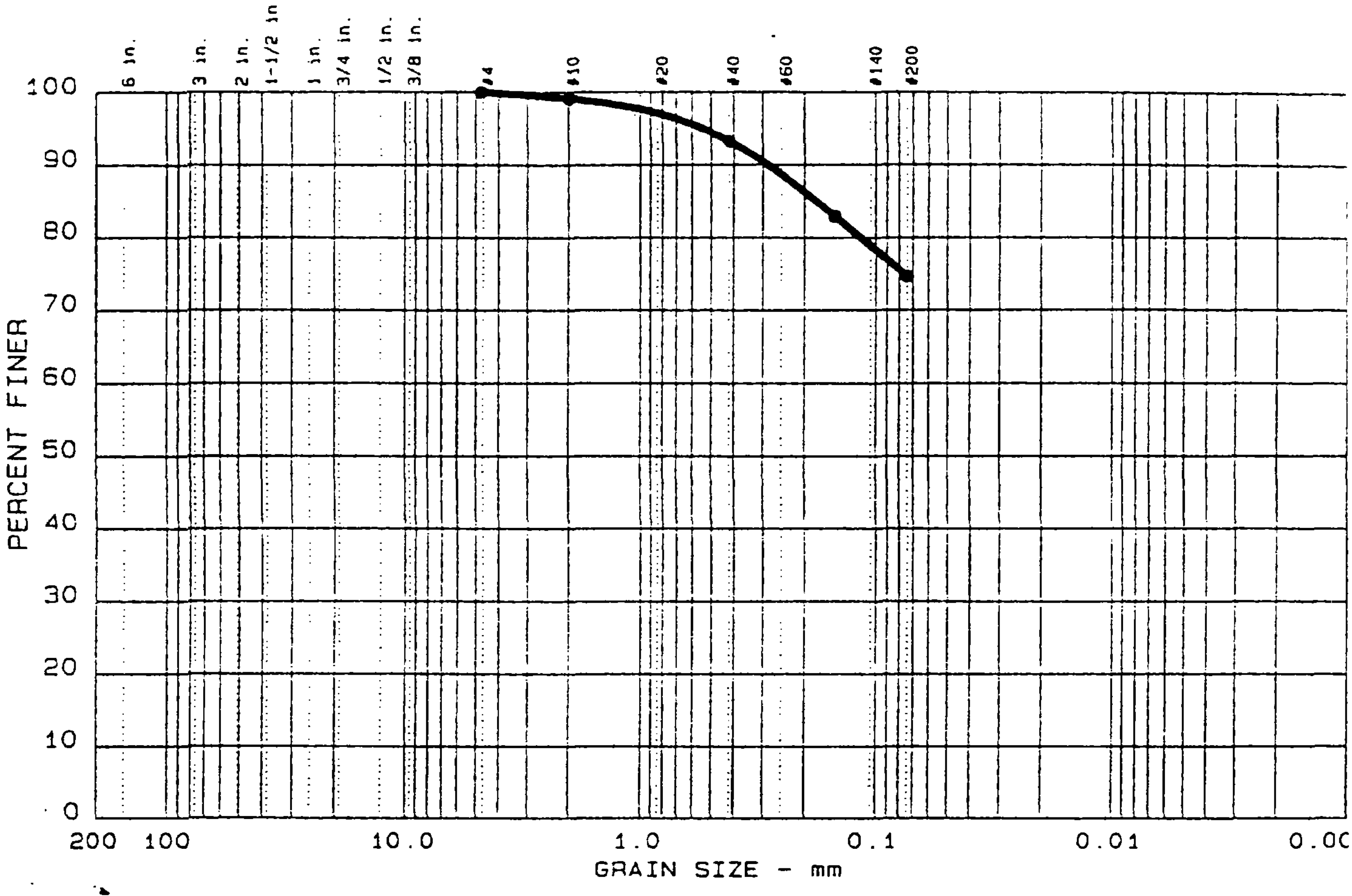
Tested By: DA

GRAIN SIZE DISTRIBUTION TEST REPORT

Bingham Engineering

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	25.4	74.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.18							

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Fine Sandy Clay	CL	A-4

Project No.: 2106-004
Project: Green River Landfill
● Location: OH-12, CA-1 Depth 8.0' to 12.0'

Date: 08-17-94

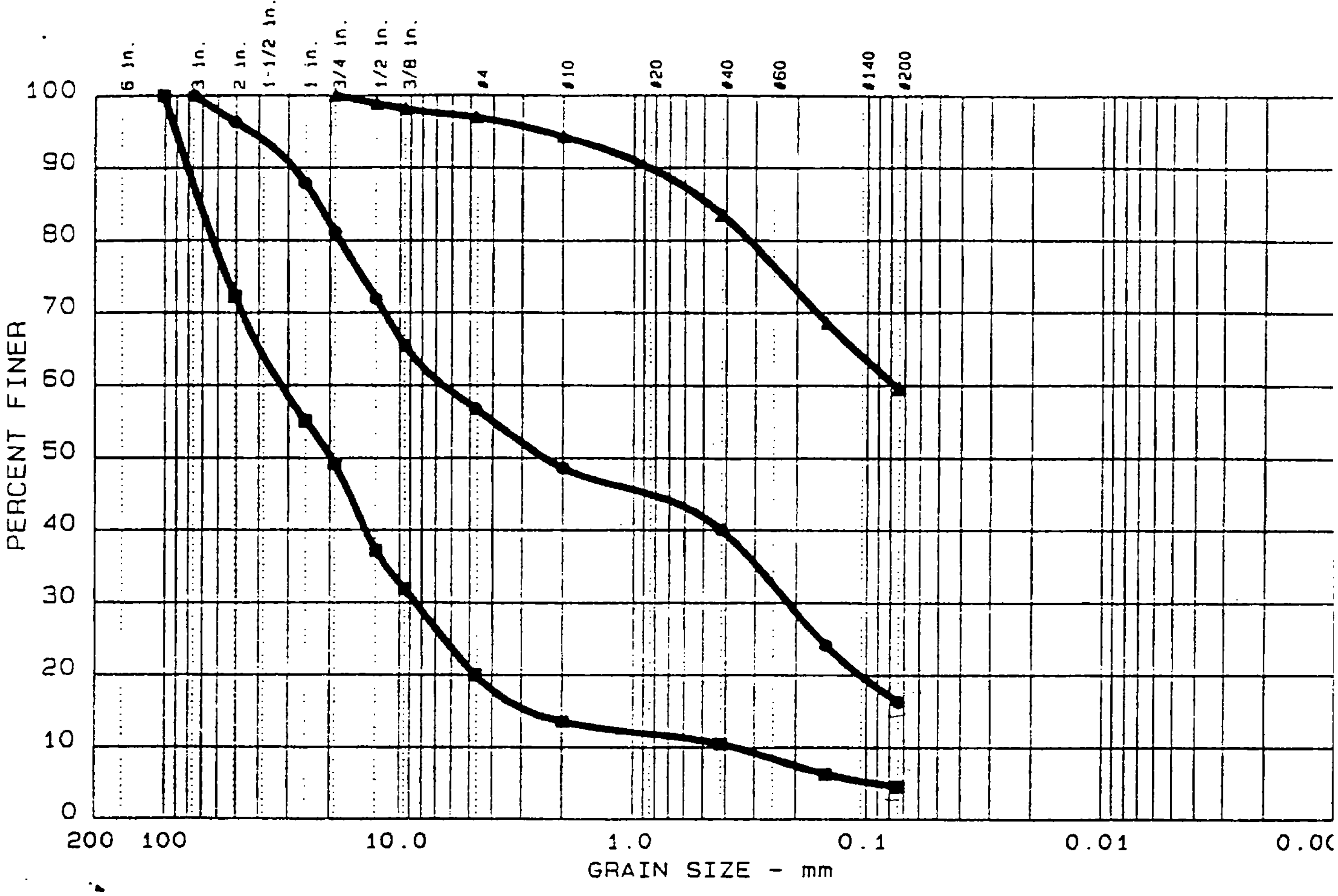
Remarks:

Tested By: JO

GRAIN SIZE DISTRIBUTION TEST REPORT
Bingham Engineering

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	43.3	40.4	16.3	
▲	0.0	3.0	37.5	59.5	
■	12.4	67.6	15.4	4.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	29	11	22.39	6.53	2.37	0.216				
▲			0.48	0.08						
■			71.45	32.28	19.66	8.482	2.7765	0.3660	6.09	88.2

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Sandy Clayey Gravel	GC	A-2-6
▲ Brown Clayey Sand	CL	A-4
■ Brown Sandy Gravel	GP	A-1-a

Project No.: 2106-004
Project: Green River Landfill
● Location: TP-1, B-1 Depth 0' to 3.0'
▲ Location: TP-3, B-1 Depth 0.0' ct 2.5'
■ Location: TP-18, B-1 Depth 0.0' to 12.0'
Date: 08-17-94

Remarks:

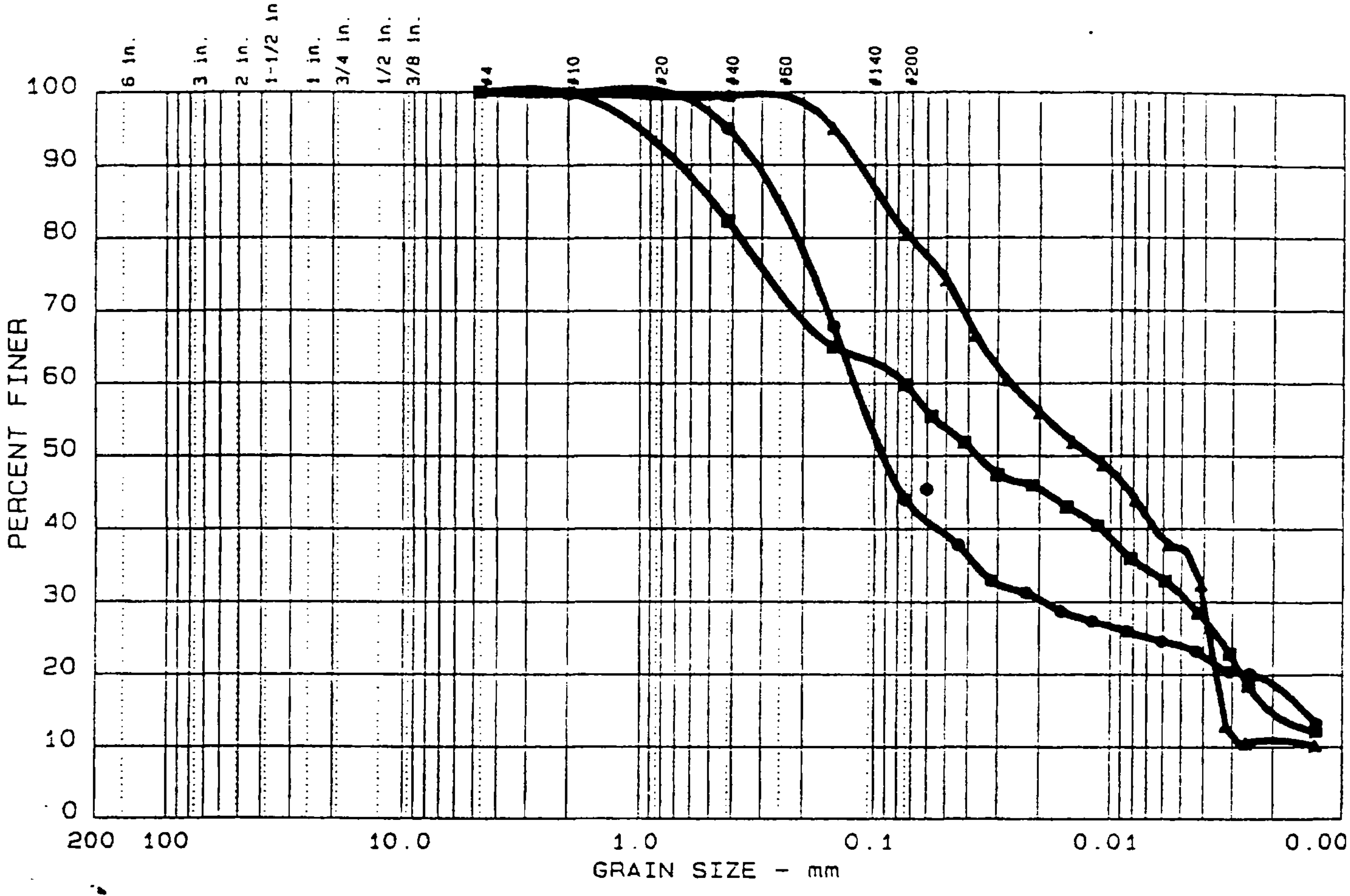
Tested By: JO

GRAIN SIZE DISTRIBUTION TEST REPORT

Bingham Engineering

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	56.0	20.0	24.0
▲	0.0	0.0	19.5	43.0	37.5
■	0.0	0.0	40.1	28.9	31.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.25	0.12	0.09	0.019	0.0015			
▲	24	9	0.09		0.01	0.004	0.0033			
■	30	11	0.49	0.07	0.04	0.005	0.0021			

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Clayey Silty Fine Sand	SC	A-4
▲ Light Tand Fine Sandy Silty Clay	CL	A-4
■ Brown Sandy Silty Clay	CL	A-6

Project No.: 2106-004
Project: Green River Landfill
● Location: DH-2, B-1
▲ Location: MW-5, CA-2 Depth 8.0' to 12.0'
■ Location: DH-5, S-1
Date: 08-17-94

Remarks:

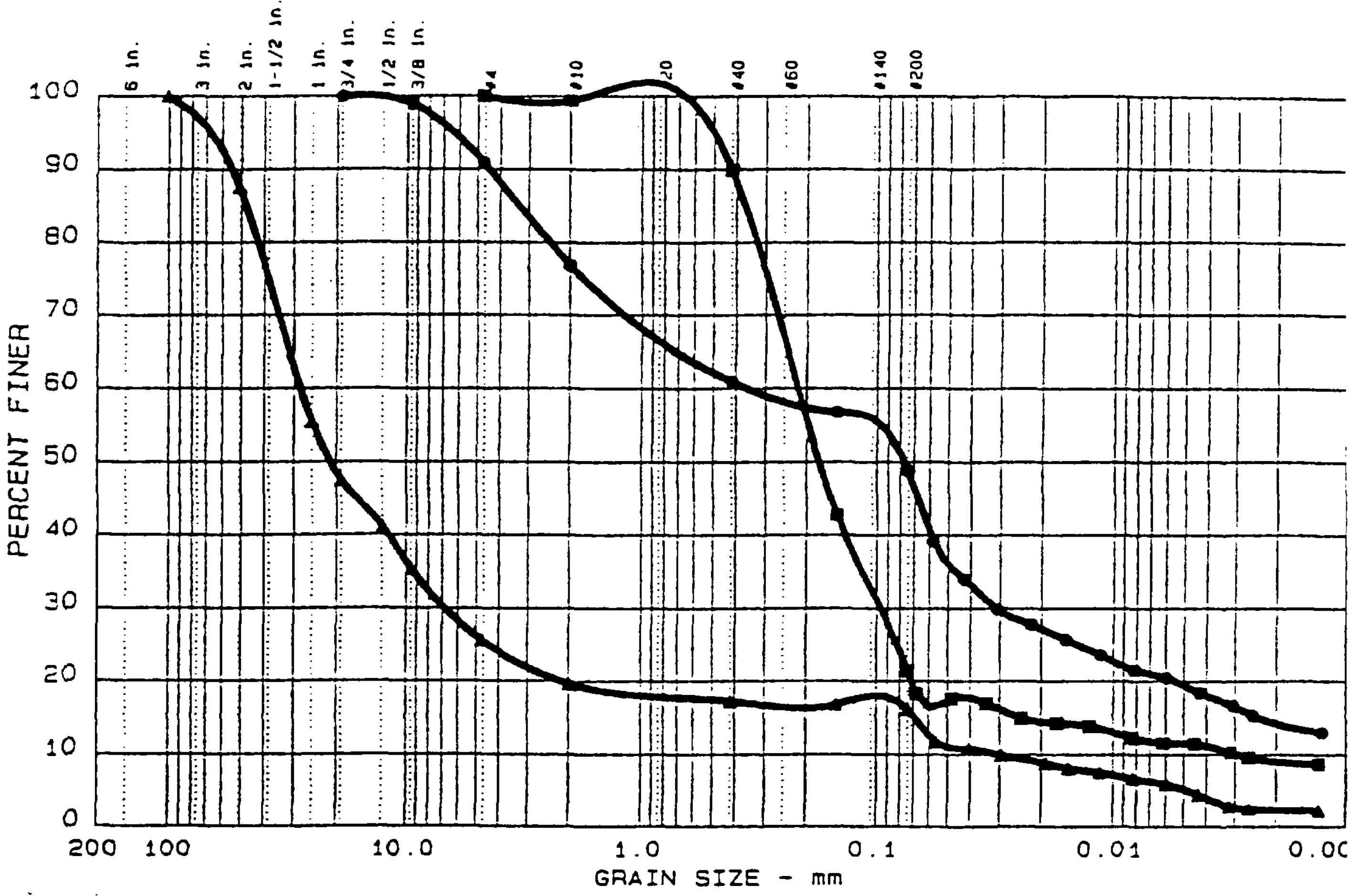
Tested By: DA

GRAIN SIZE DISTRIBUTION TEST REPORT

Bingham Engineering

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	9.1	42.2	29.4	19.3
▲	2.9	71.5	9.5	11.0	5.1
■	0.0	0.0	78.6	9.8	11.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	21	6	3.27	0.36	0.08	0.031	0.0024			
▲			47.53	28.31	21.23	6.871	0.0687	0.0307	54.33	922.6
■			0.37	0.22	0.16	0.096	0.0248	0.0029	14.42	74.3

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Clayey Silty Sand W/Some Fine Gravel	SC-SM	A-4
▲ Brown Silty Gravel W/Some Sand	GM	A-1-b
■ Brown Clayey Fine Sand	SC	Unclassifie

Project No.: 2106-004
Project: Green River Landfill
● Location: DH-8. S-1
▲ Location: TP-2. B-1
■ Location: DH-1. B-1
Date: 08-17-94

Remarks:

Tested By: DA

GRAIN SIZE DISTRIBUTION TEST REPORT

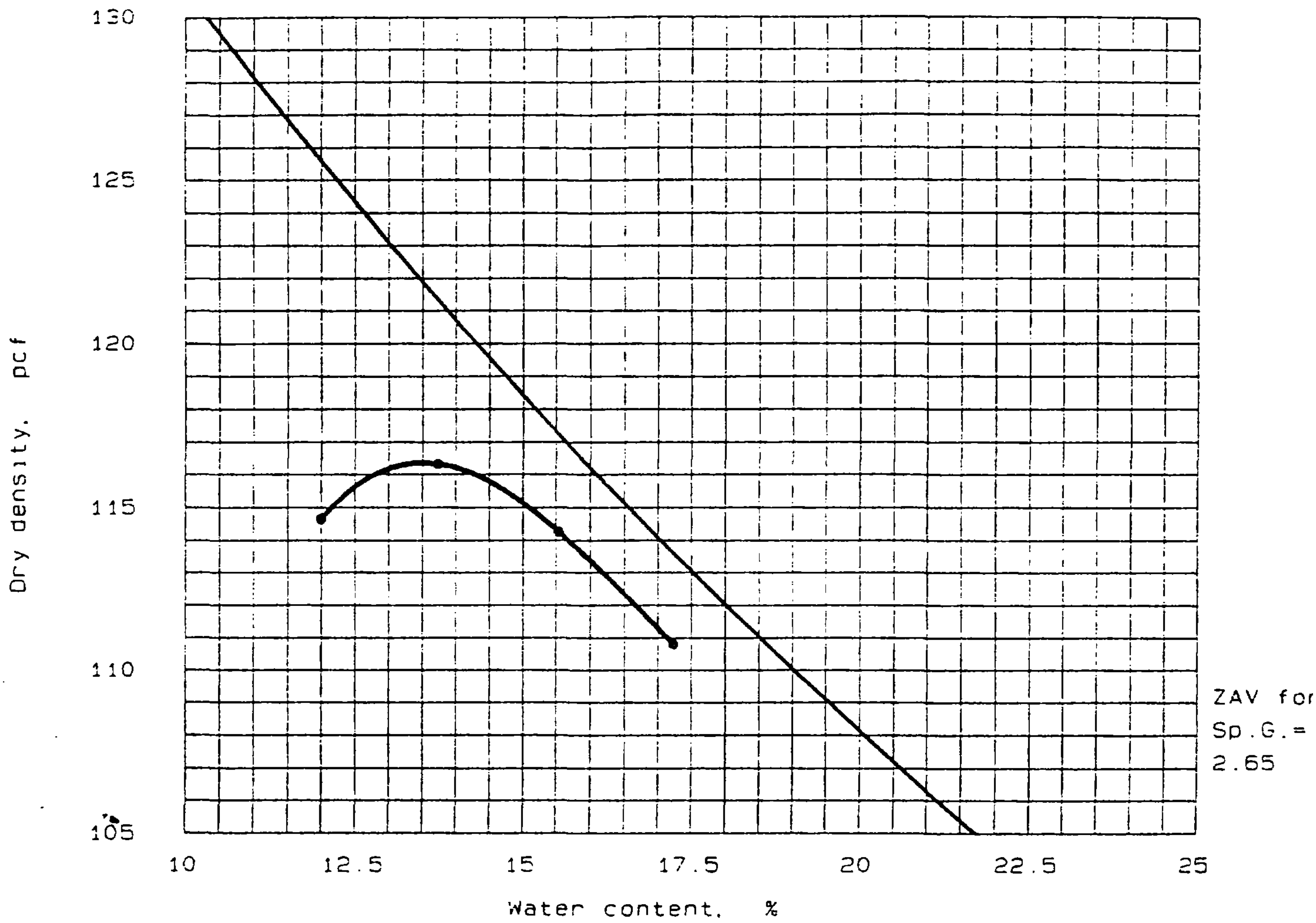
Bingham Engineering

Figure No

MOISTURE CONTENT AND UNIT WEIGHT
GREEN RIVER LANDFILL

Sample Location	Sample Number	Moisture Content	Dry Density
DH-1	CA-2	5.79	102.92
DH-3	CA-1	6.05	102.37
MW-5	CA-2	3.19	103.21
MW-7	CA-1	6.08	107.05
DH-9	CA-1	4.9	110.34
DA-12	CA-1	5.45	91.45

PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification USCS	 AASHTO	Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.20
	CL							

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 13.5 % Maximum dry density = 116.4 pcf	Sandy Silty Clay

Project No.: 2106-003

Project: Green River Landfill

Location: Composite #1

Date: 09/16/94

PROCTOR TEST REPORT

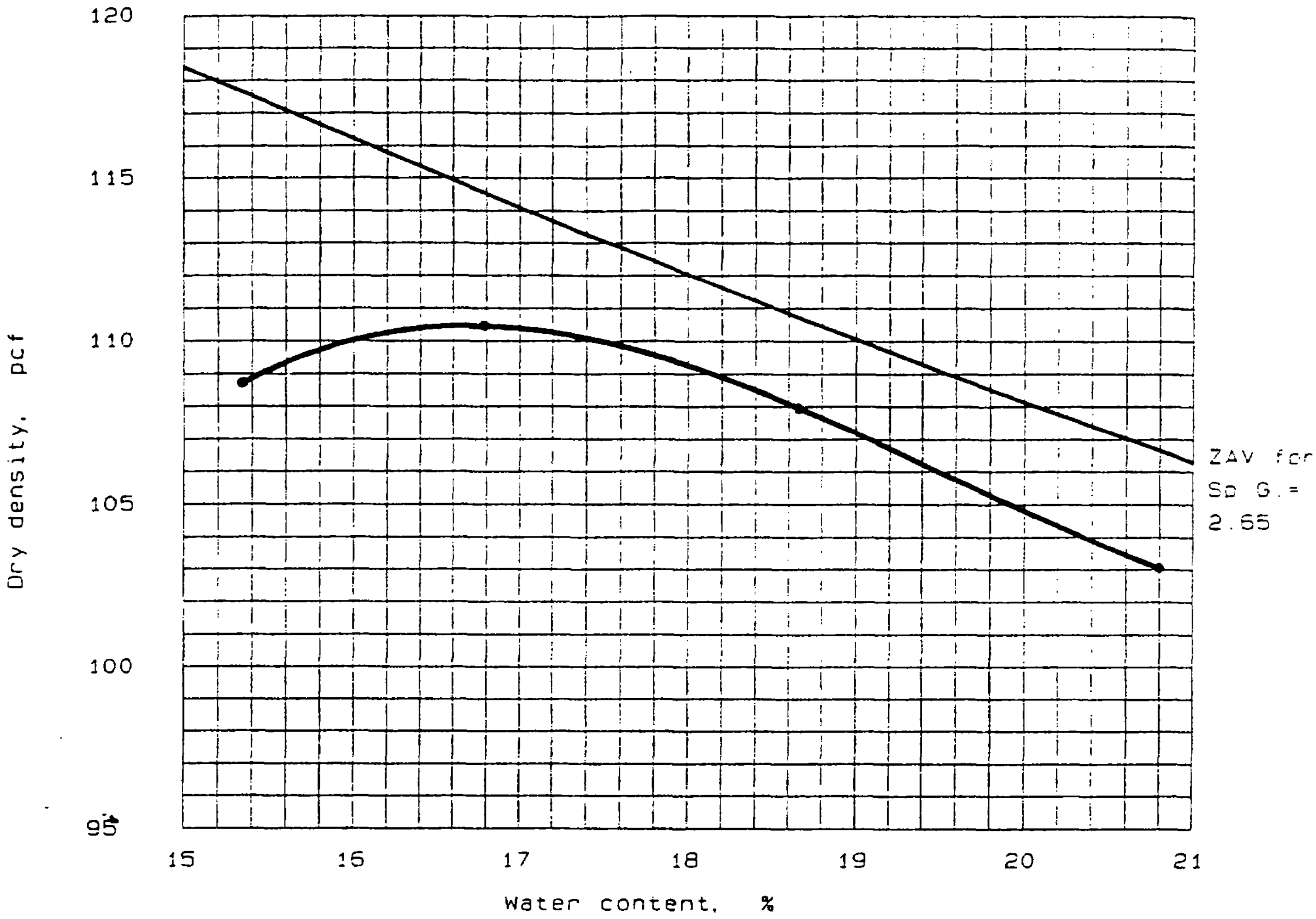
Bingham Engineering

Remarks:

M.M.

Figure No. ______

PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.20
	USCS	AASHTO						
	CL							

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 16.7 % Maximum dry density = 110.5 pcf	Gray Sandy Clay

Project No.: 2106-003

Project: Green River Landfill

Location: Composite #2

Date: 09-16-94

Remarks:

Tested By: MM

PROCTOR TEST REPORT

Bingham Engineering

Figure No. ______

PERMEABILITY TEST RESULTS
GREEN RIVER LANDFILL

Sample Location	Sample Number	Permeability (cm/sec)
DH-1	CA-2*	2.2 E -4
COMPOSITE #1		5.4 E -8
COMPOSITE #2		3.2 E -8

* uncompacted sample

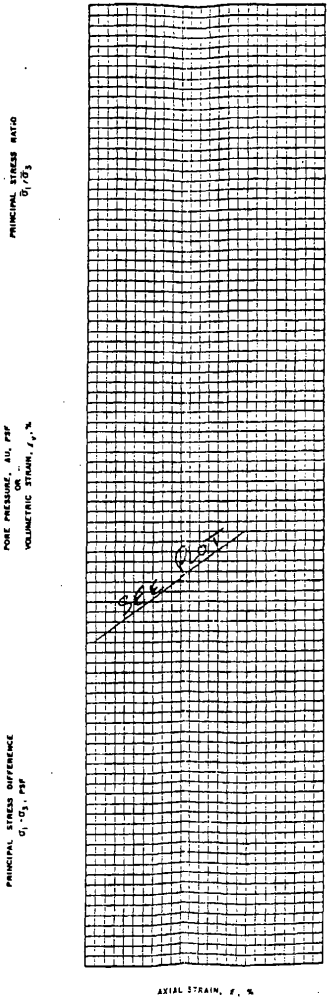
Composite #1 =	TP-2	B-1
	TP-10	B-1
	DH-1	B-2
	DH-1	B-3
	DH-1	B-4
	DH-2	B-2

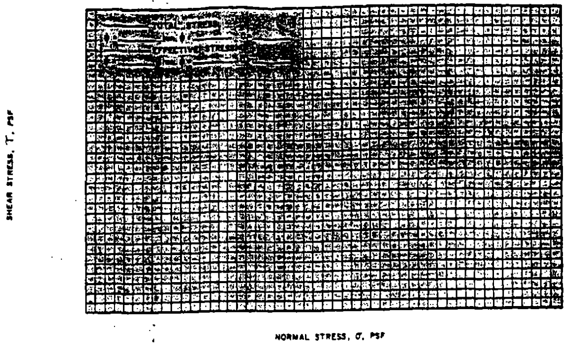
Composite #1 compacted to 95.6% Proctor
and 2.1% above optimum moisture

Composite #2 =	MW-5	S-1
	DH-6	S-1
	TP-4	B-1
	TP-8	B-1
	TP-3	B-1

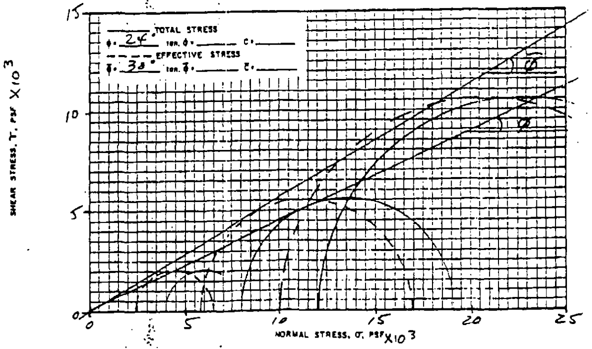
Composite #2 compacted to 95.6% Proctor
and 3.3% above optimum moisture

KEY	○		○		○		○	
BORING	COMPOSITE SAMPLE #2							
SAMPLE	REMOLD 95% MDD +3% OMC							
DEPTH (FEET)	MDD = 110.5 pcf at 16.7% OMC							
INITIAL w, %	19.7							
INITIAL γ_d, PCF	105.0							
INITIAL e_0								
INITIAL B	0.12							
FINAL w, %			MULTI - STAGED		16.7			
FINAL γ_d, PCF					118.4			
FINAL e_f								
FINAL B					1.00			
BACK PRESSURE (PSI)	29.0		29.0		29.0			
STRAIN RATE (INCHES / MINUTE)	.002		.002		.002			
STRESS CONDITION		MAX. $\bar{\sigma}_1/\bar{\sigma}_3$		MAX. $\bar{\sigma}_1/\bar{\sigma}_3$		MAX. $\bar{\sigma}_1/\bar{\sigma}_3$		MAX. $\bar{\sigma}_1/\bar{\sigma}_3$
TOTAL STRESS ϵ, %		4.13		5.89		10.86		
TOTAL STRESS TIME TO FAIL (MIN.)								
TOTAL STRESS σ_3, PSF		4032		8064		12096		
TOTAL STRESS $\sigma_1 - \sigma_3$		3973		11052		21090		
TOTAL STRESS σ_1, PSF		8005		19116		33186		
TOTAL STRESS $\frac{1}{2}(\sigma_1 - \sigma_3)$		1986		5526		10545		
TOTAL STRESS $\frac{1}{2}(\sigma_1 + \sigma_3)$		6019		13590		22641		
TOTAL STRESS u, PSF		1570		2218		2016		
TOTAL STRESS A, $u/(\sigma_1 - \sigma_3)$		0.395		0.20		0.096		
EFFECTIVE STRESS ϵ, %								
EFFECTIVE STRESS TIME TO FAIL (MIN.)								
EFFECTIVE STRESS $\bar{\sigma}_3$, PSF		2462		5846		10080		
EFFECTIVE STRESS $\bar{\sigma}_1 - \bar{\sigma}_3$		3973		11052		21090		
EFFECTIVE STRESS $\bar{\sigma}_1$, PSF		6435		16899		31170		
EFFECTIVE STRESS $\frac{1}{2}(\bar{\sigma}_1 - \bar{\sigma}_3)$		1986		5526		10545		
EFFECTIVE STRESS $\frac{1}{2}(\bar{\sigma}_1 + \bar{\sigma}_3)$		4449		11373		20625		
EFFECTIVE STRESS u, PSF		—		—		—		
EFFECTIVE STRESS A, $u/(\bar{\sigma}_1 - \bar{\sigma}_3)$		—		—		—		
$\bar{\sigma}_1/\bar{\sigma}_3$		2.61		2.89		3.09		
REMARKS								





MOHR ENVELOPE – PEAK STRESS



MOHR ENVELOPE – MAXIMUM EFFECTIVE STRESS RATIO

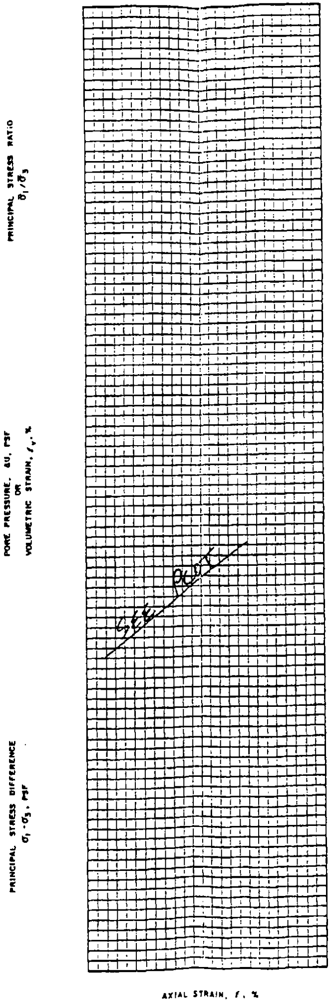
TRIAXIAL COMPRESSION TEST REPORT

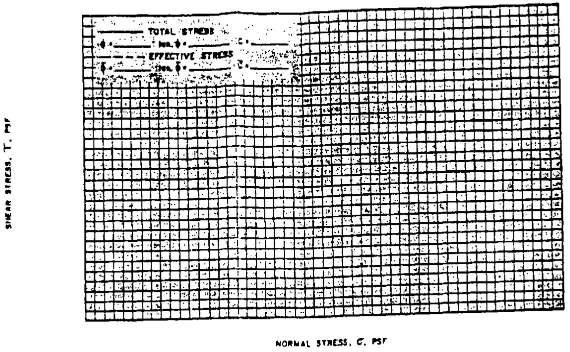
TYPE OF TEST Cons-Undrained w Pore Pressure
TYPE MATERIAL Remold

SAMPLE DESCRIPTION

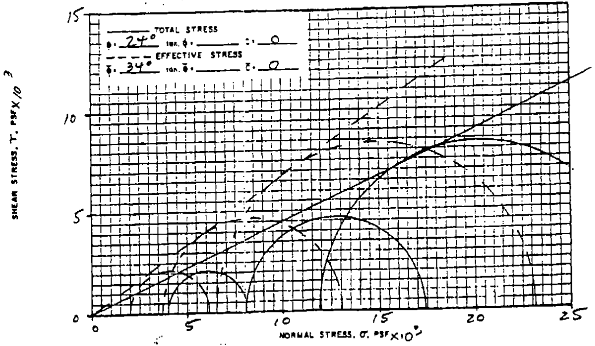
CLASSIFICATION CL
LIQUID LIMIT — PLASTIC LIMIT — SPECIFIC GRAVITY, G_s —
PROJECT Bingham Engr.
LOCATION Green River Landfill
JOB NO. 05461-029-6079 PREPARED BY EEI , 10/6/94
CHECKED BY , / /

KEY		○		○		○		○	
BORING		COMPOSITE #1							
SAMPLE		REMOLD 95% MDD at +3% OMC							
DEPTH (FEET)		MDD = 116.4 PCF at 13.5% OMC							
INITIAL	w, %	16.5							
	γ_d, PCF	110.6							
	e_0								
	S	0.1		MULTI - STAGED					
FINAL	w, %					14.7			
	γ_d, PCF					121.4			
	e_f								
	S					0.98			
BACK PRESSURE (PSI)		39.0		39.0		39.0			
STRAIN RATE (INCHES / MINUTE)		0.002		.002		.002			
STRESS CONDITION		[illegible]	MAX. $\bar{\sigma}_1/\bar{\sigma}_3$	[illegible]	MAX. $\bar{\sigma}_1/\bar{\sigma}_3$	[illegible]	MAX. $\bar{\sigma}_1/\bar{\sigma}_3$	[illegible]	MAX. $\bar{\sigma}_1/\bar{\sigma}_3$
TOTAL STRESS	ϵ, %		3.59		4.62		3.21		
	TIME TO FAIL (MIN.)								
	σ_3, PSF		4032		8064		11952		
	$\sigma_1 - \sigma_3$		4050		9355		16613		
	σ_1, PSF		8082		17419		28565		
	$\frac{1}{2}(\sigma_1 - \sigma_3)$		2025		4677		8307		
	$\frac{1}{2}(\sigma_1 + \sigma_3)$		6057		12742		20255		
	u, PSF		2002		4349		5414		
	A, $u/(\sigma_1-\sigma_3)$		0.494		0.465		0.326		
EFFECTIVE STRESS	ϵ, %								
	TIME TO FAIL (MIN.)								
	$\bar{\sigma}_3$, PSF		2030		3715		6538		
	$\bar{\sigma}_1 - \bar{\sigma}_3$		4050		9355		16613		
	$\bar{\sigma}_1$, PSF		6080		13070		23151		
	$\frac{1}{2}(\bar{\sigma}_1 - \bar{\sigma}_3)$		2025		4677		8307		
	$\frac{1}{2}(\bar{\sigma}_1 + \bar{\sigma}_3)$		4056		8392		14844		
	u, PSF		—		—		—		
	A, $u/(\bar{\sigma}_1-\bar{\sigma}_3)$		—		—		—		
	$\bar{\sigma}_1/\bar{\sigma}_3$		2.99		3.52		3.54		
REMARKS									





MOHR ENVELOPE – PEAK STRESS



MOHR ENVELOPE – MAXIMUM EFFECTIVE STRESS RATIO

TRIAXIAL COMPRESSION TEST REPORT

TYPE OF TEST Cons-Undrained w Pore Pressure
TYPE MATERIAL Remold

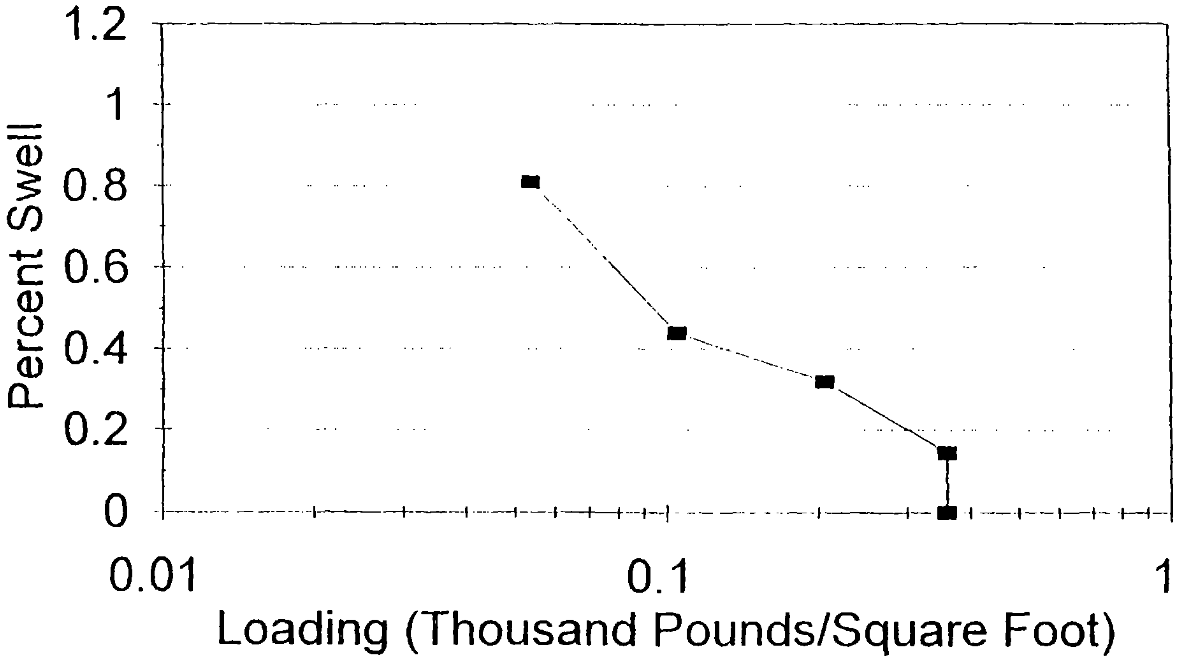
SAMPLE DESCRIPTION

CLASSIFICATION CL
LIQUID LIMIT — PLASTIC LIMIT — SPECIFIC GRAVITY, G_s —
PROJECT Bingham Engr.
LOCATION Green River Landfill
JOB NO 05461-020-6079 PREPARED BY EGd , 10/ / 94
CHECKED BY , / /

PLATE

SHALE CHARACTERISTICS
MANCOS SWELLING POTENTIAL LABORATORY TESTING
GREEN RIVER LANDFILL L.L.C.

Sample No.	Sieve Size	Specific Gravity	Initial Void Ratio	Natural Moisture	Dry Density
1	- 1" to #4	2.65	0.7168	3.1 %	96.4 pcf
2	- 1" to #4	2.65	0.6696	2.9 %	99.1 pcf
3	- #4	2.65	0.5247	6.4 %	108.5 pcf
4	- #4	2.65	0.4903	6.4 %	111.0 pcf

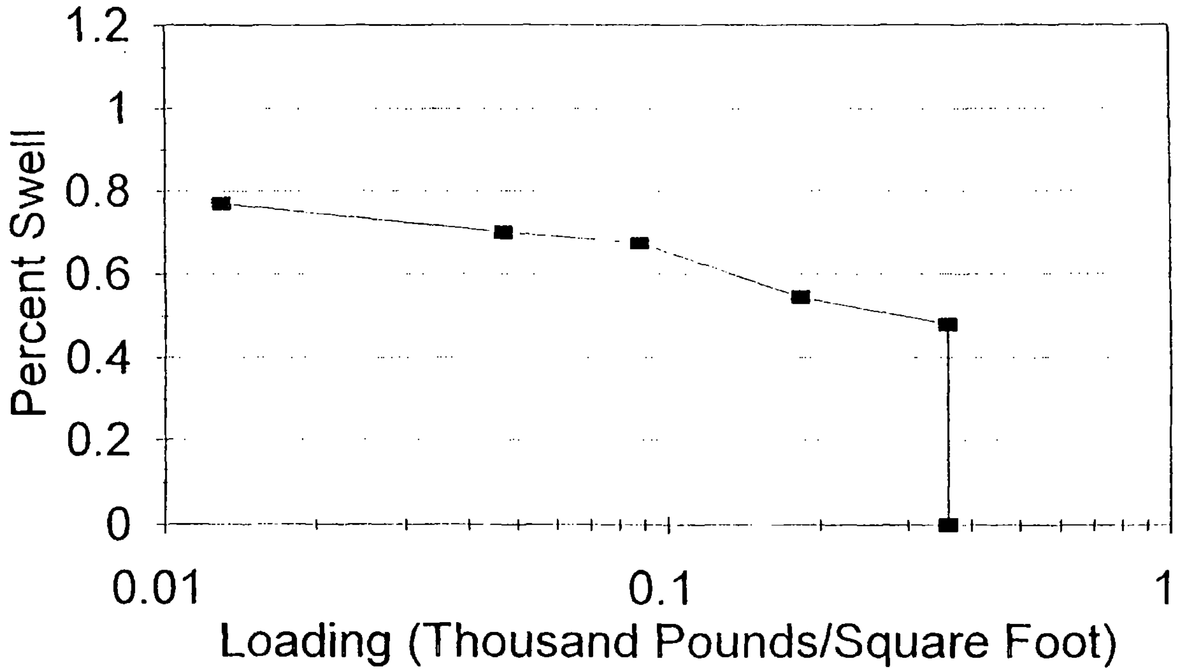


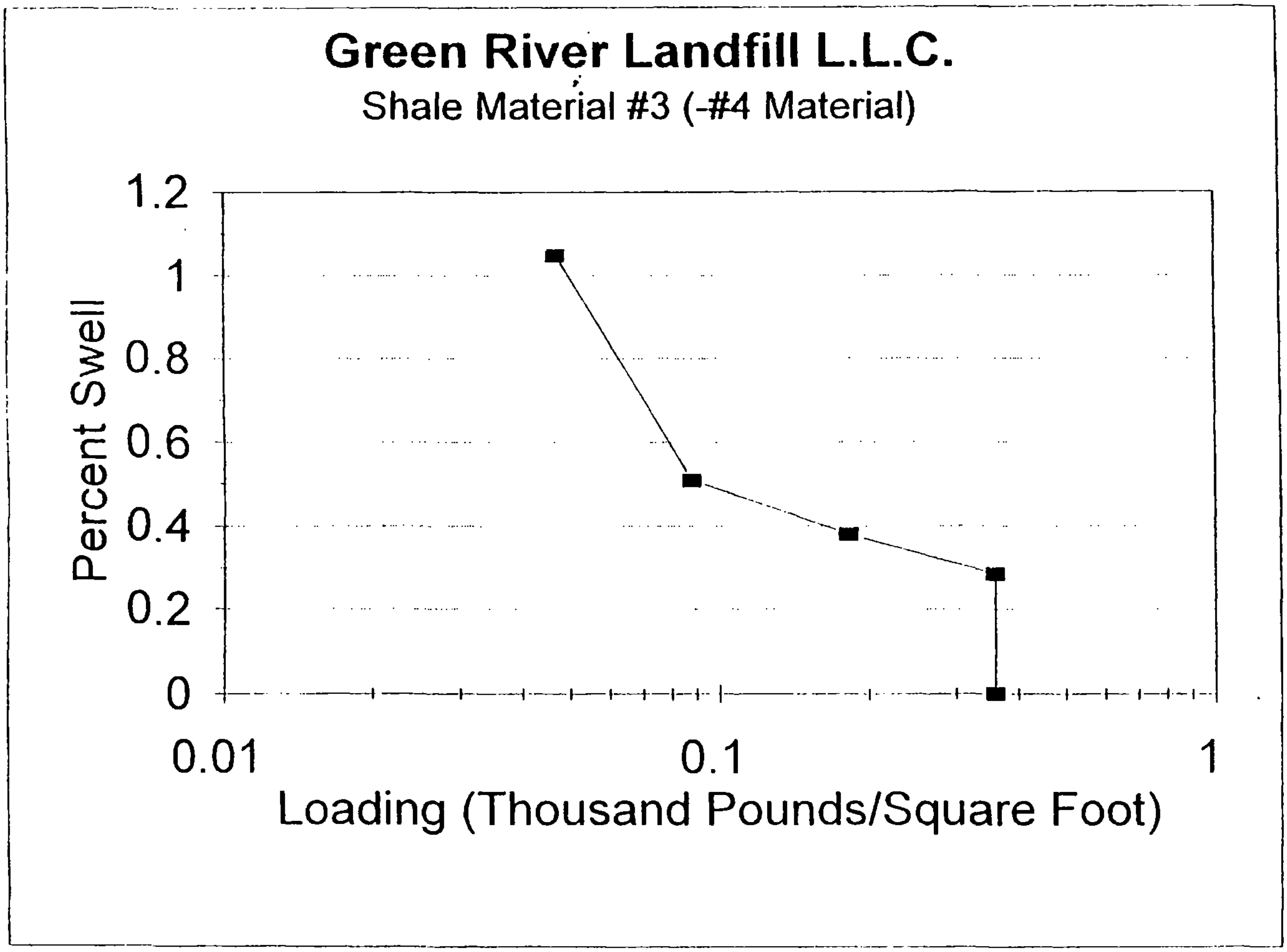
Green River Landfill L.L.C.

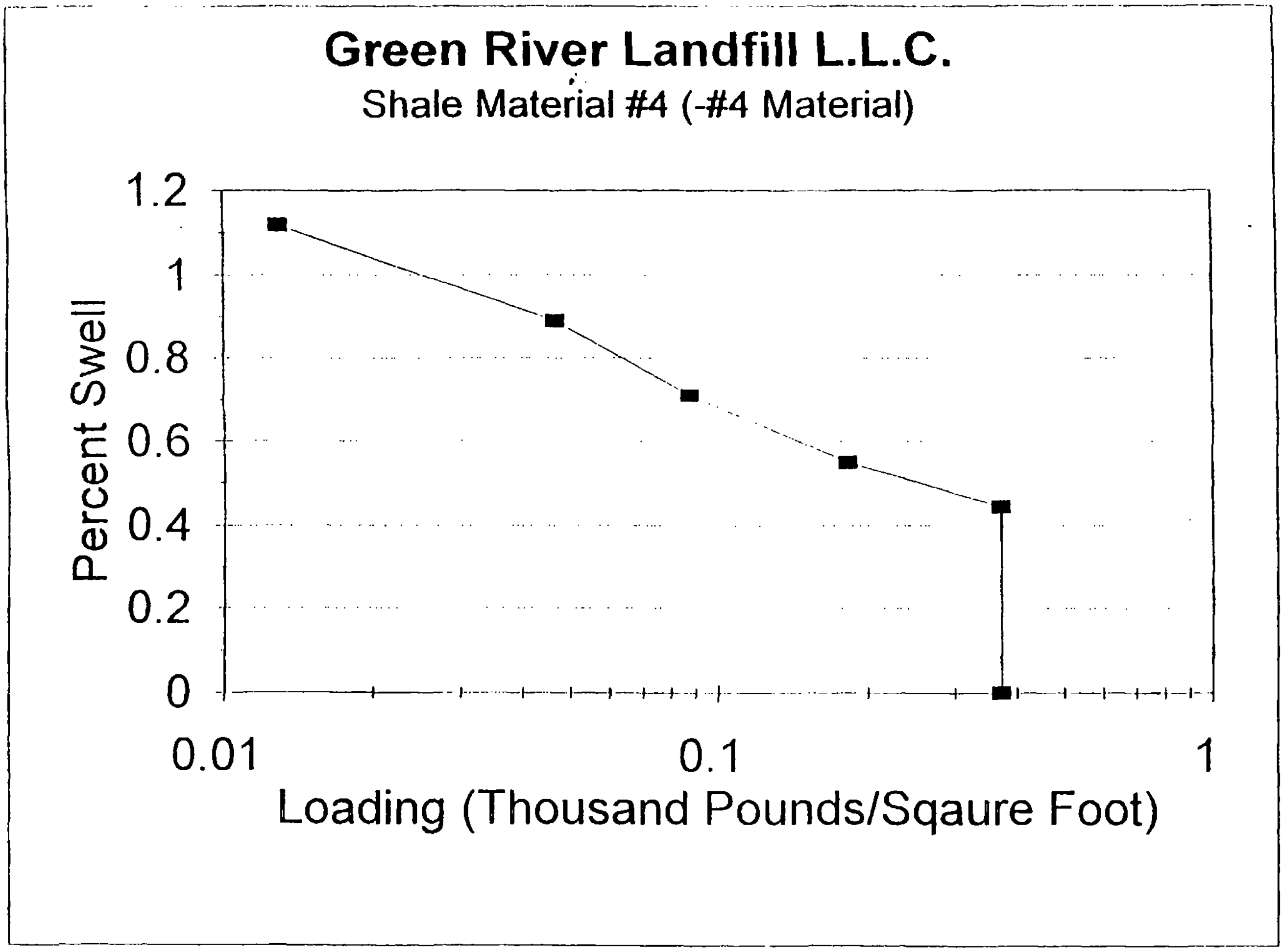
Shale Material #1 (-1" to #4 Material)

Green River Landfill L.L.C.

Shale Material #2 (-1" to #4 Material)

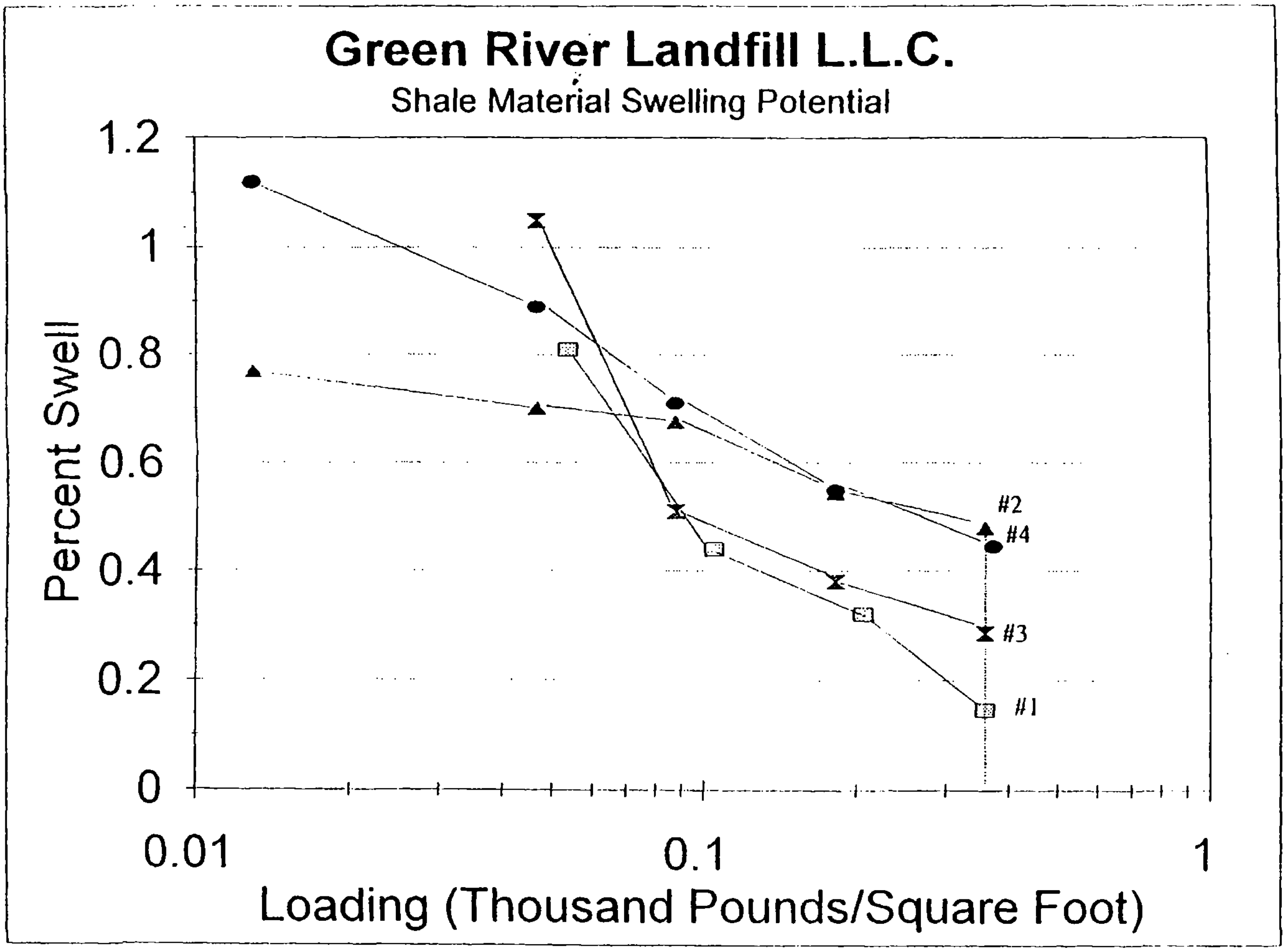



Green River Landfill L.L.C.
Shale Material #3 (-#4 Material)
Percent Swell
1.2
1
0.8
0.6
0.4
0.2
0
0.01
0.1
1
Loading (Thousand Pounds/Square Foot)



Green River Landfill L.L.C.

Shale Material #4 (-#4 Material)


Green River Landfill L.L.C.
Shale Material Swelling Potential
Percent Swell
1.2
1
0.8
0.6
0.4
0.2
0
0.01
0.1
1
Loading (Thousand Pounds/Square Foot)
#2
#4
#3
#1

5. CHEMICAL LABORATORY ANALYTICAL RESULTS

AMERICAN
WEST
NALYTICAL
BORATORIES

INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-01
Field Sample ID: Green River, UT/MW-1

Contact: Kevin Cosper
Received By: Elona Hayward

est 3600 South
lt Lake City, Utah
84115

801) 263-8686
801) 263-8687

Analytical Results

DISSOLVED METALS	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
Aluminum	6010	0.1	0.1
Antimony	6010	0.1	<0.1
Arsenic	7060	0.005	<0.005
Barium	6010	0.002	0.009
Beryllium	6010	0.005	<0.005
Cadmium	6010	0.004	0.005
Chromium	6010	0.005	<0.005
Cobalt	6010	0.01	<0.01
Copper	6010	0.004	0.014
Iron	6010	0.01	0.10
Lead	7421	0.005	<0.005
Manganese	6010	0.005	0.051
Mercury	7471	0.0002	<0.0002
Molybdenum	6010	0.1	<0.1
Nickel	6010	0.005	0.033
Selenium	7740	0.005	0.61
Silver	6010	0.005	<0.005
Thallium	6010	0.4	<0.4
Tin	6010	0.1	0.1
Vanadium	6010	0.005	0.016
Zinc	6010	0.002	0.038

Released by:
Laboratory Supervisor

Report Date 8/8/94

AMERICAN
WEST
ANALYTICAL
LABORATORIES

163 West 3600 South
Salt Lake City, Utah
84115

(801) 263-8686
Fax (801) 263-8687

INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-01
Field Sample ID: Green River, UT/MW-1

Contact: Kevin Cosper
Received By: Elona Hayward

Analytical Results

	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
TOTAL METALS			
Calcium	6010	0.01	440.
Magnesium	6010	0.01	710.
Potassium	6010	0.01	28.
Sodium	6010	0.01	6,400.
OTHER CHEMISTRIES			
Bicarbonate (as $CaCO_3$)	310.1	10.	1,100.
Carbonate (as $CaCO_3$)	310.1	10.	<10.
Chloride	4500 CLB	0.5	250.
Conductivity	120.1	10.	21,000. µmhos/cm @ 25° C
Cyanide	335.3	0.005	0.01
Fluoride	340.1	0.1	6.8
Nitrate (as N)	353.2	0.01	140.
pH	150.1	0.1	7.3
Sulfate	375.4	5.0	15,000.
TDS	160.1	1.0	20,000.

Released by: ______________
Laboratory Supervisor

Report Date 8/8/94

AMERICAN
WEST
ANALYTICAL
LABORATORIES

INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-02
Field Sample ID: Green River, UT/MW-2

Contact: Kevin Cosper
Received By: Elona Hayward

63 West 3600 South
Salt Lake City, Utah
84115

(801) 263-8686
Fax (801) 263-8687

Analytical Results

DISSOLVED METALS	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
Aluminum	6010	0.1	<0.1
Antimony	6010	0.1	<0.1
Arsenic	7060	0.005	<0.005
Barium	6010	0.002	**0.008**
Beryllium	6010	0.005	<0.005
Cadmium	6010	0.004	<0.004
Chromium	6010	0.005	<0.005
Cobalt	6010	0.01	<0.01
Copper	6010	0.004	<0.004
Iron	6010	0.01	**0.04**
Lead	7421	0.005	<0.005
Manganese	6010	0.005	**0.032**
Mercury	7471	0.0002	<0.0002
Molybdenum	6010	0.1	<0.1
Nickel	6010	0.005	<0.005
Selenium	7740	0.005	<0.005
Silver	6010	0.005	<0.005
Thallium	6010	0.4	<0.4
Tin	6010	0.1	<0.1
Vanadium	6010	0.005	<0.005
Zinc	6010	0.002	**0.008**

Released by: ______________________
Laboratory Supervisor

Report Date 8/8/94

AMERICAN
WEST
ANALYTICAL
LABORATORIES

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Salt Lake City, Utah
84115

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INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-02
Field Sample ID: Green River, UT/MW-2

Contact: Kevin Cosper
Received By: Elona Hayward

Analytical Results

TOTAL METALS	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
Calcium	6010	0.01	31.
Magnesium	6010	0.01	21.
Potassium	6010	0.01	7.9
Sodium	6010	0.01	4,500.
OTHER CHEMISTRIES			
Bicarbonate (as $CaCO_3$)	310.1	10.	1,300.
Carbonate (as $CaCO_3$)	310.1	10.	<10.
Chloride	4500 CLB	0.5	2,000.
Conductivity	120.1	10.	16,000. µmhos/cm @ 25° C
Cyanide	335.3	0.005	<0.005
Fluoride	340.1	0.1	3.0
Nitrate (as N)	353.2	0.01	0.03
pH	150.1	0.1	7.5
Sulfate	375.4	5.0	5,900.
TDS	160.1	1.0	11,000.

Released by: ______________________
Laboratory Supervisor

Report Date 8/8/94

AMERICAN
WEST
ANALYTICAL
LABORATORIES

INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-03
Field Sample ID: Green River, UT/MW-5

Contact: Kevin Cosper
Received By: Elona Hayward

63 West 3600 South
Salt Lake City, Utah
84115

(801) 263-8686
Fax (801) 263-8687

Analytical Results

DISSOLVED METALS	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
Aluminum	6010	0.1	0.1
Antimony	6010	0.1	<0.1
Arsenic	7060	0.005	<0.005
Barium	6010	0.002	0.005
Beryllium	6010	0.005	<0.005
Cadmium	6010	0.004	0.005
Chromium	6010	0.005	<0.005
Cobalt	6010	0.01	<0.01
Copper	6010	0.004	0.023
Iron	6010	0.01	0.11
Lead	7421	0.005	<0.005
Manganese	6010	0.005	0.020
Mercury	7471	0.0002	<0.0002
Molybdenum	6010	0.1	<0.1
Nickel	6010	0.005	0.032
Selenium	7740	0.005	0.51
Silver	6010	0.005	<0.005
Thallium	6010	0.4	<0.4
Tin	6010	0.1	0.1
Vanadium	6010	0.005	0.017
Zinc	6010	0.002	0.058

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Report Date 8/8/94

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INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-03
Field Sample ID: Green River, UT/MW-5

Contact: Kevin Cosper
Received By: Elona Hayward

Analytical Results

TOTAL METALS	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
Calcium	6010	0.01	440.
Magnesium	6010	0.01	720.
Potassium	6010	0.01	27.
Sodium	6010	0.01	6,400.
OTHER CHEMISTRIES			
Bicarbonate (as $CaCO_3$)	310.1	10.	1,100.
Carbonate (as $CaCO_3$)	310.1	10.	<10.
Chloride	4500 CLB	0.5	180.
Conductivity	120.1	10.	21,000. µmhos/cm @ 25° C
Cyanide	335.3	0.005	0.008
Fluoride	340.1	0.1	6.8
Nitrate (as N)	353.2	0.01	130.
pH	150.1	0.1	7.2
Sulfate	375.4	5.0	15,000.
TDS	160.1	1.0	19,000.

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Report Date 8/8/94

INORGANIC ANALYSIS REPORT

AMERICAN
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ANALYTICAL
LABORATORIES

463 West 3600 South
Salt Lake City, Utah
84115

(801) 263-8686
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Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-04
Field Sample ID: Green River, UT/DH-2

Contact: Kevin Cosper
Received By: Elona Hayward

Analytical Results

	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
TDS	160.1	1.0	9,400.

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Report Date 8/8/94

AMERICAN
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ANALYTICAL
LABORATORIES

INORGANIC ANALYSIS REPORT

Client: Bingham Environmental
Date Received: August 1, 1994
Lab Sample ID Number: 19299-05
Field Sample ID: Green River, UT/DH-10

Contact: Kevin Cosper
Received By: Elona Hayward

Analytical Results

	Method Used:	Detection Limit: mg/L	Amount Detected: mg/L
TDS	160.1	1.0	**30,000.**

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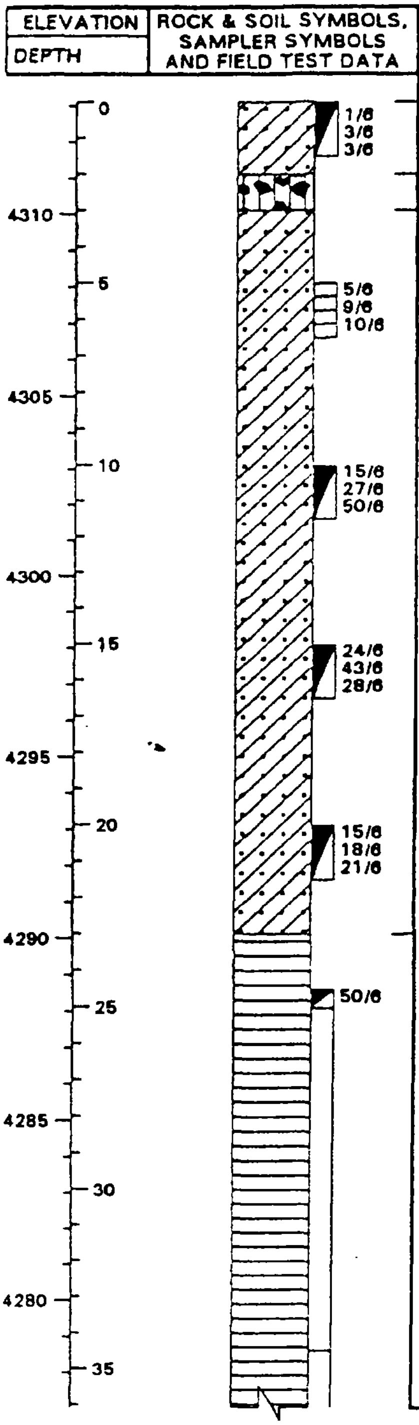
Report Date 8/8/94

6. EXPLORATORY DRILL HOLE, PIEZOMETER, AND MONITOR WELL LOGS

DRILL HOLE LOG
DRILL HOLE NO.: DH-1

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: Northwest Corner
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-21-94
TOC ELEV.: NA
GS ELEV.: 4313.12
LOGGED BY: DEW
HOLE NO.: DH-1



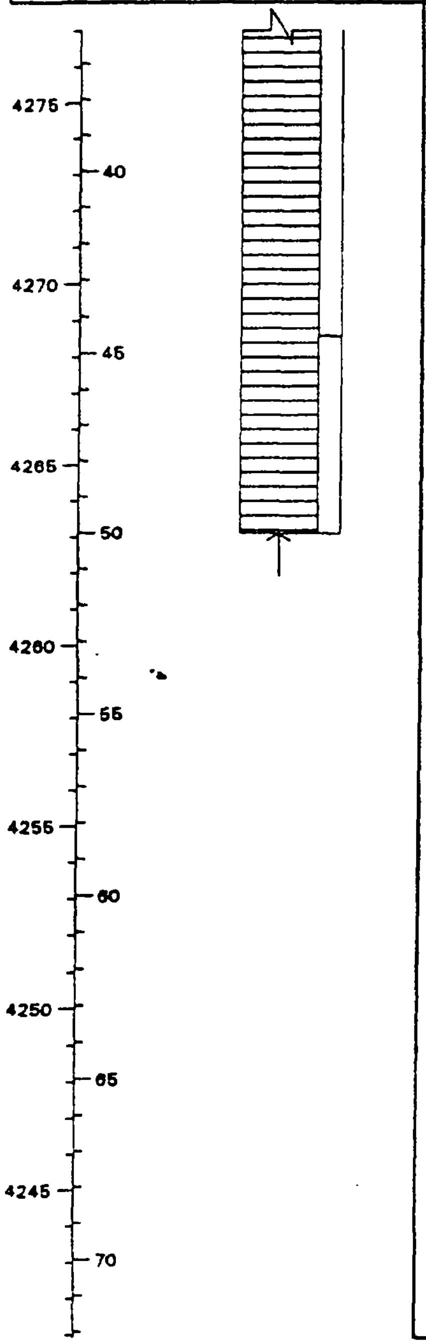
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[SC] CLAYEY SAND: Brown, slightly silty, roots, medium dense, dry.	B-1	0-1.5	14/18	
[GM] SILTY GRAVEL: Brown, slightly clayey, dense, dry.				
[SC] CLAYEY SAND: Brown, occasional gravel, medium dense to dense, slightly moist.	CA-2	5-6.5	16/18	
	B-2	10-11.5	18/18	
	B-3	15-16.5	18/18	
...Grades dense.				
	B-4	20-21.5	18/18	
SHALE: Gray, gypsum along fractures, very close to close spaced fractures, fractures are non-intersecting open planes with intersecting open planes at 26 feet, slightly weathered to fresh, dry. (Began coring at 25 feet)	B-5	24.5-25 25-34.5	6/6 114/114	0 33 58 75 83 100
...Close to moderate spaced factures from 29 to 34.5 feet.				
...Moderate spaced fractures from 34.5 to 50 feet.		34.5-44.5	120/120	

Hole diameter is 7.75 inches from 0 to 25 feet; and 4.25 inches from 25 to 50 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-1

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: Northwest Corner
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-21-94
TOC ELEV.: NA
GS ELEV.: 4313.12
LOGGED BY: DEW
HOLE NO.: DH-1

ELEVATION DEPTH	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				44.5- 50	120/ 120	

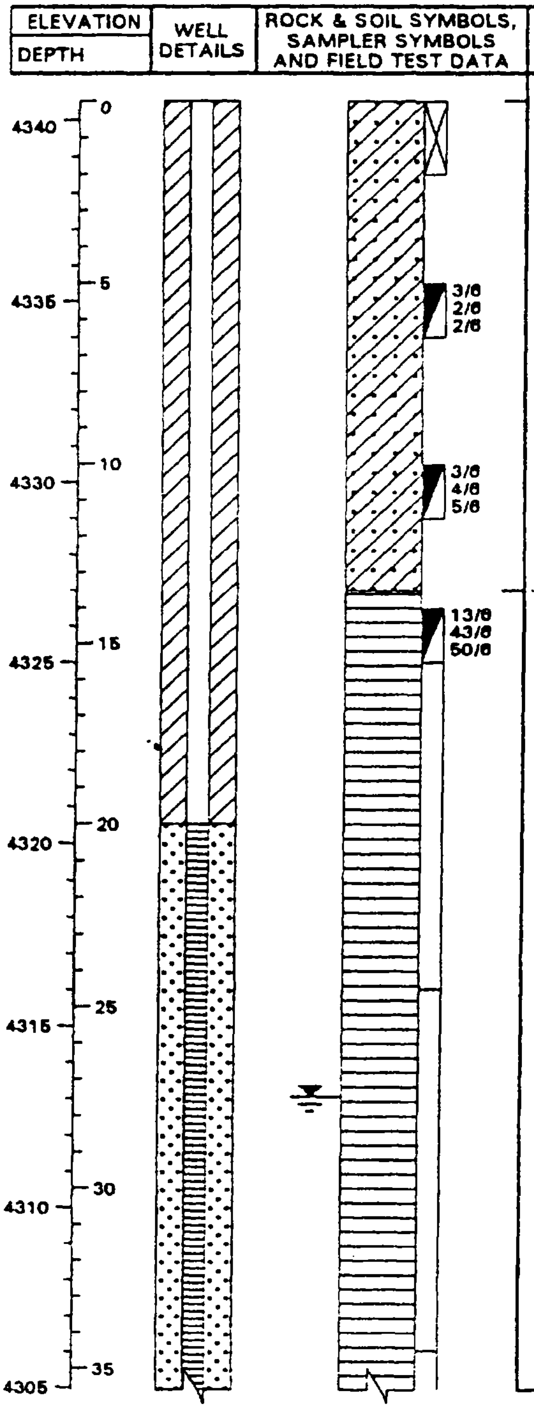
Hole diameter is 7.75 inches from 0 to 25 feet; and 4.25 inches from 25 to 50 feet.

DRILL HOLE LOG

DRILL HOLE NO.: DH-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 27.46'

PROJECT NO.: 2106-002
DATE: 6-22-94
TOC ELEV.: 4345.28
GS ELEV.: 4340.53
LOGGED BY: DEW
HOLE NO.: DH-2



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[SC] CLAYEY SAND: Brown, slightly silty, roots, occasional gravel, loose to medium dense, dry to moist.	S-1	0-2	24/24	
	B-1	5-6.5	18/18	
	B-2	10-11.5	18/18	
...Grades gravely.				
SHALE: Gray, gypsum along fractures, very close to close spaced fractures, fractures are non-intersecting open planes, fresh, dry. (Began coring at 15.5 feet)	B-3	14-15.5	18/18	
		15.5- 24.5	108/ 108	0
				58
...Moderate spaced fractures from 18.5 to 24.5 feet.				33
				100
...Close spaced fractures from 24.5 to 43.5 feet.		24.5- 34.5	120/ 120	25
				100
				0
...Grades wet.				92
				100
				75
				100
				67
		34.5-	108/	100

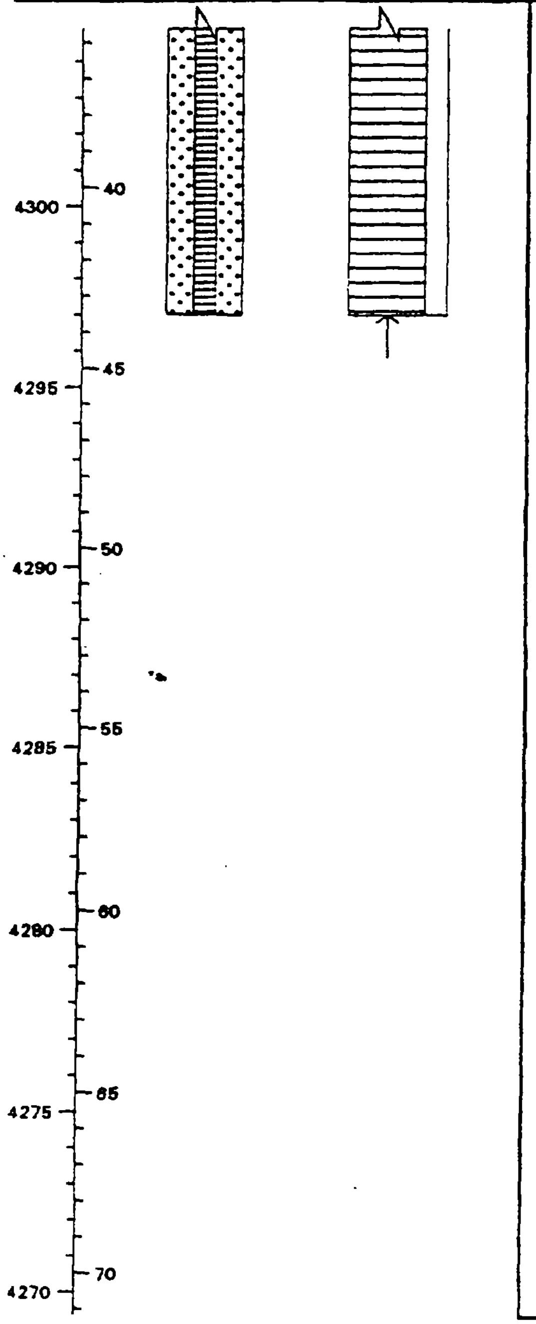
Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 43.5 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 27.46'

PROJECT NO.: 2106-002
DATE: 6-22-94
TOC ELEV.: 4345.28
GS ELEV.: 4340.53
LOGGED BY: DEW
HOLE NO.: DH-2

ELEVATION DEPTH	WELL DETAILS	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
					43.5	108	
							75



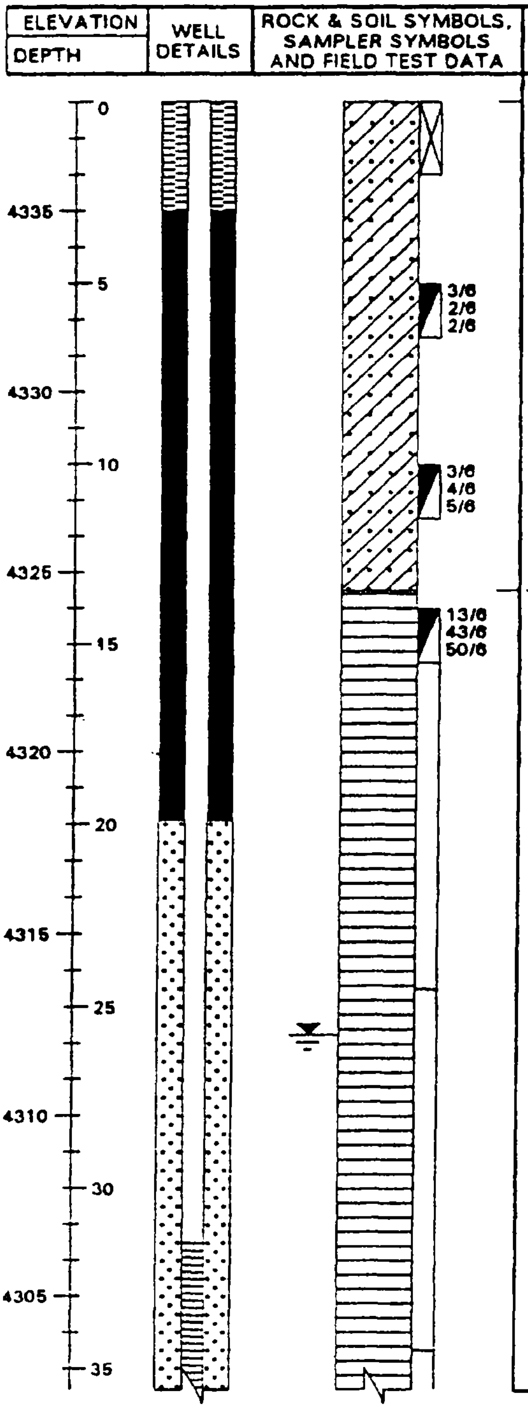
Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 43.5 feet.

BINGHAM ENVIRONMENTAL

DRILL HOLE LOG
DRILL HOLE NO.: MW-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: 38 feet north of DH-2
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 25.75'

PROJECT NO.: 2106-003
DATE: 7-12-94
TOC ELEV.:
GS ELEV.: 4338
LOGGED BY: DCH
HOLE NO.: MW-2



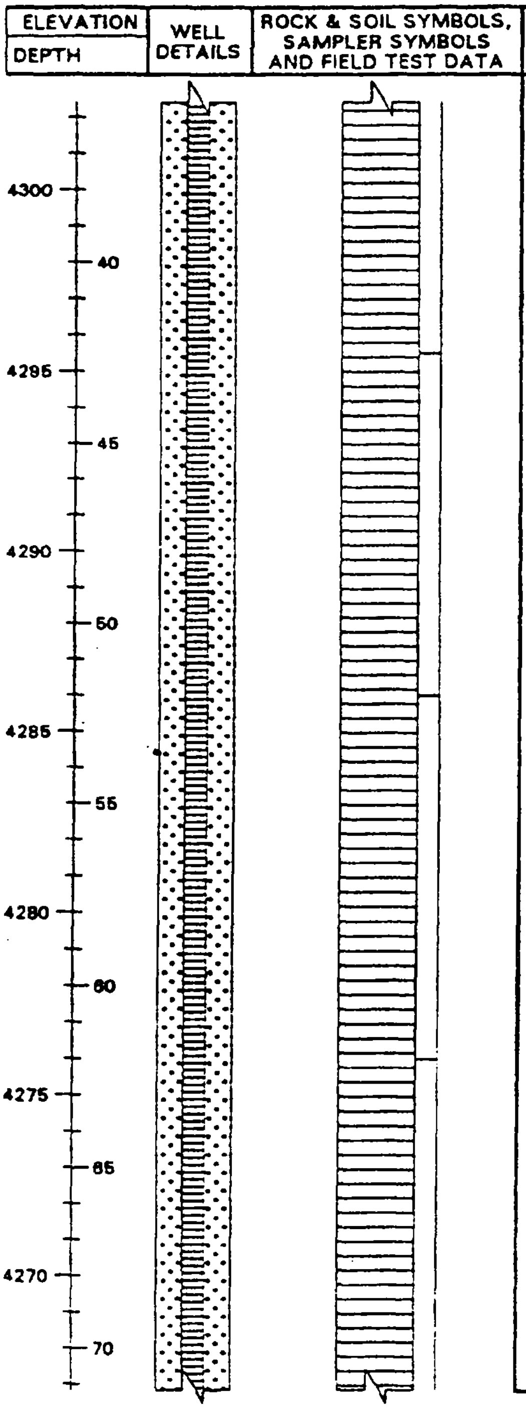
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[SC] CLAYEY SAND: Brown, slightly silty, roots, occasional gravel, loose to medium dense, dry to moist.	S-1	0-2	24/24	
	B-1	5-6.5	18/18	
	B-2	10-11.5	18/18	
...grades gravely.				
SHALE: Gray, gypsum along fractures, very close to close spaced fractures, fractures are non-intersecting open planes with intersecting open planes starting at 44 feet, fresh, dry.	B-3	14-15.5	18/18	
		15.5-24.5	108/108	0
				58
...Moderate spaced fractures from 18.5 to 24.5 feet.				33
				100
...Close spaced fractures from 24.5 to 43.5 feet.		24.5-34.5	120/120	25
				100
				0
...Grades wet.				92
				100
				75
				100
				67
		34.5-	96/96	100

Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 102 feet. Log information from 0 to 42.5 feet obtained from DH-2 log (DH-2 is 38 feet south of MW-2).

DRILL HOLE LOG
DRILL HOLE NO.: MW-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: 38 feet north of DH-2
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 25.75'

PROJECT NO.: 2106-003
DATE: 7-12-94
TOC ELEV.:
GS ELEV.: 4338
LOGGED BY: DCH
HOLE NO.: MW-2



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		42.5		
...Close to moderate spaced fractures from 42.5 to 50 feet with very close spaced fractures at 44 feet, dry with occassional wet fractures.		42.5-52	114/114	100 83 100
...Moderate to wide spaced fractures from 52 to 102 feet with very close spaced fractures at 81.8 feet.		52-62	120/120	92 75 100
		62-72	120/120	

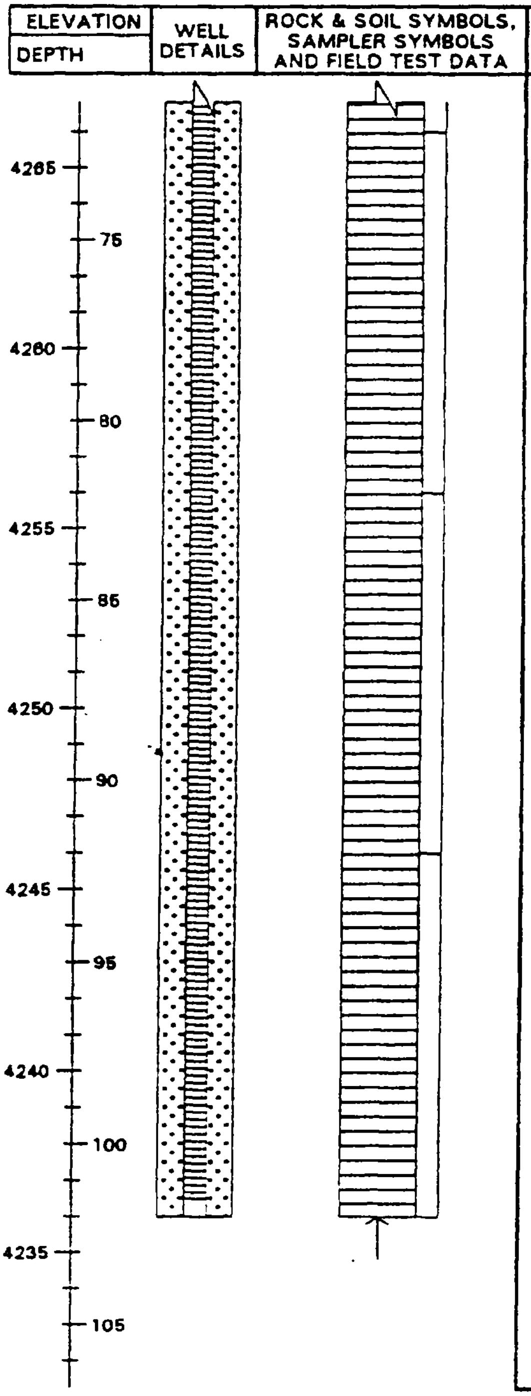
Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 102 feet. Log information from 0 to 42.5 feet obtained from DH-2 log (DH-2 is 38 feet south of MW-2).

DRILL HOLE LOG

DRILL HOLE NO.: MW-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: 38 feet north of DH-2
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 25.75'

PROJECT NO.: 2106-003
DATE: 7-12-94
TOC ELEV.:
GS ELEV.: 4338
LOGGED BY: DCH
HOLE NO.: MW-2



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		72- 82	120/ 120	
		82- 92	120/ 120	83 100
		92- 102	120/ 120	

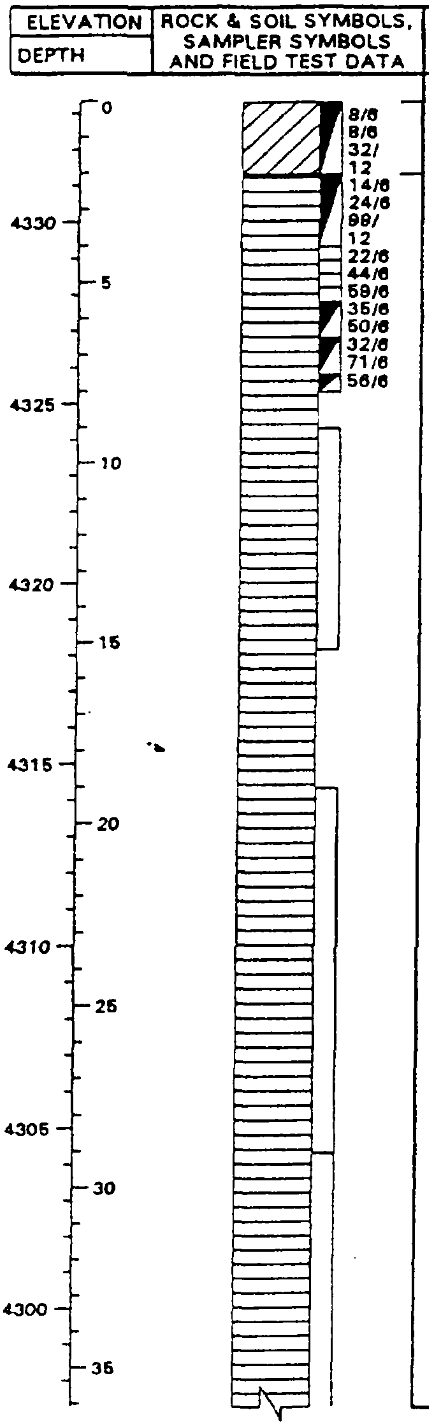
Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 102 feet. Log information from 0 to 42.5 feet obtained from DH-2 log (DH-2 is 38 feet south of MW-2).

DRILL HOLE LOG

DRILL HOLE NO.: DH-3

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-22-94
TOC ELEV.: NA
GS ELEV.: 4333.36
LOGGED BY: DEW
HOLE NO.: DH-3



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, sandy, roots, very stiff to hard, dry.	B-1	0-2	22/24	
SHALE: Gray, weathered, moderately hard, dry.	B-2	2-4	18/24	
...Gypsum in fractures.	CA-1	4-5.5	18/18	
...Grades hard.	B-3	5.5-6.5	8/12	
	B-4	6.5-7.5	10/12	
	B-5	7.5-8	6/6	
(Began coring at 9 feet.) ...Silt in fractures, very close spaced factures, fractures are non-intersecting open planes, fresh, dry.		9-16.2	74/74	0
...Shattered fractures from 13 to 16.2 feet.				
...Gypsum in fractures from 14 to 35 feet				
...Very close spaced fractures from 19 to 35 feet.		19-29	96/120	33
				0
...fractures are non-intersecting and intersecting open planes from 21 to 49 feet.				
				33
				0
...Core slightly damp		29-39	120/120	0
				42
...Moderate spaced fractures from 35 to 39 feet.				100

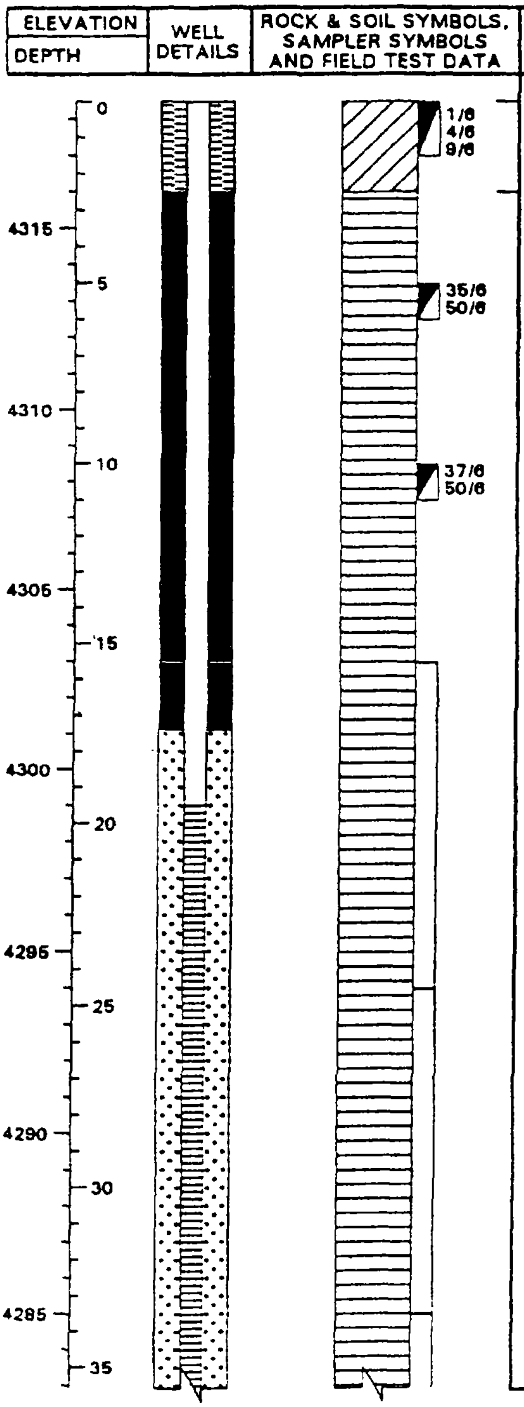
Hole diameter is 7.75 inches form 0 to 9 feet; and 4.25 inches from 9 to 49 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-4

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 6-21-94
TOC ELEV.: 4321.46
GS ELEV.: 4318.51
LOGGED BY: DEW
HOLE NO.: MW-4



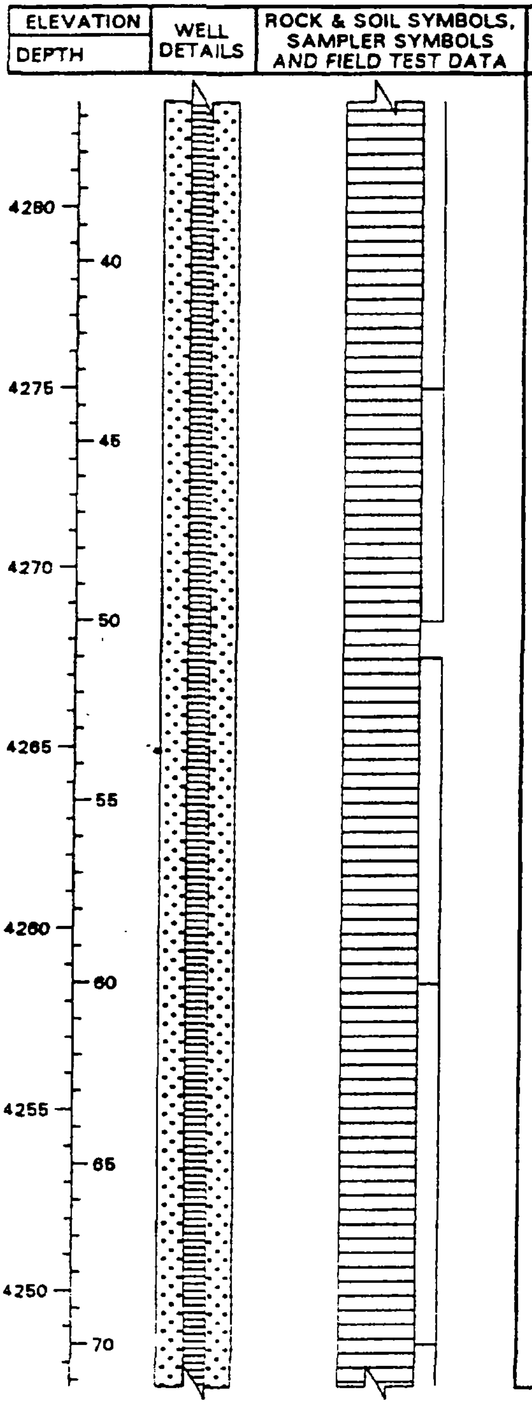
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, roots, sandy, stiff, dry. ...Grades gravely.	B-1	0-1.5	7/18	
SHALE: Gray, moderately hard to hard, dry. ...Gypsum in fractures.				
	B-2	5-6	10/12	
...grades hard.				
	B-3	10-11	10/12	
(Began coring at 15.5 feet.) ...Gypsum in fractures, very close to close spaced fractures, fractures are non-intersecting open planes with intersecting open planes at 40 feet, slightly weathered to fresh, dry.		15.5-24.5	120/120	0
				92
				67
				58
...Moderate spaced fractures from 24.5 to 50 feet, damp.		24.5-33.5	108/108	50
				100
...Grades moist.		33.5-43.5	120/120	

Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 50 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-4

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 6-21-94
TOC ELEV.: 4321.46
GS ELEV.: 4318.51
LOGGED BY: DEW
HOLE NO.: MW-4



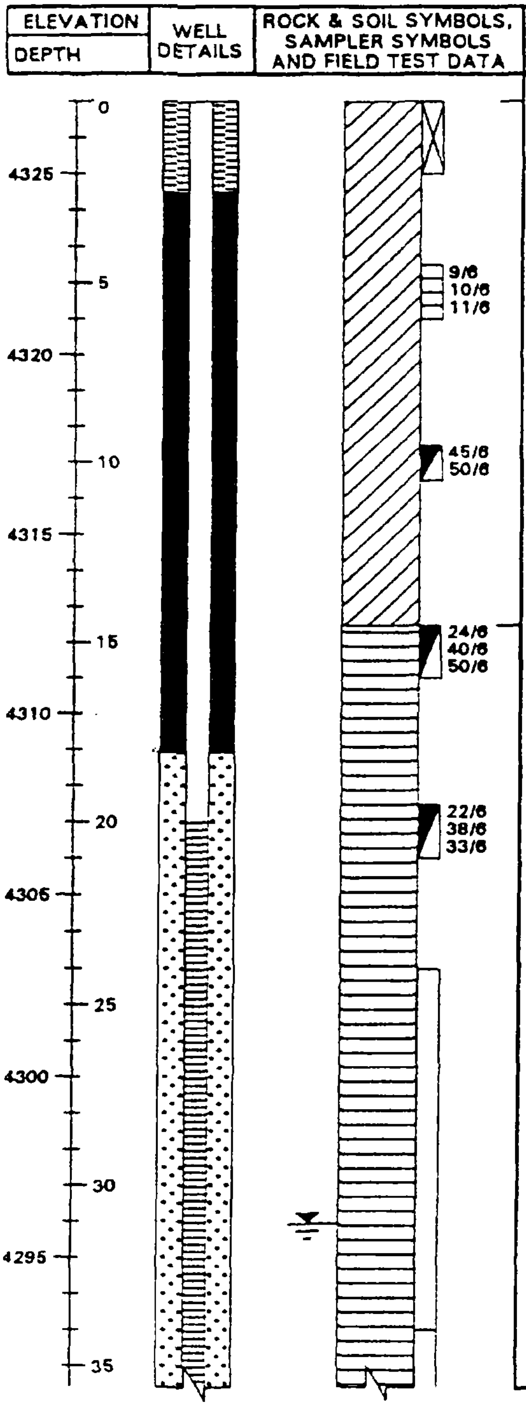
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		43.5-50	78/78	
...Fractures are spaced wide from 50 to 65 feet, fractures are non-intersecting planes from 51 to 90 feet.		51-60	108/108	
		60-70	120/120	92 100
...Fractures and spaced very wide.				
		70-80	120/120	

Hole diameter is 7.75 inches from 0 to 15.5 feet; and 4.25 inches from 15.5 to 50 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-5

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 31.05'

PROJECT NO.: 2106-003
DATE: 6-30-94
TOC ELEV.:
GS ELEV.: 4327
LOGGED BY: DCH
HOLE NO.: MW-5



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, slightly sandy, very stiff to hard, dry.	S-1	0-2	24/24	
	CA-2	4.5-6	14/16	
	B-3	9.5-10.5	8/12	
SHALE: Gray, very weathered, moderately hard, dry.	B-4	14.5-16	14/18	
	B-5	19.5-21	13/18	
(Began coring at 24 feet.) ...Gypsum along some fractures, fractures shattered to close spaced fractures from 24 to 29 feet & lose to moderate spaced fractures from 29 to 54 feet, fractures are non-intersecting and intersecting open planes, slightly weathered to fresh, dry to moist.		24-34	120/120	67 33 50 100 75 100
...Grades wet.		34-44	120/120	

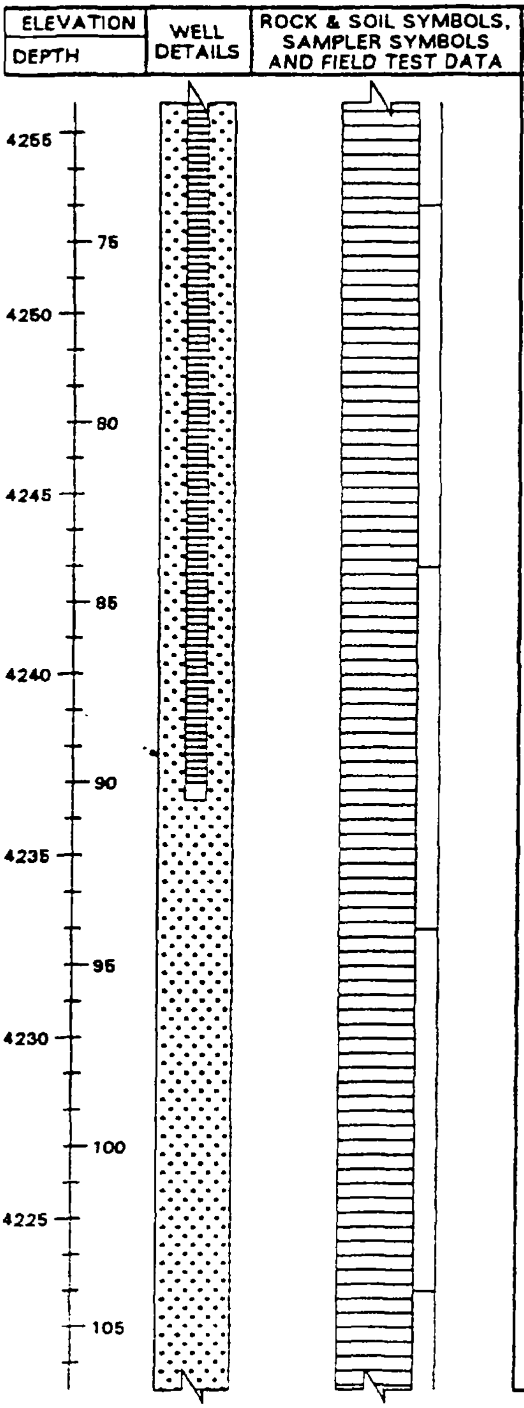
Hole diameter is 7.75 inches from 0 to 24 feet; and 4.25 inches from 24 to 139 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-5

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 31.05'

PROJECT NO.: 2106-003
DATE: 6-30-94
TOC ELEV.:
GS ELEV.: 4327
LOGGED BY: DCH
HOLE NO.: MW-5



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				92
				75
				100
		74-84	120/120	50
				100
				42
				50
				67
				92
				75
				100
		84-94	120/120	
				75
				100
				83
...Moderate to wide spaced fractures from 84 to 139.5 feet.				100
		94-104	120/120	
		104-114	120/120	

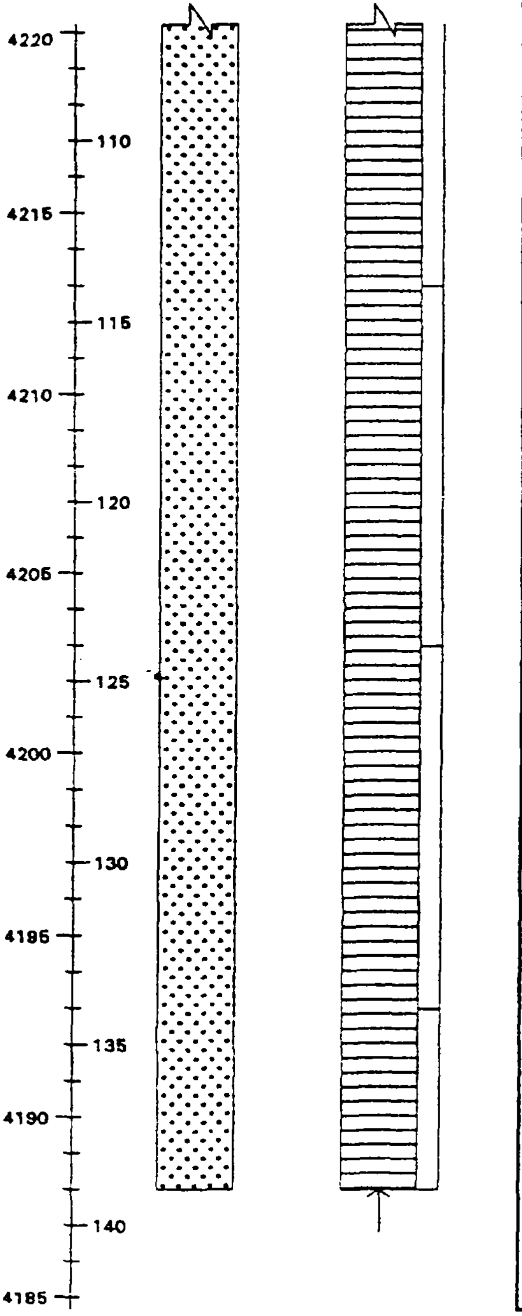
Hole diameter is 7.75 inches from 0 to 24 feet; and 4.25 inches from 24 to 139 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-5

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 31.05'

PROJECT NO.: 2106-003
DATE: 6-30-94
TOC ELEV.:
GS ELEV.: 4327
LOGGED BY: DCH
HOLE NO.: MW-5

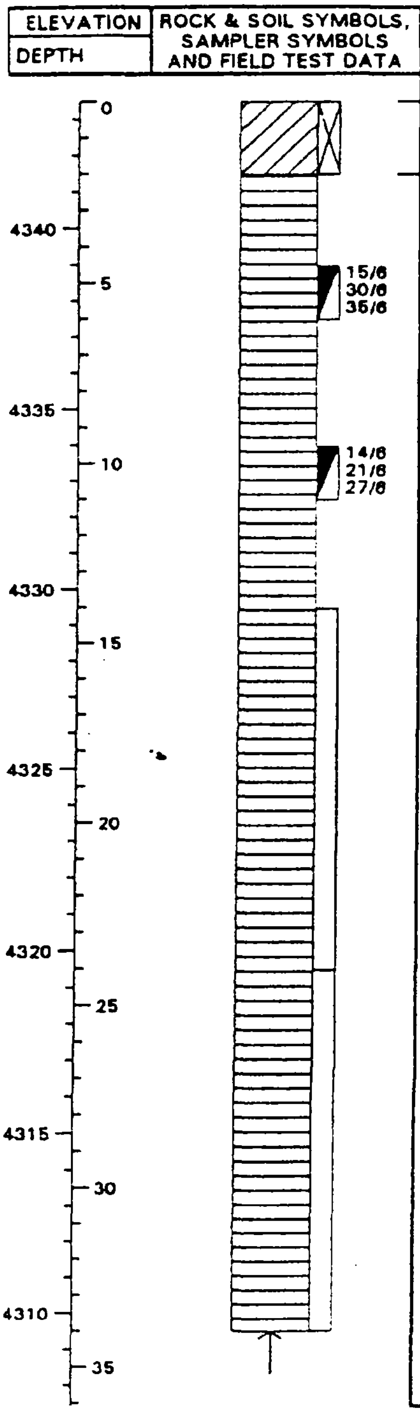


ELEVATION DEPTH	WELL DETAILS	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
					114-124	120/120	
					124-134	120/120	
					134-139	60/60	

Hole diameter is 7.75 inches from 0 to 24 feet; and 4.25 inches from 24 to 139 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-6

PROJECT: Green River Landfill	PROJECT NO.: 2106-002
CLIENT/OWNER: Green River Landfill L.L.C.	DATE: 6-23-94
LOCATION:	TOC ELEV.: NA
DRILLER: Overland Drilling, Inc.	GS ELEV.: 4343.51
DRILL RIG: CME 75	LOGGED BY: DEW
DEPTH TO WATER: None	HOLE NO.: DH-6



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, sandy, stiff, dry.	S-1	0-2	24/24	
SHALE: Gray, weathered, firm to moderately hard, dry.				
	B-1	4.5-6	16/18	
	B-2	9.5-11	16/18	
...Grades hard.				
(Began coring at 14 feet) ...very close to moderate spaced fractures fractures are non-intersecting and intersecting open planes, slightly weathered ts fresh, dry.		14-24	116/120	0
...Fractures are non-intersecting open planes from 17 to 34 feet.				42 0 100
		24-34	120/120	

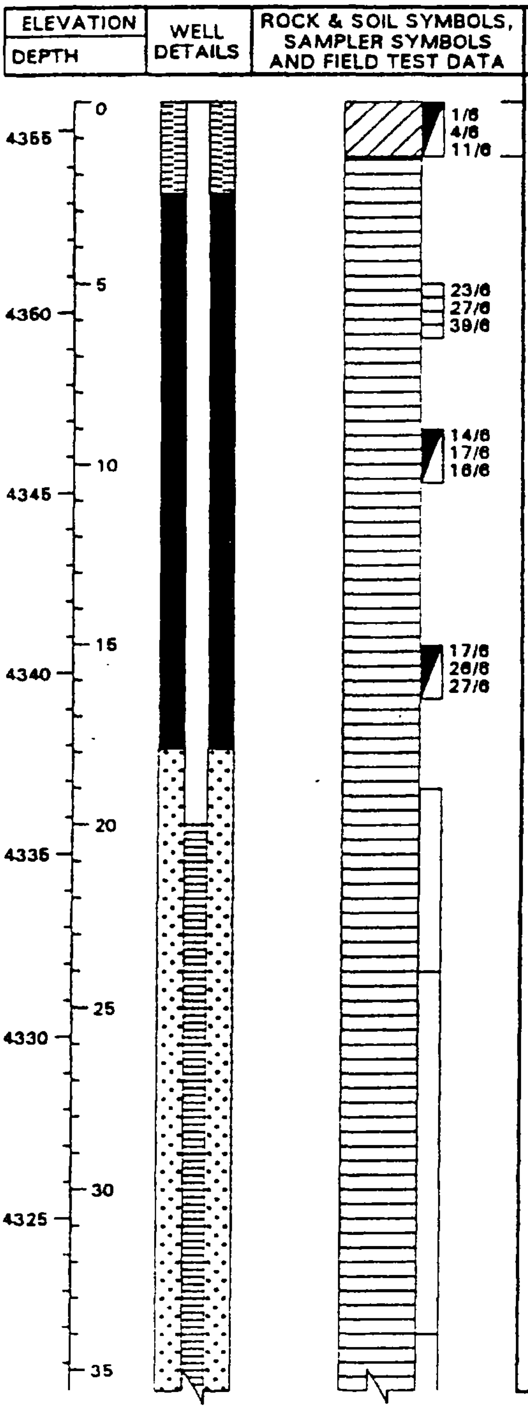
Hole diameter is 7.75 inches from 0 to 14 feet; and 4.25 inches from 14 to 34 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-7

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 6-23-94
TOC ELEV.: 4358.65
GS ELEV.: 4355.81
LOGGED BY: DEW
HOLE NO.: MW-7



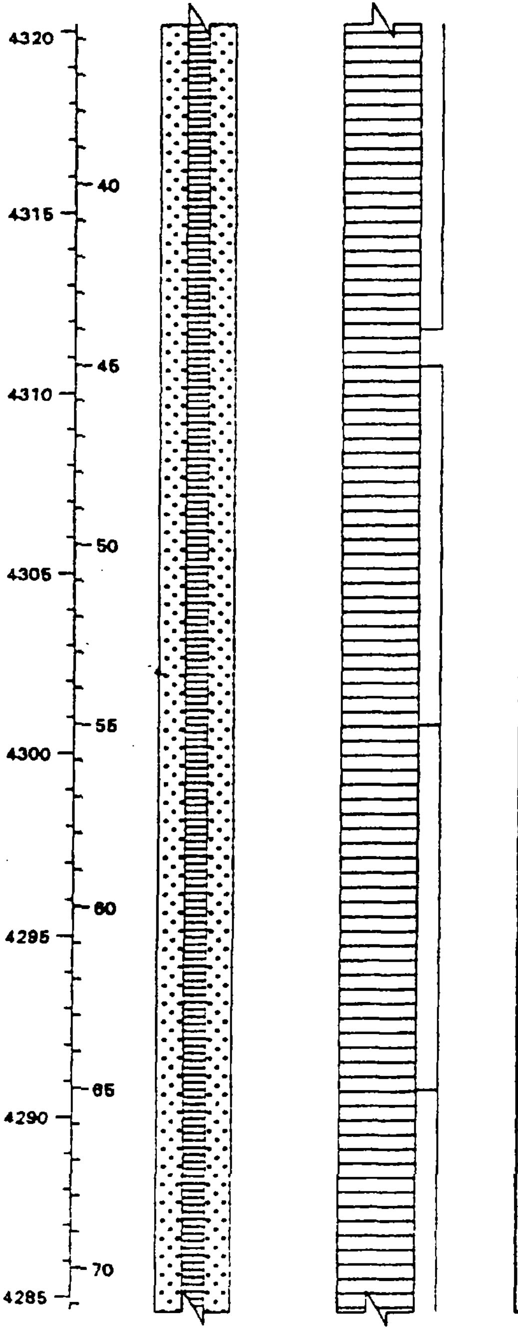
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, slightly sandy, stiff, dry.	B-1	0-1.5	16/18	
SHALE: Gray, firm to moderately hard, dry.				
	CA-1	5-6.5	18/18	
	B-2	9-10.5	16/18	
...Gypsum in fractures.	B-3	15-16.5	16/18	
(Began coring at 19 feet) ...very close spaced fractures, fractures are non-intersecting and intersecting open planes, slightly weathered to fresh, dry.		19-24	56/60	0
...Close to moderate spaced fractures from 24 to 34 feet.		24-34	120/120	33 67 100 92 100
...Wide spaced fractures from 34 to 44 feet.		34-44	120/120	

Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from 19 to 85 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-7

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 6-23-94
TOC ELEV.: 4358.65
GS ELEV.: 4355.81
LOGGED BY: DEW
HOLE NO.: MW-7



ELEVATION DEPTH	WELL DETAILS	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
			...Grades wet.				
			...Grades dry.		45- 55	120/ 120	0 100
					55- 65	120/ 120	75 100 75 42 100
					65- 75	120/ 120	0 92 100

Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from 19 to 85 feet.

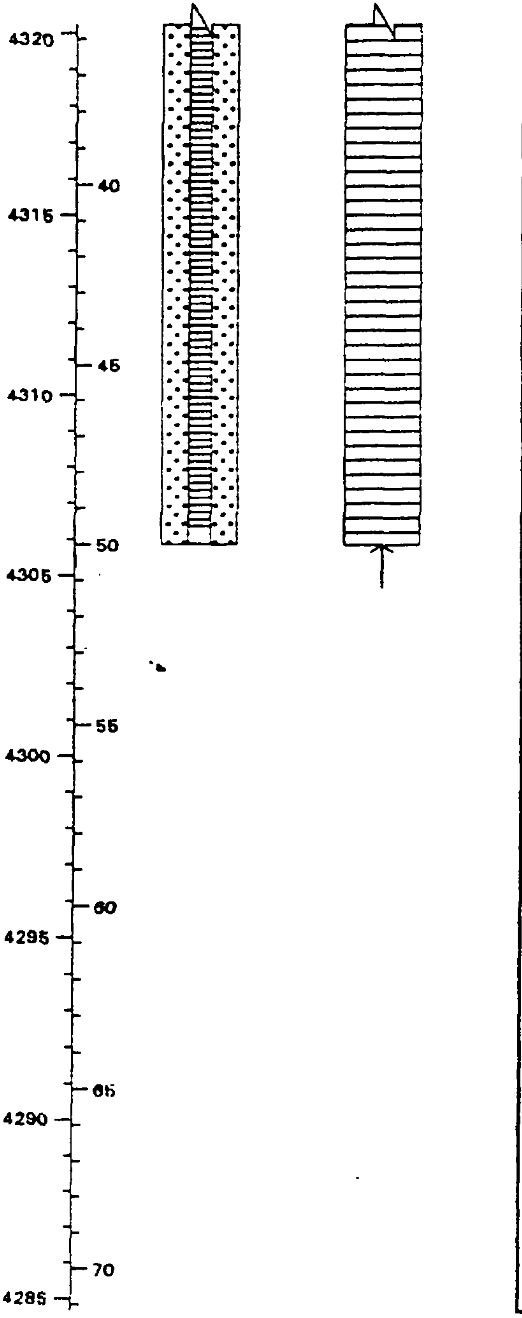
DRILL HOLE LOG

DRILL HOLE NO.: MW-7A

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill, L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 6-23-94
TOC ELEV.: 4358.67
GS ELEV.: 4355.84
LOGGED BY: DEW
HOLE NO.: MW-7A

ELEVATION DEPTH	WELL DETAILS	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)



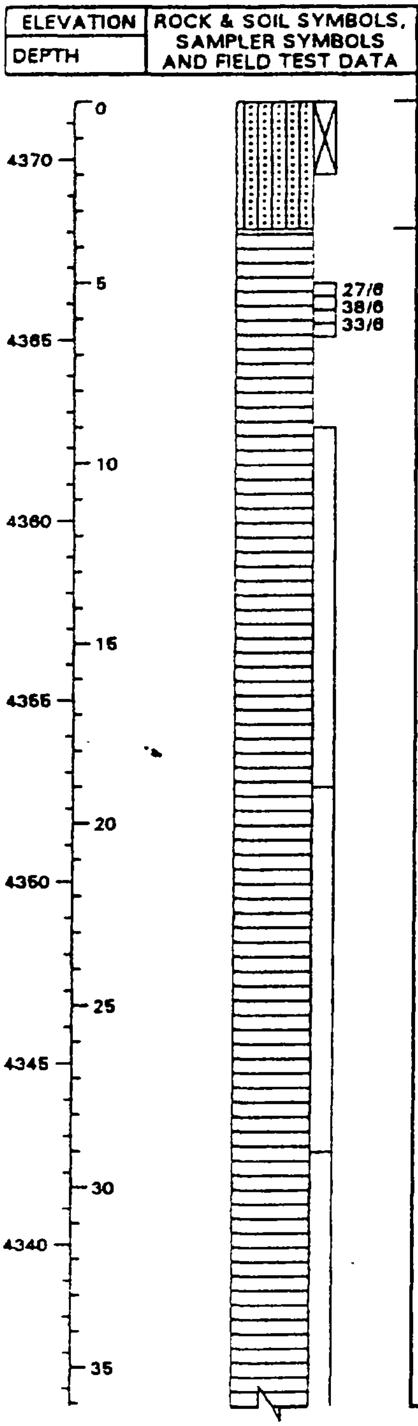
Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from 19 to 85 feet. Log information obtained from MW-7 located 15 feet west of MW-7A.

DRILL HOLE LOG

DRILL HOLE NO.: DH-8

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-24-94
TOC ELEV.: NA
GS ELEV.: 4371.59
LOGGED BY: DEW
HOLE NO.: DH-8



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[SM] SILTY SAND: Brown, roots, clayey, medium dense, dry.	S-1	0-2	22/24	
SHALE: Gray, gypsum, firm to moderately hard, dry.	CA-1	5-6.5	18/18	
(Began coring at 9 feet.) ...Gypsum along fractures, shattered to very close spaced fractures, fractures are intersecting and non-intersecting open planes, highly to moderately weathered, dry.		9-19	90/ 120	0
...Close to moderate spaced factures, non-intersecting open planes.		19-29	116/ 120	
...Weathering grades to fresh.				33 83 58 0 100
		29-39	120/ 120	

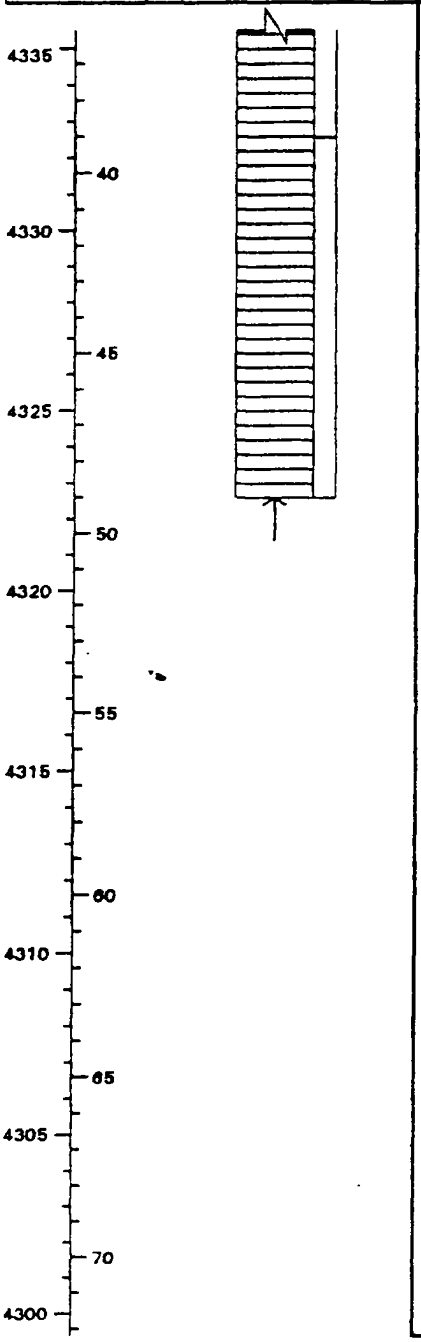
Hole diameter is 7.75 inches from 0 to 9 feet; and 4.25 inches form 9 to 49 feet.

DRILL HOLE LOG

DRILL HOLE NO.: DH-8

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-24-94
TOC ELEV.: NA
GS ELEV.: 4371.59
LOGGED BY: DEW
HOLE NO.: DH-8



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		39- 49	120/ 120	67 100
				83 100

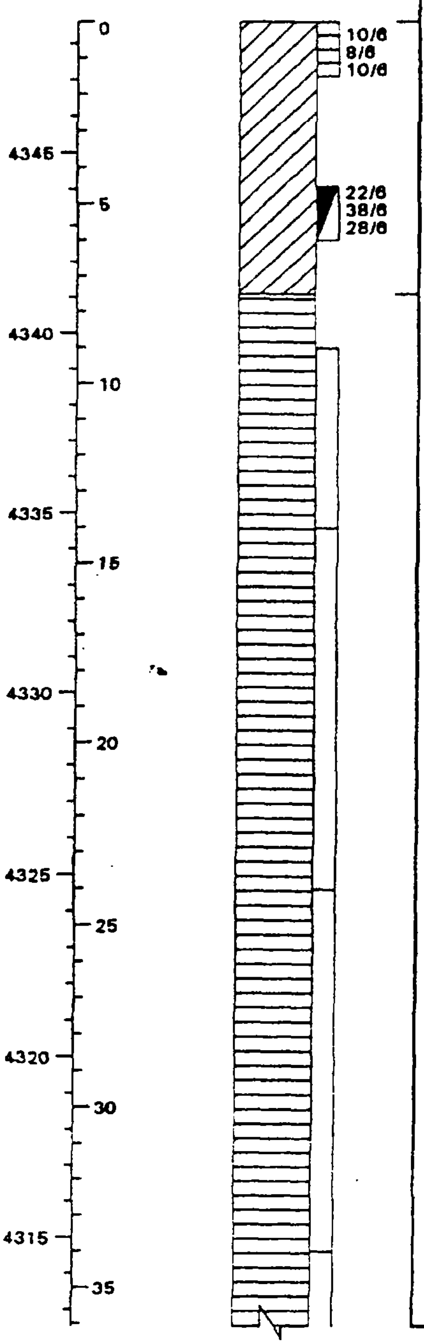
Hole diameter is 7.75 inches from 0 to 9 feet; and 4.25 inches form 9 to 49 feet.

DRILL HOLE LOG

DRILL HOLE NO.: DH-9

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-29-94
TOC ELEV.: NA
GS ELEV.: 4348.61
LOGGED BY: DCH
HOLE NO.: DH-9



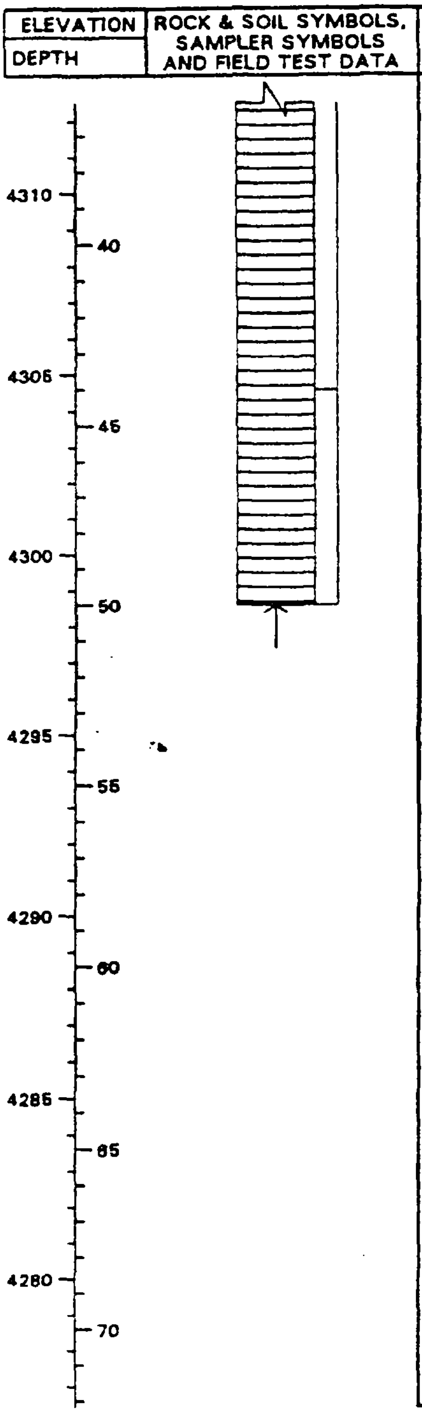
ELEVATION DEPTH	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		[CL] SILTY CLAY: Brown, roots, sandy, very stiff to hard, dry.	CA-1	0-1.5	12/18	
			B-2	4.5-6	15/18	
		SHALE: Gray, weathered, firm to hard, dry. (Began coring at 9 feet.) ...Gypsum along fractures, very close to close spaced fractures with with occasional shattered fractures, fractures are non-intersecting and intersecting open planes, lightly weathered to fresh, dry.		9-14	48/60	33 67 33 0
				14-24	109/120	33
		...Moderate spaced fractures from 18 to 34 feet.				100
				24-34	120/120	
		...Very close to close spaced fractures from 34 to 44 feet.		34-44	120/120	

Hole diameter is 7.75 inches from 0 to 9 feet; and 4.25 inches from 9 to 50 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-9

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-29-94
TOC ELEV.: NA
GS ELEV.: 4348.61
LOGGED BY: DCH
HOLE NO.: DH-9



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
...Close to moderately spaced fractures from 44 to 50 feet.		44-50	72/72	75 100 92 100 75 0 100 75 92 75 100

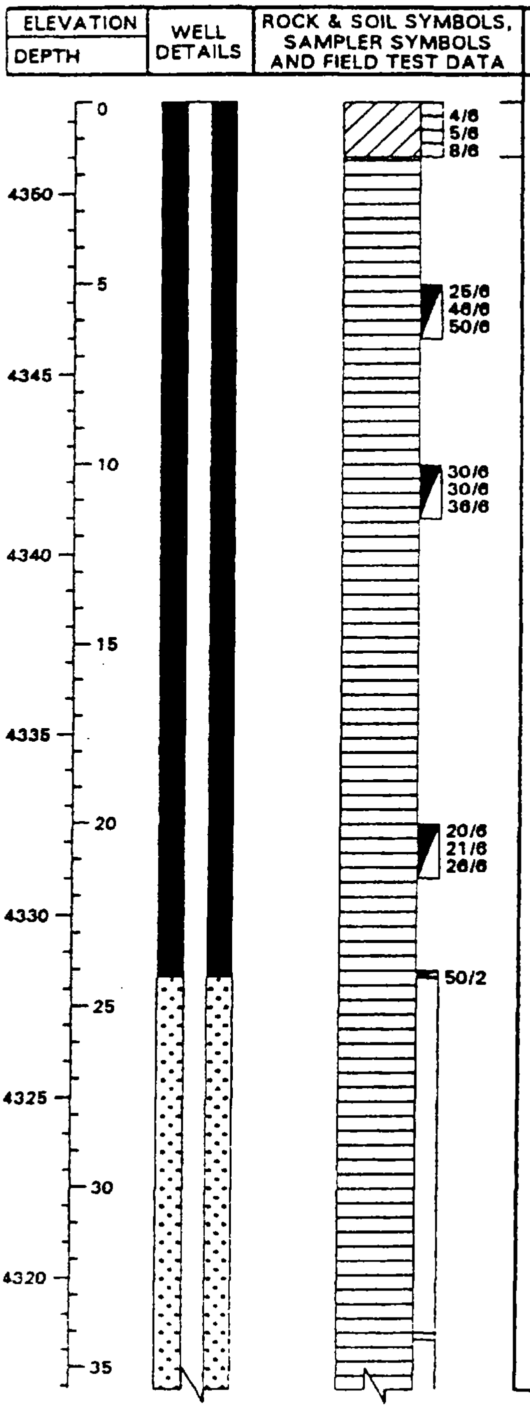
Hole diameter is 7.75 inches from 0 to 9 feet; and 4.25 inches from 9 to 50 feet.

DRILL HOLE LOG

DRILL HOLE NO.: DH-10

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 37.42'

PROJECT NO.: 2106-002
DATE: 6-27-94
TOC ELEV.: 4353.83
GS ELEV.: 4352.53
LOGGED BY: DEW
HOLE NO.: DH-10



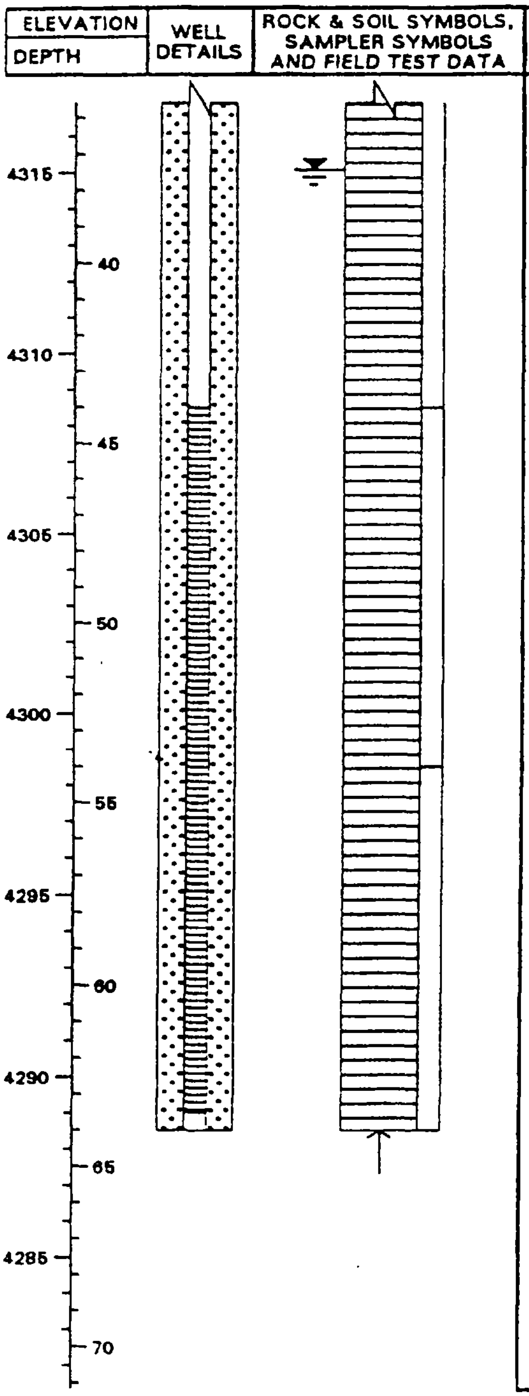
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, roots, sandy, stiff, dry.	CA-1	0-1.5	18/18	
SHALE: Gray, very to moderately weathered, moderately hard, dry.				
	B-1	5-6.5	18/18	
...Gypsum in fractures.	B-2	10-11.5	17/18	
	B-3	20-21.5	18/18	
(Began coring at 24 feet.) ...very close to close spaced fractures, fractures are intersecting and non-intersecting open planes, slightly weathered to fresh, dry.	B-4	24-24.2 24.2-34	18/18 120/120	0 43 0 67 0 43 100 33 100
		34-44	120/120	

Hole diameter is 7.75 inches from 0 to 24 feet; and 4.25 inches from 24 to 64 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-10

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: 37.42'

PROJECT NO.: 2106-002
DATE: 6-27-94
TOC ELEV.: 4353.83
GS ELEV.: 4352.53
LOGGED BY: DEW
HOLE NO.: DH-10



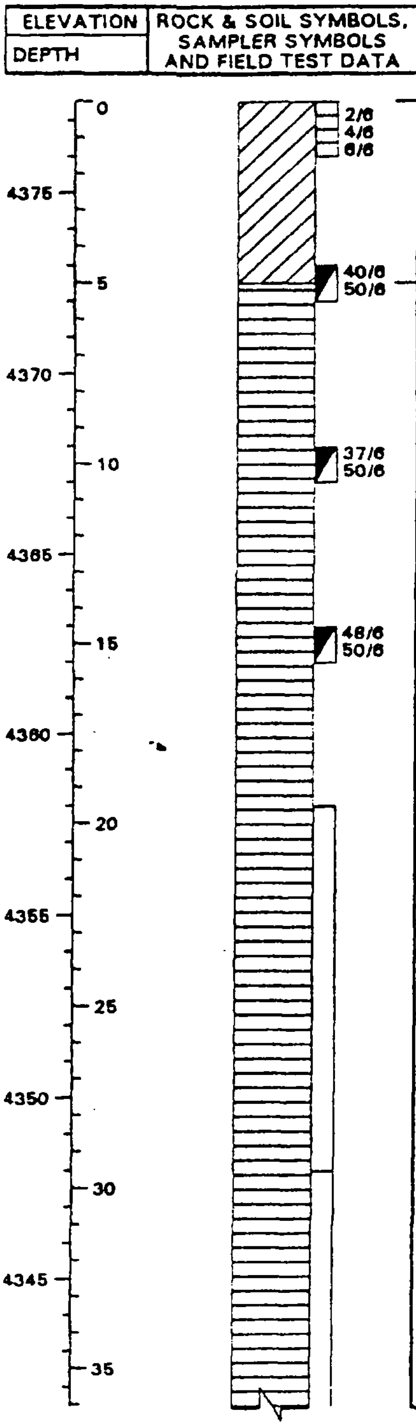
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				83
				92
				100
...Grades wet. ...Moderate spaced fractures with occasional shattered fractures.		44-54	120/120	
				75
				100
				33
				67
				100
		54-64	120/120	67
				100
				92
				100

Hole diameter is 7.75 inches from 0 to 24 feet; and 4.25 inches from 24 to 64 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-12

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-24-94
TOC ELEV.: NA
GS ELEV.: 4377.53
LOGGED BY: DEW
HOLE NO.: DH-12



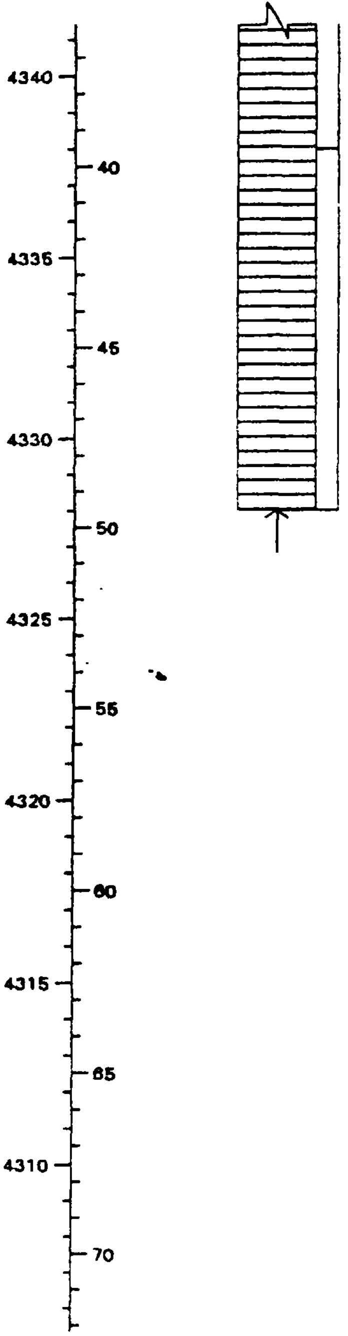
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, sandy, stiff, dry.	CA-1	0-1.5	18/18	
...Boulder approximatly 1.5 feet thick.				
SHALE: Grayish tan, very to moderately weathered, moderately hard, dry.	B-2	4.5-5.5	12/12	
	B-3	9.5-10.5	12/12	
	B-4	14.5-15.5	12/12	
(Began coring at 19.5 feet.) ...Gray, close to moderate spaced fractures, fractures are non-intersecting to intersecting open planes, slightly weathered to fresh, moist.		19.5-29.5	120/120	100 75 100 75 100
...Moderate to wide spaced fractures from 29.5 to 49.5 feet with very close spaced fractures at 20 to 20.5 feet, dry.		29.5-39.5	120/120	50 100

Hole diameter is 7.75 inches from 0 to 19.5 feet; and 4.25 inches from 19.5 to 49.5 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-12

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-24-94
TOC ELEV.: NA
GS ELEV.: 4377.53
LOGGED BY: DEW
HOLE NO.: DH-12

ELEVATION DEPTH	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				39.5- 49.5	120/ 120	58 75 100

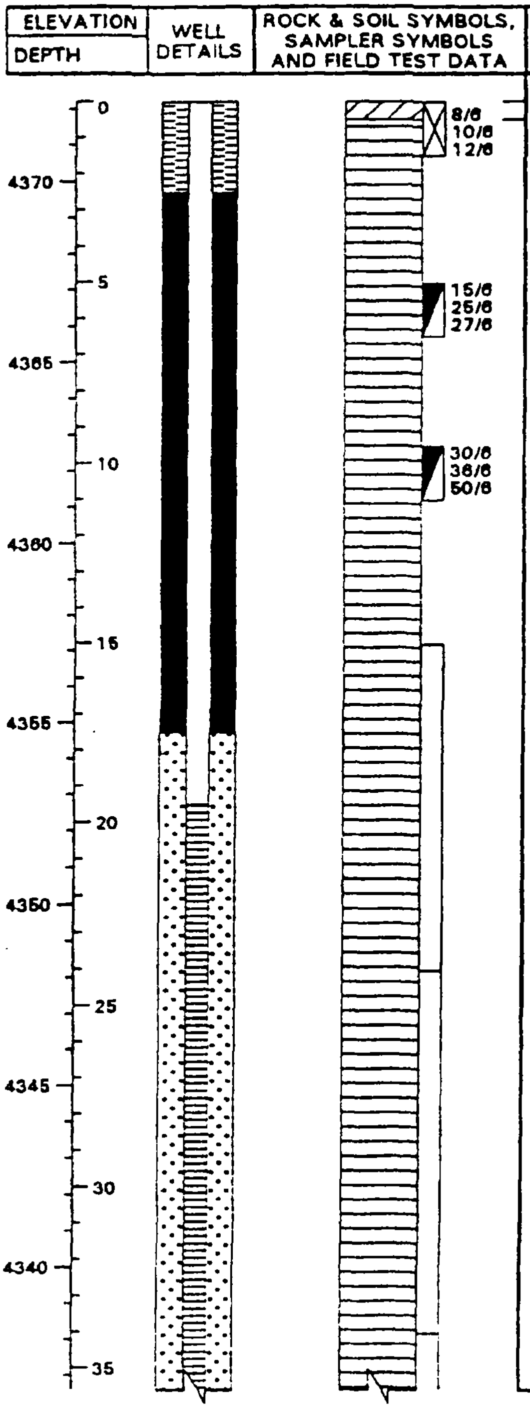
Hole diameter is 7.75 inches from 0 to 19.5 feet; and 4.25 inches from 19.5 to 49.5 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-13

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-19-94
TOC ELEV.: 4375.10
GS ELEV.: 4372.22
LOGGED BY: DCH
HOLE NO.: MW-13



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, sandy, roots, very stiff, dry.	CA-1	0-1.5	16/18	
SHALE: Grayish tan, gypsum in fractures, very to moderately weathered, moderatly hard, dry.				
	B-2	5-6.5	12/18	
	B-3	9.5-11	12/18	
(Began coring at 15 feet.) ...gypsum along some fractures, very close to close spaced fractures with occasional shattered fractures, fractures are non-intersecting and intersecting open planes, slightly weathered to fresh, dry.		15-24	108/108	33 42 33 0 100 33 50
...grades wet.		24-34	120/120	0 100 42 100
...Grades dry.		34-44	120/120	

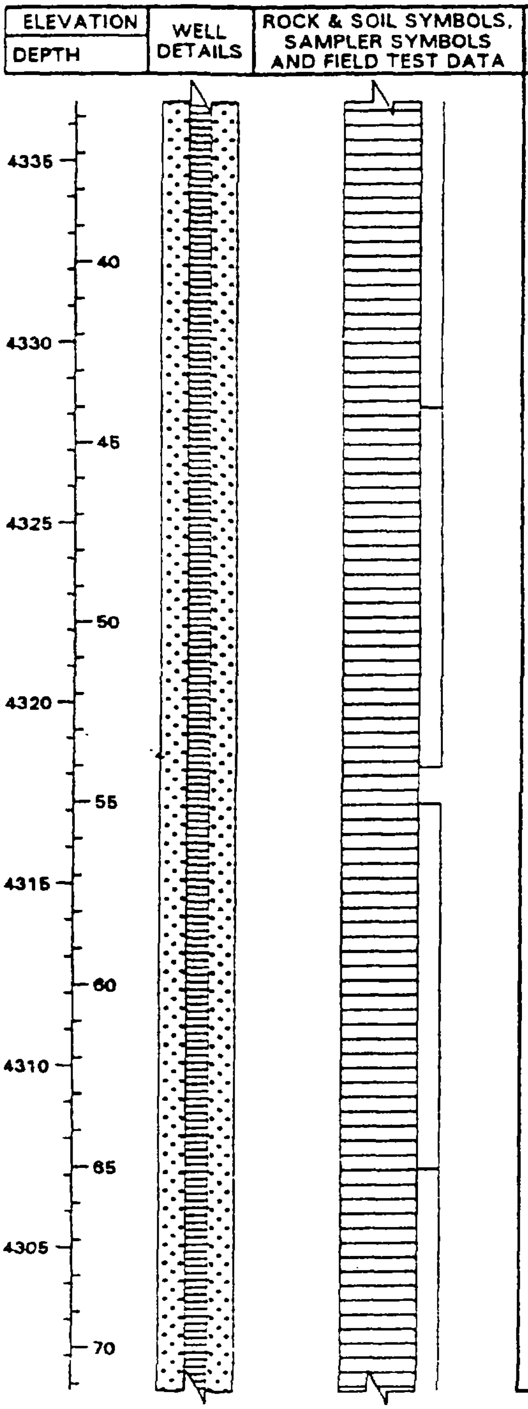
Hole diameter is 7.75 inches from 0 to 15 feet; and 4.25 inches from from 15 to 100 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-13

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-19-94
TOC ELEV.: 4375.10
GS ELEV.: 4372.22
LOGGED BY: DCH
HOLE NO.: MW-13



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				0 100 75 50 67 100 50 100
...Close to moderate spaced fractures from 44 to 49 feet & very close to close spaced fractures from 49 to 54 feet.		44-54	120/120	
				92
...Moderate to wide spaced fractures from 55 to 95 feet.		55-65	120/120	100
				83 100
		65-75	120/120	83 100
				58

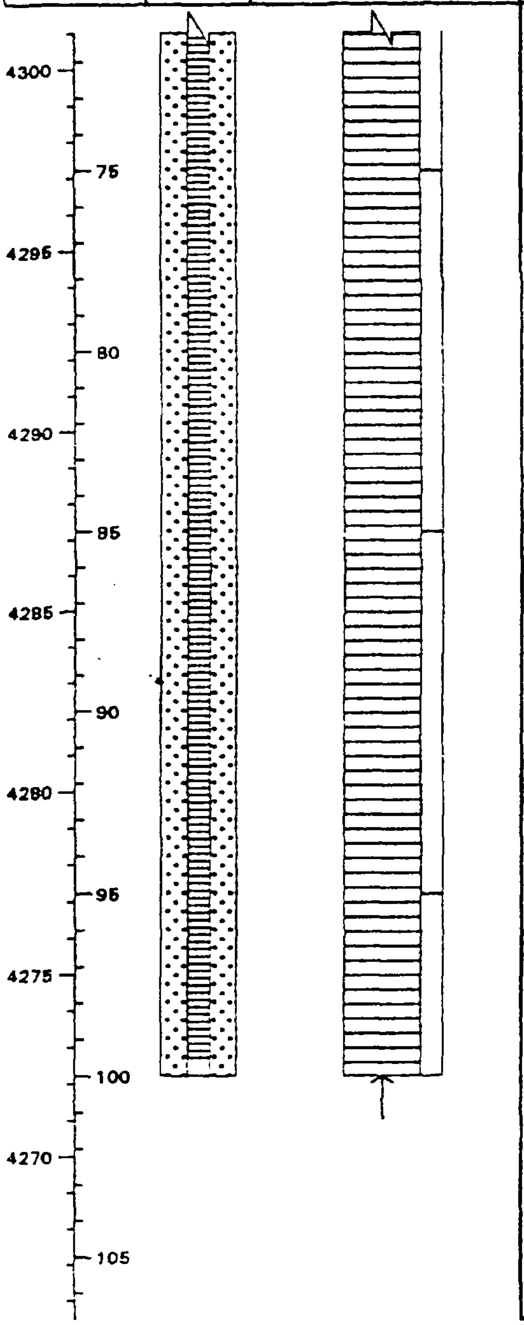
Hole diameter is 7.75 inches from 0 to 15 feet; and 4.25 inches from from 15 to 100 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-13

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-19-94
TOC ELEV.: 4375.10
GS ELEV.: 4372.22
LOGGED BY: DCH
HOLE NO.: MW-13

ELEVATION / DEPTH | WELL DETAILS | ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA



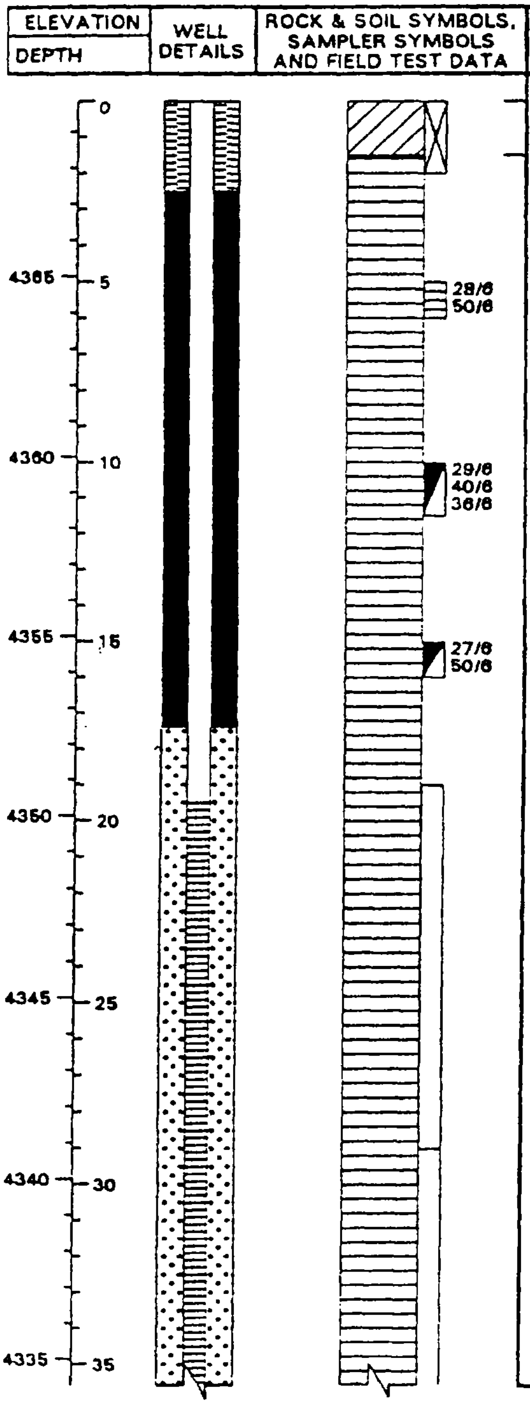
Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
				100
...Grades with very moist & wet zones from 75 to 100 feet.		75- 85	120/ 120	
...Close spaced fractures from 80.8 to 81.1 feet.				50 100
		85- 95	120/ 120	42 100
				83
		95- 100	60/60	

Hole diameter is 7.75 inches from 0 to 15 feet; and 4.25 inches from from 15 to 100 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-14

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-15-94
TOC ELEV.: 4372.77
GS ELEV.: 4369.86
LOGGED BY: DCH
HOLE NO.: MW-14



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, roots, sandy, stiff, dry.	S-1	0-2	24/24	
SHALE: Grayish tan, gypsum in fractures, very to moderately weathered, moderately hard, dry.				
	CA-2	5-6	8/12	
	B-3	10-11.5	14/18	
	B-4	15-16	8/12	
(Began coring at 19 feet.) ...Shattered to close spaced fractures, fractures are non-intersecting and intersecting open planes, slightly weathered to fresh, dry.		19-29	120/120	0 50 67 33 58 33 83 75
...Moderate spaced fractures from 27 to 29 feet.				100
...Very close to close spaced fractures from 29 to 36 feet.		29-39	120/120	0 58 100 83

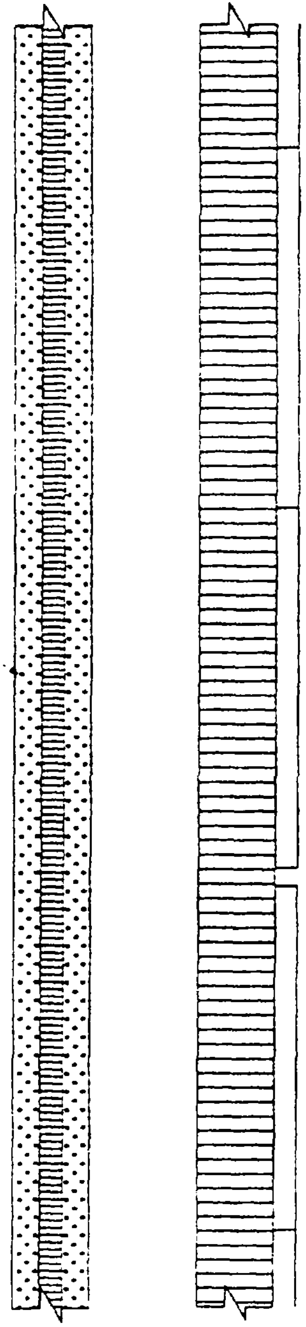
Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from from 19 to 99 feet.

DRILL HOLE LOG

DRILL HOLE NO.: MW-14

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-15-94
TOC ELEV.: 4372.77
GS ELEV.: 4369.86
LOGGED BY: DCH
HOLE NO.: MW-14



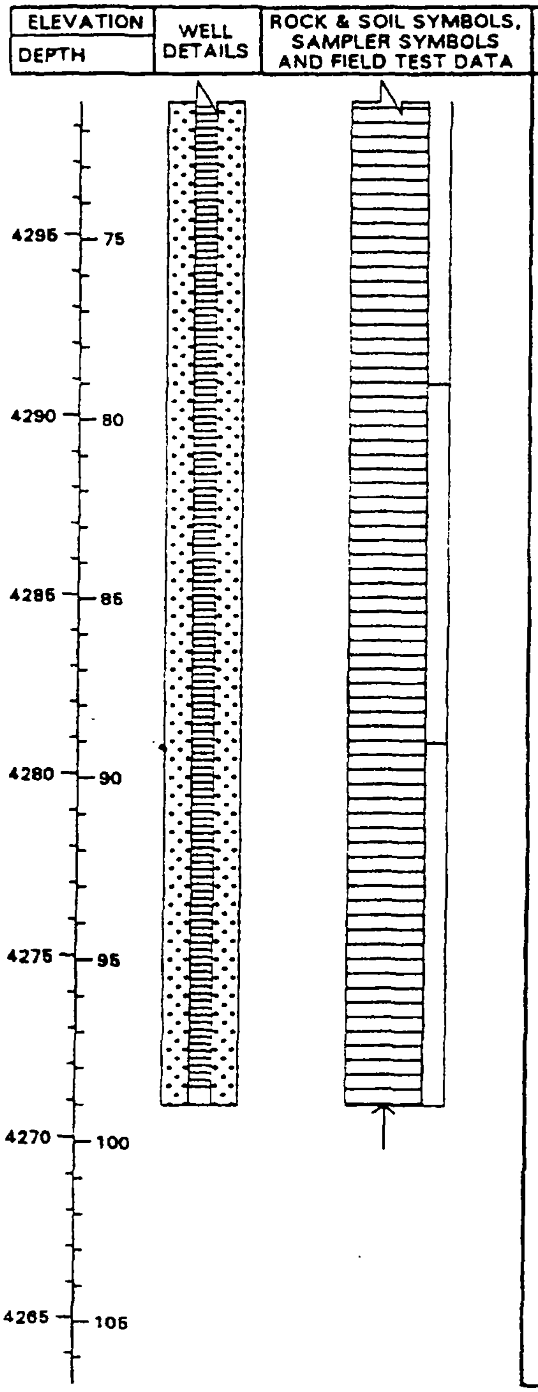
ELEVATION	DEPTH	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		...Close to moderate spaced fractures from 36 to 59 feet.				92 100
4330	40			39- 49	120/ 120	
4325	45					
4320	50			49- 59	120/ 120	75 100
4315	55					75 100
4310	60	...Wide spaced fractures from 59.5 to 99 feet.		59.5- 69	114/ 114	
4305	65					67 100
4300	70			69- 79	120/ 120	

Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from from 19 to 99 feet.

DRILL HOLE LOG
DRILL HOLE NO.: MW-14

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C. .
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-003
DATE: 7-15-94
TOC ELEV.: 4372.77
GS ELEV.: 4369.86
LOGGED BY: DCH
HOLE NO.: MW-14



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
...Grades moist to very moist.		79- 89	120/ 120	75 100
		89- 99	120/ 120	

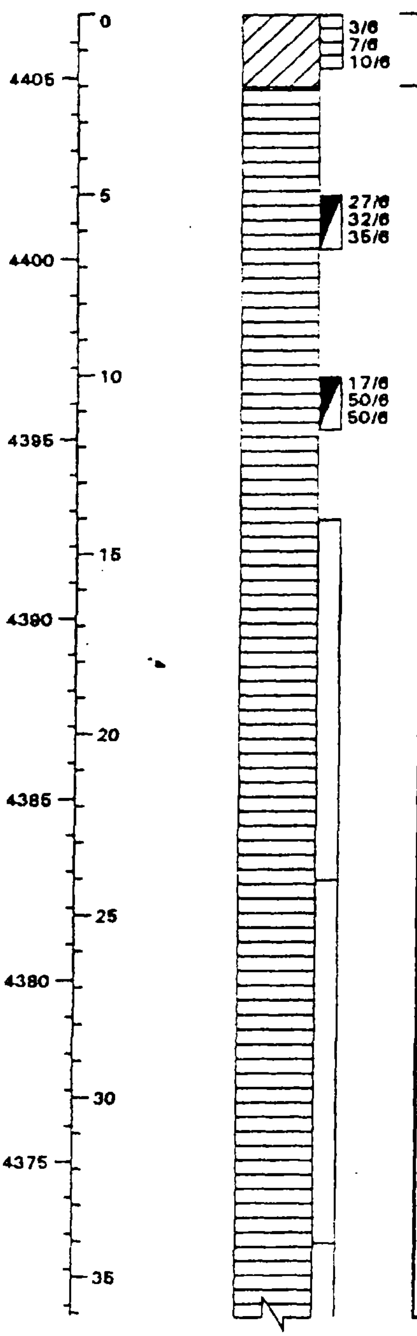
Hole diameter is 7.75 inches from 0 to 19 feet; and 4.25 inches from from 19 to 99 feet.

DRILL HOLE LOG
DRILL HOLE NO.: DH-15

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-21-94
TOC ELEV.: NA
GS ELEV.: 4406.79
LOGGED BY: DEW
HOLE NO.: DH-15

ELEVATION / DEPTH — ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA



Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
[CL] SILTY CLAY: Brown, roots, sandy, stiff to very stiff, dry.	CA-1	0-1.5	18/18	
SHALE: Tan, gypsum in fractures, highly to moderately weathered, moderately hard to hard, dry.				
	B-1	5-6.5	16/18	
	B-2	10-11.5	11/18	
(Began coring at 14 feet.) ...Gray, wide spaced fractures, fractures are non-intersecting open planes, weathered fresh, dry.		14-24	120/ 120	
...Close to moderate spaced fractures from 24 to 44 feet.		24-34	120/ 120	
		34-44	120/ 120	

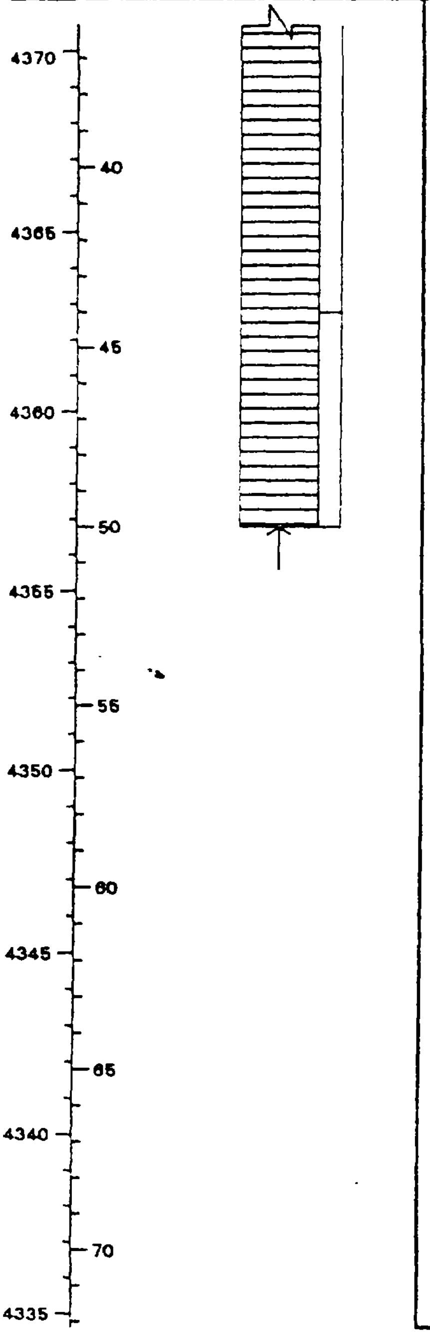
Hole diameter is 7.75 inches from 0 to 14 feet; and 4.25 inches from 14 to 50 feet.

DRILL HOLE LOG

DRILL HOLE NO.: DH-15

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION:
DRILLER: Overland Drilling, Inc.
DRILL RIG: CME 75
DEPTH TO WATER: None

PROJECT NO.: 2106-002
DATE: 6-21-94
TOC ELEV.: NA
GS ELEV.: 4406.79
LOGGED BY: DEW
HOLE NO.: DH-15



ELEVATION DEPTH	ROCK & SOIL SYMBOLS, SAMPLER SYMBOLS AND FIELD TEST DATA	Description	Sample Number	Sample Depth (ft)	Sample Recovery (in/in)	RQD (%)
		...Close spaced fractures from 44 to 50 feet		44-50	72/72	

Hole diameter is 7.75 inches from 0 to 14 feet; and 4.25 inches from 14 to 50 feet.

KEY TO SYMBOLS

Symbol	Description
<u>Strata symbols</u>	
▨	Clayey sand
▩	Silt gravel
☰	Shale
▨	Silty Clay
▦	Silty sand
<u>Misc. Symbols</u>	
⌇	Boring continues
↑	Drill hole completion depth
▼	Water table
<u>Rock and Samplers</u>	
◪	Standard penetration test (SPT)
▤	California sampler
□	Rock core

Symbol	Description
☒	Undisturbed thin wall shelby tube
<u>Monitor Well Details</u>	
▨	Assorted cuttings blank 2" O.D. PVC pipe
▤	Silica sand 20 slot 2" O.D. PVC pipe.
▥	Protective well cover set in concrete
■	Bentonite cell blank 2" O.D. PVC pipe
⁘	Silica sand blank 2" O.D. PVC pipe
⁙	Silica sand no PVC pipe

KEY TO SYMBOLS

Notes:

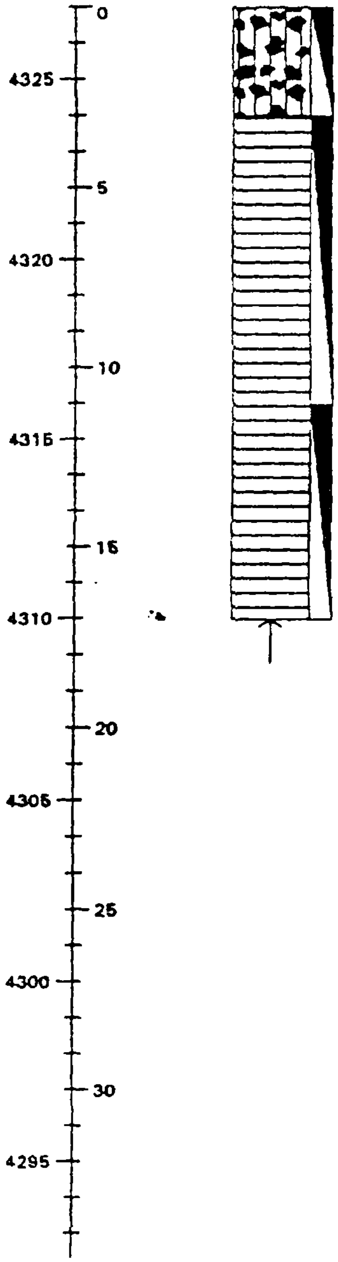
1. Drill holes DH-1,2,3,6,8,9,10,12 & 15, and monitor wells MW-2,4,5,7,7A, 13 and 14 were drilled and installed on June 20, 1994 through July 21, 1994. The holes were drill with the use of a CME 750 all-terrian drill rig utilizing 7.75 inch diameter (O.D.) hollow stem argers and an NX core drilling system.
2. Free water was encountered in drilling DH-2, DH-10, MW-2 and MW-5. Water levels were measured on July 22, 1994.
3. RQD percentage based on 12 inch length
4. These logs are subject to the limitations, conclusions, and recommendations in this report.

7. TEST PIT LOGS

TEST PIT LOG
TEST PIT NO.: TP-1

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4327.0
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/20/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-1

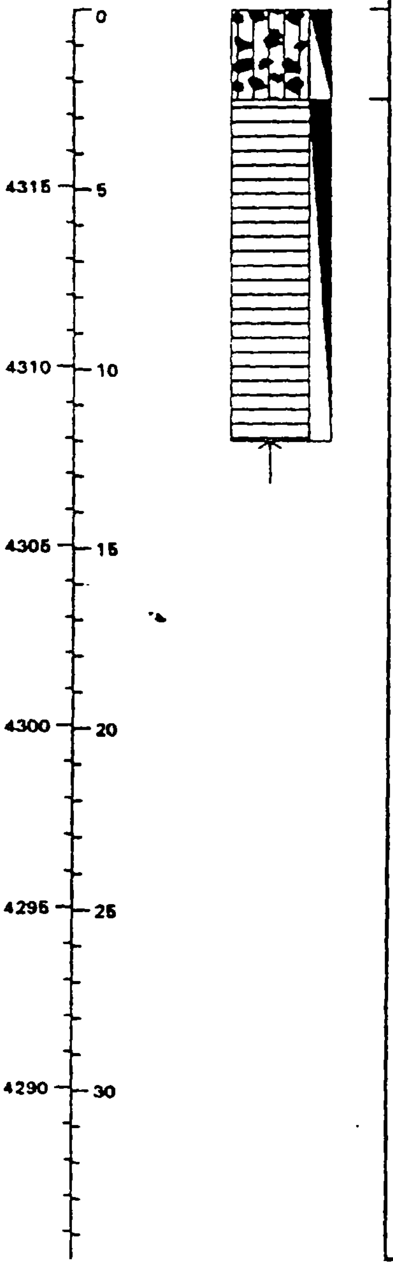
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		GM	SILTY GRAVEL: Tan, slightly clayey and sandy, dry.	B-1	0 - 3
		ROCK	SHALE, weathered, gray-black, dry	B-2	3 - 11
			grades more competent, black, dry to slightly moist	B-3	11 - 17

TEST PIT LOG

TEST PIT NO.: TP-2

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4319.9
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/20/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-2

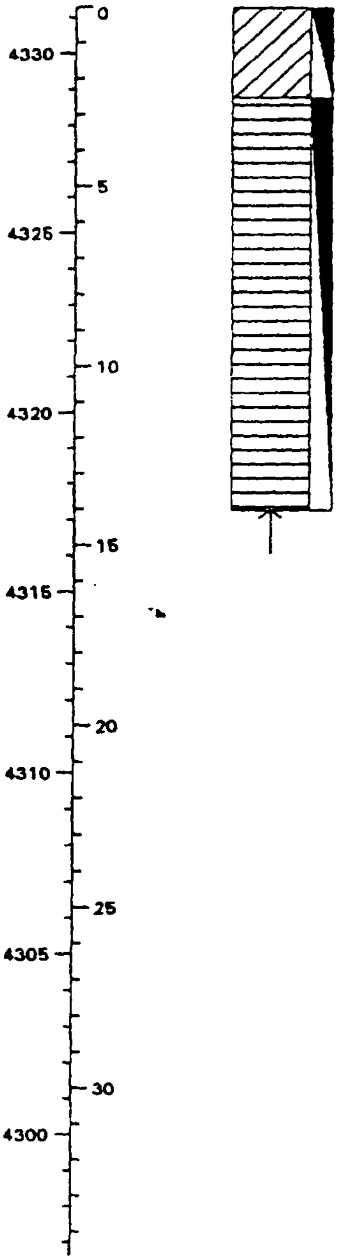


ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		GM	SILTY GRAVEL: tan, some sand, dry	B-1	0 - 2.5
		ROCK	SHALE, weathered, gray-black, dry	B-2	2.5 - 12
			grades more competent, black, dry to slightly moist		

TEST PIT LOG
TEST PIT NO.: TP-3

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4331.3
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/20/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-3

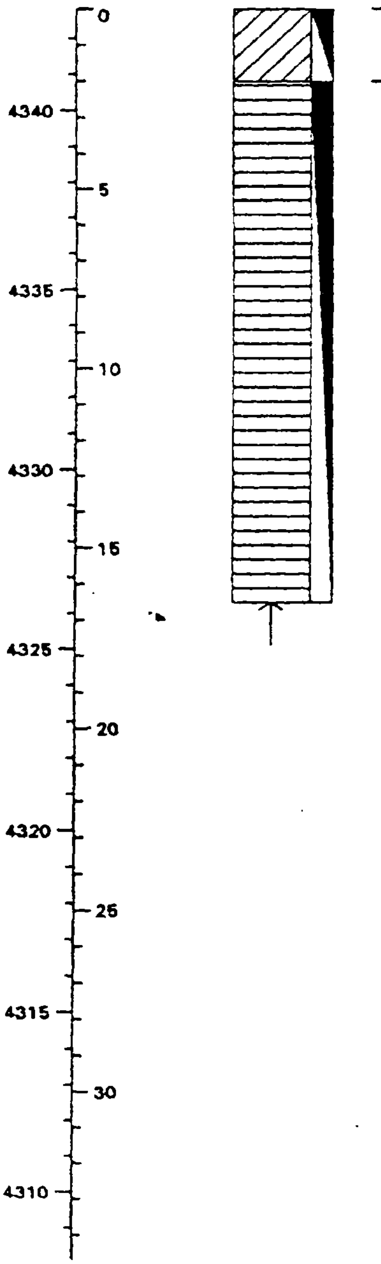
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, dry	B-1	0 - 2.5
		ROCK	SHALE, weathered, gray-black, dry	B-2	2.5 - 14
			vertical joint oriented approx. north-south noted from 5' to 10'		
			grades more competent, black, dry to slightly moist		

TEST PIT LOG

TEST PIT NO.: TP-4

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4342.8
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/20/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-4

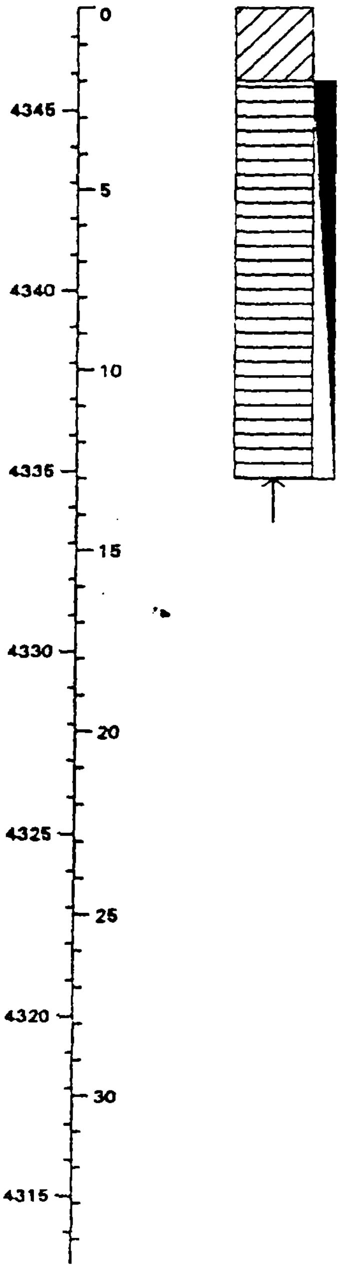


ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, root material, dry	B-1	0 - 2
		ROCK	SHALE, weathered, gray-black, dry	B-2	2 - 16.5
			grades more competent, black, dry to slightly moist		

TEST PIT LOG
TEST PIT NO.: TP-5

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4347.8
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/20/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-5



ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, root material, dry		
		ROCK	SHALE, weathered, gray-black, dry	B-1	2 - 13
			grades more competant, black, dry to sightly moist		

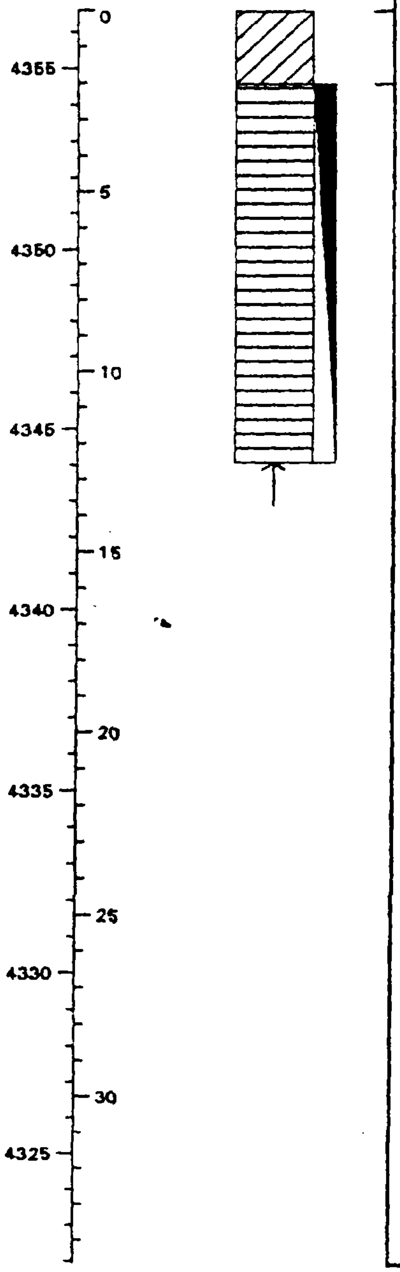
TEST PIT LOG

TEST PIT NO.: TP-6

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4356.6
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-6

ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, root material, dry		
		ROCK	SHALE, weathered, gray-black, dry hard layer 6" thick	B-1	2 - 12.5
			grades more competant, black, dry to sightly moist		

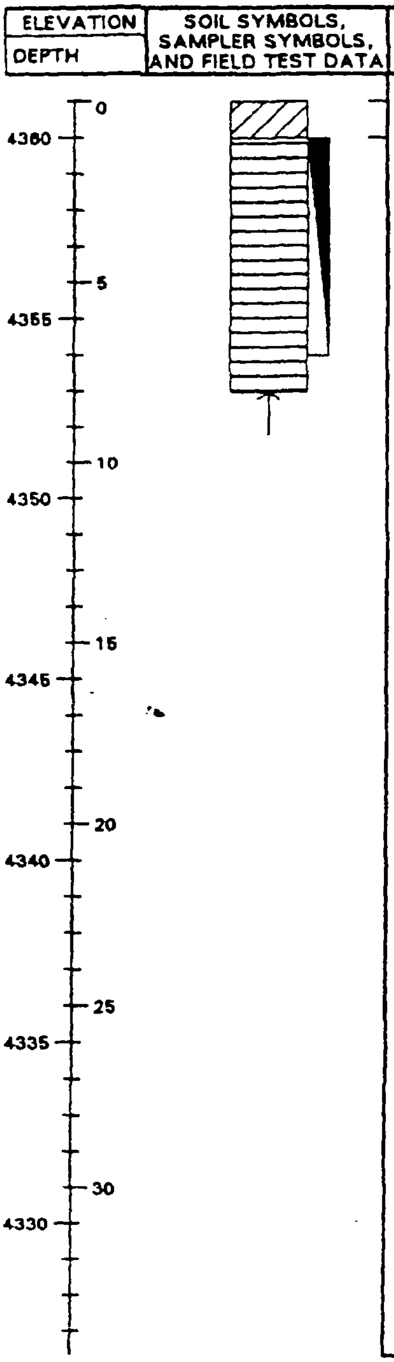


TEST PIT LOG

TEST PIT NO.: TP-7

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4361.0
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-7

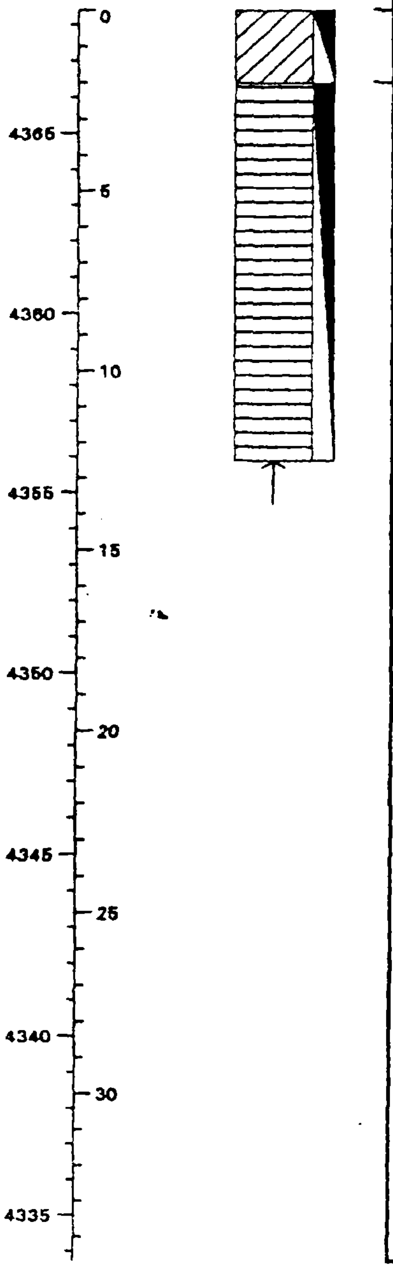


USCS	Description	Sample Number	Sample Depth (ft)
CL	SILTY CLAY: tan, dry		
ROCK	SHALE, weathered, gray-black, dry	S-1	2 - 8
	grades more competant, black, dry to sightly moist		

TEST PIT LOG
TEST PIT NO.: TP-8

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4368.4
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-8



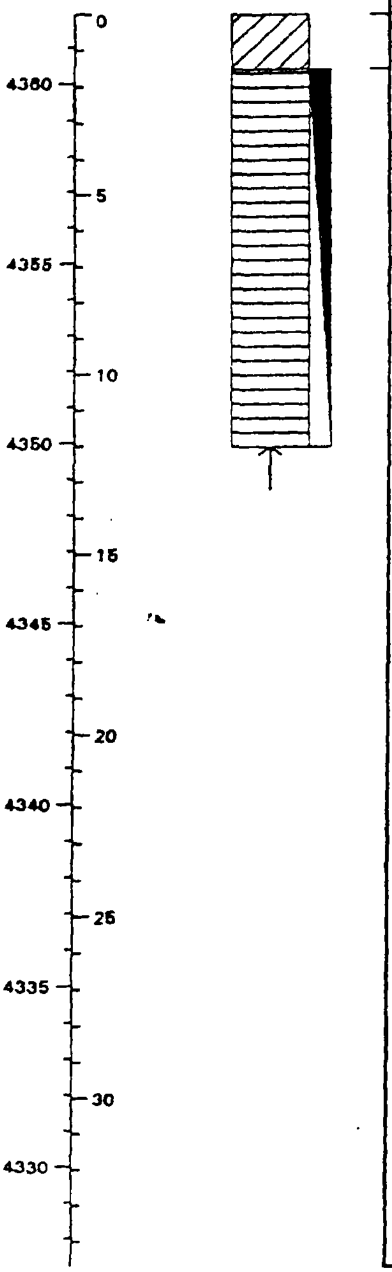
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, dead organic matter, shale flakes, some sand, dry	B-1	0 - 2
		ROCK	SHALE, gray-black, dry to slightly moist vertical joint oriented approx. north-south *from 2' depth to bottom of pit*	B-2	2 - 12.5

TEST PIT LOG

TEST PIT NO.: TP-9

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4361.9
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-9



ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, root material, dry		
		ROCK	SHALE, gray-black, dry to slightly moist	B-1	1.5 - 12

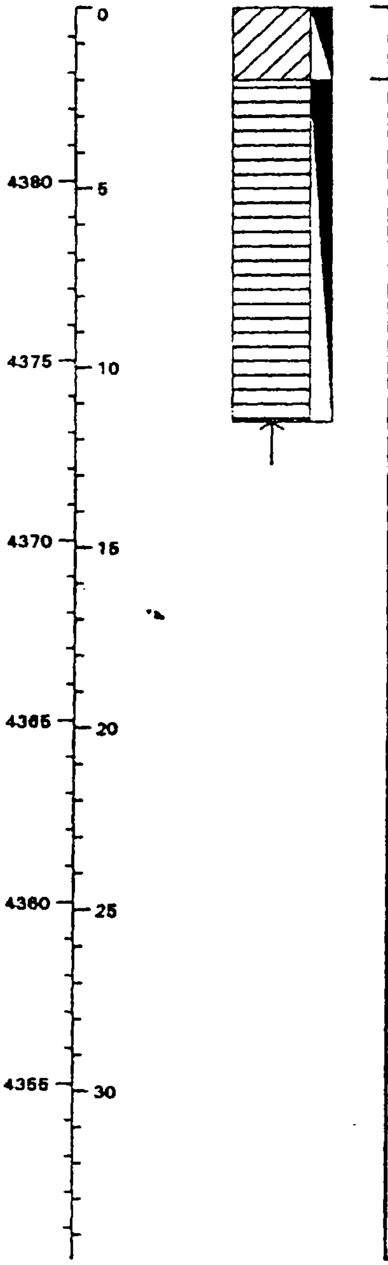
TEST PIT LOG

TEST PIT NO.: TP-10

PROJECT: Green-River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4384.8
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-10

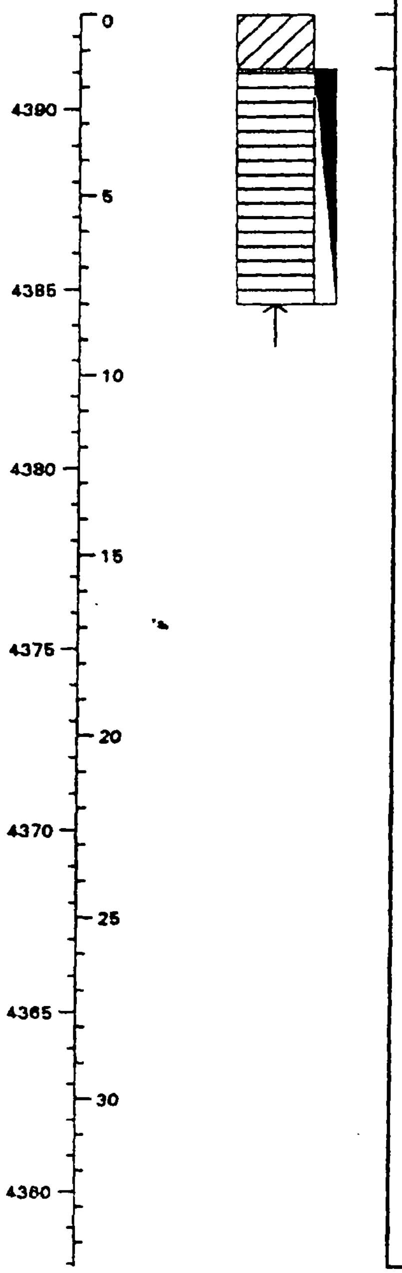
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, some sand, thin layer of gravel on surface, dry	B-1	0 - 2
		ROCK	SHALE, gray-black, dry to slightly moist, breaks into small fragments	B-2	2 - 11.5



TEST PIT LOG
TEST PIT NO.: TP-11

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4392.6
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-11



ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, some sand, root material, dry		
		ROCK	SHALE, gray-black, dry to slightly moist, blocky, breaks into blocks 5" to 8" across	B-1	1.5 - 8

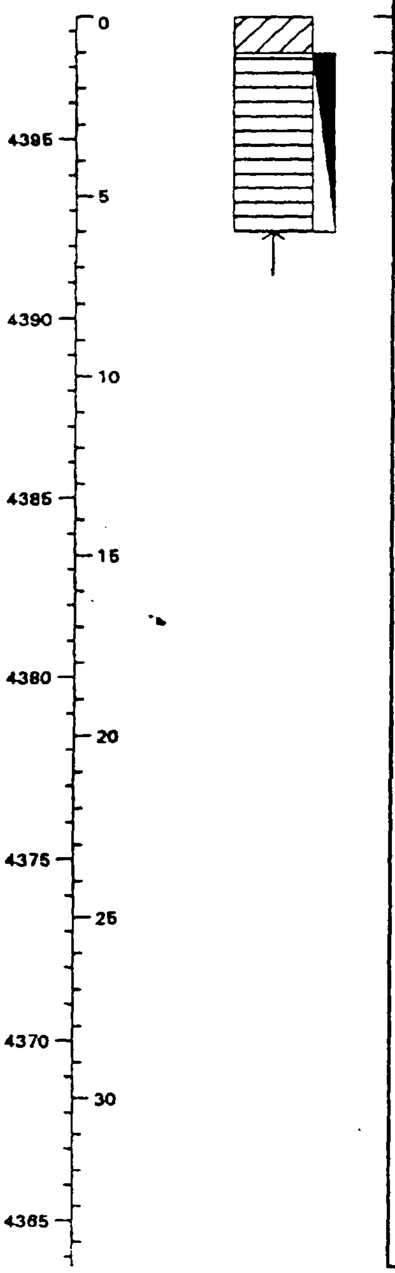
TEST PIT LOG

TEST PIT NO.: TP-12

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4398.4
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-12

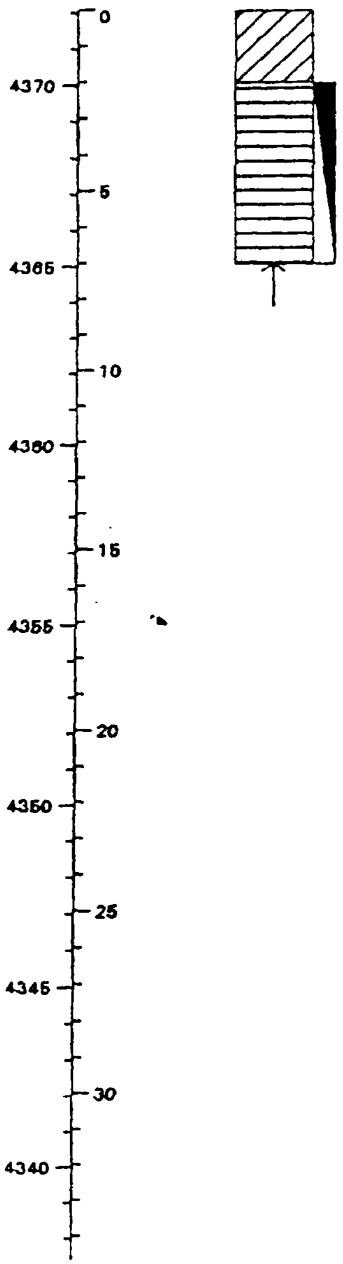
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: tan, dry		
		ROCK	SHALE, gray-black, dry to slightly moist, blocky, blocks 8" to 14" blocks, concave and convex partition surfaces	B-1	1 - 6



TEST PIT LOG
TEST PIT NO.: TP-13

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4372.1
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-13



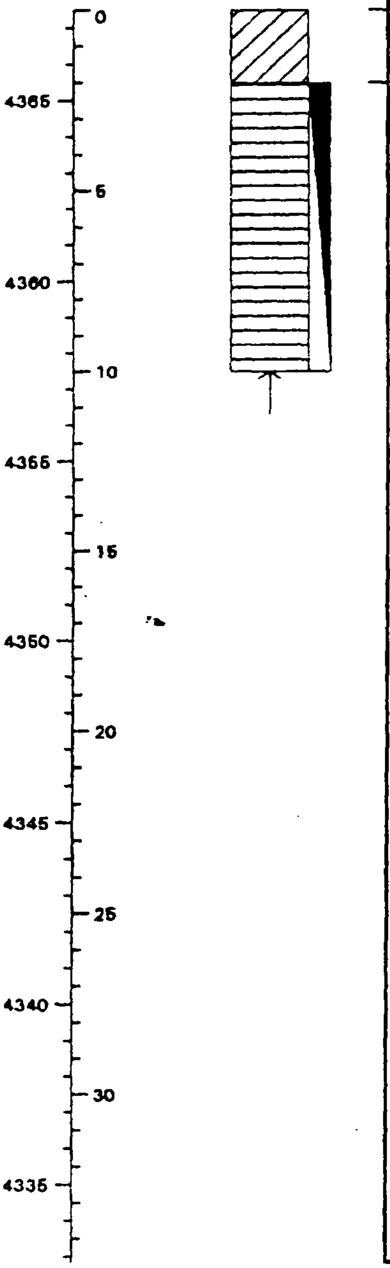
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: gray-brown, root matter, dry		
		ROCK	SHALE, gray-black, dry to slightly moist, blocky	B-1	2 - 7

TEST PIT LOG

TEST PIT NO.: TP-14

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4367.5
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-14



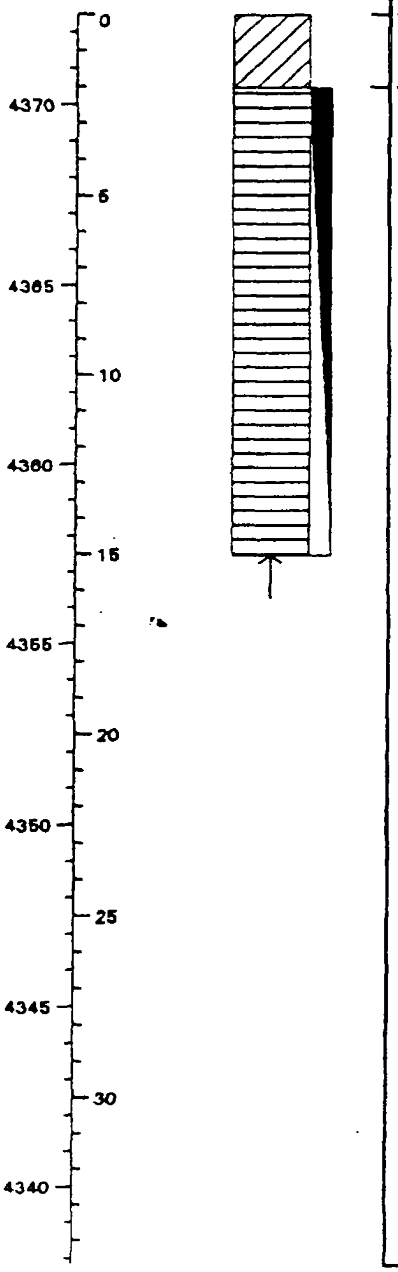
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: gray-brown, dry		
		ROCK	SHALE, gray-black, dry to slightly moist, breaks into small blocks	B-1	2 - 10

TEST PIT LOG

TEST PIT NO.: TP-15

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4372.5
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-15



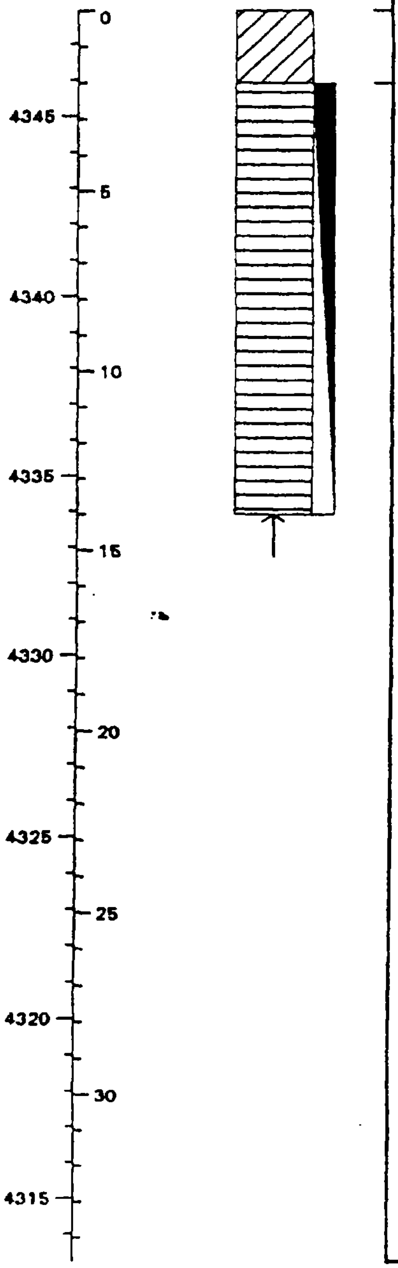
ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: gray-brown, dry orange layer of weathered shale 4" thick		
		ROCK	SHALE, gray-black, dry to slightly moist, *breaks into 1" to 4" blocks* grades more competant with 6" to 12" blocks	B-1	2 - 15

TEST PIT LOG

TEST PIT NO.: TP-16

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4347.9
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-16

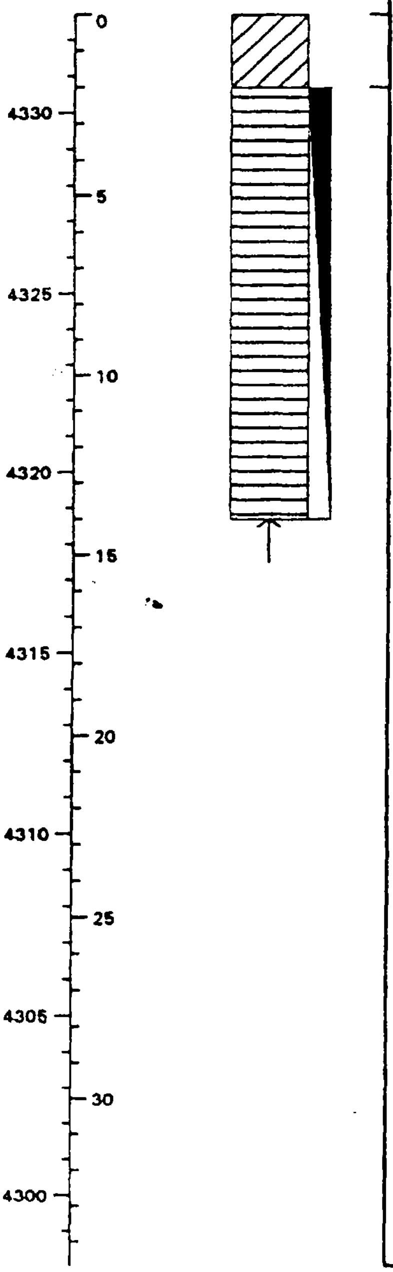


ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: gray-brown, shale fragments, dry		
		ROCK	SHALE, gray-black, dry to slightly moist large joint visible on northeast wall of trench oriented approx. north-south, extends from 2' to bottom of pit	B-1	2 - 14

TEST PIT LOG
TEST PIT NO.: TP-17

PROJECT: Green River Landfill
CLIENT/OWNER: Green River Landfill L.L.C.
LOCATION: N/A
EQUIPMENT: TRACKHOE
GS ELEV.: 4332.7
DEPTH TO WATER: N/A

PROJECT NO.: 2106-002
DATE: 6/21/94
LOGGED BY: KBC
PIT WIDTH: 3 ft
PIT LENGTH: 10 ft
TEST PIT NO.: TP-17



ELEVATION DEPTH	SOIL SYMBOLS, SAMPLER SYMBOLS, AND FIELD TEST DATA	USCS	Description	Sample Number	Sample Depth (ft)
		CL	SILTY CLAY: gray-brown, shale fragments, dry		
		ROCK	SHALE, gray-black, dry to slightly moist, blocky, blocks 1" to 6" across	B-1	2 - 14

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
▥	Silty gravel
▤	Shale
▨	Silty clay
▦	Variable gravel and silty sand mix
⁘	Well graded gravel
Misc. Symbols	
↑	Drill hole completion depth
Soil Samplers	
◩	Bulk/Grab sample

Notes:

1. Test pits were excavated on June 20 and 21, 1994 using a track-mounted backhoe.
2. No free water was encountered at the time of excavation.
3. These logs are subject to the limitations, conclusions, and recommendations in this report.

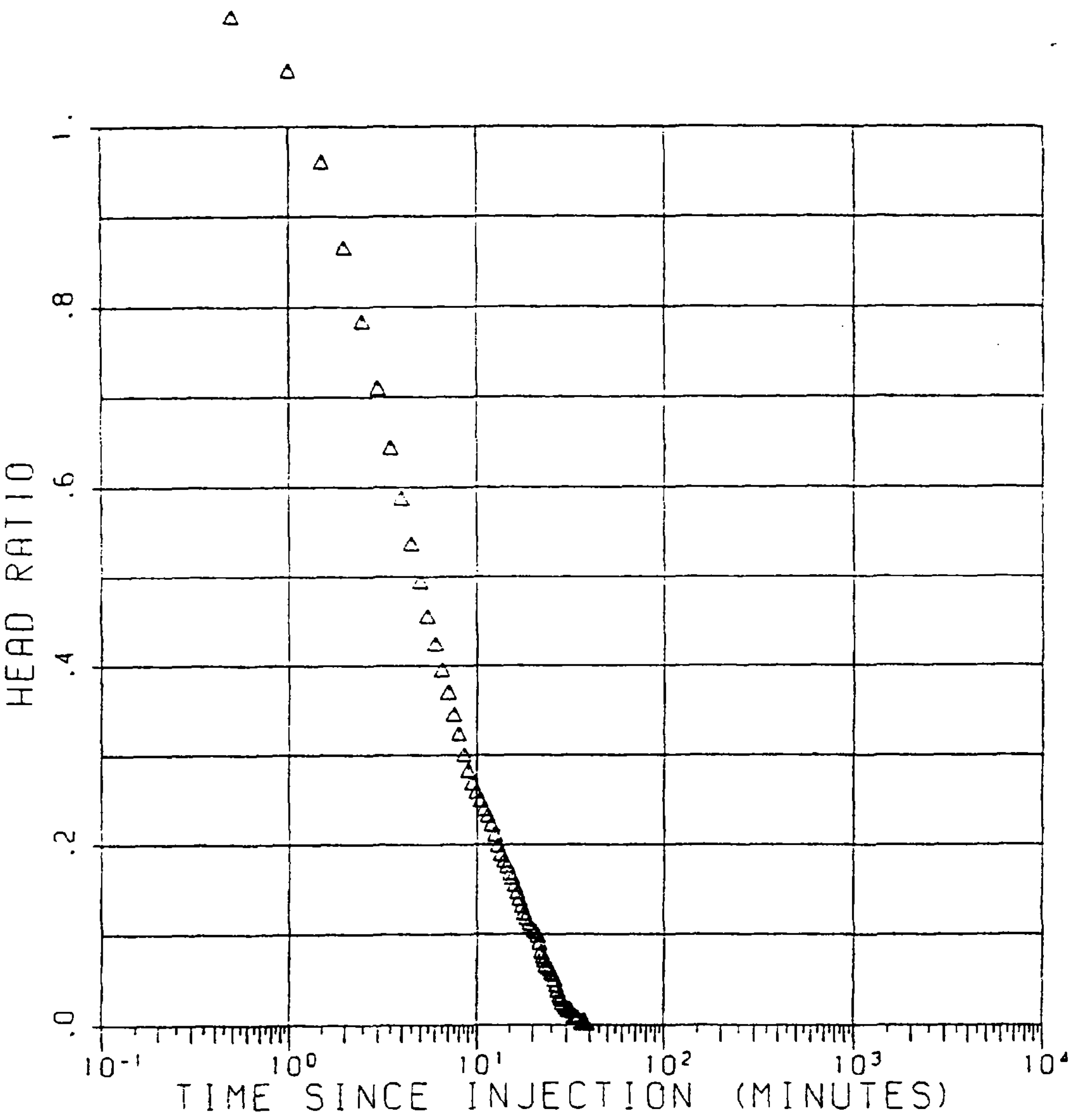
WELL # MW-5

WELL DIAMETER= 4.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .84 GALLONS
LENGTH OF AQUIFER TESTED= 60.00 FEET
VALUE OF H0= 5.15 FEET
STATIC WATER LEVEL= 5.39 FEET

SLUG TEST DATA:

TIME SINCE TEST BEGAN (MINUTES)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	HEAD RATIO	RECIPROCAL TIME (1/MINUTES)
.50	11.17	5.78	1.123	2.000
1.00	10.86	5.47	1.063	1.000
1.50	10.34	4.95	.962	.667
2.00	9.85	4.46	.866	.500
2.50	9.43	4.04	.785	.400
3.00	9.05	3.66	.711	.333
3.50	8.71	3.32	.645	.286
4.00	8.42	3.03	.589	.250
4.50	8.16	2.77	.538	.222
5.00	7.94	2.55	.495	.200
5.50	7.74	2.35	.457	.182
6.00	7.58	2.19	.425	.167
6.50	7.43	2.04	.396	.154
7.00	7.30	1.91	.371	.143
7.50	7.17	1.78	.346	.133
8.00	7.06	1.67	.324	.125
8.50	6.94	1.55	.301	.118
9.00	6.85	1.46	.284	.111
9.50	6.78	1.39	.270	.105
10.00	6.73	1.34	.260	.100
10.50	6.68	1.29	.251	.095
11.00	6.63	1.24	.241	.091
11.50	6.59	1.20	.233	.087
12.00	6.54	1.15	.223	.083
12.50	6.48	1.09	.212	.080
13.00	6.42	1.03	.200	.077
13.50	6.37	.98	.190	.074
14.00	6.33	.94	.183	.071
14.50	6.30	.91	.177	.069
15.00	6.26	.87	.169	.067
15.50	6.23	.84	.163	.065
16.00	6.19	.80	.155	.063
16.50	6.15	.76	.148	.061
17.00	6.11	.72	.140	.059
17.50	6.07	.68	.132	.057
18.00	6.03	.64	.124	.056
18.50	6.00	.61	.119	.054
19.00	5.97	.58	.113	.053
19.50	5.95	.56	.109	.051
20.00	5.93	.54	.105	.050
20.50	5.92	.53	.103	.049
21.00	5.90	.51	.099	.048

21.50	5.86	.47	.091	.047
22.00	5.81	.42	.082	.045
22.50	5.78	.39	.076	.044
23.00	5.76	.37	.072	.043
23.50	5.73	.34	.066	.043
24.00	5.72	.33	.064	.042
24.50	5.71	.32	.062	.041
25.00	5.69	.30	.058	.040
25.50	5.68	.29	.056	.039
26.00	5.65	.26	.051	.038
26.50	5.62	.23	.045	.038
27.00	5.59	.20	.039	.037
27.50	5.56	.17	.033	.036
28.00	5.54	.15	.029	.036
28.50	5.52	.13	.025	.035
29.00	5.51	.12	.023	.034
29.50	5.50	.11	.021	.034
30.00	5.49	.10	.019	.033
30.50	5.48	.09	.017	.033
31.00	5.48	.09	.017	.032
31.50	5.48	.09	.017	.032
32.00	5.47	.08	.016	.031
32.50	5.45	.06	.012	.031
33.00	5.44	.05	.010	.030
33.50	5.44	.05	.010	.030
34.00	5.43	.04	.008	.029
34.50	5.43	.04	.008	.029
35.00	5.43	.04	.008	.029
35.50	5.41	.02	.004	.028
36.00	5.40	.01	.002	.028
36.50	5.41	.02	.004	.027
37.00	5.41	.02	.004	.027
37.50	5.42	.03	.006	.027
38.00	5.41	.02	.004	.026
38.50	5.40	.01	.002	.026
39.00	5.39	.00	.000	.026



SLUG TEST OF WELL MW-5
HEAD RATIO VS LOG TIME

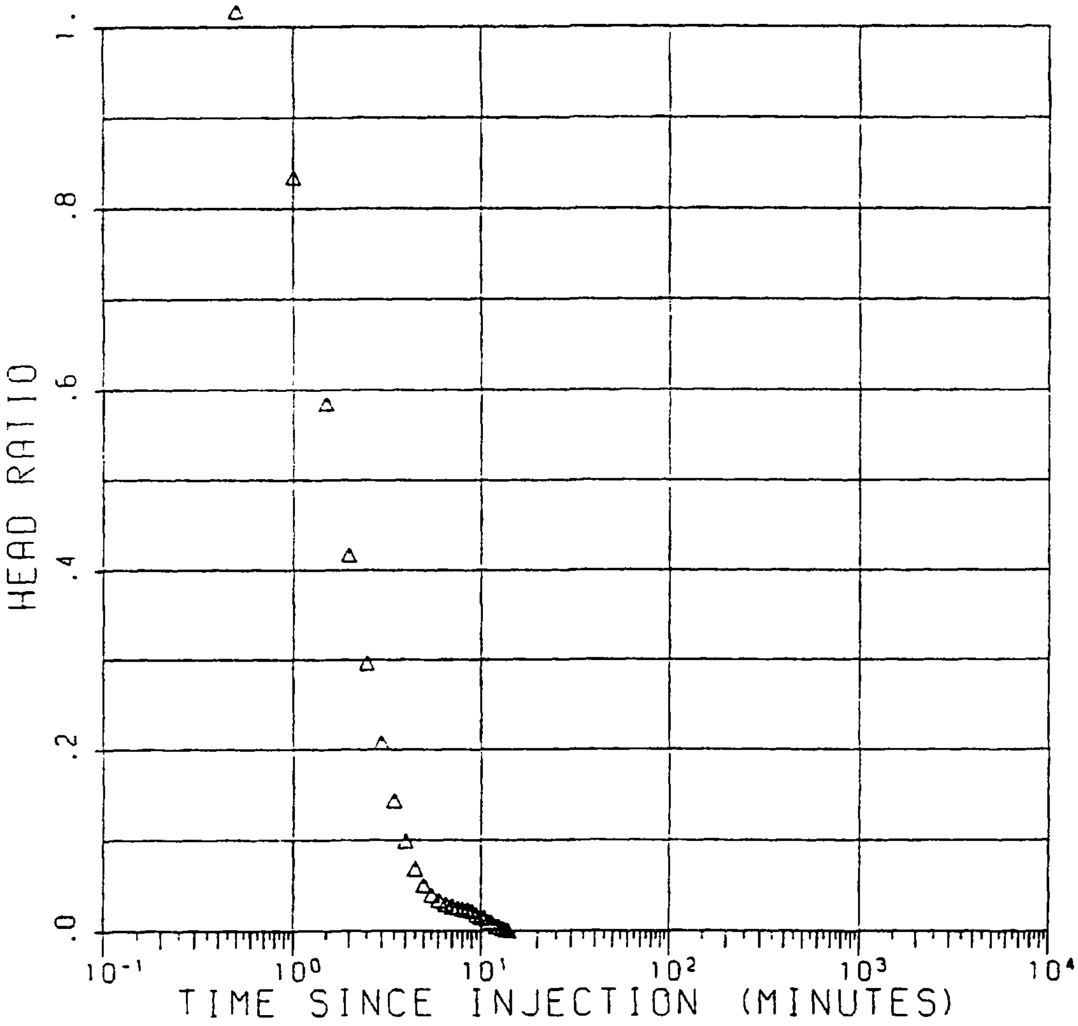
8. SLUG TESTS

WELL # MW-2

WELL DIAMETER= 4.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= 2.60 GALLONS
LENGTH OF AQUIFER TESTED= 75.00 FEET
VALUE OF H0= 15.93 FEET
STATIC WATER LEVEL= 2.75 FEET

SLUG TEST DATA:

TIME SINCE TEST BEGAN (MINUTES)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	HEAD RATIO	RECIPROCAL TIME (1/MINUTES)
.50	18.97	16.22	1.018	2.000
1.00	16.05	13.30	.835	1.000
1.50	12.08	9.33	.586	.667
2.00	9.40	6.65	.417	.500
2.50	7.48	4.73	.297	.400
3.00	6.06	3.31	.208	.333
3.50	5.04	2.29	.144	.286
4.00	4.33	1.58	.099	.250
4.50	3.85	1.10	.069	.222
5.00	3.56	.81	.051	.200
5.50	3.39	.64	.040	.182
6.00	3.29	.54	.034	.167
6.50	3.23	.48	.030	.154
7.00	3.18	.43	.027	.143
7.50	3.15	.40	.025	.133
8.00	3.13	.38	.024	.125
8.50	3.12	.37	.023	.118
9.00	3.10	.35	.022	.111
9.50	3.04	.29	.018	.105
10.00	3.00	.25	.016	.100
10.50	2.98	.23	.014	.095
11.00	2.91	.16	.010	.091
11.50	2.90	.15	.009	.087
12.00	2.83	.08	.005	.083
12.50	2.83	.08	.005	.080
13.00	2.79	.04	.003	.077
13.50	2.77	.02	.001	.074
14.00	2.76	.01	.001	.071
14.50	2.75	.00	.000	.069



SLUG TEST OF WELL MW-2

HEAD RATIO VS LOG TIME

APPENDIX E HELP MODELING RESULTS

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




PRECIPITATION DATA FILE:   C:\HELP3\PRECIP8C.D4
TEMPERATURE DATA FILE:     C:\HELP3\TEMP8C.D7
SOLAR RADIATION DATA FILE: C:\HELP3\RAD8C.D13
EVAPOTRANSPIRATION DATA:   C:\HELP3\EVAP8C.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\SOIL8C.D10
OUTPUT DATA FILE:          C:\HELP3\OUT C 8.OUT


TIME: 22:47    DATE:  8/ 5/2002



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

  TITLE:  Solitude Landfill -- Green River, Utah -- Closed Case

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



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



                      LAYER  1
                      --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   1
     THICKNESS             =     6.00   INCHES
     POROSITY              =     0.4170 VOL/VOL
```

```
FIELD CAPACITY             =     0.0450 VOL/VOL
WILTING POINT              =     0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.0974 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.999999978000E-02 CM/SEC



                  LAYER  2
                  --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
           MATERIAL TEXTURE NUMBER  10
THICKNESS                 =    24.00   INCHES
POROSITY                  =     0.3980 VOL/VOL
FIELD CAPACITY             =     0.2440 VOL/VOL
WILTING POINT              =     0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.1836 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.119999997000E-03 CM/SEC



                  LAYER  3
                  --------

           TYPE 3 - BARRIER SOIL LINER
           MATERIAL TEXTURE NUMBER  29
THICKNESS                 =    18.00   INCHES
POROSITY                  =     0.4510 VOL/VOL
FIELD CAPACITY             =     0.4190 VOL/VOL
WILTING POINT              =     0.3320 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.4510 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.680000028000E-06 CM/SEC



                  LAYER  4
                  --------

        TYPE 1 - VERTICAL PERCOLATION LAYER
           MATERIAL TEXTURE NUMBER  18
THICKNESS                 =   720.00   INCHES
POROSITY                  =     0.6710 VOL/VOL
FIELD CAPACITY             =     0.2920 VOL/VOL
WILTING POINT              =     0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2920 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.100000005000E-02 CM/SEC
```

```
                    LAYER  5
                    --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  29
          THICKNESS                =    12.00   INCHES
          POROSITY                 =     0.4510 VOL/VOL
          FIELD CAPACITY           =     0.4190 VOL/VOL
          WILTING POINT            =     0.3320 VOL/VOL
          INITIAL SOIL WATER CONTENT  =     0.4510 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  = 0.680000028000E-06 CM/SEC




             GENERAL DESIGN AND EVAPORATIVE ZONE DATA
             ----------------------------------------

          NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
                 SOIL DATA BASE USING SOIL TEXTURE # 1 WITH BARE
                 GROUND CONDITIONS. A SURFACE SLOPE OF  3.% AND
                 A SLOPE LENGTH OF  500. FEET.

          SCS RUNOFF CURVE NUMBER            =    72.40
          FRACTION OF AREA ALLOWING RUNOFF   =    100.0    PERCENT
          AREA PROJECTED ON HORIZONTAL PLANE  =   100.000  ACRES
          EVAPORATIVE ZONE DEPTH             =    30.0    INCHES
          INITIAL WATER IN EVAPORATIVE ZONE  =     4.991  INCHES
          UPPER LIMIT OF EVAPORATIVE STORAGE  =    12.054  INCHES
          LOWER LIMIT OF EVAPORATIVE STORAGE  =     3.372  INCHES
          INITIAL SNOW WATER                 =     0.000  INCHES
          INITIAL WATER IN LAYER MATERIALS   =   228.761  INCHES
          TOTAL INITIAL WATER                =   228.761  INCHES
          TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR



             EVAPOTRANSPIRATION AND WEATHER DATA
             -----------------------------------

          NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
                 GRAND JUNCTION        COLORADO

            STATION LATITUDE                  = 39.07 DEGREES
            MAXIMUM LEAF AREA INDEX           =  0.00
            START OF GROWING SEASON (JULIAN DATE) =    116
            END OF GROWING SEASON (JULIAN DATE)   =   288
            EVAPORATIVE ZONE DEPTH            =  30.0  INCHES
```

```
        AVERAGE ANNUAL WIND SPEED           =  8.10 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  60.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  36.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  36.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  57.00 %


      NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    GRAND JUNCTION      COLORADO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

    JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
    -------    -------    -------    -------    -------    -------
     0.40       0.32       0.59       0.50       0.61       0.41
     0.57       0.74       0.71       0.87       0.41       0.39


      NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    GRAND JUNCTION      COLORADO

          NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

    JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
    -------    -------    -------    -------    -------    -------
     22.90      32.60      42.90      52.40      61.90      71.30
     78.50      75.60      65.50      52.90      39.10      27.10


      NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    GRAND JUNCTION      COLORADO
               AND STATION LATITUDE  =  39.07 DEGREES




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

      AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH   20
 ----------------------------------------------------------------------------

                    JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                    -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
   TOTALS             0.33     0.29     0.51     0.54     0.59     0.45
```

```
                 0.49    0.82    0.59    0.81    0.54    0.32

  STD. DEVIATIONS    0.16    0.17    0.23    0.27    0.43    0.48
                 0.33    0.37    0.46    0.58    0.35    0.20

RUNOFF
------
  TOTALS           0.000   0.000   0.000   0.000   0.000   0.000
                 0.000   0.000   0.000   0.000   0.000   0.000

  STD. DEVIATIONS    0.000   0.000   0.000   0.000   0.000   0.000
                 0.000   0.000   0.000   0.000   0.000   0.000

EVAPOTRANSPIRATION
------------------
  TOTALS           0.310   0.318   0.417   0.480   0.705   0.491
                 0.397   0.671   0.770   0.784   0.575   0.338

  STD. DEVIATIONS    0.152   0.146   0.257   0.276   0.502   0.452
                 0.321   0.479   0.548   0.665   0.357   0.175

PERCOLATION/LEAKAGE THROUGH LAYER  3
------------------------------------
  TOTALS           0.0000  0.0008  0.0009  0.0009  0.0005  0.0005
                 0.0003  0.0010  0.0009  0.0010  0.0008  0.0003

  STD. DEVIATIONS    0.0000  0.0028  0.0011  0.0016  0.0007  0.0011
                 0.0003  0.0021  0.0026  0.0020  0.0012  0.0007

PERCOLATION/LEAKAGE THROUGH LAYER  5
------------------------------------
  TOTALS           0.0000  0.0008  0.0009  0.0009  0.0005  0.0005
                 0.0003  0.0010  0.0009  0.0010  0.0008  0.0003

  STD. DEVIATIONS    0.0000  0.0028  0.0011  0.0016  0.0007  0.0011
                 0.0003  0.0021  0.0026  0.0020  0.0012  0.0007


--------------------------------------------------------------------------
          AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
--------------------------------------------------------------------------


DAILY AVERAGE HEAD ON TOP OF LAYER  3
-------------------------------------
  AVERAGES           0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
                 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

  STD. DEVIATIONS    0.0000  0.0001  0.0000  0.0001  0.0000  0.0000
                 0.0000  0.0001  0.0001  0.0000  0.0000  0.0000
```

```
DAILY AVERAGE HEAD ON TOP OF LAYER  5
-------------------------------------
  AVERAGES          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

  STD. DEVIATIONS     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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



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

   AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH   20
----------------------------------------------------------------------------
                               INCHES          CU. FEET      PERCENT
                         -------------------  -------------  ----------
PRECIPITATION                  6.26   (  1.028)   2271109.5    100.00

RUNOFF                     0.000   (  0.0000)        0.00      0.000

EVAPOTRANSPIRATION           6.256   (  1.0693)   2270784.75    99.986

PERCOLATION/LEAKAGE THROUGH     0.00812 (  0.00713)     2947.603     0.12979
  LAYER  3

AVERAGE HEAD ON TOP          0.000 (    0.000)
  OF LAYER  3

PERCOLATION/LEAKAGE THROUGH     0.00812 (  0.00713)     2947.603     0.12979
  LAYER  5

AVERAGE HEAD ON TOP          0.000 (    0.000)
  OF LAYER  5

CHANGE IN WATER STORAGE       -0.007   (  0.3214)    -2623.24    -0.116

***************************************************************************
```

```
******************************************************************************

        PEAK DAILY VALUES FOR YEARS   1 THROUGH   20
  ----------------------------------------------------------------------------
                                        (INCHES)     (CU. FT.)
                                       ----------  -------------
    PRECIPITATION                          0.80       290400.000

    RUNOFF                              0.000          0.0000

    PERCOLATION/LEAKAGE THROUGH LAYER  3      0.005388      1955.78467

    AVERAGE HEAD ON TOP OF LAYER  3         0.004

    PERCOLATION/LEAKAGE THROUGH LAYER  5      0.005388      1955.78467

    AVERAGE HEAD ON TOP OF LAYER  5         0.002

    SNOW WATER                             0.47       170607.0310

    MAXIMUM VEG. SOIL WATER (VOL/VOL)               0.2077

    MINIMUM VEG. SOIL WATER (VOL/VOL)               0.1442

******************************************************************************
```

```
******************************************************************************

           FINAL WATER STORAGE AT END OF YEAR   20
   ----------------------------------------------------------------------
           LAYER        (INCHES)      (VOL/VOL)
           -----        --------      ---------
             1           0.2702        0.0450

             2           4.5759        0.1907

             3           8.1180        0.4510

             4         210.2400        0.2920

             5           5.4120        0.4510

          SNOW WATER       0.000

******************************************************************************
******************************************************************************
```

```
FIELD CAPACITY           =     0.3710 VOL/VOL
WILTING POINT            =     0.2510 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.3505 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.249999994000E-04 CM/SEC


                  LAYER  2
                  --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  18
THICKNESS                =    120.00   INCHES
POROSITY                 =     0.6710 VOL/VOL
FIELD CAPACITY           =     0.2920 VOL/VOL
WILTING POINT            =     0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.2735 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.100000005000E-02 CM/SEC


                  LAYER  3
                  --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER  29
THICKNESS                =     12.00   INCHES
POROSITY                 =     0.4510 VOL/VOL
FIELD CAPACITY           =     0.4190 VOL/VOL
WILTING POINT            =     0.3320 VOL/VOL
INITIAL SOIL WATER CONTENT  =     0.4510 VOL/VOL
EFFECTIVE SAT. HYD. COND.  = 0.680000028000E-06 CM/SEC


       GENERAL DESIGN AND EVAPORATIVE ZONE DATA
       ----------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
       SOIL DATA BASE USING SOIL TEXTURE #14 WITH BARE
       GROUND CONDITIONS, A SURFACE SLOPE OF  3.% AND
       A SLOPE LENGTH OF  100. FEET.

SCS RUNOFF CURVE NUMBER          =    96.60
FRACTION OF AREA ALLOWING RUNOFF   =   100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =     2.000  ACRES
EVAPORATIVE ZONE DEPTH           =    30.0    INCHES
```

```
    INITIAL WATER IN EVAPORATIVE ZONE  =     6.888  INCHES
    UPPER LIMIT OF EVAPORATIVE STORAGE =     18.978  INCHES
    LOWER LIMIT OF EVAPORATIVE STORAGE =      3.354  INCHES
    INITIAL SNOW WATER              =     0.000  INCHES
    INITIAL WATER IN LAYER MATERIALS   =   40.332  INCHES
    TOTAL INITIAL WATER             =    40.332  INCHES
    TOTAL SUBSURFACE INFLOW            =     0.00   INCHES/YEAR


           EVAPOTRANSPIRATION AND WEATHER DATA
           ----------------------------------

     NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
            GRAND JUNCTION       COLORADO

       STATION LATITUDE                   = 39.07 DEGREES
       MAXIMUM LEAF AREA INDEX              =  0.00
       START OF GROWING SEASON (JULIAN DATE) =   116
       END OF GROWING SEASON (JULIAN DATE)   =   288
       EVAPORATIVE ZONE DEPTH               = 30.0  INCHES
       AVERAGE ANNUAL WIND SPEED              =  8.10 MPH
       AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  60.00 %
       AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  36.00 %
       AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  36.00 %
       AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  57.00 %


     NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    GRAND JUNCTION      COLORADO

            NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

  JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
  -------    -------    -------    -------    -------    -------
   0.40       0.32       0.59       0.50       0.61       0.41
   0.57       0.74       0.71       0.87       0.41       0.39


     NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    GRAND JUNCTION      COLORADO

       NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

  JAN/JUL    FEB/AUG    MAR/SEP    APR/OCT    MAY/NOV    JUN/DEC
  -------    -------    -------    -------    -------    -------
   22.90      32.60      42.90      52.40      61.90      71.30
   78.50      75.60      65.50      52.90      39.10      27.10
```

```
     NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
            COEFFICIENTS FOR    GRAND JUNCTION      COLORADO
             AND STATION LATITUDE  =  39.07 DEGREES




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

     AVERAGE MONTHLY VALUES IN INCHES FOR YEARS     1 THROUGH   20
------------------------------------------------------------------------------

                  JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                  -------  -------  -------  -------  -------  -------
 PRECIPITATION
 -------------
  TOTALS               0.33     0.29     0.51     0.54     0.59     0.45
                  0.49     0.82     0.59     0.81     0.54     0.32

  STD. DEVIATIONS      0.16     0.17     0.23     0.27     0.43     0.48
                  0.33     0.37     0.46     0.58     0.35     0.20

 RUNOFF
 ------
  TOTALS               0.003    0.000    0.005    0.011    0.043    0.035
                  0.035    0.051    0.038    0.072    0.010    0.001

  STD. DEVIATIONS      0.008    0.001    0.009    0.018    0.054    0.075
                  0.065    0.065    0.054    0.127    0.018    0.005

 EVAPOTRANSPIRATION
 ------------------
  TOTALS               0.308    0.337    0.470    0.378    0.515    0.494
                  0.414    0.653    0.628    0.793    0.651    0.342

  STD. DEVIATIONS      0.151    0.143    0.260    0.144    0.416    0.444
                  0.351    0.483    0.494    0.576    0.349    0.164

 PERCOLATION/LEAKAGE THROUGH LAYER  3
 ------------------------------------
  TOTALS               0.0005  0.0011  0.0055  0.0017  0.0016  0.0055
                  0.0059  0.0041  0.0011  0.0018  0.0016  0.0010

  STD. DEVIATIONS      0.0023  0.0023  0.0157  0.0027  0.0026  0.0184
                  0.0201  0.0121  0.0016  0.0029  0.0022  0.0017
```

```
---------------------------------------------------------------------------
          AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
---------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  3
  -----------------------------------
    AVERAGES          0.0000  0.0000  0.0001  0.0000  0.0000  0.0001
                  0.0001  0.0000  0.0000  0.0000  0.0000  0.0000

    STD. DEVIATIONS      0.0000  0.0000  0.0002  0.0000  0.0000  0.0002
                  0.0002  0.0001  0.0000  0.0000  0.0000  0.0000

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



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

    AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH   20
---------------------------------------------------------------------------
                              INCHES          CU. FEET      PERCENT
                         ------------------  ------------  ---------
 PRECIPITATION                  6.26   (  1.028)    45422.2    100.00

 RUNOFF                    0.304   ( 0.1677)      2209.71     4.865

 EVAPOTRANSPIRATION             5.981   ( 1.1320)     43422.56    95.598

 PERCOLATION/LEAKAGE THROUGH     0.03130 (  0.07444)       227.209     0.50022
  LAYER  3

 AVERAGE HEAD ON TOP            0.000 (    0.000)
  OF LAYER  3

 CHANGE IN WATER STORAGE       -0.060   ( 0.5446)      -437.30    -0.963

***************************************************************************
```

```
***********************************************************************

          PEAK DAILY VALUES FOR YEARS   1 THROUGH   20
 ------------------------------------------------------------------------
                                   (INCHES)     (CU. FT.)
                                   ----------  ----------
   PRECIPITATION                         0.80        5808.000

   RUNOFF                             0.273        1983.5400

   PERCOLATION/LEAKAGE THROUGH LAYER  3      0.012390        89.94880

   AVERAGE HEAD ON TOP OF LAYER  3          0.004

   SNOW WATER                            0.47        3412.1404


   MAXIMUM VEG. SOIL WATER (VOL/VOL)              0.2447

   MINIMUM VEG. SOIL WATER (VOL/VOL)              0.1518

***********************************************************************
```

```
******************************************************************************

            FINAL WATER STORAGE AT END OF YEAR   20
    ----------------------------------------------------------------------
              LAYER        (INCHES)      (VOL/VOL)
              -----        --------      ---------
                1           1.6205         0.2701

                2          32.0952         0.2675

                3           5.4120         0.4510

             SNOW WATER       0.000

******************************************************************************
******************************************************************************
```

APPENDIX F SUPPORTING DOCUMENTATION

Needs Assessment Report

Permitting the Solitude Class V Landfill

Green River, Utah

April 16, 2003

Prepared for:

Green River Landfill, LLC
4570 Westgrove Drive, Suite 240
Addison, Texas 75001
(972) 407-0701

Infill Companies
2825 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
(801) 990-3456

```
****************************************************************************
****************************************************************************
**                                                                        **
**                                                                        **
**          HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                 **
**           HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**            DEVELOPED BY ENVIRONMENTAL LABORATORY                       **
**              USAE WATERWAYS EXPERIMENT STATION                         **
**          FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
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OUTPUT DATA FILE:          C:\HELP3\OUT O 8.OUT


TIME: 22:43    DATE:  8/ 5/2002


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  TITLE:  Solitude Landfill -- Green River, Utah -- Open Case

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


                            LAYER  1
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                  TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER 14
        THICKNESS             =     6.00   INCHES
        POROSITY              =     0.4790 VOL/VOL
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Index

1. Executive Summary

The Utah solid waste industry is clearly following the national and global trend of fewer but larger remote, disposal sites (megafills), which are owned and operated by profitable private sector entities. The March 13, 2003 request for proposal (RFP) initiated by all of the municipal solid waste (MSW) generators along the Wasatch Front reflects a real need for competition to keep the MSW market healthy.

The Solitude Landfill will provide public sector clients new innovative and efficient methods of handling and transport including access to equipment and technologies not offered or utilized by other local or nation disposal facilities. The public sector administrator will be able to select from a menu of services, equipment and options for disposal that have not been offered in the local or national MSW market before.

The Solitude landfill is located in a remote, secluded area that is accessed by both rail and surface sources. More importantly it is in a unique siting that provides exceptional benefits in low annual precipitation, high evaporation, a geological strata with little or poor quality ground water and a barrier to groundwater of over 1,100 feet of dense Mancos shale.

When considering permitting requirements the Department of Environmental Quality, Division of Hazardous Waste (DEQ) concluded that Solitude qualified for an alternative cell design that does not require groundwater monitoring or leacheat collection. Because of the favorable siting the operating, closure and post closure monitoring requirements are very cost efficient translating into significant cost savings for both public and private sector clients.

2. Background

Infill Companies (Infill) was contracted by Green River Landfill, LLC to perform a Needs Assessment for the permitting of the Solitude Class V Landfill located in the City of Green River, Emery County, Utah. The basis for this assessment complies with the requirements outlined in 19-6-108 (10) of the Utah Code, Annotated.

The Solitude Landfill is currently permitted by the Department of Environmental Quality, Division of Solid and Hazardous Waste as a Class I Landfill (#0201) based on a Municipal Solid Waste Contract (MSW) with the City of Green River. The Class V designation will allow Solitude to capitalize on additional sources of MSW both within and outside of the State of Utah.

Information contained in this assessment comes from a variety of sources including correspondence, telephone calls and meetings with MSW generators in Utah and locations throughout the United States. Information gathered during the research include telephone conversations, personal meetings, written reports, technical papers, policy studies, state, county and municipal records, waste inventory reports and internet searches.

3. Compliance to State Statute 19-6-108-(10)

19-6-108-(10)

- ***a. Evidence that the proposed commercial facility has a proven market of nonhazardous solid or hazardous waste including:***
  - ***i. Information on the sources, quantity, and price charged for treating, storing, and disposing of potential nonhazardous solid or hazardous waste in the state and regionally***

Response:

1. Utah municipal solid waste (MSW) tonnage in 2001 was 2,467,915[1] tons with the majority of that total generated on the Wasatch Front (Brigham City to Nephi)
2. Current tip fees at MSW landfills and transfer stations along the Wasatch Front are from $11.00 to $30.00 per ton[2].
3. *Envision Utah* project that in 2020 growth along the Wasatch Front will add an additional 1 million Utah residents[3]
4. Current per person generation of MSW is 5.97 lb/person/day[4] or an additional 1.1 million tons of MSW by 2020
5. Currently approximately 600,000[5] tons of the Utah MSW waste stream is transported to one Class V commercial landfill with an additional 65,844 tons from out of state sources.
6. In state MSW tip fees at that Class V landfill ranged between $20.00 to $26.00 per ton[6]
7. Nationally the February 2003 MSW totals were 1.082 tons per day[7] (±282,000,000 tons annualized)
8. The February 2003 average tip fee for that tonnage was $36.93 per ton[8]

- ***ii. A market analysis of the need for a commercial facility given existing and potential generation of nonhazardous solid or hazardous waste in the state and regionally and***

Response:

1. Addressing landfill site needs along the Wasatch Front, DEQ's *Utah Solid Waste Plan Update, March 2002* states: ***"As the population has increased the need for more disposal volume and the need for alternatives to disposal***

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[1] Department of Environmental Quality, Division of Solid & Hazardous Waste, *Utah Landfill Inventory* March 2002.

[2] Conversations with administrators of MSW facilities along the Wasatch Front during 2002 and 2003.

[3] www.envisionutah.org/Frame-3.htm

[4] Department of Environmental Quality, Division of Solid and Hazardous Waste, *Utah Solid Waste Plan Update*, March 2002 page 2

[5] Department of Environmental Quality, Division of Solid & Hazardous Waste, *Utah Landfill Inventory* March 2002.

[6] Conversations with administrators of MSW facilities along the Wasatch Front during 2002 and 2003.

[7] Chartwell Solid Waste Market Data & Research, www.wasteinfo.com April 10, 2003

[8] Ibid

has become apparent. Siting of new landfills becomes more difficult as population grows and availability of land that is suited for landfill siting is limited by encroaching housing and other land uses[9]"

2. Privatization, out-sourcing and exporting of MSW continues to be both the local and national trend for municipal landfills.
3. In 2000 the number of landfill that accepted MSW decreased to 1,967 while the average landfill size increased.[10]
4. In 1999 only 13 of the 30 largest cities in the US owned a MSW landfill[11]
5. Three of the 13 cities had or were in the process of privatization.

iii. A review of other existing and proposed commercial nonhazardous solid or hazardous waste facilities regionally and nationally that would compete for the treatment, storage or disposal of the nonhazardous solid or hazardous waste;

Response:

1. Nationally a study of commercial landfill managers conducted in 2000 showed that the 11 'major players' accounted for disposal of less than 45% of the MSW waste stream [12]
2. No 'major player' controlled more than 23% of the market share.[13]
3. Over fifty-seven percent of the total MSW waste stream is handled by non-major players[14]

b. Public Benefits of the Proposed Facility

i. The need in the state for additional capacity for the management of nonhazardous solid or hazardous waste:

Response:

1. Availability of currently permitted disposal area cannot be the only criteria for evaluation of competition. This narrow evaluation method eliminates technology advancements, developments in handling methods, efficiencies in transportation and more cost efficient siting locations.
2. Government cannot allow only one provider of services to be permitted by a state agency.
3. The essential element of competition is eliminated allowing the monopolist to ignore market conditions, customer's needs and advancement in technology.
4. A monopoly has historically always led to excessive profits and operational complacency.

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[9] Department of Environmental Quality, Division of Solid and Hazardous Waste, *Waste Plan Update*, March 2002 page 7

[10] United States Environmental Protection Agency *Municipal Solid Waste in the United States: 2000 Fact and Figures*, June 2002, page 14

[11] City of Houston, Public Works and Engineering Department, *Survey of Large Cities' Solid Waste Management Systems*, revised April 1999

[12] Reason Public Policy Institute *Privatizing Landfills: Market Solutions for Solid-Waste Disposal* May 2000 page 7

[13] ibid

[14] ibid

5. Historical growth patterns and population projections indicate that the need for MSW disposal will increase faster in Utah than on a national basis.
6. A coalition of all MSW generators along the Wasatch Front recently released an RFP seeking consultant services to evaluate existing and planned solid waste disposal sites in Utah.
7. An additional rural, environmentally friendly, geologic sound and economical based landfill will provide an alternative to the one option currently available in the state.
8. Liability will be greatly reduced as MSW will not be co-mingled with other forms and sources of waste currently being accepted in the only competing Class V landfill.
9. Strict adherence to sources and types of waste will reduce the need for environmental liability and costly remediation.
10. Preservation of existing capacity in regional municipal landfills is an immediate benefit for the permitting of the Solitude Class V Landfill.

ii. the energy and resources recoverable by the proposed facility:

Response:

1. Bale fill resources and technology will be offered to MSW generators.
2. Bale fill is a more efficient technology as the waste is compacted only once reducing significant energy and labor consumption at the transfer station, during transport and within the landfill.
3. Because of the extremely dry climate and soil conditions at Solitude, bale fill will provide a renewable source of energy for future generation.
4. Bale fill technology at the transfer station and at Solitude will help reduce handling and operational expenses.
5. Bale fill will provide heaver weight for each train car and therefore reduce energy consumption and expense during transport.

iii. The reduction of nonhazardous solid or hazardous waste management methods, which are less suitable for the environment, that would be made possible by the proposed facility;

Response:

1. Solitude is located on a unique parcel of land that has no wells and no surface or subsurface water sources. Isolated perched water is rare and when encountered has high levels of total dissolved solids (TDS) values ranging from 9,400 to 30,000 mg/l.
2. Mancos Shale underlies Solitude at least 1,100 feet thick below the surface. Permeability values for the Mancos Shale are in the range of 10 to the -7 and 10 to the -13 cm. sec.
3. The climate is very dry with average annual precipitation of 6.5 inches and evaporation of approximately 56 inches.

4. These conditions ensure that *if* any leacheat is produced and migrates into the soil the transfer will be on the order of hundredths to thousandths of an inch per year.
5. If a release did reach a subsurface source of water over eons of years there would be no negative affect to the water.

iv. whether any other available site or method for the management of hazardous waste would be less detrimental to the public health or safety or to the quality of the environment;

Response:

1. We are not requesting a hazardous waste permit.

c. compliance history of an owner or operator of a proposed commercial nonhazardous solid or hazardous waste treatment, storage, or disposal facility, which may be applied by the executive secretary in a nonhazardous solid or hazardous waste operation plan decision, including any plan conditions.

Response:

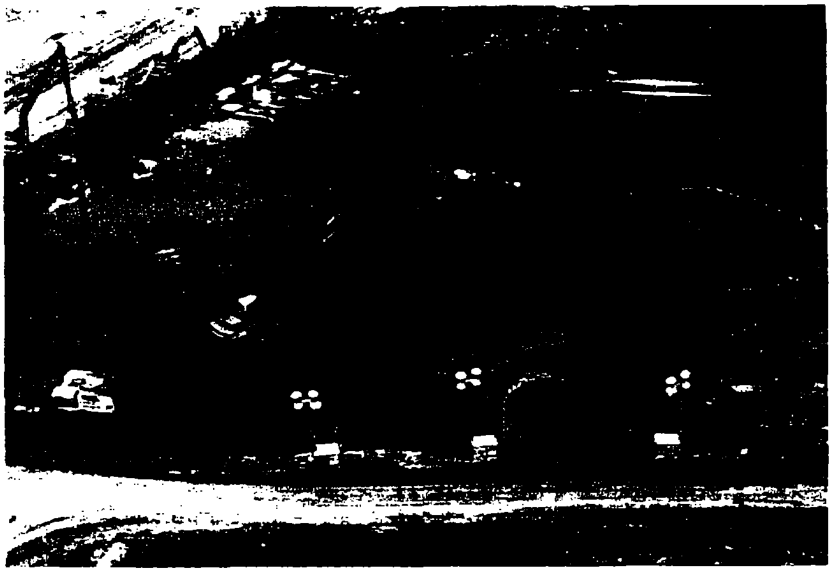
1. The principals of the owner and operator have never been found in violation of any EPA or state waste regulations. Attached please find experience résumé's outlining non-hazardous and hazardous waste management, treatment, and disposal experience.

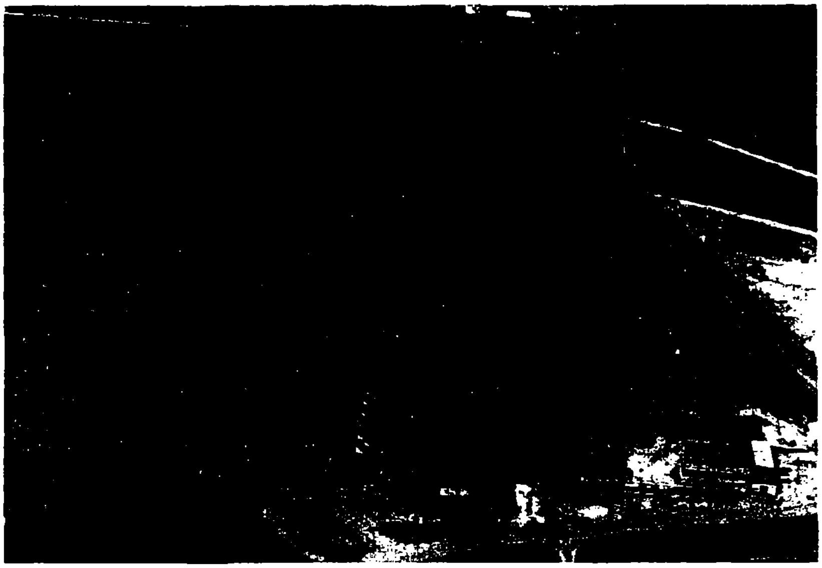
CLASS II LANDFILL DESIGN AND CONSTRUCTION PHASE I

Start Date: June 1989
Completion Date: October 1992

PROJECT DESCRIPTION

This project involved the excavation, removal and transportation of approximately 145,000 cubic yards of spent clay waste material and the development of a 400,000 cubic yard capacity Class II Landfill. The first challenge of the project was the removal of the existing waste from the planned Class II Landfill area. The material was excavated and deposited in an adjacent landfill area for future remediation by ITEX. This task was accomplished with the combination of specially constructed waste transfer pumps and long reach excavation equipment that worked from flotation units in the impoundment. During the construction of this project, ITEX negotiated with the regulatory agency for an "in-place" liner designation. The result of this "in-place" liner designation and engineering documentation by ITEX was a net savings to the client of $1,040,000.00. Phase I of the Class II Landfill was completed and received its first Class II waste in July of 1989.



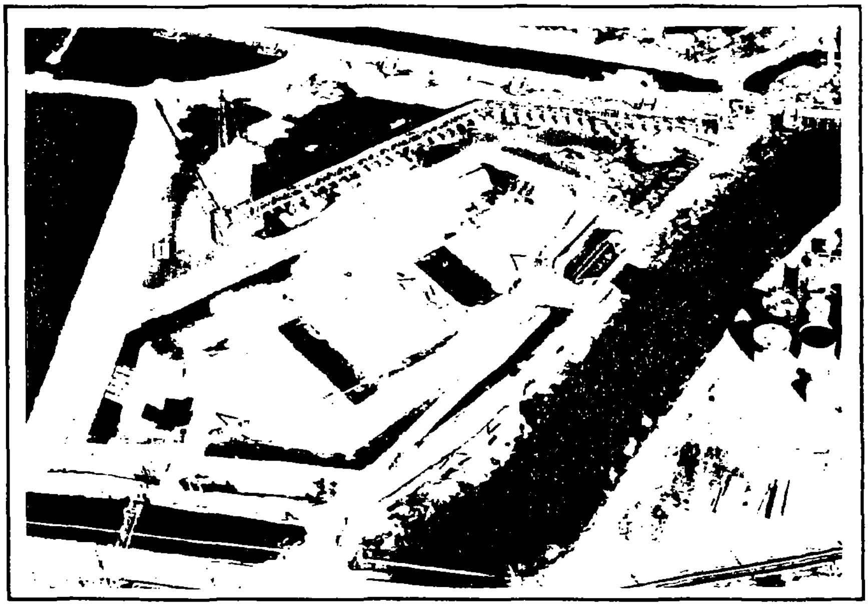


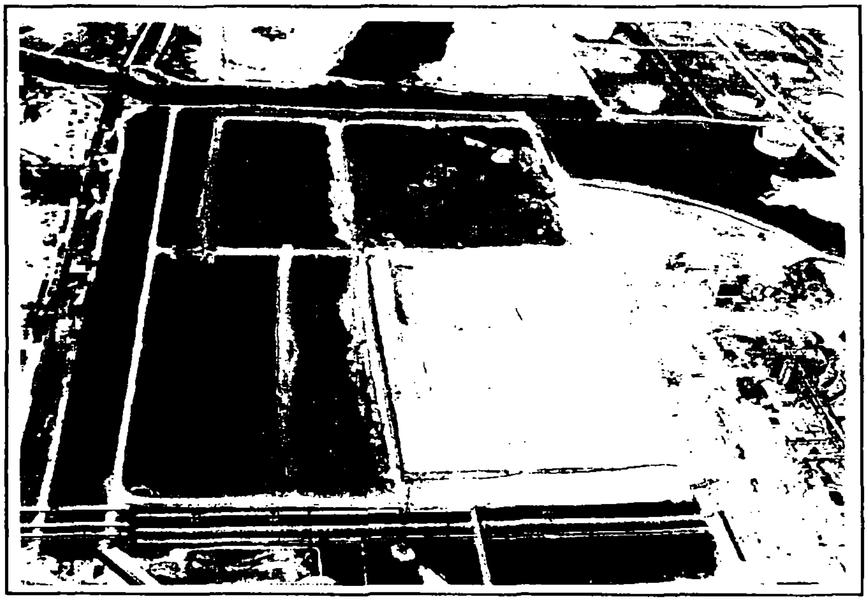
MINIMUM TECHNOLOGY REQUIRED (MTR)

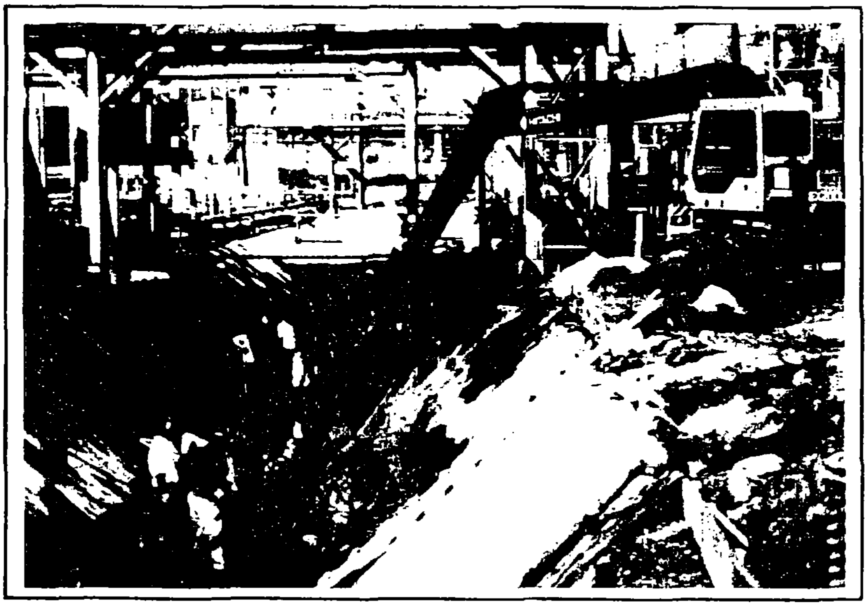
SURFACE IMPOUNDMENT CONSTRUCTION PROJECT

PROJECT DESCRIPTION

This project is a portion of the construction and clean-up effort of the Master Remediation Plan (MRP) for a major refinery. The challenge of this project was the ever changing subgrade variation and fast track construction effort necessary to meet the more stringent regulatory requirements that were about to become effective. The requirements of the project included the construction of a three (3) foot thick layer of imported and recompacted clay, a one (1) foot thick drainage layer, a leachate collection system and a flexible membrane liner with a 5" concrete protective layer. All the above layered systems, when working in unison, provide the most risk free barrier to contamination release from surface impoundments.





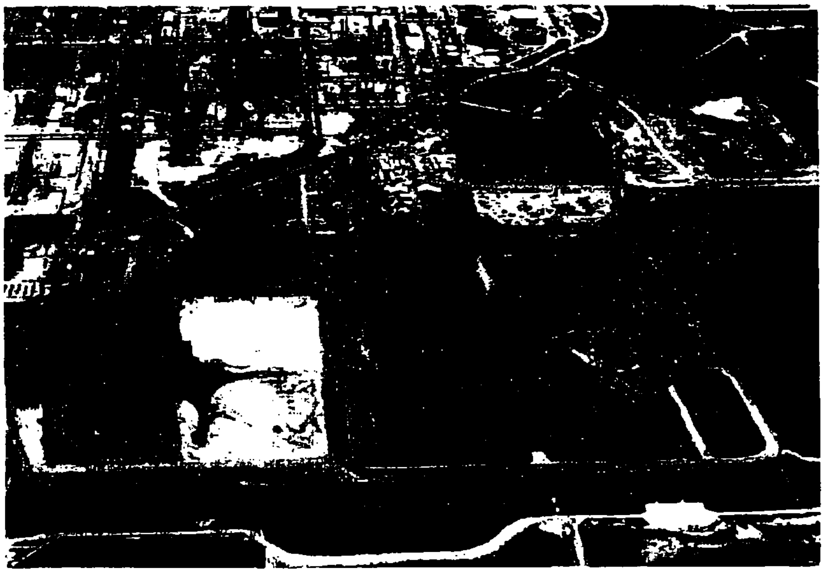


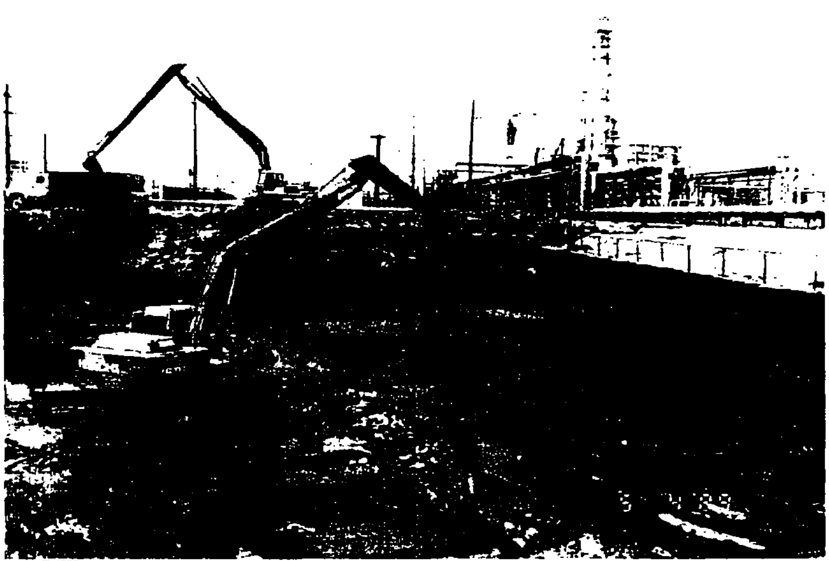
CLASS II LANDFILL DESIGN AND CONSTRUCTION PHASE II

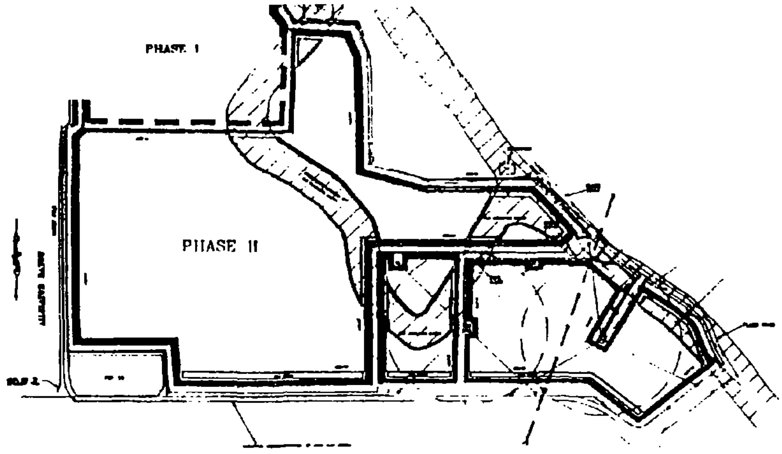
Start Date: June 1989
Completion Date: October 1992

PROJECT DESCRIPTION

This project included the remediation of 725,000 cubic yards of spent clay material through the ARCHON Solidification System and the creation of a 1,450,000 cubic yard capacity Class II landfill. On June 14, 1989, the Texas Water Commission classified ARCHON treated spent clay as Class II non-hazardous material. The Class II waste classification provided the client the flexibility of using treated spent clay as a substitute, in some cases, for imported fill material. The development of the 1,450,000 cubic yard Class II Landfill provided the client the on-plant capacity to be totally self-sufficient in their non-hazardous waste management programs.







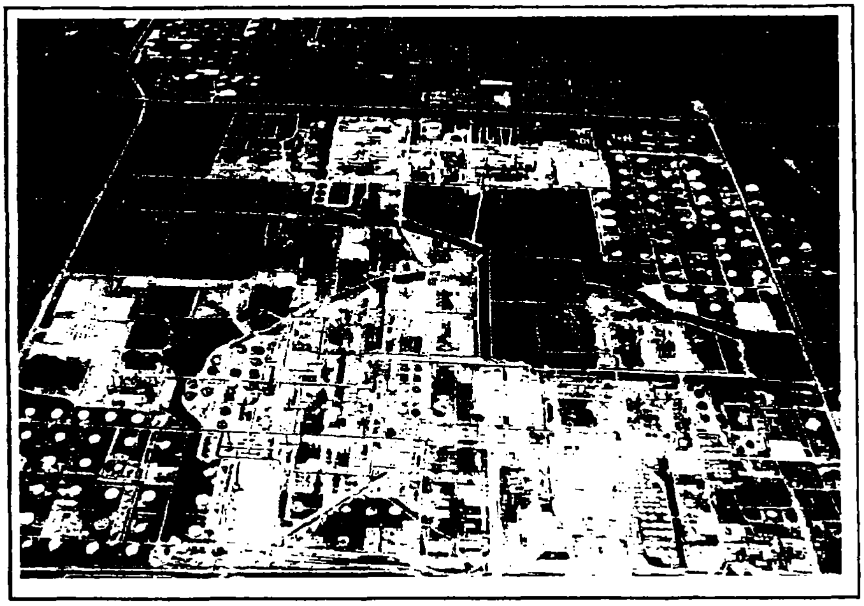
MASTER REMEDIATION PLAN
for
STAR ENTERPRISE REFINERY
Port Arthur, Texas

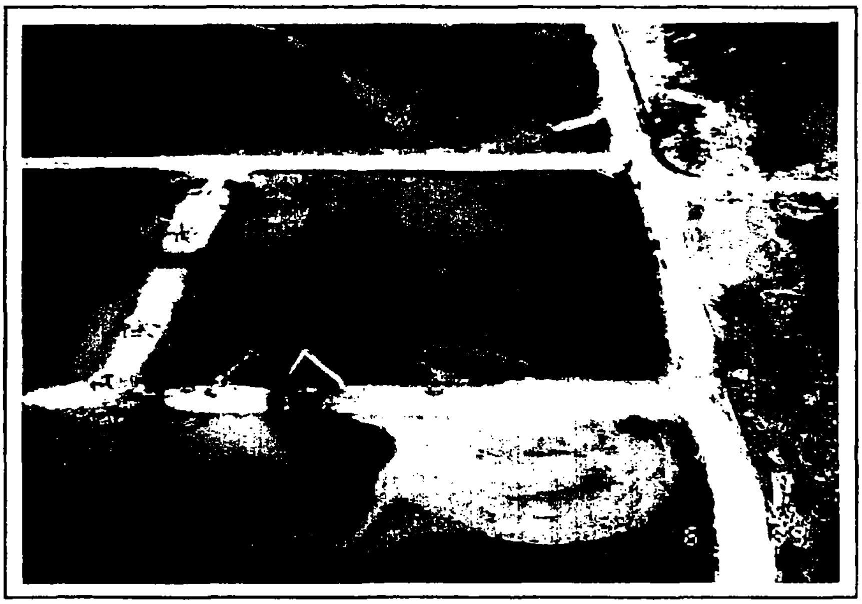
PROJECT DESCRIPTION

ITEX developed and implemented the Master Remediation Plan (MRP) when it became evident that the regulatory changes, i.e., TCLP and Primary Sludge Listing, were going to be promulgated. The basis of the MRP was to provide the refinery with operational wastewater management while consolidating and remediating the 3,000,000 cubic yards of contaminated sludge before the Primary Sludge Listing and TCLP Regulations went into effect. ITEX provided all services of the MRP with in-house staff and equipment. These services which include both engineering and construction activities are listed below:

- Analytical Testing
- Laboratory Analysis
- Surveying
- Sludge Consolidation
- Contaminated Soil Treatment and Transportation
- MTR Cell Construction
- Plant Site Preparation and Demolition
- Import Clay Hauling for Liners/Caps and Levee
- Construction of Levees and Liners
- Pipe Installation
- Quality Assurance/Quality Control
- Construction Design and Engineering

Phase I was a single source award with a twelve (12) month completion schedule. Phase I was completed in May 1991. Total project cost for Phase I was $180 million.



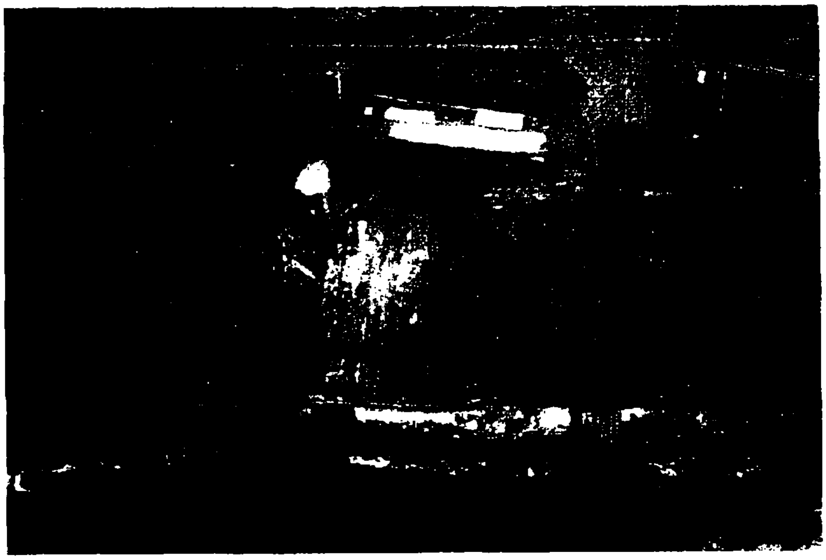


KERR-McGEE
ACID NEUTRALIZATION DEMONSTRATION
Cushing, Oklahoma

PROJECT EXPERIENCE

During the spring of 1987, ITEX was awarded a demonstration project for neutralization and solidification of acidic sludge located in five (5) open pits near Cushing, Oklahoma. The waste had been produced as a by-product of a lube oil cracking operation which was abandoned in the mid 1960's. ITEX used an in-situ process which was performed simply to increase the pH from near two (2) to above seven (7) and to create a stable material capable of supporting a cap system for closure. A second demonstration was carried out to provide an in-situ remediated waste with the same specification as above, but with more stringent requirements for size reduction and complete homogenization. ITEX realized early on that size reduction and homogenizations were key elements in the reduction of leachable constituents and the efficiency in additive utilization; therefore, allowing for cost reductions.

ITEX was successful in both demonstrations, even with the increased specifications. Experience from these demonstrations was used in the basic design and theory for the current ARCHON Solidification technique.



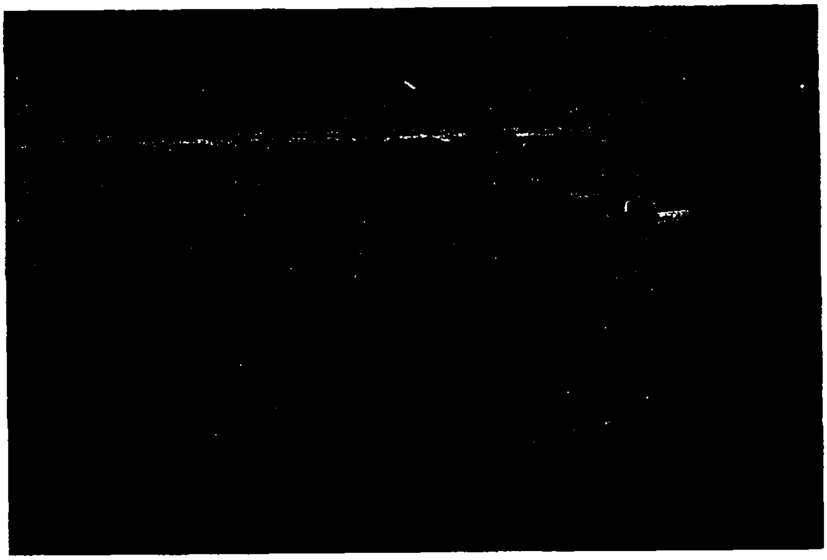
WASTE AVERAGING BASIN SLUDGE SOLIDIFICATION
La Porte, TX

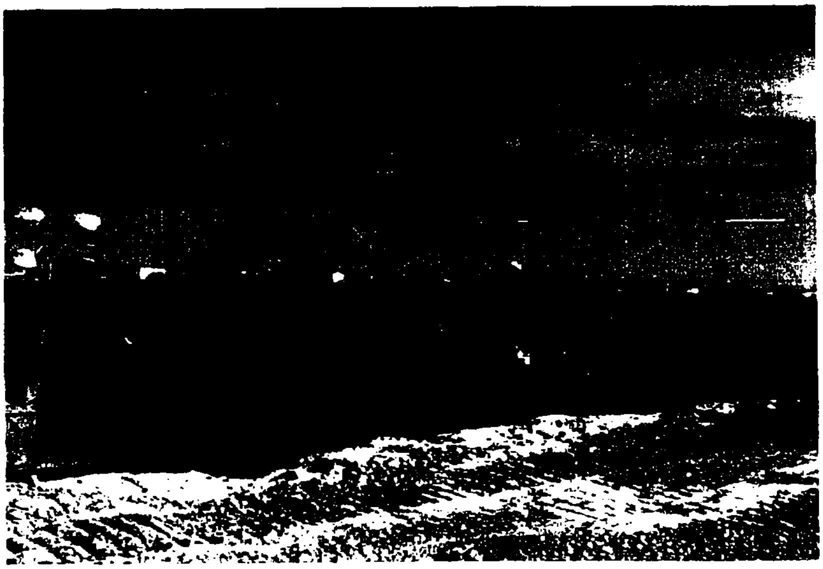
Start Date: October 1991
Completion Date: October 1991

PROJECT DESCRIPTION

This was a competitively bid project requiring ITEX to solidify and consolidate Class I non-hazardous organic sludges found in the Waste Averaging Basin at the DuPont La Porte Plant. ITEX utilized specially designed mixing apparatus to solidify the sludges in-situ with 7.5% cement. Specifications required the material to pass the Paint Filter Liquids Test by EPA Method 9095. Once passing this test, the material was consolidated into stockpiles for removal from the basin. The key element of this project was the fast track approach taken that allowed ITEX to mobilize and construct the work to achieve an early completion date.

In conjunction with this project, ITEX performed all health and safety requirements using our in-house professionals. Responsibilities include extensive daily air monitoring, personnel protection and OSHA training. All field personnel were required to maintain Level C protection.





CLOSURE OF CLASS I LANDFILL AND NON-HAZARDOUS PONDS

Texaco Refining and Marketing
Amarillo, Texas

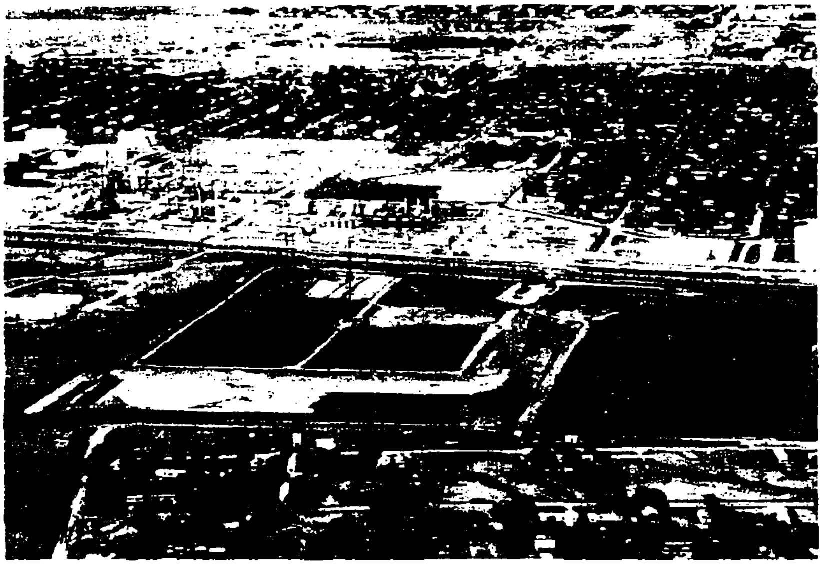
Start Date:	April 1990
Completion Date:	August 1990

PROJECT DESCRIPTION

This project at a decommissioned petroleum refinery, consisted of both inactive and active waste management units. The inactive units included a 10 acre Class I Hazardous Waste Landfill, three Wastewater Reservoirs, a Water Treatment Sludge Pond, and an undesignated contaminated area. The facility also included an active 7.5 acre Hazardous Waste Land Treatment Unit.

Prior to beginning construction activities, ITEX prepared a closure plan for non-hazardous waste and provided the technical support necessary to gain the Texas Water Commission approval. Once the closure plan was approved, ITEX completed the construction plan for remediation of this project.

Construction activities included in-situ stabilization of 110,000 cy of contaminated soils, upgrading existing levees with placement of over 35,000 cy of clay, installation of 75,000 cy of clay cap material, and placement of 30,000 cy of topsoil. Upon completion of the project, ITEX obtained final certified closure per the approved closure plan.



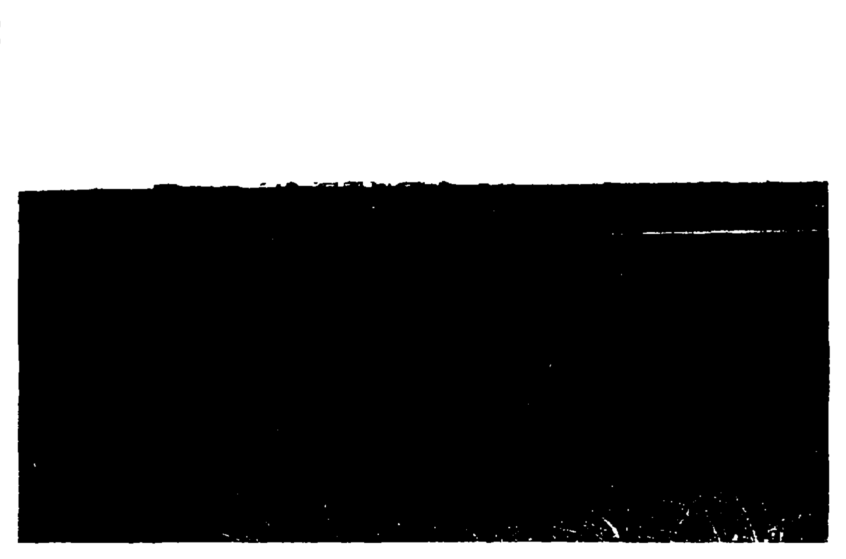
STORMWATER IMPOUNDMENT CLEAN-UP AND MAINTENANCE PROJECT
Southwest Refining

Start Date: July 1991
Completion Date: January 1992

PROJECT DESCRIPTION

This project was a competitive bid construction project that involved removal of sludges hazardous by characteristic of reactivity, and hauling those sludges in a dewatered state to Southwest Refinery's permitted hazardous waste landfarm for proper disposal. The nature of the sludge was oil (10-20%) with high moisture content (75-90%).

The key element of this job was to decant (dewater) the sludge to a level allowed for hydraulic loading at the permitted landfill. This was achieved by diesel and hydraulic pumping techniques designed for the project. The working conditions on this project required sealing of permeable levees bonded by the Houston ship channel. As the removal of the sludge progresses, the visible "clean bottom" is tested and clean clays will be installed to specifications and the impoundment will once again be ready to accept stormwater runoff from the active plant.



RETENTION POND CLOSURE
Diamond Shamrock
Three Rivers, Texas

Start Date:	April 1992
Completion Date:	June 1992

Project Description

ITEX developed and implemented a remediation plan for four active wastewater retention ponds. The four ponds contained listed hazardous waste sludges which were also classified hazardous due to the Toxicity Characteristics. This turn key project was completed prior to the effective date of new Land Disposal Restrictions for Primary Listed Sludges (F037 & F038).

The scope of work included the excavation and consolidation of over 12,000 cy of hazardous sludge and contaminated soil; the clean closing, upgrading and returning to service two of the ponds for stormwater retention; the in-situ treatment and stabilization of 22,000 cy of hazardous sludges and contaminated soils; and the construction of a RCRA cap for in-place closure of the treated material. Existing segregation levees were upgraded with clay to provide access to remote areas and to increase the barrier between the treated material and the cleaned ponds.

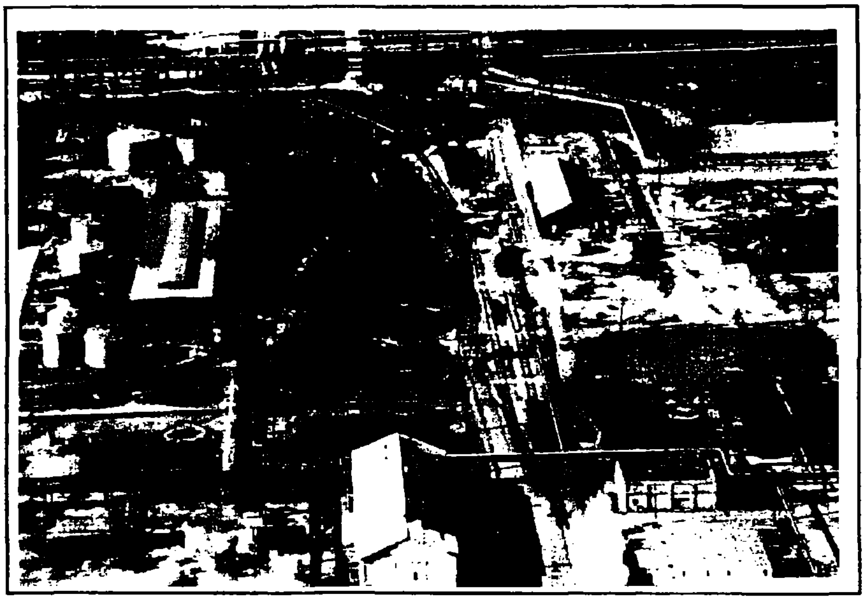
Treatment of the consolidated sludges by an in-situ method dictated that sludge had to be treated in depths as great as eight feet. This was successfully accomplished through the use of the ITEX designed in-situ processor and specially blended proprietary additive. The total project cost including all incidental work was $1.3 million.

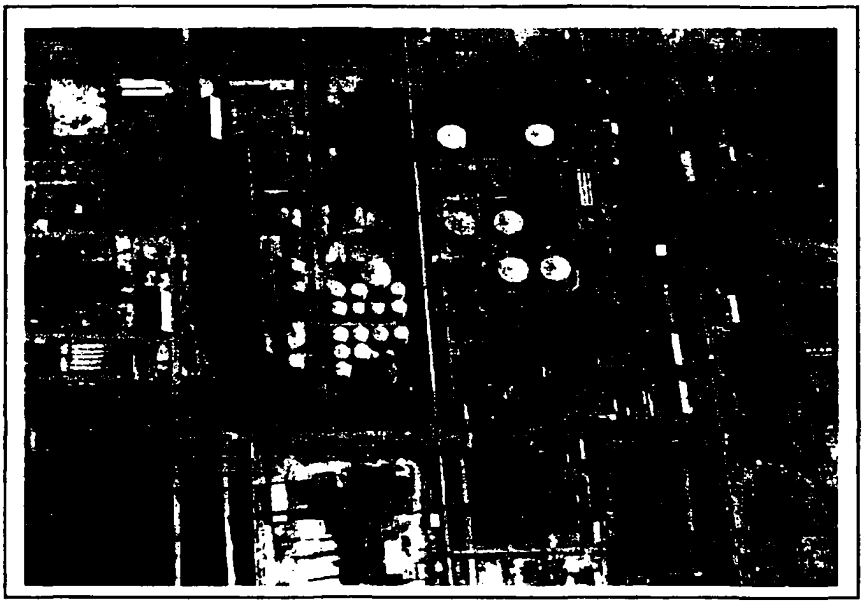
DELAYED COKER UNIT (DCU) SITE DEMOLITION AND SOIL REMEDIATION PROJECT

Start Date: May 1990
Completion Date: July 1990

PROJECT DESCRIPTION

This area required a multi-faceted approach from a design, construction and regulatory standpoint. Initially, it was thought the site required a formal closure plan in order to remediate the high metal concentration of the top eight (8) feet along with the low pH material. At this point ITEX was asked to investigate the project from a regulatory, design, and construction viewpoint. ITEX's position was that a closure plan was not necessary, and that contaminated material need only be handled in an "environmentally sound manner." The Texas Water Commission approved this approach, providing the DCU Project with the advantages of no ground water monitoring and no landfill designation. This designation was also important to the extent that the delays usually connected with a closure plan approval process were not encountered. The project consisted of excavation and hauling of approximately 40,000 cubic yards to the new Class II Landfill, treating and recompacting approximately 120,000 cubic yards of low pH contaminated material, and installation of a sheet pile cut-off wall.



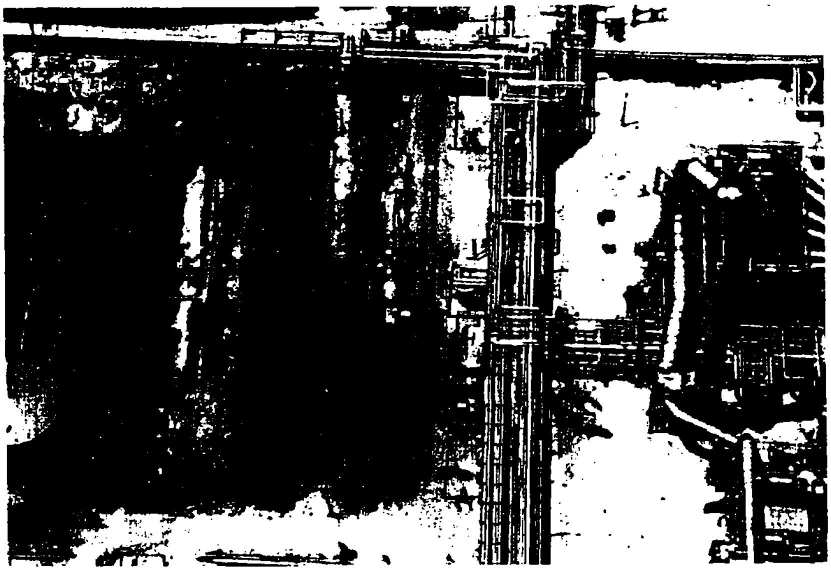


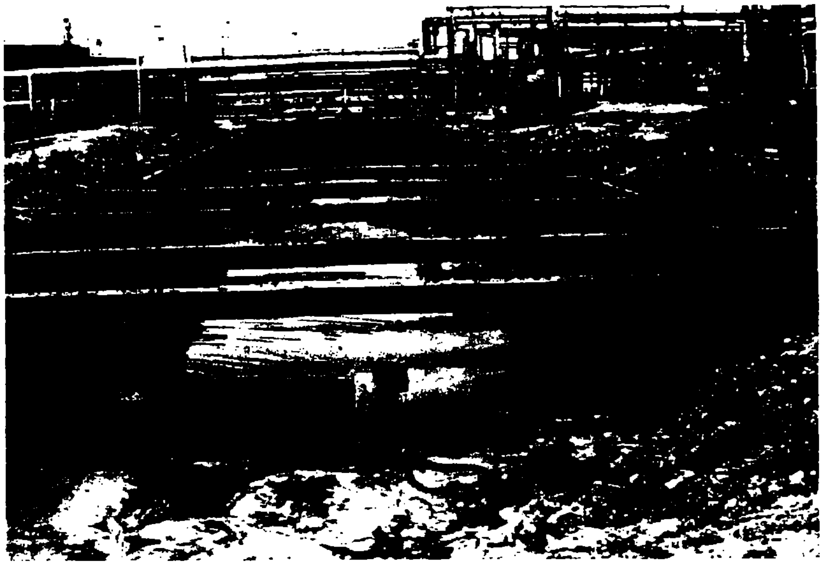
CLOSURE OF REFINERY SKIMMERS

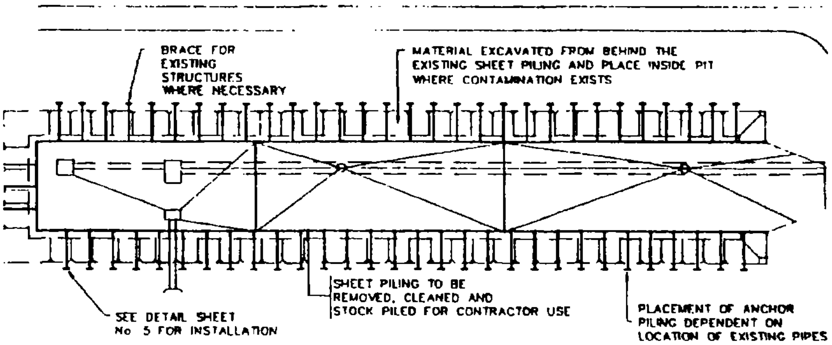
Start Date: March 1989
Completion Date: 1st Qtr. 1990

PROJECT DESCRIPTION

This project involved the removal, consolidation, cleaning, remediation and backfilling of four skimmer pits. ITEX reviewed an existing unapproved closure plan, modified the plan to secure regulatory approval and implemented a clean closure plan. The existing skimmer pit material will be processed through the ARCHON Remediation Process.







CLASS I HAZARDOUS WASTE LANDFILL CLOSURE

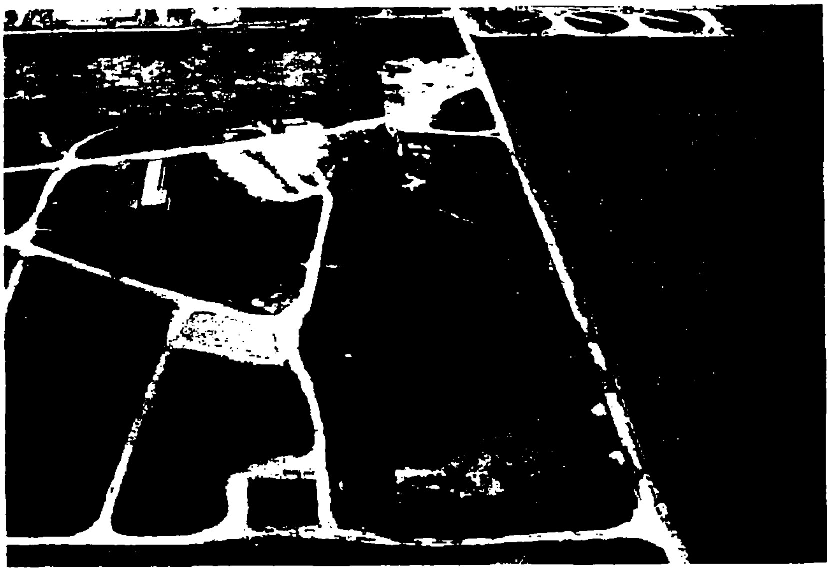
Start Date:	September 1989
Completion Date:	February 1990

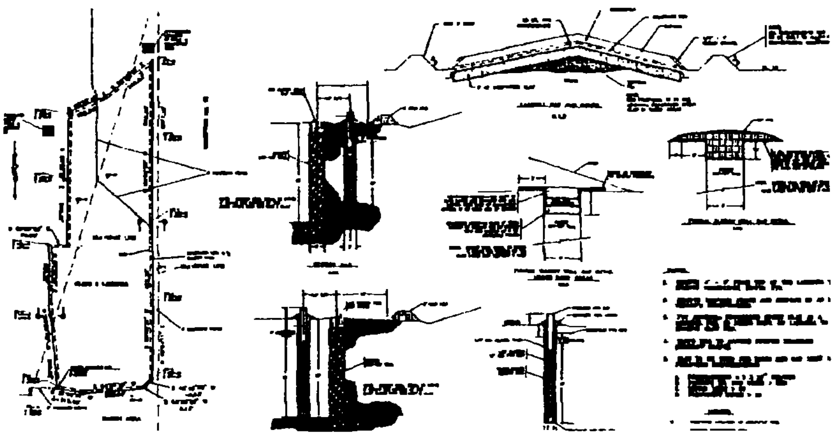
PROJECT DESCRIPTION

ITEX was the prime contractor for the containment and closure of a 10.08 acre Class I - Hazardous Waste Landfill, three wastewater reservoirs, a water treatment sludge pond and an undesignated contaminated area. The project site was located at a decommissioned petroleum refinery. ITEX physically contained the waste and developed a plan to stabilize the waste by mixing the oily sludge with waste lime laden soils. The resulting material was compacted in the Class I landfill. The final Class I cap and cover system was designed and constructed by ITEX.

All services under this contract were performed by ITEX. Environmental regulatory work prepared by ITEX for this project included:

- Sampling and characterization of Impoundment sludges.
- Preparation of a closure plan for non-hazardous impoundments.
- Preparation of an amendment to an existing closure plan for the hazardous waste landfill.



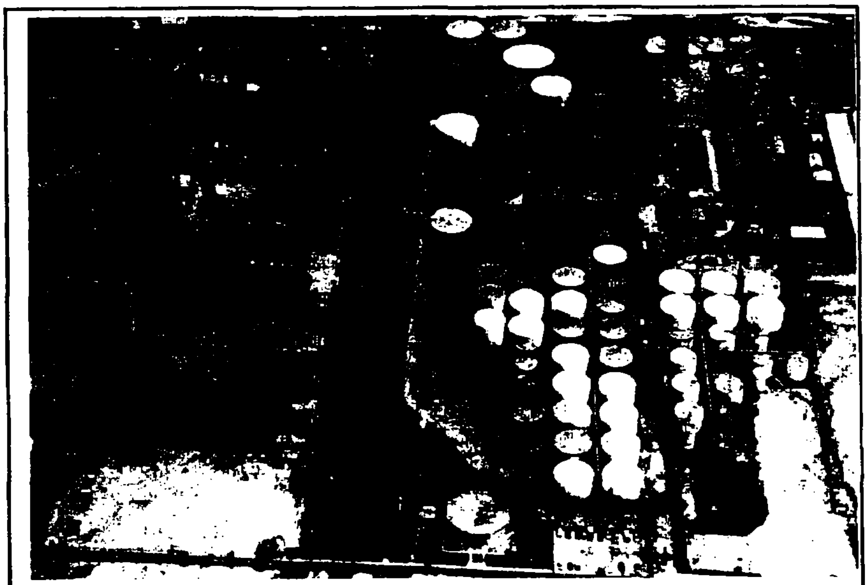


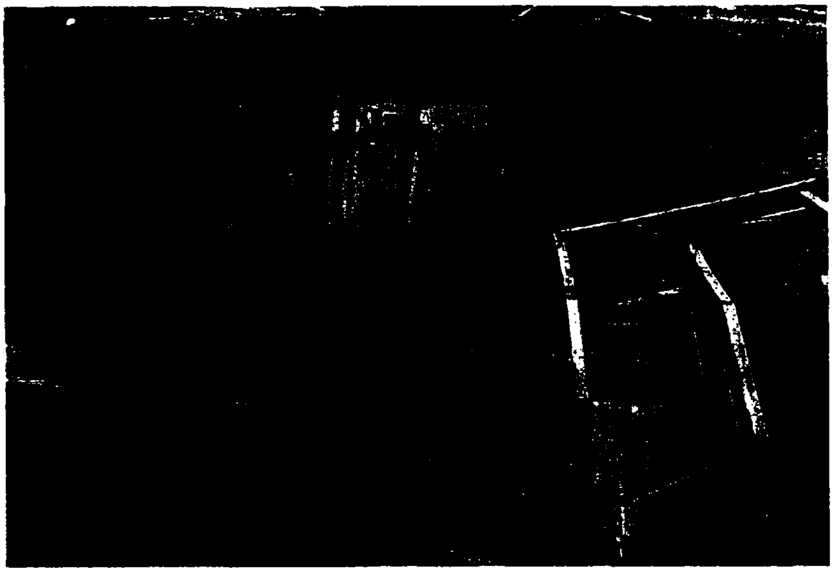
REFINERY WASTEWATER AND STORMWATER MANAGEMENT

PROJECT DESCRIPTION

This project involved an extensive study of a refinery wastewater and stormwater management system. The closing of the open ditches required extensive experience in stormwater and wastewater projects. In order to officially close the ditches, clean bottom had to be analytically proven. ITEX's plan allowed for the cleaning of the ditches while simultaneously installing all the necessary pipe systems to handle the plant's stormwater and wastewater needs. This approach maintained the ditches as clean closed while the execution and installation of properly engineered and installed wastewater and stormwater management systems occurred.

In 1989, regulations concerning all sediment upstream of API Separators being listed as a hazardous waste included the open ditches which were used for wastewater and stormwater management. The objective was to consolidate all the affected ditches into one area for remediation and disposal. The waste storage area became one hazardous waste management unit as opposed to multiple units since the ditches were later closed in place. This removed the significant monitoring requirements that closure of hazardous waste management units require. This consolidation also improved the possibility of remediating all the open ditch material prior to the primary sludge listing becoming effective.



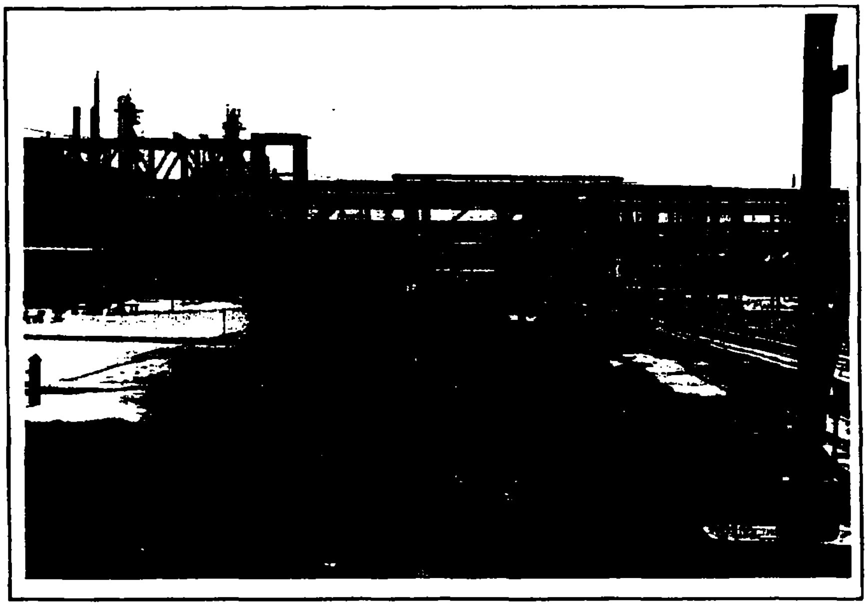


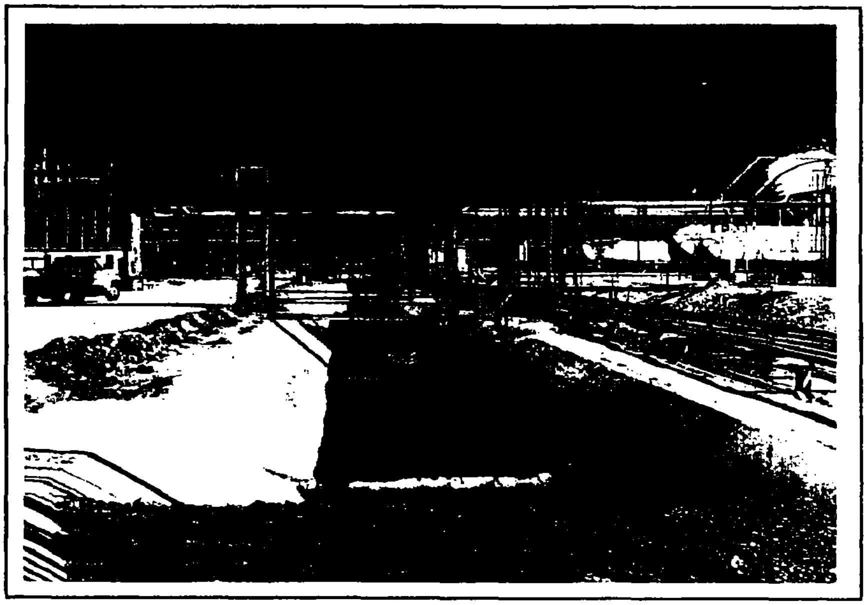
DITCH
REMEDIAL ACTION PLAN
Mobil Chemical Company

Start Date:	August 1990
Completion Date:	December 1990

PROJECT DESCRIPTION

The site consisted of open ditches with contaminated oily and low pH sludges that were to become TC regulated. This project presented ITEX with opportunity to provide the client with a fast track construction effort resulting in regulatory compliance of the ditches. ITEX overcame unique working conditions to complete this project. An active water management system had to remain largely undisturbed while construction/remediation activities were taking place. ITEX excavated from existing ditches, 30,000 cy of contaminated and uncontaminated soils. The contaminated soils were remediated using the ARCHON Solidification process and placed in an ITEX constructed, on-site landfill. The uncontaminated soils did not require treatment and were place directly into the landfill. Testing and documentation of clean ditch bottom was performed in accordance with EPA approved parameters. Following the excavation, ITEX graded and shaped the 4,100 LF of existing cleaned ditches and installed a gunite liner, double lined leachate collection system, and underdrain collection system. The newly completed lined ditch system doubled the ditch conveyance capacity of Mobil Chemical's water management system. This fast track project was completed on time and with little effect on the normal daily operation of the plant.





RADIOACTIVE WASTE DECONTAMINATION PROJECT

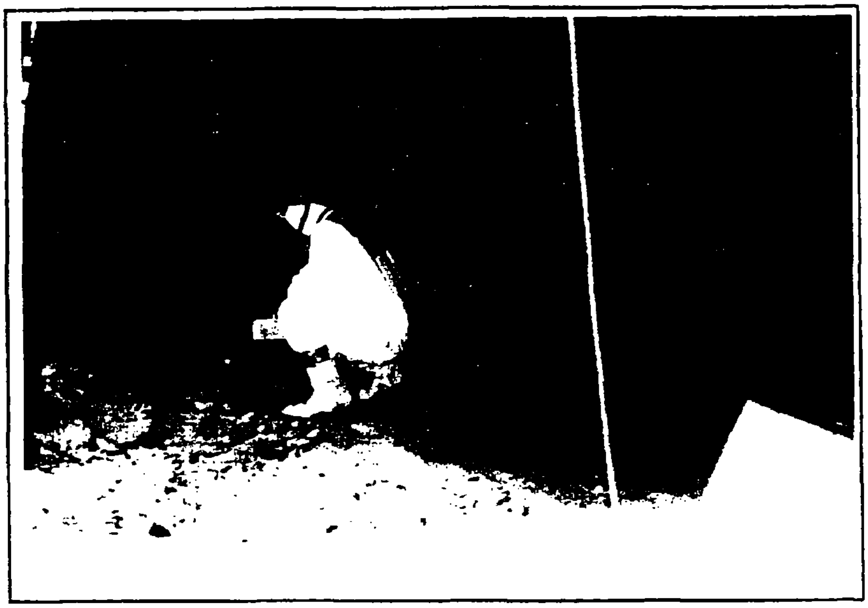
Project Description

ITEX was contracted by the owner of a steel mill in Illinois, for the removal of approximately 600 tons of K061 emission control dust. The contract was awarded following a survey of the electric furnace emission control system by the State of Illinois Department of Nuclear Safety. Upon finding Cesium 137 contamination in the emission control system, the State notified the owner that this low level radioactive contamination was to be removed and radiation levels reduced to health-based allowable levels.

ITEX was required to complete cleanup operations within a two week period, coinciding with the plant's scheduled winter shutdown. This allowed the owner to return to full production on the scheduled start-up date.

Scheduling concerns were not allowed to compromise responsibility for worker health and safety. All employees were required to wear Level C personnel protective equipment, during work and clean-up activities. An extensive program was initiated to monitor and minimize radiation exposure. When working in confined spaces, the air quality was monitored and special lighting was added to enhance working conditions.

Faced with a rapidly approaching deadline, ITEX worked around the clock, completing the project on schedule, amassing approximately 20,000 man-hours in 18 days, without serious injury or incident.



HAZARDOUS WASTE DE-LISTING PROJECT

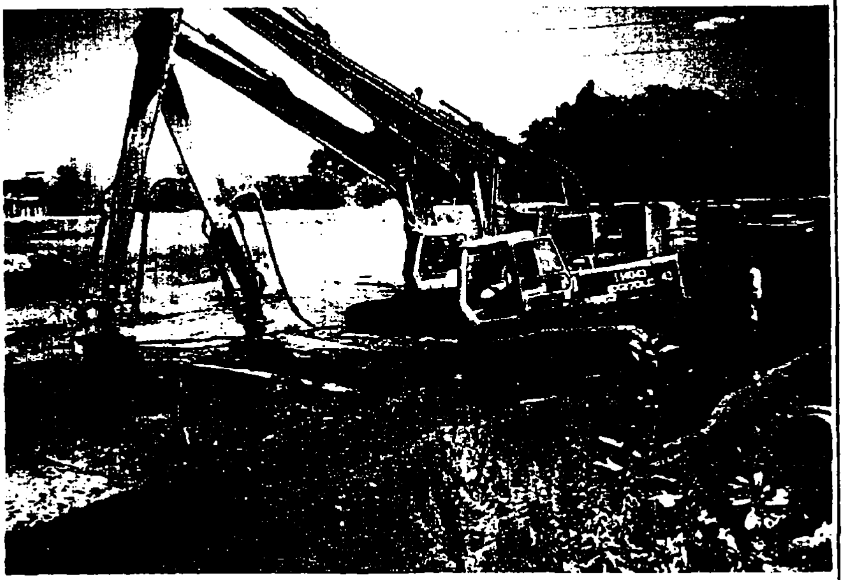
Project Description

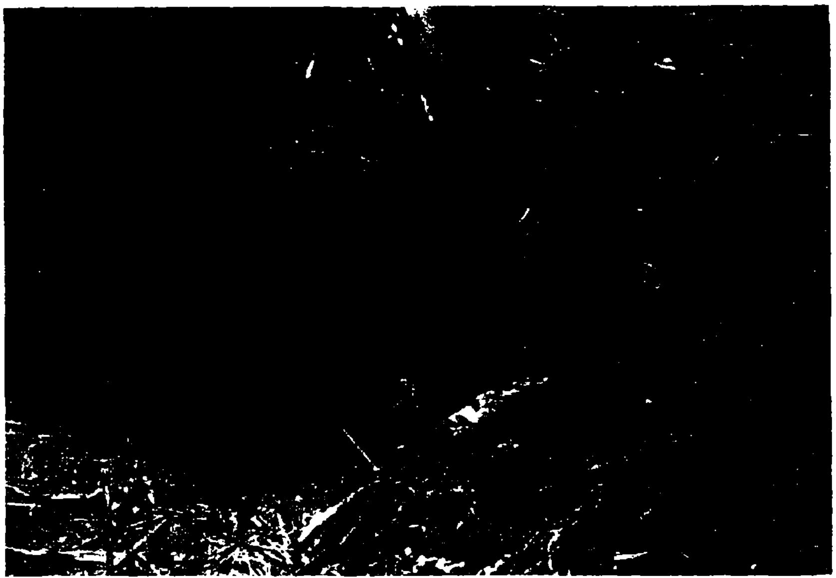
ITEX qualified and competitively bid for the de-listing of RCRA hazardous wastewater sludges, K062 spent pickle liquor solids, found at a wire mill facility in Illinois.

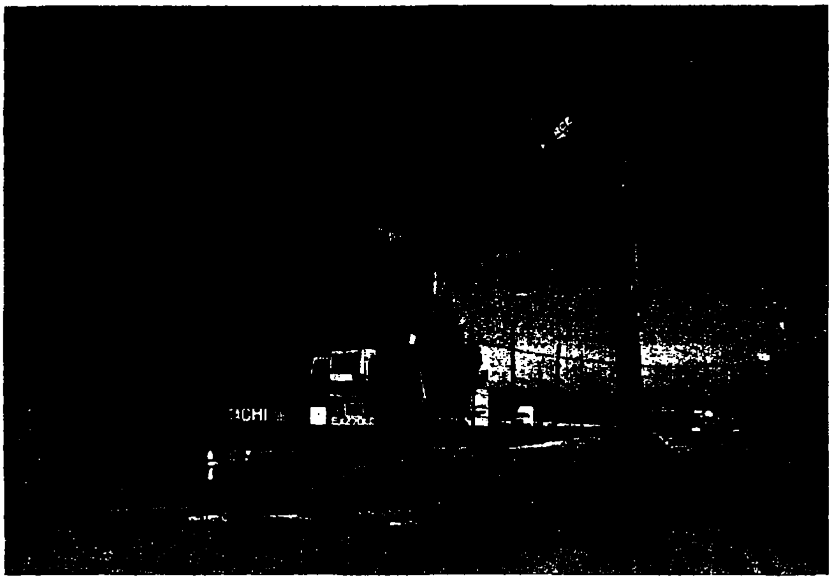
Stabilization and solidification of approximately 40,000 cubic yards of hazardous sludges and bottom soils was accomplished through utilization of the ITEX designed and fabricated In-Situ Processor. ITEX conducted bench-scale testing to develop an additive blend capable of providing cost benefits, in addition to meeting treatment requirements.

Treatment specifications required the material to pass de-listing threshold TCLP concentrations for leachable metals, with allowable concentrations for lead, the primary analyte of concern, less than 0.218 mg/1. For untreated materials, leachable lead concentrations ranged between 13 and 16 mg/1.

To track treatment progress, the retention basin was subdivided into 20'x20' cells, each containing approximately 100 cubic yards of treated material. At a frequency of one sample per 20 cubic yards of treated material, performance samples were taken to monitor adherence to treatment parameters. Performance sampling has shown 95% of TCLP samples with lead levels below detection limits. Currently, the treated material is awaiting final testing verification for submittal to the Illinois Pollution Control Board for de-listing purposes.







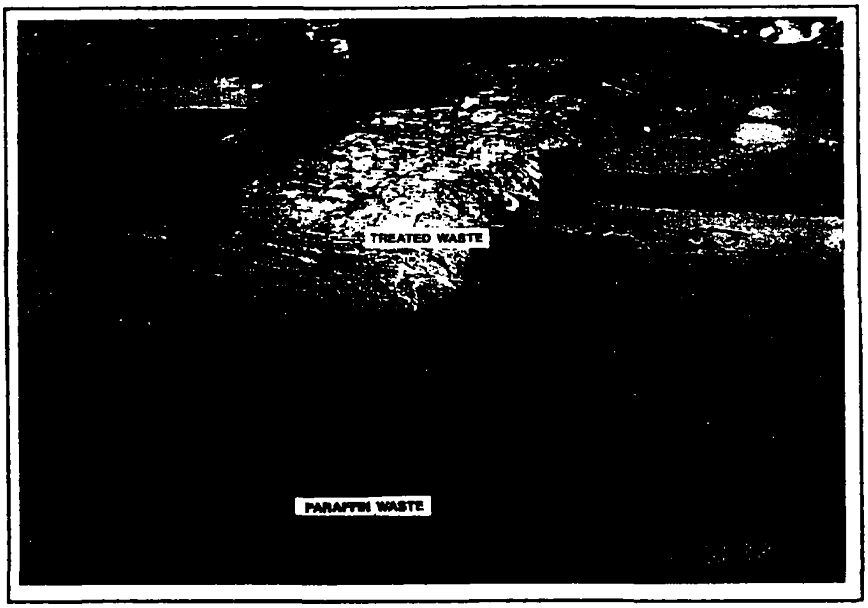
CLOSURE OF A BARGE CLEANING SETTLING POND

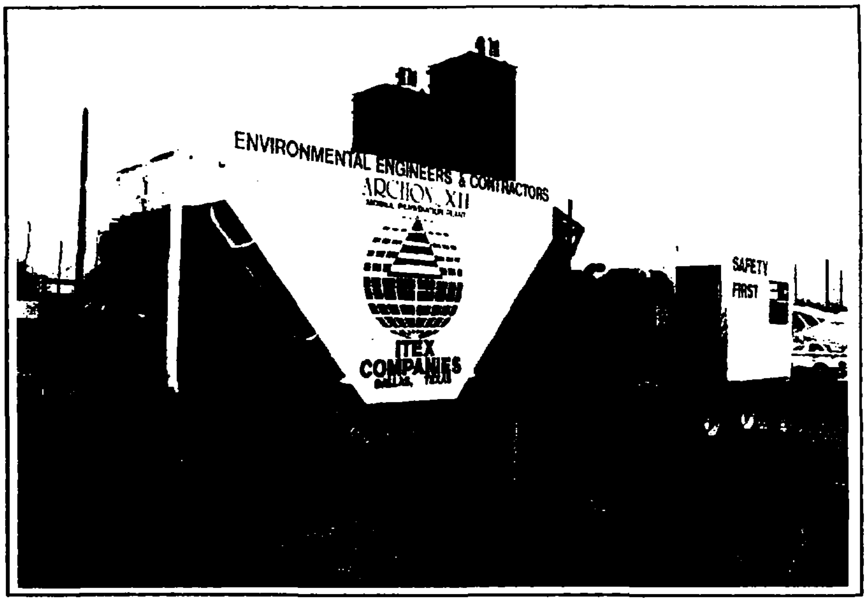
State of Louisiana

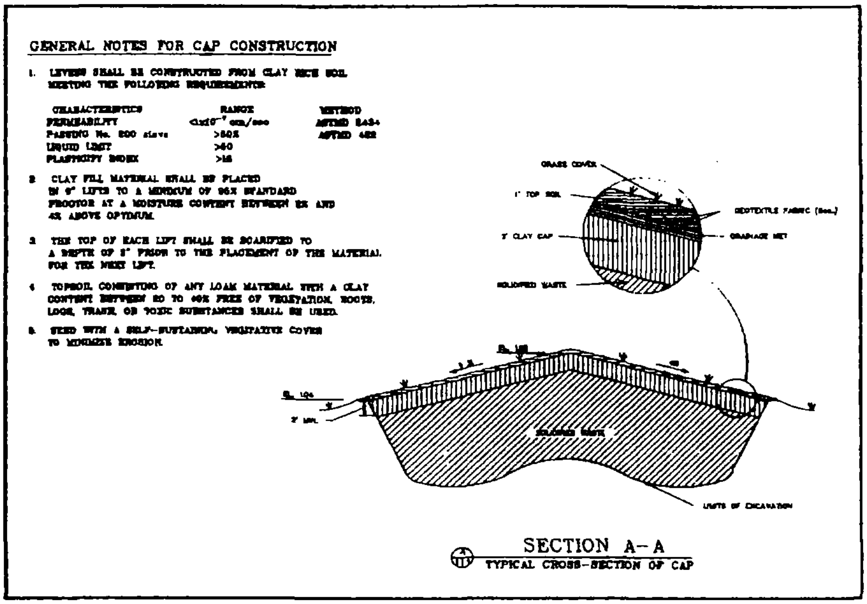
PROJECT DESCRIPTION

This project consisted of the closure of a settling pond used to store oily water from the barge cleaning process at a Gulf Coast Facility. ITEX developed a remediation and closure plan to stabilize/solidify all of the contents of the existing impoundment and close in-place as a landfill. The settling pond contains approximately 35,000 cubic yards of paraffin, oil, sludge and contaminated soil. The impoundment was divided into several sections by the construction of clay segregation levees to facilitate waste consolidation and disposal cell construction. Consolidating the paraffins, oils, sludges and soils allowed the various non-hazardous waste components to be mixed, providing a more consistent material for treatment. The consolidated waste was excavated and stabilized with the ARCHON Remediation Process and placed in the cleaned cell, for final disposal.

In preparation of this plan, ITEX conducted bench-scale and pilot-scale treatability studies for the solidification of the waste to ensure that the treatment goals were met and that the final material exhibited sufficient bearing strength to support the cap and cover system. QA/QC testing conducted during full-scale operations have confirmed that these goals have been achieved. ITEX's staff worked interactively with the facility's environmental staff and the Louisiana Department of Environmental Quality for final approval of the remediation and closure plan.







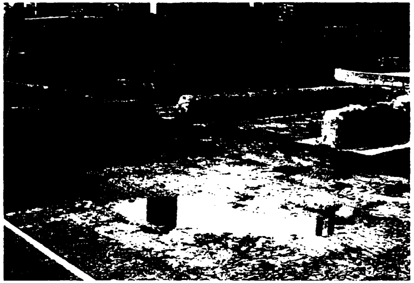
MOBIL OIL EXCAVATION AND EXPANSION PROJECT

Start Date:	July 1990
Completion Date:	October 1990

PROJECT DESCRIPTION

ITEX was responsible for the excavation and disposal of 33,000 cubic yards of contaminated soils for Mobil Oil Corporation. The work was executed under a unit price contract with a 1.7 million dollar estimate.

The excavated site was previously occupied by active process units which contributed to several large areas of contaminated underlying soils and foundations. ITEX successfully obtained the state classification and waste code from the Texas Water Commission to determine appropriate disposal and treatment methods. ITEX demolished pipe and concrete, excavated contaminated areas, transported and disposed of material in a temporary waste storage area. The site was backfilled with clean imported clay. This project began in August, 1990, and was completed in November, 1990 according to the original 4-month schedule.



4. Needs Assessment Narrative

The enactment of the Resource Conservation and Recovery Act (RCRA) has had a dramatic affect on the solid waste industry, both positive and negative. *Subtitle D* of RCRA and other regulations that govern siting, design, construction, operation and eventual closure has likewise affected the financial ability of landfills to fund necessary capital and operating costs. The paradigm of landfill ownership / management has changed dramatically over the past years and will continue to evolve for both public and private sector entities.

Nationally the generation, recycling and disposal of municipal solid waste (MSW) has also changed substantially. In 1960 the average MSW generation per person per day was 2.7 pounds. That number grew to 3.7 pounds per person per day in 1980 and increased to 4.5 pounds per person per day in the 1990's. Studies concur that the number has stabilized over the past ten years at approximately 4.5 pounds per person per day.[15]

Based on 2000 population numbers the amount of MSW generated in the US was 231.9 million tons an increase of .03 percent (900,000 tons) from the 1999 figures; approximately 55.3 percent (128,240,000 tons) of the total MSW generated was land filled.[16]

According to the *Directory of Solid Waste Disposal,* the percentage of landfill facilities owned by the public sector declined from 83% in 1984 to 73% in 1997 and 64% in 1998.[17]. Current estimates place the figure below 40%. Even with growing populations and a dramatic increase of the waste stream 8,000 operating landfills in 1988 declined to approximately 3,000 in 1996; by 2000 that number declined to 1,967 while the average size of landfills increased dramatically.[18]

Approximately one half of the operating landfills in population areas over 100,000 residents were operated by the public sector; another 10 percent were publicly owned but operated by private firms through a variety of contractual arrangements. The balance of the landfills (38%) were both privately owned and privately operated. These numbers shown that approximately half of the nation's landfills were privately owned and operated.[19]

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[15] United States Environmental Protection Agency *Municipal Solid Waster in the United States: 2000 Facts and Figures*, page 5

[16] Ibid page 14

[17] Chartwell Information Publishers, 1998 www.wasteinfo.com *Directory of Solid Waste Disposal*, p.13.

[18] United States Environmental Protection Agency *Municipal Solid Waste in the United States: 2000 Facts and Figures*, June 2002 page 14

[19] Reason Public Policy Institute by Segal and Moore *Privatizing Landfills: Market Solutions for Solid-Waste Disposal*, page 2

Exporting MSW to remote megafills continues to be an economical method of waste management for many large metropolitan producers. A 1999 study conducted by Houston's Public Works and Engineering Department found that considering the 30 largest US cities only 13 owned landfill, two of the 13 had privatized their MSW operation and a third was studying privatization.[20]

Although private firms owned only 38% of the total number of landfills for communities with populations over 100,000 they disposed of 58% (expressed in tons) of municipal solid waste. It should be noted that the private firms owned over 67% of the total landfill capacity. By comparison the public agencies owned 62% of landfill for communities with population over 100,000 but they accounted for only 42% of the municipal solid waste, again expressed in tons. The public sector owned only 33% of the disposal capacity[21].

The paradigm shift to large, remote, privately owned megafills is clear. Private sector entities usually have greater access to capital markets and are able to adapt quickly to new and innovative methods of siting, construction, transportation and operation. This flexibility develops efficient and cost effective disposal solutions for clients over an ever-expanding market area.

In 1993 disposal rates nationally at municipal and private landfills in the North East were at $85.00 to $135.00 per ton[22]. Information gathered by *Chartwell Information* shows that in February 2003 the national average disposal rates for MSW was $36.93/ton with an average daily volume of 1.082 million tons[23].

In Utah the primary source for commercial nonhazardous solid waste is centered along the Wasatch Front. This is more specifically defined as communities from Brigham City in the north to Nephi in the south, Kamas in the east and Grantsville in the west. This is where Utah's predominate concentration of the 2.2 million people live and where rail lines, transfer stations and surface roads facilitate the transportation of the current waste stream.

The population of the Wasatch Front is expected to grow an additional one million people by the year 2020 according to Envision Utah Annual Report. As reported in the Department of Environmental Quality (DEQ) Division of Solid and Hazardous Waste Plan Update, dated March 2002, the per person generation of 5.97 lb/person/day translates the population increase to approximately 1.1 million tons of additional MSW

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[20] City of Houston, Public Works and Engineering Department, *Survey of Large Cities' Solid Waste management Systems*, revised April 1999

[21] Reason Public Policy Institute by Segal and Moore *Privatizing Landfills: Market Solutions for Solid-Waste Disposal*, pages 2 & 3

[22] Reason Public Policy Institute, *Mandates or Incentives? Comparing Packaging Regulations with User Fees for Trash Collection* May 1993 by Lynn Scarlett page 21

[23] Chartwell Information, www.wasteinfo.com *Solid Waste Market Data & Research*, April 10, 2003.

by the year 2020. This source represents a 44% increase in Utah's current 2,467,915 tons of MSW.[24]

Utah imported 122,753 tons of MSW from 1995 to 2000 with a total of 65,844 tons imported in 2000 alone[25]. This will continue to increase as MSW landfills continue to follow the national trend of closing local MSW landfills and transporting their waste streams to mega regional landfills.

In addition, from 1994 to 2000, Utah generated and disposed of an average of 446,702 tons of industrial waste. In 2000, Utah generated and disposed of 580,407 tons of industrial waste, an increase of 30% over the 1994-2000 six year average[26].

From 1994 to 2000, Utah imported 3,568,411 tons of Industrial Waste, an average 509,773 tons per year. Additionally, Utah generated and disposed of 3,126,913 tons of Industrial Waste during the same period, a yearly average of 446,702 tons[27].

While the Wasatch Front may serve as the primary source of Solitude's MSW waste stream, significant quantities may be shipped by rail both regionally and nationally. Deregulation of the rail industry helped fuel the substantial decreases in the number of MSW facilities nationally and the increase of regional megafills.

Disposal rates locally, as nationally continue to increase in an effort to maintain a balance between regulatory requirements and operating expenses. Rates along the Wasatch Front range between $11.00 per ton at Tans Jordan Landfill for member municipalities to over $30.00 per ton at Utah County's North Pointe and the Salt Lake Valley Transfer Station[28]. Trans Jordan management indicated their Board is currently reviewing new pricing strategies that will result in an increase in prices.

North Point, Salt Lake Valley and Weber County Transfer Station contract with the only Class V Landfill in the State licensed to receive MSW, East Carbon Development Corporation, (ECDC). The monopolistic control of ECDC has produced concern over the ability of the municipalities and transfer stations to effectively manage their costs, both now and in the future.

On March 13, 2003 a coalition of municipal solid waste (MSW) generators and landfill operators issued a request for proposal (RFP) seeking a qualified consultant to analyze public and private disposal facilities which are, or may be available to receive MSW from their facilities.

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[24] Department of Environmental Quality, Division of Solid and Hazardous Waste, *Utah Landfill Inventory*, March 2002 page 2

[25] Ibid 7

[26] Ibid page 12

[27] Ibid page 12

[28] Conversations with administrators of MSW facilities along the Wasatch Front, 2002 and 2003

Of specific importance is that the coalition included all of the MSW generators along the Wasatch Front including: Cache, Weber, Box Elder, Davis, Salt Lake, Tooele and Utah Counties; the collective group accounts for approximately 85% of all of the MSW generated in Utah.

The Utah solid waste industry is clearly following the national and global trend of fewer but larger remote, disposal sites (megafills), which are owned and operated by profitable, private sector entities.

The March 13, 2003 (RFP) clearly reflects the need for competition in the Utah MSW market. Capacity alone is no substitute for competition.

Solitude landfill is designed and will provide public sector clients innovative and efficient methods of handling and transport of MSW, which will dramatically reduce overall expenses. Solitude will also provide services and access to equipment technologies not offered or utilized by other local or national MSW disposal facility.

Because of these efficient and cost savings innovations it will be possible for large metropolitan clients to export MSW over longer distances without dramatically increase export fees.

As the only licensed and operating Class V commercial disposal facility in Utah ECDC offers an abundance of disposal area through yet undeveloped land. They are however, a monopoly with no competition to assure that their price for disposal is reasonable and competitive with newer technologies and a landfill site that offers a safer disposal facility utilizing new and proven methods of handling and disposal.

Because Solitude landfill has obtained a Class I permit and is able to offer alternative methods of disposal and competitive price in a safer disposal environment ECDC is finally offering a variety of disposal options with the promise of competitive pricing. It is clear that having an abundance of airspace is not the only consideration the DEQ can use in determining the need for permitting additional Class V landfills in Utah.

Advances in the technology of collection, handling and disposal of municipal solid waste through transfer stations has likewise demanded advances in the technology in handling, transportation, siting of landfill facilities and the ultimate disposal of a waste stream that is both economical and environmentally safe.

The Solitude landfill is located in a remote, seclude area that is accessed by both rail and surface sources but more importantly it is in a unique siting that provides exceptional benefits in low annual precipitation, high evaporation, a geological strata with little or poor quality ground water and a barrier of over 1,100 feet of dense Mancos shale.

According to DEQ's *Utah Solid Waste Plan Update,*

> ***"As the population has increased the need for more disposal volume and the need for alternatives to disposal has become apparent. Siting of new landfills becomes more difficult as population grows and availability of land that is suited for landfill siting is limited by encroaching housing and other land uses."***[29]

Because ECDC is the only class V Landfill licensed in the State to receive MSW, these political subdivision's future disposal options are severally restricted. ECDC's monopolistic control of class V waste streams inhibits these communities ability to compare the market place's most competitive prices and newest technologies.

The fundamental goal for the public sector client to outsource is not only to provide continued economical sound service to their constituents but the goal of reducing the potential of environmental liability during the disposal, closure and post closure periods.

The lack of competition can only exacerbate a community's ability to provide the most competitive prices, technologically advanced and most environmentally safe management of their communities waste streams.

While capacity is of some concern, of more importance is the lack of viable landfill sites permitted in this area, thus inhibiting the competitive options for local and national entities. Additionally, urbanization continues to encroach on rural areas limiting the options available for politically and economically acceptable landfill sites.

The permitting of Solitude as a Class V Landfill will give local and national market clients an environmentally sound and safe landfill site that utilizes a variety of handling and transportation technologies that will result in competitive, safe disposal price.

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[29] Department of Environmental Quality, Division of Solid and Hazardous Waste, *Utah Solid Waste Plan Update,* March 2002 page 7

5. Conclusions

The March 13, 2003 request for proposal (RFP) initiated by all of the municipal solid waste (MSW) generators along the Wasatch Front indicates that Utah is moving in a similar direction as the national and global markets have taken in past years to solve MSW handling and disposal needs.

The action of the MSW generators in Utah will evaluate large, privately owned and efficiently operated 'megafills', which are capable of serving multiple public and private sector clients who are situated over a large geographical area. Currently only one Class V landfill is licensed and is in operation in the State of Utah.

The East Carbon Development Company located in Carbon County, Utah enjoys monopoly status as the only Class V landfill licensed to serve both Utah and out of state clients. They defend their position because of the large unused reserves of airspace within their facility.

Capacity of the only permitted Class V landfill must not be the base criteria for evaluation of competition by the Department of Environmental Quality. This narrow evaluation method eliminates not only competition but does not consider technology advancements, developments in handling equipment, efficiencies in transportation and more cost efficient siting locations.

Government cannot allow only one provider of services to be permitted by a state agency. The most essential element of competition is totally eliminated allowing the monopolist to ignore market conditions, customer's needs and market developments. A monopoly has historically led to unfair market control, excessive profits and operational complacency.

Competition will require all private sector entities to be more responsive to both public and private sector clients. Competition also encourages landfill entities to explore creative out-sourcing options for the public sector producer of MSW.

Competition has and will be directed by well-managed, profitable entities that rely on creative innovations and technologies, which will continually shift and advance the paradigm of MSW management.

Disposal rates on both a local and national basis have and will continue to increase as regulatory and economic conditions dictate their direction. Currently disposal rates along the Wasatch Front range between $11.00 per ton at Trans Jordan for member municipalities to over $30.00 at North Point and the Salt Lake Valley Transfer Station[30].

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[30] Conversations with administrators of MSW facilities along the Wasatch Front 2002 and 2003

Nationally rates are considerably higher at $85.00 to $135.00 per ton at some locations in the North East[31]. Information gathered by *Chartwell Information* shows that in February 2003 the national average disposal rates was $36.93/ton with an average daily volume of 1.082 million tons[32]. A large amount of that MSW is exported to remote disposal areas; considering the 30 most populated areas in the US, only 13 operate landfills[33].

The Solitude Landfill has worked diligently to site a landfill that is superior in every way to existing facilities in the Mountain Region and is implementing advancements in MSW handling technologies to provide a landfill that will be environmentally safe yet able to accommodate new paradigms for MSW disposal.

The Solitude Landfill's advances in MSW handling combined with competition for rail contracts have created significant transportation cost savings allowing MSW to be transported longer distances with minimal increase in cost. These advancements have placed a number of metropolitan areas within the Solitude Landfill market area.

It is clear that when evaluated in all areas including siting, design, transportation corridors, public and environmental safety, use of technology advancements, economics, closure and post closure maintenances the Solitude Landfill will be the most efficient and popular Class V landfill in the State of Utah.

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[31] Reason Public Policy Institute, *Mandates or Incentives? Comparing Packaging Regulations with User Fees for Trash Collection* by Lynn Scarlett page 21

[32] Chartwell Information Solid Waste Market Data & Research, April 10, 2003.

[33] City of Houston, Public Works and Engineering Department, *Survey of Large Cities' Solid Waste management Systems,* revised April 1999

6. References

Department of Environmental Quality, Division of Solid & Hazardous Waste, *Utah Landfill Inventory*, March 2002

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Segal, G.F. and Moore, A.T. Reason Public Policy Institute *Privatizing Landfills: Market Solutions for Solid-Waste Disposal,* May 2000

Lynn Scarlett, Reason Public Policy Institute, *Mandates or Incentives? Comparing Packaging Regulations with User Fees for Trash Collection* May 1993

AGREEMENT FOR SOLID WASTE DISPOSAL

THIS AGREEMENT is made and entered into as of this 13th day of August, 2002, by and between the City of Green River, a municipal corporation with official mailing address at P.O. Box 620 Green River, Utah 84525 (the "City") and Landfill Investors, L.L.C., a Nevada limited liability company ("Landfill"), as the authorized Agent-in-Fact for Green River Landfill, LLC, a Utah limited liability company ("Green River") (Landfill and Green River may sometimes hereinafter be collectively referred to as the "Owner"), whose mailing address is 4570 Westgrove Drive, Suite 240 Addison, Texas 75001.

WHEREAS, Owner owns a parcel of land located within the jurisdictional boundaries of the City and may from time to time acquire additional land contiguous to said parcel for the purpose of constructing and operation a Class V landfill (with the Municipal Exemption); and

WHEREAS, Owner has applied for a Class V Solid Waste (with the Municipal Exemption) Permit in the name of the *Solitude Landfill* ("Solitude") from the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste; and

WHEREAS, Owner and the City entered into a Memorandum of Understanding on the 12th day of February 2002 (the "MOU") which, among other matters, contemplates that prior to the City's issuance of certain permits for the construction, development and operation of Solitude by Owner, the City and Owner will negotiate and agree upon the Host Fees that will be due and payable to the City by Owner as a result of Owner's operation of Solitude (the "Host Fees"); and

WHEREAS, the Utah Solid Waste Management Act, Section 26-32-1, et. seq., Utah Code Annotated 1953, as amended (the "Act"), provides that the governing body of a public entity may assume, by agreement, responsibility for the collection and disposition of solid waste whether generated within or outside of it's jurisdictional boundaries and that the said governing body may enter into long-term agreements with private entities to provide for the operation of a solid waste management facility; and

WHEREAS, the City and Owner are desirous of expanding the benefits provided to the City under the MOU by contracting with each other to provide for the disposal and management of solid waste generated by households, governmental offices and retail establishments within the City (the "City's Solid Waste"), provided that in any given year the annual tonnage of such solid waste does not exceed the prior years tonnage by more than ten percent (10%).

Initials: BJS

NOW THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the City and Owner agree as follows:

1. *Disposal Site for the City's Solid Waste.* Owner agrees to provide, at no cost to the City, a space within Solitude for the disposal of the City's Solid Waste; provided, however, that the City's Solid Waste must be lawfully transported to Solitude by commercial carriers only at the City's sole expense. City and Owner further agree that Solitude shall not be open or otherwise be made available for access by the general public and that access thereto for the deposit of the City's Solid Waste shall be restricted to those entities licensed by City and approved by Owner for the transport of the City's Solid Waste from the City to Solitude; provided such entities deliver or transport City's Solid Waste in a manner consistent with current practices for the transportation and delivery of the City's Solid Waste to landfills currently owned or operated by Emery County, Utah.

   Owner hereby reserves the right to reject for disposal any and all of the City's Solid Waste which may be legally classified or identified as a material or substance other than Solid Waste as defined by the Act.

2. *No Host Fee Due for the City's Solid Waste.* Owner shall not owe, nor be liable to, the City for payment of any Host Fees for the disposal in Solitude of the City's Solid Waste.

3. *Term of Agreement.* This Agreement shall be effective upon its execution by City and Owner; provided, however, Owner shall not be obligated to accept the City's Solid Waster for deposit or disposal in Solitude until Owner commences operations at Solitude. This Agreement shall continue in full force and effect (i) so long as Solitude remains in operation under applicable permits issued by the State of Utah and the City or (ii) for ten (10) years following the first acceptance of the City's Solid Waste in Solitude, whichever occurs first.

   The City will have an option to renew this contract for an additional period of ten (10) years.

4. *Assignment.* This Agreement shall be assignable by Owner only upon the consent of City; provided that the City shall not unreasonably withhold such consent and provided further that the City's prior consent shall not be required for an assignment by Owner to any person or entity currently affiliated with Owner or any assignment by City to Owner.

5. *Applicable Law; Venue.* This Agreement shall be constructed and enforced in accordance with the provisions of the laws of the State of Utah. Venue of any actions brought to enforce, construe, cancel, terminate, rescind or recover for the breach of the provisions of the Agreement shall be in the courts of Salt Lake County, Utah.

6. *Entire Agreement.* The City and Owner acknowledge and agree that this Agreement contains the entire agreement between them and supercedes all previous discussions and oral agreements between them relating in any way to the arrangements for the deposit and delivery of the City's Solid Waste in Solitude and may only be modified or amended by a written agreement executed by both the Owner and the City.

7. *Agreement Binding.* This Agreement shall be binding upon and inure to the benefit of the City's and Owner's successors and assigns.

8. *Enforceability:* The City and Owner represent and warrant to the other that this Agreement is the authorized action of each, that this Agreement is duly executed in conformity with the requirements of all applicable law and that this Agreement is enforceable in accordance with its terms.

This Agreement was executed by Owner and presented to the Governing Body of the City of Green River and was accepted and approved by that Governing Body on the 13th day of August, 2002.

Attest:

Conae Black
City Recorder

City of Green River

By:
Its Mayor

Landfill Investors, LLC., on behalf of itself and as Agent-in-Fact for Green River, LLC

By:
Its President

Initials: BSS

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Kathleen Clark
Executive Director
John Kimball
Division Director

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January 10, 2002

Gretchen A. Semerad
ATC Associates, Inc.
2681 Parleys Way, Suite 106
Salt Lake City, UT 84109

Dear Ms. Semerad,

I am writing in response to your request dated December 27, 2001 for information regarding species of special concern proximal to the proposed Solitude Landfill project in Green River, Utah.

The Utah Division of Wildlife Resources (UDWR) does not have records of occurrence for any threatened, endangered, or sensitive species in the area of the proposed landfill site.

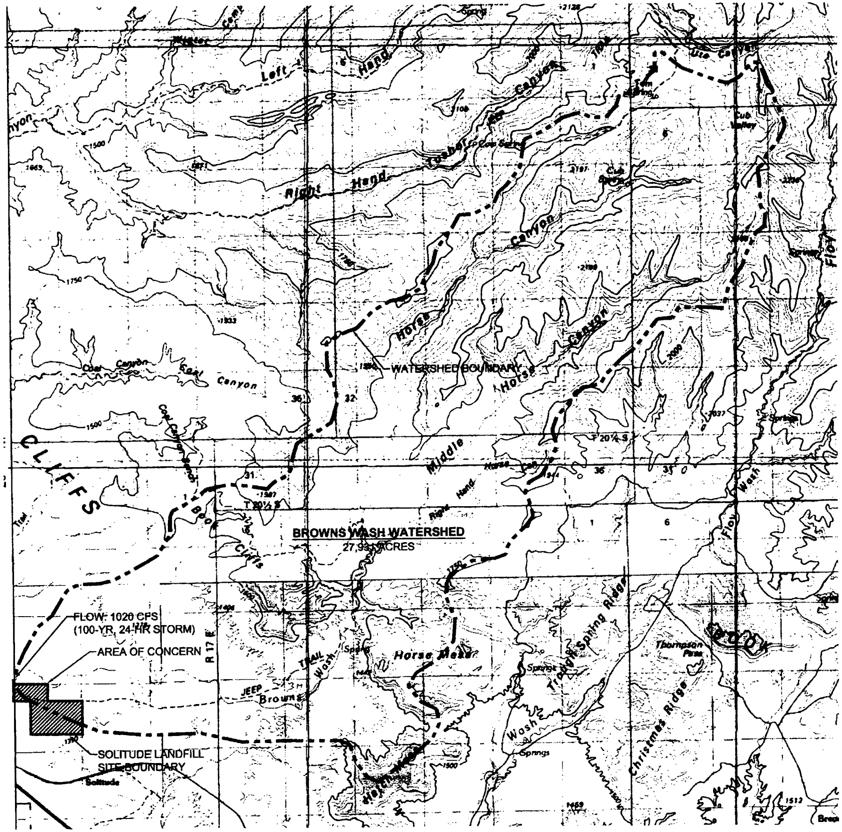
The information provided in this letter is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, and because data requests are evaluated for the specific type of proposed action, any given response is only appropriate for its respective request.

In addition to the information you requested, other significant wildlife values might also be present on the designated site. Please contact UDWR's regional habitat manager, Derris Jones, at (435) 636-0267, if you have any questions.

The UNHP normally charges for this type of request, but due to the small amount of research and time required to fulfill this request, you will not be charged for this information. Please contact our office at (801) 538-4759 if you require further assistance.

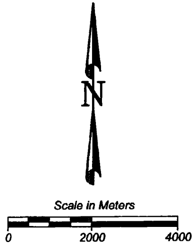
Sincerely,
Anne Axel
Information Manger

APPENDIX G ENGINEERING CALCULATIONS

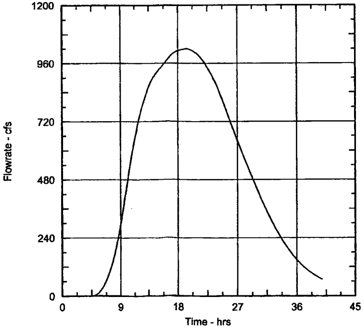


SOLITUDE LANDFILL

BROWNS WASH
SURFACE HYDROLOGY



SCS Hydrograph - Browns Wash
Peak Flow 1019.91 cfs - Time 19.2997 hrs



SOLITUDE LANDFILL

Browns Wash Surface Water Hydrology

TR-20 SCS Method

Given Input Data:

Description	Browns Wash
Drainage area	27930.74 ac
Runoff curve number, CN	65
Time of concentration, Tc	12.1455 hrs
Dimensionless Hydrograph	scsdim
Rainfall	2.63 in
Distribution Curve	tr20t2: Type 2, 24 hrs
Duration	24.0000 hrs
Antecendent Moisture Condition	Type II
Time Increment, Tp	0.1000 hrs

Computed Results:

Peak discharge, qp	1019.91 cfs
Peak Time, Tp	19.30 hrs
Peak rate factor	484
Constant, K	0.7500
Runoff Volume	0.68 in
	19273.54 cfs-hrs
	1592.77 acft

Hydraulics - Culvert Calculator

Given Input Data:

Channel Type	Trapezoidal
Flow Rate	1020 cfs
Slope	0.0035 ft/ft
Manning's Roughness	0.02 (Earth Channel)
Side Slope	3H:1V
Base Width	25 ft

Computed Results:

Velocity	8.3305 fps
Area	258.11 sf
Perimeter	62.98 ft
Wetted Area	122.32 sf
Wetted Perimeter	46.88 ft
Hydraulic Radius	2.61 ft
Top Width	45.76 ft
Percent Full	57.62 ft
Depth of Flow	3.46 ft

Hydrograph Output

```
#Units=Time,hrs,Flowrate,cfs
#SCS Hydrograph Data
#Time - hrs   Flowrate - cfs
#------------ -------------
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```

39.80000000	69.11010796
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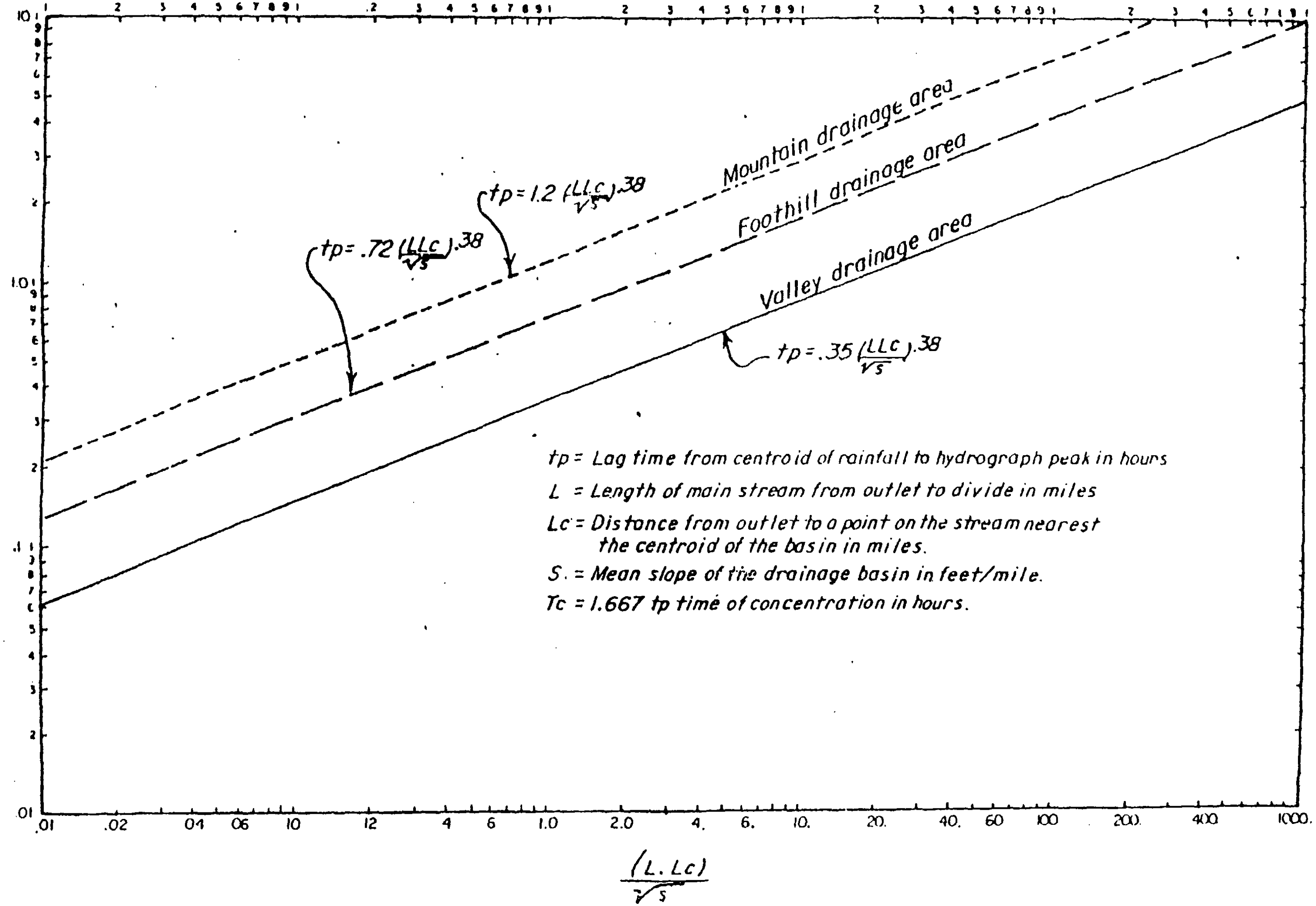
ITEX | Outfall Flows | DEW 11/15/94 2106-006

Purpose: Calculate max discharge of ~~mean~~ max outfall and use this flowrate to size the silt fence.

Assume: Flow from all contributing Areas peak at [illegible] same time
Four outfalls
25-yr, 24-hr storm
Waste cell is [illegible] (largest flow)
? "disturbed" ~~@~~ I belive, meaning cell has been stripped of vegetation

Determine Outfall Flows

1 →	1/2 of Area A	8
	Area B	60
	Area C	205
	Waste cell (200 acres)	375
		648 cfs
2 →	1/2 of Area A	8
	Waste cell (15 acres)	28
		36 cfs
3 →	Waste cell (65 acres)	122 cfs
4 →	[illegible] D	130
	[illegible] cell (40 acres)	75
		205 cfs



tp = Lag time from centroid of rainfall to hydrograph peak in hours

L = Length of main stream from outlet to divide in miles

Lc = Distance from outlet to a point on the stream nearest the centroid of the basin in miles.

S = Mean slope of the drainage basin in feet/mile.

Tc = 1.667 tp time of concentration in hours.

Relationship between basin lag and basin characteristics (U.S. Corps of Engineers)

ITEX | Runon Calcs | DEW 11/15/94 2106-006

Purpose: Calculate runon from ~~[illegible] areas~~ upgradient areas that surround the proposed site from the 25 yr - 24 hr ~~[illegible]~~ and 100 yr - 24 hr storm.

Assume: Runon from areas shown on ~~[illegible]~~ attached sheet
Use SCS method to calculate runoff
CN = 92 (Design of Small Dams, BOR 1977)
Areas are undisturbed with poor-condition herbaceous vegetation
Soil group is ([illegible]) → not sure, almost certain it is D
25 yr, 24 hr storm = 2.0" (NOAA Atlas 2, 1973)
100 yr, 24 hr storm = 2.5"
Four areas ([illegible]) produce runon

? probably just delete

	Area (mi^2)
A	0.014
B	0.058
C	0.19
D	0.14

Determine Time of Concentration (t_c)

$$t_c = 1.667(C)\left[(L)(L_c)(S)^{-1/2}\right]^{0.38}$$

C = constant based on drainage area
0.35 for valley drainage
0.72 for foothill drainage
1.2 for mountain drainage
L = Length of main stream (miles)
Lc = Distance from outlet to centroid of area (miles)
S = Mean slope (feet/mile)

A → L = 500'
L_c = 200'
S = 265 foot/mile
C = 0.72
t_c = 0.05 hr

B → L = 2000'
L_c = 700'
S = 90
C = 0.72
t_c = 0.16 hr

C → [illegible] 1200'
[illegible] 510'
S = 220
C = 0.72
t_c = 0.10 hr

D → L = 2800
L_c = 1200
S = 170
C = 0.72
t_c = 0.20 hr

```
ITEX, Site Runoff (Undisturbed, 0.25 sq. miles), 100-yr, 24 hr Storm
      STORM HYDROGRAPH  RAIN = 2.500  DURATION = 24.0  RUNOFF = 1.693
      STORM DISTRIBUTION IS SCS 24-HR
      CURVE NUMBER METHOD   CN =92.0

             TIME        RAINFALL      NET RAIN      DISCHARGE
            (HOURS)      (INCHES)      (INCHES)       (CFS)

            22.500      .0030      .0028      4.52
            22.600      .0030      .0028      4.52
            22.700      .0030      .0028      4.52
            22.800      .0030      .0028      4.52
            22.900      .0030      .0028      4.52
            23.000      .0030      .0028      4.52
            23.100      .0030      .0028      4.52
            23.200      .0030      .0028      4.52
            23.300      .0030      .0028      4.52
            23.400      .0030      .0028      4.53
            23.500      .0030      .0028      4.53
            23.600      .0030      .0028      4.53
            23.700      .0030      .0028      4.53
            23.800      .0030      .0028      4.53
            23.900      .0030      .0028      4.53
            24.000      .0030      .0028      4.53
            24.100      .0000      .0000      4.53
            24.200      .0000      .0000      1.50
            24.300      .0000      .0000       .34
            24.400      .0000      .0000       .06
            24.500      .0000      .0000       .00

            TOTALS          2.500        1.6931       2761.68

      STORM HYDROGRAPH VOLUME =       22.82  ACRE-FEET
      MAXIMUN STORM DISCHARGE =     362.05  CFS
```

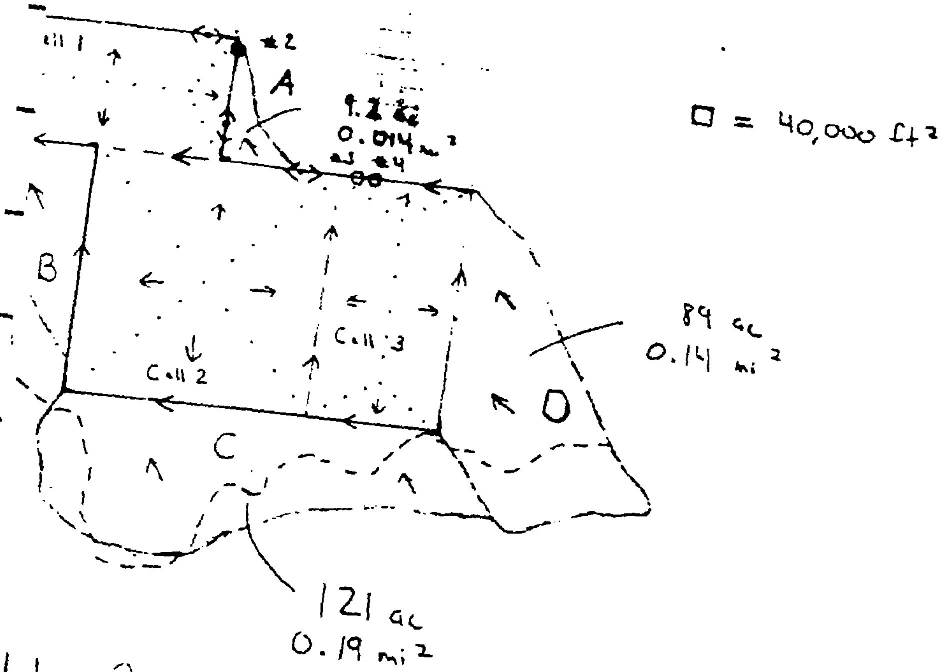
ITEX | Runon Calcs | DEW 11/15/94, 2106-006

Calculate Runoff

Flow (cfs)

Area	25-yr 24-hr	100-yr 24-hr	10-yr, 24-hr
A	15	20	12
B	60	20	42
C	200	275	150
D	130	175	110
	410		

ITEX, 2106-006, DEW, 11/15/94



ulate Drainage Areas

ITEX, Drainage "A" Runon, 25-yr, 24 hr Storm

```
STORM HYDROGRAPH  RAIN = 2.000  DURATION = 24.0  RUNOFF = 1.237
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD   CN =92.0

      TIME       RAINFALL      NET RAIN     DISCHARGE
     (HOURS)      (INCHES)     (INCHES)      (CFS)

      .000      .0000      .0000      .00
      .100      .0024      .0000      .00
      .200      .0024      .0000      .00
      .300      .0024      .0000      .00
      .400      .0024      .0000      .00
      .500      .0024      .0000      .00
      .600      .0024      .0000      .00
      .700      .0024      .0000      .00
      .800      .0024      .0000      .00
      .900      .0024      .0000      .00
     1.000      .0024      .0000      .00
                     NO RUNOFF
     6.500      .0040      .0000      .00
     6.600      .0040      .0001      .00
     6.700      .0040      .0001      .01
     6.800      .0040      .0001      .01
     6.900      .0040      .0002      .01
     7.000      .0040      .0002      .02
     7.100      .0040      .0002      .02
     7.200      .0040      .0003      .02
     7.300      .0040      .0003      .02
     7.400      .0040      .0003      .03
     7.500      .0040      .0004      .03
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     7.700      .0040      .0004      .04
     7.800      .0040      .0005      .04
     7.900      .0040      .0005      .04
     8.000      .0040      .0005      .04
     8.100      .0054      .0008      .05
     8.200      .0054      .0008      .06
     8.300      .0054      .0009      .07
     8.400      .0054      .0009      .08
     8.500      .0054      .0010      .08
     8.600      .0054      .0010      .08
     8.700      .0054      .0011      .09
     8.800      .0054      .0011      .09
     8.900      .0054      .0012      .10
     9.000      .0054      .0012      .10
     9.100      .0064      .0015      .11

     9.200      .0064      .0016      .13
     9.300      .0064      .0016      .14
     9.400      .0064      .0017      .14
     9.500      .0064      .0017      .15
     9.600      .0072      .0020      .15
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9.700	.0072	.0021	.17
9.800	.0072	.0022	.18
9.900	.0072	.0022	.19
10.000	.0072	.0023	.19
10.100	.0092	.0030	.20
10.200	.0092	.0031	.26
10.300	.0092	.0032	.27
10.400	.0092	.0033	.28
10.500	.0092	.0034	.29
10.600	.0124	.0048	.30
10.700	.0124	.0050	.40
10.800	.0124	.0051	.43
10.900	.0124	.0053	.45
11.000	.0124	.0054	.46
11.100	.0192	.0087	.47
11.200	.0192	.0090	.72
11.300	.0192	.0093	.78
11.400	.0192	.0096	.81
11.500	.0192	.0099	.84
11.600	.0832	.0461	.87
11.700	.0832	.0504	3.61
11.800	.1520	.1011	4.33
11.900	.2208	.1621	8.26
12.000	.2208	.1749	13.43
12.100	.0288	.0235	15.12
12.200	.0288	.0237	3.85
12.300	.0288	.0238	2.24
12.400	.0288	.0240	2.09
12.500	.0288	.0241	2.10
12.600	.0148	.0124	2.11
12.700	.0148	.0125	1.23
12.800	.0148	.0125	1.10
12.900	.0148	.0125	1.09
13.000	.0148	.0126	1.10
13.100	.0108	.0092	1.10
13.200	.0108	.0092	.84
13.300	.0108	.0092	.81
13.400	.0108	.0092	.81
13.500	.0108	.0092	.81
13.600	.0084	.0072	.81
13.700	.0084	.0072	.66
13.800	.0084	.0072	.63
13.900	.0084	.0072	.63
14.000	.0084	.0072	.63
14.100	.0060	.0052	.63
14.200	.0060	.0052	.48
14.300	.0060	.0052	.46
14.400	.0060	.0052	.45
14.500	.0060	.0052	.45
14.600	.0060	.0052	.45
14.700	.0060	.0052	.46
14.800	.0060	.0052	.46
14.900	.0060	.0052	.46
15.000	.0060	.0052	.46
15.100	.0060	.0052	.46

15.200	.0060	.0052	.46
15.300	.0060	.0052	.46
15.400	.0060	.0052	.46
15.500	.0060	.0052	.46
15.600	.0060	.0052	.46
15.700	.0060	.0052	.46
15.800	.0060	.0052	.46
15.900	.0060	.0052	.46
16.000	.0060	.0052	.46
16.100	.0036	.0031	.46
16.200	.0036	.0032	.30
16.300	.0036	.0032	.28
16.400	.0036	.0032	.28
16.500	.0036	.0032	.28
16.600	.0036	.0032	.28
16.700	.0036	.0032	.28
16.800	.0036	.0032	.28
16.900	.0036	.0032	.28
17.000	.0036	.0032	.28
17.100	.0036	.0032	.28
17.200	.0036	.0032	.28
17.300	.0036	.0032	.28
17.400	.0036	.0032	.28
17.500	.0036	.0032	.28
17.600	.0036	.0032	.28
17.700	.0036	.0032	.28
17.800	.0036	.0032	.28
17.900	.0036	.0032	.28
18.000	.0036	.0032	.28
18.100	.0036	.0032	.28
18.200	.0036	.0032	.28
18.300	.0036	.0032	.28
18.400	.0036	.0032	.28
18.500	.0036	.0032	.28
18.600	.0036	.0032	.28
18.700	.0036	.0032	.28
18.800	.0036	.0032	.28
18.900	.0036	.0032	.28
19.000	.0036	.0032	.28
19.100	.0036	.0032	.28
19.200	.0036	.0032	.28
19.300	.0036	.0032	.28
19.400	.0036	.0032	.28
19.500	.0036	.0032	.28
19.600	.0036	.0032	.28
19.700	.0036	.0032	.28
19.800	.0036	.0032	.28
19.900	.0036	.0032	.28
20.000	.0036	.0032	.28
20.100	.0024	.0021	.28
20.200	.0024	.0021	.20
20.300	.0024	.0021	.19
20.400	.0024	.0021	.19
20.500	.0024	.0021	.19
20.600	.0024	.0021	.19

```
    20.700      .0024      .0021       .19
    20.800      .0024      .0021       .19
    20.900      .0024      .0021       .19
    21.000      .0024      .0021       .19
    21.100      .0024      .0021       .19
    21.200      .0024      .0021       .19
    21.300      .0024      .0021       .19
    21.400      .0024      .0021       .19
    21.500      .0024      .0021       .19
    21.600      .0024      .0021       .19
    21.700      .0024      .0021       .19
    21.800      .0024      .0021       .19
    21.900      .0024      .0021       .19
    22.000      .0024      .0021       .19
    22.100      .0024      .0021       .19
    22.200      .0024      .0021       .19
    22.300      .0024      .0021       .19
    22.400      .0024      .0021       .19
    22.500      .0024      .0021       .19
    22.600      .0024      .0021       .19
    22.700      .0024      .0021       .19
    22.800      .0024      .0021       .19
    22.900      .0024      .0021       .19
    23.000      .0024      .0021       .19
    23.100      .0024      .0021       .19
    23.200      .0024      .0021       .19
    23.300      .0024      .0021       .19
    23.400      .0024      .0021       .19
    23.500      .0024      .0021       .19
    23.600      .0024      .0021       .19
    23.700      .0024      .0021       .19
    23.800      .0024      .0021       .19
    23.900      .0024      .0021       .19
    24.000      .0024      .0021       .19
    24.100      .0000      .0000       .19
    24.200      .0000      .0000       .03
    24.300      .0000      .0000       .00
    24.400      .0000      .0000       .00

      TOTALS        2.000      1.2370      108.44

STORM HYDROGRAPH VOLUME =       .90  ACRE-FEET
MAXIMUN STORM DISCHARGE =     15.12  CFS
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ITEX, Drainage "B" Runon, 25-yr, 24 hr Storm

STORM HYDROGRAPH RAIN = 2.000 DURATION = 24.0 RUNOFF = 1.237
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD CN =92.0

TIME (HOURS)	RAINFALL (INCHES)	NET RAIN (INCHES)	DISCHARGE (CFS)
.000	.0000	.0000	.00
.100	.0024	.0000	.00
.200	.0024	.0000	.00
.300	.0024	.0000	.00
.400	.0024	.0000	.00
.500	.0024	.0000	.00
.600	.0024	.0000	.00
.700	.0024	.0000	.00
.800	.0024	.0000	.00
.900	.0024	.0000	.00
1.000	.0024	.0000	.00
	NO RUNOFF		
6.400	.0040	.0000	.00
6.500	.0040	.0000	.00
6.600	.0040	.0001	.01
6.700	.0040	.0001	.02
6.800	.0040	.0001	.03
6.900	.0040	.0002	.04
7.000	.0040	.0002	.06
7.100	.0040	.0002	.07
7.200	.0040	.0003	.08
7.300	.0040	.0003	.10
7.400	.0040	.0003	.11
7.500	.0040	.0004	.12
7.600	.0040	.0004	.13
7.700	.0040	.0004	.15
7.800	.0040	.0005	.16
7.900	.0040	.0005	.17
8.000	.0040	.0005	.18
8.100	.0054	.0008	.19
8.200	.0054	.0008	.23
8.300	.0054	.0009	.28
8.400	.0054	.0009	.31
8.500	.0054	.0010	.33
8.600	.0054	.0010	.35
8.700	.0054	.0011	.37
8.800	.0054	.0011	.39
8.900	.0054	.0012	.41
9.000	.0054	.0012	.43
9.100	.0064	.0015	.45
9.200	.0064	.0016	.50
9.300	.0064	.0016	.56
9.400	.0064	.0017	.59
9.500	.0064	.0017	.62
9.600	.0072	.0020	.64

9.700	.0072	.0021	.70
9.800	.0072	.0022	.76
9.900	.0072	.0022	.80
10.000	.0072	.0023	.83
10.100	.0092	.0030	.86
10.200	.0092	.0031	.98
10.300	.0092	.0032	1.12
10.400	.0092	.0033	1.19
10.500	.0092	.0034	1.24
10.600	.0124	.0048	1.28
10.700	.0124	.0050	1.51
10.800	.0124	.0051	1.75
10.900	.0124	.0053	1.87
11.000	.0124	.0054	1.95
11.100	.0192	.0087	2.02
11.200	.0192	.0090	2.55
11.300	.0192	.0093	3.12
11.400	.0192	.0096	3.39
11.500	.0192	.0099	3.56
11.600	.0832	.0461	3.69
11.700	.0832	.0504	9.30
11.800	.1520	.1011	15.58
11.900	.2208	.1621	25.81
12.000	.2208	.1749	43.83
12.100	.0288	.0235	58.07
12.200	.0288	.0237	40.86
12.300	.0288	.0238	19.52
12.400	.0288	.0240	12.61
12.500	.0288	.0241	10.07
12.600	.0148	.0124	9.15
12.700	.0148	.0125	7.40
12.800	.0148	.0125	5.61
12.900	.0148	.0125	5.04
13.000	.0148	.0126	4.84
13.100	.0108	.0092	4.78
13.200	.0108	.0092	4.27
13.300	.0108	.0092	3.75
13.400	.0108	.0092	3.59
13.500	.0108	.0092	3.54
13.600	.0084	.0072	3.52
13.700	.0084	.0072	3.21
13.800	.0084	.0072	2.90
13.900	.0084	.0072	2.80
14.000	.0084	.0072	2.77
14.100	.0060	.0052	2.76
14.200	.0060	.0052	2.44
14.300	.0060	.0052	2.13
14.400	.0060	.0052	2.02
14.500	.0060	.0052	1.99
14.600	.0060	.0052	1.98
14.700	.0060	.0052	1.98
14.800	.0060	.0052	1.98
14.900	.0060	.0052	1.98
15.000	.0060	.0052	1.98
15.100	.0060	.0052	1.99

15.200	.0060	.0052	1.99
15.300	.0060	.0052	1.99
15.400	.0060	.0052	1.99
15.500	.0060	.0052	1.99
15.600	.0060	.0052	1.99
15.700	.0060	.0052	2.00
15.800	.0060	.0052	2.00
15.900	.0060	.0052	2.00
16.000	.0060	.0052	2.00
16.100	.0036	.0031	2.00
16.200	.0036	.0032	1.68
16.300	.0036	.0032	1.36
16.400	.0036	.0032	1.25
16.500	.0036	.0032	1.22
16.600	.0036	.0032	1.20
16.700	.0036	.0032	1.20
16.800	.0036	.0032	1.20
16.900	.0036	.0032	1.21
17.000	.0036	.0032	1.21
17.100	.0036	.0032	1.21
17.200	.0036	.0032	1.21
17.300	.0036	.0032	1.21
17.400	.0036	.0032	1.21
17.500	.0036	.0032	1.21
17.600	.0036	.0032	1.21
17.700	.0036	.0032	1.21
17.800	.0036	.0032	1.21
17.900	.0036	.0032	1.21
18.000	.0036	.0032	1.21
18.100	.0036	.0032	1.21
18.200	.0036	.0032	1.21
18.300	.0036	.0032	1.21
18.400	.0036	.0032	1.21
18.500	.0036	.0032	1.21
18.600	.0036	.0032	1.21
18.700	.0036	.0032	1.21
18.800	.0036	.0032	1.21
18.900	.0036	.0032	1.21
19.000	.0036	.0032	1.21
19.100	.0036	.0032	1.22
19.200	.0036	.0032	1.22
19.300	.0036	.0032	1.22
19.400	.0036	.0032	1.22
19.500	.0036	.0032	1.22
19.600	.0036	.0032	1.22
19.700	.0036	.0032	1.22
19.800	.0036	.0032	1.22
19.900	.0036	.0032	1.22
20.000	.0036	.0032	1.22
20.100	.0024	.0021	1.22
20.200	.0024	.0021	1.06
20.300	.0024	.0021	.89
20.400	.0024	.0021	.84
20.500	.0024	.0021	.82
20.600	.0024	.0021	.81

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    20.700     .0024     .0021      .81
    20.800     .0024     .0021      .81
    20.900     .0024     .0021      .81
    21.000     .0024     .0021      .81
    21.100     .0024     .0021      .82
    21.200     .0024     .0021      .82
    21.300     .0024     .0021      .82
    21.400     .0024     .0021      .82
    21.500     .0024     .0021      .82
    21.600     .0024     .0021      .82
    21.700     .0024     .0021      .82
    21.800     .0024     .0021      .82
    21.900     .0024     .0021      .82
    22.000     .0024     .0021      .82
    22.100     .0024     .0021      .82
    22.200     .0024     .0021      .82
    22.300     .0024     .0021      .82
    22.400     .0024     .0021      .82
    22.500     .0024     .0021      .82
    22.600     .0024     .0021      .82
    22.700     .0024     .0021      .82
    22.800     .0024     .0021      .82
    22.900     .0024     .0021      .82
    23.000     .0024     .0021      .82
    23.100     .0024     .0021      .82
    23.200     .0024     .0021      .82
    23.300     .0024     .0021      .82
    23.400     .0024     .0021      .82
    23.500     .0024     .0021      .82
    23.600     .0024     .0021      .82
    23.700     .0024     .0021      .82
    23.800     .0024     .0021      .82
    23.900     .0024     .0021      .82
    24.000     .0024     .0021      .82
    24.100     .0000     .0000      .82
    24.200     .0000     .0000      .49
    24.300     .0000     .0000      .16
    24.400     .0000     .0000      .05
    24.500     .0000     .0000      .01
    24.600     .0000     .0000      .00

      TOTALS        2.000      1.2370      472.13

STORM HYDROGRAPH VOLUME =      3.90  ACRE-FEET
MAXIMUN STORM DISCHARGE =     58.07  CFS
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ITEX, Drainage "C" Runon, 25-yr, 24 hr Storm

STORM HYDROGRAPH RAIN = 2.000 DURATION = 24.0 RUNOFF = 1.237
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD CN =92.0

TIME (HOURS)	RAINFALL (INCHES)	NET RAIN (INCHES)	DISCHARGE (CFS)
.000	.0000	.0000	.00
.100	.0024	.0000	.00
.200	.0024	.0000	.00
.300	.0024	.0000	.00
.400	.0024	.0000	.00
.500	.0024	.0000	.00
.600	.0024	.0000	.00
.700	.0024	.0000	.00
.800	.0024	.0000	.00
.900	.0024	.0000	.00
1.000	.0024	.0000	.00
	NO RUNOFF		
6.400	.0040	.0000	.00
6.500	.0040	.0000	.00
6.600	.0040	.0001	.03
6.700	.0040	.0001	.07
6.800	.0040	.0001	.12
6.900	.0040	.0002	.16
7.000	.0040	.0002	.20
7.100	.0040	.0002	.25
7.200	.0040	.0003	.29
7.300	.0040	.0003	.33
7.400	.0040	.0003	.37
7.500	.0040	.0004	.41
7.600	.0040	.0004	.45
7.700	.0040	.0004	.49
7.800	.0040	.0005	.53
7.900	.0040	.0005	.57
8.000	.0040	.0005	.60
8.100	.0054	.0008	.64
8.200	.0054	.0008	.85
8.300	.0054	.0009	.97
8.400	.0054	.0009	1.05
8.500	.0054	.0010	1.11
8.600	.0054	.0010	1.17
8.700	.0054	.0011	1.24
8.800	.0054	.0011	1.30
8.900	.0054	.0012	1.36
9.000	.0054	.0012	1.42
9.100	.0064	.0015	1.47
9.200	.0064	.0016	1.73
9.300	.0064	.0016	1.87
9.400	.0064	.0017	1.97
9.500	.0064	.0017	2.05
9.600	.0072	.0020	2.12

9.700	.0072	.0021	2.38
9.800	.0072	.0022	2.54
9.900	.0072	.0022	2.64
10.000	.0072	.0023	2.73
10.100	.0092	.0030	2.82
10.200	.0092	.0031	3.45
10.300	.0092	.0032	3.78
10.400	.0092	.0033	3.96
10.500	.0092	.0034	4.09
10.600	.0124	.0048	4.21
10.700	.0124	.0050	5.37
10.800	.0124	.0051	5.95
10.900	.0124	.0053	6.24
11.000	.0124	.0054	6.45
11.100	.0192	.0087	6.65
11.200	.0192	.0090	9.41
11.300	.0192	.0093	10.74
11.400	.0192	.0096	11.36
11.500	.0192	.0099	11.80
11.600	.0832	.0461	12.17
11.700	.0832	.0504	42.26
11.800	.1520	.1011	57.34
11.900	.2208	.1621	103.47
12.000	.2208	.1749	171.02
12.100	.0288	.0235	204.99
12.200	.0288	.0237	89.22
12.300	.0288	.0238	43.38
12.400	.0288	.0240	31.98
12.500	.0288	.0241	29.64
12.600	.0148	.0124	29.80
12.700	.0148	.0125	20.19
12.800	.0148	.0125	16.53
12.900	.0148	.0125	15.66
13.000	.0148	.0126	15.51
13.100	.0108	.0092	15.55
13.200	.0108	.0092	12.76
13.300	.0108	.0092	11.71
13.400	.0108	.0092	11.47
13.500	.0108	.0092	11.43
13.600	.0084	.0072	11.45
13.700	.0084	.0072	9.76
13.800	.0084	.0072	9.12
13.900	.0084	.0072	8.97
14.000	.0084	.0072	8.95
14.100	.0060	.0052	8.96
14.200	.0060	.0052	7.26
14.300	.0060	.0052	6.61
14.400	.0060	.0052	6.45
14.500	.0060	.0052	6.42
14.600	.0060	.0052	6.43
14.700	.0060	.0052	6.43
14.800	.0060	.0052	6.44
14.900	.0060	.0052	6.44
15.000	.0060	.0052	6.45
15.100	.0060	.0052	6.45

15.200	.0060	.0052	6.46
15.300	.0060	.0052	6.46
15.400	.0060	.0052	6.47
15.500	.0060	.0052	6.47
15.600	.0060	.0052	6.48
15.700	.0060	.0052	6.48
15.800	.0060	.0052	6.49
15.900	.0060	.0052	6.49
16.000	.0060	.0052	6.50
16.100	.0036	.0031	6.50
16.200	.0036	.0032	4.77
16.300	.0036	.0032	4.10
16.400	.0036	.0032	3.94
16.500	.0036	.0032	3.91
16.600	.0036	.0032	3.91
16.700	.0036	.0032	3.91
16.800	.0036	.0032	3.91
16.900	.0036	.0032	3.91
17.000	.0036	.0032	3.92
17.100	.0036	.0032	3.92
17.200	.0036	.0032	3.92
17.300	.0036	.0032	3.92
17.400	.0036	.0032	3.92
17.500	.0036	.0032	3.92
17.600	.0036	.0032	3.93
17.700	.0036	.0032	3.93
17.800	.0036	.0032	3.93
17.900	.0036	.0032	3.93
18.000	.0036	.0032	3.93
18.100	.0036	.0032	3.93
18.200	.0036	.0032	3.93
18.300	.0036	.0032	3.94
18.400	.0036	.0032	3.94
18.500	.0036	.0032	3.94
18.600	.0036	.0032	3.94
18.700	.0036	.0032	3.94
18.800	.0036	.0032	3.94
18.900	.0036	.0032	3.95
19.000	.0036	.0032	3.95
19.100	.0036	.0032	3.95
19.200	.0036	.0032	3.95
19.300	.0036	.0032	3.95
19.400	.0036	.0032	3.95
19.500	.0036	.0032	3.95
19.600	.0036	.0032	3.96
19.700	.0036	.0032	3.96
19.800	.0036	.0032	3.96
19.900	.0036	.0032	3.96
20.000	.0036	.0032	3.96
20.100	.0024	.0021	3.96
20.200	.0024	.0021	3.08
20.300	.0024	.0021	2.74
20.400	.0024	.0021	2.66
20.500	.0024	.0021	2.64
20.600	.0024	.0021	2.64

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 20.700    .0024    .0021    2.65
 20.800    .0024    .0021    2.65
 20.900    .0024    .0021    2.65
 21.000    .0024    .0021    2.65
 21.100    .0024    .0021    2.65
 21.200    .0024    .0021    2.65
 21.300    .0024    .0021    2.65
 21.400    .0024    .0021    2.65
 21.500    .0024    .0021    2.65
 21.600    .0024    .0021    2.65
 21.700    .0024    .0021    2.65
 21.800    .0024    .0021    2.65
 21.900    .0024    .0021    2.65
 22.000    .0024    .0021    2.65
 22.100    .0024    .0021    2.65
 22.200    .0024    .0021    2.65
 22.300    .0024    .0021    2.65
 22.400    .0024    .0021    2.66
 22.500    .0024    .0021    2.66
 22.600    .0024    .0021    2.66
 22.700    .0024    .0021    2.66
 22.800    .0024    .0021    2.66
 22.900    .0024    .0021    2.66
 23.000    .0024    .0021    2.66
 23.100    .0024    .0021    2.66
 23.200    .0024    .0021    2.66
 23.300    .0024    .0021    2.66
 23.400    .0024    .0021    2.66
 23.500    .0024    .0021    2.66
 23.600    .0024    .0021    2.66
 23.700    .0024    .0021    2.66
 23.800    .0024    .0021    2.66
 23.900    .0024    .0021    2.66
 24.000    .0024    .0021    2.66
 24.100    .0000    .0000    2.66
 24.200    .0000    .0000     .88
 24.300    .0000    .0000     .20
 24.400    .0000    .0000     .04
 24.500    .0000    .0000     .00

   TOTALS      2.000     1.2370     1533.46

STORM HYDROGRAPH VOLUME =      12.67  ACRE-FEET
MAXIMUN STORM DISCHARGE =    204.99  CFS
```

ITEX, Drainage "D" Runon, 25-yr, 24 hr Storm

```
STORM HYDROGRAPH  RAIN = 2.000  DURATION = 24.0  RUNOFF = 1.237
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD   CN =92.0

    TIME      RAINFALL     NET RAIN     DISCHARGE
  (HOURS)     (INCHES)     (INCHES)     (CFS)

   .000     .0000     .0000      .00
   .100     .0024     .0000      .00
   .200     .0024     .0000      .00
   .300     .0024     .0000      .00
   .400     .0024     .0000      .00
   .500     .0024     .0000      .00
   .600     .0024     .0000      .00
   .700     .0024     .0000      .00
   .800     .0024     .0000      .00
   .900     .0024     .0000      .00
  1.000     .0024     .0000      .00
            NO RUNOFF
  6.400     .0040     .0000      .00
  6.500     .0040     .0000      .00
  6.600     .0040     .0001      .01
  6.700     .0040     .0001      .03
  6.800     .0040     .0001      .06
  6.900     .0040     .0002      .09
  7.000     .0040     .0002      .12
  7.100     .0040     .0002      .15
  7.200     .0040     .0003      .19
  7.300     .0040     .0003      .22
  7.400     .0040     .0003      .25
  7.500     .0040     .0004      .28
  7.600     .0040     .0004      .30
  7.700     .0040     .0004      .33
  7.800     .0040     .0005      .36
  7.900     .0040     .0005      .39
  8.000     .0040     .0005      .42
  8.100     .0054     .0008      .44
  8.200     .0054     .0008      .52
  8.300     .0054     .0009      .63
  8.400     .0054     .0009      .71
  8.500     .0054     .0010      .76
  8.600     .0054     .0010      .82
  8.700     .0054     .0011      .86
  8.800     .0054     .0011      .91
  8.900     .0054     .0012      .95
  9.000     .0054     .0012      .99
  9.100     .0064     .0015     1.04
  9.200     .0064     .0016     1.14
  9.300     .0064     .0016     1.27
  9.400     .0064     .0017     1.36
  9.500     .0064     .0017     1.43
  9.600     .0072     .0020     1.49
```

9.700	.0072	.0021	1.61
9.800	.0072	.0022	1.75
9.900	.0072	.0022	1.85
10.000	.0072	.0023	1.92
10.100	.0092	.0030	1.99
10.200	.0092	.0031	2.23
10.300	.0092	.0032	2.55
10.400	.0092	.0033	2.74
10.500	.0092	.0034	2.87
10.600	.0124	.0048	2.98
10.700	.0124	.0050	3.39
10.800	.0124	.0051	3.97
10.900	.0124	.0053	4.31
11.000	.0124	.0054	4.53
11.100	.0192	.0087	4.70
11.200	.0192	.0090	5.64
11.300	.0192	.0093	7.00
11.400	.0192	.0096	7.76
11.500	.0192	.0099	8.23
11.600	.0832	.0461	8.59
11.700	.0832	.0504	18.01
11.800	.1520	.1011	32.80
11.900	.2208	.1621	53.31
12.000	.2208	.1749	90.93
12.100	.0288	.0235	126.84
12.200	.0288	.0237	107.03
12.300	.0288	.0238	57.63
12.400	.0288	.0240	35.80
12.500	.0288	.0241	27.20
12.600	.0148	.0124	23.13
12.700	.0148	.0125	18.64
12.800	.0148	.0125	14.30
12.900	.0148	.0125	12.40
13.000	.0148	.0126	11.68
13.100	.0108	.0092	11.38
13.200	.0108	.0092	10.42
13.300	.0108	.0092	9.16
13.400	.0108	.0092	8.61
13.500	.0108	.0092	8.41
13.600	.0084	.0072	8.33
13.700	.0084	.0072	7.78
13.800	.0084	.0072	7.02
13.900	.0084	.0072	6.69
14.000	.0084	.0072	6.57
14.100	.0060	.0052	6.51
14.200	.0060	.0052	5.97
14.300	.0060	.0052	5.20
14.400	.0060	.0052	4.87
14.500	.0060	.0052	4.74
14.600	.0060	.0052	4.68
14.700	.0060	.0052	4.66
14.800	.0060	.0052	4.67
14.900	.0060	.0052	4.67
15.000	.0060	.0052	4.67
15.100	.0060	.0052	4.68

15.200	.0060	.0052	4.68
15.300	.0060	.0052	4.69
15.400	.0060	.0052	4.69
15.500	.0060	.0052	4.69
15.600	.0060	.0052	4.70
15.700	.0060	.0052	4.70
15.800	.0060	.0052	4.70
15.900	.0060	.0052	4.71
16.000	.0060	.0052	4.71
16.100	.0036	.0031	4.71
16.200	.0036	.0032	4.18
16.300	.0036	.0032	3.39
16.400	.0036	.0032	3.05
16.500	.0036	.0032	2.92
16.600	.0036	.0032	2.86
16.700	.0036	.0032	2.84
16.800	.0036	.0032	2.84
16.900	.0036	.0032	2.84
17.000	.0036	.0032	2.84
17.100	.0036	.0032	2.84
17.200	.0036	.0032	2.84
17.300	.0036	.0032	2.84
17.400	.0036	.0032	2.84
17.500	.0036	.0032	2.85
17.600	.0036	.0032	2.85
17.700	.0036	.0032	2.85
17.800	.0036	.0032	2.85
17.900	.0036	.0032	2.85
18.000	.0036	.0032	2.85
18.100	.0036	.0032	2.85
18.200	.0036	.0032	2.85
18.300	.0036	.0032	2.85
18.400	.0036	.0032	2.86
18.500	.0036	.0032	2.86
18.600	.0036	.0032	2.86
18.700	.0036	.0032	2.86
18.800	.0036	.0032	2.86
18.900	.0036	.0032	2.86
19.000	.0036	.0032	2.86
19.100	.0036	.0032	2.86
19.200	.0036	.0032	2.86
19.300	.0036	.0032	2.86
19.400	.0036	.0032	2.87
19.500	.0036	.0032	2.87
19.600	.0036	.0032	2.87
19.700	.0036	.0032	2.87
19.800	.0036	.0032	2.87
19.900	.0036	.0032	2.87
20.000	.0036	.0032	2.87
20.100	.0024	.0021	2.87
20.200	.0024	.0021	2.60
20.300	.0024	.0021	2.20
20.400	.0024	.0021	2.03
20.500	.0024	.0021	1.96
20.600	.0024	.0021	1.93

```
        20.700      .0024      .0021      1.92
        20.800      .0024      .0021      1.92
        20.900      .0024      .0021      1.92
        21.000      .0024      .0021      1.92
        21.100      .0024      .0021      1.92
        21.200      .0024      .0021      1.92
        21.300      .0024      .0021      1.92
        21.400      .0024      .0021      1.92
        21.500      .0024      .0021      1.92
        21.600      .0024      .0021      1.92
        21.700      .0024      .0021      1.92
        21.800      .0024      .0021      1.92
        21.900      .0024      .0021      1.92
        22.000      .0024      .0021      1.92
        22.100      .0024      .0021      1.92
        22.200      .0024      .0021      1.92
        22.300      .0024      .0021      1.93
        22.400      .0024      .0021      1.93
        22.500      .0024      .0021      1.93
        22.600      .0024      .0021      1.93
        22.700      .0024      .0021      1.93
        22.800      .0024      .0021      1.93
        22.900      .0024      .0021      1.93
        23.000      .0024      .0021      1.93
        23.100      .0024      .0021      1.93
        23.200      .0024      .0021      1.93
        23.300      .0024      .0021      1.93
        23.400      .0024      .0021      1.93
        23.500      .0024      .0021      1.93
        23.600      .0024      .0021      1.93
        23.700      .0024      .0021      1.93
        23.800      .0024      .0021      1.93
        23.900      .0024      .0021      1.93
        24.000      .0024      .0021      1.93
        24.100      .0000      .0000      1.93
        24.200      .0000      .0000      1.39
        24.300      .0000      .0000       .58
        24.400      .0000      .0000       .22
        24.500      .0000      .0000       .08
        24.600      .0000      .0000       .02
        24.700      .0000      .0000       .00

         TOTALS        2.000      1.2370      1112.24

    STORM HYDROGRAPH VOLUME =       9.19  ACRE-FEET
    MAXIMUN STORM DISCHARGE =     126.84  CFS
```

```
ITEX, Drainage "A" Runon, 10-yr, 24 hr Storm
     STORM HYDROGRAPH  RAIN = 1.600  DURATION = 24.0  RUNOFF =  .886
     STORM DISTRIBUTION IS SCS 24-HR
     CURVE NUMBER METHOD   CN =92.0

          TIME       RAINFALL      NET RAIN     DISCHARGE
         (HOURS)     (INCHES)      (INCHES)      (CFS)

          23.500       .0019        .0016          .14
          23.600       .0019        .0016          .14
          23.700       .0019        .0016          .14
          23.800       .0019        .0016          .14
          23.900       .0019        .0016          .14
          24.000       .0019        .0016          .14
          24.100       .0000        .0000          .14
          24.200       .0000        .0000          .02
          24.300       .0000        .0000          .00
          24.400       .0000        .0000          .00

          TOTALS        1.600        .8859        77.66

     STORM HYDROGRAPH VOLUME =        .64  ACRE-FEET
     MAXIMUN STORM DISCHARGE =      11.07  CFS
```

```
ITEX, Drainage "B" Runon, 10-yr, 24 hr Storm
      STORM HYDROGRAPH  RAIN = 1.600  DURATION = 24.0  RUNOFF =  .886
      STORM DISTRIBUTION IS SCS 24-HR
      CURVE NUMBER METHOD   CN =92.0

            TIME       RAINFALL      NET RAIN     DISCHARGE
           (HOURS)     (INCHES)      (INCHES)      (CFS)

           23.800      .0019       .0016         .63
            23.900      .0019       .0016         .63
            24.000      .0019       .0016         .63
            24.100      .0000       .0000         .63
            24.200      .0000       .0000         .38
            24.300      .0000       .0000         .12
            24.400      .0000       .0000         .04
            24.500      .0000       .0000         .01
            24.600      .0000       .0000         .00

            TOTALS        1.600        .8859      338.12

      STORM HYDROGRAPH VOLUME =       2.79  ACRE-FEET
      MAXIMUN STORM DISCHARGE =      41.98  CFS
```

```
ITEX, Drainage "C" Runon, 10-yr, 24 hr Storm
      STORM HYDROGRAPH  RAIN = 1.600  DURATION = 24.0  RUNOFF =  .886
      STORM DISTRIBUTION IS SCS 24-HR
      CURVE NUMBER METHOD   CN =92.0

            TIME       RAINFALL      NET RAIN     DISCHARGE
           (HOURS)     (INCHES)      (INCHES)      (CFS)

           23.100       .0019        .0016         2.03
           23.200       .0019        .0016         2.03
           23.300       .0019        .0016         2.03
           23.400       .0019        .0016         2.03
           23.500       .0019        .0016         2.03
           23.600       .0019        .0016         2.04
           23.700       .0019        .0016         2.04
           23.800       .0019        .0016         2.04
           23.900       .0019        .0016         2.04
           24.000       .0019        .0016         2.04
           24.100       .0000        .0000         2.04
           24.200       .0000        .0000          .68
           24.300       .0000        .0000          .16
           24.400       .0000        .0000          .03
           24.500       .0000        .0000          .00

           TOTALS         1.600        .8859      1098.20

      STORM HYDROGRAPH VOLUME =        9.08  ACRE-FEET
      MAXIMUN STORM DISCHARGE =      149.38  CFS
```

```
ITEX, Drainage "D" Runon, 10-yr, 24 hr Storm
     STORM HYDROGRAPH  RAIN = 1.600  DURATION = 24.0  RUNOFF =  .886
     STORM DISTRIBUTION IS SCS 24-HR
     CURVE NUMBER METHOD   CN =92.0

           TIME       RAINFALL      NET RAIN     DISCHARGE
          (HOURS)      (INCHES)      (INCHES)      (CFS)

          23.400       .0019        .0016         1.50
          23.500       .0019        .0016         1.50
          23.600       .0019        .0016         1.50
          23.700       .0019        .0016         1.50
          23.800       .0019        .0016         1.50
          23.900       .0019        .0016         1.50
          24.000       .0019        .0016         1.50
          24.100       .0000        .0000         1.50
          24.200       .0000        .0000          .50
          24.300       .0000        .0000          .11
          24.400       .0000        .0000          .02
          24.500       .0000        .0000          .00

          TOTALS        1.600        .8859        809.20

     STORM HYDROGRAPH VOLUME =        6.69  ACRE-FEET
     MAXIMUN STORM DISCHARGE =      110.07  CFS
```

ITEX | Runoff Calcs | REW 11/15/94 2106-036

Purpose: Calculate runoff from upgradient area (0.25 mi²) of the landfill. Assume both disturbed and undisturbed conditions.

0.25 mile²

Assume: Use SCS method to calculate runoff from landfill.

CN = 94 for disturbed areas. Viessman, 1989

CN - 92 for undisturbed areas.

$t_c \simeq 0$, [illegible] because runoff is [illegible]

instantaneous?

~~instantaneous?~~

25 yr 24 hr storm = 2.0"

100 yr 24 hr storm 2.5"

10-yr, 24 hr storm = 1.0"

not exactly sure, need to look @ my Viessman book.

basically saying time of concentration (t_c) is zero because runoff is instaneous.

Results From STORM

Runoff from 0.25 mile² area (cfs)

~~Runoff from 0.25 mile² area (cfs)~~

	25-yr 24-hr	100-yr 24-hr	10-yr, 24-hr
Disturbed	300	390	225
Undisturbed	270	365	

ITEX, Site Runoff (Disturbed, 0.25 sq. miles), 25-yr, 24 hr Storm
STORM HYDROGRAPH RAIN = 2.000 DURATION = 24.0 RUNOFF = 1.396
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD CN =94.0

TIME (HOURS)	RAINFALL (INCHES)	NET RAIN (INCHES)	DISCHARGE (CFS)
.000	.0000	.0000	.00
.100	.0024	.0000	.00
.200	.0024	.0000	.00
.300	.0024	.0000	.00
.400	.0024	.0000	.00
.500	.0024	.0000	.00
	No Runoff		
4.900	.0032	.0000	.00
5.000	.0032	.0000	.00
5.100	.0032	.0000	.00
5.200	.0032	.0001	.02
5.300	.0032	.0001	.06
5.400	.0032	.0001	.11
5.500	.0032	.0001	.16
5.600	.0032	.0002	.21
5.700	.0032	.0002	.26
5.800	.0032	.0002	.31
5.900	.0032	.0003	.36
6.000	.0032	.0003	.40
6.100	.0040	.0004	.45
6.200	.0040	.0004	.59
6.300	.0040	.0005	.68
6.400	.0040	.0005	.76
6.500	.0040	.0006	.82
6.600	.0040	.0006	.89
6.700	.0040	.0006	.96
6.800	.0040	.0007	1.02
6.900	.0040	.0007	1.08
7.000	.0040	.0008	1.14
7.100	.0040	.0008	1.21
7.200	.0040	.0008	1.27
7.300	.0040	.0009	1.32
7.400	.0040	.0009	1.38
7.500	.0040	.0009	1.44
7.600	.0040	.0010	1.49
7.700	.0040	.0010	1.55
7.800	.0040	.0010	1.60
7.900	.0040	.0011	1.66
8.000	.0040	.0011	1.71
8.100	.0054	.0015	1.76
8.200	.0054	.0016	2.25
8.300	.0054	.0016	2.49
8.400	.0054	.0017	2.62
8.500	.0054	.0017	2.71
8.600	.0054	.0018	2.80

8.700	.0054	.0018	2.88
8.800	.0054	.0019	2.96
8.900	.0054	.0019	3.04
9.000	.0054	.0020	3.12
9.100	.0064	.0024	3.20
9.200	.0064	.0025	3.68
9.300	.0064	.0025	3.94
9.400	.0064	.0026	4.07
9.500	.0064	.0026	4.18
9.600	.0072	.0030	4.28
9.700	.0072	.0031	4.74
9.800	.0072	.0032	4.99
9.900	.0072	.0033	5.14
10.000	.0072	.0033	5.26
10.100	.0092	.0043	5.36
10.200	.0092	.0044	6.50
10.300	.0092	.0045	7.04
10.400	.0092	.0046	7.30
10.500	.0092	.0047	7.47
10.600	.0124	.0065	7.62
10.700	.0124	.0066	9.61
10.800	.0124	.0068	10.54
10.900	.0124	.0069	10.95
11.000	.0124	.0071	11.22
11.100	.0192	.0112	11.45
11.200	.0192	.0115	16.04
11.300	.0192	.0118	18.11
11.400	.0192	.0121	18.98
11.500	.0192	.0123	19.51
11.600	.0832	.0561	19.94
11.700	.0832	.0597	67.73
11.800	.1520	.1163	89.96
11.900	.2208	.1809	157.66
12.000	.2208	.1905	253.00
12.100	.0288	.0254	296.25
12.200	.0288	.0255	128.13
12.300	.0288	.0256	61.78
12.400	.0288	.0257	45.25
12.500	.0288	.0258	41.81
12.600	.0148	.0133	41.96
12.700	.0148	.0133	28.40
12.800	.0148	.0133	23.22
12.900	.0148	.0133	21.98
13.000	.0148	.0134	21.74
13.100	.0108	.0098	21.78
13.200	.0108	.0098	17.87
13.300	.0108	.0098	16.38
13.400	.0108	.0098	16.03
13.500	.0108	.0098	15.97
13.600	.0084	.0076	15.99
13.700	.0084	.0076	13.62
13.800	.0084	.0076	12.73
13.900	.0084	.0077	12.51
14.000	.0084	.0077	12.48
14.100	.0060	.0055	12.49

14.200	.0060	.0055	10.11
14.300	.0060	.0055	9.20
14.400	.0060	.0055	8.98
14.500	.0060	.0055	8.94
14.600	.0060	.0055	8.94
14.700	.0060	.0055	8.95
14.800	.0060	.0055	8.95
14.900	.0060	.0055	8.96
15.000	.0060	.0055	8.96
15.100	.0060	.0055	8.97
15.200	.0060	.0055	8.97
15.300	.0060	.0055	8.98
15.400	.0060	.0055	8.98
15.500	.0060	.0055	8.98
15.600	.0060	.0055	8.99
15.700	.0060	.0055	8.99
15.800	.0060	.0055	9.00
15.900	.0060	.0055	9.00
16.000	.0060	.0055	9.01
16.100	.0036	.0033	9.01
16.200	.0036	.0033	6.60
16.300	.0036	.0033	5.68
16.400	.0036	.0033	5.46
16.500	.0036	.0033	5.41
16.600	.0036	.0033	5.41
16.700	.0036	.0033	5.42
16.800	.0036	.0033	5.42
16.900	.0036	.0033	5.42
17.000	.0036	.0033	5.42
17.100	.0036	.0033	5.42
17.200	.0036	.0033	5.42
17.300	.0036	.0033	5.42
17.400	.0036	.0033	5.43
17.500	.0036	.0033	5.43
17.600	.0036	.0033	5.43
17.700	.0036	.0033	5.43
17.800	.0036	.0033	5.43
17.900	.0036	.0033	5.43
18.000	.0036	.0033	5.43
18.100	.0036	.0033	5.43
18.200	.0036	.0033	5.44
18.300	.0036	.0033	5.44
18.400	.0036	.0033	5.44
18.500	.0036	.0033	5.44
18.600	.0036	.0033	5.44
18.700	.0036	.0033	5.44
18.800	.0036	.0033	5.44
18.900	.0036	.0033	5.45
19.000	.0036	.0033	5.45
19.100	.0036	.0033	5.45
19.200	.0036	.0033	5.45
19.300	.0036	.0033	5.45
19.400	.0036	.0033	5.45
19.500	.0036	.0033	5.45
19.600	.0036	.0033	5.45

19.700	.0036	.0033	5.46
19.800	.0036	.0033	5.46
19.900	.0036	.0033	5.46
20.000	.0036	.0033	5.46
20.100	.0024	.0022	5.46
20.200	.0024	.0022	4.24
20.300	.0024	.0022	3.78
20.400	.0024	.0022	3.67
20.500	.0024	.0022	3.64
20.600	.0024	.0022	3.64
20.700	.0024	.0022	3.64
20.800	.0024	.0022	3.64
20.900	.0024	.0022	3.64
21.000	.0024	.0022	3.65
21.100	.0024	.0022	3.65
21.200	.0024	.0022	3.65
21.300	.0024	.0022	3.65
21.400	.0024	.0022	3.65
21.500	.0024	.0022	3.65
21.600	.0024	.0022	3.65
21.700	.0024	.0022	3.65
21.800	.0024	.0022	3.65
21.900	.0024	.0022	3.65
22.000	.0024	.0022	3.65
22.100	.0024	.0022	3.65
22.200	.0024	.0022	3.65
22.300	.0024	.0022	3.65
22.400	.0024	.0022	3.65
22.500	.0024	.0022	3.65
22.600	.0024	.0022	3.65
22.700	.0024	.0022	3.65
22.800	.0024	.0022	3.65
22.900	.0024	.0022	3.66
23.000	.0024	.0022	3.66
23.100	.0024	.0022	3.66
23.200	.0024	.0022	3.66
23.300	.0024	.0022	3.66
23.400	.0024	.0022	3.66
23.500	.0024	.0022	3.66
23.600	.0024	.0022	3.66
23.700	.0024	.0022	3.66
23.800	.0024	.0022	3.66
23.900	.0024	.0022	3.66
24.000	.0024	.0022	3.66
24.100	.0000	.0000	3.66
24.200	.0000	.0000	1.21
24.300	.0000	.0000	.28
24.400	.0000	.0000	.05
24.500	.0000	.0000	.00
TOTALS	2.000	1.3963	2277.54

STORM HYDROGRAPH VOLUME = 18.82 ACRE-FEET
MAXIMUM STORM DISCHARGE = 296.25 CFS

ITEX, *Site Runoff (Undisturbed, 0.25 sq. miles), 25-yr, 24 hr Storm*
STORM HYDROGRAPH RAIN = 2.000 DURATION = 24.0 RUNOFF = 1.237
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD CN =92.0

TIME (HOURS)	RAINFALL (INCHES)	NET RAIN (INCHES)	DISCHARGE (CFS)
.000	.0000	.0000	.00
.100	.0024	.0000	.00
.200	.0024	.0000	.00
.300	.0024	.0000	.00
	No Runoff		
6.200	.0040	.0000	.00
6.300	.0040	.0000	.00
6.400	.0040	.0000	.00
6.500	.0040	.0000	.01
6.600	.0040	.0001	.04
6.700	.0040	.0001	.10
6.800	.0040	.0001	.15
6.900	.0040	.0002	.21
7.000	.0040	.0002	.27
7.100	.0040	.0002	.32
7.200	.0040	.0003	.38
7.300	.0040	.0003	.43
7.400	.0040	.0003	.49
7.500	.0040	.0004	.54
7.600	.0040	.0004	.59
7.700	.0040	.0004	.64
7.800	.0040	.0005	.70
7.900	.0040	.0005	.75
8.000	.0040	.0005	.80
8.100	.0054	.0008	.84
8.200	.0054	.0008	1.11
8.300	.0054	.0009	1.27
8.400	.0054	.0009	1.38
8.500	.0054	.0010	1.46
8.600	.0054	.0010	1.55
8.700	.0054	.0011	1.63
8.800	.0054	.0011	1.71
8.900	.0054	.0012	1.79
9.000	.0054	.0012	1.86
9.100	.0064	.0015	1.94
9.200	.0064	.0016	2.27
9.300	.0064	.0016	2.46
9.400	.0064	.0017	2.59
9.500	.0064	.0017	2.69
9.600	.0072	.0020	2.79
9.700	.0072	.0021	3.13
9.800	.0072	.0022	3.34
9.900	.0072	.0022	3.47
10.000	.0072	.0023	3.59
10.100	.0092	.0030	3.70

10.200	.0092	.0031	4.54
10.300	.0092	.0032	4.97
10.400	.0092	.0033	5.20
10.500	.0092	.0034	5.38
10.600	.0124	.0048	5.54
10.700	.0124	.0050	7.07
10.800	.0124	.0051	7.82
10.900	.0124	.0053	8.21
11.000	.0124	.0054	8.49
11.100	.0192	.0087	8.74
11.200	.0192	.0090	12.38
11.300	.0192	.0093	14.13
11.400	.0192	.0096	14.95
11.500	.0192	.0099	15.52
11.600	.0832	.0461	16.01
11.700	.0832	.0504	55.61
11.800	.1520	.1011	75.44
11.900	.2208	.1621	136.14
12.000	.2208	.1749	225.03
12.100	.0288	.0235	269.72
12.200	.0288	.0237	117.40
12.300	.0288	.0238	57.07
12.400	.0288	.0240	42.08
12.500	.0288	.0241	39.00
12.600	.0148	.0124	39.21
12.700	.0148	.0125	26.57
12.800	.0148	.0125	21.75
12.900	.0148	.0125	20.61
13.000	.0148	.0126	20.41
13.100	.0108	.0092	20.46
13.200	.0108	.0092	16.79
13.300	.0108	.0092	15.41
13.400	.0108	.0092	15.09
13.500	.0108	.0092	15.04
13.600	.0084	.0072	15.06
13.700	.0084	.0072	12.84
13.800	.0084	.0072	12.00
13.900	.0084	.0072	11.81
14.000	.0084	.0072	11.78
14.100	.0060	.0052	11.79
14.200	.0060	.0052	9.55
14.300	.0060	.0052	8.69
14.400	.0060	.0052	8.49
14.500	.0060	.0052	8.45
14.600	.0060	.0052	8.46
14.700	.0060	.0052	8.46
14.800	.0060	.0052	8.47
14.900	.0060	.0052	8.48
15.000	.0060	.0052	8.48
15.100	.0060	.0052	8.49
15.200	.0060	.0052	8.50
15.300	.0060	.0052	8.50
15.400	.0060	.0052	8.51
15.500	.0060	.0052	8.52
15.600	.0060	.0052	8.52

15.700	.0060	.0052	8.53
15.800	.0060	.0052	8.54
15.900	.0060	.0052	8.54
16.000	.0060	.0052	8.55
16.100	.0036	.0031	8.55
16.200	.0036	.0032	6.27
16.300	.0036	.0032	5.40
16.400	.0036	.0032	5.19
16.500	.0036	.0032	5.14
16.600	.0036	.0032	5.14
16.700	.0036	.0032	5.15
16.800	.0036	.0032	5.15
16.900	.0036	.0032	5.15
17.000	.0036	.0032	5.15
17.100	.0036	.0032	5.15
17.200	.0036	.0032	5.16
17.300	.0036	.0032	5.16
17.400	.0036	.0032	5.16
17.500	.0036	.0032	5.16
17.600	.0036	.0032	5.17
17.700	.0036	.0032	5.17
17.800	.0036	.0032	5.17
17.900	.0036	.0032	5.17
18.000	.0036	.0032	5.17
18.100	.0036	.0032	5.18
18.200	.0036	.0032	5.18
18.300	.0036	.0032	5.18
18.400	.0036	.0032	5.18
18.500	.0036	.0032	5.18
18.600	.0036	.0032	5.18
18.700	.0036	.0032	5.19
18.800	.0036	.0032	5.19
18.900	.0036	.0032	5.19
19.000	.0036	.0032	5.19
19.100	.0036	.0032	5.19
19.200	.0036	.0032	5.20
19.300	.0036	.0032	5.20
19.400	.0036	.0032	5.20
19.500	.0036	.0032	5.20
19.600	.0036	.0032	5.20
19.700	.0036	.0032	5.21
19.800	.0036	.0032	5.21
19.900	.0036	.0032	5.21
20.000	.0036	.0032	5.21
20.100	.0024	.0021	5.21
20.200	.0024	.0021	4.05
20.300	.0024	.0021	3.61
20.400	.0024	.0021	3.50
20.500	.0024	.0021	3.48
20.600	.0024	.0021	3.48
20.700	.0024	.0021	3.48
20.800	.0024	.0021	3.48
20.900	.0024	.0021	3.48
21.000	.0024	.0021	3.48
21.100	.0024	.0021	3.48

21.200	.0024	.0021	3.48
21.300	.0024	.0021	3.49
21.400	.0024	.0021	3.49
21.500	.0024	.0021	3.49
21.600	.0024	.0021	3.49
21.700	.0024	.0021	3.49
21.800	.0024	.0021	3.49
21.900	.0024	.0021	3.49
22.000	.0024	.0021	3.49
22.100	.0024	.0021	3.49
22.200	.0024	.0021	3.49
22.300	.0024	.0021	3.49
22.400	.0024	.0021	3.49
22.500	.0024	.0021	3.49
22.600	.0024	.0021	3.50
22.700	.0024	.0021	3.50
22.800	.0024	.0021	3.50
22.900	.0024	.0021	3.50
23.000	.0024	.0021	3.50
23.100	.0024	.0021	3.50
23.200	.0024	.0021	3.50
23.300	.0024	.0021	3.50
23.400	.0024	.0021	3.50
23.500	.0024	.0021	3.50
23.600	.0024	.0021	3.50
23.700	.0024	.0021	3.50
23.800	.0024	.0021	3.50
23.900	.0024	.0021	3.51
24.000	.0024	.0021	3.51
24.100	.0000	.0000	3.51
24.200	.0000	.0000	1.16
24.300	.0000	.0000	.27
24.400	.0000	.0000	.05
24.500	.0000	.0000	.00
TOTALS	2.000	1.2370	2017.71

STORM HYDROGRAPH VOLUME = 16.68 ACRE-FEET
MAXIMUM STORM DISCHARGE = 269.72 CFS

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ITEX, Site Runoff (Disturbed, 0.25 sq. miles), 100-yr, 24 hr Storm
STORM HYDROGRAPH  RAIN = 2.500  DURATION = 24.0  RUNOFF = 1.869
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD   CN =94.0

    TIME      RAINFALL    NET RAIN    DISCHARGE
   (HOURS)    (INCHES)    (INCHES)     (CFS)

   .000      .0000      .0000      .00
   .100      .0030      .0000      .00
   .200      .0030      .0000      .00
   .300      .0030      .0000      .00
              No Runoff
  4.200      .0040      .0000      .00
  4.300      .0040      .0000      .00
  4.400      .0040      .0001      .03
  4.500      .0040      .0001      .10
  4.600      .0040      .0002      .17
  4.700      .0040      .0002      .25
  4.800      .0040      .0003      .33
  4.900      .0040      .0003      .40
  5.000      .0040      .0004      .48
  5.100      .0040      .0004      .55
  5.200      .0040      .0004      .62
  5.300      .0040      .0005      .69
  5.400      .0040      .0005      .76
  5.500      .0040      .0006      .82
  5.600      .0040      .0006      .89
  5.700      .0040      .0006      .96
  5.800      .0040      .0007     1.02
  5.900      .0040      .0007     1.08
  6.000      .0040      .0008     1.14
  6.100      .0050      .0010     1.21
  6.200      .0050      .0010     1.49
  6.300      .0050      .0011     1.65
  6.400      .0050      .0012     1.76
  6.500      .0050      .0012     1.85
  6.600      .0050      .0013     1.94
  6.700      .0050      .0013     2.02
  6.800      .0050      .0014     2.10
  6.900      .0050      .0014     2.18
  7.000      .0050      .0015     2.26
  7.100      .0050      .0015     2.34
  7.200      .0050      .0015     2.42
  7.300      .0050      .0016     2.49
  7.400      .0050      .0016     2.57
  7.500      .0050      .0017     2.64
  7.600      .0050      .0017     2.71
  7.700      .0050      .0018     2.78
  7.800      .0050      .0018     2.84
  7.900      .0050      .0018     2.91
  8.000      .0050      .0019     2.98
  8.100      .0067      .0026     3.04
  8.200      .0067      .0027     3.85
  8.300      .0068      .0027     4.22
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8.400	.0068	.0028	4.40
8.500	.0067	.0029	4.52
8.600	.0068	.0029	4.62
8.700	.0068	.0030	4.73
8.800	.0067	.0030	4.83
8.900	.0068	.0031	4.92
9.000	.0068	.0032	5.02
9.100	.0080	.0038	5.11
9.200	.0080	.0039	5.85
9.300	.0080	.0040	6.22
9.400	.0080	.0040	6.39
9.500	.0080	.0041	6.52
9.600	.0090	.0047	6.64
9.700	.0090	.0048	7.32
9.800	.0090	.0049	7.67
9.900	.0090	.0049	7.85
10.000	.0090	.0050	7.99
10.100	.0115	.0065	8.12
10.200	.0115	.0066	9.79
10.300	.0115	.0067	10.56
10.400	.0115	.0068	10.88
10.500	.0115	.0070	11.09
10.600	.0155	.0095	11.27
10.700	.0155	.0097	14.13
10.800	.0155	.0099	15.41
10.900	.0155	.0100	15.93
11.000	.0155	.0102	16.25
11.100	.0240	.0161	16.51
11.200	.0240	.0164	23.00
11.300	.0240	.0167	25.83
11.400	.0240	.0170	26.92
11.500	.0240	.0173	27.53
11.600	.1040	.0777	27.99
11.700	.1040	.0815	93.99
11.800	.1900	.1564	123.40
11.900	.2760	.2392	212.83
12.000	.2760	.2486	336.02
12.100	.0360	.0329	388.48
12.200	.0360	.0330	167.43
12.300	.0360	.0331	80.38
12.400	.0360	.0332	58.67
12.500	.0360	.0333	54.11
12.600	.0185	.0171	54.25
12.700	.0185	.0172	36.69
12.800	.0185	.0172	29.99
12.900	.0185	.0172	28.37
13.000	.0185	.0172	28.05
13.100	.0135	.0126	28.08
13.200	.0135	.0126	23.03
13.300	.0135	.0126	21.11
13.400	.0135	.0126	20.65
13.500	.0135	.0126	20.56
13.600	.0105	.0098	20.58
13.700	.0105	.0098	17.53
13.800	.0105	.0098	16.38
13.900	.0105	.0098	16.10
14.000	.0105	.0098	16.05

14.100	.0075	.0070	16.05
14.200	.0075	.0070	12.99
14.300	.0075	.0070	11.83
14.400	.0075	.0070	11.54
14.500	.0075	.0070	11.49
14.600	.0075	.0070	11.49
14.700	.0075	.0071	11.50
14.800	.0075	.0071	11.50
14.900	.0075	.0071	11.50
15.000	.0075	.0071	11.51
15.100	.0075	.0071	11.51
15.200	.0075	.0071	11.52
15.300	.0075	.0071	11.52
15.400	.0075	.0071	11.52
15.500	.0075	.0071	11.53
15.600	.0075	.0071	11.53
15.700	.0075	.0071	11.54
15.800	.0075	.0071	11.54
15.900	.0075	.0071	11.54
16.000	.0075	.0071	11.55
16.100	.0045	.0043	11.55
16.200	.0045	.0043	8.47
16.300	.0045	.0043	7.29
16.400	.0045	.0043	7.00
16.500	.0045	.0043	6.94
16.600	.0045	.0043	6.94
16.700	.0045	.0043	6.94
16.800	.0045	.0043	6.94
16.900	.0045	.0043	6.94
17.000	.0045	.0043	6.94
17.100	.0045	.0043	6.94
17.200	.0045	.0043	6.95
17.300	.0045	.0043	6.95
17.400	.0045	.0043	6.95
17.500	.0045	.0043	6.95
17.600	.0045	.0043	6.95
17.700	.0045	.0043	6.95
17.800	.0045	.0043	6.95
17.900	.0045	.0043	6.96
18.000	.0045	.0043	6.96
18.100	.0045	.0043	6.96
18.200	.0045	.0043	6.96
18.300	.0045	.0043	6.96
18.400	.0045	.0043	6.96
18.500	.0045	.0043	6.96
18.600	.0045	.0043	6.96
18.700	.0045	.0043	6.97
18.800	.0045	.0043	6.97
18.900	.0045	.0043	6.97
19.000	.0045	.0043	6.97
19.100	.0045	.0043	6.97
19.200	.0045	.0043	6.97
19.300	.0045	.0043	6.97
19.400	.0045	.0043	6.97
19.500	.0045	.0043	6.97
19.600	.0045	.0043	6.98
19.700	.0045	.0043	6.98

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   19.800      .0045      .0043      6.98
   19.900      .0045      .0043      6.98
   20.000      .0045      .0043      6.98
   20.100      .0030      .0029      6.98
   20.200      .0030      .0029      5.43
   20.300      .0030      .0029      4.83
   20.400      .0030      .0029      4.69
   20.500      .0030      .0029      4.66
   20.600      .0030      .0029      4.66
   20.700      .0030      .0029      4.66
   20.800      .0030      .0029      4.66
   20.900      .0030      .0029      4.66
   21.000      .0030      .0029      4.66
   21.100      .0030      .0029      4.66
   21.200      .0030      .0029      4.66
   21.300      .0030      .0029      4.66
   21.400      .0030      .0029      4.66
   21.500      .0030      .0029      4.66
   21.600      .0030      .0029      4.66
   21.700      .0030      .0029      4.66
   21.800      .0030      .0029      4.66
   21.900      .0030      .0029      4.66
   22.000      .0030      .0029      4.66
   22.100      .0030      .0029      4.66
   22.200      .0030      .0029      4.66
   22.300      .0030      .0029      4.66
   22.400      .0030      .0029      4.67
   22.500      .0030      .0029      4.67
   22.600      .0030      .0029      4.67
   22.700      .0030      .0029      4.67
   22.800      .0030      .0029      4.67
   22.900      .0030      .0029      4.67
   23.000      .0030      .0029      4.67
   23.100      .0030      .0029      4.67
   23.200      .0030      .0029      4.67
   23.300      .0030      .0029      4.67
   23.400      .0030      .0029      4.67
   23.500      .0030      .0029      4.67
   23.600      .0030      .0029      4.67
   23.700      .0030      .0029      4.67
   23.800      .0030      .0029      4.67
   23.900      .0030      .0029      4.67
   24.000      .0030      .0029      4.67
   24.100      .0000      .0000      4.67
   24.200      .0000      .0000      1.55
   24.300      .0000      .0000       .36
   24.400      .0000      .0000       .06
   24.500      .0000      .0000       .00

     TOTALS       2.500      1.8694      3049.13

STORM HYDROGRAPH VOLUME =      25.20  ACRE-FEET
MAXIMUM STORM DISCHARGE =     388.48  CFS
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ITEX, Site Runoff (Undisturbed, 0.25 sq. miles), 100-yr, 24 hr Storm
STORM HYDROGRAPH RAIN = 2.500 DURATION = 24.0 RUNOFF = 1.693
STORM DISTRIBUTION IS SCS 24-HR
CURVE NUMBER METHOD CN =92.0

TIME (HOURS)	RAINFALL (INCHES)	NET RAIN (INCHES)	DISCHARGE (CFS)
.000	.0000	.0000	.00
.100	.0030	.0000	.00
.200	.0030	.0000	.00
.300	.0030	.0000	.00
	No Runoff		
5.300	.0040	.0000	.00
5.400	.0040	.0000	.00
5.500	.0040	.0000	.01
5.600	.0040	.0001	.04
5.700	.0040	.0001	.10
5.800	.0040	.0001	.15
5.900	.0040	.0002	.21
6.000	.0040	.0002	.27
6.100	.0050	.0003	.32
6.200	.0050	.0004	.45
6.300	.0050	.0004	.55
6.400	.0050	.0005	.64
6.500	.0050	.0005	.73
6.600	.0050	.0006	.81
6.700	.0050	.0006	.89
6.800	.0050	.0007	.96
6.900	.0050	.0007	1.04
7.000	.0050	.0007	1.12
7.100	.0050	.0008	1.19
7.200	.0050	.0008	1.27
7.300	.0050	.0009	1.34
7.400	.0050	.0009	1.41
7.500	.0050	.0010	1.48
7.600	.0050	.0010	1.55
7.700	.0050	.0010	1.62
7.800	.0050	.0011	1.68
7.900	.0050	.0011	1.75
8.000	.0050	.0012	1.81
8.100	.0067	.0016	1.88
8.200	.0067	.0017	2.41
8.300	.0068	.0018	2.68
8.400	.0068	.0018	2.83
8.500	.0067	.0019	2.95
8.600	.0068	.0020	3.06
8.700	.0068	.0020	3.16
8.800	.0067	.0021	3.26
8.900	.0068	.0021	3.36
9.000	.0068	.0022	3.46
9.100	.0080	.0027	3.56
9.200	.0080	.0028	4.11

9.300	.0080	.0028	4.41
9.400	.0080	.0029	4.58
9.500	.0080	.0030	4.71
9.600	.0090	.0035	4.83
9.700	.0090	.0035	5.37
9.800	.0090	.0036	5.67
9.900	.0090	.0037	5.85
10.000	.0090	.0038	6.00
10.100	.0115	.0050	6.14
10.200	.0115	.0051	7.46
10.300	.0115	.0052	8.10
10.400	.0115	.0053	8.41
10.500	.0115	.0055	8.63
10.600	.0155	.0075	8.83
10.700	.0155	.0077	11.16
10.800	.0155	.0079	12.25
10.900	.0155	.0081	12.76
11.000	.0155	.0083	13.11
11.100	.0240	.0132	13.41
11.200	.0240	.0136	18.83
11.300	.0240	.0139	21.31
11.400	.0240	.0143	22.38
11.500	.0240	.0146	23.06
11.600	.1040	.0668	23.62
11.700	.1040	.0716	80.69
11.800	.1900	.1405	107.73
11.900	.2760	.2202	190.17
12.000	.2760	.2333	307.41
12.100	.0360	.0312	362.05
12.200	.0360	.0313	156.83
12.300	.0360	.0314	75.78
12.400	.0360	.0316	55.60
12.500	.0360	.0317	51.40
12.600	.0185	.0163	51.61
12.700	.0185	.0164	34.94
12.800	.0185	.0164	28.58
12.900	.0185	.0164	27.06
13.000	.0185	.0165	26.77
13.100	.0135	.0120	26.82
13.200	.0135	.0120	22.01
13.300	.0135	.0121	20.18
13.400	.0135	.0121	19.75
13.500	.0135	.0121	19.68
13.600	.0105	.0094	19.70
13.700	.0105	.0094	16.79
13.800	.0105	.0094	15.69
13.900	.0105	.0094	15.43
14.000	.0105	.0094	15.38
14.100	.0075	.0067	15.40
14.200	.0075	.0068	12.47
14.300	.0075	.0068	11.35
14.400	.0075	.0068	11.08
14.500	.0075	.0068	11.03
14.600	.0075	.0068	11.03
14.700	.0075	.0068	11.04

14.800	.0075	.0068	11.05
14.900	.0075	.0068	11.05
15.000	.0075	.0068	11.06
15.100	.0075	.0068	11.06
15.200	.0075	.0068	11.07
15.300	.0075	.0068	11.08
15.400	.0075	.0068	11.08
15.500	.0075	.0068	11.09
15.600	.0075	.0068	11.10
15.700	.0075	.0068	11.10
15.800	.0075	.0068	11.11
15.900	.0075	.0068	11.11
16.000	.0075	.0068	11.12
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16.300	.0045	.0041	7.02
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16.500	.0045	.0041	6.68
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16.700	.0045	.0041	6.69
16.800	.0045	.0041	6.69
16.900	.0045	.0041	6.69
17.000	.0045	.0041	6.69
17.100	.0045	.0041	6.70
17.200	.0045	.0041	6.70
17.300	.0045	.0041	6.70
17.400	.0045	.0041	6.70
17.500	.0045	.0041	6.70
17.600	.0045	.0041	6.71
17.700	.0045	.0041	6.71
17.800	.0045	.0041	6.71
17.900	.0045	.0041	6.71
18.000	.0045	.0041	6.71
18.100	.0045	.0041	6.72
18.200	.0045	.0041	6.72
18.300	.0045	.0041	6.72
18.400	.0045	.0041	6.72
18.500	.0045	.0041	6.72
18.600	.0045	.0041	6.72
18.700	.0045	.0041	6.73
18.800	.0045	.0041	6.73
18.900	.0045	.0041	6.73
19.000	.0045	.0041	6.73
19.100	.0045	.0041	6.73
19.200	.0045	.0041	6.74
19.300	.0045	.0041	6.74
19.400	.0045	.0041	6.74
19.500	.0045	.0041	6.74
19.600	.0045	.0041	6.74
19.700	.0045	.0041	6.74
19.800	.0045	.0041	6.75
19.900	.0045	.0041	6.75
20.000	.0045	.0041	6.75
20.100	.0030	.0028	6.75
20.200	.0030	.0028	5.25

```
    20.300      .0030      .0028      4.67
    20.400      .0030      .0028      4.53
    20.500      .0030      .0028      4.50
    20.600      .0030      .0028      4.51
    20.700      .0030      .0028      4.51
    20.800      .0030      .0028      4.51
    20.900      .0030      .0028      4.51
    21.000      .0030      .0028      4.51
    21.100      .0030      .0028      4.51
    21.200      .0030      .0028      4.51
    21.300      .0030      .0028      4.51
    21.400      .0030      .0028      4.51
    21.500      .0030      .0028      4.51
    21.600      .0030      .0028      4.51
    21.700      .0030      .0028      4.51
    21.800      .0030      .0028      4.51
    21.900      .0030      .0028      4.51
    22.000      .0030      .0028      4.52
    22.100      .0030      .0028      4.52
    22.200      .0030      .0028      4.52
    22.300      .0030      .0028      4.52
    22.400      .0030      .0028      4.52
    22.500      .0030      .0028      4.52
    22.600      .0030      .0028      4.52
    22.700      .0030      .0028      4.52
    22.800      .0030      .0028      4.52
    22.900      .0030      .0028      4.52
    23.000      .0030      .0028      4.52
    23.100      .0030      .0028      4.52
    23.200      .0030      .0028      4.52
    23.300      .0030      .0028      4.52
    23.400      .0030      .0028      4.53
    23.500      .0030      .0028      4.53
    23.600      .0030      .0028      4.53
    23.700      .0030      .0028      4.53
    23.800      .0030      .0028      4.53
    23.900      .0030      .0028      4.53
    24.000      .0030      .0028      4.53
    24.100      .0000      .0000      4.53
    24.200      .0000      .0000      1.50
    24.300      .0000      .0000       .34
    24.400      .0000      .0000       .06
    24.500      .0000      .0000       .00

     TOTALS        2.500      1.6931      2761.68

STORM HYDROGRAPH VOLUME =      22.82  ACRE-FEET
MAXIMUN STORM DISCHARGE =     362.05  CFS
```

```
ITEX, Site Runoff (Disturbed, 160 acres), 10-yr, 24 hr Storm
     STORM HYDROGRAPH  RAIN = 1.600  DURATION = 24.0  RUNOFF = 1.027
     STORM DISTRIBUTION IS SCS 24-HR
     CURVE NUMBER METHOD   CN =94.0

          TIME       RAINFALL     NET RAIN    DISCHARGE
         (HOURS)     (INCHES)     (INCHES)     (CFS)

         23.600       .0019        .0017        2.84
         23.700       .0019        .0017        2.84
         23.800       .0019        .0017        2.84
         23.900       .0019        .0017        2.84
         24.000       .0019        .0017        2.84
         24.100       .0000        .0000        2.84
         24.200       .0000        .0000         .94
         24.300       .0000        .0000         .22
         24.400       .0000        .0000         .04
         24.500       .0000        .0000         .00

         TOTALS        1.600       1.0271      1675.26

     STORM HYDROGRAPH VOLUME =      13.85  ACRE-FEET
     MAXIMUN STORM DISCHARGE =     222.31  CFS.
```

ITEX | Drainage Swale Sizing | DEW 11/15/94, 2106-006 | 1

Purpose: Size drainage swales to convey 100-yr, 24-hr storm

Assume:
- Swale around the perimeter of the landfill is excavated into the shale bedrock, n =
- Swale between cells
- Side slope = 2:1
- Size swale to convey runon/runoff
- Assume entire site is disturbed and contributes runoff
- Runon → A 20
  - B 80 Max flow (cfs)
  - C 275
  - D 175
- Runoff from site = 390 cfs per 160 acres
- Use Manning's Equation to size channel

South and West Perimeter Swale

Swale runs from SE corner of Cell 3 to NW corner of Cell 2 to outfall #1.

* SE corner of Cell 3 to midpoint to SW corner of Cell 2

Flow = 1/2 Area C = 138 cfs
Waste cell (30ac) = 73 cfs
Use 210 cfs

Min slope = 1%
n = 0.03 (Flemmer, 1986)
Min depth = 4'

Size channel

assume b = 2' → y = 3.4' width = 3.4(4)+2 = 15.6
b = 4' → y = 3.0' 3.0(4)+4 = 16.0

To elev 4375' use b = 3', y = 4' (max velocity = 8.3 fps)

* Midpoint (SE Cell 3 to SW Cell 2) to SW corner Cell 2

Flow = Area C = 275 cfs
Waste cell (55ac) = 135 cfs
Use 410 cfs

Min depth = 4'
n = 0.03
min. slope = 1%

Size channel
assume b = 6' → y = 3.7'

Use: b = 6', y = 4' (min) → velocity = 8.3 fps
b = 2' y = 5' (min)
b = 0 for y ≥ 6' → velocity = 7.8 fps

If s = 0.5%, b = 3' → y = 4.9'

From elev 4375 to 4359 use b = 3' y = 5' (max velocity = 8.4 fps)

* From SW corner Cell 2 to NW corner Cell 2

Flow = Area C = 275 cfs
Waste Cell (95ac) = 232 cfs
Use 510 cfs

Min slope = 1%

assume b = 3' → y = 4.7'

(from 4340 to 4330)

From elev 4359 to 4320 use b = 3', y = 5' (max velocity = 14.4 fps)

* From NW corner of Cell 2 to Outfall 1

Flow = Area C = 275
Area B = 80
Waste cell (215 ac) = 524

Use flow = 880 cfs

Swale → $b = 3'$, $s = 1\%$, $m = 2$, $y = 5.86'$
$b = 3'$, $s = 0.5\%$ → $y = 6.8'$

Use $b = 3'$, $y = 6'$ for slope 1% or greater
$b = 3'$, $y = 7'$ (min) for $0.5\% \leq \text{slope} \leq 1.0\%$

East and North Perimeter Swale

Swale runs for SE corner of cell 3 TO NE corner of cell 3 to NW corner of cell 3

* SE corner of cell 3 to midpoint of East side of cell 3

Flow = Area D (3/4 AREA) = 131 cfs
Waste Cell (15.7 acres) = 38 cfs

Use FLOW = 169 cfs

Min Slope = 1%
$n = 0.03$

Swale → $b = 3'$, $S = 1\%$, $m = 2$, $y = 2.87$

USE $b = 3'$, $y = 3'$ FROM SE CORNER cell 3 to midpoint EAST SIDE CELL 3 @ 1% min slope (Max Vel. = 8.72 fps)

* MIDPOINT EAST SIDE cell 3 to NE corner cell 3

FLOW = AREA D = 175 cfs
Waste cell (14.5 + 15.7 acres) = 73.6 cfs

Use 249 cfs

Min slope = 1%
n = 0.03

Size channel.

Swale b= 3', y= 3.41' Vel = 7.43 fps

Use b= 3' y= 4', (max velocity = 9.62 fps)

* NE corner cell 3 TO OUTFALL

FLOW = AREA D = 175 cfs
Waste Cell (14.5 + 15.7 + 9.6 acres) = 97 cfs

Use 272 cfs

Min slope = 1%
n = 0.03

SIZE CHANNEL

Swale b= 3'; y= 3.55', VEL= 7.59 fps

Use b=3' y=4'; (MAX VELOCITY = 7.59 fps)

NORTHEAST CORNER CELL 1

Swale runs East into NE corner + North into NE corner

* North Side Cell 1 Elev 4340 → OUTFALL

FLOW = Waste Cell (3.5 acres) = 8.5 cfs

Min Slope = 1%
n = 0.03

Size channel:
Swale b= 2', y= .77' Vel = 3.12 fps

* East Side Cell 1, Elev 4350 → OUTFALL NE corner

FLOW = Waste Cell (6.4 acres) = 15.6 cfs
½ Area A = 10 cfs
Use 25.6 cfs
Min Slope = 1%
n = 0.03

SIZE CHANNEL

Swale b = 2', y = 1.32 ft Vel = 4.18 fps

Use b = 2', y = 2' (Max Vel. = 5.40 fps)

NORTH SIDE CELL 1 TO OUTFALL ON WEST SIDE CELL 1

Swale runs West on North side Cell 1 Then South to Outfall

* ELEV 4340 TO NW corner CELL 1

FLOW = Waste Cell (26.8 acres) = 65 cfs

Min slope = 0.7%
n = 0.03
Use 65 cfs

SIZE CHANNEL

Swale b = 3', y = 1.56', Vel = 6.80 fps

Use b = 3', y = 2', (Max Vel = 8.78 fps)

* NW corner Cell 1 TO outfall

Flow = Waste Cell (26.8 + 4.8 acres) = 77 cfs
Use 77 cfs
Min Slope = 0.6%
n = 0.03

Size Channel

Swale b = 3', y = 2.25', Vel = 4.55 fps

Use b = 3', y = 3' (Max Vel = 4.55 fps)

NORTH SIDE Cell 2 TO NW CORNER CELL 2

Swale runs West from Elev 4360 Between Cell 1 + Cell 2 TO NW Corner Cell 1

* East Side Cell 1 South to SE corner Cell 1

FLOW = ½ Area A = 10 cfs
Waste Cell (2.9 acres) = 7 cfs
Use 17 cfs

Min Slope = 1%
n = 0.03

Size Channel

Swale b = 2', y = .92, V = 4.85 fps

Use b = 2' y = 1' (Max Vel = 4.85 fps)

* North side Cell 2 TO SE corner Cell 1

FLOW = Waste Cell (24.7 acres) = 60 cfs
Use 77 cfs

Min Slope = 2%
n = 0.03

Size Channel

Swale b = 3', y = 1.50', Vel = 6.66 fps

Use b = 3', y = 2 (Max Vel = 6.66 fps)

* SE corner Cell 1 to NW corner Cell 2

FLOW = WASTE CELL 2 (24.7 + 31.1) = 136 cfs
WASTE CELL 1 (2.9 ac) = 7 cfs
Area A = 10 cfs
Use 153 cfs

Min slope = 1%
n = 0.03

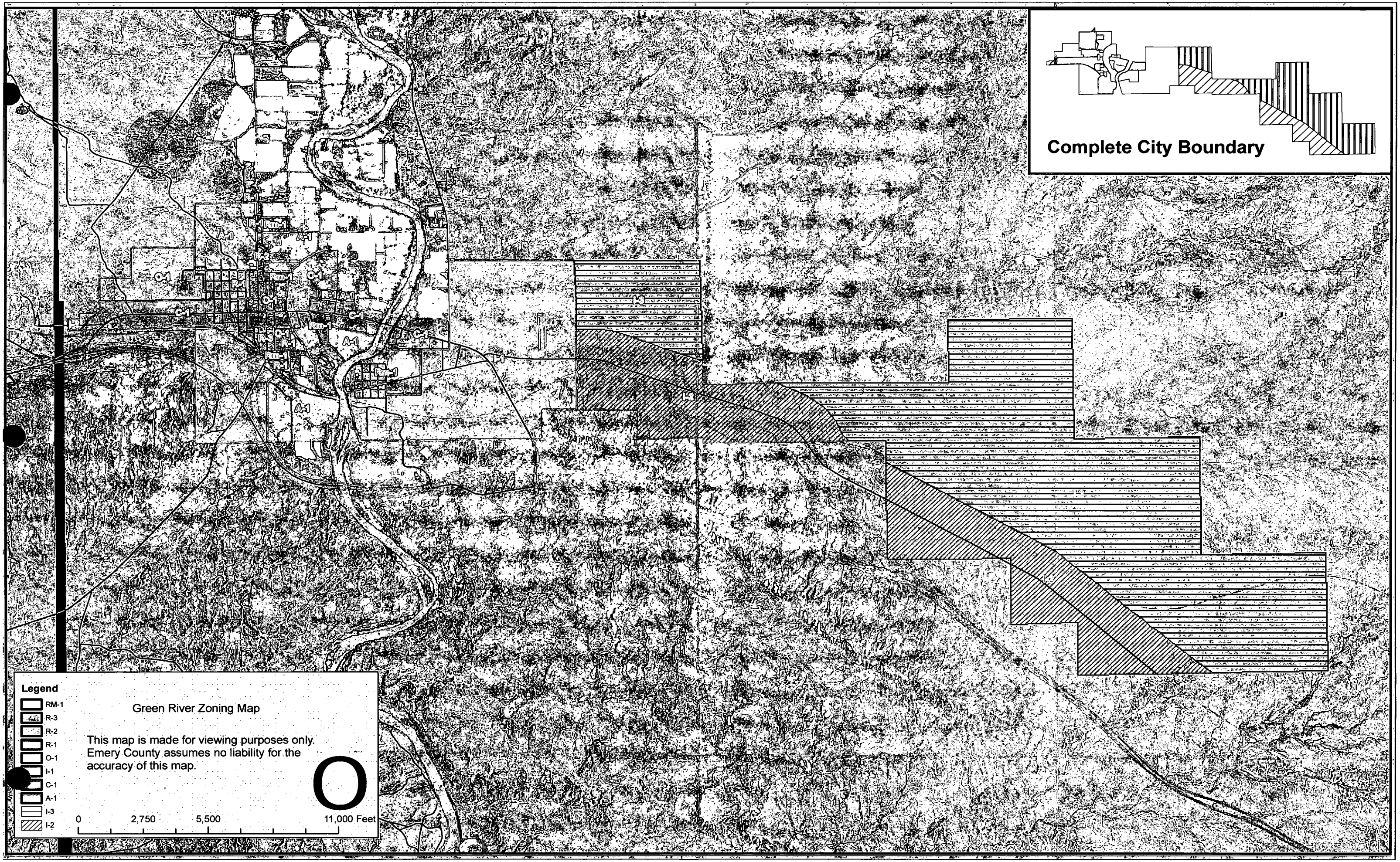
SIZE CHANNEL

Swale b = 3', y = 2.75' Vel = 6.56 fps

USE b = 3', y = 3' (Max Vel = 8.50 fps)

EXHIBIT B

LAND USE ZONING MAP



Green River Zoning Map

This map is made for viewing purposes only. Emery County assumes no liability for the accuracy of this map.

EXHIBIT C

NOTICE OF INTENT LETTER TO SURROUNDING PROPERTY OWNERS

TLA
BALETECH LLC

April 1, 2008

U.S. Department of the Interior
Bureau of Land Management (BLM)
Utah State Office
440 West 200 South
Suite 500
Salt Lake City, Utah 84101

U.S. Department of the Interior
Bureau of Land Management (BLM)
Canyon County District Office
(Moab Field Office)
82 East Dogwood
Moab, Utah 84532

State of Utah
School and Institutional Trust Lands Administration (SITLA)
675 East 500 South
Suite 500
Salt Lake City, Utah 84102

Re: Solitude Landfill Permit Renewal

Notice is hereby given that TLA-Bale Tech LLC, through its subsidiary Green River Landfill LLC, intends to apply with the Utah Division of Solid and Hazardous Waste for renewal of a permit to own and operate a Class V Landfill Facility (Solitude Landfill) within Section 22, Township 21 South, Range 17 West, Salt Lake Base & Meridian. The property is located approximately 6 miles east of the Green River and within the limits of the City of Green River, Emery County, Utah.

Sincerely,
TLC-Bale Tech LLC

Marlene P. Wheaton

76 South Orange Avenue · Suite 208 · South Orange, NJ 07079
Tel: 973-762-6060 · Fax 973-762-6169

EXHIBIT D

HISTORICAL SURVEY

MONTGOMERY
ARCHAEOLOGICAL
CONSULTANTS
Box 219, 322 East 100 South, Moab, Utah 84532 (435) 259-5764 Fax (435) 259-5608

March 20, 2008

Kent Staheli
Hansen, Allen and Luce Inc.
23 S. Carbon Ave., Ste. 21
Price, UT 84501

Dear Mr. Staheli:

Enclosed, please find a copy of the report entitled "Cultural Resource Inventory of Transload America's Solitude Landfill in Grand County, Utah Township 21 South, Range 17 East, Section 22". The inventory resulted in the documentation of three new sites (42Gr4008, 42Gr4009, and 42Gr4010) none of which are recommended eligible to the NRHP. Based on these findings, a recommendation "No Historic Properties Affected" is proposed for this undertaking pursuant to Section 106, CFR 800.

If you have any questions or comments please call me.

Sincerely,

Keith R Montgomery
Keith R. Montgomery
Principal Investigator

cc: Matt Seddon, Deputy State Historic Preservation Officer, SLC
Scott Evans, Transload America Inc., South Orange, NJ

CULTURAL RESOURCE INVENTORY OF
TRANSLOAD AMERICA'S SOLITUDE LANDFILL
GRAND COUNTY, UTAH
TOWNSHIP 21 SOUTH, RANGE 17 EAST, SECTION 22

CULTURAL RESOURCE INVENTORY OF TRANSLOAD AMERICA'S SOLITUDE LANDFILL GRAND COUNTY, UTAH TOWNSHIP 21 SOUTH, RANGE 17 EAST, SECTION 22

By:

Hannah Russell

Prepared For:

Utah State Historic Preservation Office
300 S. Rio Grande St.
Salt Lake City, Utah 84101

Prepared Under Contract With:

Transload America
76 South Orange Ave.
Suite 208
South Orange, New Jersey 07079

Prepared By:

Montgomery Archaeological Consultants, Inc.
P.O. Box 219
Moab, Utah 84532

MOAC Report No. 08-043

March 20, 2008

United States Department of Interior (FLPMA)
Permit No. 07-UT-60122

State of Utah Public Lands Policy
Archaeological Survey Permit No. 117

State of Utah Antiquities Project (Survey)
Permit No. U-08-MQ-0095p

ABSTRACT

A cultural resource inventory was conducted by Montgomery Archaeological Consultants Inc. (MOAC) for the proposed Solitude landfill in March 2008. The fieldwork was initiated at the request of Scott Evans, Transload America, South Orange, New Jersey. The project area is located between Green River, and Crescent Junction, Utah, and south of the Book Cliffs. The legal description is Township 21 South, Range 17 East, Section 22. A total of 320 acres were inventoried on private land.

The inventory resulted in the documentation in three new historic sites (42Gr4008-42Gr4010). All three historic sites are recommended ineligible for inclusion into the National Register of Historic Places (NRPH). These include a historic oil well with associated trash scatter, a trash scatter associated with oil and gas exploration, and another trash scatter associated with cattle ranching. The sites are not associated with persons or events that are significant within history, nor do they retain structural integrity or possess the capacity to yield additional information that would be important to the history of the area. Based on these findings, a determination of "no historic properties adversely affected" is proposed for the undertaking pursuant to Section 106, CFR 800.

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LIST OF FIGURES

INTRODUCTION

A cultural resource inventory was conducted by Montgomery Archaeological Consultants, Inc. (MOAC) for the proposed Solitude Landfill in March 2008. The fieldwork was initiated at the request of Scott Evans, Transload America, South Orange, New Jersey. The project area is located in Gunnison Valley approximately five miles east of Elgin in Grand County, Utah. The legal description is Township 21 South, Range 17 East, Section 22. A total of 320 acres was inventoried on private land.

The objective of the inventory was to locate, document, and evaluate any cultural resources within the project area in order to attain compliance with a number of federal and state mandates, including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act of 1969, the Archaeological and Historic Conservation Act of 1972, the Archaeological Resources Protection Act of 1979, the American Indian Religious Freedom Act of 1978, and the Utah State Antiquities Act of 1973 (amended 1992).

The fieldwork was performed by Jody Patterson (Principal Investigator) with the assistance of Hannah Russell (Field Supervisor), Adam Thomas, and Dan Dugan between March 11 and 13, 2008 under the auspices of U.S.D.I. (FLPMA) Permit No. 07-UT-60122, State of Utah Public Lands Policy Archaeological Survey Permit No. 117, and State of Utah Antiquities Project (Survey) No. U-08-MQ-0095p issued to MOAC, Moab, Utah.

A file search for previous cultural resource inventories was performed by Hannah Russell at the Bureau of Land Management, Moab Field Office on March 7, 2008. This consultation indicated that one previous cultural resource inventory occurs within the vicinity of the current project area. In 1985, Abajo Archaeology conducted a cultural resource inventory of CEJA corporations ten seismograph lines in Grand County, Utah (Westfall, 1985). This inventory resulted in the documentation of no archaeological resources within the current project area.

DESCRIPTION OF PROJECT AREA

The project area is located east of Elgin, Utah, west of Crescent Junction, Utah and south of the Book Cliffs through Gunnison Valley. The legal description is Township 21 South, Range 17 East, Section 22.

Environmental Setting

The study area lies in the Mancos Shale Lowlands of the Colorado Plateau Province which is characterized by badlands, sloping pediments, and flat-bottomed alluvial valleys (Stokes 1986) Geologic formations include Mancos Shale, an early Cretaceous age formation, consisting of marine deposits and older alluvial deposits, as well as the Morrison formation, a series of terrestrial Jurassic age deposits. These formations are well known for Mesozoic fossils particularly dinosaurs and Permo-Triassic red beds such as the Chinle and Cedar Mountain Sandstone (Ibid 1986). Most of the Mancos Shale Lowlands are composed of clayey alluvial and residual soils derived from Mancos shale on shale pediments, broad flat plains, and steep escarpments. The nearest permanent water source is the Green River; intermittent sources include Browns Wash, Solitude Wash, and Crescent Wash. Situated within the Upper Sonoran Life Zone, vegetation includes sagebrush, blackbrush, greasewood, saltbrush, ephedra, galleta, winterfat, and Indian ricegrass.

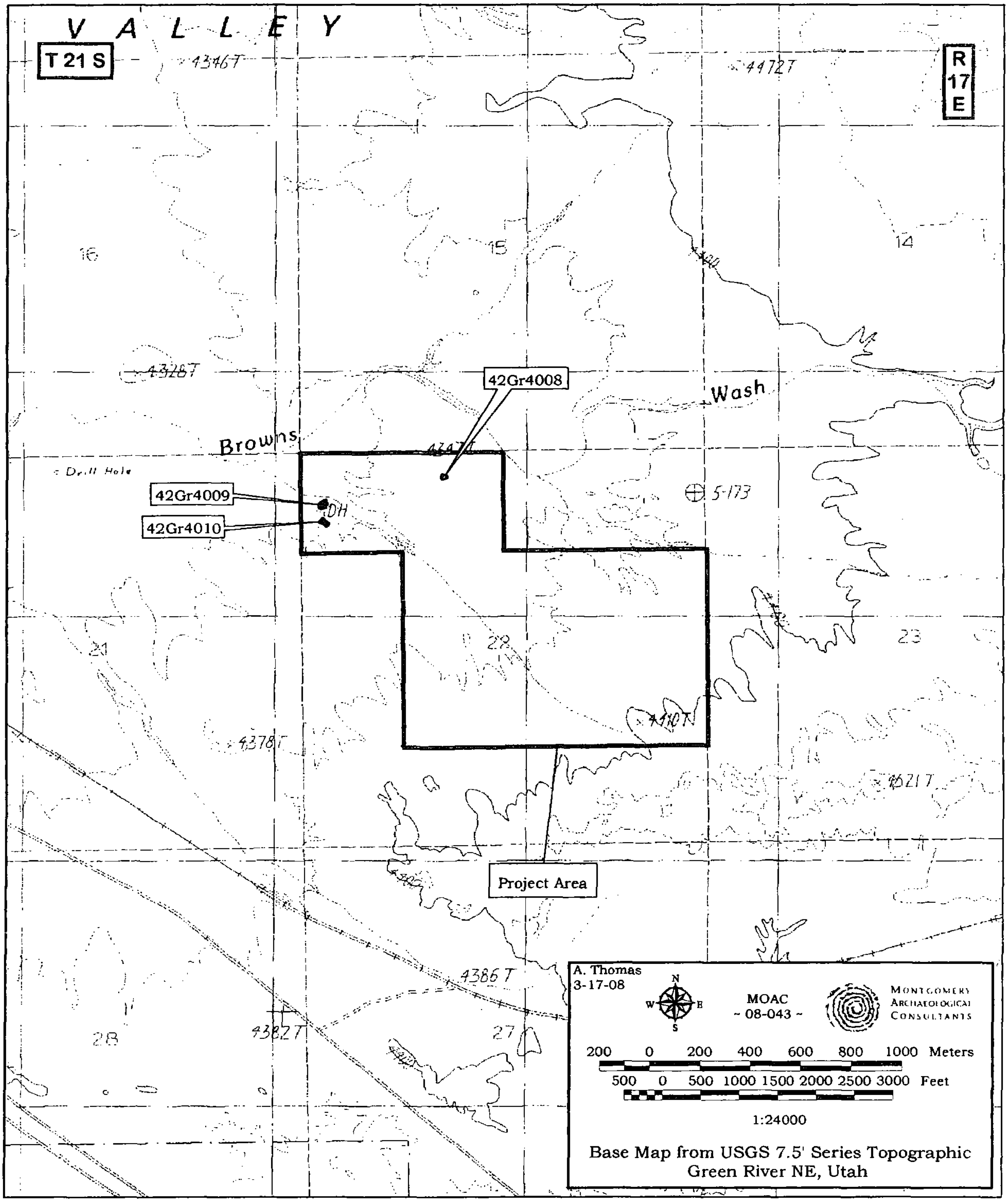

Figure 1. Inventory Area of the Proposed Solitude Landfill Showing Cultural Resources

Historical Overview

The first officially sanctioned exploration of southern Utah consisted of Spanish explorers led by Juan Maria Antonio de Rivera in 1765, in search of trading and prospective routes throughout the Southwest. This expedition apparently reached the Colorado River at Castle Valley (Barnes 1991). In 1776, the Dominguez-Escalante expedition entered portions of western Colorado and Utah, coming into contact with numerous Ute groups. Their route, portions of which became the Spanish Trail, was a long, meandering route with a large loop to the north crossing Grand County and extending well into central Utah. In the 1820s, trappers, such as Antoine Robidoux and the French-Canadian Etienne Provost, began to frequent the region. Government exploration and surveying parties in the area included John C. Fremont who successfully completed two expeditions in 1843 and 1845 for the U.S. Army Corps Topographical Engineers (Horn et al. 1994:149). Fremont led another private expedition in late 1853, following the route taken earlier that year by the Gunnison Expedition (Ibid:150). The first Mormon colony in Grand County was established in 1855 at present-day Moab, by settlers from Manti, Utah (Firmage 1996:79). The missionaries constructed a fort of adobe and stone and began to plant crops, but were deterred by conflicts with the Utes, and departed the valley in haste.

During the nineteenth century, cattle and later sheep ranching were the most widespread economic enterprises undertaken in southeastern Utah. In 1883, the Denver & Rio Grande Railroad narrow gauge, built between Denver and Salt Lake City, established a railhead at Thompson Springs, Utah (Daughters of Utah Pioneers 1972). During the 1880s, there were reportedly thousands of cattle on the range between Grand Junction and Green River (Horn et al. 1994:154). The Denver & Rio Grande Railroad narrow gauge line, built between Denver and Salt Lake City, established a railhead at Thompson Springs, Utah, in 1883. This location soon became an important transportation and shipping point for the stockmen of Grand and San Juan Counties, since cattle could be shipped from any of the narrow gauge railroad stations to the stockyards in Kansas City. Access to the railroad made it possible for ranchers to make a living on the uncultivable desert (Barnes 1991). One of the last areas to be filled with cattle was the rugged territory west of Moab between the Green and Colorado Rivers. The Murphy Cattle Company of Moab was one of the first companies to graze cattle in this area (Horn et al. 1994:155). In order for their cattle to survive, they improved the range by building reservoirs. In the 1920s, Bill Tibbetts moved his cattle into the Big Flat area, Gray's Pasture, Spring Canyon, and Arth's Pasture - where cattle were already being grazed by Albert Beach, John Jackson, the Taylors, Pattersons, Murphys, and Snyder and Riordan (Tibbetts et al. 1992).

Sheep gradually became the preferred livestock in the region during the latter part of the 1800s. However, while the cattlemen were more or less stabilized and kept their livestock near their holdings, the shepards were migratory. Around 1887, the Denver & Rio Grande Western Railroad began catering to the sheep herders by providing corrals and wool warehouses at Thompson, Cisco, and other locations along its line (Peterson 1975). In 1939, the Grazing Service (the Bureau of Land Management's predecessor) and the Soil Conservation Service purchased easements across properties on the western edge of Moab and established a livestock driveway that bypassed the town (Barnes 1991:26). The driveway extended from the winter ranges in San Juan County to the railhead at Thompson, following the main highway in most areas. The driveway was one mile in width, except in Moab Valley where it narrowed to 1/4 mile (Eardley 1991). Watering facilities and holding corrals were also constructed along the trail. The driveway between Moab and Thompson was designated the Central Stock Driveway, posted by the CCC, with present day physical remains consisting of metal signs mounted on juniper or metal posts. The livestock driveway to Thompson ceased being used in 1956, when cattle and sheep were all transported by truck to Grand Junction (Eardley 1991).

Mining began in the area with the discovery of small amounts of gold along the Colorado and Little Dolores Rivers, with most of the larger projects located near the head of Westwater Canyon. Most of the mining took place between the 1880s and 1920s, with some sporadic attempts in later years (Horn et al. 1994:187). Copper was also mined in the Salt Valley and about 10 miles south of the Little Grande (Floy) railroad station. Miners in these areas were Silas and Donald Knowles, Sr., Thomas Trout, Henry Green, and the American Continuous Report Company (Firmage 1996:248). In the early 1900s uranium and radium had become sufficiently valuable for mining in Grand County to be profitable. One of the earliest mining operations in the area was the Yellow Circle Mine near Upper Kane Springs with the initial uranium ore shipments being processed and used as coloring agents for ceramics (Balsley 1991). Between 1924 and 1934, the demand for uranium was limited, and nearly all was supplied by Howard Balsley from the Yellow Circle Mine (Horn et al. 1994:189). Uranium prospecting increased dramatically after 1948, spurred by government demand for the ore because of the developing Cold War with the Soviet Union. The uranium boom continued into the late 1950s, dissipating during the mid-1960s when the military had stockpiled all the ore it could possibly use (Firmage 1996:310). Vanadium was recognized as an important steel additive in the 1900s. It was also associated with uranium ore, both were generally found in the Morrison Formation geologic stratum. Some limited vanadium mining was done in Dry Valley by the International Vanadium Corporation in 1930 (Shumway 1964). Potash, which was mined in the area on a small scale during World War I, developed substantially after 1940. An intensive and successful drilling campaign for potash began in 1956 in the Sevenmile area, just north of Moab, later extending to the Cane Creek area (Tanner-McConkie 1976:22).

In 1961, the United States government acquired 3,450 acres of arid desert approximately 1.2 miles southeast of Green River, Utah for the construction of the Green River Launch Complex (Utah Launch Complex), a satellite installation of the White Sands Missile Range. Although Senator Frank Moss and others expressed concern over potential misfirings and falling booster debris, national security concerns resulted in rapid construction of the complex (Firmage 1996). The complex included, but was not limited to, a cantonment area, two launch facilities, magazine storage areas, and property for missile abort and fallout. The site functioned as a launching point for Athena and Pershing missiles, the last of which was fired in 1975. The site was officially deactivated in 1983.

SURVEY METHODOLOGY

An intensive pedestrian survey was performed for this project which is considered 100% coverage. The inventory area was examined for cultural resources by the archaeologists walking parallel transects spaced no more than 10 m (33 ft) apart. Ground visibility was considered good. A total of 320 acres was inventoried for cultural resources, all of which occurs on privately owned land.

Cultural resources were recorded as archaeological sites defined as spatially definable areas with features and/or ten or more artifacts. Sites were documented by the archaeologist walking transects across the site, spaced no more than 3 m (10 ft) apart, and marking the locations of cultural materials with pinflags. This procedure allowed clear definition of site boundaries and artifact concentrations. At the completion of the surface inspection, a Geo-Explorer Trimble was employed to map the sites, including diagnostic artifacts and other relevant features in reference to the site datum. Archaeological sites were photographed, with site data entered on an Intermountain Antiquities Computer System (IMACS, 1990 version) inventory form (Appendix A). A rebar with an aluminum cap stamped with the temporary site number was placed at each of the sites.

INVENTORY RESULTS

The inventory of Transload America's proposed Solitude Landfill in Township 21 South, Range 17 East, Section 22 resulted in the documentation of three new archaeological sites (42Gr4008, 42Gr4009, and 42Gr4010).

Smithsonian Site No.:	42Gr4008
Temporary Site No.:	08-43-01
Land Status:	Private
NRHP Eligibility:	Not Eligible

Description: The site consists of a small, sparse historic trash scatter located in a valley with very low rolling hills and knolls, cut by narrow, but deep ephemeral washes. Vegetation includes shadscale, ephedra, prickly pear cactus, cheatgrass, and low forbs. The site includes three "Owens Illinois" bottles, an "Adolphus Busch Glass Manufacturing Co." bottle, a fifth, unknown brown glass bottle, two sanitary cans, six wire nails, and several pieces of milled lumber. The lumber was aligned in a three sided square, however none of the pieces of wood are attached to one another. The artifact assemblage suggests two date ranges, the first date range appears between 1904-1908, and the second dates from 1929-1954. The area appears to have been used extensively for cattle ranching.

Smithsonian Site No.:	42Gr4009
Temporary Site No.:	08-43-02
Land Status:	Private
NRHP Eligibility:	Not Eligible

Description: The site consists of a capped oil well with associated trash scatter located in a valley cut by low rolling hills and knolls, and narrow but deep ephemeral washes. Vegetation is limited to halogeton, shadscale, and cheatgrass. The site includes a capped oil well with 10 bullet holes punctured through the west side of the well, and a soil stain that is eroding downslope to the northwest. Coal clinkers are scattered across the site, along with milled lumber and a brick concentration (Feature B). The oil well was likely an early steam powered rig which accounts for the clinkers. Artifacts include manganese solarized glass, brown glass, a hole-in-cap can, heavy ferrous metal, tin metal sheeting, braided metal cable, an enameled coffee cup, canvas, and wire nails. When the well was capped the site appears to have been demolished. The artifact assemblage suggests a date range from the 1880s to 1919. This particular well was never documented, however, the Crescent Drilling Company was actively drilling in the immediate area in the decade before the Leasing Act of 1920.

Smithsonian Site No.:	42Gr4010
Temporary Site No.:	08-43-03
Land Status:	Private
NRHP Eligibility:	Not Eligible

Description: The site is a small historic trash scatter located in a valley with low rolling hills, and narrow, but deep ephemeral washes. The site is sparsely populated by shadscale and cheatgrass. Artifacts include brown glass beer bottles, manganese solarized glass shards, aqua glass, three ceramic vessels, a sanitary can, bottle caps, milled wood, heavy canvas, nails, and a metal pipe. The majority of artifacts occur within Concentration A located on the northern portion of the site. The concentration measures 20 ft 8 inches north-south by 32 ft 6 inches east-west. The concentration includes approximately 16 whole and shattered brown glass beer bottles, 30 manganese solarized glass shards, two bottle caps and milled wood. Feature A, a coal concentration that measures 95 inches (N-S) x 110 inches (E-W), is situated southeast of

Concentration A. The feature consists of over 200 pieces of coal (measuring up to 3 1/4 x 1 3/4 x 1 inch). An ant hill, and six small pieces of unburnt milled wood are located in the center of the concentration. The artifact assemblage suggests a date range of 1880-1930. The site is likely associated with the historic capped oil well (42Gr4009) located just north of the site which was likely in operation in the 1910s.

NATIONAL REGISTER OF HISTORIC PLACES EVALUATION

The National Register Criteria for Evaluation of Significance and procedures for nominating cultural resources to the National Register of Historic Places (NRHP) are outlined in 36 CFR 60.4 as follows:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, material, workmanship, feeling, and association, and that they:
>
> a)...are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> b)...are associated with the lives of persons significant to our past; or
>
> c)...embody the distinctive characteristics of a type, period, or method of construction; or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> d)...have yielded or may be likely to yield information important in prehistory or history.

The inventory of Transload America's Solitude Landfill resulted in the documentation of three new cultural resources. Sites 42Gr4008 and 412Gr4010 are trash scatters which could be associated with grazing or resource exploration endeavors. Although these sites contain several types of artifacts, there remains minimal diagnostic information to address such research topics as consumer behavior patterns or meaningful trash disposal patterns. Therefore these sites are recommended ineligible to the NRHP because they fail to address Criteria A through D. Site 42Gr4009 appears to be the remnants of a historic oil well with associated trash. The site retains minimal physical integrity and only a few diagnostic artifacts. Although 42Gr4009 may represent the vestiges of early oil exploration in the area, the site contains limited additional information to qualify it as eligible to the NRHP.

MANAGEMENT RECOMMENDATIONS

The inventory of Transload America's proposed Solitude Landfill resulted in the documentation of three new cultural resources (42Gr4008, 42Gr4009, and 42Gr4010) that are recommended ineligible to the NRHP. Based on these findings, a determination of "no historic properties adversely affected" is proposed for the undertaking pursuant to Section 106, CFR 800.

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APPENDIX A:

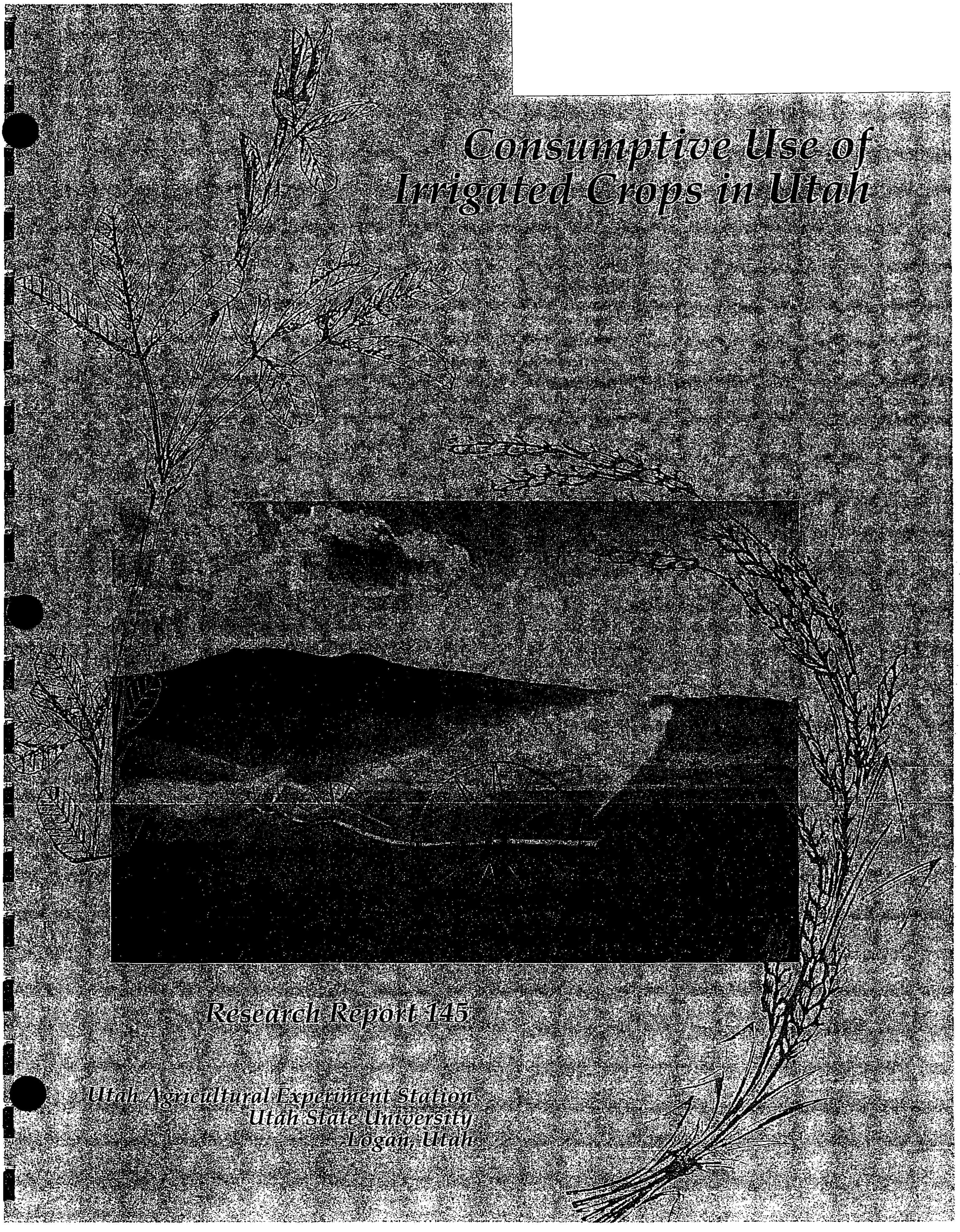
INTERMOUNTAIN ANTIQUITIES COMPUTER SITE FORMS (IMACS)

On file at the
Utah Division of State History
Salt Lake City

EXHIBIT E

SITE ANNUAL EVAPORATION AND PRECIPITATION DATA

Consumptive Use of Irrigated Crops in Utah



Research Report 145

Utah Agricultural Experiment Station
Utah State University
Logan, Utah

Estimated Consumptive Use for the NWS Station at GREEN RIVER AVN
From a Calibrated SCS Blaney-Criddle Equation using data from GREEN RIVER / LA SAL 10-26-1994
Years of Data Available; NWS: 1961-1990 GREEN RIVER / LA SAL: 1986-1992 Elev. 4070 ft., Lat. 39.00

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
% Day Light	6.79	6.71	8.29	8.91	9.99	10.06	10.22	9.56	8.39	7.75	6.75	6.59	100.00
Avg Temp F	22.77	32.89	42.90	52.44	61.95	71.45	78.53	75.61	65.40	52.89	39.08	27.06	51.91
Std Dev Temp	6.84	5.39	2.89	3.21	2.42	2.74	1.26	1.86	2.47	2.92	2.64	3.90	1.37
Avg Prec in.	0.40	0.32	0.59	0.50	0.61	0.41	0.57	0.74	0.71	0.87	0.41	0.39	6.52
Std Dev Prec	0.41	0.32	0.54	0.40	0.49	0.48	0.64	0.59	0.61	0.92	0.42	0.38	2.26
SCS-BC f in.	0.46	0.70	1.53	2.79	4.70	6.64	8.39	7.19	4.49	2.47	0.97	0.54	40.87
Std Dev f	0.14	0.15	0.28	0.43	0.45	0.60	0.31	0.41	0.40	0.34	0.16	0.08	1.76
ALFALFA													
Cal SCS-BC k				1.11	1.58	1.02	0.92	1.11	1.00	1.07			
Cal SCS-BC Et				3.09	7.45	6.77	7.69	7.96	4.49	2.64			40.10
Std Dev Et				0.48	0.71	0.61	0.28	0.45	0.40	0.37			1.86
Net Irr in.				2.70	6.96	6.45	7.23	7.37	3.92	1.94			36.57
PASTURE													
Cal SCS-BC k			0.20	0.99	1.03	0.90	0.79	0.79	0.93	1.00			
Cal SCS-BC Et			0.30	2.77	4.85	5.96	6.61	5.69	4.18	2.47			32.83
Std Dev Et			0.06	0.43	0.46	0.54	0.24	0.32	0.37	0.34			1.53
Net Irr in.				2.37	4.36	5.63	6.15	5.10	3.62	1.77			29.00
SP GRAIN													
Cal SCS-BC k			0.06	0.62	1.44	1.37	0.59						
Cal SCS-BC Et			0.09	1.73	6.76	9.13	4.92						22.64
Std Dev Et			0.02	0.27	0.64	0.83	0.18						1.38
Net Irr in.				1.34	6.27	8.80	4.46						20.87
CORN													
Cal SCS-BC k					0.28	0.53	1.03	1.14	0.63				
Cal SCS-BC Et					1.32	3.55	8.60	8.21	2.81				24.50
Std Dev Et					0.13	0.32	0.32	0.47	0.25				0.93
Net Irr in.					0.83	3.22	8.14	7.62	2.25				22.07
ORCHARD													
Cal SCS-BC k				0.26	0.99	1.32	1.31	1.32	1.48	0.61			
Cal SCS-BC Et				0.72	4.66	8.77	11.02	9.52	6.63	1.51			42.84
Std Dev Et				0.11	0.44	0.79	0.40	0.54	0.59	0.21			1.75
Net Irr in.				0.33	4.17	8.44	10.56	8.93	6.07	0.81			39.31
TURF													
Cal SCS-BC k			0.37	0.97	0.89	0.77	0.68	0.68	0.80	0.86			
Cal SCS-BC Et			0.57	2.72	4.18	5.13	5.70	4.90	3.60	2.13			28.93
Std Dev Et			0.11	0.42	0.40	0.46	0.21	0.28	0.32	0.29			1.37
Net Irr in.			0.10	2.32	3.69	4.81	5.24	4.31	3.04	1.43			24.93

GARDEN													
Cal SCS-BC k					0.42	0.65	0.95	0.64	0.30	0.16			
Cal SCS-BC Et					1.99	4.31	7.93	4.61	1.33	0.40			20.58
Std Dev Et					0.19	0.39	0.29	0.26	0.12	0.06			0.80
Net Irr in.					1.50	3.99	7.47	4.02	0.76				17.74
E-LAKE													
Cal SCS-BC k	2.00	2.00	1.83	1.39	1.29	0.93	0.80	0.90	1.21	1.40	1.88	2.00	
Cal SCS-BC Evap	0.93	1.40	2.80	3.87	6.05	6.17	6.68	6.44	5.45	3.47	1.83	1.07	46.15
Std Dev Evap	0.28	0.31	0.52	0.60	0.57	0.56	0.25	0.37	0.49	0.48	0.30	0.15	2.12
Net Loss in.	0.52	1.08	2.21	3.37	5.44	5.76	6.11	5.70	4.74	2.60	1.42	0.68	39.63
ET Ref													
Cal SCS-BC k	4.17	3.29	1.53	1.78	1.59	1.38	1.21	1.22	1.43	1.56	1.41	2.60	
Estimated Etr	1.93	2.30	2.34	4.97	7.46	9.16	10.17	8.76	6.44	3.86	1.37	1.39	60.15
Std Dev Et	0.58	0.50	0.43	0.77	0.71	0.83	0.37	0.50	0.58	0.53	0.23	0.20	2.71

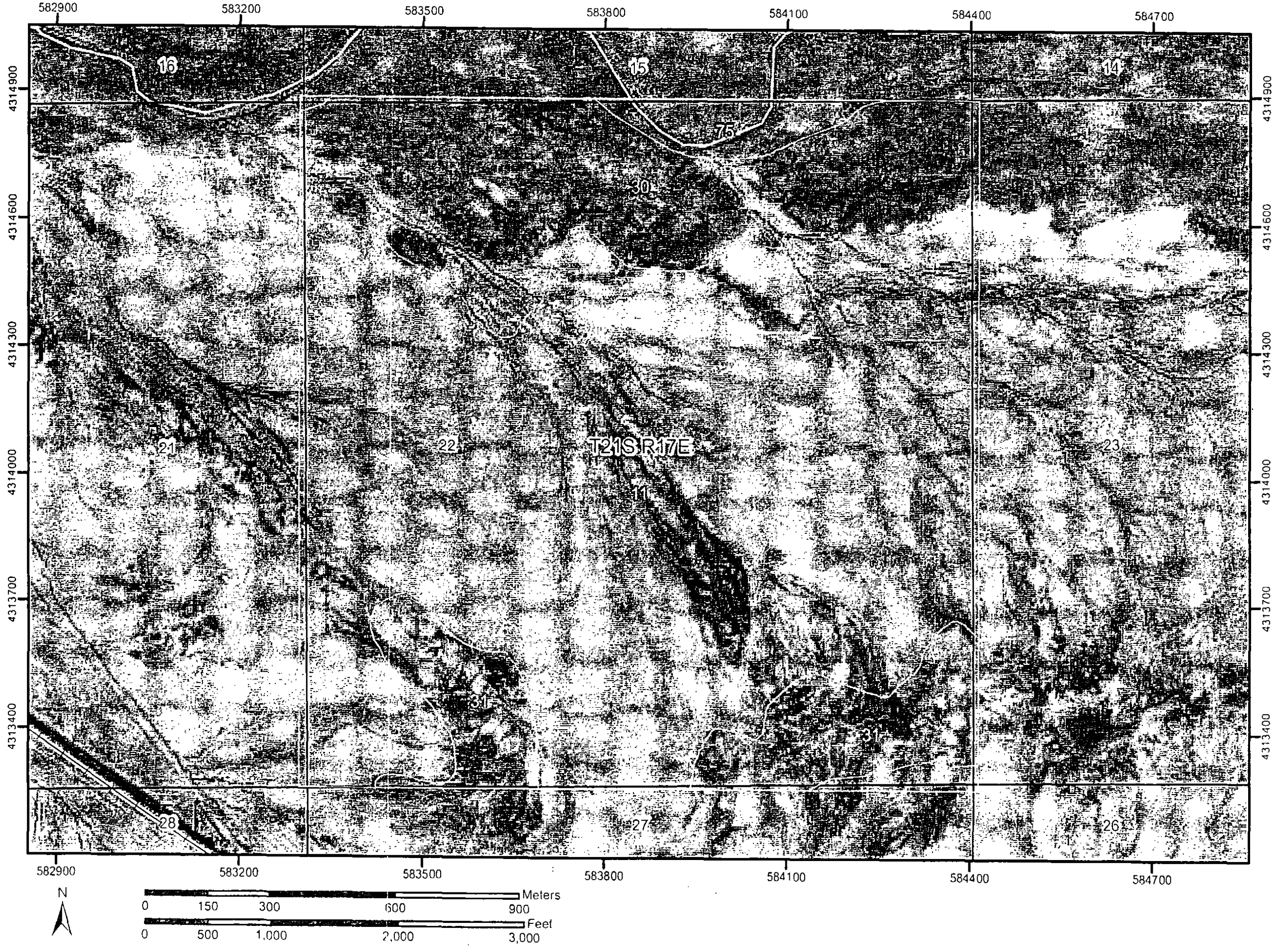
All Values are 30 Year Averages. Effective Precipitation is 80 Percent of Total During Growing Season
Blank values (if any) of ET Ref in early and late months denotes only seasonal calibration data
Adapted from Hill, 1994, Consumptive Use of Irrigated Crops in Utah, Ut Ag Exp Stn Res Rpt #145 Utah State Univ., Logan UT

EXHIBIT F

NATIONAL RESOURCE CONSERVATION SERVICE

SITE SOILS FROM SOIL SURVEY AND REGIONAL GROUND WATER

Soil Map–Grand County, Utah - Central Part
(Soil Survey Map)



Natural Resources
Conservation Service

Web Soil Survey 2.0
National Cooperative Soil Survey

4/21/2008
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- ☒ Borrow Pit
- Clay Spot
- ◆ Closed Depression
- Gravel Pit
- ∴ Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- ◎ Miscellaneous Water
- ◉ Perennial Water
- ∨ Rock Outcrop
- + Saline Spot
- ⁙ Sandy Spot
- ═ Severely Eroded Spot
- ◇ Sinkhole
- Slide or Slip
- Sodic Spot
- ≡ Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- ▲ Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features

Public Land Survey
- ☐ Township and Range
- ☐ Section

Municipalities
- ○ Cities
- ☐ Urban Areas

Water Features
- ▨ Oceans
- Streams and Canals

Transportation
- +++ Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grand County, Utah - Central Part
Survey Area Data: Version 4, Dec 21, 2006

Date(s) aerial images were photographed: 7/6/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Grand County, Utah - Central Part (UT624)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	447.3	68.0%
30	Mesa fine sandy loam, 2 to 6 percent slopes	133.0	20.2%
31	Mesa-Chipeta-Thedalund family complex	61.9	9.4%
75	Toddler-Ravola-Glenton families association	15.9	2.4%
Totals for Area of Interest (AOI)		658.0	100.0%

Component Legend

Grand County, Utah - Central Part

Map unit symbol and name	Pct. of map unit	Component name	Component kind	Pct. slope		
				Low	RV	High
11: Chipeta complex						
	40	Chipeta	Series	1	6	10
	30	Chipeta	Series	1	6	10
30· Mesa fine sandy loam, 2 to 6 percent slopes						
	75	Mesa	Series	2	4	6
31: Mesa-Chipeta-Thedalund family complex						
	25	Chipeta	Series	25	38	50
	25	Mesa	Series	2	4	6
	20	Thedalund family	Family	30	40	50
75: Toddler-Ravola-Glenton families association						
	25	Ravola family	Family	0	2	3
	25	Toddler family	Family	0	2	3
	20	Glenton family	Family	0	2	3

This report shows only the major soils in each map unit. Others may exist

Tabular Data Version: 4
Tabular Data Version Date: 12/21/2006

Source of Reclamation Material

Source of Reclamation Material— Summary by Map Unit — Grand County, Utah - Central Part						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (rating values)**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	Poor	Chipeta (40%)	Droughty (0.00)	450.5	67.8%
				Depth to bedrock (0.00)		
				Too alkaline (0.00)		
				Carbonate content (0.08)		
				Organic matter content low (0.13)		
			Chipeta (30%)	Too clayey (0.00)		
				Droughty (0.00)		
				Depth to bedrock (0.00)		
				Too alkaline (0.00)		
				Carbonate content (0.08)		
30	Mesa fine sandy loam, 2 to 6 percent slopes	Poor	Mesa (75%)	Too alkaline (0.00)	134.5	20.2%
				Carbonate content (0.08)		
				Organic matter content low (0.13)		
				Sodium content (0.97)		
				Water erosion (0.99)		

Source of Reclamation Material— Summary by Map Unit — Grand County, Utah - Central Part

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (rating values)	Acres in AOI	Percent of AOI
31	Mesa-Chipeta-Thedalund family complex	Poor	Mesa (25%)	Too alkaline (0 00)	62.8	9.4%
				Carbonate content (0.08)		
				Organic matter content low (0.13)		
				Sodium content (0.97)		
				Water erosion (0.99)		
			Chipeta (25%)	Too clayey (0.00)		
				Droughty (0.00)		
				Depth to bedrock (0.00)		
				Too alkaline (0.00)		
				Carbonate content (0.08)		
75	Toddler-Ravola-Glenton families association	Fair	Toddler family (25%)	Organic matter content low (0.50)	17.1	2.6%
				Water erosion (0.90)		
			Ravola family (25%)	Carbonate content (0.08)		
				Salinity (0.88)		
				Water erosion (0.90)		
				Sodium content (0.97)		
Totals for Area of Interest (AOI)					664.9	100.0%

Source of Reclamation Material— Summary by Rating Value

Rating	Acres in AOI	Percent of AOI
Poor	647.8	97.4%
Fair	17.1	2.6%

Description

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings do not apply to quarries or other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reclaimed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

The soils are rated "good," "fair," or "poor" as potential sources of reclamation material. The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential). Normal compaction, minor processing, and other standard construction practices are assumed.

When the material is properly used in reclamation, a rating of "good" means that establishing and maintaining vegetation are relatively easy, that the surface is stable and resists erosion, and that the reclaimed soil has good potential productivity. A rating of "fair" means that vegetation can be established and maintained and the soil can be stabilized through modification of one or more properties. For satisfactory performance, it may be necessary to topdress with better suited material or add soil amendments. A rating of "poor" means that revegetation and stabilization are very difficult and costly. To establish and maintain vegetation, it is necessary to topdress with better suited material.

Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of reclamation material. The lower the number, the greater the limitation.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Topsoil Source

Topsoil Source— Summary by Map Unit — Grand County, Utah - Central Part						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (rating values)**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	Poor	Chipeta (40%)	Salinity (0.00) Depth to bedrock (0.00) Carbonate content (0.08) Sodium content (0.22) Too clayey (0.57)	450.5	67.8%
			Chipeta (30%)	Too clayey (0.00) Salinity (0.00) Depth to bedrock (0.00) Carbonate content (0.08) Sodium content (0.22)		
30	Mesa fine sandy loam, 2 to 6 percent slopes	Poor	Mesa (75%)	Hard to reclaim (rock fragments) (0.00) Carbonate content (0.68) Salinity (0.88) Sodium content (0.98)	134.5	20.2%

Topsoil Source— Summary by Map Unit — Grand County, Utah - Central Part						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (rating values)**	**Acres in AOI**	**Percent of AOI**
31	Mesa-Chipeta-Thedalund family complex	Poor	Mesa (25%)	Hard to reclaim (rock fragments) (0.00)	62.8	9.4%
				Carbonate content (0.68)		
				Salinity (0.88)		
				Sodium content (0.98)		
			Chipeta (25%)	Slope (0.00)		
				Too clayey (0.00)		
				Salinity (0.00)		
				Depth to bedrock (0.00)		
				Carbonate content (0.08)		
			Thedalund family (20%)	Slope (0.00)		
				Depth to bedrock (0.10)		
				Too clayey (0.48)		
				Rock fragments (0.81)		
75	Toddler-Ravola-Glenton families association	Fair	Toddler family (25%)	Salinity (0.88)	17.1	2.6%
			Glenton family (20%)	Carbonate content (0.08)		
				Sodium content (0.98)		

Totals for Area of Interest (AOI)	664.9	100.0%

Topsoil Source— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Poor	647.8	97.4%
Fair	17.1	2.6%

Description

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated "good," "fair," or "poor" as potential sources of topsoil. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil. The lower the number, the greater the limitation.

The surface layer of most soils is generally preferred for topsoil because of its content of organic matter. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Roadfill Source

Roadfill Source— Summary by Map Unit — Grand County, Utah - Central Part

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (rating values)	Acres in AOI	Percent of AOI
11	Chipeta complex	Poor	Chipeta (40%)	Depth to bedrock (0.00)	450.5	67.8%
				Low strength (0.00)		
			Chipeta (30%)	Depth to bedrock (0.00)		
				Low strength (0.00)		
				Shrink-swell (0.79)		
30	Mesa fine sandy loam, 2 to 6 percent slopes	Good	Mesa (75%)		134.5	20.2%
31	Mesa-Chipeta-Thedalund family complex	Poor	Chipeta (25%)	Depth to bedrock (0.00)	62.8	9.4%
				Slope (0.00)		
				Low strength (0.00)		
			Thedalund family (20%)	Slope (0.00)		
				Depth to bedrock (0.00)		
				Low strength (0.00)		
				Shrink-swell (0.87)		
75	Toddler-Ravola-Glenton families association	Good	Toddler family (25%)		17.1	2.6%
			Ravola family (25%)			
			Glenton family (20%)			
Totals for Area of Interest (AOI)					664.9	100.0%

Roadfill Source— Summary by Rating Value

Rating	Acres in AOI	Percent of AOI
Poor	513.3	77.2%
Good	151.6	22.8%

Description

Roadfill is soil material that is excavated in one place and used in road embankments in another place. The soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The soils are rated "good," "fair," or "poor" as potential sources of roadfill. The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential). Normal compaction, minor processing, and other standard construction practices are assumed.

Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of roadfill. The lower the number, the greater the limitation.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Gravel Source

Gravel Source— Summary by Map Unit — Grand County, Utah - Central Part						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (rating values)	Acres in AOI	Percent of AOI
11	Chipeta complex	Poor	Chipeta (40%)	Bottom layer (0.00)	450.5	67.8%
				Thickest layer (0.00)		
			Chipeta (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
30	Mesa fine sandy loam, 2 to 6 percent slopes	Fair	Mesa (75%)	Bottom layer (0.00)	134.5	20.2%
				Thickest layer (0.19)		
31	Mesa-Chipeta-Thedalund family complex	Poor	Chipeta (25%)	Bottom layer (0.00)	62.8	9.4%
				Thickest layer (0.00)		
			Thedalund family (20%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
75	Toddler-Ravola-Glenton families association	Poor	Toddler family (25%)	Bottom layer (0.00)	17.1	2.6%
				Thickest layer (0.00)		
			Ravola family (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Glenton family (20%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Totals for Area of Interest (AOI)					664.9	100.0%

Gravel Source— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Poor	530.4	79.8%
Fair	134.5	20.2%

Description

Gravel consists of natural aggregates (2 to 75 millimeters in diameter) suitable for commercial use with a minimum of processing. It is used in many kinds of construction. Specifications for each use vary widely. Only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel, the soil is considered a likely source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be gravel.

The soils are rated "good," "fair," or "poor" as potential sources of gravel. A rating of "good" or "fair" means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Sand Source

Sand Source— Summary by Map Unit — Grand County, Utah - Central Part

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (rating values)	Acres in AOI	Percent of AOI
11	Chipeta complex	Poor	Chipeta (40%)	Bottom layer (0.00)	450.5	67.8%
				Thickest layer (0.00)		
			Chipeta (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
30	Mesa fine sandy loam, 2 to 6 percent slopes	Poor	Mesa (75%)	Bottom layer (0.00)	134.5	20.2%
				Thickest layer (0.00)		
31	Mesa-Chipeta-Thedalund family complex	Poor	Mesa (25%)	Bottom layer (0.00)	62.8	9.4%
				Thickest layer (0.00)		
			Chipeta (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Thedalund family (20%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
75	Toddler-Ravola-Glenton families association	Poor	Toddler family (25%)	Bottom layer (0.00)	17.1	2.6%
				Thickest layer (0.00)		
			Ravola family (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Totals for Area of Interest (AOI)					664.9	100.0%

Sand Source— Summary by Rating Value

Rating	Acres in AOI	Percent of AOI
Poor	664.9	100.0%

Description

Sand is a natural aggregate (0.05 millimeter to 2 millimeters in diameter) suitable for commercial use with a minimum of processing. It is used in many kinds of construction. Specifications for each use vary widely. Only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand, the soil is considered a likely source regardless of thickness. The assumption is that the sand layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet.

The soils are rated "good," "fair," or "poor" as potential sources of sand. A rating of "good" or "fair" means that sand is likely to be in or below the soil. The bottom layer and the thickest layer of the soil are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand. The number 0.00 indicates that the layer is a "poor source." The number 1.00 indicates that the layer is a "good source." A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Representative Slope

Representative Slope— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	6.0	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	4.0	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	38.0	67.2	9.8%
75	Toddler-Ravola-Glenton families association	2.0	17.1	2.5%

Totals for Area of Interest (AOI)		
	683.4	100.0%

Description

Slope gradient is the difference in elevation between two points, expressed as a percentage of the distance between those points.

The slope gradient is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	D	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	B	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	B	67.2	9.8%
75	Toddler-Ravola-Glenton families association	B	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Drainage Class

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
11	Chipeta complex	Well drained	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	Well drained	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	Well drained	67.2	9.8%
75	Toddler-Ravola-Glenton families association	Well drained	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Drainage Class— Summary by Map Unit — Grand County, Utah - Central Part

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

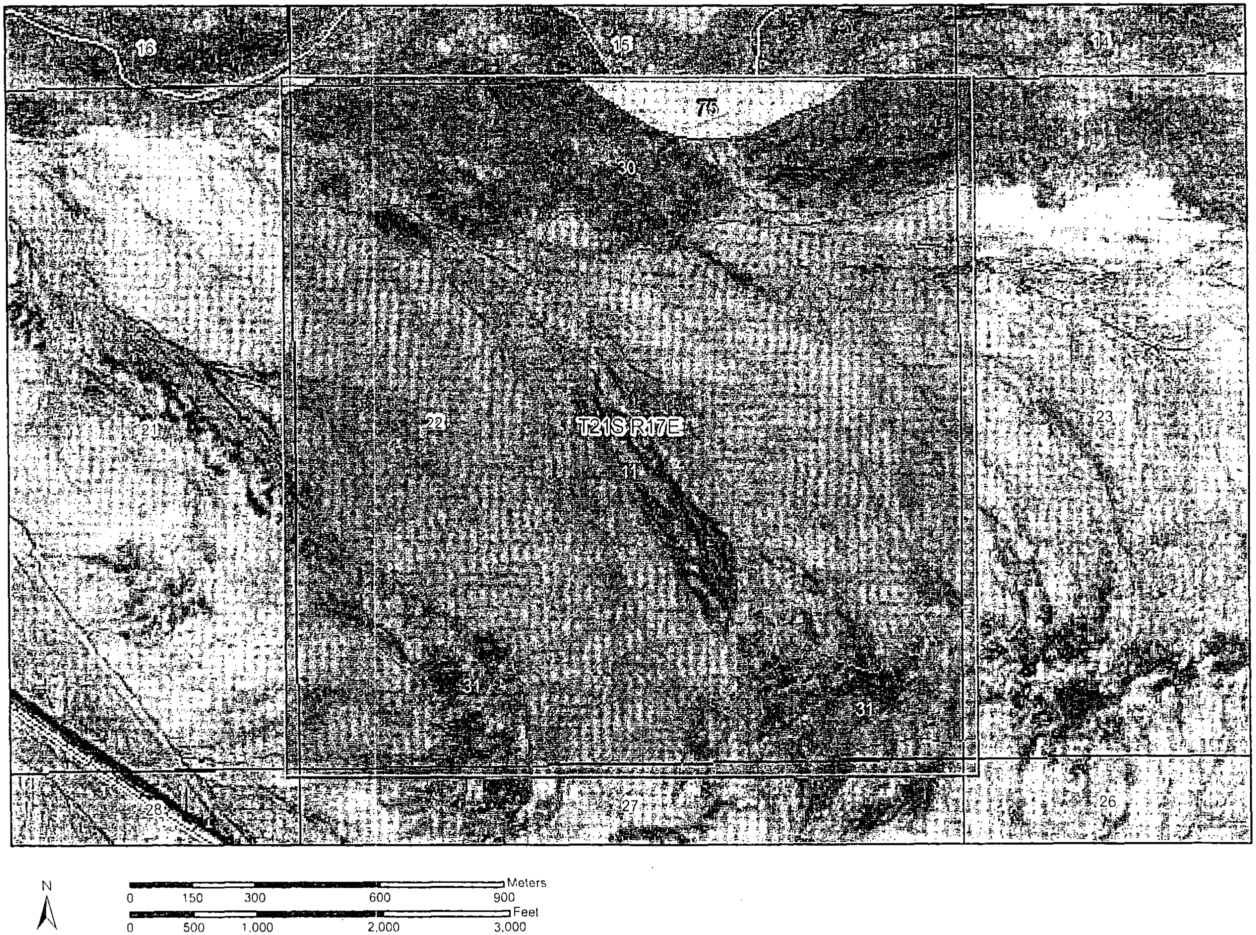
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Flooding Frequency Class—[illegible]nd County, Utah - Central Part
(Solitude Landfill)



Flooding Frequency Class–Grand County, Utah - Central Part
(Solitude Landfill)

MAP LEGEND

Area of Interest (AOI)
Area of Interest (AOI)

Soils
Soil Map Units

Soil Ratings
☐ None
☐ Very Rare
☐ Rare
☐ Occasional
☐ Frequent
☐ Very Frequent

Political Features

Public Land Survey
☐ Township and Range
☐ Section

Municipalities
○ Cities
☐ Urban Areas

Water Features
Oceans
Streams and Canals

Transportation
+++ Rails

Roads
Interstate Highways
US Routes
State Highways
Local Roads
Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grand County, Utah - Central Part
Survey Area Data: Version 4, Dec 21, 2006

Date(s) aerial images were photographed: 7/6/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Flooding Frequency Class

Flooding Frequency Class— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	None	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	None	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	None	67.2	9.8%
75	Toddler-Ravola-Glenton families association	Rare	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Description

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent.

"None" means that flooding is not probable. The chance of flooding is nearly 0 percent in any year. Flooding occurs less than once in 500 years.

"Very rare" means that flooding is very unlikely but possible under extremely unusual weather conditions. The chance of flooding is less than 1 percent in any year.

"Rare" means that flooding is unlikely but possible under unusual weather conditions. The chance of flooding is 1 to 5 percent in any year.

"Occasional" means that flooding occurs infrequently under normal weather conditions. The chance of flooding is 5 to 50 percent in any year.

"Frequent" means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year.

"Very frequent" means that flooding is likely to occur very often under normal weather conditions. The chance of flooding is more than 50 percent in all months of any year.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: More Frequent

Beginning Month: January

Ending Month: December

Depth to Water Table

Depth to Water Table— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	>200	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	>200	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	>200	67.2	9.8%
75	Toddler-Ravola-Glenton families association	>200	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

K Factor, Rock Free

K Factor, Rock Free— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	.37	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	.28	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	.37	67.2	9.8%
75	Toddler-Ravola-Glenton families association	.43	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Layer Options: Surface Layer

Frost Action

Frost Action— Summary by Map Unit — Grand County, Utah - Central Part				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
11	Chipeta complex	Low	462.7	67.7%
30	Mesa fine sandy loam, 2 to 6 percent slopes	Low	136.3	19.9%
31	Mesa-Chipeta-Thedalund family complex	Low	67.2	9.8%
75	Toddler-Ravola-Glenton families association	Low	17.1	2.5%
Totals for Area of Interest (AOI)			683.4	100.0%

Description

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (Ksat), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Chemical Soil Properties

Grand County, Utah - Central Part

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100 g*	*meq/100 g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
11:								
Chipeta	0-3	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	3-8	14-19	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	8-12	---	---	---	---	---	---	---
Chipeta	0-2	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	2-4	14-19	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	4-11	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	11-18	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	18-22	---	---	---	---	---	---	---
30:								
Mesa	0-3	4.0-10	---	7.4-8.4	1-3	0	0.0-2.0	0-2
	3-10	9.0-14	---	7.9-9.0	1-3	0	0.0-2.0	0-8
	10-24	9.0-14	---	8.5-9.0	20-40	0	2.0-8.0	0-10
	24-37	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	37-54	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	54-60	4.0-10	---	8.5-9.6	0	0-5	2.0-8.0	1-15
31:								
Chipeta	0-3	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	3-8	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	8-12	---	---	---	---	---	---	---
Mesa	0-3	4.0-10	---	7.4-8.4	1-3	0	0.0-2.0	0-2
	3-10	9.0-14	---	7.9-9.0	1-3	0	0.0-2.0	0-8
	10-24	9.0-14	---	8.5-9.0	20-40	0	2.0-8.0	0-10
	24-37	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	37-54	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	54-60	4.0-10	---	8.5-9.6	0	0-5	2.0-8.0	1-15
Thedalund family	0-4	0.0-14	---	7.9-9.0	1-3	0-5	0.0-2.0	0-1
	4-9	10-17	---	7.9-9.0	1-15	0-5	0.0-2.0	0-2
	9-24	14-19	---	7.9-9.0	0	1-5	0.0-2.0	0-3
	24-28	---	---	---	---	---	---	---
75:								
Ravola family	0-3	7.0-14	---	7.9-9.0	30-40	0	2.0-8.0	0-4
	3-7	7.0-13	---	7.9-9.0	30-40	0	2.0-8.0	0-8
	7-10	7.0-10	---	7.9-9.0	30-40	0-2	4.0-16.0	2-8
	10-29	10-14	---	7.9-9.0	30-40	0-4	4.0-16.0	2-8
	29-60	10-14	---	7.9-9.0	30-40	0-4	4.0-16.0	2-10

This report shows only the major soils in each map unit. Others may exist.

Chemical Soil Properties

Grand County, Utah - Central Part

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100 g*	*meq/100 g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
75:								
Toddler family	0-7	10-16	---	7.9-9.0	3-15	0-1	2.0-8.0	0-4
	7-12	9.0-14	---	7.9-9.0	1-3	0-3	2.0-8.0	0-4
	12-36	14-18	---	7.9-9.0	1-3	0-3	2.0-8.0	0-4
	36-60	9.0-10	---	7.9-9.0	3-15	0-3	2.0-8.0	1-10
Glenton family	0-2	3.0-11	---	7.9-9.6	30-40	0	0.0-8.0	0-5
	2-6	2.0-9.0	---	7.9-9.6	30-40	0	0.0-8.0	0-5
	6-19	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	19-31	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	31-55	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	55-62	2.0-9.0	---	7.9-9.6	15-30	0-3	0.0-8.0	0-10

This report shows only the major soils in each map unit. Others may exist.

Chemical Soil Properties

Grand County, Utah - Central Part

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100 g*	*meq/100 g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
11:								
Chipeta	0-3	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	3-8	14-19	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	8-12	---	---	---	---	---	---	---
Chipeta	0-2	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	2-4	14-19	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	4-11	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	11-18	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	18-22	---	---	---	---	---	---	---
30:								
Mesa	0-3	4.0-10	---	7.4-8.4	1-3	0	0.0-2.0	0-2
	3-10	9.0-14	---	7.9-9.0	1-3	0	0.0-2.0	0-8
	10-24	9.0-14	---	8.5-9.0	20-40	0	2.0-8.0	0-10
	24-37	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	37-54	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	54-60	4.0-10	---	8.5-9.6	0	0-5	2.0-8.0	1-15
31:								
Chipeta	0-3	15-22	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	3-8	20-26	---	8.5-9.6	30-40	1-10	8.0-16.0	5-15
	8-12	---	---	---	---	---	---	---
Mesa	0-3	4.0-10	---	7.4-8.4	1-3	0	0.0-2.0	0-2
	3-10	9.0-14	---	7.9-9.0	1-3	0	0.0-2.0	0-8
	10-24	9.0-14	---	8.5-9.0	20-40	0	2.0-8.0	0-10
	24-37	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	37-54	5.0-9.0	---	8.5-9.6	30-40	0-2	2.0-8.0	1-13
	54-60	4.0-10	---	8.5-9.6	0	0-5	2.0-8.0	1-15
Thedalund family	0-4	0.0-14	---	7.9-9.0	1-3	0-5	0.0-2.0	0-1
	4-9	10-17	---	7.9-9.0	1-15	0-5	0.0-2.0	0-2
	9-24	14-19	---	7.9-9.0	0	1-5	0.0-2.0	0-3
	24-28	---	---	---	---	---	---	---
75:								
Ravola family	0-3	7.0-14	---	7.9-9.0	30-40	0	2.0-8.0	0-4
	3-7	7.0-13	---	7.9-9.0	30-40	0	2.0-8.0	0-8
	7-10	7.0-10	---	7.9-9.0	30-40	0-2	4.0-16.0	2-8
	10-29	10-14	---	7.9-9.0	30-40	0-4	4.0-16.0	2-8
	29-60	10-14	---	7.9-9.0	30-40	0-4	4.0-16.0	2-10

This report shows only the major soils in each map unit. Others may exist.

Tabular Data Version: 4
Tabular Data Version Date: 12/21/2006

Chemical Soil Properties

Grand County, Utah - Central Part

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100 g*	*meq/100 g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
75:								
Toddler family	0-7	10-16	---	7.9-9.0	3-15	0-1	2.0-8.0	0-4
	7-12	9.0-14	---	7.9-9.0	1-3	0-3	2.0-8.0	0-4
	12-36	14-18	---	7.9-9.0	1-3	0-3	2.0-8.0	0-4
	36-60	9.0-10	---	7.9-9.0	3-15	0-3	2.0-8.0	1-10
Glenton family	0-2	3.0-11	---	7.9-9.6	30-40	0	0.0-8.0	0-5
	2-6	2.0-9.0	---	7.9-9.6	30-40	0	0.0-8.0	0-5
	6-19	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	19-31	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	31-55	2.0-9.0	---	7.9-9.6	30-40	0-1	0.0-8.0	0-10
	55-62	2.0-9.0	---	7.9-9.6	15-30	0-3	0.0-8.0	0-10

This report shows only the major soils in each map unit. Others may exist.

Tabular Data Version: 4
Tabular Data Version Date: 12/21/2006

EXHIBIT G

BROWN'S WASH HYDROLOGY

CLIENT [illegible] America
PROJECT Solitude Land Fill
FEATURE Brown's Wash Hydrology
PROJECT NO 332.01.100

SHEET 1 OF
COMPUTED BDM
CHECKED
DATE March 18, 2008

Brown's Wash Hydrology

Introduction: As part of the permit renewal process for the Solitude proposed landfill, the hydrology of Brown's Wash has been examined

Storm water flows within Brown's Wash pass through a corner of the project site.

Methodology: A HEC-HMS hydrological model was developed for Browns Wash. The model was used to predict peak runoff for a 100-YR 24 HR storm event.

The attached calculations develop input parameters for the model + provide modeling results. Calculations address the following:

Precipitation: Sheet(s) 2 - 7
Basin size : Sheet(s) 8
Curve Number: Sheet(s) 8 - 13
Basin Lag Time: Sheet(s) 14
Model Type + Results: Sheet(s). 15
Channel Capacity: Sheet(s): 19

Results: A peak flow of 2,705 cfs is predicted. This flow is within the capacity of the existing channel with at least 2 feet of freeboard remaining.

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Transload America
PROJECT Solitude
FEATURE Precipitation
PROJECT NO 332.01.100

SHEET 2 OF
COMPUTED RDM
CHECKED
DATE March 14, 2008

ESTIMATE PRECIPITATION

Use National Weather Service NOAA Atlas 14 to estimate precipitation for Brown's Wash.

Find a point in approximately the center of the watershed.

Lat: 39° 02' 30" N } This location is shown on
Long: -109° 55' 00" W } sheet 3 attached.

In decimal degrees:

Lat: 39.0416667 N

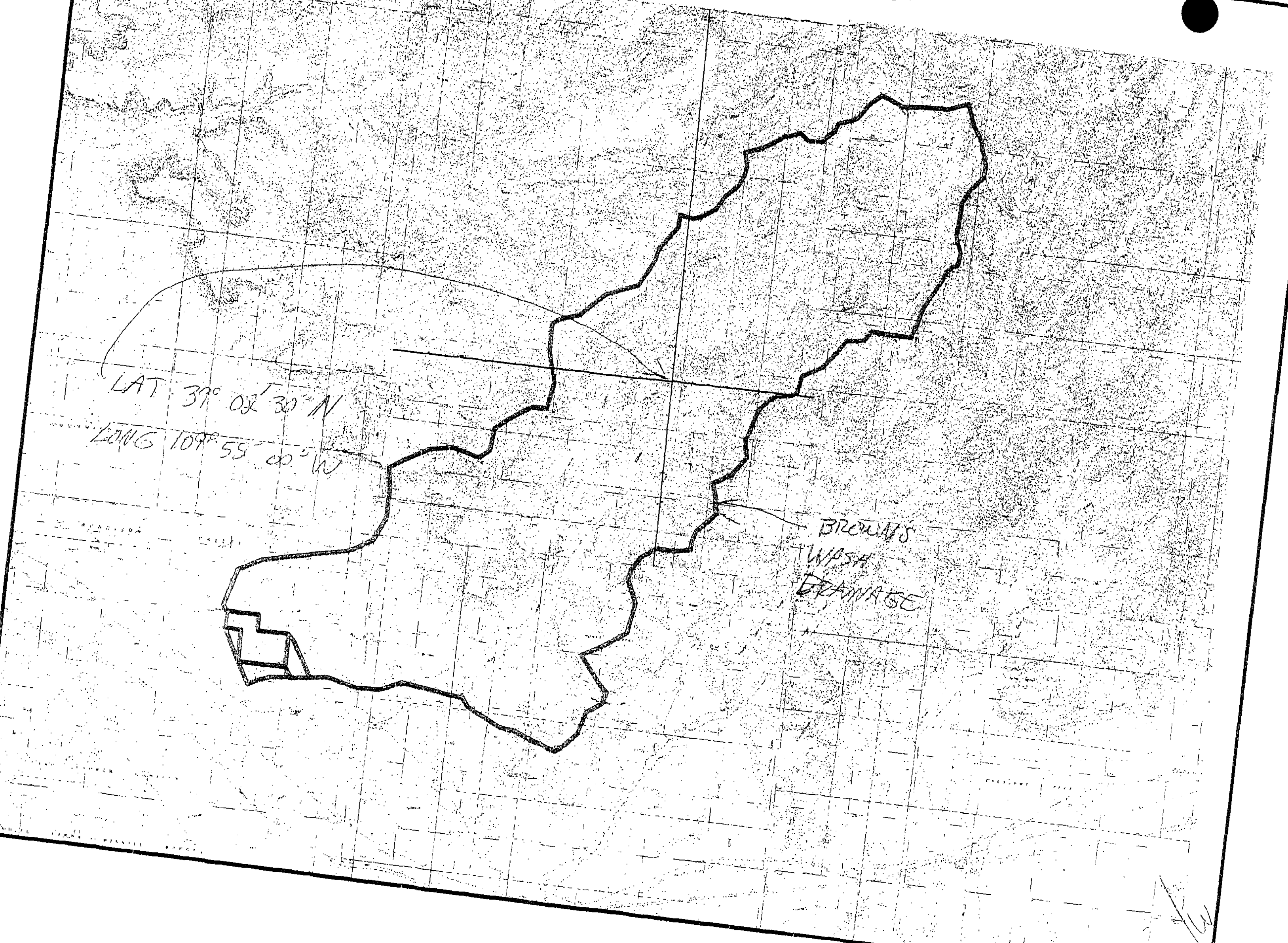
Long: -109.91667 W

The NWS - NOAA Atlas 14 precipitation frequency estimate is attached as sheets 4-7

The predicted 100 Yr - 24 hr storm depth is 2.81 inches. This is slightly higher than the value of 2.63 inches used in the previous permit application.

marica - Solitude

BROWN'S C[illegible]YON PRECIPITATION



4

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Utah 39.0417 N 109.9167 W 5816 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Fri Mar 14 2008

Confidence Limits Seasonality Location Maps Other Info GIS data Maps Help Docs U.S. Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.23	0.31	0.38	0.46	0.51	0.64	0.79	1.02	1.17	1.35	1.57	1.76	2.26	2.75	3.36	3.98
2	0.16	0.24	0.30	0.40	0.50	0.59	0.65	0.80	0.98	1.27	1.46	1.69	1.97	2.21	2.85	3.46	4.23	5.01
5	0.21	0.33	0.41	0.55	0.68	0.79	0.84	1.01	1.22	1.58	1.83	2.14	2.50	2.81	3.60	4.33	5.30	6.27
10	0.27	0.41	0.50	0.68	0.84	0.97	1.03	1.20	1.44	1.85	2.13	2.51	2.94	3.28	4.20	5.02	6.14	7.25
25	0.35	0.53	0.66	0.89	1.10	1.28	1.32	1.48	1.73	2.21	2.57	3.03	3.56	3.96	5.02	5.96	7.30	8.55
50	0.42	0.64	0.80	1.07	1.33	1.56	1.59	1.72	1.97	2.50	2.92	3.45	4.07	4.49	5.67	6.69	8.20	9.55
100	0.51	0.78	0.96	1.29	1.60	1.89	1.93	2.01	2.24	2.81	3.30	3.91	4.61	5.06	6.35	7.44	9.15	10.58
200	0.61	0.93	1.15	1.55	1.92	2.30	2.33	2.41	2.56	3.12	3.71	4.39	5.18	5.66	7.05	8.20	10.12	11.64
500	0.78	1.18	1.47	1.98	2.44	2.95	2.99	3.06	3.21	3.57	4.28	5.08	6.01	6.52	8.04	9.25	11.49	13.08
1000	0.93	1.42	1.76	2.37	2.93	3.57	3.60	3.66	3.81	3.93	4.76	5.64	6.68	7.21	8.81	10.07	12.60	14.23

Text version of table

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.14	0.22	0.27	0.36	0.45	0.53	0.58	0.72	0.87	1.12	1.28	1.49	1.74	1.95	2.50	3.04	3.70	4.40
2	0.19	0.28	0.35	0.47	0.58	0.68	0.74	0.90	1.09	1.40	1.61	1.87	2.19	2.45	3.15	3.82	4.66	5.54
5	0.25	0.38	0.47	0.64	0.79	0.91	0.96	1.13	1.36	1.75	2.02	2.36	2.79	3.11	3.99	4.79	5.84	6.95
10	0.32	0.48	0.59	0.80	0.99	1.12	1.17	1.35	1.60	2.04	2.35	2.77	3.28	3.64	4.66	5.57	6.79	8.04
25	0.41	0.63	0.78	1.05	1.30	1.48	1.51	1.67	1.94	2.46	2.85	3.38	4.00	4.41	5.60	6.64	8.12	9.52
50	0.51	0.77	0.95	1.28	1.59	1.81	1.83	1.95	2.21	2.80	3.27	3.87	4.59	5.04	6.35	7.49	9.18	10.69
100	0.62	0.94	1.17	1.57	1.95	2.22	2.23	2.31	2.53	3.17	3.74	4.42	5.26	5.73	7.18	8.38	10.30	11.92
200	0.76	1.16	1.43	1.93	2.39	2.73	2.73	2.79	2.92	3.57	4.26	5.03	5.99	6.48	8.06	9.34	11.51	13.22
500	0.99	1.51	1.88	2.53	3.13	3.60	3.64	3.67	3.72	4.16	5.04	5.94	7.10	7.60	9.32	10.68	13.24	15.06
1000	1.23	1.88	2.33	3.14	3.88	4.44	4.49	4.53	4.58	4.67	5.73	6.73	8.06	8.59	10.36	11.79	14.69	16.59

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.11	0.16	0.20	0.27	0.34	0.41	0.46	0.58	0.71	0.93	1.06	1.22	1.42	1.60	2.04	2.49	3.03	3.59
2	0.14	0.21	0.26	0.36	0.44	0.52	0.58	0.72	0.89	1.16	1.32	1.53	1.79	2.01	2.57	3.13	3.81	4.52
5	0.19	0.29	0.35	0.48	0.59	0.69	0.75	0.91	1.10	1.44	1.65	1.93	2.26	2.53	3.24	3.90	4.76	5.64
10	0.23	0.35	0.44	0.59	0.73	0.85	0.91	1.07	1.28	1.67	1.91	2.25	2.63	2.95	3.76	4.49	5.50	6.48
25	0.30	0.45	0.56	0.76	0.94	1.09	1.15	1.30	1.54	1.98	2.28	2.69	3.15	3.52	4.45	5.28	6.46	7.57
50	0.35	0.54	0.67	0.90	1.11	1.30	1.35	1.50	1.73	2.22	2.56	3.02	3.55	3.95	4.98	5.87	7.20	8.38
100	0.42	0.64	0.79	1.07	1.32	1.53	1.60	1.72	1.94	2.46	2.85	3.37	3.97	4.39	5.51	6.45	7.94	9.19
200	0.49	0.75	0.93	1.25	1.54	1.80	1.89	2.02	2.19	2.70	3.14	3.73	4.39	4.85	6.04	7.02	8.67	9.99

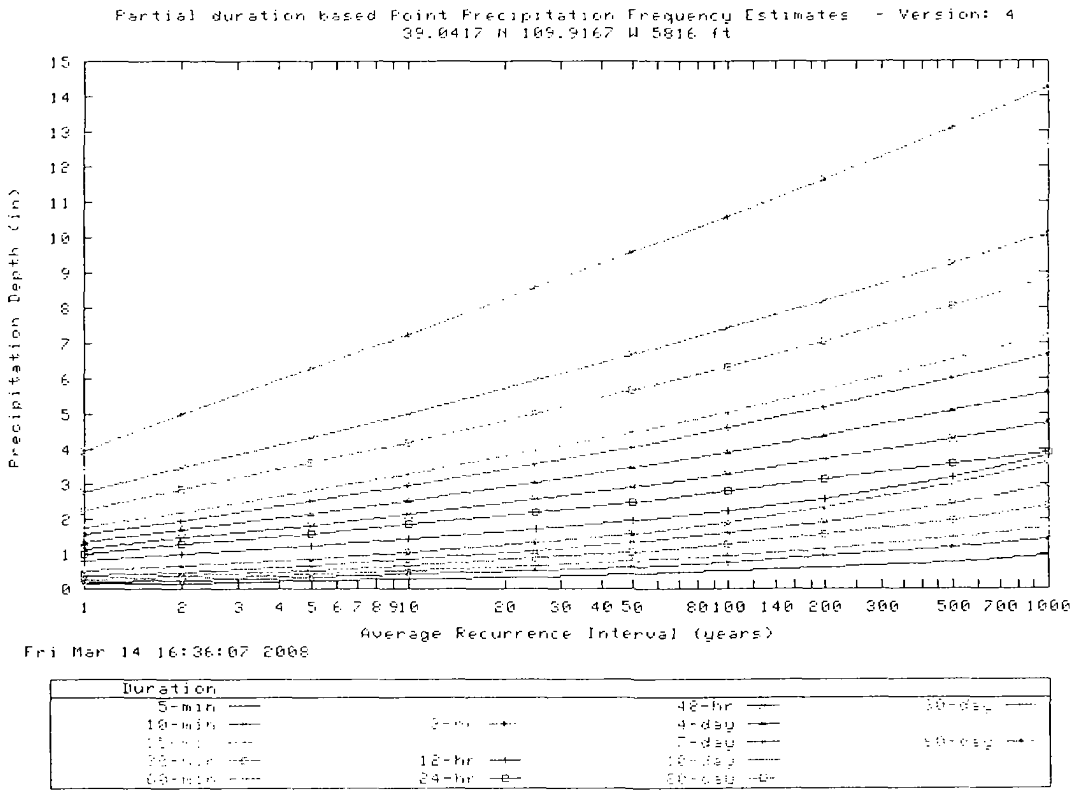
5

500	0 60	0 91	1 13	1 52	1 88	2 21	2.32	2 49	2 70	3.02	3 54	4.20	4 97	5 45	6.73	7 77	9 64	11 03
1000	0.69	1 05	1 31	1 76	2 18	2 56	2 70	2 92	3 16	3.25	3 84	4.57	5 41	5 92	7.26	8.33	10 38	11 80

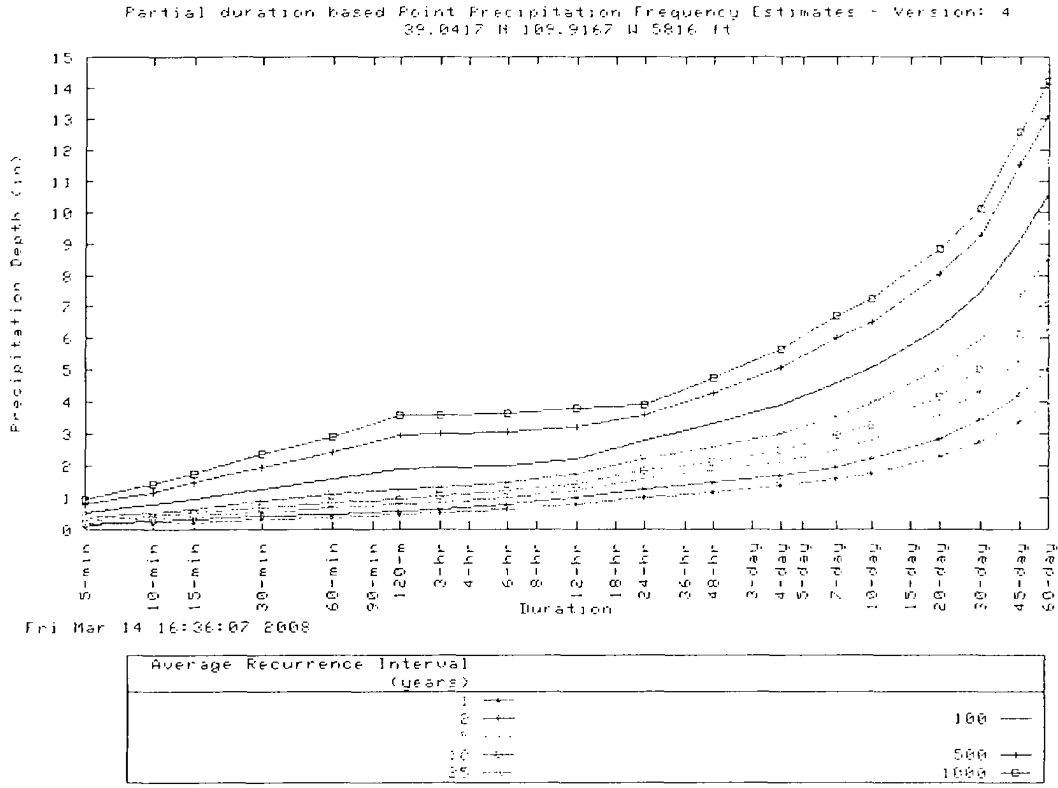
* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than

** These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval

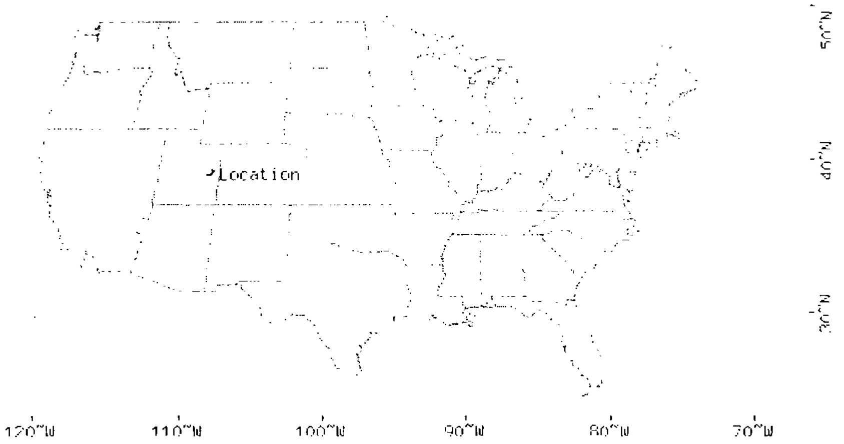
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero



6/



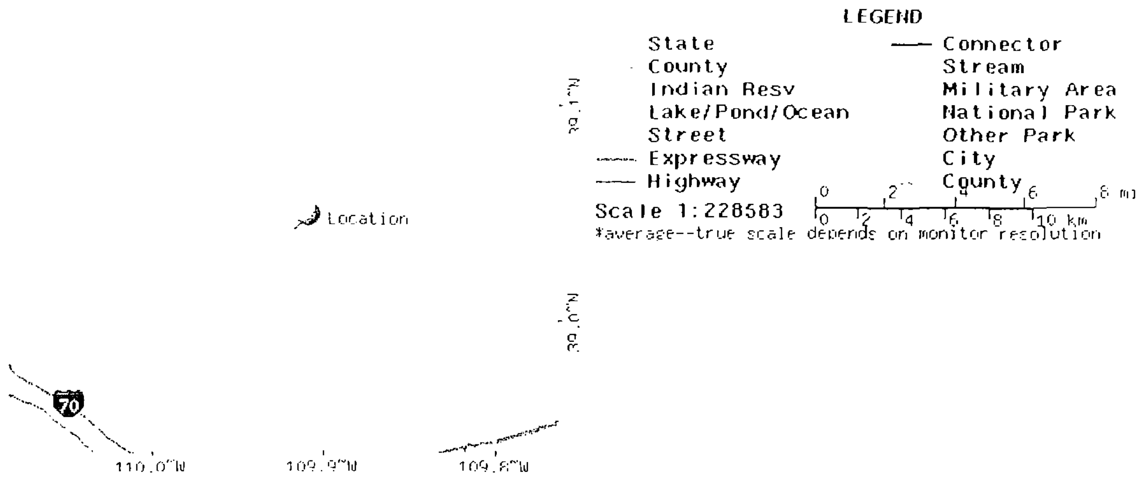
Maps -



These maps were produced using a direct map request from the
U.S. Census Bureau Mapping and Cartographic Resources
Tiger Map Server

Please read disclaimer for more information

7



Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (39.0417/-109.9167). Digital ASCII data can be obtained directly from NCDC.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669

Questions?: HDSC.Questions@noaa.gov

Disclaimer

CLIENT Transload America
PROJECT Solitude
FEATURE Browns Wash Hydrological Characteristics
PROJECT NO 332.01.100

SHEET 0 OF
COMPUTED BJM
CHECKED
DATE March 14, 2008

Brown's Wash Hydrological Charactertistics

Determine Basin Size

The area tributary to Brown's Wash was estimated by delineating the tributary area in ESRI ArcMap 9.2 using digitized 7.5 minute quadrangle maps.

see the attached figure.

The drainage area upstream of solitude was calulated as 27,800 acres, using the ArcMap calculator. This is substantially the same provided by the previous permit hydrology.

Estimate Curve Number

In order to estimate the curve number, the areas of each hydrologic soil group were estimated. GIS shapefiles were downloaded from the NRCS data transfer site. These shapefiles included soil data for Utah Grand County – Central Part. The hydrologic groups for the soil are presented on Figure ______, attached. A summary spreadsheet is also provided showing the area total of each soil type.

It may be observed that the Brown's Wash Drainage includes 39% B soils, 33% C soils + 28% D soils according to the NRCS estimates.

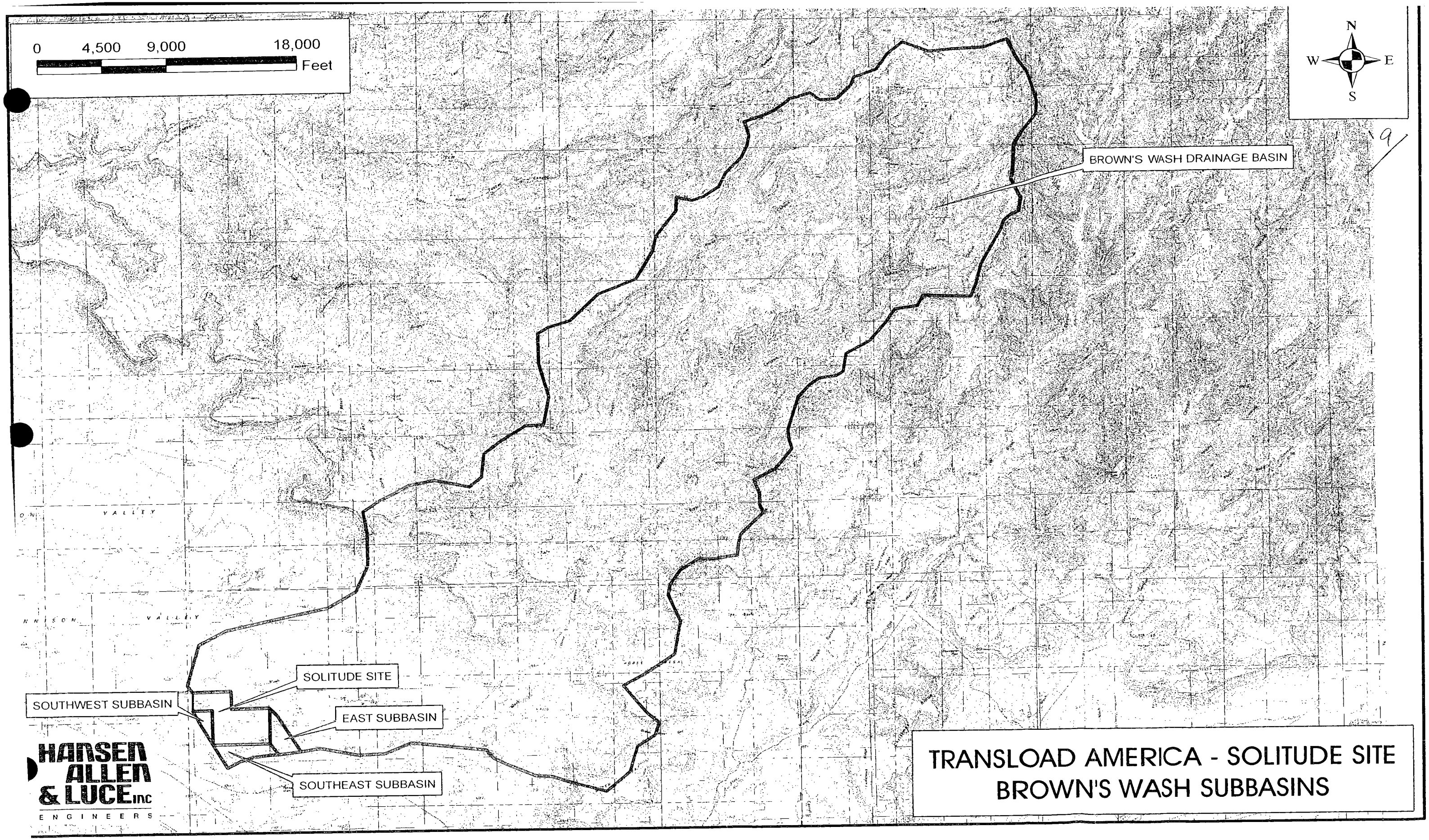
From Table 2-2d of TR 55 (210-VI-TR-55, 2nd Ed., June 1986)

Cover Type = Pinyon-Juniper 85% Poor, 15% Fair (on top)

$$\left.\begin{array}{l} 0.15(0.39(58) + 0.33(73) + 0.28(80)) = \\ +\ 0.85(0.39(75) + 0.33(85) + 0.28(89)) = \end{array}\right\} 80$$

CN = 80

This value is much higher than the CN 65 Predicted by the previous permit



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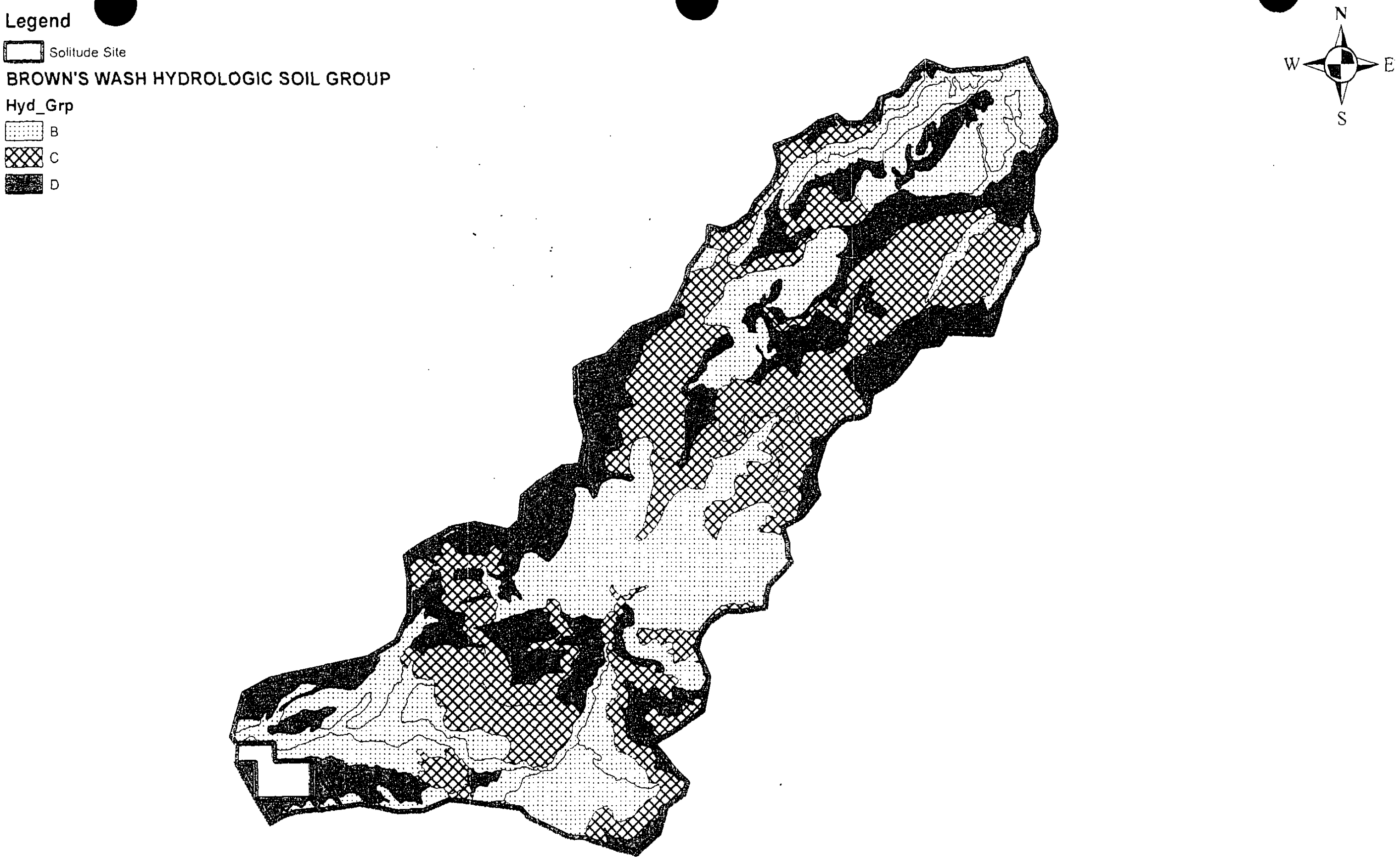
ENGINEERS

TRANSLOAD AMERICA - SOLITUDE SITE
BROWN'S WASH SUBBASINS



10

HANSEN ALLEN & LUCE inc
ENGINEERS

BROWN'S WASH
HYDROLOGIC SOIL GROUP

0 5,000 10,000 20,000 Feet

TRANSLOAD AMERICA - SOLITUDE
332.01 100
MARCH 14, 2008

11/

Sub-basin	ACRES_2	HYD_GRP	Total Area for Hydrologic Soil Group
Browns Wash	7	B	
Browns Wash	8	B	
Browns Wash	240	B	
Browns Wash	51	B	
Browns Wash	115	B	
Browns Wash	117	B	
Browns Wash	969	B	
Browns Wash	441	B	
Browns Wash	152	B	
Browns Wash	156	B	
Browns Wash	1	B	
Browns Wash	491	B	
Browns Wash	839	B	
Browns Wash	414	B	
Browns Wash	1178	B	
Browns Wash	3860	B	
Browns Wash	367	B	
Browns Wash	26	B	
Browns Wash	131	B	
Browns Wash	55	B	
Browns Wash	197	B	
Browns Wash	811	B	
Browns Wash	301	B	
Browns Wash	0	B	10,927
Browns Wash	2003	C	
Browns Wash	1086	C	
Browns Wash	122	C	
Browns Wash	884	C	
Browns Wash	58	C	
Browns Wash	25	C	
Browns Wash	181	C	
Browns Wash	2716	C	
Browns Wash	1010	C	
Browns Wash	950	C	9,035
Browns Wash	706	[redacted]	
Browns Wash	563	[redacted]	
Browns Wash	466	[redacted]	
Browns Wash	665	[redacted]	
Browns Wash	107	[redacted]	
Browns Wash	429	[redacted]	
Browns Wash	114	[redacted]	
Browns Wash	161	[redacted]	
Browns Wash	134	[redacted]	
Browns Wash	34	[redacted]	
Browns Wash	211	[redacted]	
Browns Wash	153	[redacted]	
Browns Wash	137	[redacted]	
Browns Wash	330	[redacted]	
Browns Wash	121	[redacted]	
Browns Wash	342	[redacted]	

39% B

33% C

12

TRANSLOAD AMERICA - SOLITUDE
332 01.100
MARCH 14, 2008

Browns Wash	53	[redacted]	
Browns Wash	118	[redacted]	
Browns Wash	72	[redacted]	
Browns Wash	234	[redacted]	
Browns Wash	196	[redacted]	
Browns Wash	563	[redacted]	
Browns Wash	275	[redacted]	
Browns Wash	261	[redacted]	
Browns Wash	40	[redacted]	
Browns Wash	303	[redacted]	
Browns Wash	243	[redacted]	
Browns Wash	18	[redacted]	
Browns Wash	85	[redacted]	
Browns Wash	262	[redacted]	
Browns Wash	392	[redacted]	
Browns Wash	0	[redacted]	7,788

28% D

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1] Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

[2] Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.

[3] Curve numbers for group A have been developed only for desert shrub.

CLIENT Transload America
PROJECT Solitude
FEATURE Brown's Wash Hydrological Characteristics
PROJECT NO 332.01.100

SHEET 1 OF
COMPUTED BDM
CHECKED
DATE March 17 2008

Brown's Wash Hydrological Characteristics - Lag Time

Find lag time. Use SCS equation*.

$$t_L = \frac{L^{0.8}(S_p+1)^{0.7}}{1900\,S^{0.7}}$$

L = hydraulic length (ft)

$S_p = \frac{1000}{CN} - 10$

S = slope of watershed (avg) in percent.

CN = curve number

$L = 105{,}700$ ft $\quad S_p = \frac{1000}{80} - 10 = 2.5$

$S = (7300 - 4400) / 105700 = 2.74\ \%$

$$t_L = \frac{(105700)^{0.8}(2.5+1)^{0.7}}{1900\,(2.74)^{0.7}} = 6.5 \text{ hrs.}$$

$= 390$ minutes.

*Ref: Elementary Hydrology, Vijay P. Singh. Prentice Hall. N.J.

HANSEN ALLEN & LUCE inc
ENGINEERS

CLIENT Transload America
PROJECT Solitude
FEATURE Brown's Wash Hydrological Characteristics
PROJECT NO 332.01.100

SHEET 1 OF
COMPUTED BDM
CHECKED
DATE March 18, 2008

Brown's Wash Hydrological Characteristics

Precipitation Distribution Model

Use SCS Type II, 24 hour storm. This is a conservative, i.e. intense, storm distribution for this area.

Modeling

HEC-HMS V. 3.1.0 was used to model

- The model input is included as sheets ____________

- The model output is included as sheets ____________

- The model predicted a 100 YR 24 HR peak flow of 2,705 cfs flow.

Transload America - Solitude Landfill
Brown's Wash Hydrology
HEC-HMS Input
Project No.: 332.01.100

March 18, 2008

```
Basin: Browns Drainage
    Last Modified Date: 18 March 2008
    Last Modified Time: 21:19:05
    Version: 3.1.0
    Unit System: English
    Missing Flow To Zero: No
    Enable Flow Ratio: No
    Allow Blending: No
    Compute Local Flow At Junctions: No
End:

Subbasin: Subbasin-1
    Canvas X: -665.4343807763407
    Canvas Y: 748.6136783733828
    Area: 43.64

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 80

    Transform: SCS
    Lag: 390

    Baseflow: None

    Erosion: None
End:

Basin Schematic Properties:
    Last View N: 5000.0
    Last View S: -5000.0
    Last View W: -5000.0
    Last View E: 5000.0
    Maximum View N: 5000.0
    Maximum View S: -5000.0
    Maximum View W: -5000.0
    Maximum View E: 5000.0
    Extent Method: Elements
    Buffer: 0
    Draw Icons: Yes
    Draw Icon Labels: Yes
    Draw Gridlines: Yes
    Draw Flow Direction: No
End:
```

Transload America - Solitude
332.01.100

17

Project: Browns Wash Simulation Run: Run 1

Start of Run: 01Jul2008, 00:00 Basin Model: Browns Dra
End of Run: 03Jul2008, 00:10 Meteorologic Model: Met 1
Compute Time: 18Mar2008, 15:19:11 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Subbasin-1	43.64	2704.8	01Jul2008, 19:20	1.11

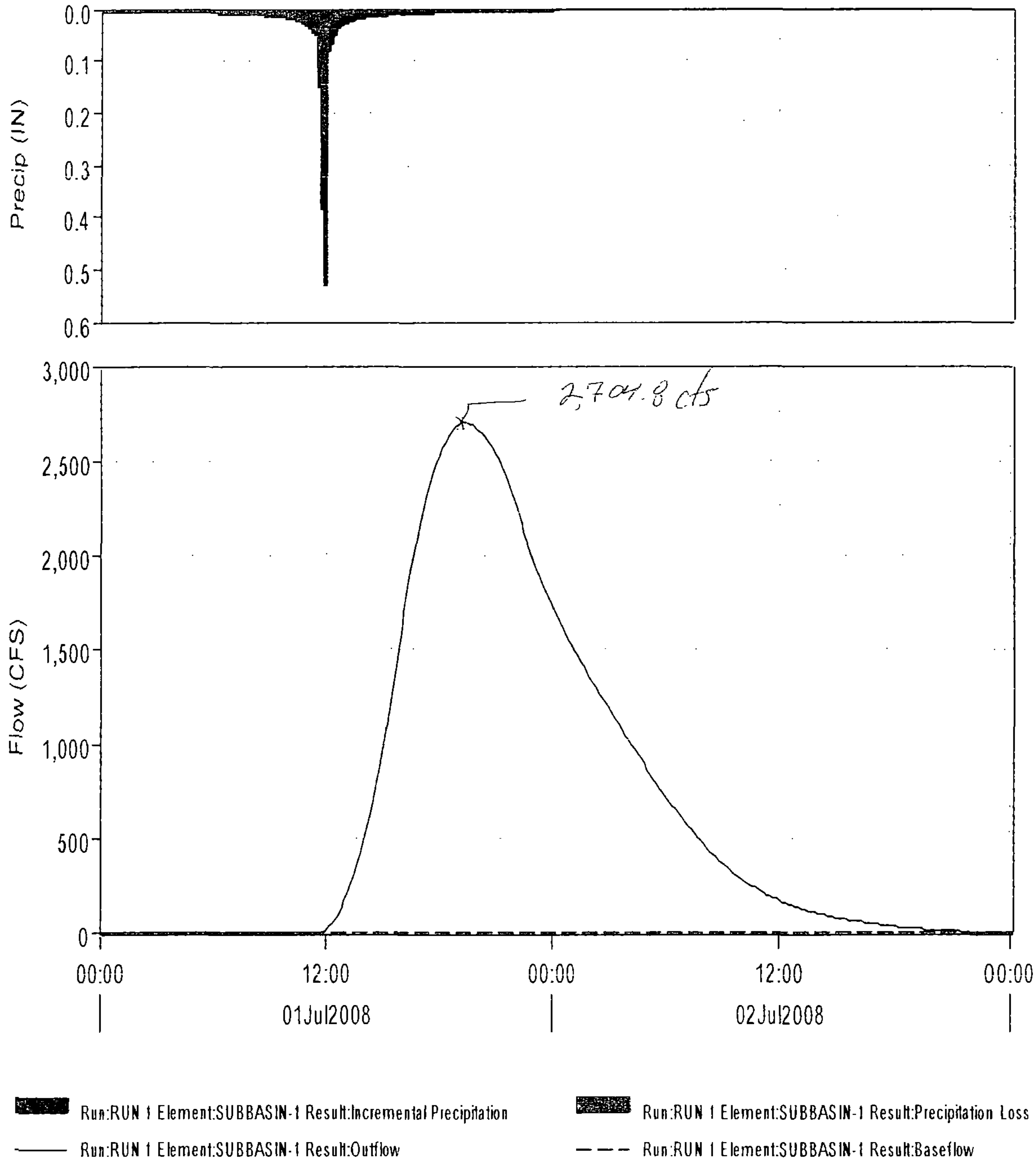
PEAK DISCHARGE

Transload America - Solitude Landfill

332 01.100

March 18, 2008

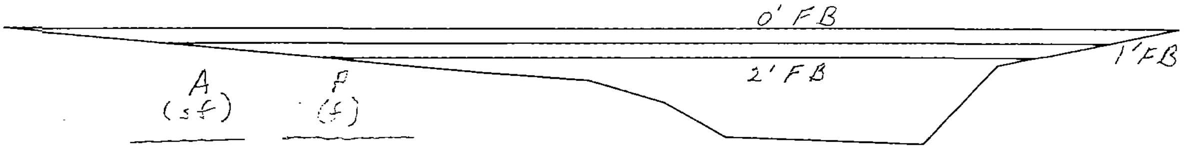
Subbasin Element "Subbasin-1" Results for Run "Run 1"



CLIENT Transload America, Inc
PROJECT Solitude LF, Permit Renewal
FEATURE Brown's Wash Hydraulics
PROJECT NO 332.01.100
SHEET 11 OF
COMPUTED KLS
CHECKED
DATE 3-11-08

Check the capacity of Brown's Wash at the NE corner of the Facility

Two sections were measured through Brown's wash at the NE Corner of the facility.



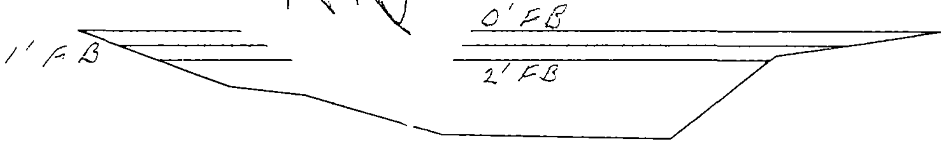
	A (sf)	P (f)
0' FB	255	81
1' FB	185	66
2' FB	131	50

Section
slope =

TO BE REVISED

0'
1'
2'

Section 2
slope = 0.008



The ground surface continues to slope upward slightly from both sides of the channel for possibly a foot or more.

Determine the Capacities of each section using Manning EQ

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$ using $n = 0.030$ clean, little to no vegetation, small gravel & some rock, mostly earth (clay)

Client: Transload America
Project: Solitude Landfill Permit Renewal
Feature: Brown's Wash Capacity
Date: 10-Mar-08

Description	A (sf)	P (f)	R (sf/f)	S (f/f)	n	Q (cfs)
Section 1						
0' freeboard	255	81	3.148	0.007	0.030	2276 ✓
1' freeboard	185	66	2.803	0.007	0.030	1528 ✓
2' freeboard	131	50	2.620	0.007	0.030	1035 ✓
Section 2						
0' freeboard	241	60	4.017	0.008	0.030	2705 ✓
1' freeboard	189	51	3.706	0.008	0.030	2011 ✓
2' freeboard	145	43	3.372	0.008	0.030	1448 ✓

CLIENT Transtech America
PROJECT Solitude LF Permit Renewal
FEATURE Brown's Wash Hydrology
PROJECT NO 333.01.103

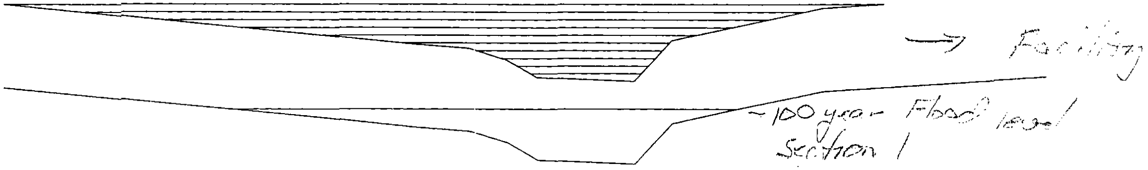
SHEET 17 OF
COMPUTED KCS
CHECKED
DATE 3-11-02

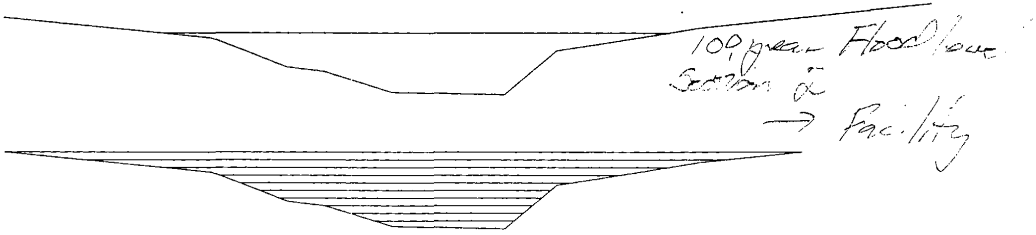
Check the capacity of Brown's Wash at the Northeast corner of the Facility

Two sections were measured near the northeast corner of the Facility and a stage versus capacity relationship was developed for each section using Manning equation for open channel flow.

The sections developed and the stage versus capacity relationships are presented on the following pages.

Calculations show that run-off from the 100-year precipitation event will adequately flow within Brown's Wash without flooding the Facility.

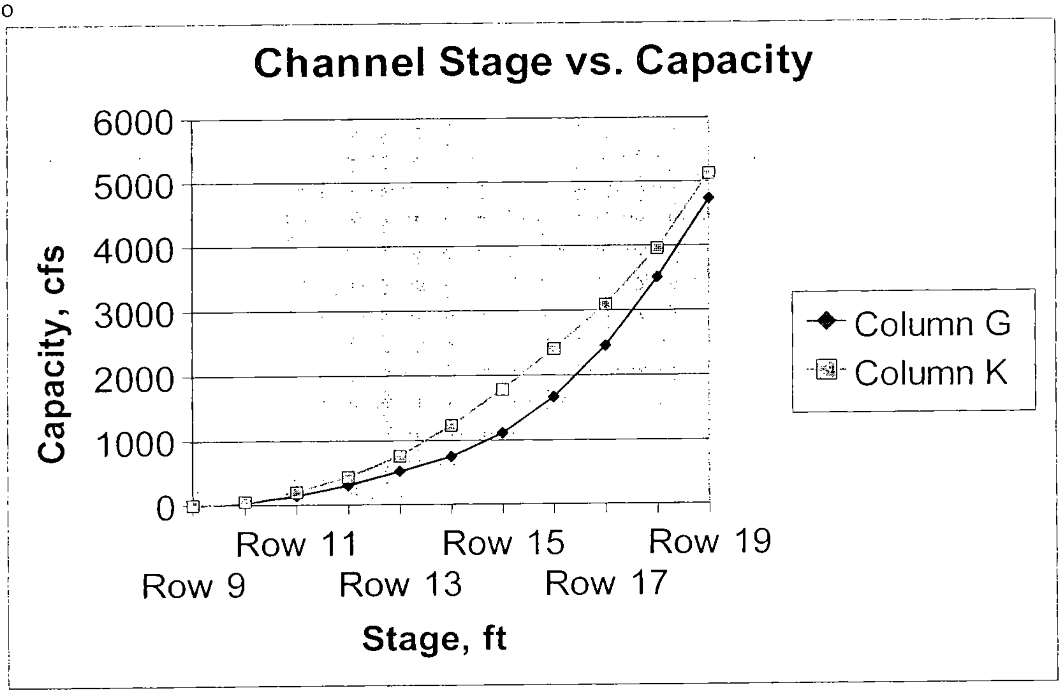

→ Facility
~100 year Flood level
Section 1


100 year Flood level
Section 2
→ Facility

Client: Transload America
Project: Solitude Landfill Permit Renewal
Feature: Brown's Wash Capacity
Date: 10-Mar-08

Stage (ft)	A (sf)	P (f)	R (sf/f)	S (f/f)	n	Q (cfs)
Section 1 - Up-gradient from Northeast Corner						
0	0	0	0.000	0.01	0.030	0
1	10.4	15.4	0.675	0.01	0.030	33
2	26.6	18.8	1.415	0.01	0.030	139
3	45.5	22.4	2.031	0.01	0.030	303
4	68.1	27.3	2.495	0.01	0.030	520
5	97.5	38.9	2.506	0.01	0.030	748
6	140.1	53.3	2.629	0.01	0.030	1109
7	197.9	68.9	2.872	0.01	0.030	1662
8	271	84.4	3.211	0.01	0.030	2451
9	359.5	100	3.595	0.01	0.030	3506
10	464.9	121.3	3.833	0.01	0.030	4731
Section 2 - Down-gradient form Northeast Corner						
0	0	0	0.000	0.01	0.030	0
1	14.1	19	0.742	0.01	0.030	51
2	35	24.1	1.452	0.01	0.030	199
3	60.4	29.2	2.068	0.01	0.030	436
4	92.4	36.9	2.504	0.01	0.030	757
5	129.3	41.3	3.131	0.01	0.030	1229
6	170.3	47.2	3.608	0.01	0.030	1780
7	219.1	56.5	3.878	0.01	0.030	2402
8	278.5	70.6	3.945	0.01	0.030	3089
9	354.4	89	3.982	0.01	0.030	3955
10	450.3	109.8	4.101	0.01	0.030	5125

co



STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL
QUALITY

RECEIPT

Date 6-30 **20** 08 91872

Received From Transload America / 08.02145

Address Green River Landfill

Dollars ($ 100 00 **)**

For Landfill Permit Renewal App.

ACCOUNT			HOW PAID		
AMT. OF ACCOUNT			CASH		
AMT. PAID			CHECK	# 5033	
BALANCE DUE			MONEY ORDER		

UNIT	ACCT.	PROGRAM	FUNCTION	
6500	2316			

By CChristoff