HAND DELIVERED

MAR 07 2012

UTAH DIVISION OF
SOLID & HAZARDOUS WASTE

2012.00719

LOGAN

CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

North Valley Landfill Class I Permit Application

March 7, 2012

LOGAN

ENVIRONMENTAL DEPARTMENT

March 7, 2012

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UTAH DIVISION OF
SOLID & HAZARDOUS WASTE
2012.00719

Mr. Scott T. Anderson, Director
Utah Division of Solid and Hazardous Waste
Department of Environmental Quality
State of Utah
195 North 1950 West
P.O. Box 144880
Salt Lake City, Utah 84114-4880

RE: North Valley Landfill Class I Permit Application

Dear Mr. Anderson,

Please find attached the Class I Permit Application for the North Valley Landfill located in Cache County submitted for your Division's review.

The North Valley Landfill is intended to serve as the replacement facility for the existing Logan Sanitary Landfill that serves the residents and businesses of Cache Valley.

If you or your staff has any questions regarding the permit package, please call at your earliest convenience.

Respectfully submitted,

Issa Hamud
Environmental Director

Cc: Brett Mickelson, P.E., IGES

450 North 1000 West Logan, Utah 84321 • ph: 435.716.9755 • fx: 435.716.9751 environmental.loganutah.org

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LOGAN
CITY

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SOLID & HAZARDOUS WASTE

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APPENDIX O – Closure / Post Closure Costs

INTRODUCTION

This document presents an application to obtain a permit to operate solid waste disposal facilities approximately 5 miles north of Clarkston in Cache County. Property for the proposed facility (North Valley Landfill) is owned by the City of Logan Corporation (Logan City) and once permitted will be operated by Logan City. The North Valley Landfill is intended to be a replacement landfill for the existing Logan City Class I Landfill (Logan Sanitary Landfill) located approximately 1.8 miles west of the center of Logan City on 200 North.

The North Valley Landfill (NVL) is intended to take waste from a transfer station that will be owned and operated by Logan City. The transfer station is currently being designed with construction anticipated to take place concurrently with the development of the NVL. The transfer station will be located next to the current Logan City Landfill. Specific access routes from the transfer station to the NVL have not been finalized at this time.

Access to the NVL will be restricted to Logan City employees and Logan City collection vehicles only; the facility will have limited accessibility to the public (occasional special waste deliveries only). Collection of municipal solid waste (MSW) will continue as it is currently being performed by Logan City with MSW being delivered to the transfer station once it is operational. MSW will be processed at the transfer station and loaded into transfer trucks for delivery to the NVL. Active areas of the NVL will be entirely fenced with transfer trucks accessing the site through a locking gate. Occasionally or at least once a week MSW collection trucks operating in the northwest area of Cache County will haul MSW directly to the NVL bypassing the transfer station for hauling efficiency. A truck scale will be installed at the NVL to weigh the collection trucks that haul directly to the landfill with all transfer trucks being weighed prior to departure from the transfer station.

The application has been organized to follow the general outline of the applicable sections of R315-301 through R315-310. This organization results in some duplication and repetition of information, but it is intended to simplify the review and approval of the permit application.

Part I of this document duplicates the standard form outlining general data pertaining to the proposed landfill site.

Part II is a general report that includes a facility description, legal description of the property (proof of ownership) and operations plan.

Part III is the technical report and includes the following:

- Geohydrological Assessment
- Engineering Report
- Closure Plan
- Post-Closure Care Plan
- Financial Assurance Plan

PERMIT APPLICATION TO
OPERATE A CLASS I LANDFILL

North Valley Landfill
Cache Valley, Utah

PART I - GENERAL DATA

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
195 North 1950 West
Salt Lake City, Utah 84116

Phone (801) 536-0200
Fax (801) 536-0222
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) 536-0200 to determine if this form is still current. When completed, please return this form and support documents, forms, drawings, and maps to:

Scott T. Anderson, 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

III. Facility Name and Location

Legal Name of Facility
North ValleyLandfill

Site Address (street or directions to site)
14200 Stink Creek Road

County
Cache

City North ofClarkston | Zip Code 84305 | Telephone TBD

Township 15 N | Range 2 W | Section(s) 34,35 | Quarter/Quarter Section SW | Quarter Section SE

Main Gate Latitude degrees 41 minutes 59 seconds 24 | Longitude degrees 112 minutes 3 seconds 7

IV. Facility Owner(s) Information

Legal Name of Facility Owner
Logan City

Address (mailing)
290 N 100 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9000

V. Facility Operator(s) Information

Legal Name of Facility Operator
Logan City

Address (mailing)
290 N 100 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9000

VI. Property Owner(s) Information

Legal Name of Property Owner
Logan City

Address (mailing)
290 N 100 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9000

VII. Contact Information

Owner Contact Issa Hamud | Title Environmental Director

Address (mailing)
450 N 1000 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9752

Email Address issa.hamud@loganutah.org | Alternative Telephone (cell or other) (435)716-9755

Operator Contact Issa Hamud | Title Environmental Director

Address (mailing)
450 N 1000 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9752

Email Address issa.hamud@loganutah.org | Alternative Telephone (cell or other) -4357169755

Property Owner Contact Issa Hamud | Title Environmental Director

Address (mailing)
450 N 1000 W

City Logan | State UT | Zip Code 84321 | Telephone (435) 716-9752

Utah Class I and V Landfill Permit Application Form

rt 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:

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	532	acres
Disposal Area	133	acres
Design Capacity		
Years	81	
Cubic Yards	26,700,000	
Tons	14,950,000	

X. Fee and Application Documents

Indicate Documents Attached To This Application ☐ Application Fee: Amount $

☒ 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	Title	Date
Randy Watts	Mayor	3-5-12
Name typed or printed: Randy Watts	Address: 290 N 100 W Logan, Ut 84321	

Signature of Authorized Land Owner Representative (if applicable)	Title	Date
Randy Watts	Mayor	3-5-12
Name typed or printed: Randy Watts	Address: 290 N 100 W Logan, Utah 84321	

ınature of Authorized Operator Representative (if applicable)	Title	Date
	Director	3/5/12
Name typed or printed: Issa A. Hamud	Address: 450 N 1000 W Logan ut 84321	

Email Address	Alternative Telephone (cell or other)
Issa.Hamud@loganutah.org	435.881.5339

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. Please take note of the heading of each section for the facilities that the section applies to.

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 801-536-0200. 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)	Part I
General description of the facility (R315-310-3(1)(b))	Part I - Introduction
Legal description of property (R315-310-3(1)(c))	Part II, Sec. 2.1 and Appendix B
Proof of ownership, lease agreement, or other mechanism (R315-310-3(1)(c))	Part II, Sec. 2.2 and Appendix B
Area served by the facility including population (R315-310-3(1)(d))	Part II, Sec. 1.3
If the permit application is for a class I landfill a demonstration that the landfill is not a commercial facility	Part II, Sec 1.3
Waste type and anticipated daily volume (R315-310-3(1)(d))	Part II Sec. 3 and Part III sec. 3.2
Ib. Information Required - All New Or Laterally Expanding Class I and V Landfills	
Intended schedule of construction (R315-302-2(2)(a))	Part II Sec. 3.1
Name and address of all property owners within 1000 feet of the facility boundary (R315-310-3(2)(a)(i))	Appendix B
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))	Appendix B

I. **Facility General Information**	
Description of Item	Location In Document
Name of the local government with jurisdiction over the facility site (R315-310-3(2)(iii))	Part II Sec. 1.2
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)	Part III, Section 3.1.1
Land use compatibility (R315-302-1(2)(a))	
Maps showing the existing land use, topography, residences, parks, monuments, recreation areas or wilderness areas within 1000 feet of the site boundary	Appendix A, Appendix K
Certifications that no ecologically or scientifically significant areas or endangered species are present in site area	Part III, sec. 3.1.1 Appendix K
List of airports within five miles of facility and distance to each	Part III, sec. 3.1.1 Appendix K
Geology (R315-302-1(2)(b))	
Geologic maps showing significant geologic features, faults, and unstable areas	Appendix J
Maps showing site soils	Appendix K, Appendix J
Surface water (R315-302-1(2)(c))	
Magnitude of 24 hour 25 year and 100 year storm events	Part III, sec 3.5
Average annual rainfall	Part III, sec 3.5
Maximum elevation of flood waters proximate to the facility	n/a
Maximum elevation of flood water from 100 year flood for waters proximate to the facility	n/a
Wetlands (R315-302-1(2)(d))	Appendix K
Ground water (R315-302-1(2)(e))	Appendix A, F
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 R315-302-2(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))	Part II, sec 3.2 and 3.11 Appendix E
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))	Part II, sec 3.3 & sec 3.13 Appendix E, F,H, I
Contingency plans in the event of a fire or explosion (R315-302-2(2)(d))	Part II, sec 3.5.1, 3.5.2 & 3.5.3
Corrective action programs to be initiated if ground water is contaminated (R315-302-2(2)(e))	Part II, sec 3.5.5
Contingency plans for other releases, e.g. explosive gases or failure of run-off collection system (R315-302-2(2)(f))	Part II, sec 3.5.2 and 3.5.4

I. **Facility General Information**	
Description of Item	Location In Document
Plan to control fugitive dust generated from roads, construction, general operations, and covering the waste (R315-302-2(2)(g))	Part II, sec 3.8.4
Plan for litter control and collection (R315-302-2(2)(h))	Part II, sec 3.8.5
Description of maintenance of installed equipment (R315-302-2(2)(i))	Part II, sec 3.7
Procedures for excluding the receipt of prohibited hazardous or PCB containing wastes (R315-302-2(2)(j))	Part II, sec 3.3
Procedures for controlling disease vectors (R315-302-2(2)(k))	Part II, sec 3.8
A plan for alternative waste handling (R315-302-2(2)(l))	Part II, sec 3.6 Appendix E
A general training plan for site operations (R315-302-2(2)(o))	Part II, sec 3.10
Any recycling programs planned at the facility (R315-303-4(6))	Part II, sec 3.9
Closure and post-closure care Plan (R315-302-2(2)(m))	Part III, sec 5
Procedures for the handling of special wastes (R315-315)	Part II, sec 3.2.4
Plans and operation procedures to minimize liquids (R315-303-3(1))	Part II, sec 3.2
Plans and procedures to address the requirements of R315-303-3(7)(c) through (i) and R315-303-4	Part II, sec 3.1. 3.2 Part II, sec 1 Part II, sec 3.5.1 Part II, sec 3.8
Any other site specific information pertaining to the plan of operation required by the Executive Secretary (R315-302-2(2)(p))	n/a
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))	n/a
Approval from the local government within which the solid waste facility sits	n/a

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))	Appendix 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))	Appendix A
IIb. Geohydrological Assessment - All Class I and V Landfills (R315-310-4(2)(b))	

II **Facility Technical Information**	
Description of Item	Location In Document
Local and regional geology and hydrology including faults, unstable slopes and subsidence areas on site (R315-310-4(2)(b)(i))	Part III, sec 2.1 Part III, sec 2.1.2
Evaluation of bedrock and soil types and properties including permeability rates (R315-310-4(2)(b)(ii))	Part III, sec 2, Appendix K
Depth to ground water (R315-310-4(2)(b)(iii))	Part III, sec 2.5 Appendix A: Shts 4-5
Direction and flow rate of ground water (R315-310-4(2)(b)(iv))	Appendix A, Shts 4-5, Appendix F
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))	Part III, sec 2.4 Appendix L
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))	Part III, sec 2.4 Appendix L
Identification and description of all surface waters on-site and within one mile of the facility boundary (R315-310-4(2)(b)(vii))	Part III, sec 2.3
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))	Part III, sec 2.5 Appendix F
Ground Water Monitoring (R315-303-3(7)(b) and R315-308)	Part III, sec 2.5 Appendix F
Statistical method to be used (R315-308-2(8))	n/a
Calculation of site water balance (R315-310-4(2)(b)(ix))	Appendix G
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	Part III, sec 3.4
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))	Appendix G
Anticipated facility life and the basis for calculating the facility's life (R315-310-4(2)(c)(ii))	Part III, sec 3.2; Appendix N
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))	Part III, sec 3.3.4 Appendix A
Leachate collection system design and calculations showing system meets the requirements of R315-303-3(2)	Part III, sec 3.4.3
Equipment requirements and availability (R315-310-4(2)(c)(iii))	Part II, sec 1.5
Identification of borrow sources for daily and final cover and for soil liners (R315-310-4(2)(c)(iv))	Part III, sec 3.3.3
Run-On and run-off diversion designs (R315-303-3(1)(c), (d) and (e))	Part III, sec 3.5

II Facility Technical Information	
Description of Item	Location In Document
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))	Part III, sec 3.4.3
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))	Part III, sec 3.4.1 Appendix F
Landfill gas monitoring and control plan that meets the requirements of Subsection R315-303-3(5) (R315-310-4(2)(c)(vii))	Part III, sec 3.4.4
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))	Part III, sec 3.1.2.3 Appendix M
Design and location of run-on and run-off control systems (R315-310-4(2)(c)(viii))	Part III, sec 3.5
IId. Closure Plan - All Class I and V Landfills (R315-310-3(1)(h))	
Closure Plan (R315-302-3(2) and (3))	Part III, sec 4
Closure schedule (R315-310-4(2)(d)(i))	Part III, sec 4.3.1
Design of final cover (R315-303-3(4) and R315-310-4(2)(c)(iii))	Part III, sec 3.1.2.3
Capacity of site in volume and tonnage (R315-310-4(2)(d)(ii))	Part I
Final inspection by regulatory agencies (R315-310-4(2)(d)(iii))	Part III, sec 4.4.5
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))	Part III, sec 5
Site monitoring of landfill gases, ground water, and surface water, if required (R315-310-4(2)(e)(i))	Part III, sec 5.2.2
Changes to record of title, land use, and zoning restrictions (R315-310-4(2)(e)(v))	Part III, sec 5.2.1
Maintenance activities to maintain cover and run-on/run-off control systems (R315-310-4(2)(e)(iii))	Part III, sec 5.2.3
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))	Part I
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))	Part III, sec 4.4 Appendix O
Identification of post-closure care costs including cost calculations (R315-310-4(2)(e)(iv))	Appendix O
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))	Part III, sec 7.3

APPLICATION OPERATE A CLASS I LANDFILL

North Valley Landfill
Cache Valley, Utah

PART II - GENERAL REPORT

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SECTION 1 – FACILITY DESCRIPTION

1.1 LOCATION

The proposed North Valley Landfill (NVL) is located on 532 acres of land approximately 5 miles north of Clarkston, Utah abutting the Idaho state line. The property is located in the northwest quarter and northern half of the northeast quarter of Section 3, Township 14 North, Range 2 West; also the eastern half of Section 34, Township 15 North, Range 2 West, Salt Lake Base and Meridian. The general location is shown in Drawing 1, Appendix A.

1.2 GENERAL INFORMATION

The NVL will serve Logan City and other areas of Cache County that have historically utilized the Logan Sanitary Landfill. Of the 532 acres of land that Logan City owns north of Clarkston, only 329 acres located east of the crest of the hill will be utilized for landfill development. Appendix B contains land ownership documentation for the landfill property and letters to adjacent property owners. The actual MSW landfill footprint will be approximately 133 acres and will be developed in three Phases. The first Phase (Phase I) will be developed at the north central portion of the property and provide landfill capacity for Cache County for approximately 20 years. Phase II and Phase III will provide a minimum of an additional 61 years of waste capacity (depending on actual growth rates) and are located as indicated on (Drawing 3 – Appendix A).

Each of the Phases of landfill development will be broken into individual cells with each Phase containing 3 Cells. The waste placement method to be utilized in each of the cells will be the area fill method. The planned excavation within the 133 acre landfill footprint will vary from the existing ground surface to as much as 120 feet above current ground surface. The average height of the landfill will be approximately 125 feet above constructed cell floor. An area of the property has been set aside for the eventual development of a construction and demolition (C&D) cell and an asbestos cell located near the entrance to the facility (Drawing 2 – Appendix A).

The soil beneath the landfill varies but includes layers of clay, silt and silty sands with vertical permeability as low as 3.8×10^{-8} cm/sec. All areas of the MSW landfill footprint will be lined with a composite lining system. The upper liner will be a minimum of 60 mils in thickness

and the lower liner hydraulic conductivity will be equivalent to 2 feet of compacted soil at 1 x 10^{-7} cm/sec.

The final cover of the landfill will be no flatter than 10% with perimeter side slopes no steeper than 4 horizontal to 1 vertical. Interior slopes, created for operational purposes, such as slopes between Cells and Phases will be no steeper than 3 horizontal to 1 vertical.

1.3 AREA SERVED BY THE FACILITY

The NVL will replace the existing Logan Sanitary Landfill and will serve all of the unincorporated areas of Cache County and include each of the political subdivisions of the State of Utah (State) that are located in the County. As of the 2010 U.S. Census, Cache County was home to 112,656 residents. From 2000-2010 the population had increased by 23.3%. Areas to be served by the NVL include:

NVL Service Area

Amalga	Lewiston	Nibley	River Heights
Clarkston	Logan	North Logan	Smithfield
Cornish	Mendon	Paradise	Trenton
Hyde Park	Millville	Providence	Wellsville
Hyrum	Newton	Richmond	Unincorporated County

MSW collection and disposal in Cache County is administered by the Cache County Service Area No. 1 (service area). This service area, by virtue of interlocal agreements signed by each participating community, is empowered to collect and dispose of all municipal solid waste in the County. On June 18, 1979 the service area contracted with Logan City Corporation to provide collection and disposal service for all of the cities within Cache County. MSW collection will continue as in the existing agreements with Logan City with one modification. Once the transfer station (and the NVL) becomes operational, MSW will be delivered to the transfer station rather than the existing Logan Sanitary Landfill.

The NVL will be a Class I Landfill operated for the benefit of Cache County residents and will be a not-for-profit operation. All funds generated by the landfilling tipping fees will be reinvested into the landfill facilities or other waste related activities (composting, recycling, household hazard waste collection, etc.) across Cache County.

1.4 WASTE TYPES

The NVL will receive the waste that would normally be delivered to the Logan City Sanitary Landfill which includes following waste materials:

- Municipal Solid Waste, which includes Household Waste and Commercial Solid Waste
- Industrial Solid Waste (non-hazardous)
- Special Waste in accordance with Rule R315-315
- Infectious Waste in accordance with Rule R315-316

A summary of the types and volumes of wastes currently being processed at the Logan City Sanitary Landfill are presented in the most recent annual report for that facility. Initial type and volume of waste delivered to the NVL will closely resemble that reported in the most recent Logan City Sanitary Landfill annual report. A copy of the most recent annual report is included in Appendix C.

Waste composition and quantity projections, reviews of the solid waste collections, green waste operations, and other waste related program trends for Cache County are presented in the Logan Five-Year Solid Waste Management Master Plan (LBA Associates, 2005). A Table of Contents of this Plan is contained in Appendix D. The entire Logan Five-Year Solid Waste Management Plan is not included in this permit application.

1.5 LANDFILL EQUIPMENT

Equipment to be utilized at the NVL will be owned and operated by Logan City. The specifics of day-to-day operations are not fully developed at this time. Based on years of landfill operations at the Logan City Sanitary Landfill and operational experience derived from other MSW facilities, the following equipment may be utilized in the landfill operations:

- 1 MSW Compactor
- 1 Trackhoe
- 2 Off-road Haul Trucks
- 1 Service / Fuel Truck

- 1 Supervisory Utility Vehicle

Once the Logan City Sanitary Landfill is closed, some landfill equipment that is of operational value will be transferred to the NVL. The following equipment, which is owned and operated by Logan City, can be assigned to the NVL operation on an as-needed basis:

- 1 Water Truck
- 1 Road Grader
- 1 Equipment Maintenance Vehicle
- 1 Water Truck (Street and Water Departments)
- 1 Road Grader (Street Department)
- 1 Equipment Maintenance Vehicle (Shops Department)

Firefighting equipment is available through the Logan City and Cache County Fire Departments. During periods of major overhaul or extended breakdown, replacement equipment will be rented locally.

1.6 LANDFILL PERSONNEL

The following persons will be responsible for on-site landfill operations at the NVL facility:

Director of Solid Waste Management (Director) – The Director will be responsible for all matters relating to the solid waste program for Logan City. These matters include; NVL landfill operations, transfer station operation, MSW collection, current landfill operations, green waste facility (composting), and all recycling and green waste functions across the County. The Director will be responsible that the NVL meets all DSHW permit requirements. The Director will be assisted by the Landfill Engineer and Landfill Manager.

Landfill Engineer (Engineer) – The Engineer will be responsible for environmental and regulatory compliance including preparing and/or reviewing technical submittals. The Engineer will provide technical support for necessary plans required under the DSHW permit and Quality Assurance/Quality Control (QA/QC) activities. The Engineer's responsibilities will also include assisting the Director in complying with the requirements of the landfill permit and DSHW rules and regulations. Additional responsibilities will include the maintenance and oversight of the ground water monitoring program.

Landfill Manager (Manager) –The Manager will conduct regular facility inspections and will monitor all landfill activities. The Manager's responsibilities include operating the landfill per the requirements of the landfill permit and DSHW requirements. The Manager will be responsible for all operational documentation including the preparation of the annual reports for NVL to be submitted to the DSHW. The Manager will also be responsible for all persons working at or visiting the NVL facilities. Additional responsibilities include maintenance and oversight of the landfill cover, storm water management, and all mobile equipment. The Landfill Manager will be assisted by a Landfill Foreman, Transfer Station Foreman, Equipment Operators, Landfill Inspector, and Landfill Attendants.

Landfill Foreman: The Landfill Foreman will work directly with the Manager and will be responsible for all day-to-day landfill activities. Daily responsibilities include road maintenance, general site access, site safety, traffic control, waste screening, and all landfill related operations. The Landfill Foreman will assist with landfill reports, inspections, and other documentation as necessary. The Landfill Foreman shall be the responsible supervisor as assigned by the Manager should the Manager be absent or on leave.

Transfer Station Foreman: The Transfer Station Foreman will work directly with the Manager and will be responsible for all day-to-day transfer station activities. Daily responsibilities include road maintenance, general site access, site safety, traffic control, waste screening, all transfer station related operations, record keeping, inspections, and other documentation as necessary. The Transfer Station Foreman shall be the responsible supervisor as assigned by the Manager should the Manager be absent or on leave.

Equipment Operators (Operators) – The Operators will be responsible for all day-to-day activities at the landfill and transfer station. These responsibilities include; waste acceptance, waste placement, traffic control, safe operation and maintenance of all equipment, visual inspection of incoming waste and general construction as it pertains to landfill operations.

This position will require at least two years' experience in the operation and maintenance of heavy equipment. Operators must possess a Commercial Driver's License.

Landfill Inspector (Inspector) – The Inspector will be responsible for conducting landfill inspections, assist in performing quarterly gas sampling, waste inspections, random waste screening, leachate sampling, storm water sampling, and other record keeping as necessary.

The inspector will assist in collection, handling, identification, containment, and storage of waste at the City's Hazardous Waste Storage Facility. In addition, the Inspector will manage used oils, tires, electronics, and operation of the household hazardous waste reuse shed. When Logan City collection vehicles are delivering waste directly to the NVL once a week, the Inspector will be at the NVL to conduct random waste inspections.

Landfill Attendants (Attendants) – Since the majority of MSW delivered to the NVL will be from the transfer station where initial waste screening and weighing of the MSW has occurred; the use of Attendants may be limited. At present the responsibilities for attendants will largely focus on scale-house duties which include accurate weighing, recording and pre-screening of waste delivered to the site.

The Attendant position will require a good working knowledge of landfills and with applicable State of Utah DSHW regulations for landfill operations.

SECTION 2 - LEGAL DESCRIPTION AND PROOF OF OWNERSHIP

All properties used for the disposal of waste and supporting functions are owned by Logan City, a municipal corporation operating under the laws of the State of Utah. Additional properties have been acquired to facilitate modifications to run-off, run-on, and access control facilities.

2.1 LEGAL DESCRIPTION

The subject property is comprised of several parcels that were acquired for development of a landfill by the City of Logan. The following paragraphs contain the legal descriptions of the associated parcels:

PARCEL 1: Beginning at the Southwest Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence East 49.5 feet; thence North 610 feet; thence East 2079 feet; thence South 98.5 feet; thence East 9 rods; thence North 9 rods; thence West 20.75 chains; thence North 35.5 chains; thence West 14.5 chains; thence South 45.5 chains to the beginning.

PARCEL 2: Part of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, described as follows: Beginning 1500 feet West of the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West; running thence West 1500 feet; thence South 1161.5 feet; thence East 1500 feet; thence North 1161.5 feet to the beginning.

PARCEL 3: Beginning 9.5 chains North of the Southeast Corner of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24.97 chains; thence North 17.79 chains; thence East 24.97 chains; thence South 17.79 chains to beginning.

PARCEL 4: Beginning at the Southeast Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence North 9.5 chains; thence West 4.02 chains; thence South 9 rods, thence West 9 rods; thence North 98.5 feet; thence West 2079 feet; thence South 610 feet; thence East 2590 feet on Section line to beginning.

PARCEL 5: Beginning at the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian and running thence West 750 feet; thence South 1161.5 feet; thence East 750 feet, thence North 1161.5 feet to the beginning.

PARCEL 6: Beginning at a point 17.40 chains South of the Northeast Corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West to the Section line, thence South 17.7 chains; thence East to a point South of beginning; thence North 17.7 chains to beginning.

PARCEL 7: Beginning at the Southwest Corner of the Southwest Quarter of Section 35 Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence East 20 chains; thence North 9.25 chains; thence West 20 chains more or less to a point 9.50 chains North of the point of beginning; thence South 9.50 chains to the beginning.

PARCEL 8: The North half of the Northeast Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 9: The East half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 10: The West half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Also the North 26.67 Rods of the Northwest Quarter of the Southwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 11: Beginning at the Center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence South 26.666 rods; thence East 160 rods; thence North 26.666 rods; thence West 160 rods to beginning, less right-of-way; also the North half of the following: Beginning at the Center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24 rods; thence South 13 1/3 rods; thence East 24 rods; thence North 13 1/3 rods to beginning.

2.2 PROOF OF OWNERSHIP

Appendix B provides documentation of ownership.

SECTION 3 – PLAN OF OPERATION

This Plan of Operation has been written to address the requirements of UAC R315-302-2 and briefly describes the anticipated operations of the NVL facility.

The purpose of the Plan of Operation is to provide the Manager, Foreman, Operators and Attendants with standard procedures for day-to-day operation of the landfill. A copy of the final permit application (including the Plan of Operation) and Landfill Permit (to be issued by the DSHW) will be kept at the landfill for reference.

As previously stated the function of the NVL is to provide for the responsible disposal of MSW generated by the citizens of Cache County. The landfill is subject to and will be operated in accordance with applicable sections of the Utah Solid and Hazardous Wastes Control Board, Utah Solid Waste Permitting and Management Committee Rules, Utah Administrative Code (R315-301 through 320).

3.1 SCHEDULE OF CONSTRUCTION

Construction of the NVL facility will largely be concurrent with the construction of the transfer station. Development of the required ground water monitoring system has already started with initial ground water samples being collected in December of 2011. Contingent upon the DSHW landfill permit, site infrastructure development would likely begin during 2013 with the facility becoming operational in 2014 or 2015.

The development sequence envisioned for the NVL would be as follows:

- Development of the water management system. The system would include measures for run-on control along a perimeter road, the development of a run-off detention pond, and the installation of culverts.
- Development of site access roads.
- Fencing of active portions of the facility.

- Stockpiling of topsoil.
- Excavation of the first Cell in Phase I.
- Development of a leachate pond.
- Installation of truck scales.
- Power, water, site sanitation, etc. as appropriate.

Site soils will be utilized as the primary cover material for construction activities on site as well as cover for MSW working faces. NVL is designed such that no import soil will be required for site development or landfill operations, all required soils will be available on Logan City property associated with the NVL operations.

3.2 WASTE STREAM MANAGEMENT - DESCRIPTION OF HANDLING PROCEDURES

3.2.1 General

An effective waste control program is designed to detect and deter attempts to dispose of hazardous and other unacceptable wastes and will be implemented at the NVL. The program is designed to protect the health and safety of employees and customers as well as to protect against the contamination of the environment.

The landfill will not be open for public disposal (with the exception of occasional special waste loads) and will be accessed via locked gate by landfill employees only. Signs will be posted at the landfill entrance clearly indicating that the facility is owned and operated by Logan City (along with contact information for the City) with signage indicating that the facility is a private facility.

Most of the waste being delivered to the NVL will be initially processed through the transfer station. Initial processing at the transfer station will include the initial waste screening and weighing of the MSW. It may be beneficial for the City to haul waste collected in the northwest portion of the County directly to the NVL facility. If that is the case, waste will be

delivered directly to the NVL facility where it will be weighed on site and screened for improper waste at the site by a landfill Operator, Attendant, or Inspector.

Logan City personnel's efforts to deter disposal of hazardous and unacceptable waste begins with the collection of MSW. Collection truck drivers are instructed to observe all waste they collect and screen the waste as it is collected. All waste delivered to Logan City facilities (either the existing landfill or the future transfer station) will stop at a scalehouse to be weighed. The scale attendant will inquire the nature of each load as part of the weighing transaction.

Any vehicle suspected of carrying unacceptable materials (liquid waste, sludges, or hazardous waste) will be prevented from entering the disposal site (transfer station) unless the driver can provide evidence that the waste is acceptable for disposal at a MSW facility. Logan City reserves the right to refuse service to any suspect load. Vehicles carrying unacceptable materials will be required to exit the site without discharging their load and the Bear River Health Department will be informed about the incident. If a load is suspected of containing unacceptable materials (but not rejected at the scalehouse), the following information will be recorded: date, time, name of the hauler, driver, telephone number of hauler, vehicle license plate, and source of the waste. The scalehouse attendant will then notify an Operator that a load is suspect and that load will be further inspected as the hauler deposits the load on the transfer station tipping floor. If the load is acceptable to be sent to the NVL it will be loaded into transfer trucks, if not it will be loaded back into the haulers vehicle and rejected for disposal. Appendix E contains typical forms to be utilized to document waste inspections.

If a discharged load contains inappropriate or unacceptable material, the discharger will be required to reload the material and remove it from the transfer station. If the discharger is not immediately identified, the area where the unacceptable material was discharged will be cordoned off. Unacceptable material will be moved to a designated area for identification and preparation for proper disposal but not transferred to the NVL.

If waste delivered to the NVL is found to be unacceptable upon waste screening performed at the landfill, the area where the unacceptable waste is located will be cordoned off.

Unacceptable material will be moved to a designated area within the lined landfill cell for identification and prepared for proper disposal.

3.2.2 Waste Acceptance

Waste delivered to the NVL will be primarily through the transfer station where the bulk of the waste acceptance activity will take place. Logan City currently uses a software package entitled "DMS Plus" in the scalehouse (and will utilize the software in the upcoming transfer station) to record information about incoming loads being disposed of at the Logan City Sanitary Landfill or at the NVL. The program records data like weights, waste type, account information and amount charged. With this program Logan City personnel are able to track all incoming waste as well as bill and receive payment from all customers.

Currently a vehicle with waste stops on the scale; the scale operator identifies the load as to whether it is a commercial hauler, general public or private individual with an account. The proper codes are entered into the computer identifying the material, hauler, and account number. All loads larger than a pickup or a single axle trailer are weighed and charged accordingly. This information is printed on a two-part ticket; the customer receives one copy and one copy is saved for use by the Manager, or any other employee who has responsibilities relating to the landfill that may need information from these tickets.

Solid waste transaction tickets will be ultimately stored at the Logan City Environmental Center. All transactions are backed up on a nightly basis to the Logan City's computer network. Data extracted from the scale house computer is used to create a portion of the daily landfill record. Any or all transactions may be retrieved as necessary. A copy of a typical Daily Operating Record, Daily Cash Reconciliation & Revenue Receipt, and Material Summary Reports are included in Appendix E.

A waste acceptance program similar to the existing system will be utilized for waste acceptance once the transfer station becomes operational. A remotely controlled scale will be installed at the NVL to weigh the city trucks as they enter the facility. Since the only vehicles that will be hauling to the NVL will be city trucks (or special wastes processed at the transfer

station), the information tracked will be limited to the day of disposal, vehicle hauling the load and the weight of the load only if the load has not been weighed through the transfer station. The tare weight will be periodically determined for each of the City collection trucks that will potentially be hauling directly so the weight of waste hauled to the NVL can readily be documented.

For waste that may be delivered directly to the NVL (waste in collection trucks operating in the northwest portion of the County) waste screening will be done as needed or scheduled according to the procedures outiined in Section 3.3 Waste Inspection. No open burning will be allowed in association with the NVL nor will smoking be allowed anywhere on the landfill.

3.2.3 Waste Disposal

Once waste is delivered to the site, the waste will be dumped at the toe of the work face when possible and spread up the slope in one to two foot lifts, keeping the slope at a maximum of three to one (horizontal to vertical) configuration.

Work face dimensions will be kept narrow enough to minimize blowing litter and reduce the amount of material needed for daily cover. Typically, the width of the working face will be two to four times the width of the compactor blade (30 - 60 feet). The narrow working face will help to facilitate complete compaction of the waste and keeps the width narrow enough to minimize the amount of daily cover required.

Typically the compactor will be operated with the blade facing uphill. Equipment operations across the slope will be avoided to minimize the potential of equipment tipping over. In addition to safety concerns, a toe of slope to crest of slope working orientation provides the following benefits:

- Minimizes blowing litter problems
- Increases equipment compactive effectiveness
- Increased visibility for waste placement and compaction, and
- More uniform waste distribution.

Grade stakes or other grade control measures will be used if necessary to control cell height and top surface grade. The top of the interim surfaces will typically range from 2 to 5 percent to promote runoff within the cell which will be directed to the leachate pond. The working heights of each cell will range from 10 to 15 feet depending upon operational access considerations.

Wastes will be compacted by making three to five passes up and down the slope. Compaction reduces litter, differential settlement, and the quantities of cover soil needed. Compaction also extends the life of the landfill, reduces unit costs, and leaves fewer voids to help reduce vector problems. Care will be taken that no holes are left in the compacted waste. All voids will be filled with additional waste as necessary.

Intermediate cover will be applied to all areas of the active cell that will not receive additional waste within 30 days. Intermediate cover will consist of an additional 12 inches of soil being placed over the 6 inches of daily cover soil.

3.2.4 Special Wastes

3.2.4.1 Used Oil and Batteries

The existing Logan City Sanitary Landfill is a "Used Oil Recycle Center". When a customer has used oil to dispose of they fill out the form "UTAH DIYer USED OIL LOG" provided by UDEQ. A report generated from this form is turned in quarterly stating the amount of oil deposited and the customer's names. Waste oil will continue to be accepted at the existing landfill and later at the transfer station when it is operational. No used oil will be transferred to or accepted at the NVL.

The existing Logan City Sanitary Landfill provides an area to collect and store used batteries and will continue to do so until the transfer station becomes operational. Batteries are stored until a sufficient number is accumulated to facilitate delivery to a recycler. No batteries will be transferred to or accepted at the NVL.

3.2.4.2 Bulky Wastes

White goods are currently accepted at the Logan City Sanitary Landfill and are separated for recycling. All appliances containing refrigerants are segregated in a separate area, with refrigerant being removed by a qualified contractor. Used cars will not be accepted at the NVL. Persons seeking to dispose of used car bodies will be directed to take the car to local recyclers: Valley Metal Recycling, Dd Auto Salvage Inc., or Western Metals located near Plymouth, Utah. Bulky waste (i.e. furniture, appliances) will continue to be accepted at the existing landfill until the transfer station is operational. Bulky waste will be transferred to NVL through the transfer station.

3.2.4.3 Tires

The existing Logan City Sanitary Landfill charges for and accepts tires from the general public. Commercial tire outlets are prohibited from disposing of tires at the landfill. All tires are stored in a designated tire storage area. When sufficient quantities of tires are collected, a tire recycler is called and the tires are removed from the facility for recycling. Tires will continue to be accepted at the existing landfill and at the transfer station once operational. However, no tires will be transferred to or accepted at the NVL.

3.2.4.4 Dead Animals

Dead animals are currently accepted at the existing Logan City Sanitary Landfill. Once the transfer station and the NVL become operational, dead animals will be processed according to the size of the animal. Small animals will be incorporated into the general waste mass and processed directly into transfer trucks. Large animals (horses and cows) may be processed into a designated roll off container at the transfer station or arrangements may be made with Logan City staff to directly haul the dead animal to the NVL.

NVL personnel will incorporate the dead animals into the working face of the landfill. The incorporation of the carcasses into the landfill will be accomplished by pushing up the toe of the face and depositing the animal in the bottom of the toe; waste is then pushed over the top of the animal.

3.2.4.5 Asbestos Waste

The Logan City Sanitary Landfill is permitted to accept asbestos waste. Asbestos waste is handled, transported and disposed in a manner that will not permit the release of asbestos fibers into the air and that complies with Sections R315-315-2 of the State regulation. No transporter or disposal facility shall accept friable asbestos waste unless the waste has been adequately wetted and containerized. The existing landfill will continue to accept asbestos waste until an asbestos cell is constructed as part of the NVL.

3.2.4.6 Grease Pit and Animal Waste By-Products

Waste from restaurant grease traps and slaughterhouse by-products will be accepted at the NVL after processing at the transfer station. These wastes will require 24 to 48 hour notice before disposal and will require the hauler to initially transport the wastes to the transfer station for weighing. Transfer station employees will notify the NVL personnel that a special waste load will be delivered directly to the NVL. The transporter will then haul the wastes directly to the NVL and present a copy of the weight ticket from the transfer station and discharge the load as directed. If the waste passes the paint filter test, it will be at the toe of the working face and immediately covered. If excess liquid is present in the waste, the waste will be unloaded on a specially prepared drying pad within the lined cell. The waste will remain on the drying pad until the moisture has been sufficiently reduced to pass the paint filter test. Once the waste passes the paint filter test, the waste will be deposited at the toe of the working face where it will be immediately covered.

3.3 WASTE INSPECTION

3.3.1 Landfill Spotting

Learning to identify and exclude prohibited and hazardous waste is necessary for the safe operation of all landfills. The Operators (or Attendants) assigned to the NVL will be required to receive initial and periodic hazardous waste inspection training. Certificates of initial and annual training will be kept in the personnel files of the landfill personnel.

Hazardous wastes have either physical or chemical characteristics that could harm human health or the environment. A waste is considered hazardous if it falls into either of two categories: 1) a listed waste, or 2) a characteristic waste. Hazardous wastes will not be accepted at the NVL. Logan City has a household hazardous waste exclusion and collection program.

Small quantity generators (<100 kg/month) and household quantities are exempt from hazardous waste regulations. However, hazardous wastes are most likely to enter the landfill mixed in with common household waste being processed through the transfer station. Public education and periodic waste screening are the tools to be utilized to minimize the amount of inadvertent hazardous waste entering the NVL.

3.3.2 Random Waste Screening

Although most of the waste to be disposed of at the NVL will be processed through the transfer station (including waste screening), random inspections of incoming loads will be conducted according to the schedule established by the landfill management. A portion of the waste collected from the northern portions of the county will be hauled directly to the site by Logan City collection trucks once a week. More than one percent of the vehicles coming in the landfill on that day will be selected randomly for inspection according to the schedule. If frequent violations are detected, additional random checks will be scheduled at the discretion of the landfill Manager with waste screening results shared with the transfer station management.

If a suspicious or unknown waste is encountered, the Operator will proceed with the waste screening as follows:

- The driver of the vehicle containing the suspect material will be directed to the waste screening area within the lined cell.
- The waste screening form will be completed by the Operator (or Attendant if utilized at the NVL) and placed on file.
- Protective gear will be worn (leather gloves, steel-toed boots, goggles, coveralls, and hard hat) while waste is screened.

- The suspect material will be spread out with the compactor or hand tools and visually examined.
- Suspicious marking or materials, like the ones listed below, will be investigated further:

    - Containers labeled hazardous
    - Material with unusual amounts of moisture
    - Biomedical (red bag) waste
    - Unidentified powders, smoke, or vapors
    - Liquids, sludges, pastes, or slurries
    - Asbestos or asbestos contaminated materials
    - Batteries
    - Other wastes not accepted by the landfill

The landfill management will be called if unstable wastes that cannot be handled safely or radioactive wastes are discovered or suspected. The forms utilized by landfill personnel to record waste screening activities are included in Appendix E.

3.3.3 Removal of Hazardous or Prohibited Waste

Logan City has a household hazardous waste exclusion and collection program. Should hazardous or prohibited wastes be discovered during random waste screening or during tipping, the waste will be removed from the landfill as follows:

The waste is loaded back on the hauler's vehicle (Logan City truck). The landfill management will arrange to have the waste transported to the proper disposal site and attempt to locate the waste origin. The landfill management will also inform Bear River Health Department about the incident.

A record of the removal of all hazardous or prohibited wastes will be kept in the site operational records.

3.3.4 Hazardous or Prohibited Waste Discovered After the Fact

If hazardous or prohibited wastes are discovered in the landfill, the following procedure will be used to remove them:

- Access to the area will be restricted.
- The landfill management will be immediately notified.
- The Operator will remove the waste from the working face if it is safe to do so.
- The waste will be isolated in a secure area of the lined landfill and the area cordoned off.
- Logan City's Hazardous Materials Team (HazMat) will be notified.
- The Bear River Health Department will also be notified

The DSHW, the hauler (if known), and the generator (if known) will be notified within 24 hours of the discovery. The generator (if known) of the hazardous will be responsible for the proper cleanup, transportation, and disposal of the waste.

3.3.5 Notification Procedures

The following agencies and people are contacted if any hazardous materials are discovered at the landfill:

Carl Francis, Landfill Manager .....(435) 716-9791
Bear River Health Department.....(435) 792-6500
Issa Hamud, Environmental Dept. Director.....(435) 716-9752 or (435) 881-5339
Logan City Fire Department .....(435) 716-9500

A record of conversation will be completed as each of the entities is contacted. The record of conversation is kept in the site operational records.

3.4 FACILITY MONITORING AND INSPECTION

3.4.1 Ground Water

The NVL will comply with all aspects of the required ground water monitoring requirements as referenced in R315-308. The Ground Water Monitoring Plan includes sampling and analysis plans and frequency of sampling indicated to meet the regulatory requirements for the monitoring of ground water at the NVL. Appendix F includes a copy of the Ground Water Monitoring Plan.

3.4.2 Surface Water

The NVL permit drawings (Appendix A) illustrate the locations and details of the surface water drainage control systems for both run-on and run-off. With regards to this permit, run-on water is defined as the water that will be diverted around the landfill area and diverted into existing drainages. Run-off is the water that falls on the landfill footprint that does not contact waste. Run-off will be directed to a run-off pond. Storm water that falls within the footprint of the landfill, that comes in contact with waste is defined as leachate and will be directed to a lined leachate pond.

In general, run-on is prevented from running into the active landfill area by ditches associated with a perimeter access road. The permit drawings (Appendix A) indicate the location of the run-off basin. Calculations of the anticipated run-off volumes are shown in Appendix G. Run-off from the final cover will be managed by a combination of berms and ditches. The berms will be placed to divert the water around the active area through culverts to the run-off pond.

Ditches and berms used for management of the run-on waters are shown on the permit drawings (Appendix A) with the run-on calculations presented in Appendix G.

Landfill staff will inspect the drainage system monthly. Temporary repairs will be made to any observed deficiencies until permanent repairs can be scheduled. Logan City personnel or a licensed general contractor will repair drainage facilities as required.

Prior to site development activities at the NVL, the Logan City will prepare and submit for approval a Utah Pollutant Discharge Elimination System (UPDES) Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity, Coverage No. UTR000703. Appendix H contains an example of the approved UPDES permit associated with the existing Logan City Sanitary Landfill.

3.4.3 Leachate Collection

The NVL will have a composite landfill liner system installed in all of the landfill cells which will serve as the primary element in a leachate collection system. The leachate collection and recovery system (LCRS), installed in each of the lined landfill cells, will be maintained so that it operates from initial construction throughout the post-closure maintenance period. The LCRS will consist of lined landfill cells, a drainage media to transport leachate along the cell bottoms, leachate collection sumps (located in each cell), a leachate collection pipe, and a lined leachate pond. The locations of the LCRS components are as illustrated in the permit drawings (Appendix A).

The LCRS system will be inspected no less than quarterly by landfill staff for signs of deterioration. Logan City personnel or a licensed contractor will make required repairs to the system as required. Cleanouts will be located to aid in system operation and maintenance and will be detailed as part of individual cell designs.

3.4.4 Landfill Gas

An active landfill gas management system will be constructed at the NVL associated with the construction of the final cover. Details of the landfill gas collection system will be developed and submitted to the DSHW for approval prior to final cover construction.

This facility will be monitored for methane gas on a quarterly basis. Concentrations of methane gas will be measured with a hand-held gas monitor. Gas readings will be recorded at any site structures developed on landfill property, all ground water monitoring well locations, and at all property boundaries. Readings will be recorded on the "Gas Log" sheet and kept on file in the office.

If methane releases are detected in excess of 25 percent of the LEL, in any landfill structure or more than 100 percent of LEL at the property boundary, the procedure outlined in the "Explosive Gases" section will be followed. The forms utilized by landfill personnel to record gas monitoring activities are included in Appendix E.

Prior to the start of operations, the NVL will develop a Title V Operating Permit application to be submitted for approval from the Division of Air Quality. Logan City personnel have previously applied for and received a Title V Permit for the Logan City Sanitary Landfill; a portion of that permit and applicable reporting forms have been included in Appendix I as documentation of Logan City Personnel's familiarity with Department of Environmental Quality requirements.

3.4.5 General Inspections and Quarterly Inspection

Routine inspections are necessary to prevent malfunctions and deterioration, operator errors, and discharges that may cause or lead to release of wastes to the environment or a threat to human health. Operators will be responsible for conducting and recording routine inspections of the landfill facilities according to the following schedule:

Operators will perform pre-operational inspections of all equipment daily. A post-operational inspection will be performed at the end of each shift while equipment is cooling down.

All equipment will be on a regular maintenance schedule. A logbook will be maintained on each piece of mobile equipment that will include a record of any repairs and operational related comments concerning the equipment. Oil samples will be pulled when each machine is serviced and results will be recorded in the machine log.

Facility inspections will be completed on a quarterly basis. Any needed corrective action items will be recorded and the Operators (Attendants) will complete needed repairs. If a problem is of an urgent nature, the problem will be corrected immediately.

Scale maintenance will be performed annually at a minimum. If specific problems arise before scheduled maintenance, scale maintenance will be performed as required. The scale will be certified on an annual basis.

Landfill personnel will also conduct quarterly inspections. Quarterly inspection will be performed by a team of qualified landfill employees and is intended to assess the condition of various areas of the landfill. Quarterly inspections will include dust control activities, cover conditions, waste control, scale operations, perimeter fence, run-off / run-on system, roads, buildings (if any in the future), ground water monitoring wells, tipping face, disease vector control activities, and general facility appearance. The forms to be utilized by landfill personnel to record general and quarterly inspection activities are included in Appendix E.

3.5 CONTIGENCY AND CORRECTIVE ACTION PLANS

The following sections outline procedures that will be followed in case of fire, explosion, ground water contamination, release of explosive gases, or failure of the storm water management system.

HazMat will be contacted in all cases where hazardous materials or materials contaminated with PCB's are suspected to be involved.

3.5.1 Fire

The potential for fire is a concern in all landfills. The NVL staff will follow a waste handling procedure to minimize the potential for a landfill fire. If any load comes to the landfill on fire, the driver of the vehicle will be directed to an area away from the working face. The burning waste will be unloaded, spread out, and immediately covered with sufficient amounts of soil to smother the fire. Once the burning waste cools and is deemed safe, the material will be incorporated into the working face. Some loads coming to the landfill may be on fire but not detected until after being unloaded at the working face. If a load of waste that is on fire is unloaded at the working face, the load of waste will be immediately removed from the working face, spread out, and covered with soil.

The Logan Fire Department will be called if it appears that landfill personnel and equipment cannot contain any fire at the landfill. The Logan Fire Department will also be called if a fire is burning below the landfill surface or is difficult to reach or isolate.

In case of fire, the Manager and Director will be notified immediately. A written report detailing the event will be placed in the operating record within seven days, including any corrective action taken.

3.5.2 Release of Explosive Gases

Methane gas generation and concentration is not anticipated to be a problem at the NVL. However, due to the production of methane in all landfills, landfill gas levels will be monitored quarterly. If a concentration of methane is detected in excess of 25 percent of the lower explosive limit (LEL) in a landfill building, 100 percent LEL at the property boundary, or over 100 parts per million in an off-site building, the following procedure will be followed:

- Landfill operations will cease immediately. The landfill will be evacuated if personnel or buildings may be threatened.
- If gas is detected in a building, the doors and windows will be opened to allow the gas to escape.
- If off-site buildings or structures appear to be threatened, the Logan Fire Department will be called, the property evacuated, and the surrounding property owners notified.
- The Manager and Director will be notified as soon as possible. The release will be monitored and a temporary corrective action implemented as soon as possible. A permanent corrective action will be completed as soon as practicable with details acceptable to the DSHW.

The DSHW will be notified immediately and a written report submitted within 14 days of detecting the release. The gas levels detected and a description of the steps taken to protect human health will be placed in the operating record within seven days of detection. A remediation plan for the methane gas release will be placed in the operating record within 60 days of detection and the Executive Secretary will be notified that the plan has been implemented.

3.5.3 Explosion

If an explosion occurs or seems eminent, all personnel and site visitors (if persons other than Logan City personnel are on site) will be accounted for and the landfill evacuated. A corrective action plan will be immediately formulated and implemented as soon as practicable.

The Manager and Director will be notified immediately and the Logan Fire Department will be called. The Executive Secretary will be notified immediately.

If the explosion is the result of methane gas, the gas levels detected and a description of the steps taken to protect human health will be placed in the operating record within seven days of detection. A remediation plan for the methane gas release will be placed in the operating record within 60 days of detection and the Executive Secretary will be notified that the plan has been implemented.

3.5.4 Failure of Run-On/Run-Off Containment

The purpose of the run-on/run-off control systems is to manage the storm water falling in or near the landfill. Run-on water is water running toward the landfill that will be diverted away from landfill operations using a series of ditches, berms, and a perimeter road. These structures will be inspected on a regular basis and repaired as needed. All storm waters falling or flowing near the active landfill cell will be prevented from flowing into the active area by diversion berms and ditches.

If the run-on system fails, temporary measures such as temporary berms, ditches, sumps and pumps or other methods will be used to divert water from the active landfill cell.

Run-off waters are waters falling within the landfill footprint that has not fallen on waste. Run-off waters will be collected via diversion ditches and berms and directed to a run-off pond located down-hill from the landfill. If a run-off ditch or berm fails, temporary berms or ditches will be constructed until a permanent run-off structure can be constructed.

Any temporary berms or other structures will be checked twice a day until permanent repairs can be made. Permanent improvements or repairs will be made as soon as practicable.

The Manager and Director will be notified immediately if a failure of either of the run-on or run-off systems is discovered. The event will be fully documented in the operating record, including corrective action within 14 days.

3.5.5 Ground water Contamination

The NVL will utilize a series of upgradient and downgradient monitor wells to establish background water quality for the site. If, during routine ground water sampling, any chemical constituent is detected above established background water quality levels Logan City personnel will utilize a statistical data analysis method to determine if the change in water quality is statistically significant.

If the change in ground water quality is statistically significant and the source of the contamination cannot be demonstrated to be something other than the waste in the landfill, the NVL will initiate assessment monitoring. All ground water monitoring will be conducted in accordance with R315-308. The ground water monitoring program may be updated and corrective action taken as deemed necessary, with the approval of the Executive Secretary.

3.6 CONTINGENCY PLAN FOR ALTERNATIVE WASTE HANDLING

The most probable reason for a disruption in the waste handling procedures at the NVL will be weather related. The landfill may close during periods of inclement weather such as high winds, heavy rain, snow, flooding, or any other weather-related condition that would make travel or operations dangerous. The NVL may also close for other reasons like fire, natural disaster, etc. In general, the NVL will minimize the possibility of disruption of waste disposal services from an operational standpoint by minimizing the possibility of fire, maintaining run-off and run-on control structures and by conducting daily site inspections.

In case of equipment failure other Logan City departments will provide the necessary equipment to continue operations while repairs are being made to the NVL equipment. If

necessary substitute equipment is not available through other city departments, replacement equipment will be rented via commercial vendors. If the NVL landfill is not operational for any reasons, the Director will be notified.

Logan City has a reciprocal agreement with Box Elder County Landfill to provide an alternative site for temporary disposal of municipal solid waste should the need arise. A copy of this agreement has been included in Appendix E.

3.7 MAINTENANCE PLAN

3.7.1 Groundwater Monitoring Wells and Leachate System

The NVL personnel or qualified consultant will conduct quarterly inspection of all ground water monitoring wells and LCRS components.

3.7.2 Gas Monitoring System

The NVL will be equipped with a landfill gas recovery and management system. This system will be installed in conjunction with the final cover construction. Quarterly gas monitoring will be conducted using a hand held meter.

3.8 DISEASE AND VECTOR CONTROL

The vectors anticipated to be encountered at the NVL are flies, birds, mosquitoes, rodents, skunks, and snakes. The program for controlling these vectors is as follows:

3.8.1 Insects

Eliminating breeding areas is essential in the control of insects. NVL will minimize the breeding areas by covering the waste daily and maintaining landfill surfaces to reduce ponded water. The Logan City mosquito abatement program personnel will assist the landfill as necessary.

3.8.2 Rodents

Reducing potential food sources minimizes rodent populations at landfills. The NVL personnel will reduce the potential food sources by properly applying daily cover over all waste.

In the event of a significant increase in the number of rodents at the landfill, a professional exterminator will be contacted. The exterminator would then establish an appropriate protocol for pest control in accordance with all county, state and federal regulations.

3.8.3 Birds

Due to the presence of birds at many landfills, it is likely that the NVL may have birds (seagulls) periodically at the landfill. Good landfilling practices of waste compaction, daily covering of active working face, and the minimization of ponded water will alleviate most of the bird problems. In the event that daily covering of waste and minimizing ponded water is not sufficient, additional efforts will be utilized to minimize bird congestion. Methods will include using cracker and whistler shells, propane cannons, bird netting, or air treatment systems.

3.8.4 Fugitive Dust

The roads leading to the NVL site are anticipated to be paved with site access being provided via a maintained gravel access road. Some construction activities and daily truck traffic will produce a certain amount of dust. Landfill activities will be compounded by the occasional high wind to present a periodic fugitive dust problem. If the dust problem elevates above the "minimum avoidable dust level", the landfill personnel will apply water to problem areas.

The landfill will have a water truck on site or have access to a Logan City water truck used to suppress the dust. Water will be applied to the gravel roads leading to all landfill facilities and to the tipping face. The water will be applied as often as needed to control the dust.

3.8.5 Litter Control

Due to the nature of landfilling operations, litter control will be an ongoing challenge. Landfill personnel will perform routine litter cleanup to keep the landfill and surrounding properties clear of windblown debris.

Whenever possible, the working face will be placed downwind so that blowing litter is worked into the landfill face. Based on available wind measurements for the Logan Airport, wind will generally originate from the north. The landfill will use a litter fence to catch any litter blown during landfill operation. During windy conditions, landfill personnel will minimize the spreading of the waste to reduce the amount of windblown debris. Application of daily cover over the waste will also help to minimize windblown debris. The location and operation of the landfill working face will be modified to account for variations in the wind direction and velocity.

3.9 RECYCLING

Concurrent with the development of the NVL site, Logan City will construct a waste transfer station. The transfer station will provide bins for the recycling of cardboard, newspaper, magazines, carpet padding and scrap metal. The Logan City Environmental Department will continue to implement the county-wide single stream residential recycling program to provide additional recycling opportunities to County residents.

Logan City will continue to divert as much green waste as possible from the MSW waste stream to the composting facility that operates immediately east of the existing Logan City Sanitary Landfill and is managed by the Environmental Department. The City operates a composting facility that accepts manure, hay, yard wastes, trees, tree limbs and some untreated lumber. These materials are composted or ground and processed to produce various landscaping products that are sold to the public. Logs and tree limbs brought to the facility that are too large to feasibly process into landscaping materials are stockpiled and sold as firewood. The existing compost facility will continue to be operational in support of the transfer station and NVL operations.

The Logan City Environmental Department operates and services several green waste recycling drop sites in the county outside of Logan City and they provide an optional drop site green waste recycling service to county residents.

3.10 TRAINING PROGRAM

As part of the initial training of new employees, the NVL employees will be required to read the NVL permit. The Manager will conduct annual training with all landfill personnel that will include a review of the landfill permit, specifically the provisions of the Plan of Operation.

All personnel associated with the operation of the NVL will receive annual training in the operational aspects of landfills. The "Landfill Operations Basics Course" offered by the Solid Waste Association of North America (SWANA) will be required by all employees within 1 year of hire date. Certificates of Completion will be kept in personnel files. Regular safety and equipment maintenance training sessions will be held to ensure that employees are aware of the latest technologies and that good safety practices are used at all times.

The NVL Manager will maintain a current SWANA "Manager of Landfill Operations" (MOLO) certification.

3.11 RECORDKEEPING

A daily operating record will be maintained as part of a permanent record on the following items:

- Number of loads entering the landfill and types of wastes received
- Deviations from the approved Plan of Operation
- Number of waste inspections conducted
- Percentage of loads inspected
- Amount and type of cover material used
- Asbestos cell monitoring (when operational)
- Dust control record keeping
- Personnel training and notification procedures
- Landfill gas-monitoring results

An example copy of daily operating record can be found in Appendix E.

3.12 SUBMITTAL OF ANNUAL REPORT

The Logan City Environmental Department will submit a copy of its solid waste facility annual report to the Executive Secretary by March 1 of each year for the most recent calendar or fiscal year of facility operation. The annual report will include facility activities during the previous year and will include, at a minimum, the following:

- Name and address of facility
- Calendar or fiscal year covered by the annual report
- Facility type and status
- Annual quantity, in tons or volume, in cubic yards of solid waste handled for each disposal facility
- Annual update of required financial assurances mechanism pursuant to Utah Administrative Code R315-309
- Ground water monitoring results
- Explosive gas monitoring results
- Annual training documentation

3.13 INSPECTIONS

The Manager, or his/her designee, will inspect the facility to minimize the likelihood of malfunctions, operator errors, and discharges that may cause or lead to the release of wastes to the environment or to a threat to human health. These inspections will be conducted on a quarterly basis, at a minimum. An inspection log will be kept as part of the operating record. This log will include at least the date and time of inspection, the printed name and handwritten signature of the inspector, a notation of observations made, and the date and nature of any repairs or corrective actions. Inspection records will be available to the Executive Secretary or an authorized representative upon request.

3.14 RECORDING WITH COUNTY RECORDER

Plats and other data, as required by the County Recorder, will be recorded with the Cache County Recorder as part of the record of title no later than 60 days after certification of closure.

3.15 STATE AND LOCAL REQUIREMENTS

The NVL will comply with all applicable state and local requirements including zoning, fire protection, water pollution prevention, air pollution prevention, and nuisance control.

3.16 SAFETY

Landfill personnel will be required to participate in an ongoing safety program. This program will comply with the Occupational Safety and Health Administration (OSHA), and the National Institute of Occupational Safety and Health (NIOSH) regulations as applicable. This program will be designed to make the site and equipment as secure as possible and to educate landfill personnel about safe work practices.

The NVL personnel will be trained in First Aid, CPR, accident investigation, drug and alcohol policy, confined space entry, blood born pathogen, hazard communication, defensive driving, spill prevention control and counter measure, hazardous waste, and commercial driving license requirements. Some personnel will also be trained in storm water management, leachate monitoring, and landfill gas monitoring.

3.17 EMERGENCY PROCEDURES

In the event of an accident or any other emergency situation, the Operator (Attendant) will notify the Manager and proceed as directed. If the Manager is not available, the Operator (Attendant) will call the Director or the appropriate emergency number posted by the telephone. The emergency telephone numbers are:

Cache County Central Dispatch 911
Carl Francis, Landfill Manager .....(435) 716-9791
Issa Hamud, Environmental Dept. Director.....(435) 716-9752 or (435) 881-5339

PERMIT APPLICATION
TO OPERATE A CLASS I LANDFILL

North Valley Landfill - Logan City
Clarkston, Utah

PART HI - TECHNICAL REPORT

TABLE OF CONTENTS: PART HI – TECHNICAL REPORT

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SECTION 1 – MAPS

Plans and details of proposed landfill development are presented in Appendix A. Drawing titles are listed on Drawing 1 which also includes site location and vicinity maps. A U.S. Geological Survey topographic map (7-1/2 minute series) has been used to show the facility boundary with proximity to Clarkston, Utah. Drawing 2 provides a General Arrangement of the proposed landfill layout. The groundwater monitoring wells are shown on Drawing 4 and discussed further in the Groundwater Monitoring Plan contained in Appendix F (Logan City, 2012). Geologic maps used for identification of geologic hazards and preliminary assessment of the local and regional soil/rock conditions anticipated for the site are contained in Appendix J. Maps detailing the site's compliance with location standards were prepared as a part of a multi-year landfill siting study performed by HDR; applicable maps are included in Appendix K.

Development plans contained in Appendix A show planned landfill phases, cells, closure stages and details of proposed grading, liner and cover installation. These drawings provide a general concept and proposed sequencing of construction to aid in planning for landfill construction. As the landfill develops these plans may need to be modified to reflect operational changes. Detailed plans and quantities will be prepared for specific portions of landfill development/construction and closure at the appropriate time.

Prior to the construction of every landfill cell or landfill closure phase, a quality assurance / quality control (QA/QC) plan, engineering plans, construction specifications and bid packages will be prepared. All construction documents will be submitted to the DSHW for review and approval prior to any construction activity.

SECTION 2 - GEOHYDROLOGICAL ASSESSMENT

2.1 GEOLOGY

2.1.1 Regional Geology

Cache Valley in northern Utah is a intermontane valley that trends north-south and is part of a structural transition zone between the uplifted Middle Rocky Mountain Province on the east and the extensional Basin and Range Province on the west (Black et al., 2000). Cache Valley is located near the center of the Intermountain seismic belt (Smith and Sbar, 1974; Smith et al., 1991), and is seismically characterized by three major active fault zones that are in or adjacent to the valley. These fault zones are the Wasatch, East Cache, and West Cache (Black et al., 2000). Structurally, Cache Valley is a narrow, elongate graben formed by high-angle normal faults, bounded by the horst-block mountain ranges which were formed by the movement of the East and West Cache fault zones (Fenneman, 1931; Black et al., 2000).

The mountains surrounding Cache Valley consist mainly of sedimentary and metamorphic rocks of Permian to Precambrian age, including limestone, dolomite, quartzite, sandstone, mudstone, siltstone and shale. These rocks are the source of most of the detrital material that makes up the deposits of Tertiary and Quaternary age in the valley. Rocks of Tertiary age in Cache Valley include the poorly cemented to well-cemented conglomerate, sandstone and limestone of the Wasatch Formation (Bjorklund and McGreevy, 1971) and the poorly consolidated rocks of the Salt Lake Formation (Williams, 1962). The Salt Lake Formation is exposed in an almost continuous belt in the foothills around the valley and consists of a lower conglomerate unit, a tuff unit, and an upper conglomerate and sandstone unit (Williams, 1962).

The majority of surficial deposits located on the floor of Cache Valley consist of unconsolidated basin-fill deposits of Quaternary age from former Lake Bonneville and older lakes, and younger alluvium. The unconsolidated basin fill deposits have an approximate maximum thickness of 1,340 feet (Bjorklund, 1971). Alluvial fan and landslide deposits of Quaternary pre-Lake Bonneville age are exposed locally at the margins of the valley. In the valley interior, at least several hundred feet of fluvial and lacustrine sediments of Quaternary age underlie Lake Bonneville deposits and overlie the Salt Lake Formation (Williams, 1962). Sediments deposited by Lake Bonneville include the Alpine and Bonneville Formations,

which consist mostly of silt with some gravel, and the overlying Provo Formation, which consists of intertonguing layers of gravel, sand, silt and clay (Williams, 1962). Gravel and sand of Lake Bonneville age were deposited as shore embankments, deltas, bars, and spits near the mountain fronts while silt and clay settled from suspension in the lake water in the lower elevation of Cache Valley.

2.1.2 Local Geology

The West Cache fault zone (WCFZ) extends on the western side of Cache Valley for approximately 35 miles running from the Utah-Idaho border to just south of Wellsville, Utah (Solomon, 1999). The fault zone consists of three major normal faults that dip down to the east. The closest of these faults to the North Valley Landfill is the Clarkston fault. The site is also located near the Dayton fault. Based on the surface-rupture length, displacement, and slip rate, the Clarkston fault is considered capable of producing earthquakes that have a moment magnitude (M_w) ranging from 6.9 to 7.4 (Black et al., 2000).

The local geologic units mapped in and around the North Valley Landfill (NVL) include lacustrine sand, silt and gravel deposits from the Lake Bonneville cycles (Qlsb and Qlgb), alluvial and colluvial deposits (Qac), and deposits of the Salt Lake Formation (Tslw) (Biek et al., 2003). The Lake Bonneville deposits are mapped in the lower elevations of the North Valley Landfill within Phases 1 and 3. The Qac deposits are mostly confined to the swales and small drainages and are mapped within Phases 1 and 3. Majority of Phases 1 and 3, as well as all of Phase 2, are mapped as the Salt Lake Formation which consists of silt and clay deposits with interbedded sand, pebbly sand, and gravel (Biek et al., 2003).

The area in and around the NVL is underlain by fine-grained, low-permeability lacustrine soil with generally moderate to high plasticity. Sand lenses, where present, are typically located in the upper 80 feet. Between 80 and 200 feet, the low permeability soil is occasionally interrupted by thinner and less frequent sand and gravel lenses. There are no known faults or subsidence areas in the vicinity of the NVL.

Moisture contents varied with depth and type of soil; however, most soils measured moisture near 28%. Natural dry density of soils was measured between 72.2 and 103.8 pounds per cubic foot (pcf) (average of 85.8 pcf). Despite the relatively high moisture levels measured in deeper fine-grained soil deposits, the soils are hard/dense and difficult to drill and sample. Measured soil permeability averaged 1.00×10^{-5} cm/sec and was measured as low as 3.8×10^{-8}

cm/sec. Geologic and geotechnical data obtained from laboratory testing is included in Appendix J.

2.2 HYDROGEOLOGIC CONDITIONS

2.2.1 Regional Hydrogeology

The Cache Valley is one of four hydrologic provinces that make up the Bear River Basin. The Bear River originates in the Uinta Mountains of northern Utah and winds its way through over 500 miles of Wyoming, Idaho and Utah to terminate in a freshwater bay of the Great Salt Lake just 90 miles west of its source. Over most of its course through Idaho, the Bear River is gaining and in direct hydraulic communication with the major aquifer systems of the four hydrologic provinces.

Ground water in the Bear River Basin is found in Holocene alluvium, Pleistocene basalt and rocks of the Pliocene Salt Lake Formation, pre-Tertiary undifferentiated bedrock, and possibly the Eocene Wasatch Formation. Rocks of the Salt Lake Formation, which include freshwater limestone, tuffaceous sandstone, rhyolite tuff and poorly-consolidated conglomerate, outcrop along the major valley margins and may underlie the valley-fill alluvium. Many of the wells drilled into this formation do not yield water. The few wells that do produce water yield as much as 1,800 gallons per minute (gpm) from beds of sandstone and conglomerate.

Natural ground water discharge is by flow to the Bear River, springs, seeps along riverbanks, and evapotranspiration in large marsh areas. Ground water is obtained from both springs and wells in the Bear River Basin. Hundreds of springs issue primarily from fractures and solution openings in the bedrock on the margins of the basin. Water production from wells in the four hydrologic provinces is primarily from alluvial and basalt aquifers; however, some wells tap conglomerate, sandstone, limestone and shale aquifers of the Salt Lake and possibly the Wasatch formations.

Cache Valley is a complex graben covering about 310 square miles in southeastern Idaho and 350 square miles in northeastern Utah. It was once a bay of ancient Lake Bonneville resulting in lake terraces along the margins of the valley. The related topographic features and deposits of ancient lakes affect the occurrence and movement of ground water.

The major aquifers are composed of sand and gravel in fans and deltas; interbedded layers of lake-bottom clays and silts confine the aquifers and cause artesian conditions throughout the valley. Deltas and fans from streams entering the valley generally contain a high percentage of gravel and are considered good aquifers. The exception is the Bear River delta, composed mostly of fine sand and silt, which contains poor aquifers.

Aquifer recharge occurs mainly by infiltration of water from precipitation, streams, canals, ditches and irrigated lands and by subsurface inflow. The principle recharge area is along the margins of the valley that are underlain by permeable unconsolidated materials.

Ground water is discharged by springs, seeps, drains, evapotranspiration and wells. Potentiometric levels vary but are typically about 4,500 feet near the Idaho-Utah border. Generally, the ground water flow direction is locally toward the Bear River and regionally south through the Cache Valley in Utah.

Most wells in the valley produce water from the unconsolidated basin deposits. Driller's logs indicate that the alluvium may contain several aquifers separated by silt and clay. The most productive aquifer systems near the project site are in the area of Weston Creek and in fan deposits along the north and west sides of the valley. Aquifer tests near Weston indicate an average transmissivity of about 30,000 ft^2/day (Idaho DEQ, 2003, p. 8-10).

2.2.2 Local Hydrogeology

There is little data available regarding the hydrogeology in the immediate vicinity of the landfill. Based on mapping of Cache Valley's principal aquifer and recharge areas (Thomas, et. al., 2011) the Washboards are not located along the "margins of the valley" nor are they in another area associated with aquifer recharge. Subsurface drilling and sampling performed recently at the site showed conditions similar to those reported as "driller's logs" in Idaho DEQ, 2003 (p. 10). Namely, some coarse-grained alluvial deposits encountered during drilling contain perched ground water, aquifers, which are separated by silt and clay.

In order to better document and understand local hydrogeology, seven monitoring wells were installed at the site in 2010 and 2011. Some of these will remain in place through the landfill life; others will be abandoned as the landfill is developed. Based on the initial measurements in these wells ground water was encountered between 31 and 105 feet below the pre-development ground surface.

2.3 SURFACE WATER HYDROLOGY

2.3.1 Regional Surface Water Hydrology

Surface water flows into the valley via the Bear River from Gem Valley, Idaho, from various streams draining the surrounding mountains, or flows from springs and seeps inside the valley itself. Except for the Bear River, perennial streams that enter Cache Valley originate in the Bear River Range. Surface water is the primary source of irrigation water in Cache Valley, and it also is used for recreation, aquaculture, and public supply. Total mean annual stream flow entering Cache Valley for 1960-1990 was about 1,751 cubic feet per second (1,268,600 acre-feet per year; Kariya, et al, 1994).

Surface water leaves Cache Valley through the Bear River, West Side Canal, and Hammond Main Canal, all of which flow from Cutler Reservoir. Total mean annual surface water outflow from Cache Valley for 1960-1990 was about 1,959 cubic feet per second (1,419,300 acre-feet per year, Kariya, et al, 1994).

Mean annual surface water outflow for 1960-1990 was greater than inflow by about 210 cubic feet per second (152,100 acre-feet per year). The difference is not significant because of potential errors associated with these estimations and in the accuracy of stream flow measurements (Kariya, et al, 1994).

The largest stream in the area is the Bear River, which enters the northern end of Cache Valley from Oneida Narrows Reservoir in Idaho and exits through Cutler Reservoir in Utah. Where the Bear River enters Cache Valley, mean annual flow for 1960-1990 was 1,023 cubic feet per second (741,100 acre-feet per year). At the Utah-Idaho state line, mean annual flow of the Bear River was about 1,124 cubic feet per second (814,300 acre-feet per year) for 1960-1990. Where the Bear River leaves Cache Valley, mean annual flow for 1960-1990 was 1,682 cubic feet per second (1,179,500 acre-feet per year).

The Bear River flows through most of Cache Valley in a deep cut in the unconsolidated basin-fill deposits. This cut ranges in depth from a maximum of about 450 feet near Riverdale, Idaho, to a minimum of about 50 feet near Benson, Utah (Kariya, et al, 1994) and is deepest in the thick deposits of the Bear River delta in the north end of the valley.

The Logan River drains about 214 square miles of the adjacent Bear River range. Where the Logan River enters Cache Valley, mean annual flow for 1960-1990 was 257 cubic feet per second (186,200 acre-feet per year). The Logan River channel is incised as much as 200 feet into the surrounding basin-till deposits near the mouth of Logan canyon and as little as a few feet near U.S. Highway 89. Downstream from the confluence with the Blacksmith Fork, the Logan River flows in to the south end of Cutler Reservoir. The mean annual flow of the Logan River into the Cutler Reservoir is about 290 cubic feet per second (210,000 acre-feet per year; Kariya, et al, 1994).

2.3.2 Local Surface Water Hydrology

The site is located on the east-facing slopes of the Washboards and surface flows generally travel in that same direction. Based on topographic mapping of the area surface run-off collects in natural drainage channels which flow east and then north across the Utah-Idaho border until they join Weston Creek approximately 3/4 miles southwest of Weston, Idaho.

These natural drainage channels are dry through the majority of the year, carrying flows only during rainfall and snowmelt events. Weston Creek eventually joins the Bear River approximately 2.25 miles east of Weston.

There are no bodies of surface water near the landfill. Based on regional hydrogeologic studies referenced previously, observations made during subsurface exploration, topographic relief, sampling and testing we do not believe that surface flows have significant impact on ground water recharge around the site. Moisture contents are variable, but near surface soils are typically fine-grained, indicative of lower permeability. Combining these observations with the sloping native surface it is expected that surface run-off will increase and infiltration be limited in the vicinity of the landfill.

2.4 WATER RIGHTS

A search of the Utah Division of Water Rights database indicates that there is 1 point of diversion within 2,000 feet (ft) of the proposed landfill boundary. This point is an underground well owned by the City of Logan and is actually located on a portion of the property that is planned to remain undeveloped; it is approximately 1,200 ft east of the nearest point on the landfill footprint. This well is capable of producing 0.003 cfs, is permitted for stock-watering. Appendix L contains details regarding this well.

Because the site is located less than one mile south of the Utah-Idaho border, inquiries were also made to determine proximity to water rights in Idaho. A water-rights search was performed for property in Franklin County within approximately 1 mile of the site (contained in southern half of southeast quarter of Section 30, and southwest 1/4 of southwest 1/4 of Section 29, Township 16 South, Range 38 East). No water rights or points of diversion were listed within 1-mile of the landfill on the north side of the Utah-Idaho border.

The nearest public water supply system is the City of Weston PWS (#6210019) in Franklin County, Idaho. The water system includes two wells and two springs. Both wells are located in a field of hay and weeds near Weston Creek in Weston Canyon; the springs are located further east along Weston Creek (Idaho DEQ, 2003). The four diversion points are located approximately 3.25 - 4.5 miles north of the landfill and because ground water flow is typically eastward towards the Bear River, do not appear to be down-gradient of the landfill. Surface run-off from the areas surrounding the landfill do flow northward and eventually into Weston Creek approximately 1.5 miles east (downstream) from the two springs and 3 - 3.5 miles downstream of the wells. A letter to the Mayor of Weston inquiring about the drinking water supplies for Weston along with the "City of Weston (PWS 6210019) Source Water Assessment Final Report" in included in Appendix L.

2.5 GROUND WATER QUALITY

2.5.1 Ground Water Data

Background water quality in the shallow water bearing zone was evaluated from samples taken from both upgradient and downgradient monitoring wells. Based on initial depth measurements the water moves eastward through water bearing zones toward the Bear River. The location of the existing wells is shown on Drawing 4 (Appendix A) and referenced in Ground Water Monitoring Plan (Appendix F). Seven wells were installed in 2010 and 2011 and the first round of sampling and testing was performed on December 6 and 7, 2011. All seven of the wells were installed prior to establishing the landfill development plan; as a result some will have to be abandoned during landfill development. Additional wells will be installed as the landfill develops in order to better define and effectively monitor ground water quality. The proposed additional monitoring wells are indicated on Drawing 6 (Appendix A).

Initial water chemistry data has shown that of the constituents evaluated, background water levels are in excess of ground water protection standards for Arsenic (NV-1 and NV-4) and Lead (NV-4). All other metals, minerals and volatile organic compounds (VOC's) evaluated were found to be either below test reporting limits, or below ground water protection standards. A complete list of the chemical constituents and associated reporting limits are presented in Appendix F.

A summary of the sampling periods, techniques, and procedures are provided in the Groundwater Monitoring Plan (Appendix F). The results of the analyses will be provided in an Annual Report to the Utah Division of Solid and Hazardous Waste (DSHW).

SECTION 3 – ENGINEERING REPORT

3.1 LOCATION STANDARDS

In accordance with the Subtitle D criteria, UDEQ has adopted specific location standards. The location standards are for new landfills or lateral expansions of existing landfills. The Utah location standards for Municipal Solid Waste Landfills (MSWLFs), as presented in the Solid Waste Permitting and Management Rules (R315-302), are outlined below.

1 — Land Use Compatibility

Not to be located within 1000 feet of parks and protected areas
Not to be located in an ecologically and scientifically significant area
Not to be located on prime or unique farmland
Not to be located within ¼ mile of existing dwellings, incompatible or historical structures, unless allowed by local land use planning or zoning
Not to be located within 5,000 feet of airport runways
Not to be located on archeological sites

2 — Geologic Hazards

Proximity to a Holocene Fault
Considerations for constructing in a seismic impact zone
Consideration given to unstable areas

3 — Surface Water

Will not affect public water system
Will not affect existing lakes, reservoirs and ponds
Cannot be located in a floodplain unless certain criteria are met

4 —Wetlands

Not allowed unless:
Alternative location has been denied previously
Will not violate state water quality standard or Clean Water Act
Will not jeopardize threatened or endangered species
Will not cause or contribute to significant degradation of the wetlands

5 — Ground water

Ground water/landfill cell separation
Sole source aquifer
Ground water quality
Source protection areas

The following sections present the Utah MSWLF location standards and discuss the NVL's compliance with those requirements.

3.1.1 Land Use Compatibility

The NVL is not known to be out of compliance with any element of the land use compatibility standard. Many of these findings are a result of a multi-year study of possible landfill locations within Cache County that was completed by HDR in 2004. The entire text and maps associated with this report have not been included in this permit; however, it is available on Logan City's web page (http://loganutah.org/Environmental/Landfill/FAQ.cfm). Selected maps have been included in Appendix K as discussed in the following paragraphs.

The site is not located within 1,000 feet of a park or protected area. The nearest park is located 4.5 miles east of the site near Cornish, Utah. Caribou National forest is 4 miles west of the site.

Source(s): Cache County Landfill Siting Study, HDR, map dated August 10, 2000 (Parks & Recreation Areas) included in Appendix K.

The site is not located in a Utah Division of Wildlife Resources (UDWR) Wildlife Management Area and as such is not restricted from landfill development. A portion of the property owned is located on "high value" habitat for bald eagles; however, that portion is outside the planned landfill. The site is also listed as "moderately constrained" for sensitive species, but is not listed as sensitive for migratory birds.

A search of the sensitive species database maintained by the Utah Natural Heritage Program indicated that sensitive species in the area consist of the sharp-tailed grouse and grasshopper sparrow (within 1/2-mile). Expanding the search radius to 2-miles revealed recent records for short-eared owls and historical records of occurrence of the

pygmy rabbit. UDWR has been contacted throughout the site selection process and responded specifically about the Clarkston site in 2003 (letter included in Appendix K). At that time they stated their main concern was potential loss of habitat for the sharp-tailed grouse. They requested performance of a multi-year survey to determine population of grouse that would be impacted or displaced. In recent communications the UDWR has not changed their position. This study has not yet been performed; however, the City of Logan will continue to work with representatives from UDWR to determine the potential impacts and the appropriate mitigation.

Source(s): Cache County Landfill Siting Study, HDR, maps dated August 10, 2000 (Bald Eagle Habitat) and September 14, 2000 (Species of Special Concern and Migratory Birds), respectively. All three maps are included in Appendix K.

The site is not located on any farmland that has been designated as prime or unique. A portion of the site is listed as 'Special Farmland of State Importance - Non-irrigated'. A letter from the North Cache Conservation District indicated that this designation does not have any stipulations that would impact a site being considered for a landfill.

Source(s): Cache County Landfill Siting Study, HDR, map dated August 10, 2000 (Special Farm Areas) included in Appendix K.

Letter from S. Bruce Karren, North Cache Conservation District, November 30, 2011, included in Appendix K.

The site is not located within 1/4 mile of any dwelling, incompatible or historic structures. The nearest historic property to the site is the Clarkston Cemetery located approximately 4 miles south of the site. The property is zoned as "Agricultural" but was placed in a "Public Infrastructure Overlay Zone" in October 2011 by Cache County officials to allow for use as a landfill.

Source(s): Cache County Landfill Siting Study, HDR, maps dated August 10, 2000 (Development Constraints, Historic Sites) included in Appendix K.

The site is not located within 5,000 feet of any airport runway. The airport runway nearest the site is at the Logan-Cache Airport; located approximately 16 miles southeast of the site.

Source(s): Cache County Landfill Siting Study, HDR, map dated May 31, 2001 (Airport Restrictions) included in Appendix K.

The site is not located on any known archeological sites. As mentioned previously, the site of the proposed NVL (north of Clarkston) was selected as a result of an extensive multi-year siting study (HDR, 2004). In that study, this location was referred to as "Site C." Research and field investigations performed during that study concluded that:

"Site C has a low probability for containing historic sites. Its rugged terrain and remote location do not make it a strong candidate for habitation sites. Today some of it is farmed, but most appears to be undeveloped. Because little information exists on the specific prehistoric and Native American settlement-subsistence patterns in the valley, site rankings assume a correlation between human occupation and use and proximity to major waterways. Give this assumption Site C has the least potential for substantial prehistoric or historic Native American sites because it is farthest from the major rivers."

A letter summarizing HDR's findings regarding historic properties and archaeological sites was prepared and sent to the State Historical Preservation Office (SHPO) for their review and comment. A copy of this letter is included in Appendix K.

3.1.2 Geologic Hazards

The Utah State Regulations indicate "No new facility or lateral expansion of an existing facility shall be located in a subsidence area, a dam failure flood area, above an underground mine, above a salt dome, above a salt bed, or on or adjacent to geologic features which could compromise the structural integrity of the facility".

The NVL is not known to be located in a subsidence area, a dam failure flood area, above an underground mine, above a salt dome, or above a salt bed as mentioned in the Utah State Regulations. A review of geologic hazards mapping for Cache County (Solomon, 1999, Elliot and Harty, 2010) did show that portions of the east facing slopes of the "Washboards" have experienced some landsliding. None of the mapped landslide deposits are within the property boundary; they are located south and east of the site. According to Solomon, the landslides

that did occur nearest the site "were caused either by wave erosion of the Bonneville shoreline, rapid dewatering of oversteepened slopes during the Bonneville flood, or earthquakes." The conditions associated with Lake Bonneville are no longer present and therefore will not cause additional landsliding. A more detailed discussion of potential earthquake induced slope instability will be presented in section 3.1.2.3 - Seismic Impact Zone Analysis.

Source(s): Cache County Landfill Siting Study, HDR, map dated August 11, 2000 (Faults) included in Appendix K.

3.1.2.1 Fault Areas

The landfill site is not located over or within 200 feet of any known Holocene fault. The nearest mapped fault is the Clarkston Fault (class A), located approximately 2.25 miles west of the site, a part of the West Cache fault zone. The West Cache Fault Zone is a series of three related east-dipping normal faults that extend 80 km (50 mi) along the west side of Cache Valley from northern Utah into Southern Idaho (Black et al, 2000)

Source(s): Cache County Landfill Siting Study, HDR, map dated August 10, 2000 (Faults) included in Appendix K.

USGS, 2011, Fault and Fold Database, earthquake.usgs.gov/hazards/qfaults/google.php

3.1.2.2 Seismic Impact Zone

The EPA and the UDEQ define a seismic impact zone as any location where the expected peak bedrock acceleration from earthquake activity exceeds 0.10 times the acceleration due to gravity (g). The predicted Maximum Horizontal Acceleration (MHA) at the site is approximately 0.321g, which places the site within a Seismic Impact Zone.

The MHA in lithified earth material is defined in 40 CFR part 258.14 as the "maximum expected horizontal acceleration depicted on a seismic hazard map with a 90% or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on site specific seismic risk assessment." This definition was

adopted in full by the UDEQ. The acceleration value of approximately 0.321g was obtained from the United States Geologic Survey's (USGS) Earthquake Hazards Program – National Seismic Hazard Mapping Project. The value is an estimated ground surface acceleration of a "very dense soil and soft rock" site (site class C), which is identified as having a shear-wave velocity between 1,200-2,500 m/sec in the top 30 meters; sites with different soil types may amplify or de-amplify this value. Section 3.1.2.3 discusses the seismic impact zone analysis performed for this permit application.

3.1.2.3 Seismic Impact Zone Analysis

An analysis was performed by IGES to evaluate static and seismic stability of the design soil cut and waste fill slopes. Input information for the stability analyses was evaluated based on the investigation and planning information regarding the site as well as published information on material properties for waste, liner and cover materials. Appendix M contains the results of the slope stability analysis.

Withiam et al, 1995, performed a large-scale direct shear test in-situ to measure strength properties of MSW. These test results defined a cohesion intercept of 209 psf and a friction angle of 30 degrees. Other work by Kavazanjian et al, 1995 suggest a friction angle of 33 degrees for MSW and a shear strength of 500 psf below an overburden stress of 627 psf. Based on data from similar sites MSW unit weight was approximated at 50 pcf. An assumed unit weight of 115 pcf for compacted native sand and silt was used for daily cover. The unit weight of the MSW in the landfill was estimated to be 67.5 pcf assuming 25% of the landfill is composed of sand and silt from daily cover. The chosen higher unit weight of MSW and waste used in analysis is conservative and represents a higher instability driving force for both the static and pseudo-static cases. A value of 30 degrees for the angle of internal friction and 150 psf for the cohesion intercept were used to define the strength properties of the anticipated MSW.

Strength properties and unit weights of the native in situ silt and sands were estimated based on laboratory testing. For stability analysis they have been assigned a friction angle of 31 degrees and a cohesion intercept of 400 psf. The in situ lean CLAY was assumed to have a conservatively low friction angle of 27 degrees and cohesion intercept of 500 psf. A summary of the input soil parameters is provided in the following table:

Material	Internal friction angle, ϕ (degrees)	Cohesion intercept, c (psf)	Unit weight, γ (pcf)
MSW	30	150	68
Native Sand and Silt	31	400	115
Native Lean Clay	27	500	115

The soil unit weight values were derived from testing performed on relatively undisturbed samples collected at the site as well as from published information and experience.

Using the parameters outlined above and the planned landfill geometry, static slope stability analyses were performed for the three most critical slope geometries expected during planned development of the landfill: largest cut slope (2.5H:1V), largest intermediate waste slope (3H:1V) and largest final cover slope (4H:1V). The static slope stability analyses were completed using the computer program SLIDE v.6.0 by RocScience. While a safety factor greater than 1.0 indicates a stable slope, this assumes that the model created provides an accurate representation of material properties and slope geometry when evaluating slope stability. In most cases a safety factor of 1.5 or greater is sought under static conditions to account for some unknowns in stratigraphy and soil strength. The results of static stability analysis are shown in the following table.

Slope Geometry	Static Factor of Safety
Cut Slope (2.5H:1V)	1.73
Intermediate Waste Slope (3H:1V)	1.94
Final Waste Slope (4H:1V)	2.52

Depending on the sequence of waste generation and placement in the landfill configuration presented in this permit it is possible that "worst-case" cut and intermediate waste slopes could remain unsupported for a period of several years. For this reason a seismic assessment of these slopes was performed as well as for the final cover slope. Seismic loading various slope geometries was considered based on 2% probability of exceedance in 50 years of the Maximum Credible Earthquake. The value generated for Peak Ground Acceleration (PGA) by the USGS Earthquake Ground Motion Tool was 0.321g for a very dense soil site (site classification C). The PGA of 0.321g was used as the ground surface acceleration at the base of the refuse. Using the attenuation curves developed by Singh and Sun (1995), the peak acceleration for a 200 foot high waste fill was 0.215g. Since the fill is a maximum 278 feet and strain of the MSW reduces the Peak Horizontal Acceleration (PHA) as it gets taller, 0.215g is considered conservative. An average acceleration of 0.268g was used as the baseline for seismic stability and deformation analysis performed for the temporary and final waste slopes.

A simplistic deformation analysis was performed based on the methods suggested by Hynes and Franklin. Based on their research, deformations are anticipated to be one meter or less if the yield acceleration is less than or equal to one-half the horizontal acceleration, with a 20% reduction in shear strength of the waste mass. Therefore, using a horizontal acceleration of 0.134g to obtain a pseudo-static factor of safety of 1.0 or greater indicates satisfactory performance of the waste mass under seismic conditions (deformation less than 1 meter). The Pseudo-static analysis indicates a factor of safety of 1.23 for the final cover and 1.03 for the intermediate waste slope. Deformation of the intermediate waste slope may require earthwork to replace temporary cover soils; however, this would occur prior to placement of additional MSW or the final cover materials. A more detailed analysis of the final cover slope was also performed and will be discussed later in this section.

For the cut slope into native soils a simplistic pseudo-static analysis was also performed. In this case the full PGA (0.321g) was utilized because the ground motions will not attenuate as much through native soils as it will in a waste mass. In this case a factor of safety of 1.18 was obtained through the Hynes and Franklin method.

Due to the generalizations associated with the Hynes and Franklin (1984) methodology, a seismic slope displacement analysis was performed for the final cover slopes as recommended by Bray et al. (1998), with sliding length modification suggested by Rathje and Bray (2006, unpublished) (SCEC, 2002). This method incorporates site specific parameters including the

radius to the nearest contributing seismic source, maximum anticipated earthquake magnitude, shear wave velocity, slope height, and yield acceleration from a pseudostatic analysis. It is the opinion of IGES that the approach recommended by Bray et al. (1998) provides a more accurate representation of the response of the landfill during a seismic event due to the displacement analysis input parameters being site specific, not empirical and arbitrary data.

Pseudostatic slope stability analyses were performed on the above mentioned slope in order to determine the yield acceleration, k_y, and the depth to the critical sliding surface. The graphical presentations of the results from the pseudostatic slope stability analyses are presented in Appendix M.

As mentioned in Section 3.1.2.1 of this report, the nearest Class A fault is the Clarkston fault; a part of the West Cache Fault Zone (fault ID 2521a) located approximately 3.6 km (2.2 miles) west of the site. According to the USGS (2007), a class A fault shows "Geological evidence demonstrates the existence of a Quaternary fault tectonic origin, whether the fault is exposed by mapping or inferred from liquefaction or other deformational features". The West Cache fault zone, Clarkston section is characterized by a maximum magnitude 6.66 earthquake (USGS, 2008). The shear wave velocity of the MSW was estimated to be approximately 700 ft/sec, using the higher bound (worst case) velocity from Singh and Sun (1995). The results from the simplified seismic slope analysis yielded a maximum anticipated displacement less than 1 cm during a seismic event (Plate N-11). A summary of the simplified seismic slope displacement inputs and results for the global stability are shown in the following table:

Slope Geometry	Yield acceleration, k_y (g)	Maximum depth to critical surface, H (ft)	Displacement (cm)
Final Waste Slope (4:1)	0.212	103	<1
Cut Slope (2.5:1)	0.237	206	<1

The proposed final cover is a total of approximately 42-inches in thickness and consists of the following layers from top to bottom: 6-inch topsoil layer, 18-inch site soils, drain net

(geocomposite), HDPE, GCL, 18-inch intermediate cover soils. Due to the simplistic geometry of the cover, an infinite slope stability analysis was chosen to evaluate the performance of the cover, with a slope angle of 4H:1V. The internal friction angle and cohesion intercept of the reinforced GCL liner, the interface friction angle and cohesion intercept of the GCL to the soil, and the interface friction angle and cohesion intercept of the GCL to the polyethylene geocomposite (drainage layer) were evaluated to provide input parameters to be used in the slope stability analysis. Information was obtained for these various conditions from the GCL manufacturer who has had several independent laboratories perform the testing. This information is summarized in the following table:

Model:	Mulch/soil interface	Soil/drain net interface	Drain net/HDPE interface	HDPE/GCL interface	GCL	GCL/soil interface	Total cover/MSW interface
Thickness, H (ft) =	0.52	2.05	2.07	2.08	2.09	2.11	3.65
Unit weight, γ (pcf) =	65.0	102.5	101.3	101.2	100.6	100.4	106.3
Friction angle, ϕ (deg) =	25.0	30.0	25.0	25.0	34.0	30.0	24.0
Cohesion intercept, c (psf) =	150.0	100.0	60.0	60.0	120.0	100.0	120.0
Slope angle, β (deg) =	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Static factor of safety, FS =	20.726	4.332	3.081	3.077	5.123	4.316	3.096

As indicated by the safety factors (all >1.5) the components of the composite cover are stable under static conditions.

The same previously mentioned simplified seismic slope displacement (Bray et al., 1998) was performed on the planned cover and its' components, applied to the infinite slope stability analysis. A summary of the simplified seismic slope displacement inputs and results for the cover stability are shown in the following table:

Model/interface	Yield acceleration, k_y (g)	Maximum depth to critical surface, H (ft)	Displacement (cm)
Mulch/Soil	4.417	0.52	<1
Soil/Drain net	0.728	2.05	<1
Drain net/HDPE	0.466	2.07	<1
HDPE/GCL	0.465	2.08	<1
GCL	0.882	2.09	<1
GCL/Soil	0.724	2.11	<1
Composite Cover/MSW	0.471	3.65	<1

The industry-standard minimum required factors of safety of 1.5 for static slope stability analyses were met. The maximum amount of deformation as a result of an earthquake for the global stability is <1 cm, and <1 cm inches for the final cover. This amount of deformation is considered acceptable.

3.1.2.4 Unstable Areas

The owner or operator of a landfill must consider several factors when determining whether an area is unstable. In guidance document R315-302, these factors are listed as; 1) soil

conditions that may result in significant differential settling, 2) geologic or geomorphic features and 3) human-made features or events, both surface and subsurface.

Based on the site location, local geology and subsurface conditions, one potential for instability could be landslide/slope failure. There are no existing mapped slides within the subject property; however some have been mapped in the near vicinity (Solomon, 1999; Elliott & Harty, 2010) on the adjacent eastern slopes of the Washboards. Most of the conditions that are probable causes of the previous slope instability in the area, namely Lake Bonneville, no longer exist. However, construction of the planned landfill cells will require excavation into the native slopes. This could impact the performance of various design elements of the landfill; therefore, slope stability has been assessed as part of landfill design.

3.1.3 Surface Water

The NVL is not located near any standing surface water and is not located in a drinking water protection zone.

> *Source(s): Cache County Landfill Siting Study, HDR, map dated August 10, 2000 (Drinking Water Protection Areas) included in Appendix K.*

Design considerations have been implemented to minimize the release of surface water from the site to nearby drainage channels leading to rivers lakes, reservoirs or ponds located downstream of the site. Run-off will be controlled as previously discussed to provide protection against transporting potential contaminants off-site.

3.1.4 Wetlands

The proposed landfill is not located on or near any existing wetlands. Identified wetlands nearest site are located approximately 5 miles south of the property adjacent to the Newton Reservoir and Clarkston Creek.

> *Source(s): Cache County Landfill Siting Study, HDR, map dated August 11, 2000 (Wetlands) included in Appendix K.*

3.1.5 Ground water

This landfill is to be lined with preliminary liner elevation designed to be at least 10 feet above ground water (Drawing 5, Appendix A).

Seven preliminary subsurface explorations extending up to 250 feet below the existing elevation of the landfill property have all encountered ground water. Investigations have identified higher permeability zones of relatively course-grained soils (sand and gravel) that form perched water tables. The combination of relatively steep native slope and low permeability fine-grained soils likely limit the saturation of subsurface soils from precipitation. Monitoring wells have been installed in all seven explorations in order to monitor water in these zones and collect samples for water quality testing. The deeper borings did not show the existence of water at depth.

Background water chemistry analysis was performed on samples collected on December 6 and 7, 2011 by Logan City. This water quality data, along with applicable ground water protection measures, are summarized in the Ground Water Monitoring Plan (Appendix F).

3.2 ESTIMATED FACILITY LIFE

The property owned by Logan City contains approximately 532 acres of land, the operational plan calls for 133 acres of that land to be utilized for MSW disposal. Based on the projected waste streams, the estimated life of the facility is approximately 81 years. Details of the landfill life analysis are contained in Appendix N.

Based on current figures, approximately 243 tons per operational day (75,520 ton/year) of MSW would be disposed of at the NVL. Logan City anticipates that future compost operations and recycling, will keep the waste stream increases to approximately 2% per year. A total of approximately 310 operational days per year is anticipated for the NVL operation.

Section 4.3 Staged Closure provides greater detail of each of the planned landfilling Phases.

3.3 LANDFILL DEVELOPMENT AND OPERATION

The current plans call for development of the landfill in three Phases; these are shown on Drawing 3, Appendix A. The first phase of development will include development of site access roads and run-on controls beginning from Stink Creek Road and proceeding northward

around the north and eastern portions of the proposed landfill. Presently, with the exception of some dirt roadways there is not vehicle access around the landfill site. The first phase of road development will terminate near the northwest corner of Phase I. Fill needed for the initial road construction (372,000 cyd) will be generated from the Phase I cut (1.06 Mcyd) and the remaining soil generated will be stockpiled for use as daily cover. The floor of the landfill cells is designed with a cross slope (2.5 and 7 %). All water will be diverted in a southeasterly direction away from active working areas and toward the eastern limits of the proposed landfill footprint. Based on the waste stream projections we anticipate that Cell 1 will accommodate the projected waste stream for approximately 4.5 years. During this time development of Cells 2 and 3 will continue.

3.3.1 Liner

Liner installation will begin in Phase I, Cell 1 in preparation for waste acceptance. We estimate that approximately 556,250 sq-ft of landfill area will be lined in this cell. The landfill floor and side walls will be lined using a primary HDPE liner and secondary GCL. Preparation for liner placement will include removal of oversize cobbles in order to protect liner materials, a layer of protective soil will be placed over liner materials in order to guard from liner distress due to equipment and waste placement. A geocomposite drain net will also be used on the landfill floor for collection of leachate. Subsequent cell and Phase development will tie into existing liner materials to maintain a continuous liner system throughout the remaining development phases.

3.3.2 Fill Method

Wastes will be dumped at the toe of work face and spread up the slope in one to two foot layers, keeping the working slope at a maximum of three horizontal to one vertical.

Work face dimensions will be kept narrow enough to minimize blowing litter and reduce the amount of daily cover. Wastes will typically be compacted by making three to five passes up and down the slope. Compaction reduces litter, differential settlement and the quantities of cover soil needed. Compaction also extends the life of the site, reduces unit costs and leaves fewer voids to help reduce vector problems. Care will be taken that no holes are left in the compacted waste. Voids are filled with additional waste as they develop.

3.3.3 Daily, Intermediate and Final Cover

3.3.3.1 Daily and Intermediate Soil Cover

Daily and intermediate cover soils will meet the 6-inch and 12-inch minimum requirements, respectively, as governed by R315-303-4. Borrow soils will be generated by excavation of landfill cells, and soils generated will be stockpiled for use as daily and intermediate soil cover. Efforts will be made to stockpile soils in an area adjacent to the working face. Based upon the nature of available soil at the landfill; crushing and screening will not be required to produce suitable cover soils.

3.3.3.2 Final Cover

The NVL will initiate its final cover system installation within 30 days after disposal reaches final elevation in any particular landfill closure Stage (Appendix A, Drawing 14). Installation of the cover will be complete within 180 days after initiation. It is anticipated that final cover will be placed over the landfill areas in several separate events as sufficient area is brought to final elevation. The minimum area planned for placement of final cover is approximately 4-acres; the largest area is just under 14-acres. Closure Stages may be adjusted to better accommodate landfill operation and waste placement.

The engineered final cover system will prevent surface water infiltration (thereby minimizing leachate generation), control gas migration, maintain slope stability, control surface water and erosion, and be capable of supporting vegetative cover. The vegetative cover will be selected with shallow root systems to reduce cover soil penetration. The cover will be constructed as indicated on the permit drawings in Appendix A (Drawing 13). Beginning at the surface the planned cover consists of a minimum of 6-inches of topsoil (mulch/compost), 18-inches low permeability site soils, geocomposite (drain-net), HDPE and GCL over 18-inches of intermediate cover soils. Prior to construction of the final cover in each of the stages, an engineering design package consisting of Drawings, Specifications and a QA/QC plan will be submitted to the DSHW for approval.

Final cover side slopes will be constructed and maintained at a maximum of 4H:1V. The final cover surface will also contain roads which provide access for final cover maintenance and break up long drainage paths to minimize erosion. The roadway benches will slope up to 5%

to ensure adequate drainage (while minimizing erosion) and will incorporate a drainage channel on the inside of the bench at the toe of the slope.

3.3.4 Elevation of Final Cover

As illustrated on Drawing 12 (Appendix A), the natural ground surface at the site of the landfill slopes generally downward from west to east. Within the proposed landfill footprint the natural elevation of the surface drops from approximately 5,355 to 5,035 feet and the final cover has a maximum elevation of 5,455 and a minimum elevation of approximately 5,042 feet above mean sea level (msl).

3.3.5 Equipment Requirements and Availability

Section 1.5 and 1.6 of Part II – General Report, contains a listing of equipment and personnel located at the landfill and the availability of additional equipment as needed.

3.4 MONITORING SYSTEM DESIGN

3.4.1 Ground Water Monitoring System

At present the ground water monitoring system consists of seven wells installed in 2010 and 2011. As discussed previously, some of these wells will be abandoned as the landfill is developed, additional wells will be installed. The locations of existing wells are shown on Drawing 4 (Appendix A) and discussed in the Ground Water Monitoring Plan (Appendix F).

3.4.2 Surface Water

In general, surface water will be prevented from running into the active landfill area by ditches and berms created during perimeter road construction. Run-off from the final cover will also be managed by using access roads equipped with berms and ditches. The perimeter road will divert surface flows initiated off-site around active areas of the landfill to existing nearby drainages. Culverts will be installed to enable flows to bypass proposed road fill. Landfill staff will inspect the constructed drainage system quarterly. Temporary repairs will be made to any observed deficiencies until permanent repairs can be scheduled. Landfill personnel or a licensed contractor will repair drainage facilities as required.

3.4.3 Leachate Collection and Treatment

Among the possible problems created by waste storage in any landfill is the possible contamination of soil and surface or ground water from water contacting or passing through the waste. Due to low precipitation and high evapotranspiration rates associated with the semi-arid climate in the Cache Valley, the quantity of water infiltrating the landfill is predicted to be small and subsequent leachate generation low. The landfill cover is designed to minimize infiltration and promote runoff. Furthermore, liquid waste will not be allowed in the landfill.

What leachate is generated will be collected by the leachate collection and recovery system (LCRS). The LCRS will consist of a geocomposite drainage material to provide lateral drainage of leachate directly above the liner system. The geocomposite will be placed over the entire bottom of the lined landfill cells. The grades and materials of the LCS will be designed to maintain functions during landfilling operations. The geocomposite is designed to limit leachate depths on the liner to less than one foot, even when clogged by sediments and biofouling that has been observed at other facilities. Cell construction at NVL will incorporate leachate collection/transmission pipes to enhance the removal of leachate from the liner. Each leachate collection and header pipe will be oversized to allow for periodic maintenance cleaning.

The floor itself is to be constructed with a minimum slope of 7.43% (west to east) in order to direct leachate flows to a proposed pond designated for leachate management. This pond is located outside the landfill footprint and will be sized to collect leachate generated from the largest proposed landfill cell when subjected to the design storm (100-yr, 24-hour storm; 3.72 inches). As currently planned the largest area to be lined/open at one time will be Cell 7, approximately 950,000 ft2 (21.8 acres). The leachate pond will be sized to completely capture all run-off from the design storm falling on this area. The minimum required pond capacity in this scenario is 6.76 acre-ft. The area set aside for the leachate collection/evaporation pond is approximately 4.8 acres in size. This requires an average pond depth of 1.4 feet. The pond will be constructed and lined a minimum depth of 4.5 feet to allow for necessary freeboard and to provide adequate capacity in the event the design storm occurs when the pond is not completely empty. The 100-yr design storm is a conservative parameter since only the 24-hour, 25-yr storm is required by regulation.

Leachate sumps will be constructed in each landfill cell. These collection sumps will be located at the lowest elevation in each cell and connected via transmission piping (buried) to the lined leachate pond. Evaporation will typically be the means of liquid removal; however

in the event that water level in the pond nears capacity, leachate will be pumped out and removed from the site to an appropriate treatment/disposal facility or recirculated over the lined landfill as a dust control practice.

3.4.4 Landfill Gas

The decomposition of solid waste produces methane, a potentially flammable gas. The accumulation of methane in site structures can result in fire and explosions that can injure employees and property, users of the landfill, and occupants of nearby structures. During Phase I of the landfill life the only structure planned for the site may be a small scale house. In accordance with Subtitle D and Utah rules, NVL will conduct subsurface and facility structure gas monitoring at least quarterly for methane detection. The concentration of methane gas generated by the landfill must not exceed 25% of the lower explosive limit (LEL) in the facility structures (excluding gas control or recovery system components). The concentration of methane gas generated by the landfill must not exceed the LEL at the facility boundary. As outlined in EPA Subtitle D, Subpart C and the State of Utah Regulations, NVL will take all necessary steps to protect human health and will immediately notify UDEQ of methane levels detected above required limits and actions taken, if any. Within 10 days of an incident, NVL will place documentation of the methane gas levels detected and a description of the interim steps taken to protect human health in the operating record. Within 60 days of detection, NVL personnel will implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify UDEQ that the plan has been implemented. The remediation plan will describe the nature and extent of the problem and describe the proposed remedy.

The cover soils for the NVL site will be predominantly fine-grained silts and clays that are native to the site. Methane which may be produced may not be able to easily exit through the cover. The gas transmission layer will be utilized to direct the MSW generated gases to collector pipe for delivery to end users or a methane flare.

3.5 DESIGN AND LOCATION OF RUN-ON/RUN-OFF CONTROL SYSTEM(S)

Exact precipitation records for the site are not available, but a weather station will be installed in conjunction with landfill construction. The two nearest weather stations to the site are in Trenton and at the Cutler Reservoir; these two stations show the average annual rainfall to be 18.28 and 17.75 inches, respectively. Both these stations are located at a lower elevation and several miles south-southeast of the landfill site (Trenton 7.5 miles, Cutler Reservoir, 14.5

miles). A statewide map available from the United States Department of Agriculture (USDA) indicated that the site should expect to receive 18-20 inches of precipitation annually.

3.5.1 Run-On from a 25-Year, 24-Hour Storm

The landfill site is located on the east facing slope of the "Washboards" and there is potential for surface flows to run-on to the site from areas to the northwest and southwest of the site. There are also two natural ephemeral channels that convey the concentrated flows from slopes west of the landfill into a single drainage channel to the east. In order to develop vehicle access around the perimeter of the proposed cells there will be cuts and fills of varying heights constructed as part of the access road construction. Surface flows from areas north, west and south and west of the landfill will be diverted around the landfill until they can be reintroduced to the natural ephemeral channel(s) near the eastern limits of proposed landfill construction.

Fill areas will create a barrier to eastward flows and a continuous channel will be constructed on the outside edge of the perimeter access road that is capable of transmitting flows from a 25-year, 24-hour storm (2.95 inches - NOAA Atlas 14). The placement of fill within existing drainage swales will create periodic detention ponds which will serve to reduce the peak flows. The high point of the perimeter road will be located near the center of the final landfill footprint along the western side, from this high point flows will be diverted north or south along the perimeter road until the topography carries them eastward where they can be directed back into the natural drainage channel. Preliminary calculations of the peak flow rates from the predicted run-on areas used for initial design of the storm water collection ditches are provided in Appendix G.

Run-on from the northwest will be diverted by means of the road embankment constructed during Phase I of landfill operations. The constructed road embankment will detour flows temporarily until they can re-enter the natural drainage channel. Run-on from the southwest will also be intercepted by Phase I road construction, but will flow through a culvert (SW-1) into the natural drainage channel. Run-on from the southwest will be diverted through SW-1 until Phase III of landfill operations when perimeter road construction is complete. At that time SW-1 will only pass flows from any undeveloped areas within the landfill perimeter and run-on from the southwest will pass through a future culvert (SW-2) installed just west of the scale. As the remainder of Phase III is developed for waste acceptance, SW-1 will be

abandoned. Until the perimeter road is completed diversion berms will be constructed to divert run-on from working areas within the landfill.

3.5.2 Run-Off from a 25-Year, 24-Hour Storm

The design for the landfill will incorporate a run-off control system that will divert the surface flows resulting from a 25-year, 24-hour storm (2.95 inches – NOAA Atlas 14) that falls on the landfill cover. The proposed final cover surface will be divided into 2 sub-areas by grading of the cover. Collection ditches located along the proposed perimeter road (see Drawings, 6, 9 and 11, Appendix A) will collect cap run-off and transport it to two culverts (RO-N and RO-S) located near the eastern limits of the landfill. These culverts will carry flows into the run-off detention pond where sediment will be allowed to settle out during evaporation. Preliminary calculations of the flow rates from the predicted runoff to be used for design of the storm water collection ditches are provided in Appendix G. Preliminary storm water collection ditch design calculations are also included in Appendix G. All ditches will be constructed with 2H:1V side slopes, maximum depth of flow was calculated to be 2.5 feet in the south run-off channel.

Surface water that flows off the intermediate cover will be intercepted by control berms and will be treated as non-contact run-off. The intermediate cover will be graded to provide the maximum slopes consistent with slope stability to minimize the amount of precipitation that would infiltrate into the waste materials.

Berms and ditches will be incorporated into the active landfill areas to direct the precipitation away from the working faces.

NVL personnel will be responsible for the maintenance of the slopes and drainage systems to ensure the efficient operation of the run-off system.

As shown on several of the permit drawings (Appendix A) two separate ponds will be constructed at the site: one for collection/evaporation of leachate and the other for detention and control of storm run-off. In order to account for the presence of some water in the ponds at the time of the design storm event the ponds will be sized to contain leachate or run-off from the 100-year 24 hour storm (3.72-inches - NOAA Atlas 14).

The NVL is designed and will be constructed so as not to cause point or non-point source discharges to surface waters, including wetlands, in violation of the CWA or in violation of State of Utah water quality management plans approved under Section 208 or 319 of the CWA. Prior to initiation of work at the site a Utah Pollutant Discharge Elimination System (UPDES) permit will be obtained. Logan City, having previously applied for a UPDES permit at the existing Logan City Sanitary Landfill is familiar with the requirements and procedures for obtaining the necessary permit. A portion of the existing permit documentation and samples of applicable reporting forms are contained in Appendix H.

SECTION 4 – CLOSURE PLAN

4.1 GENERAL

Closure of the NVL will occur in Stages that proceed from the northern-most corner of the landfill and progress initially clockwise to the southeast to close the areas associated with Phase I (Cells 1-3). After completion of the first closure Stages; closure activity will proceed in a counterclockwise direction over the cells associated with Phase II (Cells 4-6) with the final closure being the area associated with Phase III (Cells 7-9) which will terminate along the southern and eastern limits of the landfill footprint. Drawing 14 (Appendix A) show the closure Stages for the landfill.

The landfill is intended to be closed sequentially beginning with Stage A and proceeding in alphabetical order to Stage O. The following Sections discuss the closure of the landfill under intermediate conditions (any point in time before total design capacity) and for the designed closure at full capacity.

4.2 IMMEDIATE CLOSURE

Although unlikely, it may become necessary or advantageous to close the NVL short of the final design capacity. Reasons for premature closure range from residential pressures, political pressures, alternate waste disposal options, to regulatory pressures.

Immediate closure would be closure of the landfill at any point short of ultimate design capacity. During that period of time, waste would need to be deposited and sloped in a manner to create a positively sloped final cover. Design, regulatory approval, and construction of a final cover system would need to be completed over the entire MSW landfill footprint.

4.3 STAGED CLOSURE

The most probable scenario for the NVL is one of Staged Closure. Staged Closure would consist of closing the landfill under the following plan, in accordance with Rules R315-302-2 and 3. Drawing 14 (Appendix A) shows the planned contours of the final cover.

4.3.1 Closure Sequencing

The closure of the NVL will be completed in at least 15 Stages. The life of each Stage will vary, and closures may be performed as individual cells (or combined portions of cells) reach final grade in order to manage the associated costs. The lateral extent of final cover completed and predicted duration of each of the Phases is as follows:

4.3.1.1 Landfill Area Associated with Phase I Cells: Stages A-C

Cells 1-3 comprise the eastern half of the northern portions of the proposed landfill and will provide approximately 4,093,330 cubic yards of airspace. Based on the waste projections outlined previously it will reach capacity in approximately 23 years after waste is first accepted at the landfill. At the end of waste acceptance in Phase I, approximately 860,000 sq-ft (20.05-acres) will be at final cover elevation and ready for closure. In order to more quickly initiate the placement of final cover Phase I will be closed in at least three stages:

Stage A: 6.29-acres
Stage B: 6.74-acres
Stage C: 7.02-acres

4.3.1.2 Landfill Area Associated with Phase II Cells: Stages D-G

Cells 4-6 are located immediately west of Cells 1-3. Phase II of the proposed landfill will provide approximately 8,828,750 cubic yards of airspace. Based on the waste projections outlined previously it will reach capacity in approximately 37 years after the completion of Phase I. At the end of waste acceptance in Phase II, approximately 1,093,200 sq-ft (25.1 - acres) of additional area will be at final cover elevation and ready for closure. In order to more quickly initiate the placement of final cover Phase II will be closed in at least four Stages:

Stage D: 7.00-acres
Stage E: 7.02-acres
Stage F: 6.68-acres
Stage G: 4.40-acres

4.3.1.3 Landfill Area Associated with Phase III Cells: Stages H-O

Cells 7-9 are located along the southern and eastern limits of the landfill. They constitute Phase III of the proposed landfill and will provide approximately 13,769,020 cubic yards of airspace. Based on the waste projections outlined previously it will reach capacity in approximately 39 years after the completion of Phase II. At the end of waste acceptance in Phase III, the remaining 3,858,000 sq-ft (88.47-acres) of cover surface area will be at final elevation and ready for closure. In order to more quickly initiate the placement of final cover Phase III will be closed in at least eight stages:

Stage H: 6.83-acres
Stage I: 10.50-acres
Stage J: 13.94-acres
Stage K: 12.66-acres
Stage L: 13.92-acres
Stage M: 9.62-acres
Stage N: 10.36-acres
Stage O: 10.64-acres

Financial assurance for the site will be based on the costs for the largest planned closure stage (Stage J).

4.3.1.4 Total Capacity of the Site.

The approximate quantity of air space available at the NVL is 26,691,000 cubic yards (CY) including daily and intermediate cover. Removing daily, intermediate and final cover soils volume leaves approximately 21,352,800 cubic yards for waste. A projection of landfill life is provided in Appendix N. This analysis assumes a steady 2% population growth and indicates that the landfill will reach its design capacity in approximately 81 years from the time waste is first accepted.

4.3.2 Closure Procedures

Closure activities for each Phase of the landfill will take place in accordance with the following procedures:

4.3.2.1 Submittal of Plans, Specifications, and QA/QC Plan

Four months before the intended closure of each of the aforementioned Stages, a design package consisting of drawings, construction specifications, and a QA/QC plan will be submitted to the DSHW. The DSHW will have approximately 60 days to review and comment on the adequacy of the drawings, specifications and quality assurance/quality control measure envisioned for the construction. Comments from DSHW will be incorporated into a final "bid" package for the cover installation.

4.3.2.2 Formal Notification

The Executive Secretary of the DSHW will be notified of the intent to implement the closure plan in whole or part, 60 days prior to the date projected for final receipt of waste.

4.3.2.3 Additional Closure Activities

Additional closure activities that may be required to close either the entire landfill or only one stage are as follows:

- Regrading of all side slopes where slopes are steeper than 4 horizontal to 1 vertical.
- Regrading of all the top of the landfill to slopes between 4 horizontal to 1 vertical, but not flatter than 5 percent.
- Finalization (including DSHW comments) of the final cover design package. Final cover design package will include, at a minimum, plans, construction specifications, and QA/QC protocols to guide the construction of the final cover.
- Bidding and construction of final cover.
- Construction of a maintenance road over the cover.
- Construction of run-off control structures.
- Vegetation of the final cover soils.
- Preparation of As-Built drawings.
- Inspection of final cover construction by Owner (City of Logan), Engineer (engineer of record) and DSHW personnel.
- Preparation of Certificate of Closure by a Utah registered Professional Engineer.

- Submittal of required documents to the State DSHW and to the Cache County Recorder's office.

4.4 CLOSURE COSTS

4.4.1 Planned Closure Stages

The closure of the landfill may occur before the final design capacity is reached. If this plan is followed the largest area that is planned for final closure at one time is Stage J (13.94-acres), other areas will have been closed prior to that time and later closures are planned to be smaller in size. The costs associated with the closure of Stage J or any of the other areas at once will entail the final grading of that area, engineering of final cover, preparation of plans, specifications, and QA/QC plan as well as the final cover installation. The cost of closure for Stage J is estimated to be $1.4 million (present value). Details of this estimate are provided in Appendix O.

4.4.2 Immediate Closure

If the landfilling operations continue as proposed by this permit application, the landfill will be closed in 16 Stages described in Section 4.3.1, following this plan will spread out the total costs of closure over the life of the landfill and reduce the amount of landfill requiring final closure at any one time. It is possible that unforeseen circumstances dictate closure of larger areas. In an attempt to prepare for the costs associated with immediate closure of a partially completed phase we have attempted to identify a "worst-case" scenario for each of the three planned development phases. In these scenarios waste is complete for the initial cell of each landfill phase, subsequent cells have been lined and partial waste placement has occurred in the remaining two cells. In addition to the activities and costs associated with the planned cover stages, immediate closure activities will involve additional flattening of 3:1 intermediate slopes to 4:1 (or flatter) as required for perimeter slopes and placement of final cover over all areas that have only been treated with daily or intermediate cover. The approximate size and cost (present value) of immediate closure for each Phase is estimated as follows:

Phase I –	31.5-acres	$ 2.89M
Phase II –	36.9-acres	$ 3.37M

Phase III – 55.5-acres $ 4.25M

As described previously these Phases will be divided up into closure stages of various sizes in order to quickly cover areas that have reached final grade and spread out the closure costs over a period of time.

Details of the closure cost estimates are provided in Appendix O.

4.4.3 Final Inspection

The DSHW will be invited to inspect the final grading of the landfill. After approval of the final grading, a schedule will be established for vegetation. Agency personnel will then be invited to return to inspect the success of the erosion control system after one year.

SECTION 5 – POST-CLOSURE PLAN

5.1 GENERAL

Post-closure financial assurance will provide for continued monitoring of ground water, surface water, leachate, gas, and maintenance of the cover as described in the post-closure plan below. The total cost of post-closure care is estimated at $1.15M. A detailed analysis of post-closure costs is provided in Appendix O.

5.2 POST-CLOSURE PLAN

In accordance with rules R315-302-2 and R315-303 post-closure activities at the landfill will continue for 30 years, or as long as the Executive Secretary of the Utah Solid and Hazardous Waste Control Board deems necessary for the NVL to be stabilized and to protect human health and the environment. The post-closure activities will include the following work:

5.2.1 Changes to Record of Title

A Plat Map and Statement of Fact concerning the location of the landfill shall be recorded with the Cache County Recorder not later than 60 days after certification of closure. The recorded document will restrict future land use. Compatible land uses will be identified in the Cache County comprehensive planning documents.

5.2.2 Monitoring Plan

Post-closure activities will commence immediately upon closure of the total facility.

The monitoring frequencies for the different media are shown in the following table. Post-closure monitoring will be conducted as follows:

Post-Closure Monitoring Schedule

Type	Frequency	Apparatus
Ground Water	Semi-Annual	Refer to Ground Water Monitoring Plan
Surface Water	Semi-Annual	Refer to Operations Plan
Leachate	Quarterly	Sump at southwest corner of Landfill
Gas and Ambient Air	Quarterly	Refer to Operations Plan
Settlement	Annual	Bench mark survey

5.2.2.1 Ground Water

Wells have been installed at the site in order to collect samples and background water quality information from locations up and down-gradient of the landfill. Additional wells will be installed in the future.

5.2.2.2 Surface Water

Surface water will be monitored in accordance with procedures provided in the UPDES Permit. This permit has not yet been applied for, but will be obtained prior to the initiation of any work at the NVL. Logan City personnel have previously obtained a UPDES permit for the Logan City Sanitary Landfill, a sample of this permit is contained in Appendix H.

5.2.2.3 Leachate

The presence of leachate will be monitored in the leachate collection pond located east of the proposed Phase I development (Appendix A, Drawing 2). Accumulations of leachate in excess of 3 feet will be removed and transported the Logan City Sewage Lagoons for treatment.

5.2.2.4 Gas Monitoring

All structures (if any) associated with periodic site monitoring or landfill gas collection system will be monitored quarterly.

5.2.2.5 Settlement

At final closure, the boundary markers used to designate closed areas of the landfill will be used to measure settlement of refuse materials. Additional survey markers will be placed as necessary to monitor areas of suspected movement. Ground elevation will be measured at the base of each boundary marker.

5.2.3 Inspection and Maintenance

Monitoring facilities, fences, roads, buildings, cover, and run-on and run-off systems will be inspected in accordance with the schedule presented in the post-closure cost estimate (Appendix O).

Facilities will be inspected for damage, deterioration, and impaired function with regard to the listed standards and original design. Deficiencies will be corrected promptly. Deficiencies, repairs, and restoration of function will be documented in the landfill record.

SECTION 6 – POST-CLOSURE LAND USE

Logan City will design a post-closure land use plan to be implemented at the landfill within 5 years prior to the end of the landfill's life. Logan City will select an end use for the landfill consistent with good landfilling practices. The final land use selected for the landfill will be based upon maintaining a functional landfill cover. Land use activities will be approved by Logan City prior to implementation. Typical end uses may range from green waste processing and composting to recreational activities or open space. Since the closure of the site may be over 80 years away and with the potential development options that could occur in this area, it is not currently possible to establish a land use plan that will be consistent with surrounding land uses and the needs of area residents or Cache County.

SECTION 7 – FINANCIAL ASSURANCE

7.1 CLOSURE COSTS

Cost estimates have been developed for the closure Stages at the NVL. Appendix O – Closure/Post-Closure Costs contains the closure cost data for the NVL. Closure costs will be updated each year and submitted with the Annual Report.

7.2 POST-CLOSURE COSTS

Cost estimates have been developed for the post-closure care period at the NVL. Appendix O – Closure/Post-Closure Costs contains the post-closure cost data for the NVL. Post-Closure costs will be updated each year and submitted with the Annual Report.

7.3 FINANCIAL ASSURANCE

R315-309 details the requirements for financial assurance associated with the operation of solid waste facilities.R315-309-3 states "(1) Any financial assurance mechanism in place for a solid waste facility: (a) must be legally valid, binding and enforceable under the law; (b) must ensure that funds will be available in a timely fashion when needed; and (c) any financial assurance mechanism that guarantees payment rather than performance, but does not allow the Executive Secretary to approve partial payments to a third party, shall establish a standby trust at the time the financial assurance mechanism is established".

Several mechanisms may be utilized to establish a fund sufficient for use in the operation of a landfill including, a trust fund, surety bond, insurance, letter of credit or the local government financial test.

Logan City will use a government trust and investment fund to fulfill the requirements of financial assurance for the operation of the NVL.

SECTION 8 – REFERENCES

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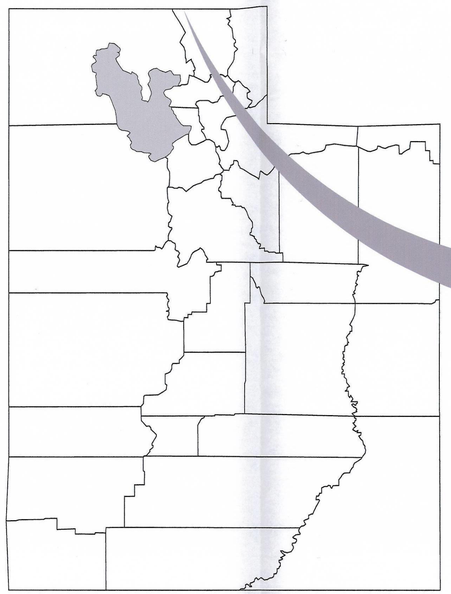
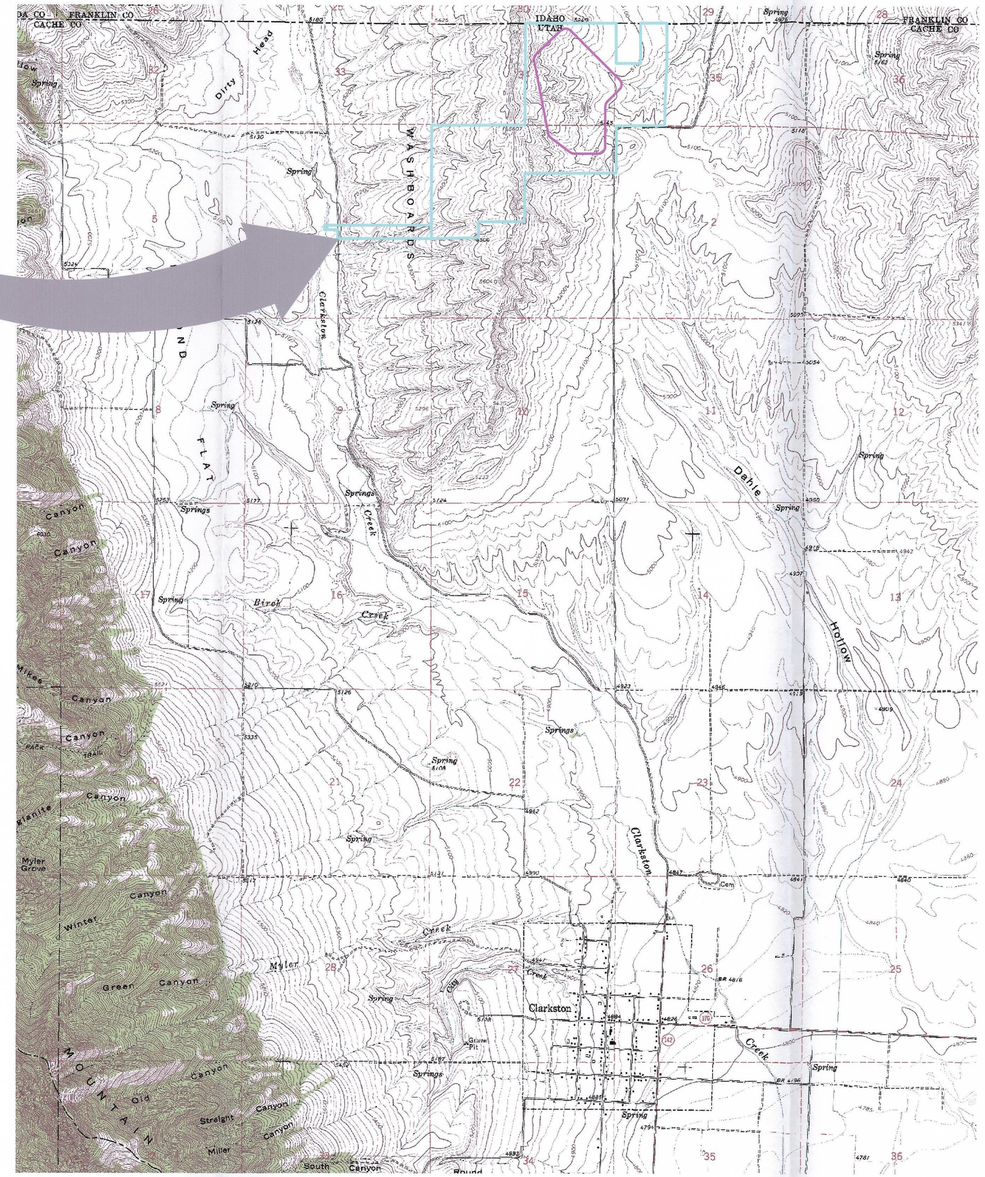
Appendix A

NORTH VALLEY LANDFILL
2012 PERMIT APPLICATION



SITE LOCATION MAP

(NOT TO SCALE)



SITE VICINITY MAP

(1" =2000 ')

REFERENCE:
USGS 7.5 MIN QUADRANGLE SERIES: CLARKSTON, UT

LIST OF DRAWINGS

1 TITLE SHEET
2 GENERAL ARRANGEMENT
3 DEVELOPMENT SEQUANCE
4 GROUND WATER SURFACE
5 GROUND WATER ELEV. VIEW
6 PHASE I DEVELOPMENT
7 PHASE I, CELL 1 AIRSPACE
8 PHASE I, CELLS 2-3 AIRSPACE
9 PHASE II DEVELOPMENT
10 PHASE II, CELLS 4-6 AIRSPACE
11 PHASE III DEVELOPMENT
12 PHASE III, CELLS 7-9 AIRSPACE
13 ELEVATION VIEW
14 LANDFILL CLOSURE STAGES
15 RUN-ON AREAS
16 RUN-OFF AREAS

LOGAN CITY PROPERTY BOUNDARY

LANDFILL FOOTPRINT

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MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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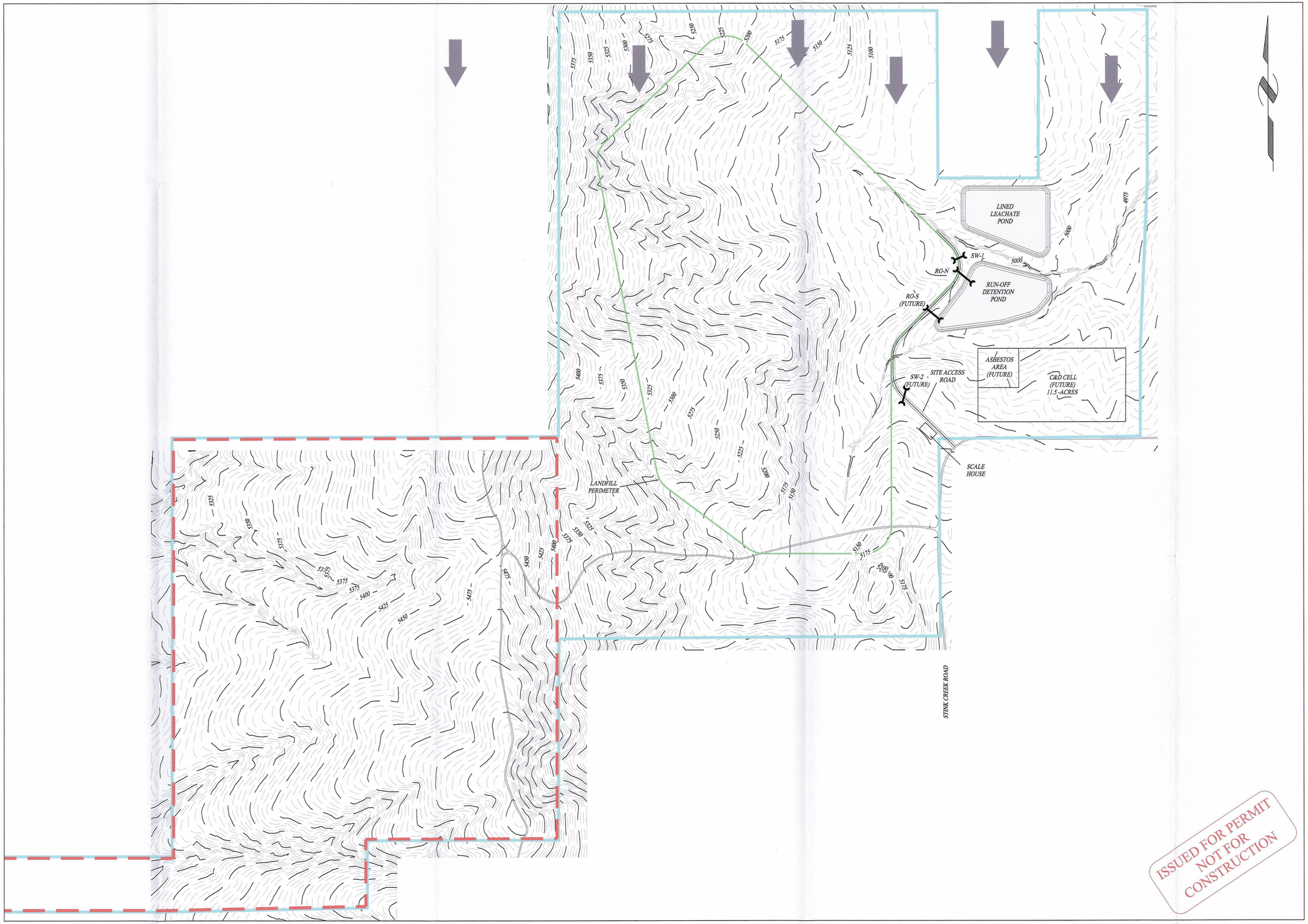
SHEET TITLE

NORTH VALLEY LANDFILL

TITLE SHEET

1



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LOGAN CITY PROPERTY BOUNDARY (532 ACRES)
UNDEVELOPED PROPERTY (203 ACRES)
LANDFILL PERIMETER (133 ACRES)
EXISTING GROUND (25' CONTOUR)
EXISTING GROUND (5' CONTOUR)
CULVERT
PREVAILING WIND

DEVELOPED PROPERTY (62%)
329 ACRES (LANDFILL - 133 ACRES)

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NORTH VALLEY LANDFILL

GENERAL ARRANGEMENT

2

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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
PHASE BOUNDARY
CELL BOUNDARY
EXISTING GROUND (25' CONTOUR)
EXISTING GROUND (5' CONTOUR)
CULVERT

MARK	DATE	DESCRIPTION
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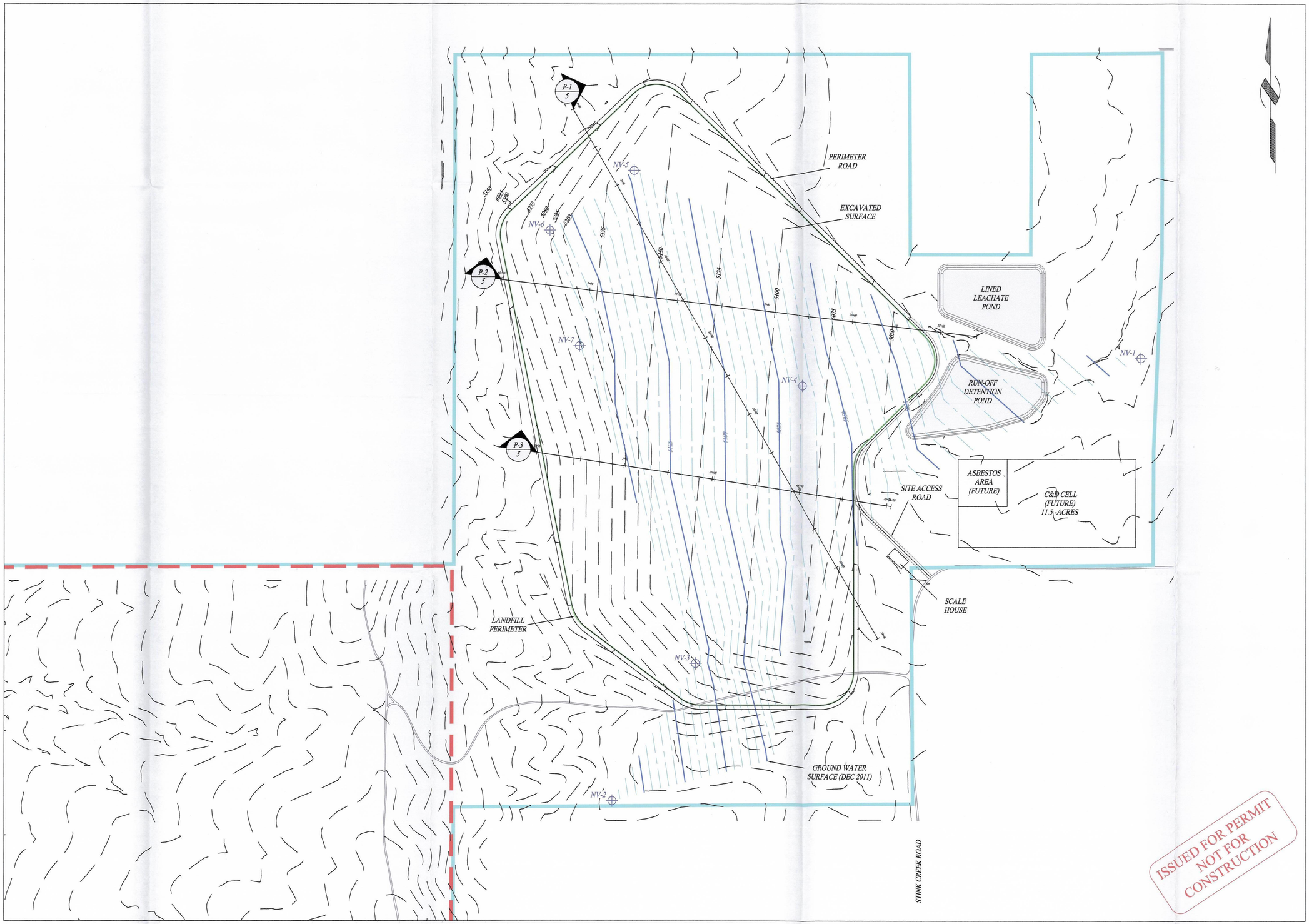
NORTH VALLEY LANDFILL

DEVELOPMENT SEQUENCE

3



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
NV-1 MONITORING WELL
PROPOSED LANDFILL FLOOR (25' CONTOUR)
LANDFILL PERIMETER
GROUNDWATER (25' CONTOUR)
GROUNDWATER (5' CONTOUR)

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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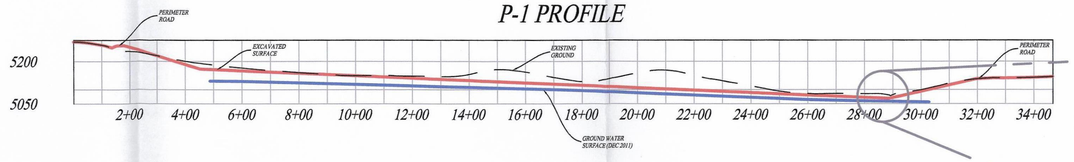
NORTH VALLEY LANDFILL

GROUND WATER SURFACE

4

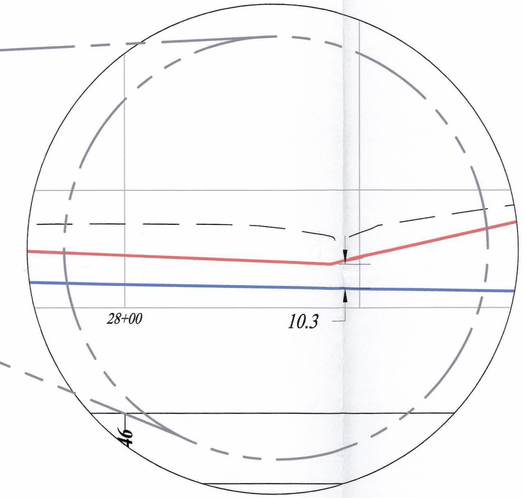
P-1 PROFILE



Depth to Groundwater (ft)

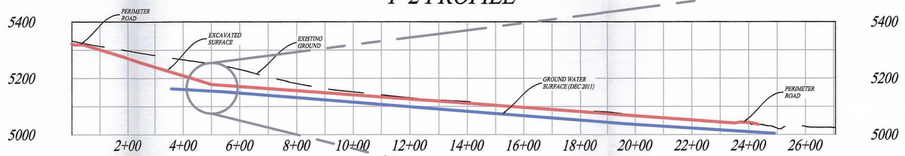
37.09	33.83	30.58	27.32	24.07	20.81	18.59	17.95	17.37	16.78	16.19	12.46	37.68

P-1 / 4 PROFILE VIEW SCALE: 1" = 250'



SCALE: 1" = 30'

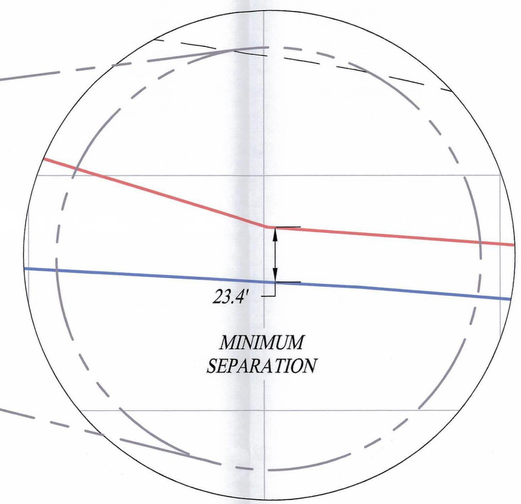
P-2 PROFILE



Depth to Groundwater (ft)

88.45	37.14	33.28	34.79	36.29	37.69	38.51	39.33	39.99	38.00

P-2 / 4 PROFILE VIEW SCALE: 1" = 250'



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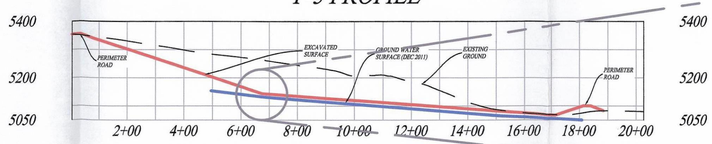
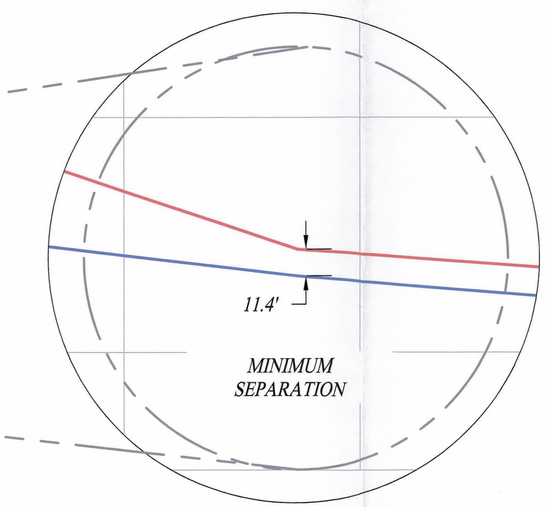


Depth to Groundwater (ft)

61.26	16.37	17.64	18.90	20.16	18.84	40.74

P-2 / 4 PROFILE VIEW SCALE: 1" = 250'



SCALE: 1" = 30'

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0 75 150 300 450
SCALE IN FEET

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EXISTING GROUND

EXCAVATED SURFACE

GROUND WATER SURFACE*

* APPROXIMATE - BASED ON WELL MEASUREMENTS, DEC 2011

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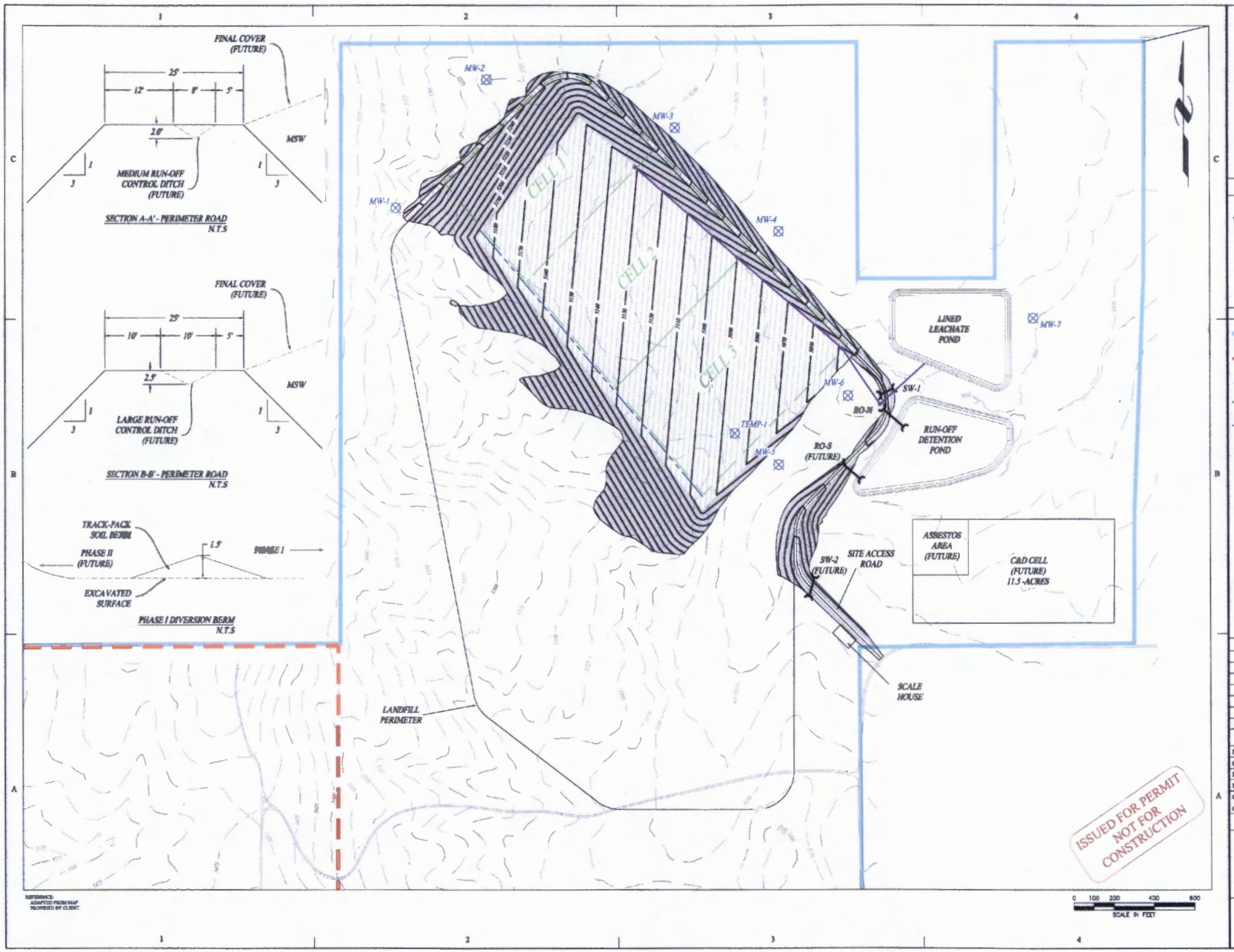
NORTH VALLEY LANDFILL

GROUNDWATER ELEV. VIEW

5



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
MW-# PROPOSED PHASE I MONITORING WELLS (TEMP-1 - EXISTING WELL)
STORM WATER CULVERT
LEACHATE INLET & TRANSMISSION PIPE

PHASE I EARTHWORK
CUT: 1,061,800 CYD
FILL: 372,400 CYD
SURPLUS: 689,400 CYD

MARK	DATE	DESCRIPTION
	5/9/12	PERMIT SET - REV 1
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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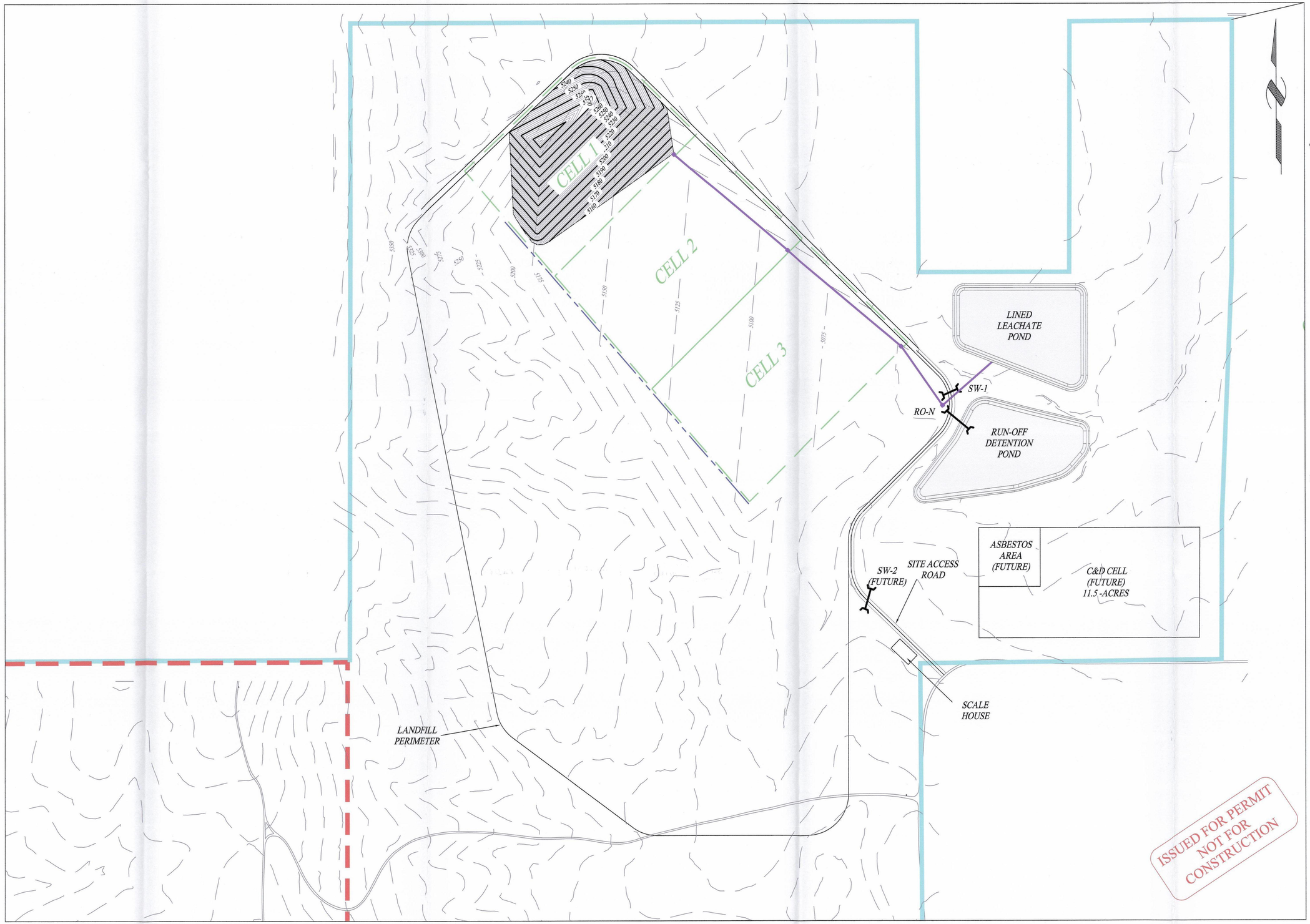
NORTH VALLEY LANDFILL
PHASE I DEVELOPMENT



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
STORM WATER CULVERT
LEACHATE INLET & TRANSMISSION PIPE

PHASE I AIRSPACE
CELL 1: 610,000 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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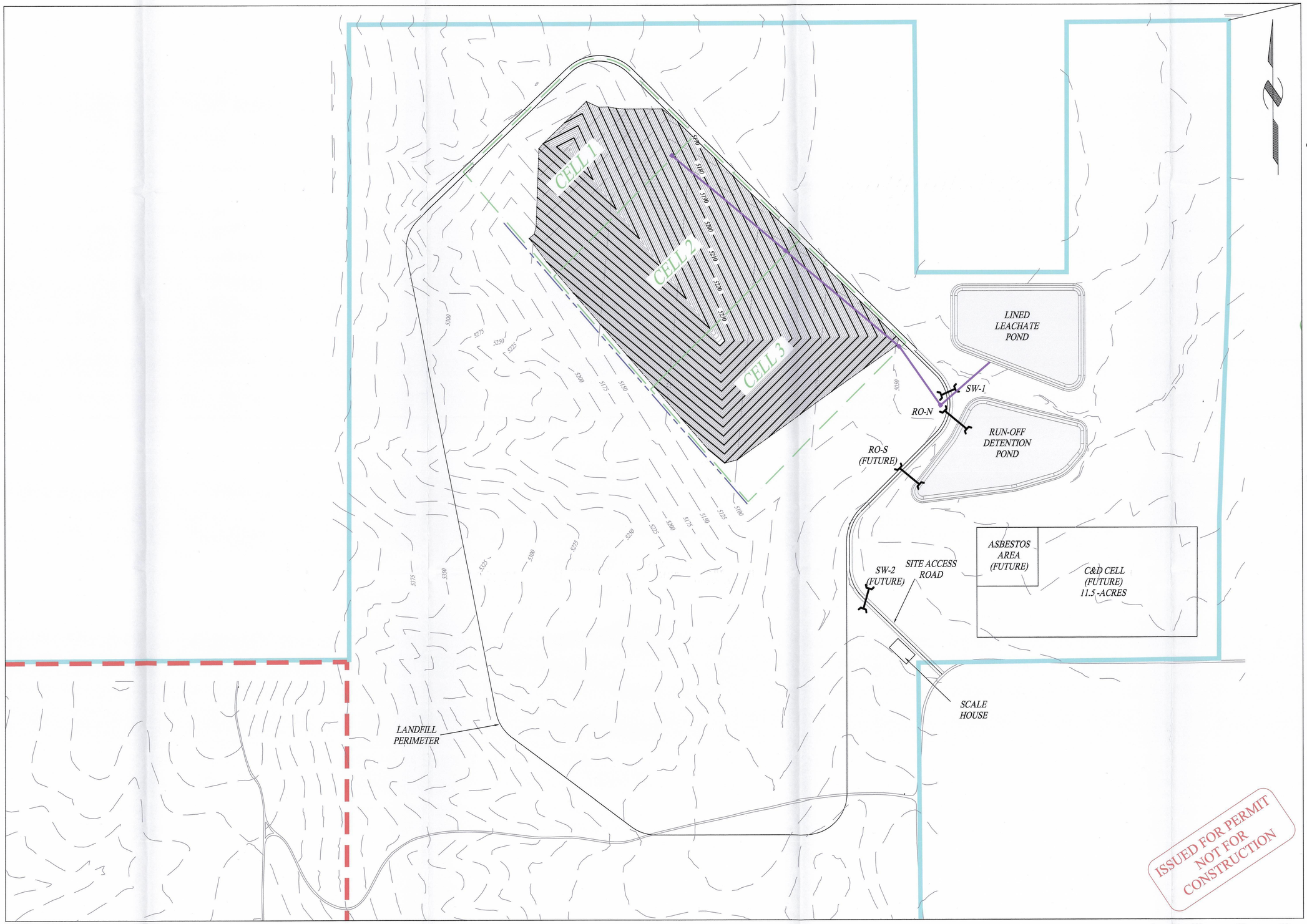
NORTH VALLEY LANDFILL

PHASE I, CELL 1 AIRSPACE



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
STORM WATER CULVERT
LEACHATE INLET & TRANSMISSION PIPE

CELL 2 & 3 AIRSPACE:
3,483,300 CYD

PHASE I TOTAL
4,093,330 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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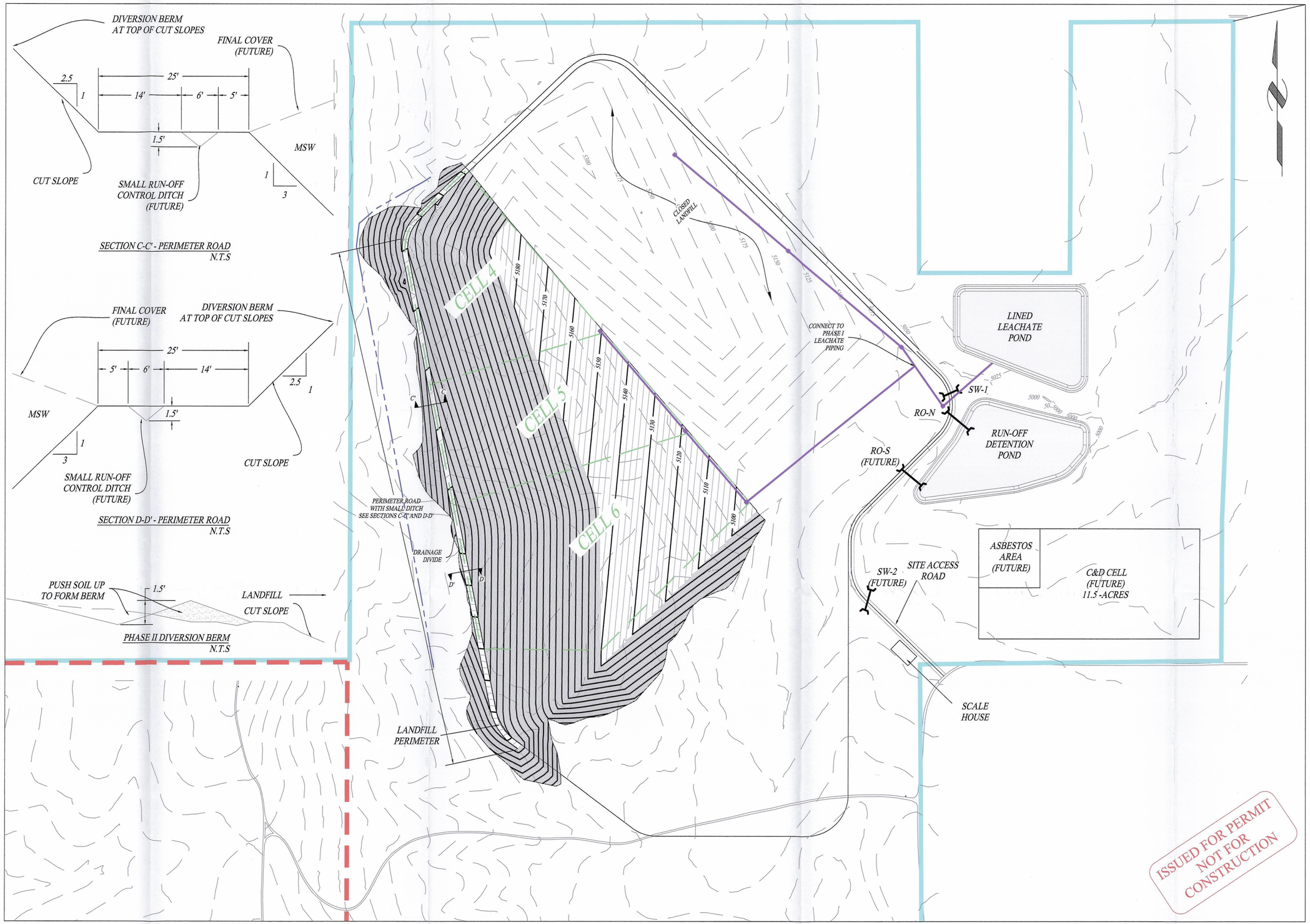
SHEET TITLE

NORTH VALLEY LANDFILL
PHASE 1, CELLS 2-3 AIRSPACE



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
STORM WATER CULVERT
LEACHATE INLET & TRANSMISSION PIPE

PHASE II EARTHWORK
CUT: 3,018,700 CYD
FILL: 425,050 CYD
SURPLUS: 2,593,650 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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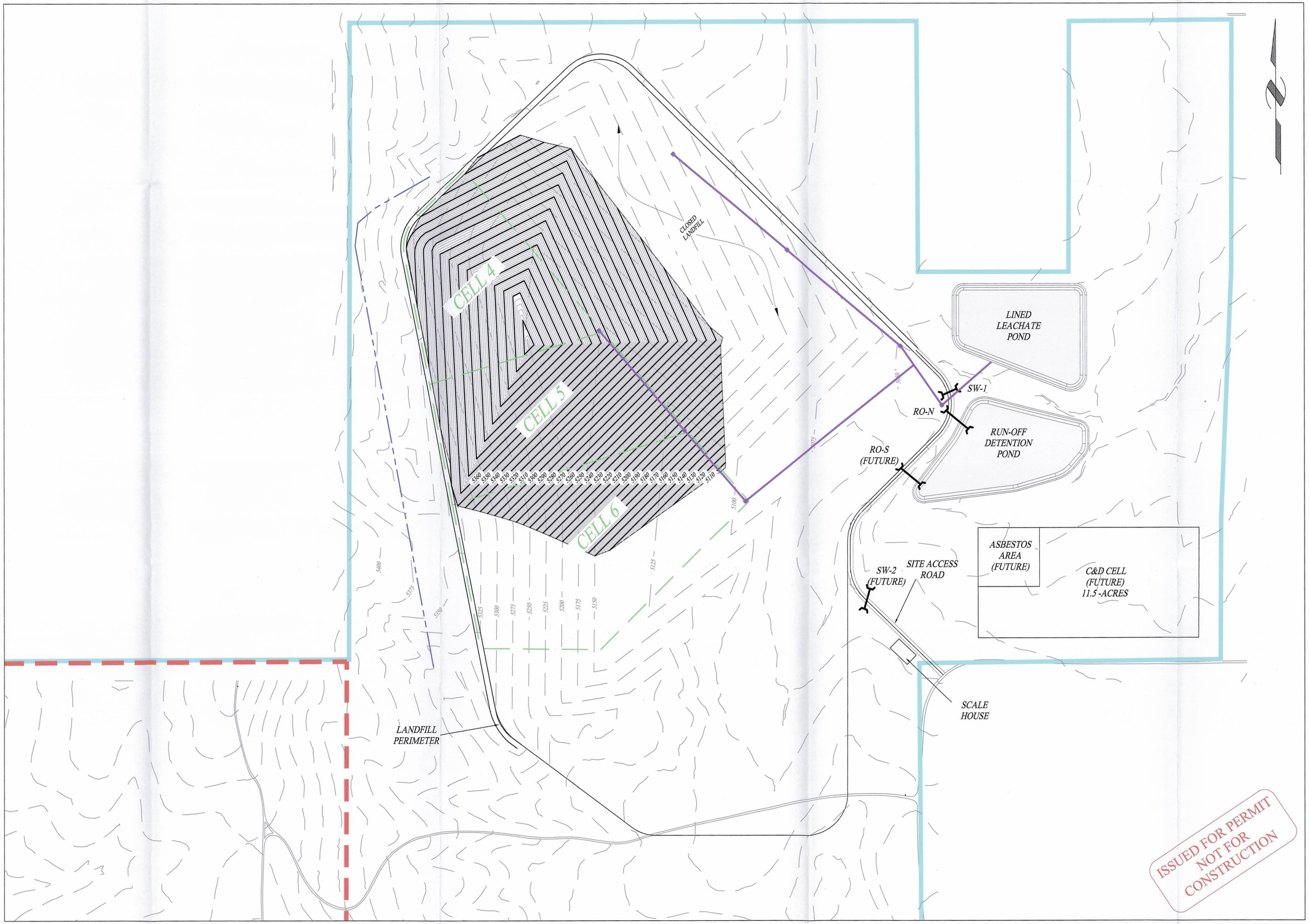
NORTH VALLEY LANDFILL
PHASE II DEVELOPMENT



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- PROPERTY BOUNDARY
- UNDEVELOPED PROPERTY
- LANDFILL BOUNDARY
- CELL BOUNDARY
- RUN-ON DIVERSION BERM
- EXISTING GROUND (25' CONTOUR)
- STORM WATER CULVERT
- LEACHATE INLET & TRANSMISSION PIPE

PHASE II (CELLS 4-6)
AIRSPACE: 8,828,750 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
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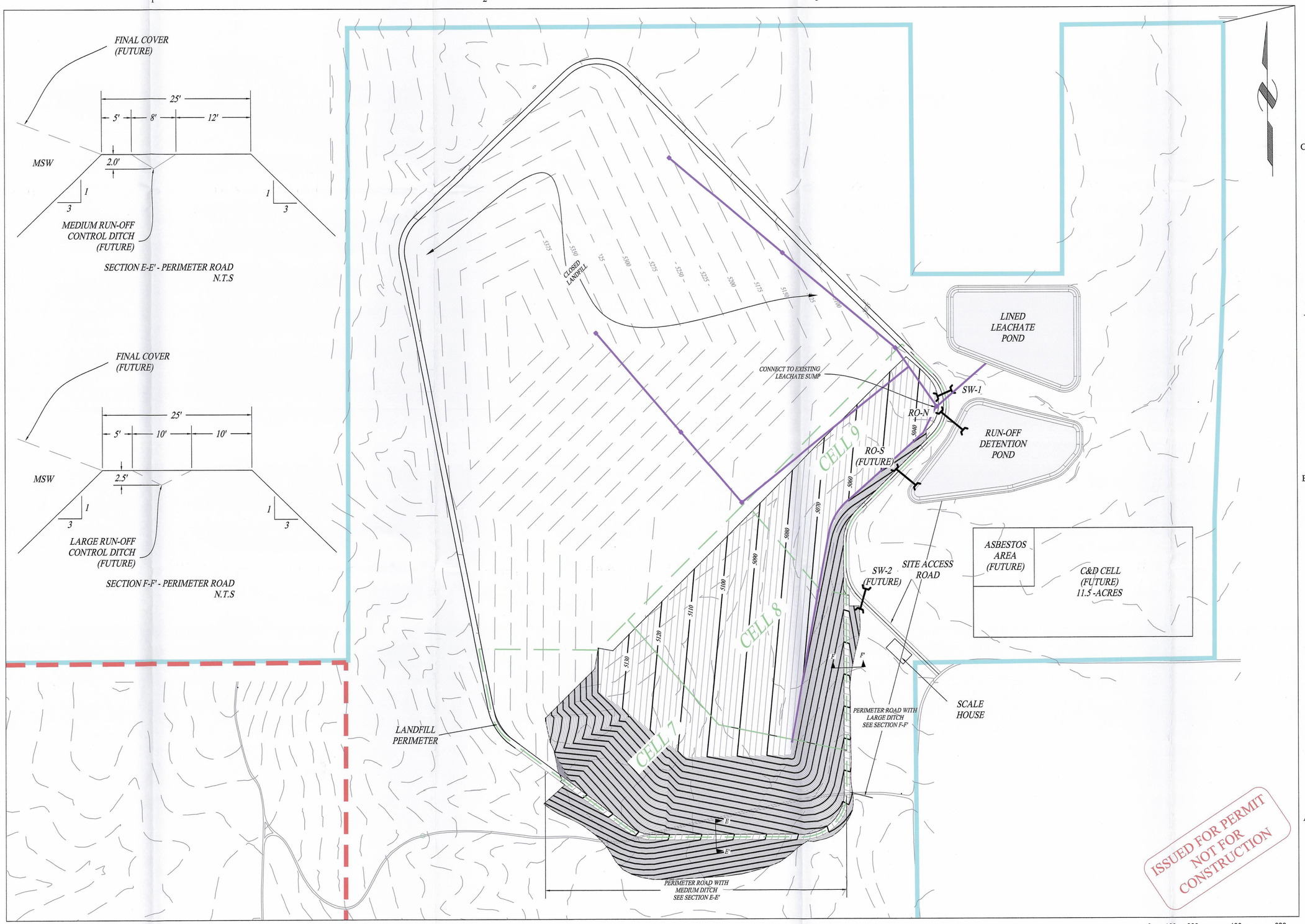
NORTH VALLEY LANDFILL

PHASE II, CELLS 4-6 AIRSPACE



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- PROPERTY BOUNDARY
- UNDEVELOPED PROPERTY
- LANDFILL BOUNDARY
- CELL BOUNDARY
- RUN-ON DIVERSION BERM
- EXISTING GROUND (25' CONTOUR)
- STORM WATER CULVERT
- LEACHATE INLET & TRANSMISSION PIPE

PHASE III EARTHWORK
CUT: 1,341,700 CYD
FILL: 686,000 CYD
SURPLUS: 655,700 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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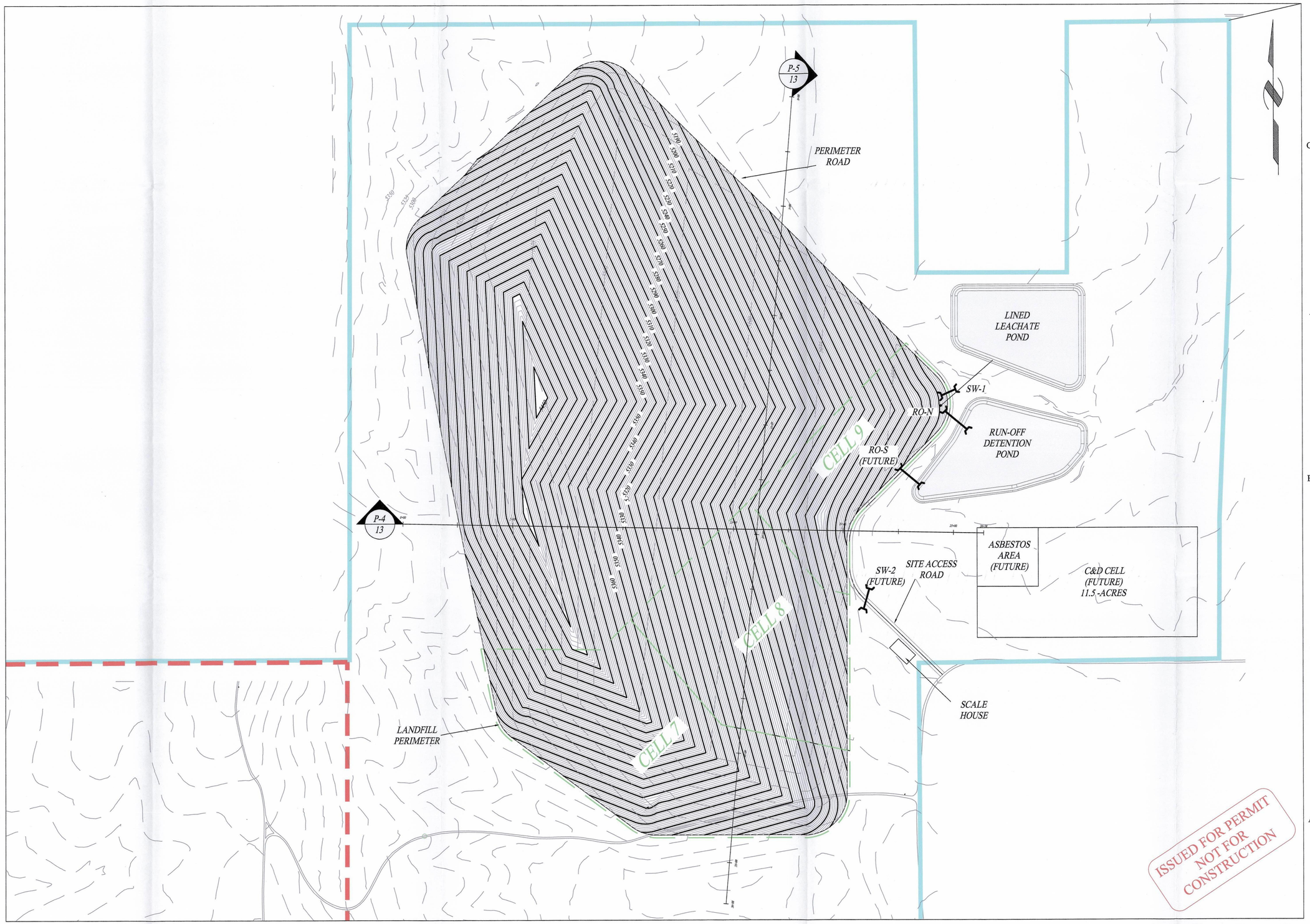
PHASE III DEVELOPMENT



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
STORM WATER CULVERT

PHASE III: CELLS 7-9
AIRSPACE: 13,769,020 CYD

PHASE I-III
TOTAL AIRSPACE: 26,691,100 CYD

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

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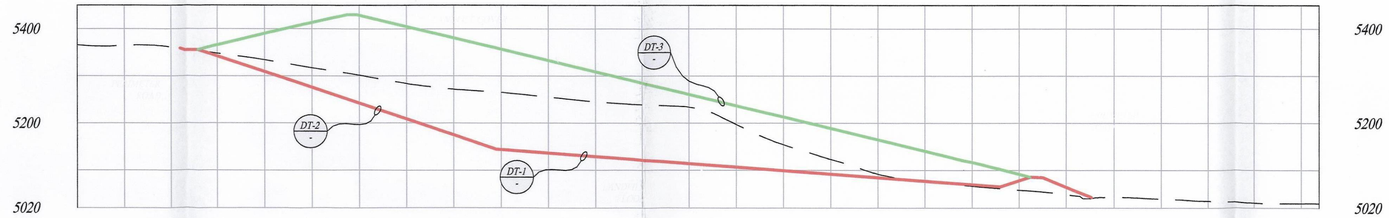
NORTH VALLEY LANDFILL

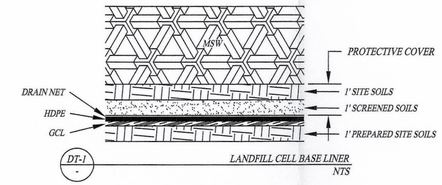
PHASE III, CELLS 7-9 AIRSPACE

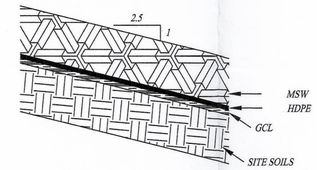
P-4 PROFILE

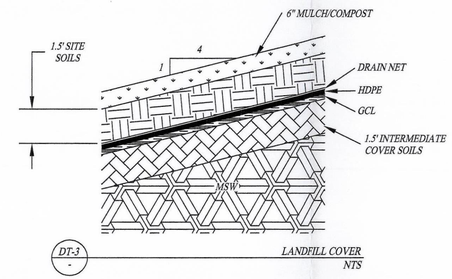


	2+00	4+00	6+00	8+00	10+00	12+00	14+00	16+00	18+00	20+00	22+00	24+00	26+00
	5361.38	5333.96 / 5390.194	5301.33 / 5428.780	5271.60 / 5380.774	5255.15 / 5332.768	5238.92 / 5294.761	5197.03 / 5236.755	5123.03 / 5188.801	5076.55 / 5140.573	5057.86 / 5091.677	5042.81	5034.50	5029.64
Soil Cut (ft)		24.82	58.92	96.83	118.91	117.51	90.44	31.26					
Waste Fill (ft)		81.06	186.37	206.00	196.53	163.35	130.16	97.03	63.63	13.52			

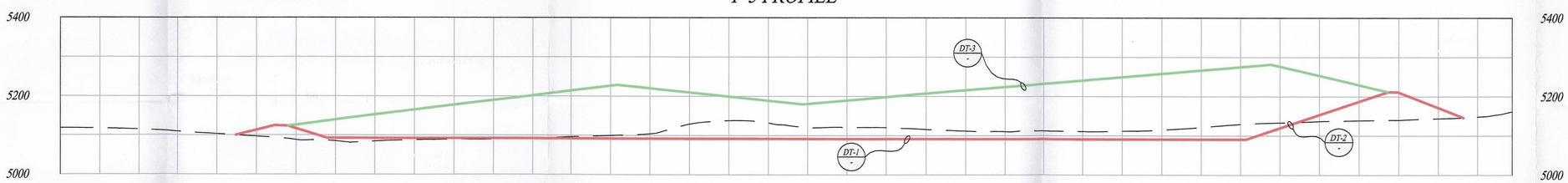
P-4 / 12 PROFILE VIEW
SCALE: 1" = 150'







P-5 PROFILE



	2+00	4+00	6+00	8+00	10+00	12+00	14+00	16+00	18+00	20+00	22+00	24+00	26+00	28+00	30+00	32+00	34+00	36+00
	5114.24	5102.70	5087.78 / 5125.983	5084.34 / 5152.509	5089.10 / 5177.355	5092.16 / 5202.045	5099.56 / 5226.648	5128.96 / 5206.570	5131.91 / 5185.656	5120.81 / 5189.268	5115.53 / 5207.389	5109.95 / 5223.982	5110.65 / 5240.689	5114.62 / 5257.831	5120.15 / 5275.014	5136.66 / 5253.198	5140.00	5148.19
Soil Cut (ft)						0.34	7.87	37.41	40.50	29.53	24.39	18.94	19.77	23.88	38.55			
Waste Fill (ft)			9.47	60.42	85.41	110.23	134.97	118.02	97.24	97.99	116.25	132.97	149.81	167.11	184.41	99.72		

P-5 / 12 PROFILE VIEW
SCALE: 1" = 150'

ISSUED FOR PERMIT
NOT FOR CONSTRUCTION

REFERENCE:
ADAPTED FROM MAP PROVIDED BY CLIENT.

0 75 150 300 450
SCALE IN FEET

LOGAN CITY UNITED IN SERVICE

290 North 100 West
Logan, Utah 84321
(435) 716-9000

CONSULTANTS

IGES®
ideas for a changing world
4153 South Commerce Drive
Salt Lake City, Utah 84107
(801)270-9400 Fax: (801)270-9401

EXISTING GROUND
LANDFILL BASE GRADE
FINAL CAP

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

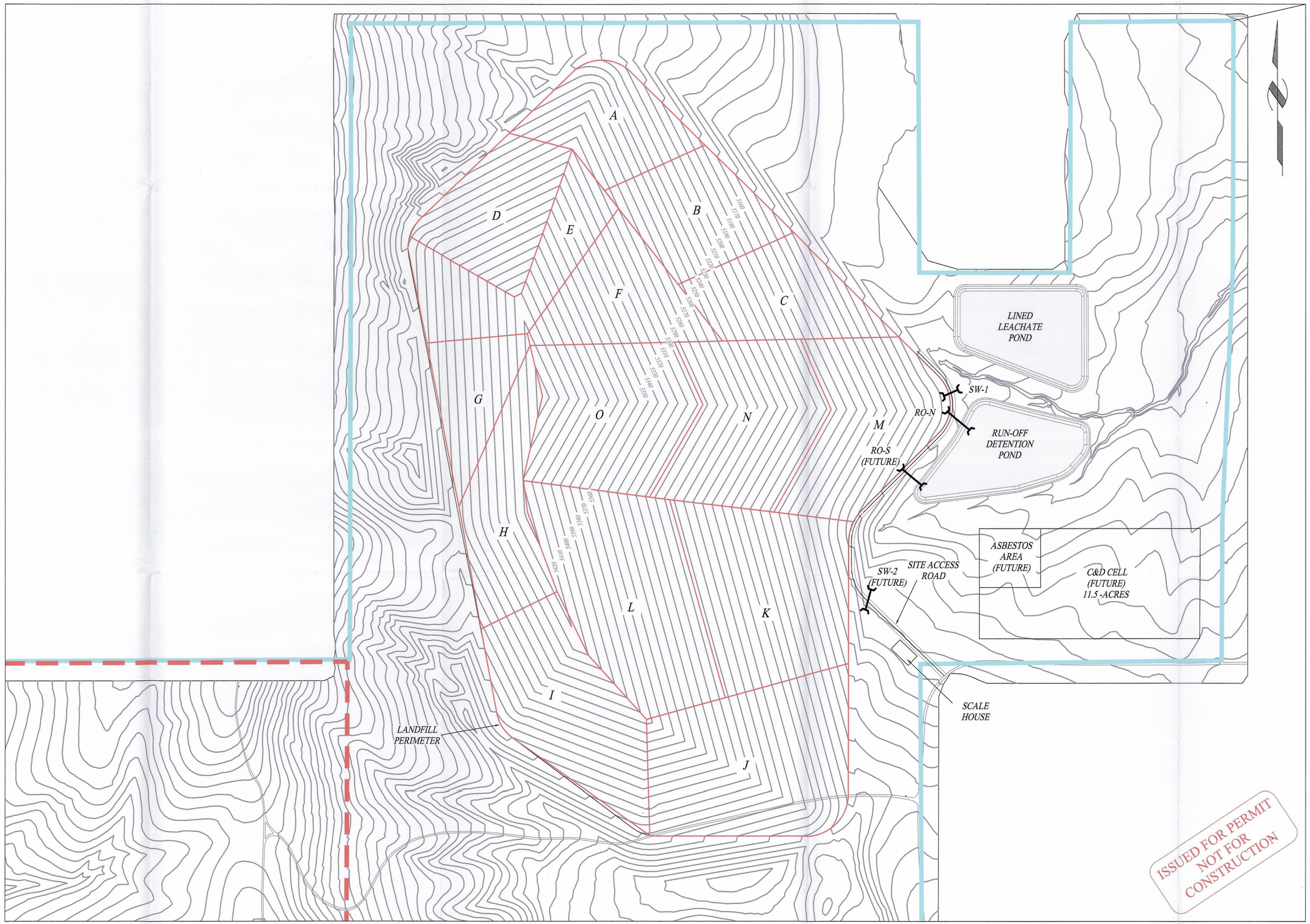
ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base map
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES 2012

SHEET TITLE

NORTH VALLEY LANDFILL
ELEVATION VIEW

13



REFERENCE:
ADAPTED FROM MAP PROVIDED BY CLIENT.

LOGAN CITY UNITED IN SERVICE

290 North 100 West
Logan, Utah 84321
(435) 716-9000

CONSULTANTS

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ideas for a changing world

4153 South Commerce Drive
Salt Lake City, Utah 84107
(801)270-9400 Fax: (801)270-9401

PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
CLOSURE STAGE
PROPOSED GROUND (10' CONTOUR)

CLOSURE STAGE AREAS (ACRES)

A- 6.29	B- 6.68
C- 6.74	D- 7.00
E- 7.02	F- 6.68
G- 4.40	H- 6.83
I- 10.50	J- 13.94
K- 12.66	L- 13.92
M- 9.62	N- 10.36
O- 10.64	

TOTAL- 133.8

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	DRAFT

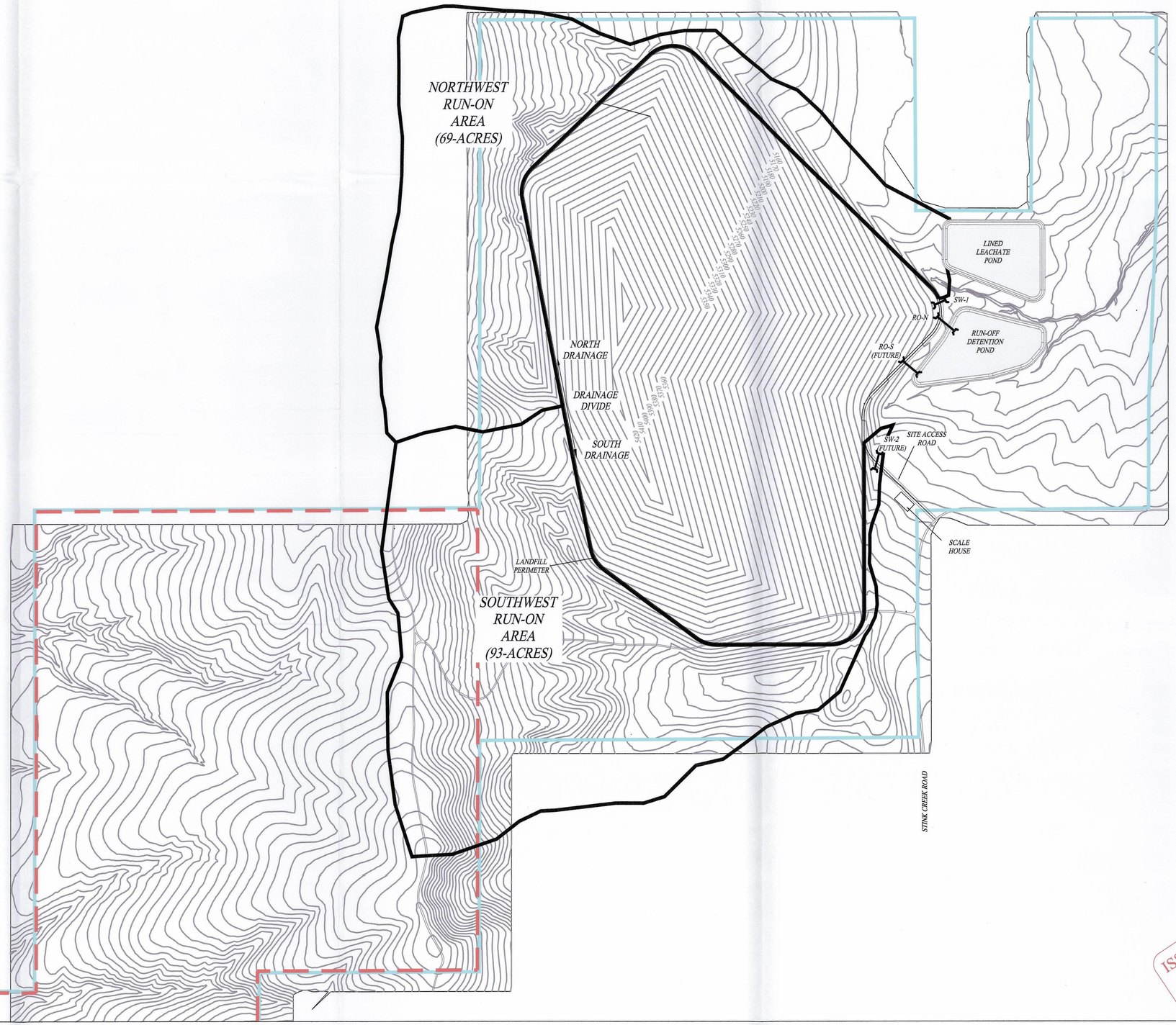
ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base map
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES 2012

SHEET TITLE

NORTH VALLEY LANDFILL

LANDFILL CLOSURE STAGES



REFERENCE:
ADAPTED FROM MAP PROVIDED BY CLIENT.

0 150 300 600 900
SCALE IN FEET

LOGAN CITY UNITED IN SERVICE

290 North 100 West
Logan, Utah 84321
(435) 716-9000

CONSULTANTS

IGES®
ideas for a changing world

4153 South Commerce Drive
Salt Lake City, Utah 84107
(801)270-9400 Fax: (801)270-9401

PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
RUN-ON AREAS

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	

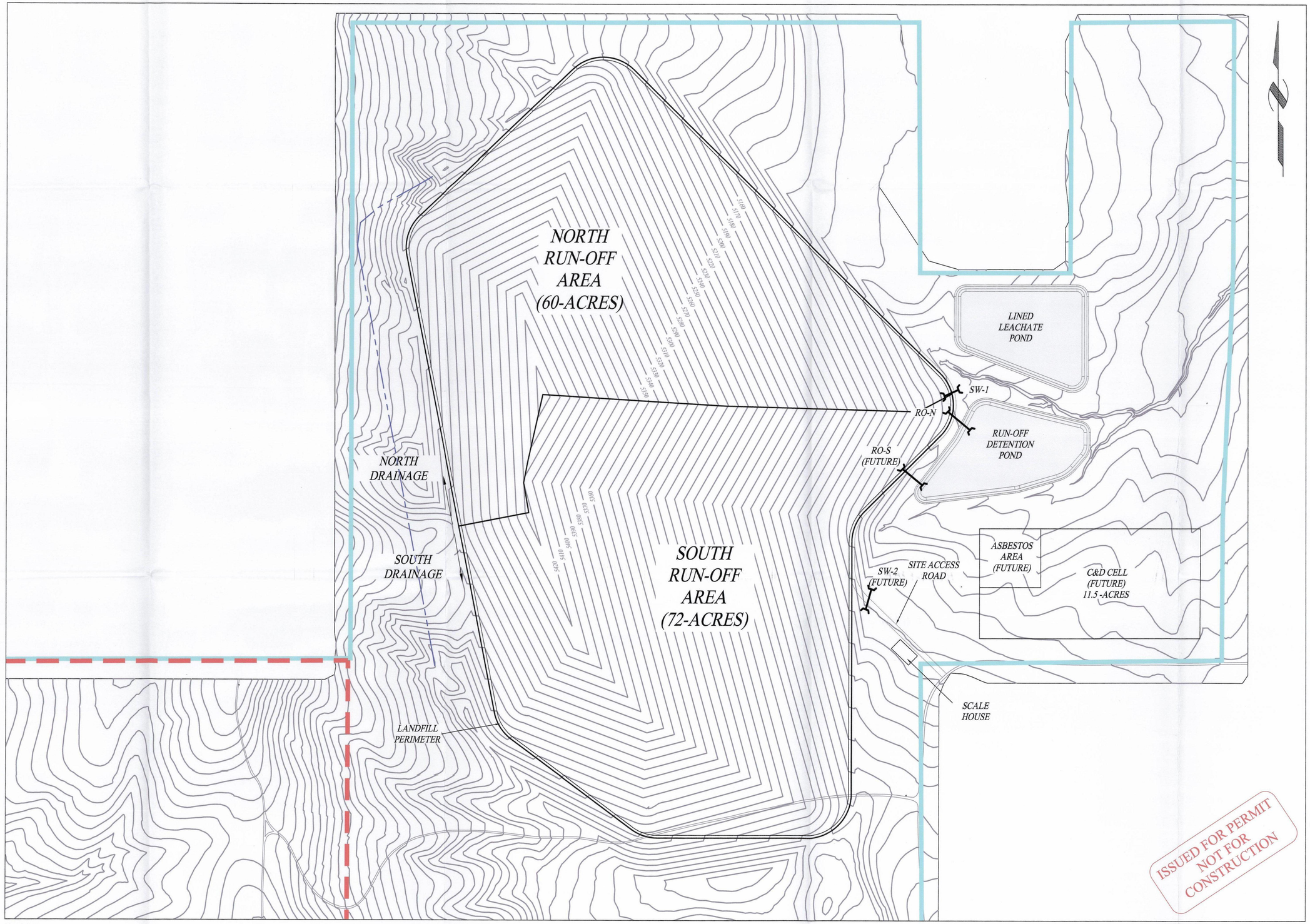
ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base map
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES 2012

SHEET TITLE

NORTH VALLEY LANDFILL

RUN-ON AREAS



REFERENCE:
ADAPTED FROM MAP PROVIDED BY CLIENT.

LOGAN CITY UNITED IN SERVICE

290 North 100 West
Logan, Utah 84321
(435) 716-9000

CONSULTANTS

IGES®
ideas for a changing world

4153 South Commerce Drive
Salt Lake City, Utah 84107
(801)270-9400 Fax: (801)270-9401

PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
FINAL GROUND SURFACE (10' CONTOUR)
STORM WATER CULVERT

MARK	DATE	DESCRIPTION
	2/17/12	PERMIT SET
	2/3/12	

ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base map
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES 2012

SHEET TITLE

NORTH VALLEY LANDFILL

RUN-OFF AREAS

Appendix B

Hickman Land Title Co.
112 North Main St. • P.O. Box 386
Logan, Utah 84323
Tel 435-752-0582 • Fax 435-752-0584

872 West Heritage Park Blvd., Suite 120
Layton, Utah 84041
Tel 801-416-8900 • Fax 801-416-8950

895 West Baxter Drive
South Jordan, Utah 84095
Tel 801-316-4500 • Fax 801-316-4550

Hickman Land Title Co
SINCE 1904

Serving Cache, Davis, Rich, Salt Lake, Utah and Weber Counties in Utah
Lincoln and Teton Counties in Wyoming

Rich Land Title Co.
P.O. Box 362
Randolph, Utah 84064-0362
Tel 435-752-0582 • Fax 435-752-0584

Land Title Co.
160 East Broadway • P.O. Box 651
Jackson, Wyoming 83001-651
Tel 307-733-4713 • Fax 307-733-6186

www.landtitleco.com
Utah Toll Free line 1-800-365-7720
Wyoming Toll Free line 1-800-289-9920

LIMITED REPORT

TO: CACHE COUNTY
120 North 100 West
Logan, Utah 84321
Darrell Gibbons

Order No. T-60505

Re: CITY OF LOGAN

Effective Date: May 19, 2011 at 7:59 a.m.

At your request, **HICKMAN LAND TITLE COMPANY,** has performed a limited search of the records of the office of the County Recorder of Cache County from July 8, 1971 to the date of this report, to the following described tract of land in said County:

LEGAL DESCRIPTION:

Parcel 1: Beginning at the Southwest Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence East 49 ½ feet; thence North 610 feet; thence East 2079 feet; thence South 98 ½ feet; thence East 9 rods; thence North 9 rods; thence West 20 ¾ chains; thence North 35.5 chains; thence West 14.5 chains; thence South 45.5 chains to beginning.

Parcel 2: Part of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, described as follows: Beginning 1500 feet West of the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West; running thence West 1500 feet; thence South 1161.5 feet; thence East 1500 feet; thence North 1161.5 feet to the beginning.

PARCEL 3: Beginning 9.5 chains North of the Southeast Corner of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24.97 chains; thence North 17.79 chains; thence East 24.97 chains; thence South 17.79 chains to beginning.

PARCEL 4: Beginning at the Southeast Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence North 9.5 chains; thence West 4.02 chains; thence South 9 rods; thence West 9 rods; thence North 98.5 feet; thence West 2079 feet; thence South 610 feet; thence East 2590 feet on Section line to beginning.

sb

PARCEL 5: Beginning at the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian and running thence West 750 feet; thence South 1161.5 feet; thence East 750 feet; thence North 1161.5 feet to the beginning.

PARCEL 6: Beginning at a point 17.40 chains South of the Northeast Corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West to Section line; thence South 17.7 chains; thence East to a point South of beginning; thence North 17.7 chains to beginning.

PARCEL 7: Beginning at the Southwest Corner of the Southwest Quarter of Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence East 20 chains; thence North 9.25 chains; thence West 20 chains more or less to a point 9.50 chains North of the point of beginning; thence South 9.50 chains to beginning.

PARCEL 8: The North half of the Northeast Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 9: The East half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 10: The West half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Also, the North 26.67 rods of the Northwest Quarter of the Southwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian.

PARCEL 11: Beginning at the Center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence South 26.666 rods; thence East 160 rods; thence North 26.666 rods; thence West 160 rods to beginning, less right-of-way; also the North half of the following: Beginning at the center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24 rods; thence South 13 1/3 rods; thence East 24 rods; thence North 13 1/3 rods to beginning.

Property Address: Not Listed

Said limited search reveals the following information:

1. The last recorded document(s) which purport(s) to convey title to said property:

   Recorded: March 1, 2005 Entry No. 884330 Book: 1341 Page: 1950
   PARCEL 1, 3, 4, 6, 7, 8, 9, 10 and 11: CITY OF LOGAN, A Municipal Corporation

   Recorded: December 27, 2005 Entry No. 907243 Book: 1387 Page: 1133
   PARCEL 2 and 5: CITY OF LOGAN

sb

2. Taxes for the year 2011, and subsequent years, not yet due and payable.
   Parcel 1: Tax Parcel No. 15-051-0007. (2010 taxes were paid in the amount of $158.47)
   Parcel 2: Tax Parcel No. 15-051-0008. (2010 taxes were paid in the amount of $167.13)
   Parcel 3: Tax Parcel No. 15-051-0009. (2010 taxes were paid in the amount of $155.02)
   Parcel 4: Tax Parcel No. 15-051-0010. (2010 taxes were paid in the amount of $130.66)
   Parcel 5: Tax Parcel No. 15-051-0012. (2010 taxes were paid in the amount of $86.66)
   Parcel 6: Tax Parcel No. 15-051-0013. (2010 taxes were paid in the amount of $175.53)
   Parcel 7: Tax Parcel No. 15-051-0014. (2010 taxes were paid in the amount of $83.74)
   Parcel 8: Tax Parcel No. 15-003-0001. (2010 taxes were paid in the amount of $284.39)
   Parcel 9: Tax Parcel No. 15-003-0002. (2010 taxes were paid in the amount of $267.24)
   Parcel 10: Tax Parcel No. 15-003-0003. (2010 taxes were paid in the amount of $345.81)
   Parcel 11: Tax Parcel No. 15-004-0004. (2010 taxes were paid in the amount of $78.00)

Judgments have been checked on the vesting listed above and from a search of the appropriate tract index covering the subject property, we found the following mortgages, deeds of trust, judgments, liens, notice of interest, and/or notices of contract recorded during said period of search which may affect the subject property: None

NOTE: No existing Deed of Trust appears of record. If this information is not correct, please notify the Company as soon as possible to provide information regarding the existing loan.

HICKMAN LAND TITLE COMPANY
by:

For Inquiries Contact Us
Logan 435-752-0582 ✻ Layton 801-416-8900 ✻ South Jordan 801-316-4500
Toll Free 800-365-7720

DECLARATIONS

1. THIS REPORT IS BASED UPON A LIMITED SEARCH OF THE PUBLIC RECORDS DESIGNATED HEREIN, AND IS NOT TO BE CONSTRUED AS ANY FORM OF TITLE INSURANCE OR AS A COMMITMENT TO INSURE TITLE. THE LIABILITY OF HICKMAN

sb

LAND TITLE COMPANY IS LIMITED TO THE COMPENSATION RECEIVED FOR THIS REPORT.

2. THIS REPORT DOES NOT INCLUDE MORTGAGES OR DEEDS OF TRUST THAT APPEAR TO HAVE BEEN RELEASED OF RECORD. NO REPRESENTATION IS MADE HEREUNDER AS TO THE EFFECT, COMPLETENESS, VALIDITY OR ACCURACY OF THE DOCUMENTS REPORTED HEREIN.

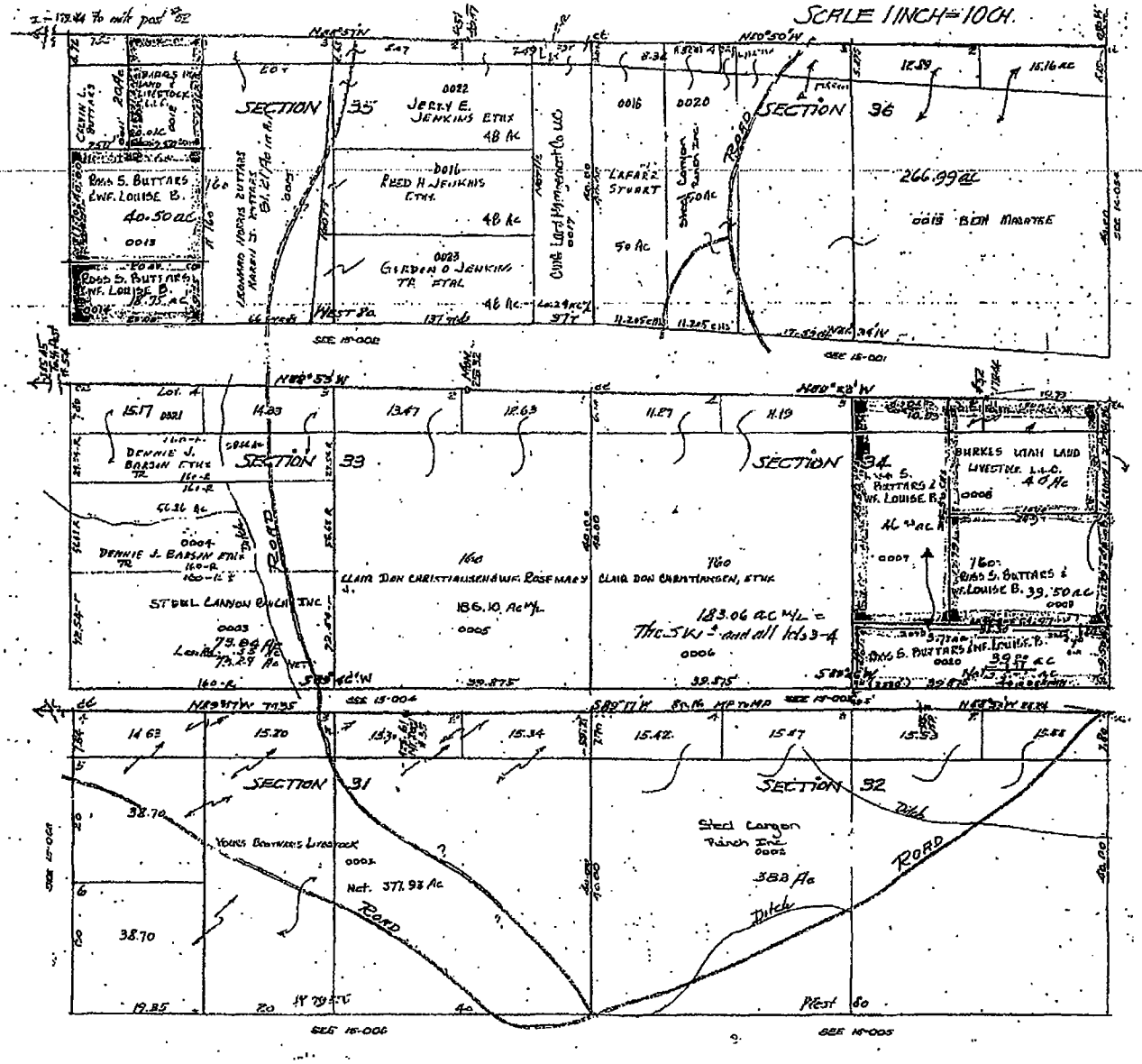
sb

TOWNSHIP 15 NORTH RANGE 2 WEST

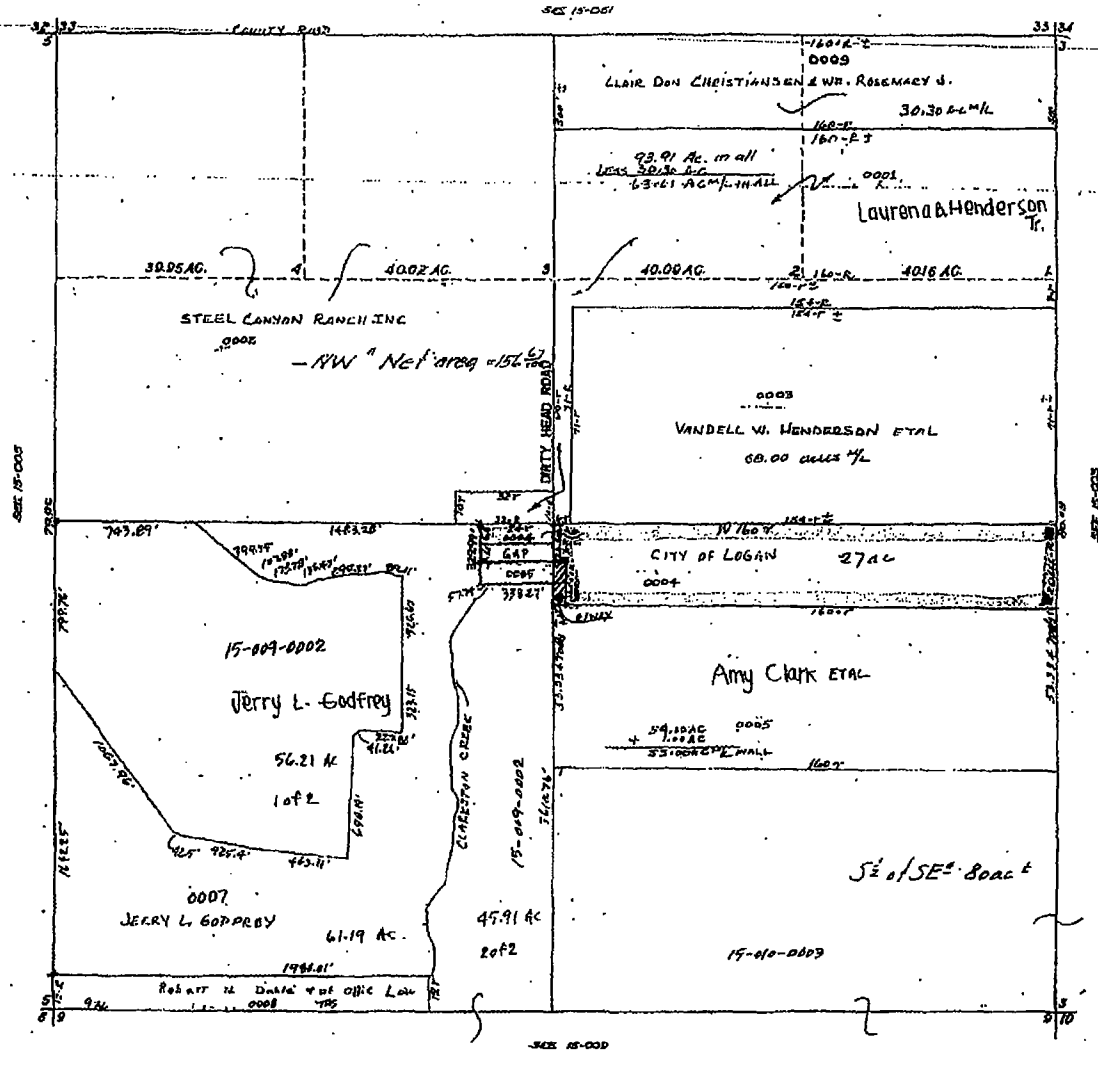
TAX UNIT 28

15-051

SCALE 1 INCH = 10 CH.



SECTION 4, TOWNSHIP 14 NORTH, RANGE 2 WEST - 15-004
SCALE 1 INCH = 6 CHAINS.
TAX UNIT 28

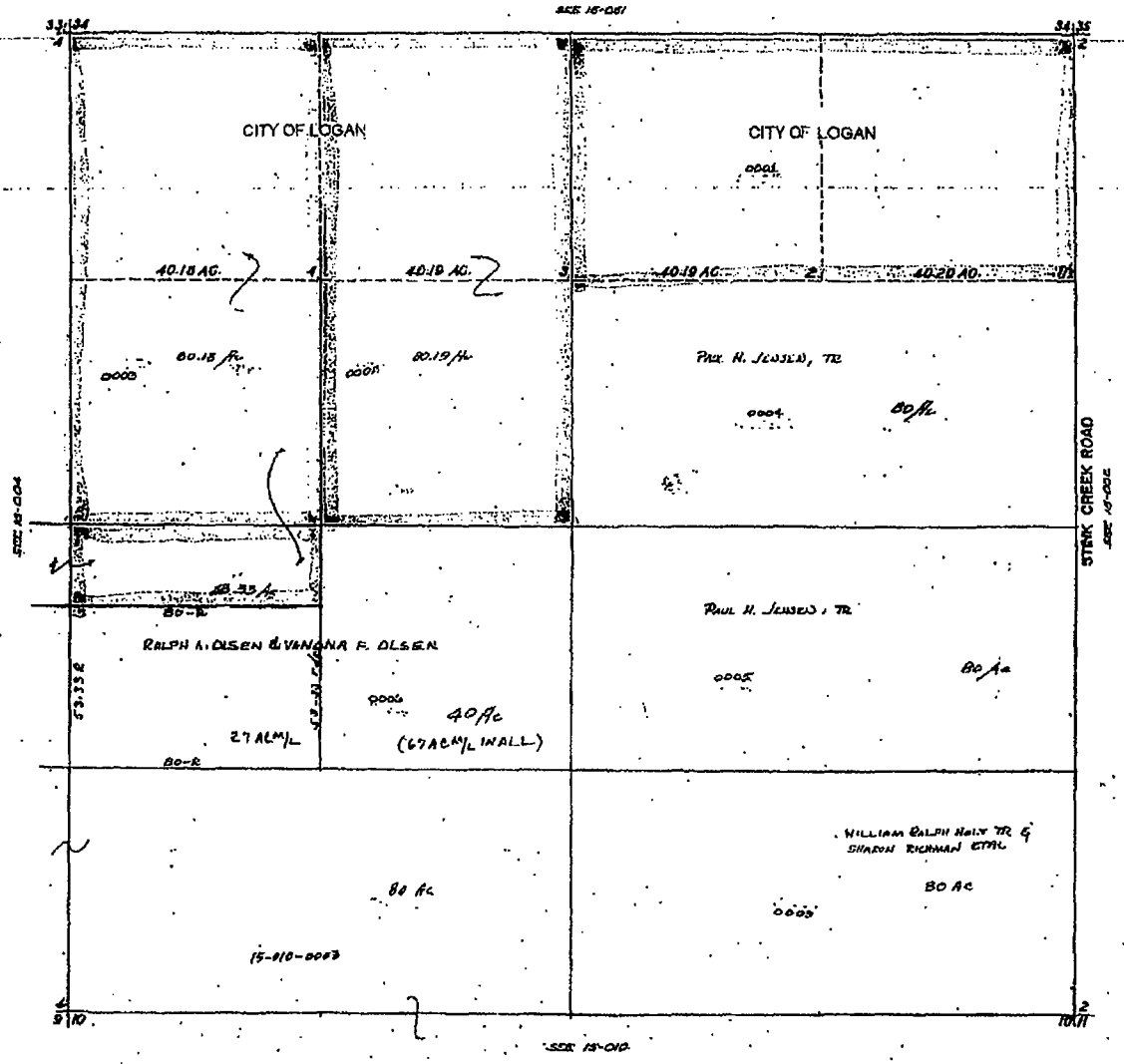


15-003

TAX UNIT 28

SECTION 3, TOWNSHIP 14 NORTH, RANGE 2 WEST.

SCALE 1 INCH = 6 CHAINS.



a corporation organized and existing under the laws of the State of Utah
grantor, with its principal office at , County of Cache, State of Utah, hereby CONVEYS and WARRANTS only as against all claiming by, through or under it to

CITY OF LOGAN

grantee of 255 North Main Street, Logan, UT 84321
for the sum of TEN DOLLARS and other good and valuable consideration
the following described tract of land in Cache County, State of Utah.

Part of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, described as follows: Beginning 1500 feet West of the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West; running thence West 1500 feet; thence South 1161.5 feet; thence East 1500 feet; thence North 1161.5 feet to the beginning.

Beginning at the Northeast corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian and running thence West 750 feet; thence South 1161.5 feet; thence East 750 feet; thence North 1161.5 feet to the beginning.

15-051-0008; 0012

The officers who sign this deed hereby certify that this deed and the transfer represented thereby was duly authorized by a quorum. In witness whereof, the grantor has caused its corporate name and seal to be hereunto affixed by its duly authorized officers this 27th day of ~~November~~ December A.D. 2005.

Signed in the presence of

BURKE'S UTAH LAND & LIVESTOCK, LLC
BY:
B. Lamont Godfrey (manager)

LIMITED LIABILITY ACKNOWLEDGMENT

Ent 907243 Bk 1387 Pg 1133
Date 27-Dec-2005 2:47PM Fee $11.00
Michael Gleed, Rec. - Filed By TJ
Cache County, UT
For KICKHAM LAND TITLE COMPANY

STATE OF UTAH)
SS
County of Cache)

On the 27th day of ~~November~~ December A.D. 2005, personally appeared before me B. Lamont Godfrey who being by me duly sworn did say, each for himself, that he/she/they is/are the members/managers of BURKE'S UTAH LAND & LIVESTOCK, LLC, a Utah Limited Liability Company and that the within and foregoing instrument was signed on behalf of said Limited Liability Company by authority of its Articles of Organization and each duly acknowledged to me that said Limited Liability Company executed the same.

Commission expires: 9-24-2009
Residing in: Logan, UT

Shirlene Davis
Notary Public

Notary Public
SHIRLENE DAVIS
112 North Main
Logan, Utah 84321
My Commission Expires
September 24, 2009
State of Utah

Warranty Deed

ROSS S. BUTTARS AND LOUISE B. BUTTARS

of **Clarkston**, County of **CACHE**, State of UTAH, hereby CONVEY and WARRANT to

CITY OF LOGAN, A MUNICIPAL CORPORATION

of **255 North Main Street, Logan, UT 84321,** Grantee for the sum of Ten Dollars and Other Good and Valuable Consideration the following described tract(s) of land in **CACHE**, State of UTAH:

See Exhibit A attached hereto and made a part hereof.

Ent 884330 Bk 1341 Pg 1950
Date 1-Mar-2005 9:49AM Fee $20.00
Michael Gleed, Rec. - Filed By TJ
Cache County, UT
For CACHE TITLE COMPANY

TOGETHER WITH ALL rights, title and interest under Water User's Claim No. 25-2792.

WITNESS, the hand(s) of said Grantor(s), this **28th** of **February**, A.D., **2005.**

Signed in the Presence of:

Ross S. Buttars
)**Ross S. Buttars**

Louise B. Buttars
)**Louise B. Buttars**

STATE OF UTAH)
COUNTY OF CACHE)

On the **28th** of **February**, A.D., **2005**, Personally appeared before me **Ross S. Buttars and Louise B. Buttars**, the signer(s) of the within instrument, who duly acknowledged to me that he executed the same.

Annette H Kent
NOTARY PUBLIC

Residing at: Logan, UT

My Commission Expires: 11/19/2006

ANNETTE H. KENT
NOTARY PUBLIC - STATE OF UTAH
233 NORTH MAIN
LOGAN, UT 84321
My Comm. Exp. 11/19/2006

Exhibit A

Parcel 1:
The East half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Tax Parcel No. 15-003-0002

Parcel 2:
The North half of the Northeast Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Tax Parcel No. 15-003-0001

Parcel 3:
The West half of the Northwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Also, the North 26.67 rods of the Northwest Quarter of the Southwest Quarter of Section 3, Township 14 North, Range 2 West of the Salt Lake Base and Meridian. Tax Parcel No. 15-003-0003

Parcel 4:
Beginning at the Center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence South 26.666 rods; thence East 160 rods; thence North 26.666 rods; thence West 160 rods to beginning, LESS right-of-way; Also, the North half of the following: Beginning at the Center of Section 4, Township 14 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24 rods; thence South 13 1/3 rods; thence East 24 rods; thence North 13 1/3 rods to beginning. Tax Parcel No. 15-004-0004

Parcel 5:
Beginning at the Southwest Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence East 49 1/2 feet; thence North 610 feet; thence East 2079 feet thence South 98 1/2 feet; thence East 9 rods; thence North 9 rods; thence West 20 3/4 chains; thence North 35.5 chains; thence West 14.5 chains; thence South 45.5 chains to beginning. Tax Parcel No. 15-051-0007

Parcel 6:
Beginning at the Southeast Corner of the Southeast Quarter of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence North 9.5 chains; thence West 4.02 chains; thence South 9 rods; thence West 9 rods; thence North 98.5 feet; thence West 2079 feet; thence South 610 feet; thence East 2590 feet on Section line to beginning. Tax Parcel No. 15-051-0010

Parcel 7:
Beginning 9.5 chains North of the Southeast Corner of Section 34, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West 24.97 chains; thence North 17.79 chains; thence East 24.97 chains, thence South 17.79 chains to beginning. Tax Parcel No. 15-051-0009

Parcel 8:
Beginning at a point 17.40 chains South of the Northeast Corner of Lot 4, Section 35, Township 15 North, Range 2 West of the Salt Lake Base and Meridian, thence West to Section line; thence South 17.7 chains; thence East to a point South of beginning; thence North 17.7 chains to beginning. Tax Parcel No. 15-051-0013

Parcel 9:
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a corporation organized and existing under the laws of the State of Utah
grantor, with its principal office at , County of Cache, State of Utah, hereby CONVEYS and WARRANTS only as against all claiming by, through or under it to

CITY OF LOGAN

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15-051-0008; 0012

The officers who sign this deed hereby certify that this deed and the transfer represented thereby was duly authorized by a quorum. In witness whereof, the grantor has caused its corporate name and seal to be hereunto affixed by its duly authorized officers this 27th day of ~~November~~ December A.D. 2005.

Signed in the presence of

BURKE'S UTAH LAND & LIVESTOCK, LLC
BY:
B. Lamont Godfrey (mngr)

LIMITED LIABILITY ACKNOWLEDGMENT

Ent 907243 Bk 1387 Pg 1133
Date 27-Dec-2005 2:47PM Fee $11.00
Michael Gleed, Rec. - Filed By TJ
Cache County, UT
For HICKMAN LAND TITLE COMPANY

STATE OF UTAH)
SS
County of Cache)

On the 27th day of ~~November~~ December A.D. 2005, personally appeared before me B. Lamont Godfrey who being by me duly sworn did say, each for himself, that he/she/they is/are the members/managers of BURKE'S UTAH LAND & LIVESTOCK, LLC, a Utah Limited Liability Company and that the within and foregoing instrument was signed on behalf of said Limited Liability Company by authority of its Articles of Organization and each duly acknowledged to me that said Limited Liability Company executed the same.

Commission expires: 9-24-2009
Residing in: Logan, UT
Shirlene Davis
Notary Public

Notary Public
SHIRLENE DAVIS
112 North Main
Logan, Utah 84321
My Commission Expires
September 24, 2009
State of Utah

Adjacent Property Owners (in UTAH)	Cache Co. tax id #	Mailing Address
Calvin L & Renate Buttars	15-051-0011	348 Taylor Ave. Ogden, UT 84404-6854
Clair Don Christiansen	15-051-0006 15-051-0005 15-004-0009	150 E 200 N P.O. Box 151, Newton, UT 84321-0151
Laurena B Henderson Trust	15-004-0001	PO Box 48, Clarkston, UT 84305-0048
Vandell Henderson Trust	15-004-0003	7 North 200 East, Clarkston, UT 84305
Amy Clark	15-004-0005 15-003-0006	4221 Lilac Lane, Mountain Green, UT 84050
Clair Don & Rosemary J Christiansen	15-003-0004 15-003-0005	150 E 200 N P.O. Box 151, Newton, UT 84321-0151
W Ralph Holt Trust	15-002-0003	155 Summit Drive, Smithfield, UT 84335-1116
Burkes Utah Land & Livestock LLC	15-002-0001	PO Box 106, Clarkston, UT 84305-0106
Leonard Norris & Karen J Buttars Trust	15-051-0015	PO Box 116, Clarkston, UT 84305-0116
Gordon O & Mary R Jenkins Trust	15-051-0023	210 North Center St., Newton, UT 84327
Reed H & Vicky P Jenkins Trust	15-051-0016	307 West Main St, Newton, UT 84327
Jerry E & Diane D Jenkins	15-051-0022	192 West 100 South, Newton, UT 84327
(in IDAHO)	Franklin Co id #	
Joseph E Atkinson Family Trust	130156 198049	215 South 200 East, Trenton, UT 84338
Bessie Jean Sheppard Et Al	182513	1482 Meadow Vista Road, Meadow Vista, CA 95722
Venna Dawn Page Revocable Trust	193109 213720	PO Box 175, Honeyville, UT 84314-0175

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Venna Dawn Page Revocable Trust
Dixie Colleen Rasmussen
PO Box 175
Honeyville, UT 84314-0175

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

The Logan City Corporation currently operates a Class I Sanitary Landfill which accepts Municipal Solid Waste under permit #9432 from the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW). The landfill has served Logan City since 1960 and began accepting waste from all of Cache County in 1974. Based on recent topographical surveys and projected waste generation rates the landfill will reach its' permitted capacity within the next 6-7 years.

In order to continue to provide this necessary service to the residents of Cache County, Logan City is planning to build a transfer station near the existing landfill and transport the waste from the transfer station to a new landfill north of Clarkston, Utah. The proposed facility will be called the North Valley Landfill.

State of Utah Solid Waste Rules, specifically Section R315-310-3(2)(ii) have requirements to notify property owners within 1,000 feet of the proposed landfill that an application has been made to the Division of Solid and Hazardous Waste. According to public records, you own property that is within 1,000 feet of the property purchased by Logan City for development of the North Valley Landfill.

If you have any questions about the proposed landfill project or would like to discuss the project further, please contact me at the following telephone number (435) 716-9752.

Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Steel Canyon Ranch, Inc.
Max Christiansen
PO Box 151
Newton, UT 84321-0151

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

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Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Iva M Godfrey Revocable Trust
PO Box 53
Riverside, UT 84334

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Bessie Jean Sheppard Et Al
1482 Meadow Vista Rd
Meadow Vista, CA 95722

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Joseph E Atkinson Family Trust
215 South 200 East
Trenton, UT 84338

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

W Ralph Holt Trust
155 Summit Drive
Smithfield, UT 84335-1116

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

The Logan City Corporation currently operates a Class I Sanitary Landfill which accepts Municipal Solid Waste under permit #9432 from the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW). The landfill has served Logan City since 1960 and began accepting waste from all of Cache County in 1974. Based on recent topographical surveys and projected waste generation rates the landfill will reach its' permitted capacity within the next 6-7 years.

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Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Burkes Utah Land & Livestock LLC
PO Box 106
Clarkston, UT 84305-0106

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

The Logan City Corporation currently operates a Class I Sanitary Landfill which accepts Municipal Solid Waste under permit #9432 from the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW). The landfill has served Logan City since 1960 and began accepting waste from all of Cache County in 1974. Based on recent topographical surveys and projected waste generation rates the landfill will reach its' permitted capacity within the next 6-7 years.

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Leonard Norris & Karen J Buttars Trust
PO Box 116
Clarkston, UT 84305-0116

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Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Laurena B. Henderson Trust
PO Box 48
Clarkston, UT 84305-0048

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

The Logan City Corporation currently operates a Class I Sanitary Landfill which accepts Municipal Solid Waste under permit #9432 from the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW). The landfill has served Logan City since 1960 and began accepting waste from all of Cache County in 1974. Based on recent topographical surveys and projected waste generation rates the landfill will reach its' permitted capacity within the next 6-7 years.

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Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Vandell Henderson Trust
7 North 200 East
Clarkston, UT 84305

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Amy Clark
4221 Lilac Lane
Mountain Green, UT 84050

RE: Notice of Intent to apply for permit - North Valley Landfill

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Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

March 5, 2012

Clair Don & Rosemary J Christiansen
150 E 200 N, P.O. Box 151
Newton, UT 84321-0151

RE: Notice of Intent to apply for permit - North Valley Landfill

To Whom this May Concern,

The Logan City Corporation currently operates a Class 1 Sanitary Landfill which accepts Municipal Solid Waste under permit #9432 from the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW). The landfill has served Logan City since 1960 and began accepting waste from all of Cache County in 1974. Based on recent topographical surveys and projected waste generation rates the landfill will reach its' permitted capacity within the next 6-7 years.

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Respectfully,

Issa Hamud P.E.
Environmental Director
Logan City

CC:
Doug Taylor, DSHW

LOGAN CITY

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Calvin L & Renate Buttars
348 Taylor Ave
Ogden, UT 84404-6854

RE: Notice of Intent to apply for permit - North Valley Landfill

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Doug Taylor, DSHW

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

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307 West Main St
Newton, UT 84327

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LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

March 5, 2012

Jerry E & Diane D Jenkins
192 West 100 South
Newton, UT 84327

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Doug Taylor, DSHW

LOGAN CITY

ENVIRONMENTAL DEPARTMENT

March 5, 2012

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210 North Center St
Newton, UT 84327

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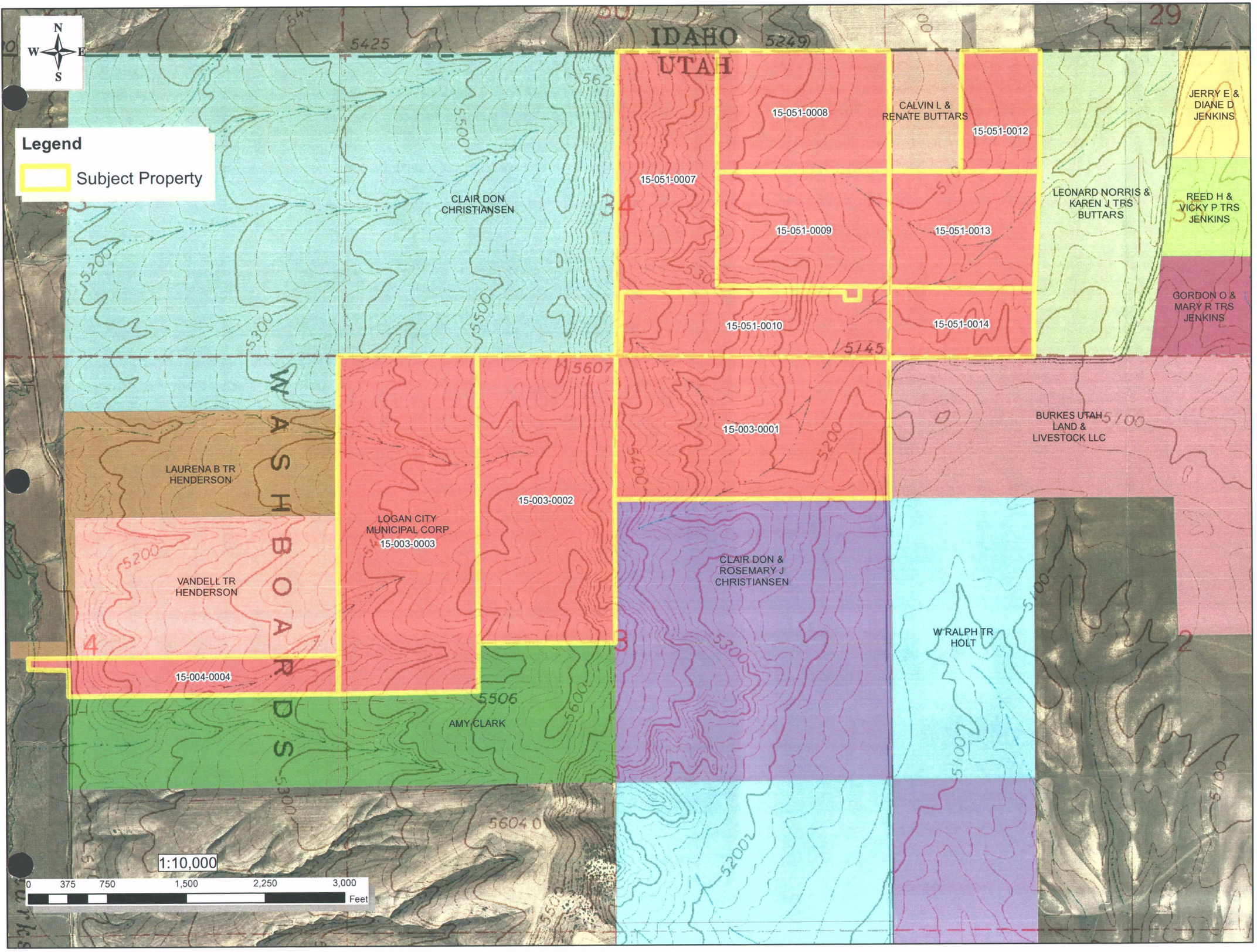
Doug Taylor, DSHW



LOGAN CITY UNITED IN SERVICE

City of Logan
290 North 100 West
Logan, Utah 84321
(435) 716-9000

IGES®
ideas for a changing world

IGES, Inc.
4153 South Commerce Drive
Salt Lake City, Utah 84107
T: (801) 270-9400 F: (801) 270-9401

Notes:

PROJECT NO.:	00386-014
FILE LOCATION:	00386\014\REZONE MAP.mxd
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES, 2011

SHEET TITLE

SITE MAP

1

196976

Gonzal # 2534

Drucilla B. Christiansen Trust

179699

#2595.00

19 30

19 30 2

Keith L. Griffin

208419 207427

#2597 150.3 Ac.

Drucilla B. Christiansen Trust

179699

#2596.00

#2592.01

Richard C. Rasmussen (Et al)

155596

226226

30

#2595.00

Clair Don Christiansen

155022

171372443

225122

231374

#2592.00

Louis Rasmussen et al

Blanche Rasmussen

226226

Joseph E. Atkinson Fam. Trust

#2594 76.4 Ac

30

Jos. Elbert Atkinson

Fam. Trust

#2593

Bessie Shoppert Et al

182513

#2590.00

30 29

SEC 30 T 16 South 1" = 660'

Rng 38 E - Boise Meridian

1947
#2537

Robert L. Hanson
193309
#2540

153968
179206
251773

20

29

#2584.00

Christiansen Family Trust

Drucilla B. Christiansen Trust
156227
#2585

37R

T 3

#2588.00
Godfrey Family Trust
24-358
162970 226756,
228660, 228661

61.50 AC

Road

Rex Godfrey
222822 #2586
58.5 Ac.

132002

Burk's Land & Livestock
168944
#2589

144694

#2587.00
Brady Atkinson

41-630
175173
253650

29

#2583.00
Richard C. Rasmussen
159[illegible]

49-278
226226

Richman Family Trust
194534
#2580

Richman Family Trust
194534
#2580

139586

Venna Dawn Page Trust Etal
193109
213720 #2582

#2581.00

Iva Godfrey Rev Trust

53-245
186364
250273
250363
250662

T-1 #2579

24-341

Bessie Sheppard Etal
182513
T1
#2590

135202

29

29

1" = 660'

SEC 29 T 16 South Range 38E
Boise Meridian

UTA

MANATRON

PIN:	**RP02594.00**	TAG:	**TAG 022-0000**	Current owner:	**ATKINSON JOSEPH E FAM TRUST**
AIN:	**02594.00**	TIF:		Ownership type:	**Fee Simple Ownership**
Status:	**Active**	Case:		Situs address	
Geocode:		Plan:		Description:	**LOT 4 SE4 SW4; 30-16-38; INST**
Rev acct:	**3703**	Roll type	**Real Property**	Class:	**512-Res Rural Tract Vacant**

Year/Bill 2011-108088 *Mass Default* Print | Print Stmt | Bill Detail

Bill type: Original

Bill dates: November 01, 2011

Amount: $32.08

Paid date: November 28, 2011

Receipt: U11.3344

Sequence no: 1

Paid by:
ATKINSON JOSEPH E FAM TRUST

Decal no:

Owner of record:
ATKINSON JOSEPH E FAM TRUST
215 S 200 E
TRENTON UT 84338

Communication:

Total Due	02/15/2012
Inst 2-June 20	$0.00
Total Current	$0.00
Delinquent	$0.00
Adv/Surplus	$0.00
Total Due	$0.00

Values/Exemptions

Value Date	1/1/2011
Total Acres	76.4000
Land Market	3,840
Imp Market	00
Total Value	3,840
Total Exemptions	0
Net Tax Value	3,840

Description: LOT 4 SE4 SW4; 30-16-38; INST # 130156 198049

Assessment Summary — Detail

Gross Tax	Credits	Net Tax	Tax Savings	Total Credits/Savings
32.08	0.00	32.08	0.00	0.00

MANATRON

PIN:	**RP02590.00**	TAG:	**TAG 022-0000**	Current owner:	**SHEPPARD BESSIE JEAN ETAL**
AIN:	**02590.00**	TIF:		Ownership type:	**Fee Simple Ownership**
Status:	**Active**	Case:		Situs address	
Geocode:		Plan:		Description:	**SW4 SW4; 29-16-38; INST # 1825**
Rev acct:	**3698**	Roll type	**Real Property**	Class:	**512-Res Rural Tract Vacant**

Year/Bill 2011-108083 *Mass Default* Print | Print Stmt | Bill Detail

Bill type: Original

Bill dates: November 01, 2011

Amount: $48.96

Paid date: November 21, 2011

Receipt: U11.3184

Sequence no: 1

Paid by:
SHEPPARD BESSIE JEAN ETAL

Decal no:

Owner of record:
SHEPPARD BESSIE JEAN ETAL
1482 MEADOW VISTA RD
MEADOW VISTA CA 95722

Communication:

Total Due	02/15/2012
Inst 2-June 20	$0.00
Total Current	$0.00
Delinquent	$0.00
Adv/Surplus	$0.00
Total Due	$0.00

Values/Exemptions	
Value Date	1/1/2011
Total Acres	40.0000
Land Market	5,860
Imp Market	00
Total Value	5,860
Total Exemptions	0
Net Tax Value	5,860

Description: SW4 SW4; 29-16-38; INST # 182513

Assessment Summary Detail

Gross Tax	Credits	Net Tax	Tax Savings	Total Credits/Savings
48.96	0.00	48.96	0.00	0.00

MANATRON

PIN:	**RP02582.00**	TAG:	**TAG 022-0000**	Current owner:	**PAGE VENNA DAWN REV TRUST**
AIN:	**02582.00**	TIF:		Ownership type:	**Fee Simple Ownership**
Status:	**Active**	Case:		Situs address	
Geocode:		Plan:		Description:	**E2 SW4; 29-16-38; INST # 19310**
Rev acct:	**3690**	Roll type	**Real Property**	Class:	**512-Res Rural Tract Vacant**

Year/Bill 2011-108075 *Mass Default* Print | Print Stmt | Bill Detail

Bill type: Original

Bill dates: November 01, 2011

Amount:

Paid date:

Receipt:

Sequence no: 0

Paid by:

Decal no:

Owner of record:

PAGE VENNA DAWN REV TRUST
RASMUSSEN DIXIE COLLEEN
PO BOX 175
HONEYVILLE UT 84314-0175

Communication:

Total Due	02/15/2012
Inst 2-June 20	$48.96
Total Current	$48.96
Delinquent	$728.39
Adv/Surplus	$0.00
Total Due	$777.35

Values/Exemptions	
Value Date	1/1/2011
Total Acres	80.0000
Land Market	11,720
Imp Market	00
Total Value	11,720
Total Exemptions	0
Net Tax Value	11,720

Description: E2 SW4; 29-16-38; INST # 193109 213720

Assessment Summary Detail

Gross Tax	Credits	Net Tax	Tax Savings	Total Credits/Savings
97.92	0.00	97.92	0.00	0.00

Appendix C

Instructions for Completing Landfill Annual Report Form

The Division of Solid and Hazardous Waste is not currently able to accept e-mailed form submissions. The attached form must be printed, signed as required by Utah Administrative Code R315-310-2(4), and mailed to the Division. Annual reports must be received by the Division on or before March 1, 2012 and should contain data for the calendar year 2011.

To save a copy of this form on your system please go to "File" and then "Save As" after which you will be prompted to enter a file name and a location where you want to save the form.

After saving the form complete all applicable sections of the form and save it again.

To print the form click the print button at the top of the following page. Only the form pages will be printed on your default printer.

Completed forms should be mailed to:

Scott T. Anderson, Director
Division of Solid and Hazardous Waste
P.O. Box 144880
Salt Lake City, Utah 84114-4880

SOLID WASTE LANDFILL ANNUAL REPORT

For Calendar year 2011

Administrative Information (Please enter all the information requested below)

Facility Name: North Valley Landfill

Facility Mailing Address: 14200 Stink Creek Road
(Number & Street, Box and/or Route)

City: Clarkston Zip Code: 84305

County: Cache Permit Number: _____

Owner

Name: Logan City Phone No.: (435)716-9001

Owner Mailing Address: 255 North Main St.
(Number & Street, Box and/or Route)

City: Logan State: Utah Zip Code: 84321

Contact Name: Issa Hamud Contact Title: Environmental Director

Contact's Mailing Address: 450 North 1000 West

Phone No.: (435)716-9752 Contact's Email Address: issa.hamud@loganutah.org

Operator (Complete this section only if the operator is not an employee of the Owner shown above)

Name: _____ Phone No.: _____

Owner Mailing Address: _____
(Number & Street, Box and/or Route)

City: _____ State: Utah Zip Code: _____

Contact Name: _____ Contact Title: _____

Contact's Mailing Address: _____

Phone No.: _____ Contact's Email Address: _____

Facility Type and Status

- [x] Class I
- [ ] Class II
- [ ] Class IIIa
- [ ] Class IIIb
- [ ] Class IVa
- [ ] Class IVb
- [ ] Class V
- [ ] Class VI
- [ ] Facility Closed during the year

Date Closed: _____

Annual Disposal (Tons received at the facility for disposal)

Waste Type	Waste Origin: In-State	Waste Origin: Out-of-State	Total	Measurement: Tons	Measurement: Cubic Yards
Municipal				[ ]	[ ]
Industrial				[ ]	[ ]
C/D*				[ ]	[ ]

*C/D waste includes all waste going to a Class IV or VI landfill cell

Conversion Factor Used

[ ] None Used [ ] Site Specific [ ] From Rules List Site Specific Conversion: _____

Recycling

Material Recycled: _____ Reported in Tons ☐ Cubic Yards ☐

Utah Disposal Fee

Disposal fee required to be paid to State Yes ☐ No ☐ (If yes please show fees paid below)

Municipal: _____ Industrial: _____ C/D: _____ Annual: _____

Municipal, Industrial and C/D are fees paid by Commercial Facilities. Annual fee is paid by facilities operated by a municipality

Current Landfill Remaining Capacity

Tons: 14,950,000.00 Cubic Yards: 26,700,000.00 Acre: 133.00 Years: 81.00

Acres Currently Open: _____ Acres Currently Closed: _____

Financial Assurance

Current Closure Cost Estimate: _____

Current Post-Closure Cost Estimate: _____

Current Amount or Balance in Mechanism: _____

(If facility permit has been renewed and if balance does not equal or exceed total for closure and post-closure care please contact the Division)

Current Financial Assurance Mechanism: _____

(ie. Bond, Trust Fund, Corporate or government Test etc.)

Current Financial Assurance Mechanism Holder: _____

(ie. Name of Bond Company, Bank etc. Account number)

Financial Assurance: Each facility must recalculate the cost of closure and post-closure care to account for inflation and design changes each year. The inflation factor can be found on the Division web page. Facilities that are using a trust account should include a copy of the most recent account statement.

Note Facilities using "Local Government Financial Test" or the "Corporate Financial Test" must provide the information required in R315-309-8(4) or R315-309-9(3) each year.

Other Reports and Information to be Submitted with Annual Report

Ground Water Monitoring: Class I and V landfills only. Check if exempt ☐

Explosive Gas Monitoring: Class I, II and V landfills only. Check if exempt ☐

Does the facility have a landfill gas collection system Yes ☐ No ☐

If yes please briefly describe use of gas, e.g., flared or used for electricity generation.

_____

Training Report: A report of all training programs or procedures completed by facility personnel during the year.

Signature: _____ Date : _____

Signature should be by an executive officer, general partner, proprietor, elected official, or a duly authorized representative. A duly authorized representative must meet the requirements of the solid waste rules (UAC R315-310-2(4)(d)).

Type Name: _____ Title: _____

SW098

LOGAN

Mayor: Randy Watts

RECEIVED
FEB 23 2012
UTAH DIVISION OF
SOLID & HAZARDOUS WASTE
2012.00452

January 31, 2012

Utah Division of Environmental Quality
Division of Solid and Hazardous Waste
P.O. Box 144880
Salt Lake City, UT 84114-4880

Attention: Scott T. Anderson, Director

Subject: Annual Landfill Report 2011

I am pleased to submit the attached Logan City Sanitary Landfill Annual Report. This report contains the completed Solid Waste Facility Annual Report Forms from the Department of Environmental Quality Division of Solid and Hazardous Waste, and additional pertinent information to Logan City Landfill operations.

This report includes the Class I Solid Waste Annual Report Form, the Class IVb Solid Waste Annual Report Form, the Compost Facility Annual Report Form, an Executive Summary, Attachments I – IV and Appendices A and B.

Attachments:

I. Financial Assurance
II. Ground Water Monitoring Report
III. Explosive Gas Monitoring Report
IV. Training Report

Appendices:

A. Tonnage Report
B. Calculations and References

If you have any questions regarding this report, please feel free to call Issa Hamud at (435) 716-9752

Sincerely,

Randy Watts
Mayor

290 North 100 West Logan, Utah 84321 ph: 435.716.9002 fx: 435.716.9003 www.loganutah.org

SOLID WASTE LANDFILL ANNUAL REPORT

For Calendar year 2011

Administrative Information (Please enter all the information requested below)

Facility Name: Logan City Sanitary Landfill

Facility Mailing Address: 450 N 1000 W
(Number & Street, Box and/or Route)

City: Logan Zip Code: 84321

County: Cache Permit Number: 9432R2

Owner

Name: City of Logan Phone No.: (435)716-9000

Owner Mailing Address: 290 N 100 W
(Number & Street, Box and/or Route)

City: Logan State: Utah Zip Code: 84323-1

Contact Name: Issa Hamud Contact Title: Environmental Director

Contact's Mailing Address: 450 N 1000 W

Phone No.: (435)716-9752 Contact's Email Address: issa.hamud@loganutah.org

Operator (Complete this section only if the operator is not an employee of the Owner shown above)

Name: Phone No.:

Owner Mailing Address:
(Number & Street, Box and/or Route)

City: State: Utah Zip Code:

Contact Name: Contact Title:

Contact's Mailing Address:

Phone No.: Contact's Email Address:

Facility Type and Status

- ☐ Class I
- ☐ Class II
- ☐ Class IIIa
- ☐ Class IIIb
- ☐ Class IVa
- ☒ Class IVb
- ☐ Class V
- ☐ Class VI
- ☐ Facility Closed during the year

Date Closed:

Annual Disposal (Tons received at the facility for disposal)

Waste Type	Waste Origin: In-State	Waste Origin: Out-of-State	Total	Measurement: Tons	Measurement: Cubic Yards
Municipal				☐	☐
Industrial				☐	☐
C/D*	24,903.00		24,903.00	☒	☐

*C/D waste includes all waste going to a Class IV or VI landfill cell

Conversion Factor Used

☐ None Used ☒ Site Specific ☐ From Rules List Site Specific Conversion: 0.33 tons per pickup

Recycling

Material Recycled: _____ Reported in Tons ☐ Cubic Yards ☐

Utah Disposal Fee

Disposal fee required to be paid to State Yes ☐ No ☒ (If yes please show fees paid below)

Municipal: _____ Industrial: _____ C/D: _____ Annual: _____

Municipal, Industrial and C/D are fees paid by Commercial Facilities. Annual fee is paid by facilities operated by a municipality

Current Landfill Remaining Capacity

Tons: 374,207.00 Cubic Yards: _____ Acre: _____ Years: _____

Acres Currently Open: 5.00 Acres Currently Closed: _____

Financial Assurance

Current Closure Cost Estimate: $6,916,481.94

Current Post-Closure Cost Estimate: $960,772.69

Current Amount or Balance in Mechanism: $1,645,005.00

(If facility permit has been renewed and if balance does not equal or exceed total for closure and post-closure care please contact the Division)

Current Financial Assurance Mechanism: Government Trust and Investment Fund

(ie. Bond, Trust Fund, Corporate or government Test etc.)

Current Financial Assurance Mechanism Holder: PTIF Account #0871

(ie. Name of Bond Company, Bank etc. Account number)

Financial Assurance: *Each facility must recalculate the cost of closure and post-closure care to account for inflation and design changes each year.* The inflation factor can be found on the Division web page. Facilities that are using a trust account should include a copy of the most recent account statement.

Note Facilities using "Local Government Financial Test" or the "Corporate Financial Test" must provide the information required in R315-309-8(4) or R315-309-9(3) each year.

Other Reports and Information to be Submitted with Annual Report

Ground Water Monitoring: Class I and V landfills only. Check if exempt ☐

Explosive Gas Monitoring: Class I, II and V landfills only. Check if exempt ☐

Does the facility have a landfill gas collection system Yes ☐ No ☒

If yes please briefly describe use of gas, e.g., flared or used for electricity generation.

_____

Training Report: A report of all training programs or procedures completed by facility personnel during the year.

Signature: _____ Date : 1-19-2012

Signature should be by an executive officer, general partner, proprietor, elected official, or a duly authorized representative. A duly authorized representative must meet the requirements of the solid waste rules (UAC R315-310-2(4)(d)).

Type Name: Issa Hamud Title: 1-19-2012

Hansen, Bradshaw, Malmrose & Erickson
A Professional Corporation
CERTIFIED PUBLIC ACCOUNTANTS

559 West 500 South
Bountiful, Utah 84010
801-296-0200
Fax 801-296-1218

E. Lynn Hansen, CPA
Clarke R. Bradshaw, CPA
Gary E. Malmrose, CPA
Edwin L. Erickson, CPA
Michael L. Smith, CPA
Jason L. Tanner, CPA

Robert D. Wood, CPA
Aaron R. Hixson, CPA
Ted C. Gardiner, CPA
Jeffrey B. Miles, CPA

Members of the American Institute of Certified Public Accountants

Members of the Private Company Practice Section

Mayor and City Council
Logan City, Utah

We have performed the procedures enumerated below, which were agreed to by Logan City, Utah ("the City") solely for the information and use of management of the City. This engagement to apply agreed-upon procedures was performed in accordance with standards established by the American Institute of Certified Public Accountants. The sufficiency of the procedures is solely the responsibility of the specified users of the report. Consequently, we make no representation regarding the sufficiency of the procedures described below either for the purpose for which this report has been requested or for any other purpose.

The procedures we performed and our findings are as follows:

1. We confirmed that the City's financial statements were prepared in accordance with Generally Accepted Accounting Principles (GAAP) as of and for the year ended June 30, 2011.

2. We confirmed that the City has not operated at a deficit equal to 5% or more, of the total annual revenue in each of the past two fiscal years (June 30, 2011 and 2010).

3. We confirmed that the City has not received an adverse opinion, disclaimer of opinion, or other qualified opinion on its audited financial statements as of and for the year ended June 30, 2011.

4. We determined that the City's outstanding general obligation bonds are secured or have a rating not lower than Baa as issued by Moody's or BBB as issued by Standard and Poor's at June 30, 2011.

We did not perform an examination on compliance with the above criteria, the objective of which would be an expression of an opinion on compliance with the criteria. Had we performed an examination, other matters may have come to our attention that would have been reported to you.

This report is intended solely for the information and use by management, the Mayor and City Council of Logan City, Utah, and the Utah Department of Environmental Quality and is not intended to be and should not be used by anyone other than these specified parties.

Hansen, Bradshaw, Malmrose & Erickson, P.C.

December 22, 2011

LOGAN
CITY UNITED IN SERVICE
FINANCE DEPARTMENT

January 9, 2012

Doug Taylor, Geologist/Environmental Scientist
Department of Environmental Quality
195 N 1950 W
P.O. Box 144880
Salt Lake City, UT 84114-4880

Dear Mr. Taylor:

I am submitting the following information to meet the financial assurance requirements for closure and post-closure costs at the Logan City Landfill in accordance with the *Utah Solid Waste Permitting and Management Rules* Subsection R315-309-8(4)(a).

Requirement 4(a)(i)

The current cost estimate covered by the financial test is $7,247,477. The cost estimates used during the year ended June 30, 2011 were prepared by the engineering firm of IGES.

Requirement 4(a)(ii)

The requirements of 8(2) are met as follows:

8(2)(a) The City's outstanding general obligation debt is currently rated as Aa2 by Moody's.

8(2)(b) Not applicable.

8(2)(c) Enclosed is a copy of the City of Logan's audited financial statements, which have been prepared in conformity with Generally Accepted Accounting Principles (GAAP).

255 North Main Street Logan, Utah 84321 · ph: 435.716.9180 · fx: 435.716.9189 www.loganutah.org

8(2)(d) Footnote 15 on page 55 of the City's financial statements makes the necessary references to closure and post-closure costs.

The requirements of 8(6) are met as follows:

8(6)(a) The closure and post-closure costs assured by the financial test are below 43% of the City's total annual revenue. The City's total annual revenue for its enterprise and governmental funds for the year ended June 30, 2011 was $98,165,243. Governmental fund revenues can be found on page 26 of the audited financial statements. Enterprise fund revenues can be found on page 30 of the financial statements. The maximum assurance for Logan City at 43% is $42,211,054.

8(6)(b) The City is not assuring any other environmental obligation through a financial test.

If you have any questions about the information provided, please call.

Sincerely,

Richard Anderson CPA, CFE, CGFM, CPFO
Director of Finance
City of Logan

City of Logan
Statement of Net Assets
June 30, 2011

	Governmental Activities	Business-type Activities	Total
ASSETS			
Current assets:			
Cash and cash equivalents	$ 16,144,552	$ 40,742,322	$ 56,886,874
Investments	4,587,260	9,172,963	13,760,223
Accounts receivable (net of allowance)	1,056,623	3,857,055	4,913,678
Property tax receivable	8,074,571	-	8,074,571
Interest receivable	20,687	3,406	24,093
Due from other governmental units	3,160,099	171,683	3,331,782
Prepaid assets	134,925	-	134,925
Inventory	7,539	605,256	612,795
Internal balances	(841,089)	841,089	-
Total current assets	32,345,167	55,393,774	87,738,941
Noncurrent assets:			
Restricted assets:			
Cash and cash equivalents	2,954,461	4,195,331	7,149,792
Deferred costs	194,319	229,560	423,879
Capital assets:			
Land	16,132,316	7,382,935	23,515,251
Buildings	36,850,528	12,670,270	49,520,798
Improvements other than buildings	12,116,050	91,570,795	103,686,845
Equipment	15,172,728	52,060,842	67,233,570
Infrastructure	38,835,447	-	38,835,447
Less accumulated depreciation	(57,558,145)	(64,598,444)	(122,156,589)
Work in progress	705,957	8,245,708	8,951,665
Total noncurrent assets	65,403,661	111,756,997	177,160,658
Total assets	97,748,828	167,150,771	264,899,599
LIABILITIES			
Current liabilities:			
Accrued liabilities	2,820,983	7,146,921	9,967,904
Deferred revenue	8,270,964	787	8,271,751
Compensated absences	1,268,812	565,052	1,833,864
Interest payable	247,496	127,232	374,728
Leases payable	154,244	-	154,244
Notes payable	3,465	-	3,465
Bonds payable	1,872,000	2,903,000	4,775,000
Total current liabilities	14,637,964	10,742,992	25,380,956
Noncurrent liabilities:			
Compensated absences	321,257	162,561	483,818
Leases payable	859,798	-	859,798
Bonds payable	12,838,460	20,733,065	33,571,525
Landfill closure/post-closure costs	-	4,027,215	4,027,215
Total noncurrent liabilities	14,019,515	24,922,841	38,942,356
Total liabilities	28,657,479	35,665,833	64,323,312
NET ASSETS			
Invested in capital assets, net of related debt	46,646,658	83,696,041	130,342,699
Restricted for:			
Debt service	1,039,630	1,397,894	2,437,524
Capital activities	2,766,210	4,049,617	6,815,827
Redevelopment	1,784,259	-	1,784,259
Other	450,795	-	450,795
Unrestricted	16,403,797	42,341,386	58,745,183
Total net assets	69,091,349	131,484,938	200,576,287
Total liabilities and net assets	$ 97,748,828	$ 167,150,771	$ 264,899,599

The accompanying notes are an integral part of this statement.

City of Logan
Balance Sheet
Governmental Funds
June 30, 2011

	General	Redevelopment Agency	Other Governmental Funds	Total Governmental Funds
ASSETS				
Cash and cash equivalents	$ 1,079,449	$ 2,986,415	$ 9,147,333	$ 13,213,197
Investments	4,587,260	-	-	4,587,260
Accounts receivable (net of allowance)	92,575	359,943	604,105	1,056,623
Property tax receivable	2,624,960	3,985,214	1,464,397	8,074,571
Interest receivable	20,687	-	-	20,687
Due from other funds	775,000	-	-	775,000
Due from other governmental units	2,880,485	-	279,614	3,160,099
Prepaid assets	57,925	-	-	57,925
Inventory	7,539	-	-	7,539
Restricted assets:				
Cash and cash equivalents	2,814,838	107	139,516	2,954,461
Total assets	14,940,718	7,331,679	11,634,965	33,907,362
LIABILITIES AND FUND BALANCES				
Liabilities:				
Accrued liabilities	1,668,147	338,236	212,565	2,218,948
Due to other funds	-	865,000	-	865,000
Deferred revenue	2,710,737	4,344,077	2,100,173	9,154,987
Total liabilities	4,378,884	5,547,313	2,312,738	12,238,935
Fund balances:				
Nonspendable	840,464	-	-	840,464
Restricted	4,056,096	1,784,366	200,432	6,040,894
Committed	-	-	9,121,795	9,121,795
Assigned	56,690	-	-	56,690
Unassigned	5,608,584	-	-	5,608,584
Total fund balances	10,561,834	1,784,366	9,322,227	21,668,427
Total liabilities and fund balances	$ 14,940,718	$ 7,331,679	$ 11,634,965	$ 33,907,362

The accompanying notes are an integral part of this statement.

City of Logan
Statement of Activities
For the Year Ended June 30, 2011

Function/Programs	Expenses	Program Revenues: Charges for Services	Program Revenues: Operating Grants and Contributions	Program Revenues: Capital Grants and Contributions	Net Revenues (Expenses) and Changes in Net Assets – Primary Government: Governmental Activities	Net Revenues (Expenses) and Changes in Net Assets – Primary Government: Business-type Activities	Net Revenues (Expenses) and Changes in Net Assets – Primary Government: Total
Primary government:							
Governmental activities:							
General government	$ 4,536,569	$ 1,692,739	$ 16,315	$ -	$ (2,827,515)	$ -	$ (2,827,515)
Public safety	13,410,929	2,695,818	408,127	-	(10,306,984)	-	(10,306,984)
Public works	5,618,065	73,739	1,375,660	437,780	(3,730,886)	-	(3,730,888)
Parks, recreation and culture	6,157,606	904,952	835,864	137,666	(4,279,124)	-	(4,279,124)
Debt service - interest and fiscal charges	722,554	-	-	-	(722,554)	-	(722,554)
Total governmental activities	30,445,723	5,367,248	2,635,966	575,446	(21,867,063)	-	(21,867,063)
Business-type activities:							
Water and sewer	6,479,924	9,415,093	17,040	449,665	-	3,401,874	3,401,874
Sewer treatment	1,683,595	5,959,987	-	-	-	4,276,392	4,276,392
Electric	29,339,903	34,991,678	-	1,586,494	-	7,238,269	7,238,269
Environmental health	8,015,044	10,974,250	-	-	-	2,959,206	2,959,206
Storm water management	595,459	1,208,046	8,310	377,958	-	998,855	998,855
Golf course	910,292	716,924	1,490	-	-	(191,878)	(191,878)
Total business-type activities	47,024,217	63,265,978	26,840	2,414,117	-	18,682,718	18,682,718
Total primary government	$ 77,469,940	$ 68,633,226	$ 2,662,806	$ 2,989,563	(21,867,063)	18,682,718	(3,184,345)
General revenues:							
Property tax					7,659,716	-	7,659,716
Sales tax and other taxes and fees					13,528,685	-	13,528,685
Grants and contributions not restricted to specific programs					966,669	-	966,669
Unrestricted investment earnings					344,296	410,835	755,131
Miscellaneous					710,155	-	710,155
Gain on sale of assets					64,315	-	64,315
Transfers					4,065,544	(4,085,544)	-
Total general revenues and transfers					27,359,380	(3,674,709)	23,684,671
Change in net assets					5,492,317	15,008,009	20,500,326
Net assets, beginning					63,599,032	116,476,929	180,075,961
Net assets, ending					$ 69,091,349	$ 131,484,938	$ 200,576,287

The accompanying notes are an integral part of this statement.

Note 14 – Economic Dependency

Utah State University is a significant customer of the City's enterprise funds. During fiscal year 2011, sales to Utah State University totaled $2,390,747.

Note 15 – Environmental Health Landfill Closure and Post-Closure Costs

The City owns and operates a landfill that manages solid waste for the entire county. State and federal laws require the City to close the landfill when it reaches capacity and to monitor and maintain the site for thirty subsequent years. The City recognizes a portion of these costs in each operating period even though actual payouts will not occur until the landfill is closed. The amount recognized each year is based on the percent landfill capacity used as of the balance sheet date. There are several methodologies used to close a landfill, which result in varying costs and landfill capacities. The following cost estimates are based on the current methodology, which includes a dome-shaped landfill cap.

As of June 30, 2011, the City had incurred a liability of $4,027,215 which represents the cost reported to date based on a 55.6 percent estimate of the landfill capacity used. Closure and post-closure costs were estimated to be $7,247,477 in a 2007 engineering study. The remaining estimated liability is $3,220,262, which will be recognized as the remaining capacity is used (estimated closing date is 2023). The estimated cost of closure and post-closure care is subject to change.

According to state and federal law, the City is required to establish a trust fund with an independent third party to accumulate assets needed for the payout of closure costs. Currently, assets reported as restricted assets totaling $1,645,005 are held for this purpose.

Annually, the City files a financial assurance report for closure and post-closure costs with the Utah Department of Environmental Quality. The Department of Environmental Quality subsequently analyzes the sufficiency of reserve funds to meet future costs.

Note 16 – Redevelopment Agency

In accordance with the Utah State Code, municipalities having established Redevelopment Agencies are required to disclose certain revenues and expenditures associated with the various project areas. The revenues and expenditures associated with the City's redevelopment areas are as follows:

Logan Downtown RDA		
Revenues:		
Tax increment collected	$	225,241
Expenditures:		
Acquisition of property		-
Site improvements		-
Installation of utilities		-
Administrative costs		66,533
Tax increment rebate		12,564
Debt:		
City of Logan		-

CLOSURE COSTS (IMMEDIATE CLOSURE)

Section 1.0 - Engineering — **CLOSURE NOW**

ESTIMATED DATE OF CLOSURE: NOW

APPROXIMATE CLOSURE AREA: 4,100,000

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Topographic Survey	LS	$7,500	1	$7,500
1.2	Boundary Survey for Closure	NA			
1.3	Site Evaluation	LS	$2,500	1	$2,500
1.4	Development of Plans	LS	$25,000	1	$25,000
1.5	Contract Administration - (Additional Assist)	LS	$7,500	1	$7,500
1.6	(Construction of Final Cover and Closure Plans)	LS	$10,000	1	$10,000
1.7	Project Management - (Construction Observation and Testing)	LS	$40,000	1	$40,000
1.8	Monitor Well Consultant Cost	NA			$0
1.9	Other Environmental Permit Co	NA			$0
			Engineering Subtotal		$92,500

Section 2.0 - Construction — **CLOSURE NOW**

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	Final Cover System				
2.1.1	*Site Preparation/Site Restoration*	ACRE	$1,500	94.1	$141,195
2.1.2	*Gas Collection Layer/Vent*	NA			$0
2.1.3	*Low-permeability Layer (Soil - if Available)*				
a	Soil Purchase	NA			$0
b	Soil Processing (Soil)	CY	$1.00	227,778	$227,778
c	Soil Transportation	CY	$2.00	227,778	$455,556
d	Soil Placement	CY	$1.00	227,778	$227,778
e	Soil Amendment (compost)	CY	$7.00	227,778	$1,594,446
2.1.4	*Low-permeability Layer (Synthetic - if Applicable)*				
a	Geonetic	NA			$0
b	GCL	NA			$0
c	Geomembrane	NA			$0
2.1.5	*Drainage Layer (Soil - if Applicable)*				
a	Geonetic	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	*Drainage Layer (Synthetic - if Applicable)*				
a	Geonetic	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	*Erosion Protective Soil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (Soil)	CY	$1.00	227,778	$227,778
c	Soil Transportation	CY	$2.00	227,778	$455,556
d	Soil Placement	CY	$1.00	227,778	$227,778
e	Soil Amendment (Compost)	CY			$0
2.1.8	*Topsoil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (Soil)	CY	$1.00	75,926	$75,926
c	Soil Transportation	CY	$2.00	75,926	$151,852
d	Soil Placement	CY	$1.00	75,926	$75,926
e	Soil Amendment	NA			$0
2.1.9	*Revegetation*				
a	Seeding	ACRE	$1,200	94.1	$112,948
b	Fertilizing	ACRE	$500	94.1	$47,067
c	Mulch	ACRE	$200	94.1	$18,827
d	Tackifier	ACRE	$200	94.1	$18,827
2.2	Stormwater Protection Structures				
a	Culverts	EA	$1,500	6	$9,000
b	Flume	NA	$2,400	5	$12,000
c	Ditches/Berms	FT	$12,000	5	$60,000
d	Detention Basins	NA			$0
2.3	Gas Collection System				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.4	Leachate Collection System				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	Groundwater Monitoring System				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	Site Security				
a	Lighting, Signs, Etc.	NA			$0
b	Fencing and Gates	NA			$0
2.7	Miscellaneous				
a	Performance Bonds	LS	$10,000	1	$10,000
b	Closure/Legal Fees	LS	$5,000	1	$5,000
			Construction Subtotal		$4,155,213

LS - LUMP SUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET

Total	$4,247,713
10% Contingency	$424,771
Estimated Closure Cost	$4,672,485

CLOSURE COSTS (PHASE I & PHASE II)

Section 1.0 - Engineering

PHASE I

ESTIMATED DATE OF CLOSURE = 2010

APPROXIMATE CLOSURE AREA = 936,000

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Topographic Survey	LS	$5,000	1	$5,000
1.2	Boundary Survey for Closure	NA			
1.3	Site Evaluation	LS	$2,500	1	$2,500
1.4	Development of Plans	LS	$15,000	1	$15,000
1.5	Contract Administration - (Bidding and Award)	LA	$7,500	1	$7,500
1.6	Administrative Costs - (Certification of Final Cover and Closure Notice)	LS	$7,500	1	$7,500
1.7	Project Management - (Construction Observation and Testing)	LS	$25,000	1	$25,000
1.8	Monitor Well Consultant Cost	NA			$0
1.9	Other Environmental Permit Costs	NA			$0
				Engineering Subtotal	$62,500

PHASE II

ESTIMATED DATE OF CLOSURE = 2015

APPROXIMATE CLOSURE AREA = 1,134,000

Unit Measure	Cost/Unit	No. Units	Total Cost
LS	$5,000	1	$5,000
NA			
LS	$2,500	1	$2,500
LS	$15,000	1	$15,000
LA	$7,500	1	$7,500
LS	$7,500	1	$7,500
LS	$25,000	1	$25,000
NA			$0
NA			$0
		Engineering Subtotal	62500

Section 2.0 - Construction

PHASE I

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	Final Cover System				
2.1.1	*Site Preparation/ Site Recontour*	ACRE	$1,500	21.5	$33,233
2.1.2	*Gas Collection Layer/Vents*	NA			$0
2.1.3	*Low permeability Layer (Soil - If Applicable)*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	52,000	$52,000
c	Soil Transportation	CY	$2.00	52,000	$104,000
d	Soil Placement	CY	$1.00	52,000	$52,000
e	Soil Amendment (compact)	CY	$7.00	52,000	$364,000
2.1.4	*Low permeability Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	GCL	NA			$0
c	Geomembrane (HDPE/PVC/LLDPE, etc...)	NA			$0
2.1.5	*Drainage Layer (Soil - If Applicable)*				
a	Geotextile	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	*Drainage Layer (Synthetic - If Applicable)*				
a	Geotextile	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	*Erosion Protection Soil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	30,000	$30,000
c	Soil Transportation	CY	$2.00	52,000	$104,000
d	Soil Placement	CY	$1.00	52,000	$52,000
e	Soil Amendment (compact)	CY			$0
2.1.8	*Topsoil Layer*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	17,333	$17,333
c	Soil Transportation	CY	$2.00	17,333	$34,667
d	Soil Placement	CY	$1.00	17,333	$17,333
e	Soil Amendment	NA			$0
2.1.9	*Revegetation*				
a	Seeding	ACRE	$1,200	21.5	$25,785
b	Fertilizing	ACRE	$500	21.5	$10,744
c	Mulch	ACRE	$200	21.5	$4,298
d	Tackifier	ACRE	$200	21.5	$4,298
2.2	Stormwater Protection Structures				
a	Culverts	EA	1,500	3	$4,500
b	Pipes	NA	400	5	$2,000
c	Ditches/Berms	FT	2,500	5	$12,500
d	Detention Basins	NA			$0
2.3	Gas Collection System				
a	Design	NA			
b	Additional Equipment / Installation	NA			
2.4	Leachate Collection System				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	Groundwater Monitoring System				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	Site Security				
a	Lighting, signs, etc...	NA			$0
b	Fencing and Gates	NA			$0
2.7	Miscellaneous				
a	Performance Bonds	LS	$10,000	1	$10,000
b	Contract/Legal fees	LS	$5,000	1	$5,000
				Construction Subtotal	$960,499

PHASE II

Unit Measure	Cost/Unit	No. Units	Total Cost
ACRE	$1,500	26.0	$39,050
NA			$0
NA			$0
CY	$1.00	63,000	$63,000
CY	$2.00	63,000	$126,000
CY	$1.00	63,000	$63,000
CY	$7.00	63,000	$441,000
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
CY	$1.00	63,000	$63,000
CY	$2.00	63,000	$126,000
CY	$1.00	63,000	$63,000
CY			$0
NA			$0
CY	$1.00	21,000	$21,000
CY	$2.00	21,000	$42,000
CY	$1.00	21,000	$21,000
NA			$0
ACRE	$1,200	26.0	$31,240
ACRE	$500	26.0	$13,013
ACRE	$200	26.0	$5,207
ACRE	$200	26.0	$5,207
EA	$1,500	1	$1,500
NA	$1,100	10	$11,000
FT	$4,000	5	$20,000
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
NA			$0
LS	$10,000	1	$10,000
LS	$5,000	1	$5,000
		Construction Subtotal	$1,130,219

LS - LUMPSUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET

	Total	$1,023,184
	10% Contingency	$102,318
	Subtotal Closure Cost	$1,125,502
Inflation Factor	1.1040	
	Inflated Closure Cost (3% inflation)	$1,242,560

	Total	$1,232,719
	10% Contingency	$123,272
	Subtotal Closure Cost	$1,355,991
Inflation Factor	1.3458	
	Inflated Closure Cost (3% inflation)	$1,824,893

CLOSURE COSTS (PHASE III & PHASE IV)

Section 1.0 - Engineering

		PHASE III				PHASE IV			
		ESTIMATED DATE OF CLOSURE =		2024		ESTIMATED DATE OF CLOSURE =		2034	
		APPROXIMATE CLOSURE AREA =		1,510,000		APPROXIMATE CLOSURE AREA =		612,000	
Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Topographic Survey	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000
1.2	Boundary Survey for Closure	NA				LS	$2,500	1	$2,500
1.3	Site Evaluation	LS	$2,500	1	$2,500	LS	$2,500	1	$2,500
1.4	Development of Plans	LS	$15,000	1	$15,000	LS	$15,000	1	$15,000
1.5	Contract Administration - (Bidding and Award)	LS	$7,500	1	$7,500	LS	$7,500	1	$7,500
1.6	Administrative Costs - (Certification of Final Cover and Closure Notice)	LS	$7,500	1	$7,500	LS	$7,500	1	$7,500
1.7	Project Management - (Construction Observation and Testing)	LS	$25,000	1	$25,000	LS	$25,000	1	$25,000
1.8	Monitor Well Consultant Cost	NA			$0	NA			$0
1.9	Other Environmental Permit Costs	NA			$0	NA			$0
				Engineering Subtotal	67,500			Engineering Subtotal	70,000

Section 2.0 - Construction

		PHASE III				PHASE IV			
Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	Final Cover System								
2.1.1	Site Preparation/ Site Restoration	ACRE	$1,000	27.8	$27,778	ACRE	$1,000	14.2	$14,164
2.1.2	Soil Cultivation Layer/Plows	NA			$0	NA			$0
2.1.3	Low permeability Layer (Soil - If Applicable)								
a	Soil Purchase	NA			$0	NA			$0
b	Soil Processing (Soil)	CY	$1.00	67,222	$67,222	CY	$1.00	34,278	$34,278
c	Soil Transportation	CY	$2.00	67,222	$134,444	CY	$2.00	34,278	$68,556
d	Soil Placement	CY	$1.00	67,222	$67,222	CY	$1.00	34,278	$34,278
e	Soil Amendment	CY	$7.00	67,222	$470,556	CY	$7.00	34,278	$239,945
2.1.4	Low permeability Layer (Synthetic - If Applicable)								
a	Geotextile	NA			$0	NA			$0
b	GCL	NA			$0	NA			$0
c	Geomembrane (HDPE/LLDPE/LLDPE, ...)	NA			$0	NA			$0
2.1.5	Drainage Layer (Soil - If Applicable)								
a	Geocomp	NA			$0	NA			$0
b	Sand/Gravel	NA			$0	NA			$0
2.1.6	Drainage Layer (Synthetic - If Applicable)								
a	Geotextile	NA			$0	NA			$0
b	Geonet/Geocomposite	NA			$0	NA			$0
2.1.7	Erosion Protection Soil Layer								
a	Soil Purchase	NA			$0	NA			$0
b	Soil Processing (Soil)	CY	$1.00	67,222	$67,222	CY	$1.00	34,278	$34,278
c	Soil Transportation	CY	$2.00	67,222	$134,444	CY	$2.00	34,278	$68,556
d	Soil Placement	CY	$1.00	67,222	$67,222	CY	$1.00	34,278	$34,278
e	Soil Amendment	CY			$0	CY			$0
2.1.8	Topsoil Layer								
a	Soil Purchase	NA			$0	NA			$0
b	Soil Processing (Soil)	CY	$1.00	22,407	$22,407	CY	$1.00	11,426	$11,426
c	Soil Transportation	CY	$2.00	22,407	$44,815	CY	$2.00	11,426	$22,852
d	Soil Placement	CY	$1.00	22,407	$22,407	CY	$1.00	11,426	$11,426
e	Soil Amendment	NA			$0	NA			$0
2.1.9	Revegetation								
a	Seeding	ACRE	$1,200	27.8	$33,333	ACRE	$1,200	14.2	$16,997
b	Fertilizing	ACRE	$550	27.8	$15,889	ACRE	$550	14.2	$7,982
c	Mulch	ACRE	$200	27.8	$5,556	ACRE	$200	14.2	$2,833
d	Tackifier	ACRE	$200	27.8	$5,556	ACRE	$200	14.2	$2,833
2.2	Stormwater Protection Structures								
a	Culvert	EA	$1,500	1	$1,500	EA			$0
b	Pipes	NA	$950	10	$9,500	NA			$0
c	Ditches/Berms	FT	$3,500	5	$17,500	FT	$2,000	5	$10,000
d	Detention Basins	NA			$0	NA			$0
2.3	Gas Collection System								
a	Design	NA			$0	NA			$0
b	Additional Equipment / Installation	NA			$0	NA			$0
2.4	Leachate Collection System								
a	Design	NA			$0	NA			$0
b	Additional Equipment / Installation	NA			$0	NA			$0
2.5	Groundwater Monitoring System								
a	Monitor Well Installation	NA			$0	NA			$0
b	Monitor Well Abandonment	NA			$0	NA			$0
2.6	Site Security								
a	Lighting, signs, etc.	NA			$0	NA			$0
b	Fencing and Gates	NA			$0	NA			$0
2.7	Miscellaneous								
a	Performance Bonds	LS	$10,000	1	$10,000	LS	$10,000	1	$10,000
b	Contractor's Fee	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000
				Construction Subtotal	$1,227,074			Construction Subtotal	$570,780
				Total	$1,289,574			Total	$640,780
				10% Contingency	$128,957			10% Contingency	$64,078
				Subtotal Closure Cost	$1,418,531			Subtotal Closure Cost	$704,858
			Inflation Factor	1.4899			Inflation Factor	1.3459	
			Inflated Closure Cost (3% inflation)		$2,107,734		Inflated Closure Cost (3% inflation)		$1,180,264

POST-CLOSURE COSTS (30 YEARS)

Section 1.0 - Engineering

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Post-Closure Plan	LS	$5,000	1	$5,000
1.2	Annual Report (including results from gas, leachate, and ground water sampling - details of maintenance performed)	LS	$5,000	30	$150,000
a	Semiannual Site Inspections	LS	$400	60	$24,000
b	Plan Update	LS	$200	30	$6,000
				Engineering Subtotal	$185,000

Section 2.0 - Gas Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	Sample Collection	LS	$250	60	$15,000
2.2	Sample Analysis	NA			$0
2.3	Report (Part of Annual Report)				
				Gas Collection System - Sampling Subtotal	$15,000

Section 3.0 - Leachate Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	Sample Collection	NA			$0
2.2	Sample Analysis	NA			$0
2.3	Report (Part of Annual Report)				
				Leachate Collection System - Sampling Subtotal	$0

Section 4.0 - Ground Water Monitoring System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
3.1	Sample Collection	LS	$965	60	$57,900
3.2	Sample Analysis	LS	$7,000	60	$420,000
3.3	Report (Part of Annual Report)				
				Ground Water Collection System - Sampling Subtotal	$477,800

Section 5.0 - Facility Operations and Maintenance

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
4.1	Cover				
a	Soil Replacement	LS	$1,000	30	$30,000
b	Vegetation/Reseeding	LS	$500	30	$15,000
4.2	Storm Water Protection Structures				
a	Ditch and Culvert Maintenance	LS	$500	30	$15,000
b	Berm and Basin Maintenance	LS	$500	30	$15,000
4.3	Gas Collection System				
a	System Operation	NA		30	$0
b	System Repair	LS	$200	30	$6,000
4.4	Leachate Collection System				
a	System Operation	NA		30	$0
b	System Repair	NA		30	$0
4.5	Ground Water Monitoring System				
a	System Operation	NA		30	$0
b	System Repair	LS	$500	30	$15,000
4.6	Site Security				
a	Lighting, signs, etc.	LS	$500	30	$15,000
b	Fencing and Gates	LS	$500	30	$15,000
4.7	Miscellaneous				
a					
b					
				Facility Operations and Maintenance Subtotal	$126,000

Total	$803,600
10% Contingency	$80,360
Total Post-Closure Cost	$883,960

Appendix D

Logan
UTAH

FIVE-YEAR SOLID WASTE MANAGEMENT MASTER PLAN

SUBMITTED BY:

LBA ASSOCIATES
532 Clarkson St.
Denver, CO 80218

In Conjunction With:
ANN ZIMMERMAN ASSOCIATES – Heber City, UT
HDR ENGINEERING, INC. – Salt Lake City, UT
BRAD MERTZ – Springville. UT

JANUARY 28, 2005

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Appendix I	Public Outreach Program

AVG	Average
CA	Collection / Administrative
CAC	Citizens Advisory Committee
C&D	Construction and demolition
CESQG	Conditionally-exempt small quantity generator
CSA	County Service Area
CY	Cubic yard
DOT	U.S. Department of Transportation
EMP	Employee
FY	Fiscal year
GW	Green waste
HH	Household
HHW	Household hazardous waste
LBS	Pounds
LF	Landfill
M	Million
MCL	Mercury-containing lamp
MRF	Materials recovery facility
MFU	Multi-family units
MSW	Municipal solid waste
MTH	Month
MUA	Modified Urban Area
NA	Not available
NAIC	National Association of Industry Codes
OCC	Old corrugated cardboard
OMG	Old magazines
ONP	Old newspaper
POR	Public Outreach
SFU	Single-family units
SPRA	Southwest Public Recycling Association
SWAB	Solid Waste Advisory Board
SWMP	Solid Waste Management Plan
TC	Technical Committee
TPD	Tons per day
UBC	Used beverage container
UDEQ	Utah Department of Quality
USU	Utah State University
WK	Week
WR	Waste reduction
YR	Year

Appendix E

ANNUAL FACILITY INSPECTION CHECKLIST- 4,000 GAL

This inspection record must be completed each year. If any response requires further elaboration, provide comments in Description & Comments space provided. Further description and comments, if necessary, must be provided on a separate sheet of paper and attached to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	4,000 gallon Tank	Y*	N	Description & Comments
Fuel Storage tanks (4,000 gallon)				
Tank surfaces show signs of leakage				
Tank is damaged, rusted or deteriorated				
Bolts, rivets or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Damage to the bollards				
Filling point spill is in place				
Exterior piping/mounting is damaged				
Pump mounting and operation is damaged				
Tank sentinel operation is damaged				
Interior piping mount is damaged				
Filler nozzles and hoses are leaking				
Shutoff valve is out of order				
Fuel meter is not working				
Filter system is damaged				
Other leaks at any location (Describe)				
Oil Tanks				
Waste oil tank is leaking				
New oil tank is leaking				
ATF tank is leaking				
All piping /Mounting is leaking				
Dispensers in the shop is leaking				
Pump mounting and operation is leaking				
Other leaks at any location (Describe)				
Lube Room				
Any leaks at any location (Describe)				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are not locked (and not in use)				
Response Equipment				
Response equipment inventory is incomplete				

Date:_____ Signature_____

ANNUAL FACILITY INSPECTION CHECKLIST- 2,000 GAL

This inspection record must be completed each year. If any response requires further elaboration, provide comments in Description & Comments space provided. Further description and comments, if necessary, must be provided on a separate sheet of paper and attached to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	2,000 gallon Tank	Y*	N	Description & Comments
Fuel Storage tanks (2,000 gallon)				
Tank surfaces show signs of leakage				
Tank is damaged, rusted or deteriorated				
Bolts, rivets or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Damage to the bollards				
Filling point spill is in place				
Exterior piping/mounting is damaged				
Pump mounting and operation is damaged				
Tank sentinel operation is damaged				
Interior piping mount is damaged				
Filler nozzles and hoses are leaking				
Shutoff valve is out of order				
Fuel meter is not working				
Filter system is damaged				
Other leaks at any location (Describe)				
Oil Tanks				
Waste oil tank is leaking				
New oil tank is leaking				
ATF tank is leaking				
All piping /Mounting is leaking				
Dispensers in the shop is leaking				
Pump mounting and operation is leaking				
Other leaks at any location (Describe)				
Lube Room				
Any leaks at any location (Describe)				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are not locked (and not in use)				
Response Equipment				
Response equipment inventory is incomplete				

Date:_____ Signature_____

ANNUAL FACILITY INSPECTION CHECKLIST- WHITE 500 GAL

This inspection record must be completed each year. If any response requires further elaboration, provide comments in Description & Comments space provided. Further description and comments, if necessary, must be provided on a separate sheet of paper and attached to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	500 gallon Tank	Y*	N	Description & Comments
Fuel Storage tanks (500 gallon)				
Tank surfaces show signs of leakage				
Tank is damaged, rusted or deteriorated				
Bolts, rivets or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Damage to the bollards				
Filling point spill is in place				
Exterior piping/mounting is damaged				
Pump mounting and operation is damaged				
Tank sentinel operation is damaged				
Interior piping mount is damaged				
Filler nozzles and hoses are leaking				
Shutoff valve is out of order				
Fuel meter is not working				
Filter system is damaged				
Other leaks at any location (Describe)				
Oil Tanks				
Waste oil tank is leaking				
New oil tank is leaking				
ATF tank is leaking				
All piping /Mounting is leaking				
Dispensers in the shop is leaking				
Pump mounting and operation is leaking				
Other leaks at any location (Describe)				
Lube Room				
Any leaks at any location (Describe)				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are not locked (and not in use)				
Response Equipment				
Response equipment inventory is incomplete				

Date:_____ Signature_____

ANNUAL FACILITY INSPECTION CHECKLIST- RED 500 GAL

This inspection record must be completed each year. If any response requires further elaboration, provide comments in Description & Comments space provided. Further description and comments, if necessary, must be provided on a separate sheet of paper and attached to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	500 gallon Tank	Y*	N	Description & Comments
Fuel Storage tanks (300 gallon)				
Tank surfaces show signs of leakage				
Tank is damaged, rusted or deteriorated				
Bolts, rivets or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Damage to the bollards				
Filling point spill is in place				
Exterior piping/mounting is damaged				
Pump mounting and operation is damaged				
Tank sentinel operation is damaged				
Interior piping mount is damaged				
Filler nozzles and hoses are leaking				
Shutoff valve is out of order				
Fuel meter is not working				
Filter system is damaged				
Other leaks at any location (Describe)				
Oil Tanks				
Waste oil tank is leaking				
New oil tank is leaking				
ATF tank is leaking				
All piping /Mounting is leaking				
Dispensers in the shop is leaking				
Pump mounting and operation is leaking				
Other leaks at any location (Describe)				
Lube Room				
Any leaks at any location (Describe)				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are not locked (and not in use)				
Response Equipment				
Response equipment inventory is incomplete				

Date:_____ Signature_____

MONTHLY INSPECTION CHECKLIST- 4,000 GAL

This inspection record must be completed each month except the month in which an annual inspection is performed. Provide further description and comments, if necessary, on a separate sheet of paper and attach to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	4,000 gallon Tank	Y*	N	Description & Comments
Storage Tanks				
Tank surfaces show signs of leakage				
Tanks are damaged, rusted or deteriorated				
Bolts, rivets, or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Secondary containment is damaged or stained				
Water/product in interstice of double-walled tank				
Dike drainage valve is open or is not locked				
Piping				
Valve seals, gaskets, or other appurtenances are leaking				
Pipelines or supports are damaged or deteriorated				
Joints, valves and other appurtenances are leaking				
Buried piping is exposed				
Loading/unloading and Transfer Equipment				
Loading/unloading rack is damaged or deteriorated				
Connections are not capped or blank-flanged				
Secondary containment is damaged or stained				
Berm drainage valve is open or is not locked				
Oil/water separator				
Oil/water separator > 2 inches of accumulated oil				
Oil/water separator effluent has a sheen				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are locked if not in use				
Response Equipment				
Response equipment inventory is complete				

Date: _____ Signature: _____

MONTHLY INSPECTION CHECKLIST- 2,000 GAL

This inspection record must be completed each month except the month in which an annual inspection is performed. Provide further description and comments, if necessary, on a separate sheet of paper and attach to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	2,000 gallon Tank	Y*	N	Description & Comments
Storage Tanks				
Tank surfaces show signs of leakage				
Tanks are damaged, rusted or deteriorated				
Bolts, rivets, or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Secondary containment is damaged or stained				
Water/product in interstice of double-walled tank				
Dike drainage valve is open or is not locked				
Piping				
Valve seals, gaskets, or other appurtenances are leaking				
Pipelines or supports are damaged or deteriorated				
Joints, valves and other appurtenances are leaking				
Buried piping is exposed				
Loading/unloading and Transfer Equipment				
Loading/unloading rack is damaged or deteriorated				
Connections are not capped or blank-flanged				
Secondary containment is damaged or stained				
Berm drainage valve is open or is not locked				
Oil/water separator				
Oil/water separator > 2 inches of accumulated oil				
Oil/water separator effluent has a sheen				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are locked if not in use				
Response Equipment				
Response equipment inventory is complete				

Date: _____ Signature: _____

MONTHLY INSPECTION CHECKLIST- WHITE 500 GAL

This inspection record must be completed each month except the month in which an annual inspection is performed. Provide further description and comments, if necessary, on a separate sheet of paper and attach to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	500 gallon Tank	Y*	N	Description & Comments
Storage Tanks				
Tank surfaces show signs of leakage				
Tanks are damaged, rusted or deteriorated				
Bolts, rivets, or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Secondary containment is damaged or stained				
Water/product in interstice of double-walled tank				
Dike drainage valve is open or is not locked				
Piping				
Valve seals, gaskets, or other appurtenances are leaking				
Pipelines or supports are damaged or deteriorated				
Joints, valves and other appurtenances are leaking				
Buried piping is exposed				
Loading/unloading and Transfer Equipment				
Loading/unloading rack is damaged or deteriorated				
Connections are not capped or blank-flanged				
Secondary containment is damaged or stained				
Berm drainage valve is open or is not locked				
Oil/water separator				
Oil/water separator > 2 inches of accumulated oil				
Oil/water separator effluent has a sheen				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are locked if not in use				
Response Equipment				
Response equipment inventory is complete				

Date: _____ Signature: _____

MONTHLY INSPECTION CHECKLIST- RED 500 GAL

This inspection record must be completed each month except the month in which an annual inspection is performed. Provide further description and comments, if necessary, on a separate sheet of paper and attach to this sheet. Any item that receives "yes" as an answer must be described and addressed immediately.

	500 gallon Tank	Y*	N	Description & Comments
Storage Tanks				
Tank surfaces show signs of leakage				
Tanks are damaged, rusted or deteriorated				
Bolts, rivets, or seams are damaged				
Tank supports are deteriorated or buckled				
Tank foundations have eroded or settled				
Level gauges or alarms are inoperative				
Vents are obstructed				
Secondary containment is damaged or stained				
Water/product in interstice of double-walled tank				
Dike drainage valve is open or is not locked				
Piping				
Valve seals, gaskets, or other appurtenances are leaking				
Pipelines or supports are damaged or deteriorated				
Joints, valves and other appurtenances are leaking				
Buried piping is exposed				
Loading/unloading and Transfer Equipment				
Loading/unloading rack is damaged or deteriorated				
Connections are not capped or blank-flanged				
Secondary containment is damaged or stained				
Berm drainage valve is open or is not locked				
Oil/water separator				
Oil/water separator > 2 inches of accumulated oil				
Oil/water separator effluent has a sheen				
Security				
Fencing, gates, or lighting is non-functional				
Pumps and valves are locked if not in use				
Response Equipment				
Response equipment inventory is complete				

Date: _____ Signature: _____

APPENDIX H: DIKE DRAINAGE LOG

Date	Bypass valve closed	Rainwater inspected	Bypass valve closed after draining	Observations/Actions	Signature of Inspector
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		

ANNUAL REMINDERS:

Hold SPCC Briefing for all oil-handling personnel (and update briefing log in the Plan);
Check contact information for key employees and response/cleanup contractors and update them in the Plan as needed;

Additional Remarks:

Date: _____ Signature: _____

APPENDIX F: DISCHARGE NOTIFICATION FORM

Part A: Discharge Information	
General information when reporting a spill to outside authorities: Name: Logan City Landfill Address: 100 N 1400 W Logan, Utah 84321 435-716-9750 Type: Municipal Landfill Owner/Operator: City of Logan 100 N 1400 W Logan, Utah 84321 435-716-9750 Primary Contact: Carl Francis, Landfill Manager Work: 435-716-9791 Cell (24 hours): 435-232-5970	
Type of oil:	Discharge Date and Time:
Quantity released:	Discovery Date and Time:
Quantity released to a water body:	Discharge Duration:
Location/Source:	
Actions taken to stop, remove, and mitigate impacts of the discharge:	
Affected media: ____air ____water ____soil	____ storm water sewer/POTW ____ dike/berm/oil-water separator ____ other: _____
Notification person:	Telephone contact: Business: 24-hr:
Nature of discharges, environmental/health effects, and damages:	

Injuries, fatalities or evacuation required?		
Part B: Notification Checklist		
	Date and time	Name of person receiving call
Discharge in any amount		
Carl Francis, Plant Operation Manager Response Coordinator Work: 435-716-9791 Cell (24 hours): 435-232-5970		
Discharge in amount exceeding 10 gallons and *not affecting a water body or groundwater*		
Local Fire Department Fire Chief: (435-716-9510) or 911		
Utah Department of Environmental Quality 801-536-4123		
Discharge in any amount and affecting (or threatening to affect) a water body		
Local Fire Department Fire Chief: 435-716-9510 or 911		
Utah Department of Environmental Quality 801-536-4123		
National Response Center (800) 424-8802		
Logan City Environmental Department 435-716-9755		
Contractor		

* The POTW should be notified of a discharge only if oil has reached or threatens sewer drains that connect to the POTW collection system.

APPENDIX J: AGENCY NOTIFICATION STANDARD REPORT

Information contained in this report, and any supporting documentation, must be submitted to the EPA Region 1 Regional Administrator, and to Utah DEQ, within 60 days of the qualifying discharge incident.

Facility:	Logan City Landfill
Owner/operator:	City of Logan 450 N 1000 W Logan, Utah 84321 435-716-9752
Name of person filing report:	
Location:	
Maximum storage capacity:	*12,700 gallons*
Daily throughput:	

Nature of qualifying incident(s):

_____Discharge to navigable waters or adjoining shorelines exceeding 1,000 gallons
_____Second discharge exceeding 42 gallons within a 12-month period.

Description of facility (attach maps, flow diagrams, and topographical maps):

City of Logan. (City of Logan) is a Municipal Landfill servicing Cache County, Utah.

City of Logan's Logan facility is located at 100 N 1400 W, Logan, Utah, and covers approximately 90 acres. Access to the facility is from the 200 North roadway. The facility is completely fenced

The primary fuel storage tank in this facility is the 4,000-gallon tank located in the North Side of the facility. This tank is a double-walled aboveground storage tank (AST). The tank is in a secondary containment system, which is made of lined concrete. The secondary containment system is lined and has the following dimensions: 14 feet long, 8 feet deep, round tank.

The fuel storage system is manually operated and is not manned on a regular basis. Fuel is delivered to the facility by Thomas Petroleum on an as-needed basis. Fuel is also dispensed to the equipment on an as-needed basis.

Agency Notification Standard Report (cont'd)
Cause of the discharge(s), including a failure analysis of the system and subsystems in which the failure occurred:
Corrective actions and countermeasures taken, including a description of equipment repairs and replacements:
Additional preventive measures taken or contemplated to minimize possibility of recurrence:
Other pertinent information:

APPENDIX D: RECORD OF ANNUAL DISCHARGE PREVENTION BRIEFINGS AND TRAINING

Briefings will be scheduled and conducted by the facility owner or operator for operating personnel at regular intervals to ensure adequate understanding of this SPCC Plan. The briefings will also highlight and describe known discharge events or failures, malfunctioning components, and recently implemented precautionary measures and best practices. Personnel will also be instructed in operation and maintenance of equipment to prevent the discharge of oil, and in applicable pollution laws, rules, and regulations. Facility operators and other personnel will have an opportunity during the briefings to share recommendations concerning health, safety, and environmental issues encountered during facility operations.

Date	Subjects Covered	Employees in Attendance	Instructor(s)

Logan City Landfill Daily Operating Record

Page ____of____

Monday July5, 2010

Load and Quantity Summary

Class I Landfill (Municipal Solid Waste)

Waste Code	Waste Description	Loads	Tons
AB	ANIMAL BYPRODUCT	0	0
CCD	CONTAMINATED C AND D	0	0
COW	COWS THAT BYPRODUCTS BRING IN	0	0
CW	COMMERCIAL WASTE	0	0
CWC	COMMERCIAL WASTE(CITY)	0	0
CWS	COMMERCIAL WASTE	0	0
DAF	DEAD ANIMALS (PER TON)	0	0
DAS	DEAD ANIMAL SMALL (NO CHARGE)	0	0
HW	HOUSEHOLD WASTE	0	0
HWC	HOUSEHOLD WASTE NO CHARGE	0	0
HWS	HOUSEHOLD WASTE	0	0
IW1	INFECTIOUS WASTE UNDER 1/2 YAR	0	0
IW2	INFECTIOUS WASTE OVER 1/2 YARD	0	0
	Total:	0	0

Class IVb Landfill (Construction and Demolition Waste)

Waste Code	Waste Description	Loads	Tons
CC	COMMUNITY CLEAN UP(PER TON)	0	0
CCS	COMUNITY CLEAN UP	0	0
CD	CONSTRUCTION DEBRIS	0	0
CDC	CONSTRUCTION DEBRIS(CITY)	0	0
CDS	CONSTRUCTION DEBRIS	0	0
CGW	CONTAMINATED GREENWASTE	0	0
CN	CONCRETE	0	0
CNC	CONCRETE(CTIY)	0	0
CNS	CONCRETE	0	0
GL	GLASS drop-off Recycling	0	0
GWH	GW HSHLD GARB.**ADD CONTAINER#	0	0
SCU	SPRING CLEAN-UP	0	0
ST	STUMPS AND ROOT BALLS	0	0
STC	Stumps and Rootballs from CITY	0	0
	Total:	0	0

Cover Material

Waste Code	Waste Description	Loads	Tons
CF	CLEAN FILL	0	0
CM	COVER MATERIAL	0	0
CMC	COVER MATERIAL(CITY)	0	0
CMS	COVER MATERIAL	0	0
CS	CONTAMINATED SOIL	0	0
	Total:	0	0

Road Building Material

Waste Code	Waste Description	Loads	Tons
AS	ASPHALT	0	0
ASC	ASPHALT(CITY)	0	0
	Total:	0	0

Asbestos Cell

Waste Code	Waste Description	Loads	Tons
AA	ASBESTOS	0	0
	Total:	0	0

Load and Quantity Summary - Continued

Green Waste Facility (Receiving)

Waste Code	Waste Description	Loads	Tons
CBS	GREENWASTE (CURBSIDE PICKUP)	0	0
GW	GREENWASTE	0	0
GWC	green waste city (ton)	0	0
GWF	GREENWASTE FIRE WOOD	0	0
GWS	GREENWASTE	0	0
LOG	FIREWOOD DROPPED OFF (PER TON)	0	0
PA	PALLETS	0	0
PAS	PALLETS	0	0
XTC	CHRISTMAS TREES (CITY)	0	0
XTD	EVERGREEN CHIPS DONATION	0	0
	Total:	0	0

Green Waste Facility (Departing)

Waste Code	Waste Description	Loads	Yards
CP	COMPOST	0	0
CPC	COMPOST FOR CITY	0	0
CPD	COMPOST, DONATION	0	0
FPD	PALLET CHIPS, DONATION	0	0
FPL	FINE PALLET CHIPS	0	0
MD	MEDIUM WOOD CHIPS	0	0
MDC	MEDIUM WOOD CHIPS FOR CITY	0	0
MDD	MEDIUM WOOD CHIPS, DONATION	0	0
PM	PREMIUM (MULCH)	0	0
PMC	PREMIUM MULCH FOR CITY	0	0
PMD	PREMIUM WOOD CHIPS, DONATION	0	0
SHD	SHREDDED TREE DONATION	0	0
SHT	COARSE SHREDDED TREES	0	0
XT	CHRISTMAS TREE CHIPS	0	0
XTD	EVERGREEN CHIP DONATION	0	0
	Total:	0	0
Waste Code	**Waste Description**	**Loads**	**Cords**
FW	FIREWOOD	0	0
PP	PALLET PICK-UP	0	0
	Total:	0	0

Notes and/or Deviations Regarding Loads and Quantities

Logan City Landfill Daily Operating Record

Monday July 5, 2010

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Waste Inspections

Class I Landfill (Municipal Solid Waste)

Number of Inspections Conducted:	
Percentage of Loads Inspected (Minimum = 1%):	#DIV/0!

* Field Note Reference No.	Problems (Yes/No)	Corrective Actions Taken	Inspector

Class IVb Landfill (Construction and Demolition Waste)

Number of Inspections Conducted:	

* Field Note Reference No.	Problems (Yes/No)	Corrective Actions Taken	Inspector

* Complete Field Inspection Notes can be found on file at the landfill. They can be referenced by the date and the Field Note Reference Number.

Logan City Landfill Daily Operating Record

Monday July 5, 2010

Waste Inspections - Continued

Scale House Inspections

** Number of Inspections Conducted:	

** See attched sheet for details regarding scale house inspections

Cover

Class I Landfill (Municipal Solid Waste)

Cover Type	Amount	Who Covered
Soil (yds^3)		
Alternate (yds^3)		
Spray (bags)		

Class IVb Landfill (Construction and Demolition Waste)

Cover Type	Amount	Who Covered
Soil (yds^3)		

Days since last covering:	

Asbestos Cell

Was asbestos disposed today?		(yes/no)
Depth of cover applied to asbestos if disposed today:		(inches)
Was Asbestos Cell Checked for proper cover today?		(yes/no)
Condition:		
Checked by:		
Time:		

Dust Control

Were any dust control measures needed today?	No	(yes/no)
If yes, what methods were used?	N/A	

Notes and/or Deviations Regarding Other Daily Landfill Operations

Attachments

Results of other inspections and monitoring required for landfill operation and compliance will be attached after this page.
This might include quarterly landfill inspections, air quality monitoring, water quality monitoring, etc.

Logan City Landfill Daily Operating Record

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Monday July 5, 2010

Summary

Those in attendance today:

Signature: _____

Landfill Inspector, Landfill Crew Chief

Signature: _____

Landfill Manager

Logan City Landfill Class I

Landfill Quarterly Inspection Form

Record ID _____

Inspector: _____

Date: _____ Time: _____

Quarter: _____ Temp: _____ Wind Dir: _____

Inspection Checklist:

1. **Tipping Face/Waste Placement:**
   Daily cover type: _____ Depth of daily cover _____
   Traffic Control: Poor Fair Good Excellent
   Litter fence condition: Poor Fair Good Excellent
   Overall litter condition: Poor Fair Good Excellent
   Working Conditions: Sunny Dusty Wet Rain Snow Muddy
   Describe problems if any and locations: _____

2. **Compaction:**
   Industry standards for daily operations (as per SWANA, 1350 lbs/cubic yard):
   Poor Fair Good Excellent

3. **Cover:**
   Erosion of top cover and side slopes on landfill: _____
   Daily: Poor Fair Good Excellent depth: _____
   Overall conditions of cover: Poor Fair Good Excellent
   Describe problems if any and locations: _____

4. **Cell Liner :** Not Applicable

5. **Perimeter Fence and Access Controls:**
   Broken fence or unusual conditions: _____
   Access Gates: Locked Unlocked/In use
   Gate Condition: Poor Fair Good Excellent
   Describe problems if any and locations: _____

Logan City Landfill Class I

Landfill Quarterly Inspection Form

Inspection Checklist continued

6. **Roads:**
   Condition of roadways: Poor Fair Good Excellent
   Dust control conditions: Poor Fair Good Excellent
   Sign conditions: Poor Fair Good Excellent
   Describe problems if any and locations: _____

7. **Run-off / Run-on System:**
   Plugged canals, streams, or high water:
   Stormwater detention: Poor Fair Good Excellent
   Retention sites: Poor Fair Good Excellent
   Westside ditch: Poor Fair Good Excellent
   Slopes/Erosion Poor Fair Good Excellent
   Other comments: _____

8. **Ground Water Monitoring Wells:**
   Check well locks? GW1 ☐ GW2 ☐ GW3B ☐ GW4 ☐
   GW5 ☐ GW6A ☐ GW9 ☐ GW10 ☐
   Soil around well heads stable? YES NO
   Describe problems if any and locations: _____

9. **Final and Intermediate Cover:**
   Intermediate Cover: Poor Fair Good Excellent Depth: _____
   Final Cover: Poor Fair Good Excellent Depth: _____
   Describe problems if any and locations: _____

10. **Litter Controls:**
    Litter Fences: Poor Fair Good Excellent
    Overall Litter Condition: Poor Fair Good Excellent
    Describe problems if any and locations: _____

11. **Disease vectors:**
    Seagull population: Fair High Acceptable
    Rock Chuck population: Fair High Acceptable

Logan City Landfill Class I

Landfill Quarterly Inspection Form

Inspection Checklist continued

12. Records:

	On-Site:		Complete:			On-Site:		Complete:	
Landfill Permit:	YES	NO	YES	NO	SWPPP:	YES	NO	YES	NO
Landfill Operation Plan:	YES	NO	YES	NO	Daily Reports:	YES	NO	YES	NO
Leachate Management:	YES	NO	YES	NO	Asbestos:	YES	NO	YES	NO
Air Quality Permit:	YES	NO	YES	NO	Used Oil:	YES	NO	YES	NO

Problems, if any:_____

13. Scalehouse:

General Operating Condition:	Poor	Fair	Good	Excellent
Paperwork in order:	YES	NO		
Vehicle Inspections:	YES	NO		
Scale Certification:	YES	NO		
Scale Programs:	YES	NO		

Problems, if any:_____

14. Recycling Area:

Overall Condition: Poor Fair Good Excellent

Other Comments:_____

15. Buildings:

General Operating Conditions:	Poor	Fair	Good	Excellent
Scalehouse:	Poor	Fair	Good	Excellent
Office:	Poor	Fair	Good	Excellent
Maintenance Shop:	Poor	Fair	Good	Excellent
HHW:	Poor	Fair	Good	Excellent
Oil Collection:	Poor	Fair	Good	Excellent

Describe problems, if any and locations:_____

16. Comoost Operations:

Sign conditions:	Poor	Fair	Good	Excellent
Litter conditions:	Poor	Fair	Good	Excellent
Work zone barricading:	Poor	Fair	Good	Excellent

Describe problems, if any and locations:_____

Logan City Landfill Class I

Landfill Quarterly Inspection Form

Inspection Checklist continued

17. Landfill Equipment:

					Complete:	
Maintenance Records:	Poor	Fair	Good	Excellent	YES	NO
Equipment Condition:	Poor	Fair	Good	Excellent	YES	NO

Describe problems if any:_____

18. Overview:

General litter conditions:	Poor	Fair	Good	Excellent
General landfill condition:	Poor	Fair	Good	Excellent

Describe problems if any and locations:_____

Additional Notes or Comments:

Inspector signature / Date:_____

Manager signature / Date:_____

Logan City Landfill Class IVb

C&D Landfill Quarterly Inspection

Record ID _____

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

Inspector: _____

Date: _____ Time: _____

Quarter: _____

Inspection Checklist

Dust Control: Poor Fair Good Excellent

Describe problems if any and locations: _____

_____

_____

Litter Control: Poor Fair Good Excellent

Describe problems if any and locations: _____

_____

_____

Cover Material Condition: Poor Fair Good Excellent

Depth of cover material_____

Describe problems if any and locations: _____

_____

_____

Waste Control: Poor Fair Good Excellent

Unacceptable waste: YES NO

Type of unacceptable waste: _____

Describe problems if any and locations: _____

_____

_____

Inspector's signature _____ ***Manager signature*** _____ **Date** _____

Revised 9/29/2008

Logan City Landfill
Asbestos Disposal Checklist

LOGAN CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

Inspector:

Date: Time:

Transportation Information

Property owner: Phone:

Address: City:

Hauler: Phone:

Address: City:

License Plate: State: Vehicle Type:

Driver's Name: _____ Driver's signature: _____

Asbestos Waste Information

Type: **FRIABLE** **NON-FRIABLE** Tonnage:

How was the waste contained? Was the waste labeled? YES NO

Was the load contaminated? YES NO Any discrepancies? YES NO

Please explain any problems:

Disposal Information

Was any Personal Protective Equipment used by Landfill personnel? YES NO NONE NEEDED

How was the material dumped off vehicle?

Any emissions observed during dump? YES NO

How was the load covered? Depth of cover:

Please describe disposal problems if any:

Equipment Operator's Name:

Location

Coordinates referenced from:

Coordinate X: Coordinate Y:

Was a copy sent with Hauler? YES NO

Manifest authorized by: _____

Inspector's name: _____

Inspector's signature: _____

		Person Inspecting	Face #	CLOT #	Asbestos Time	cell condition
Saturday, August 14, 2010	4:00 PM					
Monday, August 16, 2010	1:00 PM					
Tuesday, August 17, 2010	8:00 AM					
Wednesday, August 18, 2010	2:00 PM					
Thursday, August 19, 2010	1:00 PM					
Friday, August 20, 2010	9:00 AM					
Saturday, August 21, 2010	10:00 AM					
Monday, August 23, 2010	2:00 PM					
Tuesaday, August 24, 2010	11:00 AM					
Wednesday, August 25, 2010	9:00 AM					
Thursday, August 26, 2010	10:00 AM					
Friday, August 27, 2010	11:00 AM					
Saturday, August 28, 2010	12:00 PM					
Monday, August 30, 2010	1:00 PM					
Tuesday, August 31, 2010	2:00 PM					

September 2010

Wednesday, September 01, 2010	9:00 AM					
Thursday, September 02, 2010	12:00 PM					
Friday, September 03, 2010	4:00 PM					
Saturday, September 04, 2010	3:00 PM					
Monday, September 06, 2010	8:00 AM					
Tuesday, September 07, 2010	9:00 AM					
Wednesday, September 08, 2010	2:00 PM					
Thursday, September 09, 2010	3:00 PM					
Friday, September 10, 2010	11:00 AM					
Saturday, September 11, 2010	9:00 AM					
Monday, September 13, 2010	4:00 PM					
Tuesday, September 14, 2010	2:00 PM					
Wednesday, September 15, 2010	3:00 PM					
Thursday, September 16, 2010	8:00 AM					
Friday, September 17, 2010	10:00 AM					
Saturday, September 18, 2010	1:00 PM					
Monday, September 20, 2010	4:00 PM					
Tuesday, September 21, 2010	1:00 PM					
Wednesday, September 22, 2010	2:00 PM					
Thursday, September 23, 2010	10:00 AM					
Friday, September 24, 2010	11:00 AM					
Saturday, September 25, 2010	8:00 AM					
Monday, September 27, 2010	9:00 AM					
Tuesday, September 28, 2010	3:00 PM					
Wednesday, September 29, 2010	12:00 PM					
Thursday, September 30, 2010	2:00 PM					

October 2010

Friday, October 01, 2010	11:00 AM					
Saturday, October 02, 2010	9:00 AM					
Monday, October 04, 2010	1:00 PM					
Tuesday, October 05, 2010	12:00 PM					
Wednesday, October 06, 2010	10:00 AM					
Thursday, October 07, 2010	1:00 PM					
Friday, October 08, 2010	8:00 AM					
Saturday, October 09, 2010	10:00 AM					
Monday, October 11, 2010	11:00 AM					

Logan City Landfill Vehicle Inspection Form

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 1
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 2
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 3
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 4
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 5
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Date: _____ **Time:** _____ **Inspected By:** _____ **Vehicle License #:** _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 6
Car ☐				

Inspector Informed Of Waste: **Rex Macey** ☐ **Tony Douglass** ☐ **Other** ☐ _____

Logan City Landfill Vehicle Inspection Form

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 7
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 8
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 9
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 10
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 11
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Date: _____ Time: _____ Inspected By: _____ Vehicle License #: _____

VEHICLE TYPE	Load Description	Waste Description		
Pickup ☐	Household Waste ☐	Anti-Freeze ☐	Infectious Waste ☐	Other Hazardous Waste
Pickup w/ Trailer ☐	Commercial Waste ☐	Batteries ☐	Pesticides ☐	_____
Dump Truck ☐	Compostable Material ☐	PCB's ☐	Propane Tanks ☐	_____
1 Ton Truck ☐	Recyclable Material ☐	Motor Oil ☐	Refrigeration Units ☐	_____
Farm Truck ☐	Construction Debris ☐	Paint ☐	Tires ☐	_____ 12
Car ☐				

Inspector Informed Of Waste: Rex Macey ☐ Tony Douglass ☐ Other ☐ _____

Suspicious Waste

Reason for Suspicion

Sealed Container ☐ Unknown Chemical ☐ Unknown Liquid ☐
Radioactive ☐ Gas Cylinder ☐ Possible PCB ☐
Commercial Placards ☐ Type _____
Other Reasons _____
Field Tests _____
Tested By _____
Test Results _____
Follow up Action / Disposal Method _____

Regulated Waste

What part of the load? Front ☐ Middle ☐ Back ☐

Photo's taken? ☐ By _____

Was Generator/ Hauler notified? Yes ☐ No ☐

Was State Regulating Agency notified? Yes ☐ No ☐
Regulator _____ Date _____
Instructions given by Regulator _____

Notes / Follow up _____

Driver's Description of Load

Driver's Signature _____

Was Load Accepted Yes ☐ No ☐

Supervisor's Signature _____

Landfill Inspection
Field Notes No. 171

Random ☐ Non-Random ☐ Suspect ☐ Repeat Offender ☐

Face ☐ C&D ☐ Green Waste ☐ Recycling ☐ Transfer Station ☐

Date _____ **Time** _____:_____ AM / PM
Lic.# _____ **State** _____
Vehicle Description _____ **Trailer Type** _____
Gross _____ **Tare** _____ **Net** _____
Owner _____ **Phone** (_____)_____-_____
Address _____ **City** _____ **Zip** _____
Waste Generator _____ **Job Location** _____

Waste Type

Household ☐ **Commercial** ☐ **Industrial** ☐ **C&D** ☐
Educational ☐ **Government** ☐ **Other** _____
Driver's Name _____

Waste Composition

Cardboard ☐ Plastic ☐ Metal ☐ Paper ☐ Wood ☐
Other _____ **Notes** _____

Household Hazardous Waste

Characteristic	Description	Quantity	Units
Corrosive			
Flammable			
Reactive			
Toxic			
Other			

Notes _____

Special / Restricted Wastes

Asbestos ☐ Animals ☐ Ash ☐ Auto ☐ C&D ☐
Cont. Soil ☐ Medical ☐ White Goods ☐ Ref. Units ☐ Tires ☐
Other _____
Notes _____

LANDFILL

Daily Cash Reconciliation & Revenue Receipt

DATE: _____

NAME: _____

DOCUMENT NUMBER

FROM: _____

TO: _____

COIN:

Pennies	
Nickels	
Dimes	
Quarters	
Half Dollars	
Dollar Coin	
TOTAL:	$

ITEMIZED DEPOSIT AMOUNTS

C&D	$
COMP	$
FACE	$
RECY	$
OTHER	$
TOTAL:	$

CURRENCY:

$1.00	
$2.00	
$5.00	
$10.00	
$20.00	
$50.00	
$100.00	
TOTAL:	$

TOTALS:

Total Currency	$	
Total Coin	$	
Total Checks	$	
Total Bank Deposit	$	(Equals Money Bag)
Total Credit Cards	$	
Total Daily Deposit	$	(Includes Credit Cards & Bank Deposit)
Report Total	$	(Itemized Deposit Total)
Over/Short	$	

Treasurer's Initials: _____

D

Employee Cash Shift Transfer

Shift 1

Name _____ Co-Worker _____

Ending Cash _____ Time Out: _____ Transaction Number Out: _____

Starting Cash _____ Time In: _____ Transaction Number In: _____

Closing Cash _____ (Ending Cash - Starting Cash)

1st Cash Report Amount _____

Difference _____

Make Sure you attach the Cash Report

SIGNATURE _____

Shift 2

Name _____ Co-Worker _____

Ending Cash _____ Time Out: _____ Transaction Number Out: _____

Starting Cash _____ Time In: _____ Transaction Number In: _____

Closing Cash _____ (Ending Cash - Starting Cash)

2nd Cash Report Amount _____ (2nd cache amount - 1st cash amount)

Difference _____

Make Sure you attach the Cash Report

SIGNATURE _____

Shift 3

Name _____ Co-Worker _____

Ending Cash _____ Time Out: _____ Transaction Number Out: _____

Starting Cash _____ Time In: _____ Transaction Number In: _____

Closing Cash _____ (Ending Cash - Starting Cash)

Final Cash Report Amount _____ (Final cash amount - 2nd cash amount -1st cash amount)

Difference _____

Make Sure you attach the Cash Report

SIGNATURE _____

MUTUAL SOLID WASTE LANDFILL MUTUAL AID AGREEMENT

1. This document is an agreement between Box Elder County and the City of Logan to provide reciprocal waste handling services in an emergency. (The City of Logan provides refuse pickup and landfill services for all of Cache County.) An "emergency" is defined as a sudden, unexpected event which causes the respective landfill to close or restrict acceptance of waste. In the event of an emergency, in which either Box Elder County or Logan City is unable to access their respective landfills, the non affected landfill will accept solid waste from the disabled county.

2. Solid waste will be accepted at the receiving landfill's prevailing tipping fees.

3. Each landfill has restrictions on the types of waste that may enter the landfill. A complete list of restrictions or instructions shall be reviewed (and updated if needed) at least annually as an attachment to this agreement. A list of items that are restricted or prohibited from each landfill is attached. Although this is an emergency action plan, screening for hazardous wast will continue and all other federal, state, and local laws must be complied with during contingency operations.

4. This agreement may be invoked by phone, followed with a notice of intent in writing within 24 hours.

5. This agreement is for emergency services only. The agency who's landfill is not accessible shall work aggressively to restore or replace operations. The agency who's landfill is receiving waste may need to restrict the quantities of waste received from outside their county due to operating capability or capacity based on equipment and ability to receive refuse. The landfill managers shall meet at least once per month during shared operations to coordinate support.

6. This agreement is for five years from the date approved. It may be terminated by either agency with 60 days written notice. It may be renewed by agreement of both agencies. This agreement shall be reviewed annually by the respective landfill managers.

Approved: Date: 7-1-96

BOX ELDER COUNTY:

R. Lee Allen, Chairman

Box Elder County Commission

Approved: Date: June 29, 1996

CITY OF LOGAN:

Darla D. Clark

Mayor

ATTEST:

Lois Price, City Recorder

SPECIAL WASTE RESTRICTIONS

Box Elder County Landfill **R=Restricted Items** **P=Prohibited Items**

Contact:
Box Elder County Landfill Manager
11 South Main Street
Brigham City, UT 84302
(801)723-2031 - FAX 734-2038

1. Waste Oil....**P**
2. Batteries....**P**
3. Hazardous Waste....**P**
4. Asbestos....**R**
5. Tires....**R**
6. Sludge or Liquid Waste....**P**
7. Medical Waste....**P**
8. Contaminated Soil....**R**

Logan City Landfill **R=Restricted Items** **P=Prohibited Items**

Contact:
City of Logan Director of Environmental Health
950 West 600 North
Logan, UT 84321-7806
(801)750-9953 - FAX 752-4007

1. Waste Oil....**R**
2. Batteries....**R**
3. Hazardous Waste....**P**
4. Medical/Infectious Waste....**R**
5. Tires....**R**
6. Asbestos....**R**
7. Sludge or Liquid Waste....**P**
8. Contaminated Soil....**R**
9. Yard Trimmings....**R**
10. Reusable or Recyclable Materials....**R**
    - -Cardboard
    - -Newspaper Paper
    - -Aluminum
    - -Copper & Brass
    - -Ferrous Metals
    - -Carpet Pad
    - -Construction & Demolition Debris
    - -Wood
    - -Wood Pallets

original: Lois
cc: LF file
Brandon
R/File
Suspense file May 97

Figure 2

Ralph Bohn <rbohn@utah.gov>

FW: Mutual Aid

1 message

Brett Mickelson <brettm@igesinc.com> Fri, Jan 25, 2013 at 2:26 PM
To: rbohn@utah.gov

Here is Nathans response.

From: Nathan Rich [mailto:nathanr@wiwmd.org]
Sent: Tuesday, December 18, 2012 1:14 PM
To: Brett Mickelson
Cc: Issa A. A. Hamud; Doug Taylor
Subject: RE: Mutual Aid

Brett:

As a municipally owned and operated solid waste system, we would absolutely work with Logan in the event of an emergency to ensure environmentally sound and cost effective management of Cache County's solid waste. We currently have adequate capacity at the Davis Landfill with rates in place that would allow for immediate disposal upon delivery to the site.

Also, the Northern Utah Regional Landfill Authority (NURLA) is currently working on an agreement for just such an eventuality which would allow emergency use of member facilities to other members at current rates. Both the City of Logan and Wasatch Integrated Waste Management District are currently members of NURLA.

Please do not hesitate to contact me if you have any other questions.

Nathan Rich, P.E.

Executive Director

Wasatch Integrated Waste Management District

801.726.5018 cell

801.614.5601 direct

Appendix F

GROUNDWATER MONITORING PLAN

NORTH VALLEY LANDFILL

LOGAN CITY ENVIRONMENTAL DEPARTMENT
450 N 1000 W
LOGAN, UTAH 84321

Issa A. Hamud P.E.
Director
Logan City Environmental Department

January 12, 2012

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APPENDIX C: BORING LOGS

APPENDIX D: SAMPLING FORMS

1.0 BACKGROUND

1.1 INTRODUCTION

The North Valley landfill site is the proposed site for future solid waste disposal for all of Cache County. The objective of the groundwater monitoring plan is to fulfill requirements given in Utah Administrative Code R315-308 and sample the groundwater under the site to establish background concentrations of parameters listed in Section R315-308-4. Once the background concentrations are established, sampling will continue to detect any changes in the contaminants.

1.2 SITE DESCRIPTION

The North Valley landfill site is 320 acres and located approximately 5 miles north of Clarkston, Utah. Figure 1 shows the location of the site. Figure 2 shows the proposed layout of Phase I of the North Valley landfill consisting of three cells.

1.3 MONITORING WELLS

Prior to the start of landfilling activity new monitor wells will be installed at the North Valley Landfill. The proposed locations of monitor wells are presented on Figure 2. Currently, there are seven wells (NV-1, NV-2, NV-3, NV-4, NV-5, NV-6, and NV-7) surrounding the landfill site. The existing wells and the proposed future monitoring well locations are indicated on Figure 3. Groundwater monitoring requirements under R315-308-2 require the groundwater monitoring system to consist of at least one background or upgradient well and two downgradient wells. The downgradient wells are designated as the point of compliance. Construction details for the existing groundwater wells are summarized in Table 1. The well logs are contained in Appendix C.

2.0 SAMPLING SCHEDULE

In reference to R315-308-29(5)(a), during the first year of facility operation after wells are installed, a minimum of eight independent samples from the upgradient and four independent samples from the downgradient wells will be taken for all parameters listed in Section R315-308-4 to establish background concentrations. A summary of laboratory results is shown in Table 2.

Once the background concentrations are established, a minimum of one sample will be taken semiannually for all parameters listed in R315-308-4. The time between sampling events should be sufficient to allow groundwater to move past the point of compliance so that the samples are "independent".

3.0 PROCEDURES

This section describes the procedures that will be used for groundwater measurement, sampling, and analysis.

3.1 INTRODUCTION

The wells will be sampled using currently accepted and approved technology. Proper health and safety procedures and the use of personal protective equipment as was proper for well purging, sample collection, and preservation techniques; equipment decontamination methods, and quality assurance/quality control techniques will be followed.

3.2 PRE-SAMPLING PROCEDURES

Upon arrival at the monitoring well, prior to groundwater measurement, purging or sampling, any signs of tampering or well deterioration will be documented. A depth to groundwater measurement shall be taken using a conductivity-based water level meter or equivalent instrument capable of obtaining readings to the nearest 0.01 foot. The following method will be used to measure the groundwater elevation:

1. Verify well identification. Check to ensure proper operation of measurement equipment aboveground. Prior to opening the well, put on personal protective equipment as required.

2. Record well number, top of casing elevation, and surface elevation if available.

3. Lower the probe slowly into the well. Upon contact with water, the buzzer should sound and the indicator light should glow. Raise and lower the probe slightly about the water level a few times to determine accurate point of contact.

4. Measure and record static water level and total depth to the nearest 0.01 ft from the surveyed reference mark on the top edge of the groundwater level measurement tube. If no reference mark is present, record in the logbook where the measurement was taken from and record the depth to groundwater.

5. Record the time and day of the measurement.

6. Raise the water level probe on the spool and decontaminate.

3.3 EQUIPMENT CALIBRATION

All meters shall be calibrated prior to use in accordance with the manufacturer's directions and no meters shall be used unless they are functioning properly.

3.4 WELL PURGING

Prior to sampling, the wells will be purged to obtain fresh groundwater that is representative of formation water. Purging will be done using either: Teflon bottom-filling bailers with single strand stainless steel wire or monofilament such as fishing line; factory-wrapped disposable polyethylene bailers with disposable bailer cord; an approved type of sampling pump (such as a bladder pump) with tubing that will be decontaminated or changed between each well; or equivalent approved purging device. Submersible pumps, which can agitate water in the well, will not be used. Pumps will be configured so as not to introduce contamination through gas exhaust. Any equipment used for evacuating water from the wells will be non-leaching and non-aerating. If dedicated or disposable equipment is not used, all purging and/or sampling equipment will be decontaminated with a non-phosphate wash followed by a distilled water rinse prior to use in each well.

Four well volumes will be purged from each of the wells prior to sample collection. Well volumes shall be calculated as described below in Equation 1.

Equation 1: $V = B \times \left(\frac{D}{2}\right)^2 \times H \times 4 \times 7.48 \; {}^{gallons}/_{ft^3}$

V = Total Purge Volume (gals)

B = Pi (3.1416)

D = Inside diameter of well casing (feet)

H = Feet of water in the well (depth to well bottom minus depth to water)

When wells pump or bail dry the well shall be evacuated to dryness once. Sampling shall be conducted when the well recovers to 85% of the initial water level (or for two hours, whichever occurs sooner). Purge water will be discharged to the ground surface at least 50 feet from the wellhead.

The following method will be used to purge the wells:

Purging with a pump

1. Slowly lower the pump to the middle of the screened area of the well. Securely fasten the power cable and sample tubing. Connect the power source, controller box, gas source, etc., to the pumping equipment.

2. Use Equation 1 to calculate the number of gallons to remove a specific number of required well volumes from the well.

3a. Using a pump to purge and sample the well: Record the "purging time start" and start purging the well. Minimize well drawdown; it should stabilize before sampling. If the water level continues to decline during purging, try using a lower purging rate. Use a graduated beaker, cylinder, calibrated bucket or other device to calculate the flow rate while purging and sampling.

3b. Using a pump to purge the well and then using a grab sampler to sample the well: Record the "purging time start" and start purging the well with the pump's inlet at the top of the water column. As you are purging, slowly lower the pump so that, after the specific number or required well volumes are purged, the pump's inlet is near the bottom of the well (within ~ 1 foot).

4. Record "purging flow rate" as an average, "volume purged," "purging time stop," "purged dry (Y/N)," and any problems purging.

5a. If a pump is used to collect samples, the sampling flow rate should be as low as possible, and preferably less than the purging flow rate.

5b. If a grab sampler is used, try not to disturb the samples. If a bailer is used, use a bottom-emptying device to decant your samples.

6. Collect samples as described under Section 3.6. Record "sample flow rate" as an average, "time sample collected," and any other pertinent information related to the sampling event.

Purging with a bailer

1. Use Equation 1 to calculate the number of gallons needed for removing a specific number of required well volumes. Record this data as "well volumes."

2. Record the "purging time start." Lower and raise a decontaminated bailer in and out of the water column very slowly and purge four well volumes.

3. Use a calibrated bucket or other device to keep track of the volume of water you remove. Purge specific number of required well volumes.

4. Record "volume purged," "purging time stop," "purged dry (Y/N)," and any problems purging.

5. Sample the well by slowly and gently lowering the bailer until it is submerged and in the middle of the well screen. Do not allow the bailer to contact the bottom of the well. Very slowly and carefully raise the bailer out of the water column and to the surface.

6. Collect samples as described under Section 3.6. Use a bottom-emptying device to decant samples from a bailer. Record "time sample collected" and any other pertinent information related to the sampling event.

3.5 FIELD MEASUREMENTS

After each well has been purged, a sample will be collected into a clean beaker for measurement of pH, electrical conductivity, and temperature. These readings will be recorded, along with well I.D.

and time. To reduce the potential for cross contamination, monitoring probes will never be placed in containers to be sent to the laboratory for analysis.

3.6 SAMPLE COLLECTION AND PRESERVATION

Samples will be collected with a bailer or an approved sampling pump such as a bladder pump. When using a bailer, care will be taken to not drop the bailer in the well fast enough to cause degassing. The bailer will be slowly lowered into the well. The bailer's contents will be transferred into laboratory supplied sample containers with the minimum amount of agitation possible to reduce aeration of the sample. When using a positive gas displacement bladder pump for volatile analysis collection, the pumping rate will not exceed 100 millimeters/minute.

The sampler will wear a new pair of disposable vinyl gloves to handle sampling equipment and sample containers at each well. Samples will be collected in laboratory supplied sample bottles. Care will be taken to keep sample bottles capped until immediately prior to collecting the sample. Once filled, bottles will immediately be capped to minimize contact with dust and ambient air.

Analytes to be tested Glass bottles with Teflon lined caps will be used for organic samples. For both volatile organic and TOC samples, no headspace will be allowed in the sample container. Polyethylene containers with polypropylene caps will be used for metals analysis. Samples for dissolved metals analysis will be collected without filtering into a non-preserved polyethylene bottle. The sample must be delivered to the laboratory the same day, and the laboratory must be requested to immediately filter and preserve the sample. If needed, groundwater collected for dissolved metals analysis will be field-filtered through a 0.45 micron filter, transferred to a bottle, preserved with nitric acid to a pH less than 2 and analyzed for dissolved metals.

The first samples to be collected will be those for volatilization sensitive parameters (Volatiles, pH). Parameters that are not pH sensitive or subject to volatilization will be drawn last.

The sample collection order will be as follows:

- VOC's
- Dissolved metals
- Inorganics
- TOC
- Ammonia and nitrate

The following procedures shall be used for VOC sample collection:

1. The sample container shall be filled so that a convex meniscus forms over the neck of the opening to eliminate head-space.

2. The cap will be filled with groundwater. The teflon side of septum (in the vial cap) will be positioned against the meniscus, and the cap screwed on tightly.

3. Invert the sample bottle and tap lightly to check for air bubbles. The absence of an air bubble indicates an airtight seal. If an air bubble is observed recollect the sample following the procedures described above. This process shall be continued until the sample for VOCs contains no head space.

The following procedures shall be followed for collection of samples for analyses other than

VOCs:

1. The sample containers shall be filled in order from the least to the most stable compounds as described previously.

2. Sufficient volume shall be collected so that the scheduled analysis can be performed. The sample containers do not need to be filled to eliminate head-space.

3.7 SAMPLE HANDLING

3.7.1 NUMBERING AND LABELING

Each sample will be assigned a unique ID number that does not identify the sample location. The sample ID will be tied to the well location in the field documentation. Sample ID's will take the following format: "NV (Month) (Year) (Number)". For example, the samples collected from the first well in April 2012 would be assigned the ID number NV041201. The second well's sample would be NV041202. If a duplicate sample were collected at the second well it would be numbered NV041203.

Once collected, each sample will be immediately labeled, sealed in a water-tight ziplock baggie, and place in a sample cooler with ice. Pieces of bubble wrap or foam will be used to prevent bottles from knocking together and breaking. Immediately after placing the sample in the cooler, the sample will be recorded on a chain-of-custody.

3.7.2 CHAIN OF CUSTODY

The chain-of-custody will, at minimum, list the time and date of sample collection, sample ID, number of containers making up each sample, name of sampler, and signatures of every person who assumes custody of the sample set along with the date and time that the custody was transferred. Chain-of –custodies may also include instructions to the laboratory on the analysis to be performed.

Samples will remain in the custody of the sampler until they are relinquished to the laboratory or until they are relinquished to a qualified individual for transport to the laboratory. If, after samples are collected, the laboratory is closed, sample personnel will have 24-hour access to a "Laboratory Secure Area" (equipped with a refrigerator) for storing samples until regular laboratory hours, when sample custody can be transferred. Custody, including secure storage areas, will be documented on the chain-of-custody form.

3.7.3 FIELD DOCUMENTATION

The sampler will keep a field logbook that documents for each well sampled the following information.

- Well identification corresponding to well #
- Well depth, well casing stick up
- Static water level depth and measurement technique
- Well yield (volume purged)
- Sample collection methods
- Sample identification numbers
- Preservatives and containers used
- Parameters requested for analysis
- Field analysis data and methods
- Field observations including weather
- Name of collector

3.8 QA/QC SAMPLES

3.8.1 FIELD QA/QC

Field Duplicate

Purpose:
To check reproducibility of laboratory and field procedures and to indicate non-homogeneity.

Collection:
Samples will be taken from area that are known or suspected to be contaminated.

Sample Number:
Two separate (unique) sample numbers will be assigned to the primary and duplicate samples.

Field Blanks

Purpose:
To check cross contamination during sample collection, sample shipment, and in the laboratory. Also to check sample containers.

Collection:
Samples will be collected for each group of samples of similar matrix per day of sampling.

Sample Number:

Separate sample numbers will be assigned to each field blank.

Volatiles Trip Blank
Purpose:
To check contamination during sample handling and shipment from field to laboratory.

Collection:
Sample will be prepared using demonstrated to be free of contaminants of concern (Dl water).

Sample Number:
Separate sample numbers will be assigned to each volatile trip blank.

Equipment Blank
Purpose:
To check field decontamination procedures.

Collection:
Samples will be collected when sampling equipment is decontaminated and reused in the field. Deionized water will be used to rinse water into the sample containers.

Sample Number:
Separate sample numbers will be assigned to each equipment blank.

3.8.2 LABORATORY QA/QC

The laboratory will be required to provide results for two types of QA/QC samples: method blanks and matrix spike/matrix spike duplicates.

Method Blank
Purpose:

Method blanks provide an indication of whether an analyte may have been introduced into the sample during laboratory handling and analysis.

Collection:
Method blank results will be provided for each analyte.

Matrix Spike and Matrix Spike Duplicate
Purpose:
Matrix spike/matrix spike duplicates are prepared and analyzed to give an indication of the laboratory accuracy (ability to recover 100% of the analyte) and precision (ability to get repeatable results).

Collection:
Matrix spike and matrix spike duplicates will be analyzed for each metal and inorganic analyte, and for a representative number of volatile organic compounds.

3.9 DATA QUALITY OBJECTIVES

To obtain high quality, consistent data that facilitate tracking long-term variations and trends, several objectives have been developed, including:

- An established detection limit for each analyte
- Target ranges for accuracy and precision in laboratory data
- Target ranges for precision in field duplicates
- Criteria for acceptance of compounds found in method blanks

These objectives are discussed in more detail below.

3.9.1 REPORTING LIMITS

The laboratory will be requested to obtain the detection limits shown on Table 4. These detection limits are below Solid Waste Groundwater Protection Standards for each analyte, and are expected to be low enough to detect naturally occurring concentrations of most inorganics and metals. The laboratory may qualify very low concentrations with "J" (estimated) qualifiers if the detected concentrations are not above the laboratory's established reporting limit. The reporting limit, as required by the Utah Division of Laboratory Services, is normally 5 to 10 times the detection limit, or the lowest concentration standard run during calibration.

If the laboratory cannot meet the requested limit for analyte or group of analytes due to characteristics of the sample, the laboratory will notify the City of Logan immediately, noting the reason and presenting the lowest possible reporting limit. The problem with the sample will be evaluated by the City of Logan and will be corrected, if possible. If changes in the sampling protocol or established reporting limit are necessary, DSHW will be notified immediately.

3.9.2 PRECISION AND ACCURACY IN LABORATORY QA/QC SAMPLES

The laboratory prepares matrix spike and matrix spike duplicate samples by adding a known amount of an analyte, such as arsenic, to two aliquots of the same sample. The matrix spike and matrix spike duplicate are then analyzed. Accuracy for the matrix spike and matrix spike duplicate samples is defined as the recovery, i.e., the amount recovered in the analysis divided by the quantity "known" to be present, time 100%. A result of 100% indicates perfect accuracy. Target recoveries of 80% to 120% are acceptable for most analytes. Arsenic, selenium, and thallium (the GFAA metals) have slightly wider ranges of recovery, usually in the range of 70% to 130%, due to inter-element interferences.

Therefore, recoveries of 80 to 120% will indicate good accuracy (70 to 130% for arsenic, selenium, and thallium). If recoveries for the matrix spike and matrix spike duplicate fall outside that range, the laboratory will be contacted for an explanation so that the data can be qualified as "acceptable", "estimated", or "rejected".

Precision is defined as how close the results are for the matrix spike and matrix spike duplicate samples. Therefore, it is an indication of how well the laboratory is able to repeat a measurement. Precision between two measurements (A and B) is given as the relative percent difference, calculated as follows:

$$RPD = \frac{(A - B) \times 100\%}{\frac{(A + B)}{2}}$$

The laboratory is generally able to repeat results in a water sample within 10%. For matrix spike/matrix spike duplicates with RPDs greater than 10%, the laboratory will be contacted for an explanation so that the data can be qualified as "acceptable", "estimated", or "rejected".

3.9.3 PRECISION IN FIELD DUPLICATE SAMPLES

The RPD between two field samples indicates how repeatable the entire sampling and analysis effort is. It can be affected by slight differences in the water used to fill the two duplicate bottles, slight differences in time that containers are open, slight differences in the amount of preservative in the bottles, and variations in the laboratory analysis. The RPD for two duplicate samples, calculated just as for laboratory samples may easily be as high as 30%. When the quantity of an analyte is very small, relatively small absolute differences (1 to 2 ppm) can result in large RPDs. The person conducting the data validation will apply professional judgment to assess the validity of data with RPDs greater than 30%.

3.9.4 LABORATORY CONTAMINANTS AND ANALYTES IN METHOD BLANKS

If the laboratory reports an analyte in the method blank, such as methylene chloride, it indicates that the analyte may be present in the instrumentation and contaminating samples that are being analyzed on the instrument. Sample results that are less than 10 times the amount reported in the blank should be considered suspect and may be rejected. Additionally, if a common laboratory contaminant like acetone or methylene chloride is reported in the sample but not the blank, the reported concentrations should be compared to the reporting limit for the common laboratory contaminant. Sample results that are less than five times the reporting limit may be suspect and can be rejected if no other data exists to support the presence of the analyte in the samples.

4.0 DATA ANALYSIS PLAN

4.1 DATA VALIDATION

When the laboratory data is received, it will be reviewed to assess data validity. The data package will be checked to insure that:

- Sample IDs match chain-of-custody and field notes and can be matched to sample location, date, and time.
- Samples were analyzed within holding times.
- Analysis reporting limits are acceptable.
- Laboratory method blank results are included and acceptable.
- Laboratory MS/MSD results for representative analytes are included and acceptable.
- Field duplicate sample results are included and acceptable.

If the listed checks indicate potential problems or discrepancies, the laboratory will be notified and requested to help resolve the question. If the cause of the problem cannot be located, the affected data will be qualified or the affected wells will be resembled, depending on the severity of the problem. The person who validates the data will use professional judgment to assign qualifiers to data that do not meet the data quality objectives of section 3.9. If the data appear usable and can be combined with the historical data with no reservations, then no qualifier will be attached. The reasoning will be detailed in the report prepared for the sampling event.

If the data appear to accurately represent the presence or absence of an analyte, but the quantification of the analyte is in question, then a "J" will be assigned to the reported concentration to indicate it is an estimated quantity. An example of this might be a case where arsenic is reported in the sample, but arsenic recoveries in the matrix spike/matrix spike duplicate are very low (such as 50%). The person validating the data may feel that the reported arsenic value is useful information even if the result is probably too low. In this case, a "J" would appear next to the reported result in subsequent tabulations of the data for that well.

If the data for the well appear compromised to the point where the reported result is not useful (such as the appearance of methylene chloride in the method blank and in a sample at similar concentrations), the data will receive an "R" qualifier indicating it is rejected. The reported result will continue to be shown in subsequent tabulations, but the "R" qualifier will flag the user not to include the result in statistical compilations, etc.

In all cases where data receive qualifiers, an explanation of the validator's judgment will be given in the report of the sampling round where the qualified data are first reported.

4.2 DATA ANALYSIS

The data will be analyzed by:

- Looking for the presence of non-naturally occurring compounds in the sample (such as volatile organic compounds), and
- Plotting the concentrations of naturally occurring constituents (metals and minerals) in each well on concentration versus time for that well
- Comparing concentrations to statistically-determined control limits

If non-naturally occurring compounds are reported by the laboratory, the validity of the result(s) will be assessed by reviewing method blank results, raw laboratory data, the compound's potential status as a common laboratory contaminant, and the reported concentration relative to the method detection limit. If the positive results appear potentially valid, the affected well will be resampled to verify the result.

The relative concentrations of naturally-occurring constituents will be analyzed to assess whether the water is impacted. Background water quality will be established by collecting eight independent samples from each well.

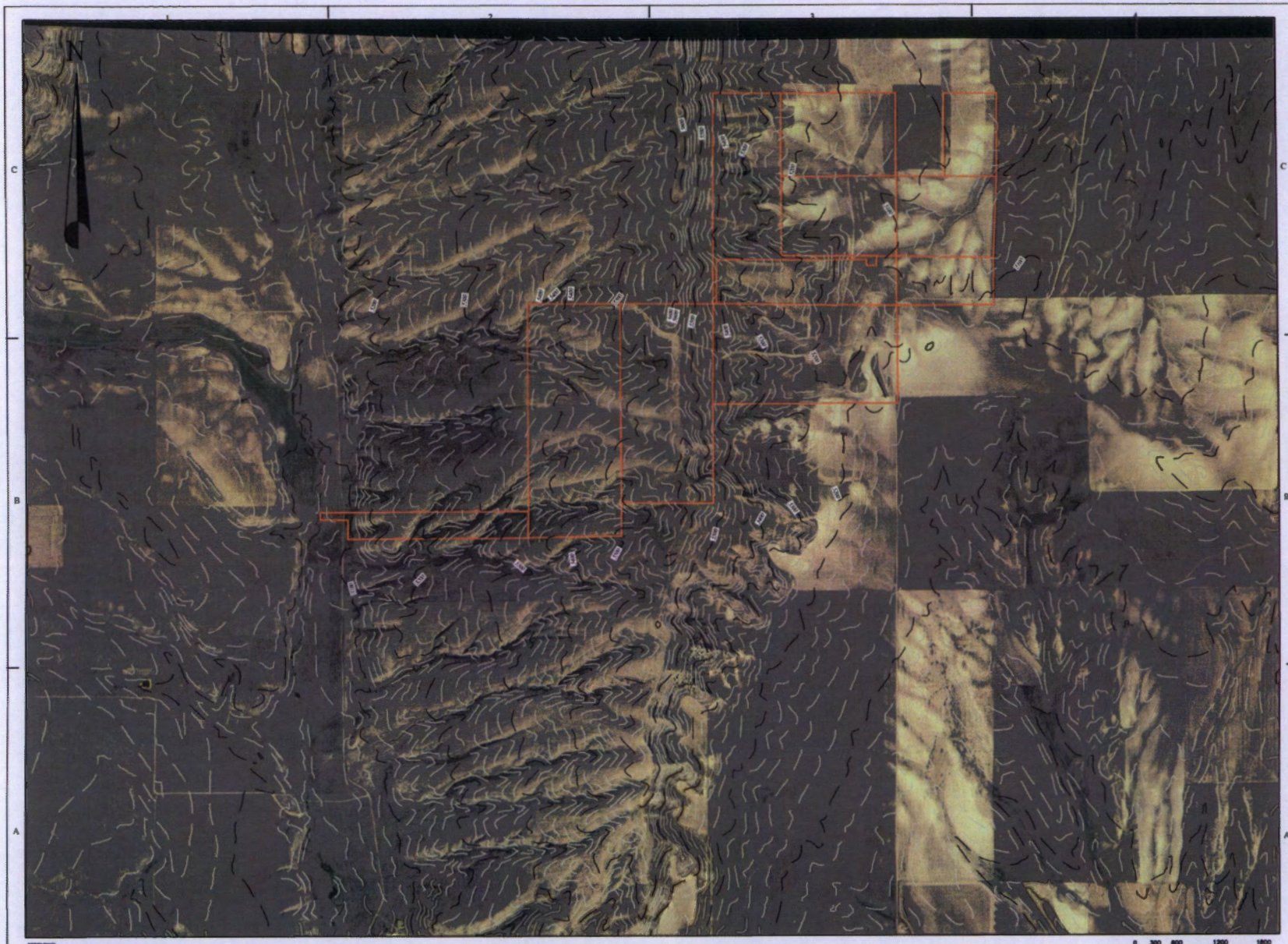
4.3 DATA REPORTING

Semi-annual monitoring reports will be prepared. Each report will include a:

- Description of sampling activities
- Discussion of data validity
- Discussion of laboratory QA/QC
- Presentation of water elevation measurements and contour map
- Presentation of field and laboratory data in tables
- Graphical presentation of trends in analyte concentrations over time
- Contours of TDS and TOC for the sampling event
- Statistical analysis of the analytical results

APPENDIX

APPENDIX A



REFERENCE:
USGS 7.5 MINUTE QUADRANGLE MAP - CLARKSTON & HRONTOK, UT
PROVIDED BY UTAH AGRC

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PROJECT NO:	00386-013
CAD DWG FILE:	00386/013/BASE.DWG
DRAWN BY:	JAH
DESIGNED BY:	BDM
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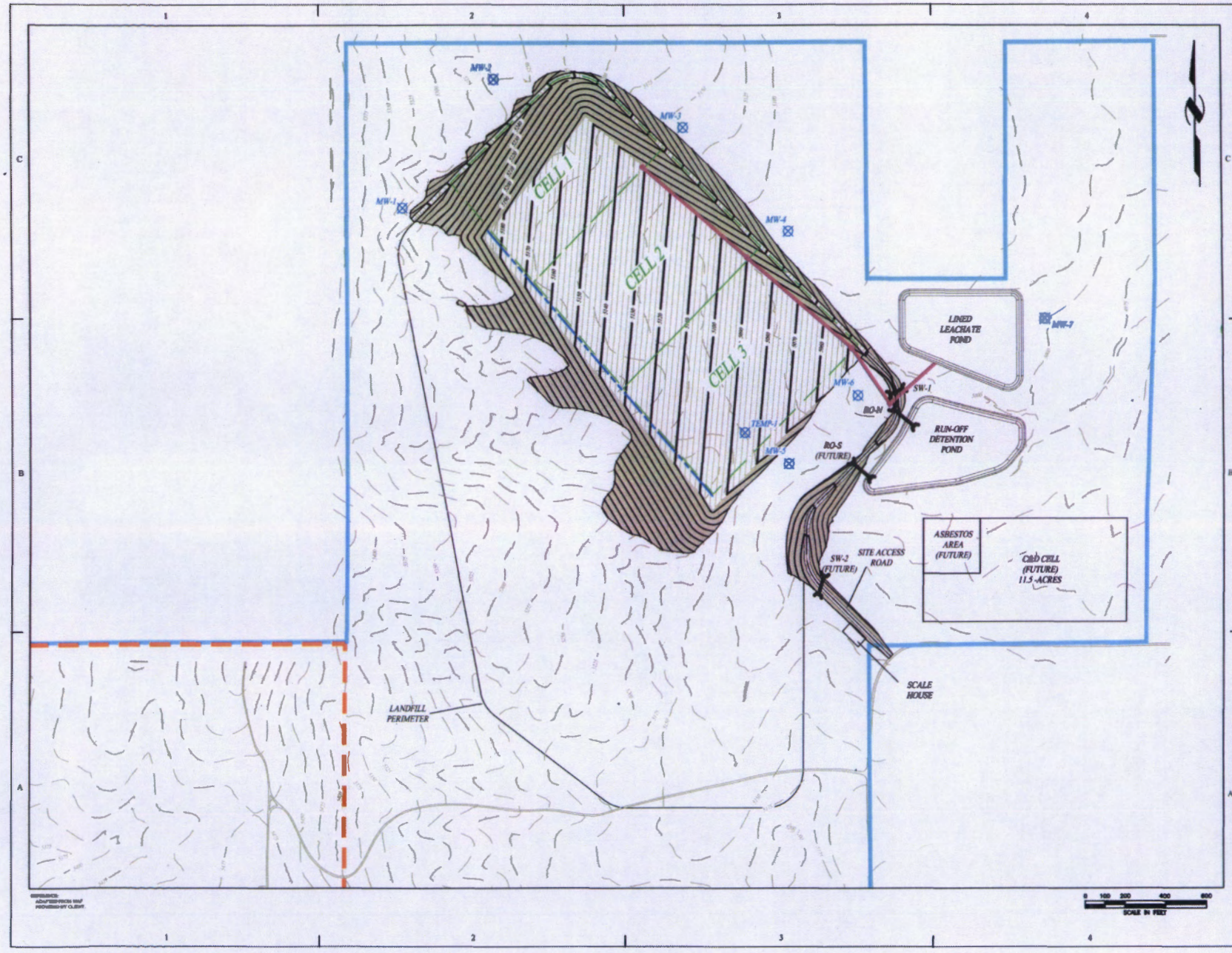
SHEET TITLE

CLARKSTON LANDFILL

VICINITY MAP

1



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PROPERTY BOUNDARY
UNDEVELOPED PROPERTY
LANDFILL BOUNDARY
CELL BOUNDARY
RUN-ON DIVERSION BERM
EXISTING GROUND (25' CONTOUR)
MW-4 PROPOSED PHASE I MONITORING WELLS (TEMP-1 - EXISTING WELL)
STORM WATER CULVERT
LEACHATE INLET & TRANSMISSION PIPE

MARK	DATE	DESCRIPTION
	2/3/12	DRAFT

ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base.mxp
DRAWN BY:	JAH
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SHEET TITLE

NORTH VALLEY LANDFILL
PHASE I DEVELOPMENT

2

REFERENCE:
AERIAL PHOTO MAP
PROVIDED BY CLIENT

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PROPERTY BOUNDARY

UNDEVELOPED PROPERTY

LANDFILL BOUNDARY

NV-4 EXISTING GROUND WATER WELLS

MW-4 PROPOSED PHASE I MONITORING WELLS

EXISTING GROUNDWATER WELL NV-4 WILL REMAIN IN PLACE AS MONITORING WELL AND BE RENAMED TEMP-1.

MARK	DATE	DESCRIPTION
	2/3/12	DRAFT

ISSUE:

PROJECT NO.:	00386-014
CAD DWG FILE:	00386\014\Drafting\Base map
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NORTH VALLEY LANDFILL

PHASE I - PROPOSED GROUNDWATER MONITORING WELLS

3

APPENDIX B

Table 1 Well Construction Details North Valley Landfill

Well Number	Year Installed	Latitude	Longitude	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft)	Boring (ft,bgs)	Screen Interval (ft,bgs)
NV-1	Aug. 2010	41° 59' 35.55708" N	112° 02' 47.00517"W	11773.79	11313.902	4997.095	71.5	
NV-2	Aug. 2010	41° 59' 10.76319" N	112° 03' 26.55313" W	9263.424	8326.592	5230.503	101.5	
NV-3	Nov. 2010	41° 59' 18.45859" N	112° 03' 20.32241" W	10042.556	8797.301	5180.711	80	60-80
NV-4	Nov. 2010	41° 59' 34.02818" N	112° 03' 12.31355" W	11618.958	9402.31	5101.68	80	60-80
NV-5	Nov. 2010	41° 59' 46.11950" N	112° 03' 24.92124" W	12843.253	8450.104	5184.715	80	60-80
NV-6	Nov. 2011	41° 59' 42.75081" N	112° 03' 31.23302" W	12502.208	7973.355	5230.654	250.5	60-80
NV-7	Nov. 2011	41° 59' 36.26975" N	112° 03' 28.99786" W	11845.985	8142.124	5271.146	250.3	105-125

Table 2 Summary of Laboratory Analytical Data North Valley Landfill Site

Analyte	Collection Date	Upgradient Wells		Down Gradient Wells			Min. Reporting Limit
		NV6	NV7	NV1	NV3	NV4	
Inorganics (mg/l)							
Ammonia	12/6/2011 to 12/7/2011	0	0	0	0.75	7.06	0.05
Carbonate	12/6/2011 to 12/7/2011	0	0	0	0	0	20
Bicarbonate	12/6/2011 to 12/7/2011	246	240	224	390	568	20
Calcium	12/6/2011 to 12/7/2011	315	187	155	322	117	10
Chloride	12/6/2011 to 12/7/2011	552	103	615	243	93.8	10
Iron	12/6/2011 to 12/7/2011	6.13	2.73	2.77	0.799	8.88	0.1
Magnesium	12/6/2011 to 12/7/2011	77.1	29.3	118	67.6	56.1	10
Manganese	12/6/2011 to 12/7/2011	0.708	0.0919	0.0941	0.0776	0.77	0.0012
Nitrate	12/6/2011 to 12/7/2011	12.4	0.584	8.56	6.22	0.0843	0.01
Potassium	12/6/2011 to 12/7/2011	24.2	11.3	25.5	19.6	25.2	10
Sodium	12/6/2011 to 12/7/2011	75.9	16.6	119	75.5	135	10
Sulfate	12/6/2011 to 12/7/2011	193	40	335	158	146	75
TDS	12/6/2011 to 12/7/2011	1690	536	2040	1080	896	20
TOC	12/6/2011 to 12/7/2011	6.37	1.83	3.59	2.9	9.48	1
COD	12/6/2011 to 12/7/2011	21	0	30	21	40	10
pH @ 25 C	12/6/2011 to 12/7/2011	7.24	7.35	7.28	6.97	7.2	
Heavy Metals (mg/l)							
Antimony	12/6/2011 to 12/7/2011	0	0	0	0.00228	0.00103	0.001
Arsenic	12/6/2011 to 12/7/2011	0.00886	0.00883	0.0182	0.00841	0.0139	0.0006
Barium	12/6/2011 to 12/7/2011	0.239	0.127	0.134	0.0529	0.239	0.0004
Beryllium	12/6/2011 to 12/7/2011	0	0	0	0	0.00112	0.0006
Cadmium	12/6/2011 to 12/7/2011	0	0.000268	0.000471	0	0	0.00018
Chromium	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
Cobalt	12/6/2011 to 12/7/2011	0.00441	0.00152	0.0024	0	0.00608	0.0012
Copper	12/6/2011 to 12/7/2011	0.00773	0.00368	0.00588	0.00396	0.0102	0.0008
Lead	12/6/2011 to 12/7/2011	0.00586	0.00296	0.00372	0.00149	0.0178	0.0004
Mercury	12/6/2011 to 12/7/2011	0	0	0	0	0	0.00015
Nickel	12/6/2011 to 12/7/2011	0.0307	0.0112	0.0288	0.0154	0.0219	0.0008
Selenium	12/6/2011 to 12/7/2011	0.0186	0.0209	0.0346	0.0049	0.00996	0.0008
Silver	12/6/2011 to 12/7/2011	0	0	0	0	0	0.0004
Thallium	12/6/2011 to 12/7/2011	0	0	0	0	0	0.0004
Vanadium	12/6/2011 to 12/7/2011	0.0103	0.00764	0.00801	0	0.00864	0.005
Zinc	12/6/2011 to 12/7/2011	0.193	0.246	0.0482	0.0202	0.362	0.005

Table 2 Summary of Laboratory Analytical Data North Valley Landfill Site

Analyte	Collection Date	Upgradient Wells		Down Gradient Wells			Min. Reporting Limit?
		NV6	NV7	NV1	NV3	NV4	
VOCs (ppb)							
Acetone	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Acrylonitrile	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Benzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromochloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromodichloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromoform	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Carbon disulfide	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Carbon tetrachloride	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chloroform	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Dibromochloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dibromo-3-chloropropane	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
1,2-Dibromoethane	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
1,2-Dichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,4-Dichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,4-Dichloro-2-butene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1-Dichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
cis-1,2-Dichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,2-Dichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dichloropropane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
cis-1,3-Dichloropropene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,3-Dichloropropene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Ethylbenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
2-Hexanone (Methyl butyl ketone)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Methyl bromide (Bromomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Methyl chloride (Chloromethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	3
Methylene bromide (Dibromomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Methylene chloride (Dichloromethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Methylethylketone (2-Butanone)	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Methyl iodide (Iodomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
4-Methyl-2-pentanone	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Styrene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2,3-Trichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,1,2-Tetrachloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,2,2-Tetrachloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Tetrachloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Toluene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,2-Trichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Trichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Trichlorofluoromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Vinyl acetate	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Vinyl chloride	12/6/2011 to 12/7/2011	0	0	0	0	0	1
Xylenes, Total	12/6/2011 to 12/7/2011	0	0	0	0	0	2

Table 3 Summary of Proposed Analytes

Inorganics		
Ammonia	Magnesium	Sulfate
Carbonate/Bicarbonate	Manganese	Total Dissolved Solids (TDS)
Calcium	Nitrate	Total Organic Carbon (TOC)
Chloride	Potassium	
Iron	Sodium	
Heavy Metals		
Antimony	Chromium	Nickel
Arsenic	Cobalt	Selenium
Barium	Copper	Silver
Beryllium	Lead	Thallium
Cadmium	Mercury	Vanadium
		Zinc
Organics		
Acetone	Dibromomethane	Iodomethane
Acrylonitrile	1,2-Dibromo-3-chloropropane	Methylene chloride
Benzene	1,2-Dibromoethane	4-Methyl-2-pentanone
Bromochloromethane	1,2-Dichlorobenzene	Styrene
Bromodichloromethane	1,4-Dichlorobenzene	Tetrachloroethene
Bromoform	1,1-Dichloroethane	Toluene
Bromomethane	1,2-Dichloroethane	Trichloroethene
2-Butanone	1,2-Dichloropropane	Trichlorofluoromethane
Carbon disulfide	cis-1,2-Dichloroethene	1,1,1,2-Tetrachloroethane
Carbon tetrachloride	cis-1,3-Dichloropropene	1,1,2,2-Tetrachloroethane
Chlorobenzene	trans-1,2-Dichloroethene	1,1,2-Trichloroethane
Chloroethane	trans-1,3-Dichloropropene	1,2,3-Trichlorobenzene
Chloroform	trans-1,4-Dichloro-2-butene	Vinyl acetate
Chloromethane	Ethylbenzene	Vinyl chloride
Dibromochloromethane	2-Hexanone	Xylenes, Total

Table 4 Requested Laboratory Detection Limits

Metals	**DL (mg/l)**
Antimony	0.003
Arsenic	0.005
Barium	0.005
Beryllium	0.001
Cadmium	0.001
Chromium	0.05
Cobalt	0.03
Copper	0.012
Lead	0.003
Mercury	0.0002
Nickel	0.01
Selenium	0.002
Silver	0.002
Thallium	0.0015
Vanadium	0.03
Zinc	0.03
Inorganics	**DL (mg/l)**
Ammonia	0.1
Cabonate/Bicarbonate	10
Calcium	0.05
Chloride	0.5
Iron	0.013
Magnesium	0.06
Manganese	0.005
Nitrate (as N)	0.05
Potassium	1
Sodium	1
Sulfate	5
Total Dissolved Solids (TDS)	40
Total Organic Carbon (TOC)	2.0

Table 4 Requested Laboratory Detection Limits

Organics	DL (ug/l)
Acetone	10
Acrylonitrile	50
Benzene	1
Bromochloromethane	1
Bromodichloromethane	1
Bromoform	1
Carbon disulfide	1
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	1
Chloroform	1
Dibromochloromethane	1
1,2-Dibromo-3-chloropropane	0.01
1,2-Dibromoethane	0.01
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	1
trans-1,4-Dichloro-2-butene	20
1,1-Dichloroethane	1
1,2-Dichloroethane	1
cis-1,2-Dichloroethene	1
trans-1,2-Dichloroethene	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
trans-1,3-Dichloropropene	1
Ethylbenzene	1
2-Hexanone (Methyl butyl ketone)	10
Methyl bromide (Bromomethane)	1
Methyl chloride (Chloromethane)	1
Methylene bromide (Dibromomethane)	1
Methylene chloride (Dichloromethane)	5
Methylethylketone (2-Butanone)	10
Methyl Iodide (Iodomethane)	10
4-Methyl-2-pentanone (MIBK)	10
Styrene	1
1,2,3-Trichlorobenzene	1
1,1,1,2-Tetrachloroethane	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethene	1
Toluene	1
1,1,2-Trichloroethane	1
Trichloroethene	1
Trichlorofluoromethane	1
Vinyl acetate	10
Vinyl chloride	1
Xylenes, Total	1

APPENDIX C

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Mari M111
Boring Type: 8-inch HSA

BORING NO: B-1
Sheet 2 of 3

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
	25													
8														
9	30			SP-SC	Poorly Graded SAND with clay and gravel - very dense, moist to very moist, grey, sand is medium-grained, gravel is subrounded, ¼- to ½-inch typical, decreasing clay with depth, sand becomes course-grained with depth	15 24 25								
10														
	35													
11														
12	40			SM	Silty SAND with trace gravel - medium dense, very moist, brown, sand is fine- to medium-grained, silt is non-plastic, alternating seams of Sandy SILT (ML) and Silty SAND (SM), some vertical seams, with thick iron staining in sandy material, gravel is subrounded, ¼- to ½-inch typical	7 8 13								
13					- groundwater encountered at 43 feet			▼						
	45													
14														
15														

N - OBSERVED BLOW COUNT PER 6-INCHES

IGES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 1

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **B-1**
Sheet 3 of 3

LOCATION
NORTHING EASTING ELEVATION feet

METERS	FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit, Moisture Content, Liquid Limit; 10 20 30 40 50 60 70 80 90)
	50			SC	Clayey SAND with gravel - very dense, wet, brown grading to grey, clay has low plasticity, sand is well-graded, gravel is angular limestone and sandstone clasts, ½- to 1-inch typical	15 34 35								
16														
	55													
17														
18														
	60			CL	Sandy Lean CLAY - very stiff, moist, green to grey, clay has low plasticity, sand is fine-grained, mild organic odor, with some preserved organic material throughout, sample is homogenous	10 14 18								
19														
	65													
20														
21														
	70				- medium stiff, wet	5 7 8								
22					Bottom of Boring @ 71.5 Feet									

N - OBSERVED BLOW COUNT PER 6-INCHES

IGES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 2

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: B-2
Sheet 1 of 5

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit; 10 20 30 40 50 60 70 80 90)
0	0			ML	Sandy SILT with gravel - soft, dry, light brown, silt is non-plastic, sand is fine-grained, with thin organics to 6 inches									
					- stiff, slightly moist, brown, with thick carbonate stringers throughout	9 11 8								
1														
	5			SM	Silty SAND with gravel - dense, moist, brown, silt is non-plastic, sand is fine-grained, gravel is subrounded, ½-inch typical, with some small pinholes, carbonate stringers throughout	7 9 11								
2					- decreasing gravel, increasing silt, sand grading to coarse-grained with depth	3 5 10								
3	10				- medium dense, increasing gravel, ¼- to ½-inch typical, with moderate cementation	5 6 8								
4														
	15				- increasing clay content	4 7 12								
5														
6	20					10 24								
				SP	Poorly Graded SAND with gravel - very dense, moist, light brown, sand is fine- to medium-grained, gravel is subrounded, ¼-inch typical, 2 inches maximum	50 for 5"								
7														

N - OBSERVED BLOW COUNT PER 6-INCHES

IGES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 3

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: B-2
Sheet 2 of 5

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
	25													
8														
9	30			ML	Sandy SILT - very stiff, moist, light brown, silt has low to no plasticity, sand is fine-grained occasional ½-inch thick seams of Silty SAND (SM) throughout, with thick iron staining, decreasing sand with depth	10 30 50 for 5"								
10														
	35													
11														
12	40			SP	Poorly Graded SAND - very dense, moist, brown to light brown, sand is fine-grained, grades into Sandy SILT (ML) with depth	11 50 for 5"								
13														
	45													
14														
15														

N - OBSERVED BLOW COUNT PER 6-INCHES

IGES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 4

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **B-2**
Sheet 3 of 5

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
	50			ML	Sandy SILT - hard, moist, grey, silt is non-plastic, sand is fine-grained, sample is homogenous	9 28 50 for 4"								
16														
	55													
17														
18														
	60			SM	Silty SAND - hard, moist, grey to dark grey, sand is fine-grained, silt is non-plastic, with some organic material throughout, sample is homogenous	16 50 for 4"		▽						
19														
	65													
20														
21														
	70			CL	Lean CLAY with sand - very stiff, moist, grey, clay has low to high plasticity, sample is homogenous	10 23 40								
22														

N - OBSERVED BLOW COUNT PER 6-INCHES

IGES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 5

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: B-2
Sheet 4 of 5

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit; 10 20 30 40 50 60 70 80 90)
23	75													
24														
	80	X			- increasing plasticity with depth, may grade into Fat CLAY (CH)	16 50 for 3"								
25														
26	85													
27														
	90	X				13 24 32								
28														
29	95													
30														

N - OBSERVED BLOW COUNT PER 6-INCHES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 6

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

Geotechnical Investigation
Cache County
Clarkston Utah
IGES Project Number: 00386-006

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: B-2
Sheet 5 of 5

LOCATION
NORTHING EASTING ELEVATION feet

DEPTH METERS	DEPTH FEET	SAMPLES	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION (AASHTO)	MATERIAL DESCRIPTION	N	(N1)60	Water Level	Dry Density(pcf)	Moisture Content (%)	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
	100	X				20 35 50 for 3"								
31					- no groundwater observed during drilling on 8/25/10, but was measured at 60 feet on 8/26/10, likely encountered perched water table Bottom of Boring @ 101.5 Feet									
32	105													
33														
	110													
34														
35	115													
36														
	120													
37														
38														

N - OBSERVED BLOW COUNT PER 6-INCHES

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SAMPLE TYPE
- 2" O.D./1.38" I.D. Split Spoon Sampler
- 3.25" O.D./2.42" I.D. 'U' Sampler
- 3" O.D. Thin-Walled Shelby Sampler
- Grab Sample
- Modified California Sampler
- Sample from Auger Cuttings

BORING LOG

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate 7

DATE	
STARTED:	11/3/10
COMPLETED:	11/3/10
BACKFILLED:	11/3/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type:

BORING NO: **Well 3**

Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit 10 20 30 40 50 60 70 80 90
0	0				ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt									
1	5				CL	Sandy Lean CLAY w/ gravel up to 1/4 inch in diameter - very stiff, slightly moist, brown to grey									
3	10					Lean CLAY w/ sand - hard, slightly moist, light brown, LP clay, 1/8 inch iron stained sand seams throughout sample	20 23 33	56							
6	20					Sandy Lean CLAY - hard, moist, light brown to grey	21 26 35	61							
9	30					Lean CLAY - hard, moist, light brown	28 50/4								
12	40					Lean CLAY - hard, moist, grey, medium to high plasticity clay - very difficult drilling around 42 feet	15 20 27	47							
15	50		▼												
18	60					Lean CLAY - hard, moist, grey, high plasticity clay, no groundwater observed in sample - groundwater measured at 61 feet - no cuttings coming up from augers, still difficult drilling	10 19 29	48							
25	80					Bottom of Boring @ 80 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 3a

DATE	
STARTED:	11/3/10
COMPLETED:	11/3/10
BACKFILLED:	11/3/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type:

WELL NO: **Well 3**

Sheet 1 of 1

LOCATION: NORTHING / EASTING / ELEVATION

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT (10 20 30 40 50 60 70 80 90)	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) (10 20 30 40 50 60 70 80 90)
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt							
1	5	CL	Sandy Lean CLAY w/ gravel up to 1/4 inch in diameter - very stiff, slightly moist, brown to grey							
3	10		Lean CLAY w/ sand - hard, slightly moist, light brown, LP clay, 1/8 inch iron stained sand seams throughout sample							
4	15									
6	20		Sandy Lean CLAY - hard, moist, light brown to grey							
8	25									
9	30		Lean CLAY - hard, moist, light brown							
11	35									
12	40		Lean CLAY - hard, moist, grey, medium to high plasticity clay - very difficult drilling around 42 feet							
14	45									
15	50									
17	55									
18	60		Lean CLAY - hard, moist, grey, high plasticity clay, no groundwater observed in sample - groundwater measured at 61 feet - no cuttings coming up from augers, still difficult drilling							
20	65									
21	70									
23	75									
24	80		Bottom of Boring @ 80 Feet							

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 3b

DATE	
STARTED:	11/4/10
COMPLETED:	11/4/10
BACKFILLED:	11/4/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep. JWW
Rig Type: CME 55
Boring Type:

BORING NO: **Well 4**
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0				ML	Sandy SILT w/ trace gravel - soft, moist, dark brown, NP silt									
1	5					Sandy SILT w/ gravel - soft to medium stiff, dark brown									
3	10	X			CL	Sandy Lean CLAY w/ trace gravel - medium stiff, moist, light brown to tan, low to medium plasticity clay	20 50/5								
4	15														
6	20	X				Lean CLAY - hard, moist, grey, medium to high plasticity clay, rust colored sand seam in bottom of sampler	25 43 45	44							
7	25														
8	30														
10	35														
12	40	X				Lean CLAY - hard, moist, grey, medium to high plasticity clay	14 30 42	72							
13	45														
15	50														
17	55														
18	60	X	▼			Lean CLAY - hard, moist, grey	14 27 39	66							
20	65														
21	70														
23	75														
24	80	X				Lean CLAY w/ some sand - hard, very moist, grey, low to medium plasticity	16 30 44	74							
25						Bottom of Boring @ 80 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

LOG OF BORING (A) 00386-014.GPJ IGES.GDT 12/21/11

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SAMPLE TYPE
- X - 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- X - 3.25" O.D./2.42" I.D. U SAMPLER
- X - 3" O.D. THIN-WALLED SHELBY SAMPLER
- X - GRAB SAMPLE
- X - Modified California Sampler
- X - 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 4a

DATE	
STARTED:	11/4/10
COMPLETED:	11/4/10
BACKFILLED:	11/4/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type:

WELL NO: **Well 4**

Sheet 1 of 1

LOCATION: NORTHING / EASTING / ELEVATION

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0	ML	Sandy SILT w/ trace gravel - soft, moist, dark brown, NP silt							
1	5		Sandy SILT w/ gravel - soft to medium stiff, dark brown							
3	10	CL	Sandy Lean CLAY w/ trace gravel - medium stiff, moist, light brown to tan, low to medium plasticity clay							
6	20		Lean CLAY - hard, moist, grey, medium to high plasticity clay, rust colored sand seam in bottom of sampler	●						
12	40		Lean CLAY - hard, moist, grey, medium to high plasticity clay	●						
18	60		Lean CLAY - hard, moist, grey	●						
24	80		Lean CLAY w/ some sand - hard, very moist, grey, low to medium plasticity	●						
25			Bottom of Boring @ 80 Feet							

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- *Modified California Sampler*

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 4b

DATE	
STARTED:	11/5/10
COMPLETED:	11/5/10
BACKFILLED:	11/5/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type:

BORING NO.
Well 5
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0				ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt									
1	5				CL-ML	Silty CLAY - medium stiff, moist, brown									
3	10	X			CL	Sandy Lean CLAY - hard, slightly moist, light brown	6 13 40	53	●						
4	15					1/2 inch seam of rust colored Poorly Graded SAND in bottom of sampler/ Lean CLAY - hard, moist, light brown, medium plasticity clay									
6	20														
8	25														
9	30	X			CL	Lean CLAY w/ sand - hard, moist, light brown to grey	13 40 50/3								
11	35														
12	40														
14	45														
15	50	X			CL	Lean CLAY w/ some sand - hard, moist, grey, low to medium plasticity clay	18 26 40	66	●						
17	55														
18	60														
20	65														
21	70	X			CL	Lean CLAY - hard, moist, grey	33 42 50/5								
23	75														
24	80														
25						Bottom of Boring @ 80 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

LOG OF BORING (A) 00386-014.GPJ IGES.GDT 12-21-11

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 5a

DATE	
STARTED:	11/5/10
COMPLETED:	11/5/10
BACKFILLED:	11/5/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type:

WELL NO: **Well 5**
Sheet 1 of 1

LOCATION: NORTHING / EASTING / ELEVATION

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt							
1	5	CL-ML	Silty CLAY - medium stiff, moist, brown							
3	10	CL	Sandy Lean CLAY - hard, slightly moist, light brown	●						
4	15		1/2 inch seam of rust colored Poorly Graded SAND in bottom of sampler							
5			Lean CLAY - hard, moist, light brown, medium plasticity clay							
6	20									
7	25									
9	30	CL	Lean CLAY w/ sand - hard, moist, light brown to grey							
10	35									
12	40									
14	45									
15	50	CL	Lean CLAY w/ some sand - hard, moist, grey, low to medium plasticity clay	●						
17	55									
18	60									
20	65									
21	70	CL	Lean CLAY - hard, moist, grey							
23	75									
24	80									
25			Bottom of Boring @ 80 Feet							

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite | 10-20 Silica Sand | 20 Slot Screen | Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 5b

DATE	
STARTED	11/7/11
COMPLETED	11/9/11
BACKFILLED	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type

BORING NO
Well 6
Sheet 1 of 3

LOCATION: NORTHING / EASTING / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10203040506070 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10203040506070 80 90
0	0					Silty SAND with gravel - medium dense, moist, light brown to brown									
1							11								
2	5	X			SM		18	16							
							24								
3	10	X			SP	Poorly Graded SAND - medium dense, moist, brown	8								
						- no recovery	15	12							
4							17								
5	15	X			GP	Poorly Graded GRAVEL with sand - medium dense, moist, brown	9								
							15	12							
							16								
6	20	X				- no recovery									
7						- driller observation: cobbles									
8	25														
9	30	X			ML	SILT - very stiff, moist, brown, somewhat cemented	39								
							61-3"								
10															
11	35														
12	40	X			ML		39								
							61/3"								
13						Lean CLAY - moist, grey									
14	45														
15	50	X			SM	Silty SAND - very dense, moist, brown with rust, somewhat cemented	84								
							16/1"								
16															
17	55														
18	60	X			SM		67								
							33/3"								
19															
20	65														
21	70	X	▼		SM	- very moist	58								
							42/5"								
22															
23	75														
24	80	X			CL	Lean CLAY - very hard, moist, cemented	100/6"								
25															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

LOG OF BORING (A) 00386-014 GPJ IGES.GDT 11/21/11

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 1a

DATE	
STARTED	11/7/11
COMPLETED	11/9/11
BACKFILLED	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type

BORING NO
Well 6
Sheet 2 of 3

LOCATION
NORTHING EASTING ELEVATION

METERS	FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10203040506070809 0	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10203040506070809 0
26	85														
27															
	90						80 20/2"								
28															
29	95														
30					SC	Clayey SAND - very dense, moist, grey, cemented									
	100						100/5"								
31															
32	105														
33															
	110														
34															
35	115														
36					CL	Lean CLAY - very hard, moist, grey, with some sand									
	120						100/6"								
37															
38	125														
39															
	130														
40															
41	135														
42															
	140				CL		100/6"								
43															
44	145														
45															
	150														
46															
47	155														
48															
	160				CL SP	Poorly Graded SAND - very dense, moist, grey	100/6"								
49															
50	165														
51															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

LOG OF BORING (A) 00386-014.GPJ IGES.GDT 11/21/11

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
- MEASURED - ESTIMATED

Figure 1b

DATE	
STARTED	11/7/11
COMPLETED	11/9/11
BACKFILLED	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah
Project Number 00386-014

IGES Rep DKS
Rig Type Fmste
Boring Type

BORING NO
Well 6
Sheet 3 of 3

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits: Plastic Limit – Moisture Content – Liquid Limit 10 20 30 40 50 60 70 80 90
52	170														
53	175														
54															
55	180				CL	Lean CLAY - very hard, moist, grey	100/5"								
56	185														
57															
58	190														
59															
60	195														
61	200				CL	- some sand pockets	100/6"								
62															
63	205														
64	210														
65															
66	215														
67	220				CL		84 18/1"								
68															
69	225														
70	230														
71															
72	235														
73	240														
74															
75	245														
76	250				CL		100/6"								
77						Bottom of Boring @ 250.5 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
- MEASURED - ESTIMATED

Figure 1c

DATE	
STARTED	11/7/11
COMPLETED	11/9/11
BACKFILLED	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type

WELL NO
Well 6
Sheet 1 of 3

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0		Silty SAND with gravel - medium dense, moist, light brown to brown							
1	5	SM								
2										
3	10	SP	Poorly Graded SAND - medium dense, moist, brown - no recovery							
4										
5	15	GP	Poorly Graded GRAVEL with sand - medium dense, moist, brown							
6	20		- no recovery - driller observation: cobbles							
7										
8	25									
9	30	ML	SILT - very stiff, moist, brown, somewhat cemented							
10										
11	35									
12	40	ML								
13			Lean CLAY - moist, grey							
14	45									
15	50	SM	Silty SAND - very dense, moist, brown with rust, somewhat cemented							
16										
17	55									
18	60	SM								
19										
20	65									
21	70	SM	- very moist							
22										
23	75									
24	80	CL	Lean CLAY - very hard, moist, cemented							
25										

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:
Benfonite | 10-20 Silica Sand | 20 Slot Screen | Grout

WATER LEVEL
- MEASURED - ESTIMATED

Figure 1d

DATE	
STARTED	11/3/11
COMPLETED	11/3/11
BACKFILLED	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type

WELL NO: **Well 7**

Sheet 1 of 3

DEPTH METERS	DEPTH FEET	SAMPLES	WELL GRAPHICS LOG	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10203040506070809 0	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10203040506070809 0
0	0				SM	Silty SAND with gravel - light brown							
1	5				SM	Silty SAND - medium dense, moist, fines are more plastic							
2	10				SP SC	Poorly Graded SAND - medium dense, moist, light brown, some silt, trace gravel							
3	15				ML	SILT - hard, moist, light brown with rust, blocky, somewhat plastic, some cementation							
4	20				ML								
5	25												
6	30				ML								
7	35												
8	40				ML								
9	45												
10	50				ML								
11	55												
12	60				ML								
13	65				SM	Silty SAND - very dense, moist, light brown with rust, SILT pockets, cemented							
14	70												
15	75				ML	SILT - hard, moist, light brown, cemented							
16	80												
17													
18													
19													
20													
21													
22													
23													
24													
25													

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL
- MEASURED ▽ - ESTIMATED

Figure 2d

DATE	
STARTED	11/1/11
COMPLETED	11/3/11
BACKFILLED	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Frasie
Boring Type

WELL NO
Well 7
Sheet 2 of 3

LOCATION: NORTHING / EASTING / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WELL GRAPHICS LOG	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 102030405060708090	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 102030405060708090
26	85												
27	90				ML								
28													
29	95												
30	100				SM	Silty SAND - very dense, moist to very moist, light brown, cemented							
31													
32	105												
33						- driller observation : gravel							
34	110												
35	115												
36						Poorly Graded SAND with silt - dense, wet, red brown, with some gravel							
37	120				SM / ML	Silty SAND - very dense, moist, light brown with rust / SILT - hard, moist, light brown with rust							
38	125												
39													
40	130					- driller observation : gravel							
41	135												
42													
43	140				CL	Lean CLAY - hard, moist, grey, somewhat cemented							
44	145												
45													
46	150												
47	155												
48													
49	160				CL								
50	165												
51													

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 2e

DATE	
STARTED	11/3/11
COMPLETED	11/3/11
BACKFILLED	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type Fraste
Boring Type

BORING NO
Well 7
Sheet 1 of 3

LOCATION
NORTHING EASTING ELEVATION

METERS	FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10203040506070809 0	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10203040506070809 0
0	0				SM	Silty SAND with gravel - light brown									
1	5	X			SM	Silty SAND - medium dense, moist, fines are more plastic	15 15 18	13							
2	10	X			SP SC	Poorly Graded SAND - medium dense, moist, light brown, some silt, trace gravel	18 21 22	17							
3	15	X			ML	SILT - hard, moist, light brown with rust, blocky, somewhat plastic, some cementation	27 67								
4	20	X			ML		34 66								
5	25														
6	30	X			ML		29 71								
7	35														
8	40	X			ML		43 57/5"								
9	45														
10	50	X			ML		44 56/5"								
11	55														
12	60	X			ML		66 44/4"								
13	65														
14	70	X			SM	Silty SAND - very dense, moist, light brown with rust, SILT pockets, cemented	89 11/1"								
15	75														
16	80	X			ML	SILT - hard, moist, light brown, cemented	69 21/2"								

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2a

DATE	
STARTED	11/1/11
COMPLETED	11/3/11
BACKFILLED	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type.

BORING NO.
Well 7
Sheet 2 of 3

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10203040506070 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10203040506070 80 90
26	85														
27															
	90				ML		67 33/3"								
28															
29	95														
30															
	100				SM	Silty SAND - very dense, moist to very moist, light brown, cemented	38 62/5"								
31															
32	105		▼												
33						- driller observation : gravel									
	110														
34															
35	115														
36						Poorly Graded SAND with silt - dense, wet, red brown, with some gravel	53								
	120				SM										
37					ML	Silty SAND - very dense, moist, light brown with rust	47/3"								
38	125					SILT - hard, moist, light brown with rust									
39															
	130					- driller observation : gravel									
40															
41	135														
42															
	140				CL	Lean CLAY - hard, moist, grey, somewhat cemented	27 33 40	50							
43															
44	145														
45															
46	150														
47	155														
48															
	160				CL		100/5"								
49															
50	165														
51															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2b

DATE	
STARTED	11/1/11
COMPLETED	11/3/11
BACKFILLED	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah
Project Number 00386-014

IGES Rep DKS
Rig Type Fraste
Boring Type

BORING NO
Well 7
Sheet 3 of 3

LOCATION
NORTHING EASTING ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10203040506070809 0	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit / Moisture Content / Liquid Limit) 10203040506070809 0
52	170														
53	175														
54															
55	180				CL		100/6"								
56	185														
57															
58	190														
59	195														
60															
61	200				CL		100/6"								
62	205														
63															
64	210														
65	215														
66															
67	220				CL		100/6"								
68	225														
69															
70	230														
71	235														
72															
73	240														
74	245														
75															
76	250				SM	Silty SAND - very dense, grey, with some gravel	100/3"								
77						Bottom of Boring @ 250.3 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2c

APPENDIX D

North Valley Sanitary Landfill- Groundwater

WELL NO.:	Date:
Sampler:	
Field Observations:	
Well Information	
Total Depth:	
Casing Diameter:	
Casing Stick-up:	
Static Depth to Water:	
Measuring Method:	Conductivity based water level meter
Field Analysis	
Water Quality Parameters:	***Instrument:***
pH:	
Temperature:	
Conductivity:	
TDS:	
Dissolved Oxygen:	
Well Purge Information	
Purge Method:	
Purge Volume:	
Recovery Data (if purged dry):	
Water Sample Information	
Sample Method:	
Sample Number:	
Time of Collection:	
Laboratory:	
Transporter:	
Sample Sequence	

Sample Order	*Analysis*	*Container*	*Preservative*
1	VOC	40 mL clear glass	HCl
2	TOC, Nutrients	500 mL amber glass	4 C
3	Dissolved Metals		
4	TDS, Minerals	64 oz. plastic	4 C

North Valley Sanitary Landfill- Groundwater

WELL NO.:	Date:
Sampler:	
Field Observations:	
Well Information	
Total Depth:	
Casing Diameter:	
Casing Stick-up:	
Static Depth to Water:	
Measuring Method:	Conductivity based water level meter
Field Analysis	
Water Quality Parameters:	***Instrument:***
pH:	
Temperature:	
Conductivity:	
TDS:	
Dissolved Oxygen:	
Well Purge Information	
Purge Method:	
Purge Volume:	
Recovery Data (if purged dry):	
Water Sample Information	
Sample Method:	
Sample Number:	
Time of Collection:	
Laboratory:	
Transporter:	
Sample Sequence	

Sample Order	*Analysis*	*Container*	*Preservative*
1	VOC	40 mL clear glass	HCl
2	TOC, Nutrients	500 mL amber glass	4 C
3	Dissolved Metals		
4	TDS, Minerals	64 oz. plastic	4 C

North Valley Sanitary Landfill- Groundwater

WELL NO.:	Date:
Sampler:	
Field Observations:	
Well Information	
Total Depth:	
Casing Diameter:	
Casing Stick-up:	
Static Depth to Water:	
Measuring Method:	Conductivity based water level meter
Field Analysis	
Water Quality Parameters:	***Instrument:***
pH:	
Temperature:	
Conductivity:	
TDS:	
Dissolved Oxygen:	
Well Purge Information	
Purge Method:	
Purge Volume:	
Recovery Data (if purged dry):	
Water Sample Information	
Sample Method:	
Sample Number:	
Time of Collection:	
Laboratory:	
Transporter:	
Sample Sequence	

Sample Order	***Analysis***	***Container***	***Preservative***
1	VOC	40 mL clear glass	HCl
2	TOC, Nutrients	500 mL amber glass	4 C
3	Dissolved Metals		
4	TDS, Minerals	64 oz. plastic	4 C

Appendix G

TRENTON, UTAH (428828)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1944 to 12/31/2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	32.3	37.8	49.5	59.8	69.0	78.8	88.1	87.2	77.3	64.0	45.7	34.3	60.3
Average Min. Temperature (F)	12.4	16.0	25.6	31.7	38.9	45.0	50.0	48.8	40.8	31.2	22.2	14.6	31.4
Average Total Precipitation (in.)	1.50	1.59	1.87	1.89	2.44	1.44	0.76	0.94	1.24	1.61	1.47	1.53	18.28
Average Total SnowFall (in.)	11.5	9.8	6.0	2.5	0.2	0.0	0.0	0.0	0.0	0.9	7.3	12.4	50.5
Average Snow Depth (in.)	5	5	2	0	0	0	0	0	0	0	1	3	1

Percent of possible observations for period of record.
Max. Temp.: 44.4% Min. Temp.: 44.4% Precipitation: 44.6% Snowfall: 44.2% Snow Depth: 43.5%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

CUTLER DAM UTAH P&L CO, UTAH (421918)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1980 to 11/30/2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	32.4	37.6	50.4	60.8	70.0	80.3	90.2	88.4	77.5	63.3	46.8	33.9	61.0
Average Min. Temperature (F)	18.0	21.5	31.4	38.5	46.3	53.9	61.4	60.1	50.0	39.5	29.4	19.6	39.1
Average Total Precipitation (in.)	1.68	1.51	1.60	1.74	2.37	1.16	0.78	0.75	1.31	1.79	1.48	1.59	17.75
Average Total SnowFall (in.)	12.4	9.3	2.5	0.2	0.0	0.0	0.0	0.0	0.0	0.5	3.3	11.0	39.1
Average Snow Depth (in.)	6	6	2	0	0	0	0	0	0	0	0	3	1

Percent of possible observations for period of record.
Max. Temp.: 95.4% Min. Temp.: 95.3% Precipitation: 97.9% Snowfall: 92.1% Snow Depth: 89.6%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

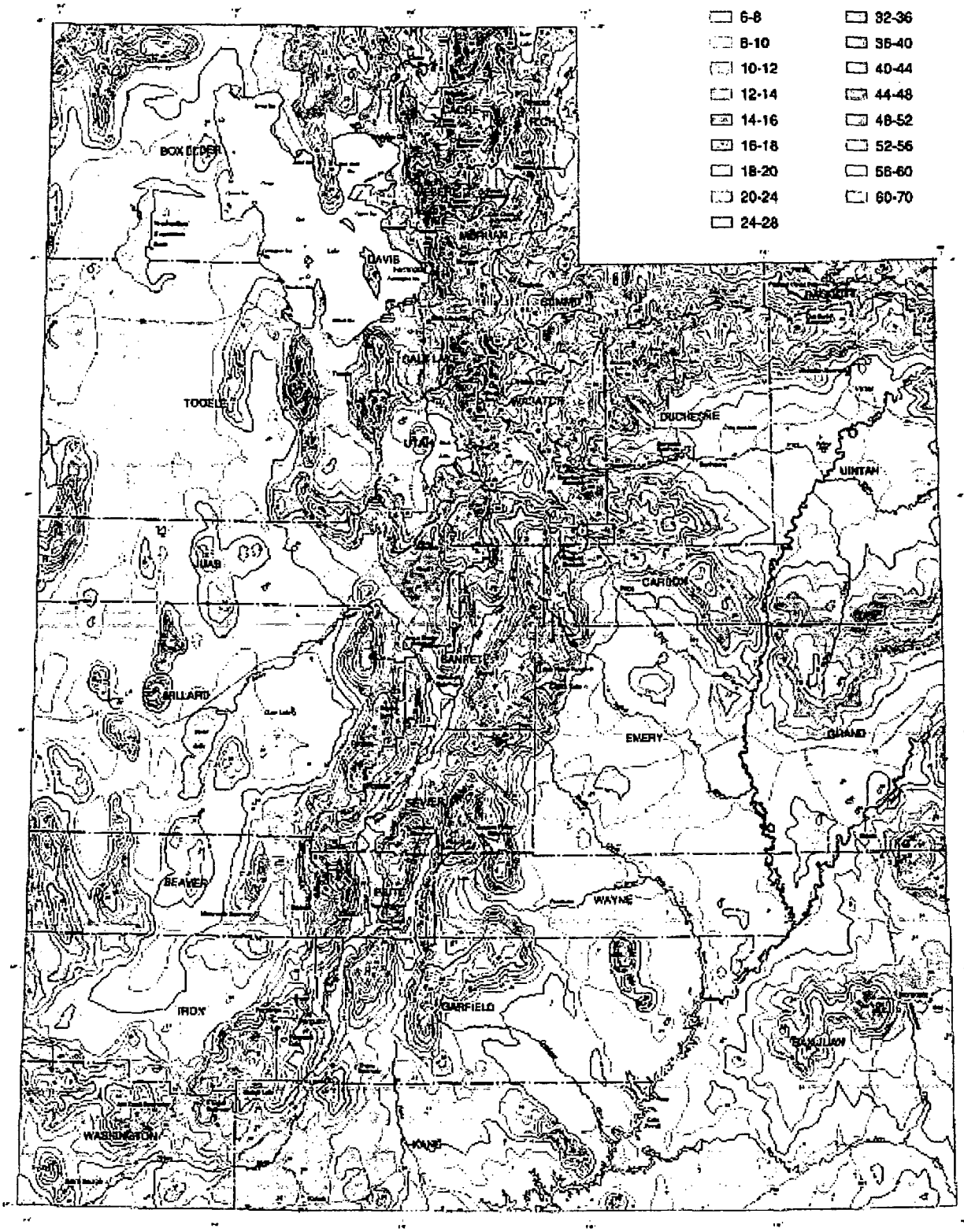
U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

UTAH
ANNUAL PRECIPITATION

Average Annual Precipitation
1961-1990
inches per year

<6	28-32
6-8	32-36
8-10	36-40
10-12	40-44
12-14	44-48
14-16	48-52
16-18	52-56
18-20	56-60
20-24	60-70
24-28	



SCALE 1:1,000,000

Runoff Curve Number and Runoff

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments:	Northwest run-on		

1. Runoff Curve Number

Soil Name and Hydrologic Soil Group	Cover Description	CN Table 2-2	CN Table 2-3	CN Table 2-4	Area (acres)	CNxArea
C-clay loam or shallow sa	Native Soils, silt & clay	77			31.1	2394.7
B-sandy loam	Native Soils, sandy	67			38	2546
						0
						0
						0
						0
						0
						0
						0
						0
						0
				TOTALS:	69.1	4940.7

CN Weighted: $\frac{\Sigma(\text{CNxArea})}{\Sigma(\text{Area})} = \frac{4940.7}{69.1} = 71.500724$ **Use CN** → **72**

2. Runoff

		Storm #1		Storm #2		Storm #3	
		ARI (Year)	Duration	ARI (Year)	Duration	ARI (Year)	Duration
		25	24-hr				
Rainfall, P	in	2.95					
S	in	3.8888889					
I_a	in	0.7777778					
Runoff (Q)	in	0.7784958					

Technical Release 55
Urban Hydrology for Small Watersheds

Time of Concentration(T_c) or Travel Time (T_t)

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments	Northwest run-on		

Sheet Flow

		Segment ID	A		
1	Surface Description (Table 3-1)		Range (natural)		
2	Manning's Roughness Coefficient, n (Table 3-1)		0.13		
3	Flow Length, L (Total L ≤ 300 ft)	ft	300		
4	2-year, 24-hr Ranifall, P2	in	1.76		
5	Land Slope	ft/ft	0.2833333		
6	Tt	hr	0.1637851		0.1637851

Shallow Concentrated Flow

		Segment ID	B		
7	Surface Description		Unpaved		
8	Flow Length, L	ft	772		
9	Land Slope	ft/ft	0.2240933		
10	Average Velocity, V (figure 3-1)		6.5		
11	Tt	hr	0.0329915		0.0329915

Channel Flow

		Segment ID	C		
	Flow Depth		1.58		
	Channel Side Slopes	?h:1V	2		
12	Cross Section flow area, a	ft^2	4.9928		
13	Wetted Perimeter, Pw	ft	5.4732806		
14	Hydraulic Radius, r	ft	0.9122134		
15	Channel Slope, s	ft/ft	0.0693654		
	Channel Material	Earth	0.02		
	Degree of Irregularity	Minor	0.005		
	Relative effect of Obstruction	Minor	0.013		
	Vegetation	Low	0.0075		
	Degree of Meandering	Severe	1.3		
16	Manning's Roughness Coefficient, n		0.05915		
17	Velocity, V	ft/sec	6.2402313		
18	Flow Length, L	ft	4570		
19	T_t	hr	0.2034291		0.2034291
20	Watershed or Subarea T_c			hr	**0.4002056**

Technical Release 55
Urban Hydrology for Small Watersheds

Graphical Peak Discharge Method

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments:	Northwest run-on		

1 Data

Drainage Area, Am	mi^2	0.10796875
Runoff curve number	CN	72
T_c	hr	0.400205596
Rainfall Distribution		II
Pond or Swamp Areas	% of Am	5.0

			Storm #1	Storm #2	Storm #3
2	Frequency	yr	25		
	Duration		24-hr		
3	Rainfall, P	in	2.95		
4	Initial Abstraction, I_a	in	0.777778		
5	Compute I_a/P		0.263653		
	Tc	hr	0.400206		
6	Unit peak discharge, q_u	csm/in	520		
7	Runoff, Q	in	0.778496		
8	Pond and Swamp Factor, F_p		0.72		
9	Peak Discharge	ft^3/sec	31.46952		

Runoff Curve Number and Runoff

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments:	Southwest run-on		

1. Runoff Curve Number

Soil Name and Hydrologic Soil Group	Cover Description	CN Table 2-2	CN Table 2-3	CN Table 2-4	Area (acres)	CNxArea
C-clay loam or shallow sa	Native Soils,	77			23.3	1794.1
B-sandy loam	Native Soils,	67			69.8	4676.6
						0
						0
						0
						0
						0
						0
						0
						0
						0
				TOTALS:	93.1	6470.7

CN Weighted: $\frac{\Sigma(\text{CNxArea})}{\Sigma(\text{Area})} = \frac{6470.7}{93.1} = 69.502685$ **Use CN** → **70**

2. Runoff

		Storm #1		Storm #2		Storm #3	
		ARI (Year)	Duration	ARI (Year)	Duration	ARI (Year)	Duration
		25	24-hr				
Rainfall, P	in	2.95					
S	in	4.2857143					
I_a	in	0.8571429					
Runoff (Q)	in	0.6866821					

Technical Release 55
Urban Hydrology for Small Watersheds

Time of Concentration(T_c) or Travel Time (T_t)

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments	Southwest run-on		

Sheet Flow

		Segment ID	A		
1	Surface Description (Table 3-1)		Residue cover <20%		
2	Manning's Roughness Coefficient, n (Table 3-1)		0.06		
3	Flow Length, L (Total L ≤ 300 ft)	ft	300		
4	2-year, 24-hr Ranifall, P2	in	1.76		
5	Land Slope	ft/ft	0.0833333		
6	Tt	hr	0.1439568		0.1439568

Shallow Concentrated Flow

		Segment ID	B		
7	Surface Description		Unpaved		
8	Flow Length, L	ft	1013		
9	Land Slope	ft/ft	0.2615992		
10	Average Velocity, V (figure 3-1)		11.5		
11	Tt	hr	0.0244686		0.0244686

Channel Flow

		Segment ID	C	D	
	Flow Depth		1.2	2.25	
	Channel Side Slopes	?h:1V	4	2	
12	Cross Section flow area, a	ft^2	5.76	10.125	
13	Wetted Perimeter, Pw	ft	5.3665631	7.7942286	
14	Hydraulic Radius, r	ft	1.0733126	1.2990381	
15	Channel Slope, s	ft/ft	0.0898473	0.0495786	
	Channel Material	Earth	0.02	0.02	
	Degree of Irregularity	Minor	0.005	0.005	
	Relative effect of Obstruction	Appreciable	0.025	0.025	
	Vegetation	Low	0.0075	0.0075	
	Degree of Meandering	Appreciable	1.15	1.15	
16	Manning's Roughness Coefficient, n		0.066125	0.066125	
17	Velocity, V	ft/sec	7.0803897	5.973317	
18	Flow Length, L	ft	1113	2017	
19	T_t	hr	0.0436652	0.0937968	0.137462
20	Watershed or Subarea T_c			hr	**0.3058874**

Technical Release 55
Urban Hydrology for Small Watersheds

Graphical Peak Discharge Method

Project:	North Valley Landfill	By:	JAH	Date:	12/14/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/14/2011
Condition:	Existing	Comments:	Southwest run-on		

1 Data

Drainage Area, Am	mi^2	0.14546875
Runoff curve number	CN	70
T_c	hr	0.305887372
Rainfall Distribution		II
Pond or Swamp Areas	% of Am	0.0

			Storm #1	Storm #2	Storm #3
2	Frequency	yr	25		
	Duration		24-hr		
3	Rainfall, P	in	2.95		
4	Initial Abstraction, I_a	in	0.857143		
5	Compute I_a/P		0.290557		
	Tc	hr	0.305887		
6	Unit peak discharge, q_u	csm/in	600		
7	Runoff, Q	in	0.686682		
8	Pond and Swamp Factor, F_p		1		
9	Peak Discharge	ft^3/sec	59.93447		

Runoff Curve Number and Runoff

Project:	North Valley Landfill	By:	JAH	Date:	12/15/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/15/2011
Condition:	Developed	Comments:	Final cover - North		

1. Runoff Curve Number

Soil Name and Hydrologic Soil Group	Cover Description	CN Table 2-2	CN Table 2-3	CN Table 2-4	Area (acres)	CNxArea
C-clay loam or shallow sa	36" native soil cover, prior to veg establishmen	85			60.22	5118.7
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
				TOTALS:	**60.22**	**5118.7**

CN Weighted: $\frac{\Sigma(\text{CNxArea})}{\Sigma(\text{Area})} = \frac{5118.7}{60.22} = 85$ **Use CN** → **85**

2. Runoff

		Storm #1		Storm #2		Storm #3	
		ARI (Year)	Duration	ARI (Year)	Duration	ARI (Year)	Duration
		25	24-hr				
Rainfall, P	in	2.95					
S	in	1.7647059					
I_a	in	0.3529412					
Runoff (Q)	in	1.546327					

Technical Release 55
Urban Hydrology for Small Watersheds

Time of Concentration(T_c) or Travel Time (T_t)

Project:	North Valley Landfill	By:	JAH	Date:	12/15/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/15/2011
Condition:	Existing	Comments	Final cover - North		

Sheet Flow

		Segment ID	A		
1	Surface Description (Table 3-1)		Residue cover <20%		
2	Manning's Roughness Coefficient, n (Table 3-1)		0.06		
3	Flow Length, L (Total L≤ 300 ft)	ft	300		
4	2-year, 24-hr Ranifall, P2	in	1.76		
5	Land Slope	ft/ft	0.2333333		
6	Tt	hr	0.0953606		0.0953606

Shallow Concentrated Flow

		Segment ID	B		
7	Surface Description		Unpaved		
8	Flow Length, L	ft	185		
9	Land Slope	ft/ft	0.2486486		
10	Average Velocity, V (figure 3-1)		7.7		
11	Tt	hr	0.0066739		0.0066739

Channel Flow

		Segment ID	C		
	Flow Depth		2.4		
	Channel Side Slopes	?h:1V	2		
12	Cross Section flow area, a	ft^2	11.52		
13	Wetted Perimeter, Pw	ft	8.3138439		
14	Hydraulic Radius, r	ft	1.3856406		
15	Channel Slope, s	ft/ft	0.0711692		
	Channel Material	Earth	0.02		
	Degree of Irregularity	Moderate	0.01		
	Relative effect of Obstruction	Minor	0.013		
	Vegetation	Low	0.0075		
	Degree of Meandering	Minor	1		
16	Manning's Roughness Coefficient, n		0.0505		
17	Velocity, V	ft/sec	9.7830596		
18	Flow Length, L	ft	4131		
19	T_t	hr	0.1172946		0.1172946
20	Watershed or Subarea T_c			hr	**0.2193291**

Technical Release 55
Urban Hydrology for Small Watersheds

Graphical Peak Discharge Method

Project:	North Valley Landfill	By:	JAH	Date:	12/15/2011
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	12/15/2011
Condition:	Existing	Comments:	Final cover - North		

1 Data

Drainage Area, Am	mi^2	0.09409375
Runoff curve number	CN	85
T_c	hr	0.219329079
Rainfall Distribution		II
Pond or Swamp Areas	% of Am	0.0

			Storm #1	Storm #2	Storm #3
2	Frequency	yr	25		
	Duration		24-hr		
3	Rainfall, P	in	2.95		
4	Initial Abstraction, I_a	in	0.352941		
5	Compute I_a/P		0.119641		
	Tc	hr	0.219329		
6	Unit peak discharge, q_u	csm/in	775		
7	Runoff, Q	in	1.546327		
8	Pond and Swamp Factor, F_p		1		
9	Peak Discharge	ft^3/sec	112.7623		

Runoff Curve Number and Runoff

Project:	North Valley Landfill	By:	JAH	Date:	2/2/2012
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	2/2/2012
Condition:	Developed	Comments:	Final cover - South		

1. Runoff Curve Number

Soil Name and Hydrologic Soil Group	Cover Description	CN Table 2-2	CN Table 2-3	CN Table 2-4	Area (acres)	CNxArea
C-clay loam or shallow sa	36" native soil cover, prior to veg establishmen	85			72.17	6134.45
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
				TOTALS:	**72.17**	**6134.45**

CN Weighted: $\frac{\Sigma(\text{CNxArea})}{\Sigma(\text{Area})} = \frac{6134.45}{72.17} = 85$ **Use CN** → **85**

2. Runoff

		Storm #1		Storm #2		Storm #3	
		ARI (Year)	Duration	ARI (Year)	Duration	ARI (Year)	Duration
		25	24-hr				
Rainfall, P	in	2.95					
S	in	1.7647059					
I_a	in	0.3529412					
Runoff (Q)	in	1.546327					

Technical Release 55
Urban Hydrology for Small Watersheds

Time of Concentration(T_c) or Travel Time (T_t)

Project:	North Valley Landfill	By:	JAH	Date:	2/2/2012
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	2/2/2012
Condition:	Existing	Comments	Final cover - South		

Sheet Flow

		Segment ID	A		
1	Surface Description (Table 3-1)		Residue cover <20%		
2	Manning's Roughness Coefficient, n (Table 3-1)		0.06		
3	Flow Length, L (Total L≤ 300 ft)	ft	300		
4	2-year, 24-hr Ranifall, P2	in	1.76		
5	Land Slope	ft/ft	0.22		
6	Tt	hr	0.0976317		0.0976317

Shallow Concentrated Flow

		Segment ID	B		
7	Surface Description		Unpaved		
8	Flow Length, L	ft	214		
9	Land Slope	ft/ft	0.2429907		
10	Average Velocity, V (figure 3-1)		7.7		
11	Tt	hr	0.0077201		0.0077201

Channel Flow

		Segment ID	C		
	Flow Depth		2.57		
	Channel Side Slopes	?h:1V	2		
12	Cross Section flow area, a	ft^2	13.2098		
13	Wetted Perimeter, Pw	ft	8.9027412		
14	Hydraulic Radius, r	ft	1.4837902		
15	Channel Slope, s	ft/ft	0.0663447		
	Channel Material	Earth	0.02		
	Degree of Irregularity	Moderate	0.01		
	Relative effect of Obstruction	Minor	0.013		
	Vegetation	Low	0.0075		
	Degree of Meandering	Minor	1		
16	Manning's Roughness Coefficient, n		0.0505		
17	Velocity, V	ft/sec	9.8865848		
18	Flow Length, L	ft	3934		
19	T_t	hr	0.1105314		0.1105314
20	Watershed or Subarea T_c			hr	**0.2158831**

Technical Release 55
Urban Hydrology for Small Watersheds

Graphical Peak Discharge Method

Project:	North Valley Landfill	By:	JAH	Date:	2/2/2012
Location:	Clarkston, Cache County, Utah	Checked:	BDM	Date:	2/2/2012
Condition:	Existing	Comments:	Final cover - South		

1 Data

Drainage Area, Am	mi^2	0.112765625
Runoff curve number	CN	85
T_c	hr	0.215883081
Rainfall Distribution		II
Pond or Swamp Areas	% of Am	0.0

			Storm #1	Storm #2	Storm #3
2	Frequency	yr	25		
	Duration		24-hr		
3	Rainfall, P	in	2.95		
4	Initial Abstraction, I_a	in	0.352941		
5	Compute I_a/P		0.119641		
	Tc	hr	0.215883		
6	Unit peak discharge, q_u	csm/in	760		
7	Runoff, Q	in	1.546327		
8	Pond and Swamp Factor, F_p		1		
9	Peak Discharge	ft^3/sec	132.5231		

Appendix H

State of Utah

Department of Environmental Quality

Dianne R. Nielson, Ph.D.
Executive Director

DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

Water Quality Board
Ray M. Child, *Chair*
Douglas E. Thompson, Vice-Chair
Paula Doughty
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Dianne R. Nielson
Jay Ivan Olsen
Joe Piccolo
Gregory L. Rowley
Ronald C. Sims
Walter L. Baker,
Executive Secretary

JON M. HUNTSMAN, JR.
Governor

GARY HERBERT
Lieutenant Governor

June 6, 2005

Mr. Issa A. Hamud
Environmental Director
City of Logan
450 N. 1000 W.
Logan, Utah 84321

Dear Mr. Hamud:

Subject: Utah Pollutant Discharge Elimination System (UPDES) Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity, Coverage No. **UTR000703.**

Our office received your "notice of intent" (NOI) for **Logan City Landfill** to obtain coverage under the *UPDES Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity, General Permit No. UTR000000* on June 02, 2005. The received NOI is for the Logan City Landfill facility located at, Approx. 100 North 1000 West, Logan City, Utah, Cache County. This letter confirms your coverage under the general permit; the permit coverage number for the facility is **No. UTR000703**. Please use this number in any future correspondence associated with this project.

This coverage is effective **June 02, 2005** and expires at midnight, **December 31, 2007.**

The permit requires a Storm Water Pollution Prevention Plan (SWP3). Maintaining a current copy of the SWP3 at the site is a requirement of the permit. Monitoring is also required as outlined in appendix II requirements. Please review these requirements if you are not familiar with them. A copy of the general permit and appendix requirements can be found on our website at http://www.waterquality.utah.gov/updes/stormwater.htm.

Storm water discharge monitoring report (SWDMR) forms are enclosed for your convenience. These forms may be used to record visual and/or analytical monitoring results.

As the agency charged with the administration of issuing UPDES Permits, we are continuously looking for ways to improve our quality of service to you. Please take

SAMPLE

a few moments to complete the enclosed questionnaire, and return it in the enclosed, self-addressed, postage paid, envelope. The results will be used to improve our quality and responsiveness and give us feed back on customer satisfaction.

If you have any questions concerning this letter or your permit coverage please do not hesitate to contact me by phone at (801) 538-9325 or by e-mail at mmgeorge@utah.gov. Thank you.

Sincerely,

Mike George, Environmental Scientist
Permits & Compliance Section

Enclosure

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SAMPLE

STORM WATER DISCHARGE MONITORING REPORT (SWDMR)

(For additional forms copy this form or contact the DWQ)

IDENTIFICATION & LOCATION

Name _____ Permit No. UTR _____

Mailing Address: _____ Location *(if different)* _____

Monitoring Period:

From: Month _____ Day _____ Year _____ To: Month _____ Day _____ Year _____

Total Storm Water Discharge Points _____ Number assigned to this Discharge Point _____

INDUSTRY SECTOR(S)

Industrial Activities or Industry Sector(s) Drained by this Discharge:

- ☐ A. Timber Products Facilities
- ☐ B. Paper and Allied Products Manufacturing Facilities.
- ☐ C. Chemical and Allied Products Manufacturing Facilities.
- ☐ D. Asphalt Paving, Roofing Materials, and Lubricant Manufacturing Facilities.
- ☐ E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities.
- ☐ F. Primary Metals Facilities.
- ☐ G. Metal Mines (Ore Mining and Dressing).
- ☐ H. Coal Mines and Coal Mine-Related Facilities.
- ☐ I. Oil or Gas Extraction Facilities.
- ☐ J. Mineral Mining and Processing Facilities.
- ☐ K. Hazardous Waste Treatment Storage or Disposal Facilities.
- ☐ L. Landfills and Land Application Sites.
- ☐ M. Automobile Salvage Yards.
- ☐ N. Scrap Recycling and Waste Recycling Facilities.
- ☐ O. Steam Electric Power Generating Facilities.
- ☐ P. Motor Freight Transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service, or Railroad Transportation Facilities.
- ☐ Q. Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities.
- ☐ R. Ship or Boat Building and Repair Yards.
- ☐ S. Vehicle Maintenance Areas, Equipment Cleaning Areas or Airport Deicing Operations located at Air Transportation Facilities.
- ☐ T. Wastewater Treatment Works.
- ☐ U. Food and Kindred Products Facilities.
- ☐ V. Textile Mills, Apparel and other Fabric Product Manufacturing Facilities.
- ☐ W. Furniture and Fixture Manufacturing Facilities.
- ☐ X. Printing and Publishing Facilities.
- ☐ Y. Rubber and Miscellaneous Plastic Product Manufacturing Facilities.
- ☐ Z. Leather Tanning and Finishing Facilities.
- ☐ AA. Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware.
- ☐ AB. Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery.
- ☐ AC. Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods
- ☐ AD. Non-Classified Facilities.

SAMPLE

SIGNATURE

Name/Title Principle Executive Officer
(Typed or Printed)

_____

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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. 1001 and 33 U.S.C. 1319. (penalties under these statues may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

_____ _____

Signature of Principle Executive Officer or Authorized Agent *Date*

Comments:

SAMPLE

VISUAL MONITORING REQUIREMENTS

Sample and Data Collection: *Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed one hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable the same individual will carry out the collection and examination of discharges for the life of the permit.*

COLOR (Circle the ones that apply):

1. Identification of Color.

Black Dark Grey Medium Grey Light Grey Dark Chocolate Brown Medium Brown

Light Brown Tan Yellow Green Other _____

2. Intensity of Color. Very intense Prominent Moderately Perceptible Hardly Perceptible

Comments: _____

_____

_____

CLARITY (Circle the right one):

Totally Opague Slightly Translucent Translucent Nearly Transparent Transparent

ODOR (Circle the ones that apply):

Diesel Gasoline Petroleum Solvent Musty Sewage Chlorine

Rotten Egg Sulfur No Odor Noxious Other _____

Comments: _____

_____

_____

_____

SAMPLE

STATE OF UTAH, DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF WATER QUALITY
288 North 1460 West, P.O. Box 144870, Salt Lake City, Utah 84114-4870 (801)538-6146

NOI

Notice of Intent (NOI) for Coverage Under the UPDES General Multi-Sector Storm Water Permit for Discharges Associat with Industrial Activity, Permit No. UTR000000.

INSTRUCTIONS ON BACK PAGE

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a UPDES permit issued for storm water discharges associated with industrial activity in the State of Utah. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit. ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM. A different NOI form is provided for construction activities disturbing over 5 acres.

I. FACILITY OPERATOR INFORMATION

Name: City Of Logan Phone: (435)716-9753

Address: 450 N. 1000 W. Status of Owner/Operator: Public

City: Logan State: Utah Zip: 84321

Facility Contact Person: Issa A. Hamud Phone: (435) 716-9752

Facility Contact Person Title: Environmental Director

II. FACILITY SITE/LOCATION INFORMATION

Is the facility located on Indian Lands? NO

Name: Logan City Landfill

Address: Approx. 100 N. 1400 W. County: Cache

City: Logan State: Utah Zip: 84321

Latitude: 41°43'54" Longitude: 111°53'06" Quarter: SE1/4, SW1/4 Section: Sec31, Sec32 Township: T12N Range: R1N

Site Contact Person: Issa A. Hamud Phone: (435) 716-9752

Site Contact Person Title: Environmental Director

III. SITE ACTIVITY INFORMATION

Name of Municipality which Operates the Storm Sewer System:

Receiving Water Body: Drainage ditch on south side of landfill running parallel to 200 S. Eventual receiving water is the Logan River.

	Yes	No
Is there existing quantitative storm water discharge data?		X
Is the facility required to do analytical monitoring? (See permit conditions Part V. and Sector monitoring requirements.)		X
Is the facility required to do visual monitoring? (See permit conditions near the end of applicable Sector(s); Appendix A to AD)		X
Is the facility required to submit monitoring data or retain it on site?	(Submit)	(Retain on site) X
Is This a New Facility, or is it an Existing Facility?	(New)	(Existing) X

If This is an Existing Facility, and the Start-up Date was After Oct. 1992, Please Fill in the Start-up Month: Month (Jan, Feb., etc.): _____ Year:

SIC or Designated Activity Code: Primary: 4953 2nd: _____ 3rd: _____ 4th: ___

If You Have Other Existing UPDES Permits, Enter Permit #'s: None

SAMPLE

IV. SECTOR IDENTIFICATION: The General Multi-Sector Permit covers all industrial activity that is required by law to be covered by a storm water permit. On the following pages the sectors are listed with a description of the industrial activity that is covered by that sector. Please check each sector that covers industrial activities whic occur at your site. The sector covered in Appendix AD is the catch-all sector and should only be used if positively no other sector covers your industrial activity. If you should elect AD, please call the Storm Water Coordinator at DWQ to discuss the need for choosing Sector AD (Non-Classified Facilities).

☐ **A. Timber Products Facilities** -- establishments [generally classified under Standard Industrial Classification (SIC) Major Group 24] that are engaged in cutting timber and pulpwood, merchant sawmills, lath mills, shingle mills, cooperage stock mills, planing mills, and plywood and veneer mills engaged in producing lumber and wood basic materials; and establishments engaged in wood preserving or in manufacturing finished articles made entirely of wood or related materials, except for wood kitchen cabinet manufacturers (SIC Code 2434), which are addressed under sector W.

☐ **B. Paper and Allied Products Manufacturing Facilities** -- facilities engaged in the manufacture of pulps from wood and other cellulose fibers and from rags; the manufacture of paper and paperboard into converted products, such as paper coated off the paper machine, paper bags, paper boxes and envelopes; and establishments primarily engaged in manufacturing bags of plastic film and sheet. These facilities are commonly identified by Standard Industrial Classification (SIC) Major Group 26.

☐ **C. Chemical and Allied Products Manufacturing Facilities** -- 1) Basic industrial inorganic chemicals (including SIC 281), 2) Plastic materials and synthetic resins, synthetic rubbers, and cellulosic and other humanmade fibers, except glass (including SIC 282), 3) Soap and other detergents and in producing glycerin from vegetable and animal fats and oils; specialty cleaning, polishing, and sanitation preparations; surface active preparations used as emulsifiers, wetting agents, and finishing agents, including sulfonated oils; and perfumes, cosmetics, and other toilet preparations (including SIC 284), 4) Paints (in paste and ready-mixed form); varnishes; lacquers; enamels and shellac; putties, wood fillers, and sealers; paint and varnish removers; paint brush cleaners; and allied paint products (including SIC 285), 5) Industrial organic chemicals (including SIC 286), 6) Nitrogenous and phosphatic basic fertilizers, mixed fertilizer, pesticides, and other agricultural chemicals (including SIC 287), 7) Industrial and household adhesives, glues, caulking compounds, sealants, and linoleum, tile, and rubber cements from vegetable, animal, or synthetic plastics materials; explosives; printing ink, including gravure ink, screen process ink, and lithographic; miscellaneous chemical preparations, such as fatty acids, essential oils, gelatin (except vegetable), sizes, bluing, laundry sours, writing and stamp pad ink, industrial compounds, such as boiler and heat insulating compounds, metal, oil, and water treatment compounds, waterproofing compounds, and chemical supplies for foundries (including facilities with SIC 289), 8) Ink and paints, including china painting enamels, india ink, drawing ink, platinum paints for burnt wood or leather work, paints for china painting, artists' paints and artists' water colors (SIC 3952, limited to those listed; for others see sectorY.), 9) Medicinal chemicals and pharmaceutical products, including the grading grinding and milling of botanicals (including SIC 283).

☐ **D. Asphalt Paving, Roofing Materials, and Lubricant Manufacturing Facilities** -- 1) facilities engaged in manufacturing asphalt paving and roofing materials, including those facilities commonly identified by Standard Industrial Classification (SIC) codes 2951 and 2952, 2) portable asphalt plant facilities (also commonly identified by SIC code 2951), 3) facilities engaged in manufacturing lubricating oils and greases, including those facilities classified as SIC code 2992. Not covered are: 1) petroleum refining facilities, including those that manufacture asphalt or asphalt products and that are classified as SIC code 2911 (see sector I.), 2) oil recycling facilities (see sector N.), and 3) fats and oils rendering (see sectorU.).

☐ **E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities** -- manufacturing flat, pressed, or blown glass or glass containers; manufacturing hydraulic cement; manufacturing clay products including tile and brick; manufacturing of pottery and porcelain electrical supplies; manufacturing concrete products; manufacturing gypsum products; nonclay refractories; and grinding or otherwise treating minerals and earths. This section generally includes the following types of manufacturing operations: flat glass, (SIC code 3211); glass containers, (SIC code 3221); pressed and blown glass, not elsewhere classified, (SIC code 3229); glass products made of purchased glass (SIC code 3231) where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water; hydraulic cement, (SIC code 3241); brick and structural clay tile, (SIC code 3251); ceramic wall and floor tile, (SIC code 3253); clay refractories, (SIC code 3255); structural clay products not elsewhere classified (SIC code 3259); vitreous china plumbing fixtures, and china and earthen ware fittings and bathroom accessories (SIC code 3261); vitreous china table and kitchen articles (SIC code 3262); fine earthenware table and kitchen articles (SIC code 3263); porcelain electrical supplies, (SIC code 3264); pottery products, (SIC code 3269); concrete block and brick, (SIC code 3271); concrete products, except block and brick (SIC code 3272); ready-mix concrete, (SIC code 3273); lime (SIC code 3274); gypsum products, (SIC code 3275); cut stone and stone products (SIC code 3281); abrasive products (SIC code 3291); asbestos products (SIC code 3292); minerals and earths, ground or otherwise treated, (SIC code 3295); mineral wool (SIC code 3296); nonclay refractories, (SIC code 3297); and nonmetallic mineral products not elsewhere classified (SIC code 3299.

☐ **F. Primary Metals Facilities** -- coking operations, sintering plants, blast furnaces, smelting operations, rolling mills, casting operations, heat treating, extruding, drawing, or forging of all types of ferrous and nonferrous metals, scrap, and ore. Coverage includes the following types of facilities: 1) Steel works, blast furnaces, and rolling and finishing mills including: steel wiredrawing and steel nails and spikes; cold-rolled steel sheet, strip, and bars; and steel pipes and tubes (SIC code 331), 2) Iron and steel foundries, including: gray and ductile iron, malleable iron, steel investment, and steel foundries not elsewhere classified (SIC code 332), 3) Primary smelting and refining of nonferrous metals, including: primary smelting and refining of copper, and primary production of aluminum (SIC code 333), 4)

Secondary smelting and refining of nonferrous metals (SIC code 334), 5) Rolling, drawing, and extruding of nonferrous metals, including: rolling, drawing, and extruding of copper; rolling, drawing, and extruding of nonferrous metals, except copper and aluminum; and drawing and insulating of nonferrous wire (SIC code 335), 6) Nonferrous foundries (castings), including: aluminum die-castings, nonferrous die-castings, except aluminum, aluminum foundries, copper foundries, and nonferrous foundries, except copper and aluminum (SIC code 336), 7) Miscellaneous primary metal products, not elsewhere classified, including: metal heat treating, and primary metal products, not elsewhere classified (SIC code 339).

☐ **G. Metal Mines (Ore Mining and Dressing)** -- active and inactive metal mining and ore dressing facilities [Standard Industrial Classification (SIC) Major Group 10] if the storm water has come into contact with, or is contaminated by, any overburden, raw material, intermediate product, finished product, byproduct, or waste product located on the site of the operation. SIC Major Group 10 includes establishments primarily engaged in mining, developing mines, or exploring for metallic minerals (ores) and also includes all ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately. For the purposes of this part of the permit, the term "metal mining" includes all ore mining and/or dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served or at mills, such as custom mills, operated separately. All storm water discharges from inactive metal mining facilities and the storm water discharges from the following areas of active, and temporarily inactive, metal mining facilities are the only discharges covered by this section of the permit: topsoil piles; offsite haul/access roads if off active area; onsite haul roads if not constructed of waste rock or if spent ore and mine water is not used for dust control; runoff from tailings dams/dikes when not constructed of waste rock/tailings and no process fluids are present; concentration building, if no contact with material piles; mill site, if no contact with material piles; chemical storage area; docking facility, if no excessive contact with waste product; explosive storage; reclaimed areas released from reclamation bonds prior to December 17, 1990; and partially/inadequately reclaimed areas or areas not released from reclamation bonds. Not covered are: 1) active metal mining facilities that are subject to the effluent limitation guidelines for the Ore Mining and Dressing Point Source Point Source Category (40 CFR Part 440). Coverage under this permit does not include adit drainage or contaminated springs or seeps at active facilities, temporarily inactive facilities, or inactive facilities. Also see permit conditions, Limitations on Coverage, *Part I.B.3.* 2) Storm water discharges associated with an industrial activity that the *Executive Secretary* has determined to be, or may reasonably be expected to be, contributing to a violation of a water quality standard, 3) Storm water discharges associated with industrial activity from inactive mining operations occurring on Federal lands where an operator cannot be identified.

☐ **H. Coal Mines and Coal Mine-Related Facilities** -- coal mining-related areas (SIC Major Group 12) if they are not subject to effluent limitations guidelines under *40 CFR Part 434*. Not covered are: inactive mining activities occurring on Federal lands where an operator cannot be identified.

☐ **I. Oil and Gas Extraction Facilities** -- oil and gas facilities listed under Standard Industrial Classification (SIC) Major Group 13 which are required to be permitted under *UAC R317-8-3.8(2)(a)3.* These include oil and gas exploration, production, processing, or treatment operations, or transmission facilities that discharge storm water contaminated by contact with or that has come into contact with any overburden raw material, intermediate products, finished products, by-products or waste products located on the site of such operations." Industries in SIC Major Group 13 include the extraction and production of crude oil, natural gas, oil sands and shale; the production of hydrocarbon liquids and natural gas from coal; and associated oil field service, supply and repair industries. This section also covers petroleum refineries listed under SIC code 2911. Contaminated storm water discharges from petroleum refining or drilling operations that are subject to nationally established BAT or BPT guidelines found at *40 CFR 419* and *435* respectively are not included. [Note that areas eligible for coverage at petroleum refineries will be very limited because the term ``contaminated runoff," as defined under *40 CFR 419.11*, includes ``... runoff which comes into contact with any raw material, intermediate product, finished product, by-product or waste product located on petroleum refinery property." Areas at petroleum refineries which may be eligible for permit coverage, provided discharges from these areas are not co-mingled with ``contaminated runoff," include: vehicle and equipment storage, maintenance and refueling areas. Most areas at refineries will not be eligible for coverage including: raw material, intermediate product, by-product, waste material, chemical, and material storage areas; loading and unloading areas; transmission pipelines, and, processing areas.] Not covered are: inactive oil and gas operations occurring on Federal lands where an operator cannot be identified are not covered by this permit.

☐ **J. Mineral Mining and Processing Facilities** -- active and inactive mineral mining and processing facilities (generally identified by Standard Industrial Classification (SIC) Major Group 14). Not covered are: 1) facilities associated with industrial activity which are subject to an existing effluent limitation guideline (*40 CFR Part 436*), 2) inactive mineral mining activities occurring on Federal lands where an operator cannot be identified are not eligible for coverage under this permit.

☐ **K. Hazardous Waste Treatment Storage or Disposal Facilities** -- facilities that treat, store, or dispose of hazardous wastes, including those that are operating under interim status or a permit under subtitle C of RCRA. [Disposal facilities that have been properly closed and capped, and have no significant materials exposed to storm water, are considered inactive and do not require permits (*UAC R317-8-3.8(6)(c)*).]

☒ **L. Landfills and Land Application Sites** -- waste disposal at landfills, land application sites, and open dumps that receive or have received industrial wastes. Open dumps are solid waste disposal units that are not in compliance with Sate/Federal criteria established under RCRA Subtitle D. Not covered are: inactive landfills, land application sites, and open dumps occurring on Federal lands where

operator cannot be identified.

☐ **M. Automobile Salvage Yards** – facilities engaged in dismantling or wrecking used motor vehicles for parts recycling or resale and for scrap (SIC Code 5015).

☐ **N. Scrap Recycling and Waste Recycling Facilities** – facilities that are engaged in the processing, reclaiming and wholesale distribution of scrap and waste materials such as ferrous and nonferrous metals, paper, plastic, cardboard, glass, animal hides (these types of activities are typically identified as SIC code 5093). Facilities that are engaged in reclaiming and recycling liquid wastes such as used oil, antifreeze, mineral spirits, and industrial solvents (also identified as SIC code 5093) are also covered under this section. Separate permit requirements have been established for recycling facilities that only receive source-separated recyclable materials primarily from non-industrial and residential sources (also identified as SIC 5093) (e.g., common consumer products including paper, newspaper, glass, cardboard, plastic containers, aluminum and tin cans). This includes recycling facilities commonly referred to as material recovery facilities (MRF).

☐ **O. Steam Electric Power Generating Facilities** – steam electric power generating facilities, including coal handling areas. Non-storm water discharges subject to effluent limitations guidelines are not covered by this permit. Storm water discharges from coal pile runoff subject to numeric limitations are eligible for coverage under this permit, but are subject to the limitations established by *40 CFR 423*. Not covered are: ancillary facilities such as fleet centers, gas turbine stations, and substations that are not contiguous to a steam electric power generating facility are not covered by this permit. Heat capture co-generation facilities are not covered by this permit; however, dual fuel co-generation facilities are included.

☐ **P. Vehicle Maintenance or Equipment Cleaning areas at Motor Freight Transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service, or Railroad Transportation Facilities** – ground transportation facilities and rail transportation facilities (generally identified by Standard Industrial Classification (SIC) codes 40, 41, 42, 43, and 5171), that have vehicle and equipment maintenance shops (vehicle and equipment rehabilitation, mechanical repairs, painting, fueling and lubrication) and/or equipment cleaning operations are eligible for coverage under this section. Also covered under this section are facilities found under SIC code 4221-4225 (public warehousing and storage) that do not have vehicle and equipment maintenance shops and/or equipment cleaning operations but have areas (exclusive of access roads and rail lines) where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products or industrial machinery are exposed to storm water.

☐ **Q. Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities** – water transportation facilities that have vehicle (vessel) maintenance shops and/or equipment cleaning operations. The water transportation industry includes facilities engaged in foreign or domestic transport of freight or passengers in deep sea or inland waters; marine cargo handling operations; ferry operations; towing and tugboat services; and marinas (facilities commonly identified by SIC code Major Group 44).

☐ **R. Ship or Boat Building and Repair Yards** – facilities engaged in ship building and repairing and boat building and repairing (SIC code 373).

☐ **S. Vehicle Maintenance Areas, Equipment Cleaning Areas or Airport Deicing Operations located at Air Transportation Facilities** – establishments and/or facilities including airports, air terminals, air carriers, flying fields, and establishments engaged in servicing or maintaining airports and/or aircraft (generally classified under Standard Industrial Classification (SIC) code 45) which have vehicle maintenance shops, material handling facilities, equipment cleaning operations or airport and/or aircraft deicing/anti-icing operations. For the purpose of this permit, the term "deicing" is defined as the process to remove frost, snow, or ice and "anti-icing" is the process which prevents the accumulation of frost, snow, or ice. Only those portions of the facility or establishment that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, or deicing/anti-icing operations are addressed under this section.

☐ **T. Wastewater Treatment Works** – treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including lands dedicated to the disposal of sewage sludge that are located within the confines of the facility with a design flow of 1.0 MGD or more, or required to have an approved pretreatment program under *40 CFR Part 403*.

☐ **U. Food and Kindred Products Facilities** – food and kindred products processing facilities (commonly identified by Standard Industrial Classification (SIC) code 20), including: meat products; dairy products; canned, frozen and preserved fruits, vegetables, and food specialties; grain mill products; bakery products; sugar and confectionery products; fats and oils; beverages; and miscellaneous food preparations and kindred products and tobacco products manufacturing (SIC Code 21), except for storm water discharges identified under paragraph I.B.3. where industrial plant yards; material handling sites; refuse sites; sites used for application or disposal of process wastewaters; sites used for storage and maintenance of material handling equipment; sites used for residential treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; and storage areas for raw material and intermediate and finished products are exposed to storm water and areas where industrial activity has taken place in the past and significant materials remain. For the purposes of this paragraph, material handling activities include the storage, loading, and unloading, transportation, or conveyance of any raw material, intermediate product, finished product, by-product, or waste product

SAMPLE

☐ **V. Textile Mills, Apparel and other Fabric Product Manufacturing Facilities** – Textile Mill Products, of and regarding facilities and establishments engaged in the preparation of fiber and subsequent manufacturing of yarn, thread, braids, twine, and cordage, the manufacturing of broad woven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn; processes involved in the dyeing and finishing of fibers, yarn fabrics, and knit apparel; the integrated manufacturing of knit apparel and other finished articles of yarn; the manufacturing of felt goods (wool), lace goods, nonwoven fabrics; miscellaneous textiles, and other apparel products (generally described by SIC codes 22 and 23). This section also covers facilities engaged in manufacturing finished leather and artificial leather products (SIC 31, except 3111).

☐ **W. Furniture and Fixture Manufacturing Facilities** – facilities involved in the manufacturing of: wood kitchen cabinets (generally described by SIC code 2434); household furniture (generally described by SIC code 251); office furniture (generally described by SIC code 252); public buildings and related furniture (generally described by SIC code 253); partitions, shelving, lockers, and office and store fixtures (generally described by SIC code 254); and miscellaneous furniture and fixtures (generally described by SIC code 259).

☐ **X. Printing and Publishing Facilities** – newspaper, periodical, and book publishing or publishing and printing (SIC Codes 2711-2731); book printing (SIC Code 2732); miscellaneous publishing (SIC Code 2741); commercial printing, lithographic (SIC Code 2752); commercial printing, gravure (SIC Code 2754); commercial printing, not elsewhere classified (SIC Code 2759); manifold business forms, greeting cards, bankbooks, looseleaf binders and devices, bookbinding and related work, and typesetting (SIC Codes 2761-2791); and, plate making and related services (SIC Code 2796).

☐ **Y. Rubber and Miscellaneous Plastic Product Manufacturing Facilities** – rubber and miscellaneous plastic products manufacturing facilities (SIC major group 30) and miscellaneous manufacturing industries, except jewelry, silverware, and plated ware (SIC major group 39, except 391).

☐ **Z. Leather Tanning and Finishing Facilities** – leather tanning, currying and finishing (commonly identified by Standard Industrial Classification (SIC) code 3111). Discharges from facilities that make fertilizer solely from leather scraps and leather dust are also covered under this section.

☐ **AA. Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware** – fabricated metals industry listed below, except for electrical related industries: fabricated metal products, except machinery and transportation equipment, SIC 34, and jewelry, silverware, and plated ware (SIC Code 391).

☐ **AB. Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery** – transportation equipment, industrial or commercial machinery manufacturing facilities (commonly described by SIC Major Group 35 except SIC 357, and SIC Major Group 37, except SIC 373). Common activities include: industrial plant yards; material handling sites; refuse sites; sites used for application or disposal of process wastewaters; sites used for storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas for raw material and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water.

☐ **AC. Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods** - - facilities that manufacture: electronic and other electrical equipment and components, except computer equipment (SIC major group 36);measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks (SIC major group 38) and computer and office equipment (SIC code 357).

☐ **AD. Non-Classified Facilities** –facilities that meet the definition of storm water associated with industrial activity (*UAC R317-8-3.8(6)(c) & (d)*, except for construction activities as defined under *UAC R317-8-3.8(6)(d)10.*) but, can not be classified in another industrial sector (i.e., sectors A to AC), and are not excluded from permit coverage elsewhere in this permit; or, the *Executive Secretary* has designated as needing a storm water permit under *UAC R317-8-3.8(1)(a)5*. Should conditions at a facility covered by this section change and industrial activities in another section(s) contained in sectors A to AC apply, the facility shall comply with any and all applicable monitoring and pollution prevention plan requirements of the other section(s) in addition to those contained in this section. The monitoring and pollution prevention plan terms and conditions of this permit are additive for industrial activities being conducted at the same industrial facility (co-located industrial activities). The operator of the facility shall determine which monitoring and pollution prevention plan section(s) of this permit (if any) are applicable to the facility.

SAMPLE

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

Print Name: Issa Hamud

Date: 5/31/05

Signature:

Amount of Permit Fee Enclosed: $_____

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

State law at UAC R317-8-3.8 prohibits point source discharges of storm water associated with industrial activity to a water body(ies) of the State without a Utah Pollutant Discharge Elimination System (UPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the UPDES Multi-Sector Storm Water General Permit. If you have questions about whether you need a permit under the UPDES Storm Water program, contact (801) 538-6146.

SAMPLE

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

Annual SWPPP Review Form

Review Date:_____

Reviewers:

Print	Signature
_____	_____
_____	_____
_____	_____

Review Checklist

1. Facility general information and SWPPP team information is current and accurate	☐ Y ☐ N	☐ N/A
2. Site map is current and accurate	☐ Y ☐ N	☐ N/A
3. Significant material inventory is current and accurate	☐ Y ☐ N	☐ N/A
4. New exposures, processes and related controls have been documented	☐ Y ☐ N	☐ N/A
5. Spills have been recorded and reported as appropriate	☐ Y ☐ N	☐ N/A
6. Records of routine preventative maintenance, housekeeping, and employee training are available in the SWPPP file	☐ Y ☐ N	☐ N/A
7. Comprehensive site inspections have been completed, certified, and filed in the SWPPP file	☐ Y ☐ N	☐ N/A
8. Corrective actions noted in the inspection reports have been completed	☐ Y ☐ N	☐ N/A
9. Certified Storm Water Operator is current	☐ Y ☐ N	☐ N/A
10. Permit renewal request has been processed	☐ Y ☐ N	☐ N/A
11. SWPPP has been reviewed and signed by the Certified Storm Water Operator and the Permittee or designated representative	☐ Y ☐ N	☐ N/A

Additional Comments

_____

_____

_____

_____

_____

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

STORM WATER WEEKLY INSPECTION REPORT

Date:_____ Time:_____

Weather Condition:_____ Date of Last Storm Event:_____

Precipitation:_____

Location	*Discharge*	*Sampled*	*Freeboard (e.g. inches)*	*Observations/Comments*
Cement Catch Basin PDP # 4	☐ ☐ Y N	☐ ☐ Y N		
West Ditch PDP # 3	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 1	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 2	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 3	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 4	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 6	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 7	☐ ☐ Y N	☐ ☐ Y N		
Retention Pond 8	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		
Other	☐ ☐ Y N	☐ ☐ Y N		

LOGAN CITY UNITED IN SERVICE

ENVIRONMENTAL DEPARTMENT

STORM WATER WEEKLY INSPECTION REPORT

Erosion: ☐ Y ☐ N

Location of Erosion: _____

_____

Standing Water: ☐ Y ☐ N

Location of Standing Water: _____

_____

Notes: _____

_____

_____

_____

_____

_____

_____ _____ _____

Inspector Date Time

STORM WATER DISCHARGE MONITORING REPORT (SWDMR)
(For additional forms copy this form or contact the DWQ)

IDENTIFICATION & LOCATION

Name _____ Permit No. UTR _____

Mailing Address: _____ Location *(if different)* _____

Monitoring Period:

From: Month _____ Day _____ Year _____ To: Month _____ Day _____ Year _____

Total Storm Water Discharge Points _____ Number assigned to this Discharge Point _____

INDUSTRY SECTOR(S)

Industrial Activities or Industry Sector(s) Drained by this Discharge:

- A. Timber Products Facilities
- B. Paper and Allied Products Manufacturing Facilities.
- C. Chemical and Allied Products Manufacturing Facilities.
- D. Asphalt Paving, Roofing Materials, and Lubricant Manufacturing Facilities.
- E. Glass, Clay, Cement, Concrete, and Gypsum Product Manufacturing Facilities.
- F. Primary Metals Facilities.
- G. Metal Mines (Ore Mining and Dressing).
- H. Coal Mines and Coal Mine-Related Facilities.
- I. Oil or Gas Extraction Facilities.
- J. Mineral Mining and Processing Facilities.
- K. Hazardous Waste Treatment Storage or Disposal Facilities.
- L. Landfills and Land Application Sites.
- M. Automobile Salvage Yards.
- N. Scrap Recycling and Waste Recycling Facilities.
- O. Steam Electric Power Generating Facilities.
- P. Motor Freight Transportation Facilities, Passenger Transportation Facilities, Petroleum Bulk Oil Stations and Terminals, the United States Postal Service, or Railroad Transportation Facilities.
- Q. Vehicle Maintenance Areas and Equipment Cleaning Areas of Water Transportation Facilities.
- R. Ship or Boat Building and Repair Yards.
- S. Vehicle Maintenance Areas, Equipment Cleaning Areas or Airport Deicing Operations located at Air Transportation Facilities.
- T. Wastewater Treatment Works.
- U. Food and Kindred Products Facilities.
- V. Textile Mills, Apparel and other Fabric Product Manufacturing Facilities.
- W. Furniture and Fixture Manufacturing Facilities.
- X. Printing and Publishing Facilities.
- Y. Rubber and Miscellaneous Plastic Product Manufacturing Facilities.
- Z. Leather Tanning and Finishing Facilities.
- AA. Facilities That Manufacture Metal Products including Jewelry, Silverware and Plated Ware.
- AB. Facilities That Manufacture Transportation Equipment, Industrial or Commercial Machinery.
- AC. Facilities That Manufacture Electronic and Electrical Equipment and Components, Photographic and Optical Goods.
- AD. Non-Classified Facilities.

ANALYTICAL MONITORING DATA *(For sectors where it is required)*

Storm Event: *All samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. This data must be submitted to the Division of Water Quality.*

Date of Storm Event	Month Day Year
Duration of Storm Event	Hours
Rain Fall Measurement	Inches
Time Elapsed Between Recorded & Previous Storm Event	Days
Estimated Total Volume of Discharge *(Include units; gal., ft^3, etc.)*	

Please check if there has been no discharge of Storm Water during this reporting period. (If none please explain in comment section)	• No Discharge

Sample Type: *Data shall be reported for a grab sample taken during the first thirty minutes of the discharge. If the collection of a grab sample during the first thirty minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first thirty minutes was impracticable.*

Parameter	Effluent Limit *(If Applicable)*	*Concentration* *(Concentration quantity, for example -14.2)*	*Units* *(Example - mg/L)*

SIGNATURE

Name/Title Principle Executive Officer
(Typed or Printed)

_____

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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. 1001 and 33 U.S.C. 1319. (penalties under these statues may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

_____ _____

Signature of Principle Executive Officer or Authorized Agent *Date*

Comments:

_____

_____

_____

_____

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_____

INFORMATION

Adverse Weather Waiver. *When a discharger is unable to collect samples within a specified sampling period due to adverse climatic conditions, the discharger shall collect a substitute sample from a separate qualifying event in the next period and submit the data along with data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricanes, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).*

Exemption to Monitoring Requirements. *(Does not apply to sector S or any Visual Monitoring Requirements.) As an alternative to monitoring an outfall, an annual certification may be made that material handling equipment or activities; raw or waste materials; intermediate, final, or by-products; industrial machinery or operations; and significant materials from past industrial activity that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and will not be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to the DWQ in accordance with Part V.B of the permit. In the case of certifying that a pollutant is not present, the permittee must submit the certification along with the monitoring reports required under reporting requirements in the sector. If the permittee cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.*

When to Monitor and Report. *Samples must be collected and analyzed at least once during each three month monitoring period. Monitoring results must be submitted annually. See Reporting for dates.*

More Frequent Monitoring. *If sampling is conducted more frequently than semi-annually, <u>all</u> sampling results must be submitted. A separate SWDMR is required for each storm event sampled.*

How to Report. *A separate SWDMR form is required for each storm event and for each outfall sampled. SWDMRs must be signed and mailed to the Division of Water Quality, and must be postmarked by the date specified under Monitoring Periods and Reporting Deadlines. The permittee should retain a copy. The address and phone number for questions or to mail the SWDMR is:*

Department of Environmental Quality
Division of Water Quality
Attention Storm Water Coordinator
PO Box 144870
Salt Lake City, UT 84114-4870

(801) 538-6146

Substantially Identical Discharges. *If there is reason to believe that the discharges from two or more outfalls are substantially identical, one of the outfalls may be monitored and that data submitted for all substantially identical outfalls. A description of the location of the outfalls, an explanation of why the outfalls have substantially identical discharges, and the size of the drainage area and runoff coefficient must be submitted as an attachment to the SWDMR.*

VISUAL MONITORING REQUIREMENTS

Sample and Data Collection: *Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed one hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable the same individual will carry out the collection and examination of discharges for the life of the permit.*

COLOR (Circle the ones that apply):

1. Identification of Color.

Black *Dark Grey* *Medium Grey* *Light Grey* *Dark Chocolate Brown* *Medium Brown*

Light Brown *Tan* *Yellow* *Green* *Other*_____

2. Intensity of Color. *Very intense* *Prominent* *Moderately Perceptible* *Hardly Perceptible*

Comments: _____

_____

_____

CLARITY (Circle the right one):

Totally Opague *Slightly Translucent* *Translucent* *Nearly Transparent* *Transparent*

ODOR (Circle the ones that apply):

Diesel *Gasoline* *Petroleum* *Solvent* *Musty* *Sewage* *Chlorine*

Rotten Egg *Sulfur* *No Odor* *Noxious* *Other* _____

Comments: _____

_____

_____

_____

SOLIDS

Floating Solids: (Description) _____

_____

_____

_____

Suspended and Settled Solids: (Description) _____

_____

_____

_____

FOAM, OIL SHEEN, OR OTHER OBVIOUS INDICATORS OF POLLUTION

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

LOGAN CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

Storm Water Preventative Maintenance and Reparation Report

Date: _____

Repair Type

- ☐ Erosion
- ☐ Leachate Seep
- ☐ Retention/Detention Pond Breach
- ☐ Ditch Building/Dredging
- ☐ Sediment Control/Silt Fencing
- ☐ Other

Action Log

_____

_____

_____

_____

_____

_____

_____

Signature

Pavement Sweeping Log

Assignment: The Landfill pavement areas should be swept using the Bobcat sweeper attachment as thoroughly as possible of all dirt & debris as necessary for both storm water pollution prevention and air quality maintenance. Make sure each sweeping is recorded on this report.

Date	Print Name	Signature	Notes

State of Utah

Department of Environmental Quality

Dianne R. Nielson, Ph.D.
Executive Director

DIVISION OF AIR QUALITY
Richard W. Sprott
Director

JON M. HUNTSMAN, JR.
Governor

GARY HERBERT
Lieutenant Governor

Site ID: 12902

Title V Operating Permit

PERMIT NUMBER: 500103001
DATE OF PERMIT: February 23, 2005
Date of Last Revision: February 23, 2005

This Operating Permit is issued to, and applies to the following:

Name of Permittee:

City of Logan
950 W 600 N
Logan, UT 84321

Permitted Location:

Logan City Landfill
Logan City Environmental Dept
450 N 1000 W
Logan, UT 84321

SIC code: 4953

SAMPLE

ABSTRACT

The City of Logan operates the Logan City Landfill, a municipal solid waste (MSW) landfill source located in Cache County, Utah. The facility accepts municipal and commercial waste. Logan City Landfill is a Title V source because 40 CFR 60 Subpart WWW and the Utah State Plan for MSW landfills (Subpart Cc) have required all landfills over 2.5 million megagrams to submit a Title V application. Logan City Landfill is subject to 40 CFR 60, Subpart A - General Provisions and to Subpart Cc - Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills. Logan City Landfill is also subject to Subpart M of the National Emission Standards for Hazardous Air Pollutants (NESHAP) - National Emission Standards for Asbestos: Standards for Active Waste Disposal Sites (40 CFR 61.154) as well as to Subpart A - General Provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP).

UTAH AIR QUALITY BOARD

By:

Richard W. Sprott, Executive Secretary

Prepared By:

James Chapman

Operating Permit History

2/23/2005 - Permit issued	Action initiated by an initial operating permit application	

SAMPLE

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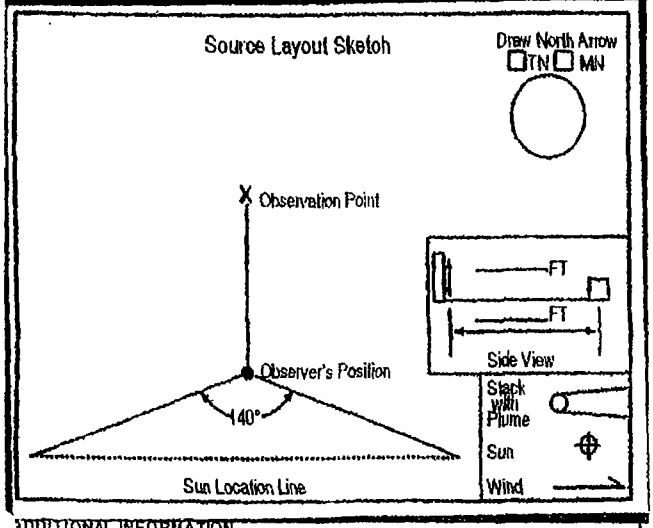
SAMPLE

MINIMUM OF 24 OBSERVATION

EPA METHOD 9 (40 CFR 60 - Appendix A)
VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Logan City Environmental Department		
LOCATION: Logan City Landfill		
LOCATION		
CITY: Logan	STATE: Utah	ZIP: 84321
PROCESS EQUIPMENT		OPERATING MODE
CONTROL EQUIPMENT		OPERATING MODE
DESCRIBE EMISSION POINT		
HEIGHT OF EMISSION POINT	HEIGHT OF EMISSION POINT RELATIVE TO OBSERVER START END	
DISTANCE TO EMISSION POINT START END	DIRECTION TO EMISSION PT. (DEGREES (0-360)) START END	
VERTICAL ANGLE TO OBSERVATION POINT START END	DIRECTION TO OBSERVATION POINT (DEGREES (0-360)) START END	
DISTANCE & DIRECTION TO OBSERVATION POINT FROM EMISSION POINT START END		
DESCRIBE EMISSIONS START END		
EMISSION COLOR START END	WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐ NONE ☐	
DESCRIBE PLUME BACKGROUND START END		
BACKGROUND COLOR START END	SKY CONDITIONS START END	
WIND SPEED START END	WIND DIRECTION START END	
AMBIENT TEMP START END	WET BULB TEMP	RH percent



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME

MIN \ SEC	0	15	30	45	COMMENTS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE	DATE
ORGANIZATION	
CERTIFIED BY	DATE

Logan City Landfill Opacity Readings

Quarter : _____

Year : _____

Date : _____

Time : _____

Location	Dust (Yes/No)	% Opacity *(within 24 hours of initial survey)*
Road to Class I Face		
Class I Working Face		
Road To C&D		
C&D Working Face		
Class I to C&D Connector Road		
South Gate Road		
Green Waste Load/Unload Area		
Green Waste Windrow Area		
Green Waste Grinder		
Green Waste Screener		
Green Waste Compost Turner		
West Wetlands Road		
Landfill Paved Roads		
Above Ground Diesel Fuel Tank		
Used Oil Tank Behind Landfill 2		
Used Oil Tanks @ Oil Collection Center (2 Tanks)		
Used Oil Space Heater		
Asbestos Cell		

Site Conditions and Comments (Weather Conditions, etc) :

Inspector (print) : _____

Signature : _____

City of Logan Sanitary Landfill
Greenhouse Gas Reporting - Monthly Data Form

YEAR: ***MONTH:***

A. Waste-in-Place Data

Total WIP for the Month (Tons)	
Scales Calibrated this Month?	☐ No ☐ Yes *(If "Yes," attach copy of the calibration documentation)*

B. Stationary Combustion Engine Fuel Usage Data

Engine	Rating (HP)	Diesel Fuel Usage (gallons)
Generator (30 Kw Kohler)	40	

C. Heating System Fuel Usage Data

Engine	Rating (HP)	Fuel Usage (gallons)
Used Oil Furnace (Reznor RA 350)	2.5 gal/ hr (30,000 BTU)	
Propane Infrared Heater (SRP UA125)	125,000 BTU/hr	

Filed By:

Logan Landfill Quarterly Gas Monitoring Quarter : Year :

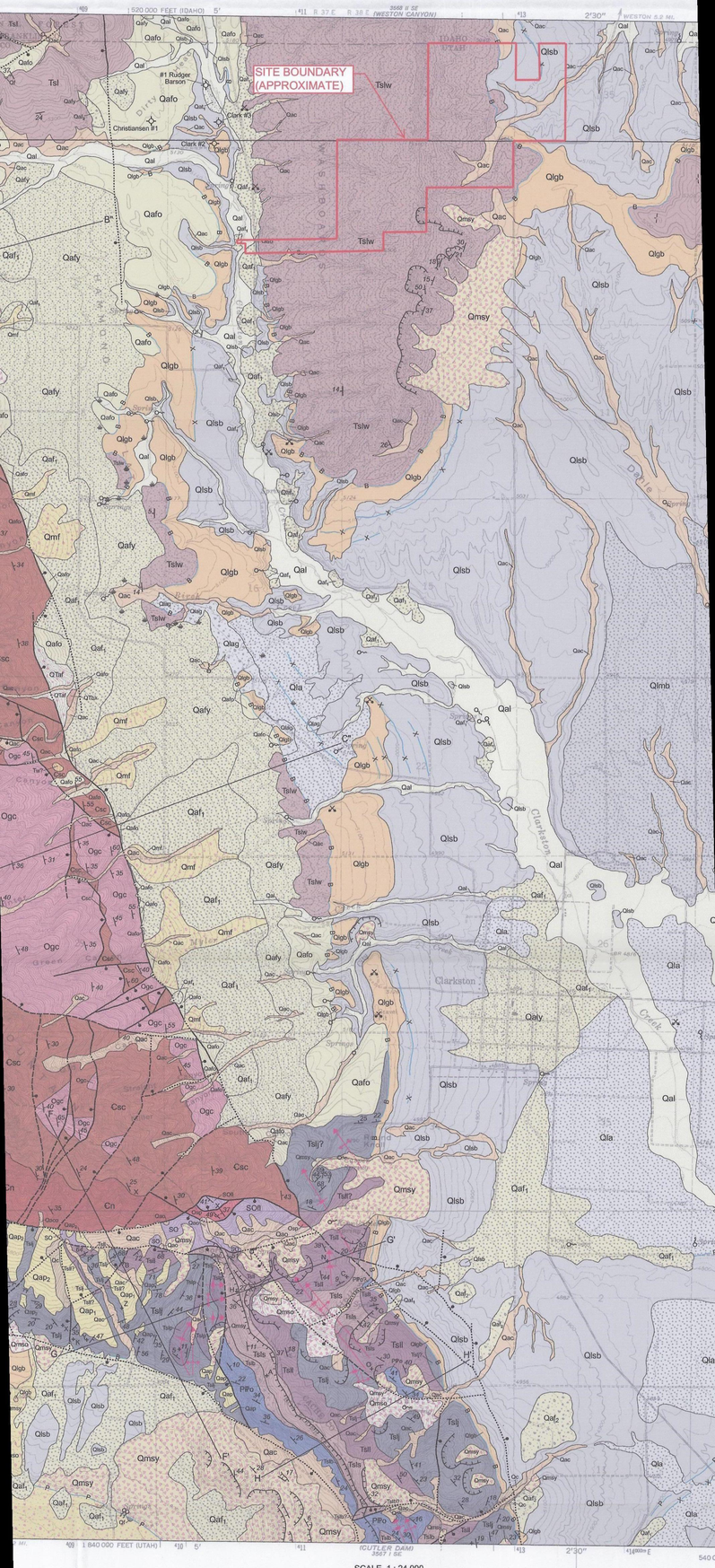
Monitoring Location	Date	Time of Day	Wind Speed (mph/direct.)	Temp (F)	Methane LEL	Hydrogen Sulfide PPM	Comments
Landfill Office							
Monitoring Well # 2A							
Monitoring Well #1							
HHW Sheds							
Landfill Mall Buildings							
New Scalehouse							
Monitoring Well # 3B							
North West Stream							
Monitoring Well # 4							
LMC *(Furthest one located to the North on 1900 W)*							
Monitoring Well # 5							
LMC *(Furthest one located to the South on 1900 W)*							
LMC *(Nearest Pump)*							
Monitoring Well # 6A							
South West Stream							
LMC # 9							
LMC # 8							
LMC # 7							
LMC # 6							
LMC # 5							
LMC # 4							
South Boundry *(Bridge over South Stream)*							
Monitoring Well # 9							
LMC # 3							
LMC # 2							
Leachate Manhole Cover (LMC) # 1 *(This manhole lies the furthest to the East)*							
South East Corner							
Monitoring Well # 10							
Little Cat Shack							
Big Equipment Shed							
Shed in Green Waste							
Scale House Green Waste							

Signature: _____ **Date:** _____

Signature: _____ **Date:** _____

Appendix J

OURCES



SCALE 1 : 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

13°38'
242 mils

2003 MAGNETIC DECLINATION
AT CENTER OF SHEET

GEOLOGIC MAP OF THE CLARKSTON QUADRANGLE, BOX ELDER AND CACHE COUNTIES, UTAH AND FRANKLIN AND ONEIDA COUNTIES, IDAHO

by

Robert F. Biek,
Robert Q. Oaks, Jr.,
Susanne U. Janecke,
Barry J. Solomon,
and L. Marie Swenson Barry

2003

UTAH

QUADRANGLE LOCATION

UTAH GEOLOGICAL SURVEY
a division of the
UTAH DEPARTMENT OF NATURAL RESOURCES

MAP UNIT DESCRIPTIONS

QUATERNARY

Qal Alluvial deposits - *Moderately sorted sand, silt, clay, and local pebble to boulder gravel. Includes river-channel, flood-plain, local small alluvial-fan and colluvial deposits, and minor terraces up to 10 feet (3 m) above current base level; 0 to 20 feet (0-6 m) thick.*

Qat$_1$ Stream-terrace deposits - *Moderately sorted sand, silt, clay, and local pebble to boulder gravel that forms isolated, level to gently sloping surfaces up to 30 feet (10 m) above modern drainages. Deposited principally in river-channel and flood-plain environments; 0 to 20 feet (0-6 m) thick.*

Qao Older alluvial deposits - *Moderately sorted, locally well-consolidated, sand and pebble- to cobble-size gravel exposed in Steel Canyon and near Short Divide; white to light gray with carbonate-coated clasts. Probably less than 40 feet (12 m) thick.*

Qag Older gravel deposits - *Unconsolidated, carbonate-coated, pebble- to cobble-size gravel scattered throughout Bergeson Hill. Probably represents lag deposits of resistant lithologies eroded from the Salt Lake Formation. Less than about 10 feet (3 m) thick).*

Qaf$_1$ Modern alluvial-fan deposits - *Poorly to moderately sorted, clay- to boulder-size sediments deposited principally by debris flows at the mouths of active drainages. Upper portions are characterized by abundant boulders and debris-flow levies that radiate away from canyon mouths. Probably less than several tens of feet thick.*

Qaf$_2$ Level 2 alluvial-fan deposits - *Poorly to moderately sorted, clay- to boulder-size sediments. Exposed thickness less than 15 feet (5 m).*

Qafy Younger undifferentiated alluvial-fan deposits - *Poorly to moderately sorted, clay- to boulder-size sediments deposited principally by debris flows at the mouths of active drainages. Forms upper portion of thick, coalesced, active alluvial apron that slopes gently away from Clarkston Mountain and the West Hills.*

Qafo Older alluvial-fan deposits - *Poorly to moderately sorted, boulder- to clay-size sediments deposited along the flanks of Clarkston Mountain and in the West Hills. Forms deeply dissected alluvial apron locally overlain by Lake Bonneville deposits, and small, fault-bounded, isolated deposits at mountain front. Exposed thickness up to several tens of feet.*

Qap$_{1-2}$, Qap Pediment-mantle deposits - *Poorly to moderately sorted, boulder- to clay-size sediment that forms planar, deeply dissected, gently sloping surfaces along the southern flank of Clarkston Mountain, south of the Short Divide fault. Subscript denotes relative level, with Qap$_1$ lower and Qap$_2$ higher; mapped as Qap where undifferentiated; 0 to about 20 feet (0-6 m) thick.*

Qf Artificial fill - *Engineered fill used in the construction of Interstate 15, and general borrow material used to create small stock and retaining ponds. Although we mapped only the larger deposits, fill should be anticipated in all developed areas, many of which are shown on the topographic base map; thickness variable.*

Qc Colluvial deposits - *Poorly to moderately sorted, clay- to boulder-size, locally derived sediment deposited on slopes principally by slopewash and soil creep. 0 to 20 feet (0-6 m) thick.*

Qlgb, Qlgp, Qlg Lacustrine sand and gravel - *Moderately to well-sorted, moderately to well-rounded, clast-supported, pebble to cobble gravel, and lesser pebbly sand; thin to thick bedded. Contains mixed clast assemblage. Gastropods common in sandy lenses. Qlgb deposited at and immediately below highest Bonneville shoreline, and Qlgp deposited at and immediately below the Provo shoreline, in beaches, bars, and spits. Qlg mapped northwest of Portage and on the flanks of the West Hills where it was probably deposited in spits below the Provo shoreline; 0 to several tens of feet thick.*

Qldp Deltaic deposits - *Moderately to well-sorted, thin- to thick-bedded, pebble- to cobble-size gravel, sand, and silt that form a planar, gently sloping surface at the Provo shoreline in the West Hills; 0 to about 80 feet (0-24 m) thick.*

Qlsb, Qlsp Lacustrine sand and silt deposits - *Coarse- to fine-grained lacustrine sand and silt, with minor clay. Typically rhythmically bedded and well sorted, locally iron stained, with locally common gastropods. Grades downslope from sandy nearshore deposits to finer grained offshore deposits. Qlsb deposited between the Bonneville and Provo shorelines, and Qlsp deposited below the Provo shoreline. Exposed thickness less than 30 feet (10 m).*

Qlmb Lacustrine silt and clay deposits - *Calcareous silt (marl) with minor clay and fine-grained sand. Exposed thickness less than 15 feet (5 m).*

Qmsy Younger landslide deposits - *Very poorly sorted, clay- to boulder-size sediment deposited principally by rotational slump processes. Characterized by hummocky topography and numerous internal scarps. Thickness highly variable.*

Qmso Older landslide deposits - *Very poorly sorted, clay- to boulder-size sediment deposited principally by rotational slump processes, but which is characterized by subdued hummocky topography and poorly preserved main scarps. Forms large, deeply dissected landslide deposit on a near dip slope of mostly Nounan strata at the head of North Canyon, and a small landslide in Nounan and lower St. Charles strata at the head of Water Hollow; other deposits developed principally in Salt Lake strata, with local truncation by the Bonneville shoreline and subdued morphology that suggest late Pleistocene age. Thickness highly variable.*

Qmf Debris-flow deposits - *Cobble- to boulder-size gravel in a matrix of silt, sand, clay, and minor pebbles; typically with well-developed levee deposits of angular rubble. Exposed thickness less than 30 feet (10 m).*

Qac, Qaco Alluvial and colluvial deposits - *Poorly to moderately sorted, clay- to boulder-size, locally derived sediment deposited in swales and small drainages. Older deposits (Qaco) are in Steel Canyon and the West Hills where they form deeply dissected surfaces. Qac is 0 to 20 feet (0-6 m) thick; Qaco is 0 to about 40 feet (0-12 m) thick.*

Qla Lacustrine and alluvial deposits - *Moderately to well-sorted, fine-grained sand, silt, and clay found principally below the Provo shoreline; 0 to several tens of feet thick.*

Qlag Lacustrine and alluvial gravelly deposits - *Moderately sorted, moderately to well-rounded, clast-supported, pebble- to cobble-size sand and gravel mapped below the Bonneville shoreline on the flanks of Clarkston Mountain and the West Hills where it is not practical to differentiate lacustrine and alluvial-fan deposits; 0 to several tens of feet thick.*

Qlam Lacustrine and alluvial fine-grained deposits - *Well-sorted, saline and alkaline silt and clay deposited in the northern portion of the Malad Valley. Forms white, irregularly vegetated ground where not disturbed by cultivation; 0 to several tens of feet thick.*

Qst Spring deposit - *Light-gray to brownish-gray, porous, calcareous tufa mapped near the head of Elbow Canyon.*

Ql/Qmsy, Ql/Qmso Lacustrine deposits over landslide deposits - *Mapped along south flank of Clarkston Mountain below the Bonneville shoreline (Ql/Qmso) where fine-grained lacustrine deposits form a discontinuous veneer over older, pre-Bonneville-shoreline landslide deposits, and similarly below the Provo shoreline (Ql/Qmsy). Lake deposits are 0 to several feet thick.*

Ql/Tsl Lacustrine deposits over the Salt Lake Formation - *Mapped along south flank of Clarkston Mountain below the Bonneville shoreline where fine-grained lacustrine deposits form a discontinuous veneer over the Salt Lake Formation. Lake deposits are 0 to several feet thick.*

QUATERNARY-TERTIARY

QTaf Alluvial-fan deposits - *Poorly to moderately sorted, clay- to boulder-size sediment that forms steeply sloping, deeply dissected surface at the entrance to Mikes Canyon. Exposed thickness less than 100 feet (30 m).*

QTb Remobilized Wasatch(?) Formation - *Bouldery, Wasatch(?)-like strata that overlie the Salt Lake Formation on the northeast flank of Clarkston Mountain. Thickness uncertain, but probably several tens of feet.*

QTbx Fault breccia - *Brecciated and re-cemented strata of the St. Charles, Nounan, and Salt Lake Formations mapped along the flanks of Clarkston Mountain. Typically forms a planar, steeply dipping veneer on faceted spurs that is 0 to 6 feet (0-2 m) thick; considerably thicker at the entrance to Mikes Canyon.*

unconformity

Tb Basaltic sills in Salt Lake Formation - *Light-gray to light-olive-gray, very fine-grained, commonly vesicular basalt. Poorly exposed and enclosed by highly altered zones that grade from black glass with pervasive conchoidal fractures; to greenish-black, light-olive-gray, and yellowish-gray, conchoidally fractured porcellanite and mudstone; to overlying beds with a phyllonitic sheen. Basalt sills and altered beds commonly have iron-manganese stains and so contrast sharply with typically white Salt Lake strata. Mapped near the entrance to North and Steel Canyons and Gowans Hollow. Less than one foot to about 10 feet (<1-3 m) thick. Yielded a K-Ar age of 8.0 ± 0.5 Ma (Don Fiesinger, Utah State University, written communication, March 8, 1999).*

Salt Lake Formation

Tsl Salt Lake Formation, undifferentiated - *Laterally and vertically variable sequence of interbedded, generally white to light-gray, thin- to medium-bedded, poorly to well-cemented, generally poorly exposed, tuffaceous siltstone, sandstone, oolitic limestone, micritic limestone, volcanic ash, porcellanite, and pebble to cobble conglomerate. Subdivided into six subunits iin the Junction Hills, south flank of Clarkston Mountain, and Bergeson Hill; subunits are queried where uncertain. Collectively, Salt Lake strata are up to about 9,250 feet (2,820 m) thick.*

Tslw Subunit of the Washboards - *Moderately sorted, thin- to medium-bedded, poorly consolidated, calcareous, very light-gray silt and clay and lesser interbedded sand, pebbly sand, and gravel. Clasts are subrounded to rounded, pebble- to cobble-size Mutual and Geertsen Canyon quartzites, Cambrian and Ordovician carbonates, green Cambrian limestone nodules, black chert, resistant greenish Salt Lake Formation mudstone clasts, and rare granitic rocks. Forms west-dipping slope veneered with lag gravels and loess at the Washboards, and isolated exposures near the Bonneville shoreline northwest of Clarkston. Estimated thickness 3,000 to 4,000 feet (915-1,220 m).*

Tslp Oolite subunit of Plymouth - *Oolitic limestone, micrite, and less common thin interbeds of pebble to cobble conglomerate, tuffaceous marl, and siltstone; 210 feet (64 m) thick.*

Tslj Tephra subunit of Junction Hills - *Volcanic ash with interbedded tuffaceous siltstone, tuffaceous limestone, porcellanite, marl, and micrite. Up to 2,550 feet (780 m) thick.*

Tsll Zeolite subunit of Long Divide - *Tuffaceous sandstone with volcanic ash and porcellanite at the base and volcanic ash at the top; common pale-greenish yellow, zeolite-bearing siltstone. About 322 to 700 feet (98-215 m) thick.*

Tsls Micrite subunit of Short Divide - *Tuffaceous pebble to cobble conglomerate, tuffaceous limestone, very fine crystalline oolitic limestone, and lesser volcanic ash beds; 400 feet (122 m) thick.*

Tslb Conglomerate subunit of Bensons Hollow - *Tuffaceous sandstone and pebble to cobble conglomerate; 203 feet (62 m) thick.*

unconformity

Tw(?) Wasatch(?) Formation - *Unconsolidated, subrounded to rounded pebbles to boulders of locally derived lithologies, including Cambrian, Ordovician, and Silurian carbonates, quartzites, and chert, and cobbles of Mississippian and Pennsylvanian strata not now present at Clarkston Mountain. Contains distinctive upper Swan Peak orthoquartzite boulders up to 6 feet (3 m) in diameter. Uncommon clasts have red, coarse sand matrix that adheres to protected recesses, and clasts locally have a thick pedogenic carbonate rind that imparts a white appearance to deposits. Forms a deeply dissected, brown to light-gray, coarse rubble sheet scattered throughout north end of Clarkston Mountain, and commonly forms a thin cover or lag that drapes over ridge tops. May be in excess of 200 feet (60 m) thick immediately north of Elgrove Canyon.*

unconformity

PALEOZOIC, undifferentiated

SOu Garden City, Swan Peak, Fish Haven, and Laketown Formations, undifferentiated - *Poorly exposed, highly brecciated upper Swan Peak, Fish Haven/Laketown, and Garden City strata preserved as a fault sliver near the west end of the Short Divide fault.*

PENNSYLVANIAN-PERMIAN, undifferentiated

PIPo Oquirrh Formation - *Interbedded, typically thin- to medium-bedded, medium- to dark-gray limestone and thin- to medium-bedded, medium-gray, very fine- to fine-grained sandstone with poorly developed ripple cross-stratification; sandstone is both calcareous and non-calcareous. Weathers to colors of grayish orange, moderate yellowish brown, and pale to moderate reddish brown. Forms steep, rounded slopes of the West Hills with few ledgy outcrops; exposures in the Junction Hills are medium- to thick-bedded, medium- to dark-gray, locally cherty, finely crystalline limestone, sandy limestone, and sandstone. Incomplete thickness in excess of 6,000 feet (1,830 m).*

unconformity

ORDOVICIAN-SILURIAN, undifferentiated

SO Fish Haven Dolomite, Laketown Dolomite, and Swan Peak Formation, undifferentiated - *Brecciated, fault-bounded blocks mapped near Short Divide.*

SOfl Fish Haven Dolomite and Laketown Dolomite, undifferentiated - *Medium- to very thick-bedded, medium to coarsely crystalline dolomite with local black and light-brown chert nodules and lenses; contains solitary and colonial corals. Forms rugged cliffs. Fish Haven strata are darker gray and less than about 100 feet (30 m) thick; Laketown strata are in excess of 2,000 feet (600 m) thick.*

unconformity

ORDOVICIAN

Osp Swan Peak Formation - *Lower 108 feet (33 m) consists of slope- and ledge-forming, thin- to medium-bedded, moderate-brown orthoquartzite with abundant fucoidal markings, lesser medium-gray to olive-gray shale, and minor thin-bedded limestone; upper part forms prominent cliffs and ledges of very thick bedded, white to light-gray, white- to grayish-orange-pink-weathering, fine- to medium-grained orthoquartzite; 574 feet (175 m) thick.*

Ogc Garden City Formation - *Slope-and ledge-forming, thin- to medium-bedded, medium-gray to medium-bluish-gray limestone and limestone intraformational conglomerate that weathers to thin, gray to tan plates; upper part contains abundant black chert nodules and stringers and local dolomite; 1,764 feet (538 m) thick.*

unconformity

CAMBRIAN

Ꞓnsc Nounan and St. Charles Formations, undifferentiated - *Brecciated, fault-bounded blocks of Nounan and St. Charles strata mapped north of Gardner Canyon.*

Ꞓsc St. Charles Formation - *Divisible into three units (not mapped separately): a ledge-forming lower sandstone unit (Worm Creek Quartzite Member), a slope- and ledge-forming middle limestone unit, and an upper, unnamed, cliff-forming, very thick-bedded dolomite unit. The lower unit, about 70 feet (20 m) thick, is interbedded, thin-bedded, silty and sandy carbonate sandwiched between two beds of medium- to very thick-bedded, brown-weathering, light-gray to brownish-gray to pale-red, fine- to medium-grained silica-cemented feldspathic sandstone that has a conchoidal fracture. The middle limestone unit, about 250 feet (75 m) thick, consists of thin- to medium-bedded, medium-gray limestone with thin interbeds of intraformational limestone conglomerate and fossil hash throughout, while its lower part contains thin interbeds of brown-weathering siltstone. The upper unit, about 700 feet (210 m) thick, consists of mostly thick- to very thick-bedded, medium- to dark-gray, medium to coarsely crystalline dolomite with local light-brown chert nodules and stringers; 1,020 feet (311 m) thick.*

Nounan Formation

Ꞓn Nounan Formation, undifferentiated - *Mapped south of Gardner Canyon, along the northwest margin of Clarkston Mountain, and east of the crest of Clarkston Mountain where the distinction between the upper and lower members is poorly developed.*

Ꞓnu Upper member - *Thin- to medium-bedded, light- to dark-gray, locally oolitic, variably sandy and silty dolomite and limestone, and interbedded, locally iron-stained and micaceous, calcareous siltstone and fine-grained sandstone. Weathers to poorly exposed, brown and reddish-brown slopes. Thins from at least 500 feet (150 m) thick in the north to about 100 feet (30 m) thick in the south.*

Ꞓnl Lower member - *Cliff-forming, thick- to very thick-bedded, medium to coarsely crystalline, light- to medium-gray dolomite; locally mottled light and dark gray with relict oncolites, oolites, fossils, and wavy to planar algal stromatolites. Thickens from about 800 feet (245 m) thick in the north to about 1,200 feet (365 m) thick in the south.*

Bloomington Formation

Ꞓb Bloomington Formation, undifferentiated - *On plate 1, may include Hodges Shale and middle limestone strata exposed in fault blocks along the northwest flank of Clarkston Mountain.*

Ꞓbc Calls Fort Shale Member - *Brown-weathering, slope-forming, laminated to very thin-bedded, brown shale and micaceous siltstone with some interbedded, thin- to very thick-bedded, locally oolitic, gray limestone and limestone intraformational conglomerate. Shales contain distinctive greenish-gray-weathering, irregularly shaped limestone nodules; 429 feet (131 m) thick.*

Ꞓbl Middle limestone member - *Ledge- and cliff-forming, thin- to very thick-bedded, medium-gray limestone, oolitic limestone, and local intraformational limestone conglomerate; 444 feet (135 m) thick.*

Ꞓbh Hodges Shale Member - *Slope- and ledge-forming, thin-bedded, medium-gray limestone, oolitic limestone, and local intraformational limestone conglomerate, and lesser interbedded light-olive-gray shale. Incomplete section 439 feet (134 m) thick.*

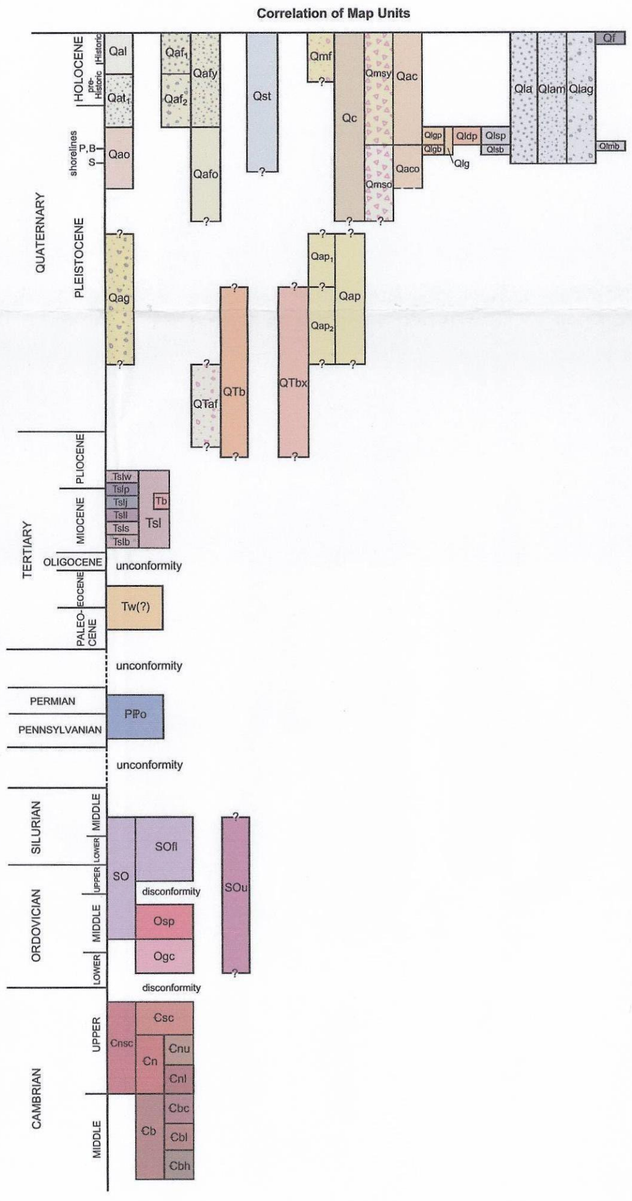
Subsurface units

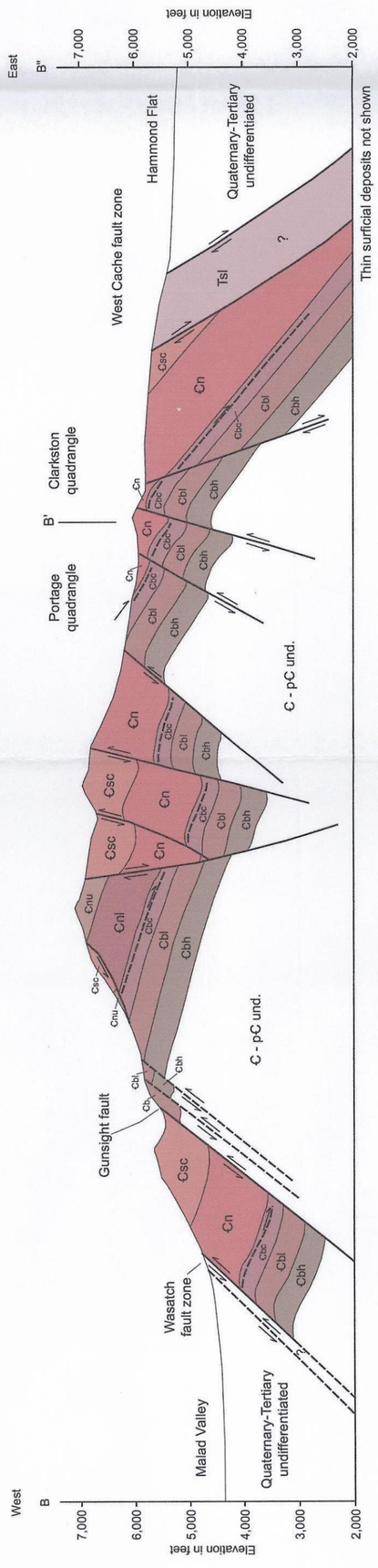
Ꞓ-pꞒ Cambrian and Precambrian, undivided - *shown in cross-section only.*

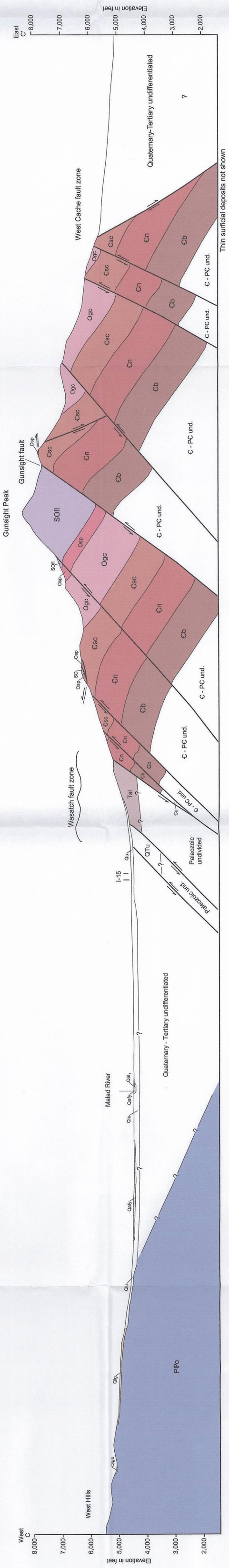
Map Symbols

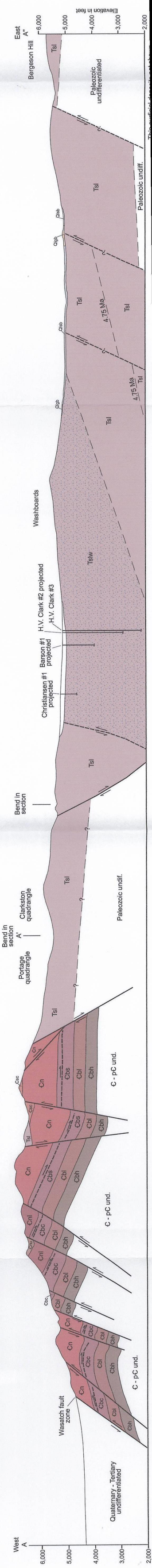
- Contact
- Normal fault, dashed where approximately located, dotted where concealed; bar and ball, or arrow with number showing dip, on down-dropped side; queried where uncertain
- Gently dipping normal fault, dotted where concealed; barbs on upper plate
- Landslide scarp, hachures on down-dropped side
- Axial trace of anticline, showing direction of plunge
- Axial trace of syncline, showing direction of plunge
- Lake Bonneville shorelines, B = Bonneville, P = Provo, S = Stansbury, X = unnamed
- 14 Strike and dip of inclined bedding
- 44 Strike and dip of overturned bedding
- Approximate directions of strike and dip of inclined bedding
- Sand and gravel pit
- Prospect
- Shaft
- Petroleum exploration well, plugged and abandoned
- Spring
- Seep
- C Location of volcanic ash sample (see also table 1 in text)

Correlation of Map Units









SYSTEM	SERIES	FORMATION		MAP UNIT SYMBOL		THICKNESS feet (meters)		LITHOLOGY
TERTIARY	PLIOCENE	Salt Lake Fm. (Tb = basaltic sills in Tsl)	Subunit of the Washboards	Tsl Tb	Tslw	3,000-4,000 (915-1,220)	9,250 (2,820)	
			Oolite subunit of Plymouth		Tslp	210 (64)		
	MIOCENE		Tephra subunit of Junction Hills		Tslj	2,550 (780)		7.9 Ma ash
			Zeolite subunit of Long Divide		Tsll	322 - 700 (98 - 215)		
			Micrite subunit of Short Divide		Tsls	400 (122)		10.94 Ma ash
	PALEOCENE-EOCENE		Conglomerate subunit of Bensons Hollow		Tslb	203 (62)		unconformity
		Wasatch? Fm.		Tw?		200 (60)		FAULT OMITS SECTION top not exposed
PENNSYLVANIAN/ PERMIAN		Oquirrh Fm.		PIPo		6,000+ (1,830)		base not exposed
								FAULT OMITS SECTION top not exposed
SILURIAN	MIDDLE	Fish Haven - Laketown undiff.	Laketown Dolomite	SO	SOfl	2,000+ (600+)	2,100+ (630+)	solitary and colonial corals
	LOWER		Fish Haven Dolomite			100 (30)		disconformity
ORDOVICIAN	UPPER							
	MIDDLE		Swan Peak Fm.	SOu	Osp	574 (175)		fucoidal markings
	LOWER		Garden City Fm.		Ogc	1,764 (538)		cherty; Intraformational limestone conglomerate
								disconformity
CAMBRIAN	UPPER		St. Charles Fm.	Ꞓnsc	Ꞓsc	1,020 (311)		Worm Creek Quartzite Member
		Nounan Fm.	upper member		Ꞓnu	N 500 - 100 (150 - 30) S	1,300 (400)	
			lower member	Ꞓn	Ꞓnl	N 800 - 1,200 (245 - 365) S		
	MIDDLE	Bloomington Fm.	Calls Fort Shale Member	Ꞓb	Ꞓbc	429 (131)	1,312+ (400)	green limestone nodules
			middle limestone member		Ꞓbl	444 (135)		oolitic limestone
			Hodges Shale Member		Ꞓbh	439+ (134+)		base not exposed

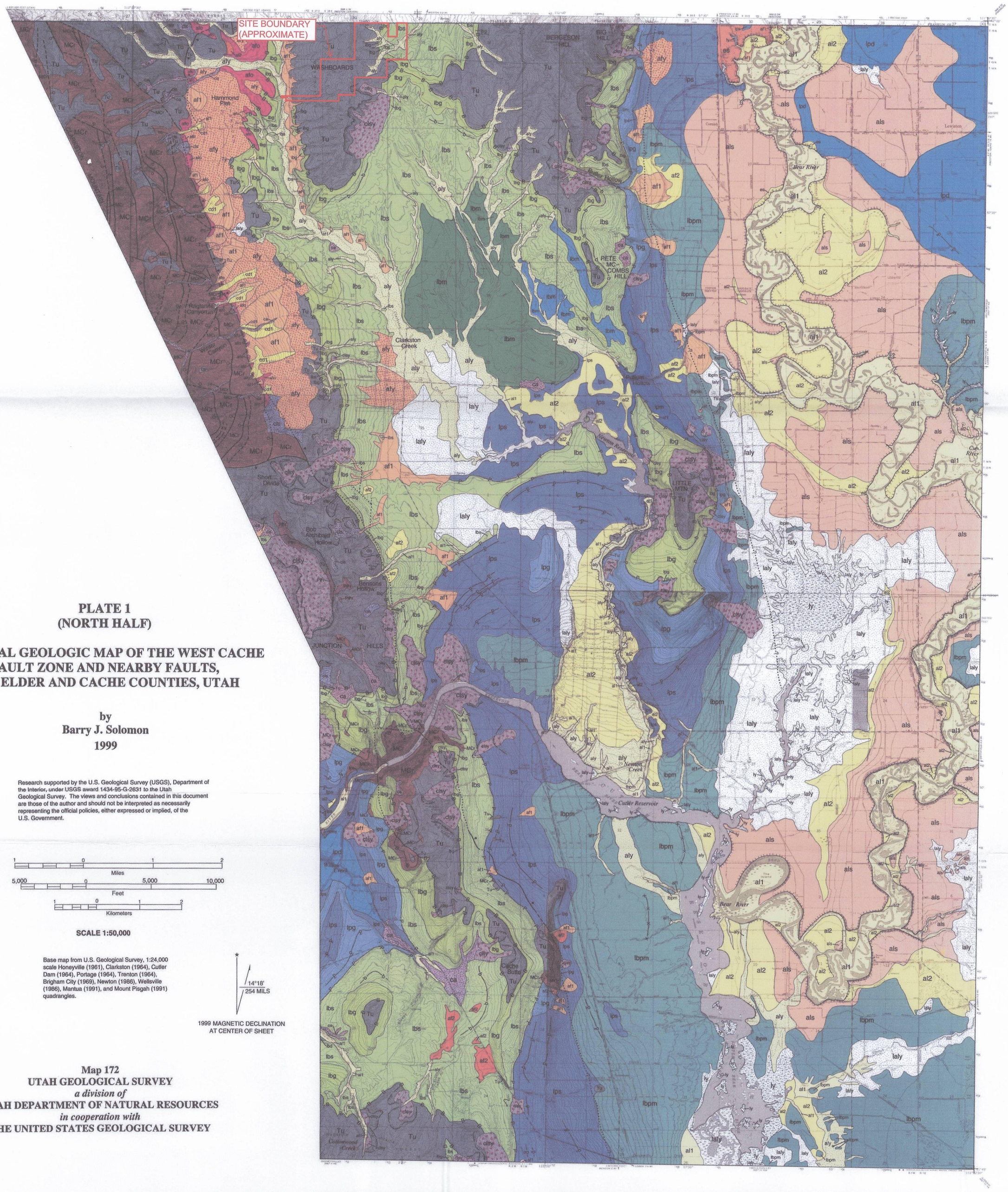


PLATE 1
(NORTH HALF)

IAL GEOLOGIC MAP OF THE WEST CACHE FAULT ZONE AND NEARBY FAULTS, K ELDER AND CACHE COUNTIES, UTAH

by
Barry J. Solomon
1999

Research supported by the U.S. Geological Survey (USGS), Department of the Interior, under USGS award 1434-95-G-2631 to the Utah Geological Survey. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

1 0 1 2
Miles

5,000 0 5,000 10,000
Feet

1 0 1 2
Kilometers

SCALE 1:50,000

Base map from U.S. Geological Survey, 1:24,000 scale Honeyville (1961), Clarkston (1964), Cutler Dam (1964), Portage (1964), Trenton (1964), Brigham City (1969), Newton (1986), Wellsville (1986), Mantua (1991), and Mount Pisgah (1991) quadrangles.

14°18'
254 MILS

1999 MAGNETIC DECLINATION
AT CENTER OF SHEET

Map 172
UTAH GEOLOGICAL SURVEY
a division of
TAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with
HE UNITED STATES GEOLOGICAL SURVEY

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

North Valley Landfill
Clarkston, Utah

Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **Well 1**

Sheet 1 of 2

LOCATION

NORTHING 11,773.79 EASTING 11,313.90 ELEVATION 4,994.60

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT with gravel - soft, dry, light brown to grey, silt is non-plastic, sand is fine-grained, with thin organics to 6 inches							
	5		- medium stiff, slightly moist, decreasing gravel	4 4 5	9					
			- moist, with some thin carbonate stringers throughout, increasing low plasticity clay	7 10 11	11	81.2	33.3	89.7		
	10	SM	Silty SAND with gravel - dense, moist, brown, sand is medium-grained, gravel is subrounded, ¼ to ½ inch typical, silt is non-plastic, sample is homogenous	4 12 16	28		9.1	15.6		
	15	CH	Fat CLAY with sand - medium stiff, moist, grey, clay has low to high plasticity, sand is fine-grained, largely located in isolated ¼-inch thick seams of Poorly Graded SAND (SP-SC) with clay, with thick iron staining in sand seams	5 2 4	6				52	28
	20	CL	Sandy Lean CLAY with trace gravel - stiff, moist, light brown to grey, clay has low plasticity, sand is fine-grained, gravel is subrounded, ¼-inch typical, sand decreases with depth, grades into Lean CLAY (CL)	7 8 11	11	81.5	33.9	78.3		
	25									
	30	SC	Clayey SAND with gravel - dense, moist, light brown	15 24 25	49		11.2	21.3		
		SP-SC	Poorly Graded SAND with clay and gravel - very dense, moist to very moist, grey, sand is medium-grained, gravel is subrounded, ¼- to ½-inch typical, decreasing clay with depth, sand becomes course-grained with depth							
	35									
	40	SM	Silty SAND with trace gravel - medium dense, very moist, brown, sand is fine- to medium-grained, silt is non-plastic, alternating seams of Sandy SILT (ML) and Silty SAND (SM), some vertical seams, with thick iron staining in sandy material, gravel is subrounded, ¼- to ½-inch typical	7 8 13	8	83.9	35.7	84.1		
	45		- groundwater encountered at 43 feet							

SAMPLES | WATER LEVEL | GRAPHICAL LOG

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 1a

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **Well 1**
Sheet 2 of 2

LOCATION
NORTHING 11,773.79 EASTING 11,313.90 ELEVATION 4,994.60

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
	50	X			SC	Clayey SAND with gravel - very dense, wet, brown grading to grey, clay has low plasticity, sand is well-graded, gravel is angular limestone and sandstone clasts, ½- to 1-inch typical	15 34 35	69			14.2	17.9			
16															
	55														
17															
18															
	60	X			CL	Sandy Lean CLAY - very stiff, moist, green to grey, clay has low plasticity, sand is fine-grained, mild organic odor, with some preserved organic material throughout, sample is homogenous	10 14 18	16		91.8	30.8		45	25	
19															
	65														
20															
21															
	70	X				- medium stiff, wet	5 7 8	15					44	27	
22						Bottom of Boring @ 71.5 Feet									
23	75														
24															
	80														
25															
26	85														
27															
	90														
28															
29	95														
30															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
- MEASURED - ESTIMATED

Figure 1b

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

North Valley Landfill
Clarkston, Utah

Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

WELL NO:
Well 1
Sheet 1 of 2

LOCATION
NORTHING 11,773.79 EASTING 11,313.90 ELEVATION 4,994.60

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT with gravel - soft, dry, light brown to grey, silt is non-plastic, sand is fine-grained, with thin organics to 6 inches					
	5		- medium stiff, slightly moist, decreasing gravel					
			- moist, with some thin carbonate stringers throughout, increasing low plasticity clay	81.2	33.3	89.7		
3	10	SM	Silty SAND with gravel - dense, moist, brown, sand is medium-grained, gravel is subrounded, ¼ to ½ inch typical, silt is non-plastic, sample is homogenous		9.1	15.6		
5	15	CH	Fat CLAY with sand - medium stiff, moist, grey, clay has low to high plasticity, sand is fine-grained, largely located in isolated ¼-inch thick seams of Poorly Graded SAND (SP-SC) with clay, with thick iron staining in sand seams				52	28
6	20	CL	Sandy Lean CLAY with trace gravel - stiff, moist, light brown to grey, clay has low plasticity, sand is fine-grained, gravel is subrounded, ¼-inch typical, sand decreases with depth, grades into Lean CLAY (CL)	81.5	33.9	78.3		
9	30	SC	Clayey SAND with gravel - dense, moist, light brown		11.2	21.3		
10		SP-SC	Poorly Graded SAND with clay and gravel - very dense, moist to very moist, grey, sand is medium-grained, gravel is subrounded, ¼- to ½-inch typical, decreasing clay with depth, sand becomes course-grained with depth					
12	40	SM	Silty SAND with trace gravel - medium dense, very moist, brown, sand is fine- to medium-grained, silt is non-plastic, alternating seams of Sandy SILT (ML) and Silty SAND (SM), some vertical seams, with thick iron staining in sandy material, gravel is subrounded, ¼- to ½-inch typical - groundwater encountered at 43 feet	83.9	35.7	84.1		
15	45							

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL
- MEASURED - ESTIMATED

Figure 1c

DATE	
STARTED:	8/24/10
COMPLETED:	8/25/10
BACKFILLED:	8/25/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

WELL NO: **Well 1**
Sheet 2 of 2

LOCATION
NORTHING 11,773.79 EASTING 11,313.90 ELEVATION 4,994.60

DEPTH METERS	DEPTH FEET	SAMPLES	WELL GRAPHICS LOG	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
	50	X			SC	Clayey SAND with gravel - very dense, wet, brown grading to grey, clay has low plasticity, sand is well-graded, gravel is angular limestone and sandstone clasts, ½- to 1-inch typical	●		14.2	17.9			●
16													
	55												
17													
18													
	60	X			CL	Sandy Lean CLAY - very stiff, moist, green to grey, clay has low plasticity, sand is fine-grained, mild organic odor, with some preserved organic material throughout, sample is homogenous	●	91.8	30.8		45	25	●
19													
	65												
20													
21													
	70	X				- medium stiff, wet	●				44	27	
22						Bottom of Boring @ 71.5 Feet							
23	75												
24													
	80												
25													
26	85												
27													
	90												
28													
29	95												
30													

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 1d

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah

Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO:
Well 2

Sheet 1 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT with gravel - soft, dry, light brown, silt is non-plastic, sand is fine-grained, with thin organics to 6 inches - stiff, slightly moist, brown, with thick carbonate stringers throughout	9 11 8 7	19						
1	5	SM	Silty SAND with gravel - dense, moist, brown, silt is non-plastic, sand is fine-grained, gravel is subrounded, ½-inch typical, with some small pinholes, carbonate stringers throughout - decreasing gravel, increasing silt, sand grading to coarse-grained with depth - medium dense, increasing gravel, ¼- to ½-inch typical, with moderate cementation	9 11 3 5 10 5 6 8 4	8 15 5		94.9 88.9	18.1 14.8 17.5	41.5		
2	10										
3	15										
4	20		Sandy Lean CLAY with gravel - stiff, moist, brown	7 12	19			17.3	58.7		
5	25	SP	Poorly Graded SAND with gravel - very dense, moist, light brown, sand is fine- to medium-grained, gravel is subrounded, ¼-inch typical, 2 inches maximum	10 24 50 for 5"	37		103.8	18.3	39.9		
6	30	SM	Silty SAND - very dense, moist, light brown, silt has low to no plasticity, sand is fine-grained, with thick iron staining, decreasing sand with depth	10 30 50 for 5"	80						
7	35										
8	40	SP	Poorly Graded SAND - very dense, moist, brown to light brown, sand is fine-grained, grades into Sandy SILT (ML) with depth	11 50/5"			90.1	29.9	45.5		
9	45										

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2a

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **Well 2**
Sheet 2 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
	50	X			ML	SILT with sand - hard, moist, grey, silt is non-plastic, sand is fine-grained, sample is homogenous	9 28 50/4"				28.3	93.2			
16															
	55														
17															
18			▽												
	60	X			SM	Silty SAND - hard, moist, grey to dark grey, sand is fine-grained, silt is non-plastic, with some organic material throughout, sample is homogenous	16 50/4"			96.9	24.5	47.1			
19															
	65														
20															
21															
	70	X			CL	Lean CLAY with sand - very stiff, moist, grey, clay has low to high plasticity, sample is homogenous	10 23 40	63							
22															
	75														
23															
24						- increasing plasticity with depth, may grade into Fat CLAY (CH)									
	80	X					16 50/3"			74.5	33.8				
25															
26	85														
27															
	90	X					13 24 32	56					70	44	
28															
29	95														
30															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2b

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

BORING NO: **Well 2**
Sheet 3 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
	100	X					20 35 50 for 3"	85			39.6	99.8			
31						- no groundwater observed during drilling on 8/25/10, but was measured at 60 feet on 8/26/10, likely encountered perched water table									
32	105														
						Bottom of Boring @ 101.5 Feet									
33															
	110														
34															
35	115														
36															
	120														
37															
38	125														
39															
	130														
40															
41	135														
42															
	140														
43															
44	145														
45															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 2c

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah

Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

WELL NO: **Well 2**

Sheet 1 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT with gravel - soft, dry, light brown, silt is non-plastic, sand is fine-grained, with thin organics to 6 inches - stiff, slightly moist, brown, with thick carbonate stringers throughout					
1–2	5	SM	Silty SAND with gravel - dense, moist, brown, silt is non-plastic, sand is fine-grained, gravel is subrounded, ½-inch typical, with some small pinholes, carbonate stringers throughout - decreasing gravel, increasing silt, sand grading to coarse-grained with depth - medium dense, increasing gravel, ¼- to ½-inch typical, with moderate cementation	94.9	18.1			
					14.8	41.5		
3	10			88.9	17.5			
4–5	15		Sandy Lean CLAY with gravel - stiff, moist, brown		17.3	58.7		
6	20	SP	Poorly Graded SAND with gravel - very dense, moist, light brown, sand is fine- to medium-grained, gravel is subrounded, ¼-inch typical, 2 inches maximum	103.8	18.3	39.9		
7–8	25							
9	30	SM	Silty SAND - very dense, moist, light brown, silt has low to no plasticity, sand is fine-grained, with thick iron staining, decreasing sand with depth					
10–11	35							
12	40	SP	Poorly Graded SAND - very dense, moist, brown to light brown, sand is fine-grained, grades into Sandy SILT (ML) with depth	90.1	29.9	45.5		
13–14	45							
15								

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 2d

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

WELL NO: **Well 2**

Sheet 2 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
	50	ML	SILT with sand - hard, moist, grey, silt is non-plastic, sand is fine-grained, sample is homogenous			28.3	93.2		
16									
	55								
17									
18									
	60	SM	Silty SAND - hard, moist, grey to dark grey, sand is fine-grained, silt is non-plastic, with some organic material throughout, sample is homogenous		96.9	24.5	47.1		
19									
	65								
20									
21									
	70	CL	Lean CLAY with sand - very stiff, moist, grey, clay has low to high plasticity, sample is homogenous						
22									
	75								
23									
24			- increasing plasticity with depth, may grade into Fat CLAY (CH)						
	80				74.5	33.8			
25									
26	85								
27									
	90							70	44
28									
29	95								
30									

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

WELL DESCRIPTION (PLATE) 00386-006 GPJ IGES.GDT 1/12/12

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:
Bentonite — 10-20 Silica Sand — 20 Slot Screen — Grout

WATER LEVEL
- MEASURED - ESTIMATED

Figure 2e

DATE	
STARTED:	8/25/10
COMPLETED:	8/26/10
BACKFILLED:	8/26/10

North Valley Landfill
Clarkston, Utah
Project Number 00386-014

IGES Rep: JSS
Rig Type: Marl M111
Boring Type: 8-inch HSA

WELL NO: **Well 2**
Sheet 3 of 3

LOCATION
NORTHING 9,263.42 EASTING 8,326.59 ELEVATION 5,228.00

DEPTH METERS	DEPTH FEET	SAMPLES	WELL GRAPHICS LOG	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
	100	X							39.6	99.8			
31						- no groundwater observed during drilling on 8/25/10, but was measured at 60 feet on 8/26/10, likely encountered perched water table							
32	105					Bottom of Boring @ 101.5 Feet							
33													
34	110												
35	115												
36													
37	120												
38	125												
39													
40	130												
41	135												
42													
43	140												
44	145												
45													

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL
- MEASURED - ESTIMATED

Figure 2f

DATE	
STARTED:	11/3/10
COMPLETED:	11/3/10
BACKFILLED:	11/3/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

BORING NO: **Well 3**

Sheet 1 of 1

LOCATION
NORTHING 10,042.56 EASTING 8,797.30 ELEVATION 5,178.21

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt							
1–2	5	CL	Sandy Lean CLAY w/ gravel up to 1/4 inch in diameter - very stiff, slightly moist, brown to grey							
3	10	ML	SILT - hard, slightly moist, light brown, 1/8 inch iron stained sand seams throughout sample	20 23 33	56		31.3	95.3	46	14
4–5	15									
6	20		Lean CLAY - hard, moist, light brown to grey	21 26 35	61		29.8	88.8		
7–8	25									
9	30	CH	Fat CLAY - hard, moist, light brown	28 50/4		82.0	38.7		80	51
10–11	35									
12	40		- hard, moist, grey - very difficult drilling around 42 feet	15 20 27	47		38.4	99.8		
13–14	45									
15	50									
16–17	55									
18	60	CH	Fat CLAY - hard, moist, grey, no groundwater observed in sample - groundwater measured at 61 feet - no cuttings coming up from augers, still difficult drilling	10 19 29	48		44.5	98.8	80	45
19–20	65									
21	70									
22–23	75									
24	80									
25			Bottom of Boring @ 80 Feet							

SAMPLES | WATER LEVEL | GRAPHICAL LOG

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 3a

DATE	
STARTED:	11/3/10
COMPLETED:	11/3/10
BACKFILLED:	11/3/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

WELL NO: **Well 3**

Sheet 1 of 1

LOCATION
NORTHING 10,042.56 EASTING 8,797.30 ELEVATION 5,178.21

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt							
1	5	CL	Sandy Lean CLAY w/ gravel up to 1/4 inch in diameter - very stiff, slightly moist, brown to grey							
3	10	ML	SILT - hard, slightly moist, light brown, 1/8 inch iron stained sand seams throughout sample			31.3	95.3	46	14	
6	20		Lean CLAY - hard, moist, light brown to grey			29.8	88.8			
9	30	CH	Fat CLAY - hard, moist, light brown		82.0	38.7		80	51	
12	40		- hard, moist, grey - very difficult drilling around 42 feet			38.4	99.8			
18	60	CH	Fat CLAY - hard, moist, grey, no groundwater observed in sample - groundwater measured at 61 feet - no cuttings coming up from augers, still difficult drilling			44.5	98.8	80	45	
25	80		Bottom of Boring @ 80 Feet							

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL
- MEASURED
- ESTIMATED

Figure 3b

DATE	
STARTED:	11/4/10
COMPLETED:	11/4/10
BACKFILLED:	11/4/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

BORING NO: **Well 4**

Sheet 1 of 1

LOCATION
NORTHING 11,618.96 EASTING 9,402.31 ELEVATION 5,099.18

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
0	0				ML	Sandy SILT w/ trace gravel - soft, moist, dark brown, NP silt									
1	5					Sandy SILT w/ gravel - soft to medium stiff, dark brown									
3	10	X			CL	Lean CLAY w/ trace gravel - medium stiff, moist, light brown to tan, low to medium plasticity clay	20 50/5				33.7	97.0			
4	15														
6	20	X			CH	Fat CLAY - hard, moist, grey, rust colored sand seam in bottom of sampler	25 43 45	44		82.7	36.8	96.7	62	34	
8	25														
9	30														
11	35														
12	40	X				- hard, moist, grey	14 30 42	72			44.3	96.6			
14	45														
15	50														
17	55														
18	60	X			MH	Elastic SILT - hard, moist, grey	14 27 39	66			49.5		72	36	
20	65														
21	70														
23	75														
24	80	X				- hard, very moist, grey	16 30 44	74			47.7	98.4			
25						Bottom of Boring @ 80 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 4a

DATE	
STARTED:	11/4/10
COMPLETED:	11/4/10
BACKFILLED:	11/4/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

WELL NO:
Well 4
Sheet 1 of 1

LOCATION
NORTHING 11,618.96 EASTING 9,402.31 ELEVATION 5,099.18

DEPTH (METERS)	DEPTH (FEET)	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT w/ trace gravel - soft, moist, dark brown, NP silt						
1	5		Sandy SILT w/ gravel - soft to medium stiff, dark brown						
3	10	CL	Lean CLAY w/ trace gravel - medium stiff, moist, light brown to tan, low to medium plasticity clay			33.7	97.0		
6	20	CH	Fat CLAY - hard, moist, grey, rust colored sand seam in bottom of sampler		82.7	36.8	96.7	62	34
12	40		- hard, moist, grey			44.3	96.6		
18	60	MH	Elastic SILT - hard, moist, grey			49.5		72	36
24	80		- hard, very moist, grey			47.7	98.4		
25			Bottom of Boring @ 80 Feet						

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:
Bentonite | 10-20 Silica Sand | 20 Slot Screen | Grout

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 4b

DATE	
STARTED:	11/5/10
COMPLETED:	11/5/10
BACKFILLED:	11/5/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

BORING NO: **Well 5**

Sheet 1 of 1

LOCATION
NORTHING 12,843.25 EASTING 8,450.10 ELEVATION 5,182.22

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt							
1	5	CL-ML	Silty CLAY - medium stiff, moist, brown							
3	10	ML	Sandy SILT - hard, slightly moist, light brown	6 13 40	53		25.1		39	7
5	15		1/2 inch seam of rust colored Poorly Graded SAND in bottom of sampler							
6	20		Lean CLAY - hard, moist, light brown, medium plasticity clay							
9	30	CL	Lean CLAY - hard, moist, light brown to grey	13 40 50/3			34.8	94.0		
15	50	CH	Lean CLAY - hard, moist, grey	18 26 40	66		39.5	99.0	65	37
21	70		- hard, moist, grey	33 42 50/5			38.7	99.4		
25	80		Bottom of Boring @ 80 Feet							

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 5a

DATE	
STARTED:	11/5/10
COMPLETED:	11/5/10
BACKFILLED:	11/5/10

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: JWW
Rig Type: CME 55
Boring Type: 8" HSA

WELL NO: **Well 5**

Sheet 1 of 1

LOCATION
NORTHING 12,843.25 EASTING 8,450.10 ELEVATION 5,182.22

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	ML	Sandy SILT w/ gravel - soft, moist, brown to grey, NP silt					
1	5	CL-ML	Silty CLAY - medium stiff, moist, brown					
3	10	ML	Sandy SILT - hard, slightly moist, light brown		25.1		39	7
4	15		1/2 inch seam of rust colored Poorly Graded SAND in bottom of sampler					
5			Lean CLAY - hard, moist, light brown, medium plasticity clay					
6	20							
7	25							
9	30	CL	Lean CLAY - hard, moist, light brown to grey		34.8	94.0		
10	35							
11								
12	40							
13								
14	45							
15	50	CH	Lean CLAY - hard, moist, grey		39.5	99.0	65	37
16								
17	55							
18	60							
19								
20	65							
21								
22	70		- hard, moist, grey		38.7	99.4		
23	75							
24								
25	80		Bottom of Boring @ 80 Feet					

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: MEASURED, ESTIMATED

Figure 5b

DATE	
STARTED:	11/7/11
COMPLETED:	11/9/11
BACKFILLED:	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 6**

Sheet 1 of 3

LOCATION
NORTHING 12,502.21 EASTING 7,973.36 ELEVATION 5,228.15

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0		Silty SAND with gravel - medium dense, moist, light brown to brown							
1	5	SM		11 18 24	16	103.7	9.1			
2										
3	10	SP	Poorly Graded SAND - medium dense, moist, brown - no recovery	8 15 17	12					
4										
5	15	GP	Poorly Graded GRAVEL with sand - medium dense, moist, brown	9 15 16	12		1.7			
6	20		- no recovery - driller observation: cobbles				7.8			
7										
8	25									
9	30	ML	SILT - very stiff, moist, brown, somewhat cemented	39 61-3"		78.8	31.3			
10										
11	35									
12	40	ML		39 61/3"						
13			Lean CLAY - moist, grey							
14	45									
15	50	SM	Silty SAND - very dense, moist, brown with rust, somewhat cemented	84 16/1"		81.5	29.3			
16										
17	55									
18	60	SM		67 33/3"		76.6	27.4			
19										
20	65									
21	70	SM	- very moist	58 42/5"		80.7	35.6	40.8		
22										
23	75									
24	80	CL	Lean CLAY - hard, moist, cemented	100/6"			30.3			
25										

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 6a

DATE	
STARTED:	11/7/11
COMPLETED:	11/9/11
BACKFILLED:	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 6**

LOCATION
NORTHING 12,502.21 EASTING 7,973.36 ELEVATION 5,228.15

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
26	85														
27															
	90						80 20/2"								
28															
29	95														
30															
	100				SC	Sandy CLAY - hard, moist, grey, cemented	100/5"				29.7	59.0			
31															
32	105														
33															
	110														
34															
35	115														
36															
	120				CL	Lean CLAY - hard, moist, grey, with some sand	100/6"				29.7				
37															
38	125														
39															
	130														
40															
41	135														
42															
	140				CL		100/6"				30.4	90.5			
43															
44	145														
45															
	150														
46															
47	155														
48															
	160				CL SP	Poorly Graded SAND - very dense, moist, grey - NP, difficult to thread in lab	100/6"				25.6				
49															
50	165														
51															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 6b

DATE	
STARTED:	11/7/11
COMPLETED:	11/9/11
BACKFILLED:	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 6**

LOCATION
NORTHING 12,502.21 EASTING 7,973.36 ELEVATION 5,228.15

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit — Moisture Content — Liquid Limit) 10 20 30 40 50 60 70 80 90
52	170														
53	175														
54															
55	180	■			CL	Lean CLAY - hard, moist, grey	100/5"								
56	185														
57															
58	190														
59	195														
60															
61	200	■			SC	Clayey SAND - some sand pockets	100/6"				28.6	69.9			●
62	205														
63															
64	210														
65	215														
66															
67	220	■			MH	Elastic SILT - hard, moist, grey	84 18/1"						59	28	●
68	225														
69															
70	230														
71	235														
72															
73	240														
74	245														
75															
76	250	■			MH		100/6"				32.9		59	27	●
77						Bottom of Boring @ 250.5 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- *Modified California Sampler*
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 6c

DATE	
STARTED:	11/7/11
COMPLETED:	11/9/11
BACKFILLED:	11/9/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

WELL NO: **Well 6**

Sheet 1 of 3

LOCATION
NORTHING 12,502.21 EASTING 7,973.36 ELEVATION 5,228.15

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT BLOW COUNT (10 20 30 40 50 60 70 80 90)	Dry Density(pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0		Silty SAND with gravel - medium dense, moist, light brown to brown						
1	5	SM			103.7	9.1			
2									
3	10	SP	Poorly Graded SAND - medium dense, moist, brown - no recovery						
4									
5	15	GP	Poorly Graded GRAVEL with sand - medium dense, moist, brown			1.7			
6	20		- no recovery - driller observation: cobbles			7.8			
7									
8	25								
9	30	ML	SILT - very stiff, moist, brown, somewhat cemented		78.8	31.3			
10									
11	35								
12	40	ML							
13			Lean CLAY - moist, grey						
14	45								
15	50	SM	Silty SAND - very dense, moist, brown with rust, somewhat cemented		81.5	29.3			
16									
17	55								
18	60	SM			76.6	27.4			
19									
20	65								
21	70	SM	- very moist		80.7	35.6	40.8		
22									
23	75								
24	80	CL	Lean CLAY - hard, moist, cemented			30.3			
25									

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 6d

DATE	
STARTED:	11/1/11
COMPLETED:	11/3/11
BACKFILLED:	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 7**

Sheet 1 of 3

LOCATION
NORTHING 11,845.99 EASTING 8,142.12 ELEVATION 5,268.65

METERS	FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	SM	Silty SAND with gravel - light brown							
1	5	SM	Silty SAND - medium dense, moist, fines are more plastic	15 15 18	13	89.3	17.1			
2	10	SP SC	Poorly Graded SAND - medium dense, moist, light brown, some silt, trace gravel	18 21 22	17	93.3	11.0			
3	15	ML	SILT - hard, moist, light brown with rust, blocky, somewhat plastic, some cementation - NP, difficult to thread in lab	27 67		87.9	29.7			
4	20	ML		34 66		85.6	30.0			
5	25									
6	30	ML		29 71		85.2	32.8	99.4		
7	35									
8	40	ML	- NP, difficult to thread in lab	43 57/5"		76.4	26.9			
9	45									
10	50	ML		44 56/5"		74.8	30.9	99.6		
11	55									
12	60	ML		66 44/4"					41	10
13	65									
14	70	SM	Silty SAND - very dense, moist, light brown with rust, SILT pockets, cemented	89 11/1"		90.7	16.1	27.6		
15	75									
16	80	ML	SILT - hard, moist, light brown, cemented	69 21/2"		91.3	24.4			

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 7a

DATE	
STARTED:	11/1/11
COMPLETED:	11/3/11
BACKFILLED:	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 7**

LOCATION
NORTHING 11,845.99 EASTING 8,142.12 ELEVATION 5,268.65

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
26	85														
27	90	■			ML		67 33/3"			72.2	30.4		38	5	
28															
29	95														
30	100	■			SM	Silty SAND - very dense, moist to very moist, light brown, cemented	38 62/5"			91.4	27.7				
31															
32	105		▼												
33						- driller observation : gravel									
34	110														
35	115														
36						Poorly Graded SAND with silt - dense, wet, red brown, with some gravel									
37	120	■			SM ML	Silty SAND - very dense, moist, light brown with rust	53 47/3"								
38	125					SILT - hard, moist, light brown with rust									
39															
40	130					- driller observation : gravel									
41	135														
42															
43	140	■			CL	Lean CLAY - hard, moist, grey, somewhat cemented	27 33 40	50			38.3				
44	145														
45															
46	150														
47	155														
48															
49	160	■			CL		100/5"								
50	165														
51															

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 7b

DATE	
STARTED:	11/1/11
COMPLETED:	11/3/11
BACKFILLED:	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah
Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

BORING NO: **Well 7**
Sheet 3 of 3

LOCATION
NORTHING 11,845.99 EASTING 8,142.12 ELEVATION 5,268.65

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	SPT BLOW COUNT 10 20 30 40 50 60 70 80 90	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index	Moisture Content and Atterberg Limits (Plastic Limit – Moisture Content – Liquid Limit) 10 20 30 40 50 60 70 80 90
52	170														
53	175														
54															
55	180	▬			CL		100/6"				30.4		44	19	
56	185														
57															
58	190														
59	195														
60															
61	200	▬			CL		100/6"			83.0	35.8				
62	205														
63															
64	210														
65	215														
66															
67	220	▬			CL		100/6"			86.1	34.5				
68	225														
69															
70	230														
71	235														
72															
73	240														
74	245														
75															
76	250	▬			SM	Silty SAND - very dense, grey, with some gravel	100/3"				25.5				
77						Bottom of Boring @ 250.3 Feet									

N - OBSERVED UNCORRECTED BLOW COUNT * N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT FR - FIELD REFUSAL

IGES®

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3.25" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler
- 2" OD PVC Geoprobe

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Figure 7c

DATE	
STARTED:	11/1/11
COMPLETED:	11/3/11
BACKFILLED:	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

WELL NO: **Well 7**

Sheet 1 of 3

LOCATION: NORTHING 11,845.99 EASTING 8,142.12 ELEVATION 5,268.65

Depth (Meters)	Depth (Feet)	Unified Soil Classification	Material Description	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	SM	Silty SAND with gravel - light brown					
1–2	5	SM	Silty SAND - medium dense, moist, fines are more plastic	89.3	17.1			
3	10	SP / SC	Poorly Graded SAND - medium dense, moist, light brown, some silt, trace gravel	93.3	11.0			
4–5	15	ML	SILT - hard, moist, light brown with rust, blocky, somewhat plastic, some cementation - NP, difficult to thread in lab	87.9	29.7			
6	20	ML		85.6	30.0			
7–8	25							
9	30	ML		85.2	32.8	99.4		
10–11	35							
12	40	ML	- NP, difficult to thread in lab	76.4	26.9			
13–14	45							
15	50	ML		74.8	30.9	99.6		
16–17	55							
18	60	ML					41	10
19–20	65							
21	70	SM	Silty SAND - very dense, moist, light brown with rust, SILT pockets, cemented	90.7	16.1	27.6		
23	75							
24–25	80	ML	SILT - hard, moist, light brown, cemented	91.3	24.4			

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits: Plastic Limit — Moisture Content — Liquid Limit (10 20 30 40 50 60 70 80 90)

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES: Bentonite, 10-20 Silica Sand, 20 Slot Screen, Grout

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Figure 7d

DATE	
STARTED:	11/1/11
COMPLETED:	11/3/11
BACKFILLED:	11/3/11

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number 00386-014

IGES Rep: DKS
Rig Type: Fraste
Boring Type: Air/Mud Rotary

WELL NO: **Well 7**

Sheet 2 of 3

LOCATION
NORTHING 11,845.99 EASTING 8,142.12 ELEVATION 5,268.65

DEPTH METERS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
26	85							
27	90	ML		72.2	30.4		38	5
28								
29	95							
30	100	SM	Silty SAND - very dense, moist to very moist, light brown, cemented	91.4	27.7			
31								
32	105							
33			- driller observation : gravel					
34	110							
35	115							
36			Poorly Graded SAND with silt - dense, wet, red brown, with some gravel					
37	120	SM						
		ML	Silty SAND - very dense, moist, light brown with rust					
38	125		SILT - hard, moist, light brown with rust					
39								
40	130		- driller observation : gravel					
41	135							
42								
43	140	CL	Lean CLAY - hard, moist, grey, somewhat cemented		38.3			
44	145							
45								
46	150							
47	155							
48								
49	160	CL						
50	165							
51								

SPT BLOW COUNT 10 20 30 40 50 60 70 80 90

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

IGES®

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SAMPLE TYPE
- 2" O.D./1.38 I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.42" I.D. U SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

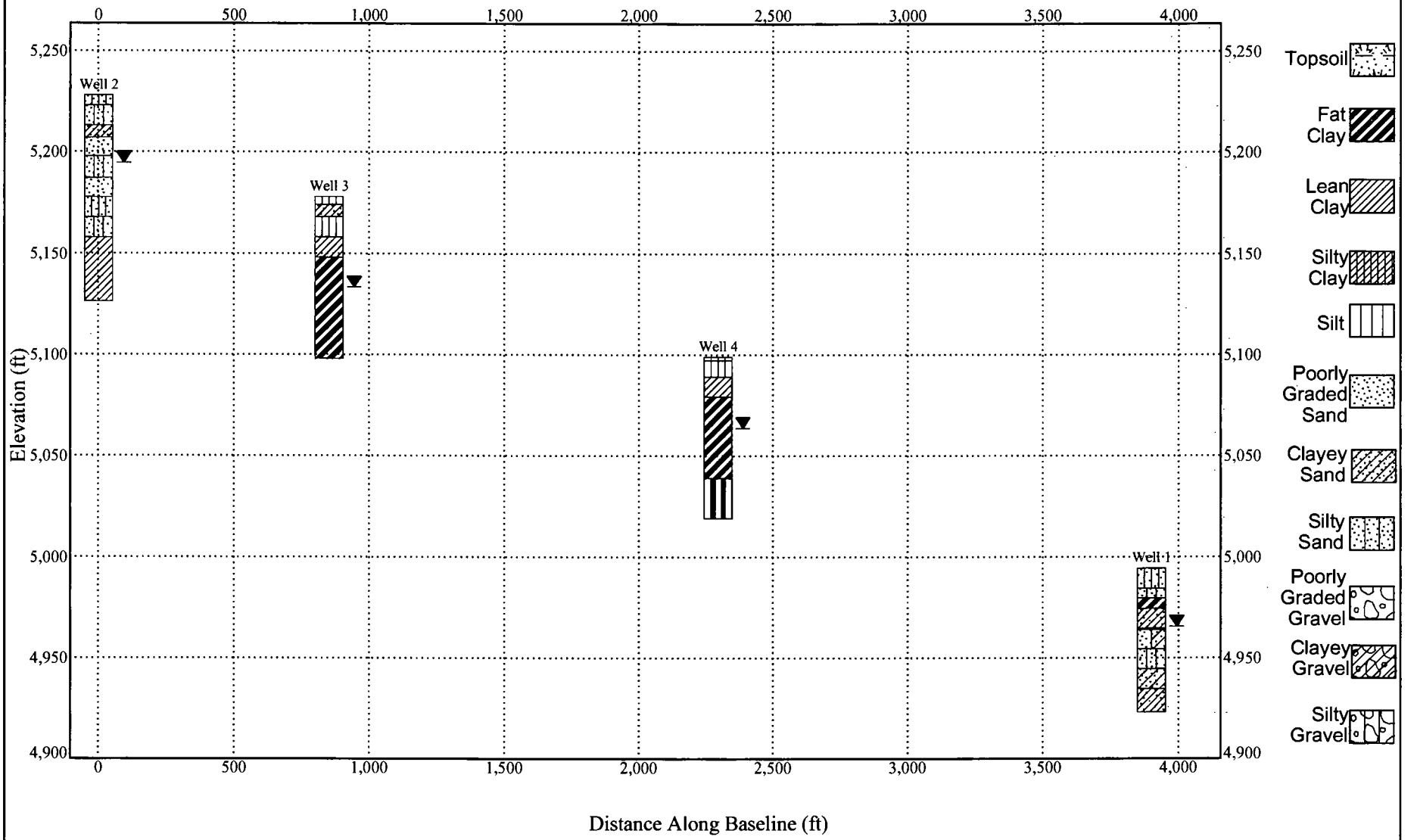
NOTES:
Bentonite | 10-20 Silica Sand | 20 Slot Screen | Grout

WATER LEVEL
- MEASURED - ESTIMATED

Figure 7e

Sample Date	Well ID	Top of Casing (ft)	Depth to Groundwater (ft)	Groundwater Elev (ft)
12/7/2011	NV1	4997.095	31.41	4965.685
12/6/2011	NV2	5230.503	35.63	5194.873
12/6/2011	NV3	5180.711	47.2	5133.511
12/6/2011	NV4	5101.68	37.81	5063.87
12/7/2011	NV5	5184.715	62.31	5122.405
12/7/2011	NV6	5230.654	71.15	5159.504
12/7/2011	NV7	5271.146	105.125	5166.021

*Depth to water in NV7 was estimated with steel tape (104.25-106)because the electric depth gauge is only 100ft.



IGES®

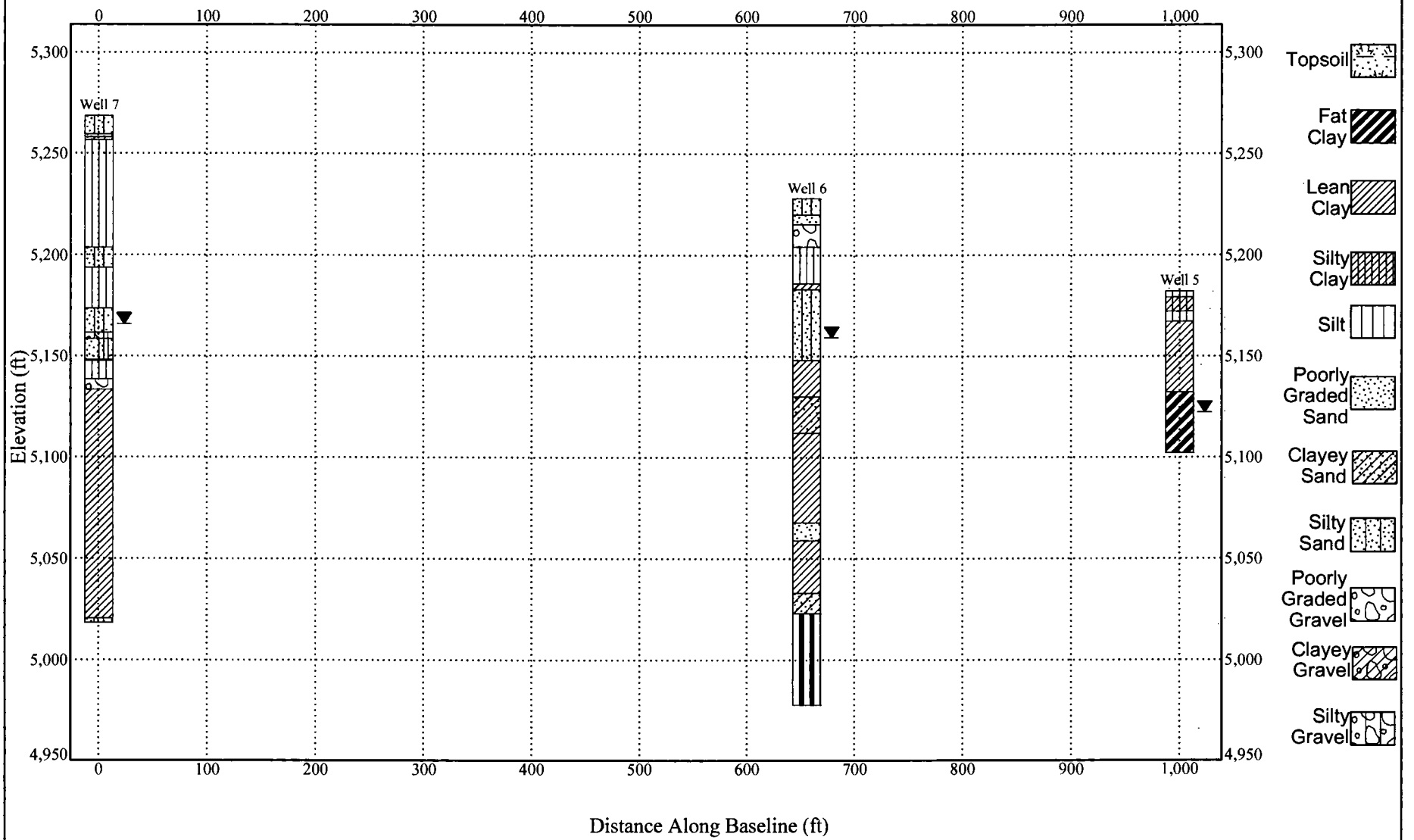
WATER LEVEL

▼- MEASURED
▽- ESTIMATED

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number: 00386-014

FENCE (A) 00386-014 COMPLETE FOR FENCE.GPJ IGES.GDT 2/13/12



IGES®

WATER LEVEL

▼- MEASURED
▽- ESTIMATED

Geotechnical Investigation
North Cache Valley
Clarkston, Utah

Project Number: 00386-014

FENCE (A) 00386-014 COMPLETE FOR FENCE.GPJ IGES.GDT 2/13/12

SUMMARY OF LABORATORY TEST RESULTS TABLE

Geotechnical Investigation **Logan City - North Valley Landfill** **00386-014**

SAMPLE LOCATION		NATURAL DRY DENSITY (pcf)	NATURAL MOISTURE CONTENT %	GRADATION (%)			ATTERBERG LIMITS		DIRECT SHEAR		CONSOLIDATION			PERMEABILITY (cm/s)
Point No.	Depth (ft)			Gravel >#4	Sand	Silt and Clay <#200	Liquid Limit	Plasticity Index	C (C') (psf)	Ø (Ø')	Compression Ratio	Recompression Ratio	Over Consolidation Ratio	
Well 1	7.5	81.2	33.3			89.7								
Well 1	10		9.1	30.1	54.3	15.6								
Well 1	15						52	28						
Well 1	20	81.5	33.9			78.3								
Well 1	30		11.2	37.9	40.8	21.3								
Well 1	40	83.9	35.7	0.0	15.9	84.1								
Well 1	50		14.2			17.9								
Well 1	60	91.8	30.8				45	25			0.11	0.02	2.2	
Well 1	70						44	27						
Well 2	5	94.9	18.1											
Well 2	7.5		14.8	19.2	39.3	41.5								
Well 2	10	88.9	17.5											
Well 2	15		17.3			58.7								
Well 2	20	103.8	18.3	16.5	43.6	39.9								
Well 2	40	90.1	29.9	0.0	54.5	45.5								
Well 2	50		28.3			93.2								
Well 2	60	96.9	24.5	0.0	52.9	47.1								
Well 2	80	74.5	33.8								0.05	0.006	3.1	
Well 2	90						70	44						
Well 2	100		39.6			99.8								
Well 3	10		31.3			95.3	46	14						
Well 3	20		29.8	0.1	11.1	88.8								
Well 3	30	82.0	38.7				80	51						
Well 3	40		38.4			99.8								
Well 3	60		44.5	0.0	1.2	98.8	80	45						
Well 4	10		33.7			97.0								
Well 4	20	82.7	36.8			96.7	62	34						
Well 4	40		44.3	0.0	3.4	96.6								
Well 4	60		49.5				72	36						
Well 4	80		47.7			98.4								
Well 5	10		25.1				39	7						
Well 5	30		34.8			94.0								
Well 5	50		39.5	0.0	1.0	99.0	65	37						
Well 5	70		38.7			99.4								
Well 6	5.5	103.7	9.1											
Well 6	15		1.7											
Well 6	20		7.8											
Well 6	30	78.8	31.3						1260	22				
Well 6	40	75.0	30.4											1.7E-05
Well 6	50	81.5	29.3											
Well 6	60	76.6	27.4						552	32				
Well 6	70	80.7	35.6	0.0	59.2	40.8								
Well 6	80		30.3											
Well 6	100		29.7			59.0								
Well 6	120		29.7											
Well 6	140		30.4			90.5								
Well 6	160		25.6				NP	NP						
Well 6	200		28.6			69.9								
Well 6	220						59	28						
Well 6	250		32.9				59	27						

SUMMARY OF LABORATORY TEST RESULTS TABLE

Geotechnical Investigation **Logan City - North Valley Landfill** **00386-014**

SAMPLE LOCATION		NATURAL DRY DENSITY (pcf)	NATURAL MOISTURE CONTENT %	GRADATION (%)			ATTERBERG LIMITS		DIRECT SHEAR		CONSOLIDATION			PERMEABILITY (cm/s)
Point No.	Depth (ft)			Gravel >#4	Sand	Silt and Clay <#200	Liquid Limit	Plasticity Index	C (C') (psf)	Ø (Ø')	Compression Ratio	Recompression Ratio	Over Consolidation Ratio	
Well 7	5	89.3	17.1											
Well 7	10.5	93.3	11.0						198	31				
Well 7	15	87.9	29.7				NP	NP						
Well 7	20	85.6	30.0						480	35				
Well 7	30	85.2	32.8	0.0	0.6	99.4								
Well 7	40	76.4	26.9				NP	NP						
Well 7	50	74.8	30.9			99.6								
Well 7	60						41	10						
Well 7	70	90.7	16.1			27.6								
Well 7	80	91.3	24.4						912	37				
Well 7	90	72.2	30.4				38	5						
Well 7	100	91.4	27.7											1.3E-05
Well 7	140		38.3											
Well 7	180	90.5	30.4				44	19						3.8E-08
Well 7	200	83.0	35.8											
Well 7	220	86.1	34.5											
Well 7	250		25.5											

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

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Project: **Logan City Landfill**
No: **00386-014**
Location: Cache County, UT
Date: 9/9/2010
By: BRR

Sample Info.	Boring No.	B-1	B-1	B-1	B-1	B-2	B-2	B-2	B-2
	Sample:								
	Depth:	7.5'	20'	40'	60'	5'	10'	15'	20'
Unit Weight Info.	Sample height, H (in)	5.000	6.000	6.000	4.000	5.000	4.000		6.000
	Sample diameter, D (in)	2.416	2.416	2.416	2.416	2.416	2.416		2.416
	Sample volume, V (ft^3)	0.0133	0.0159	0.0159	0.0106	0.0133	0.0106		0.0159
	Wt. rings + wet soil (g)	875.88	1048.94	1082.96	751.84	897.80	683.73		1147.14
	Wt. rings/tare (g)	224.56	260.73	261.27	173.93	223.39	181.07		260.59
	Moist soil, Ws (g)	651.32	788.21	821.69	577.91	674.41	502.66		886.55
	Moist unit wt., γ_m (pcf)	108.25	109.17	113.80	120.06	112.09	104.43		122.79
Moisture	Wet soil + tare (g)	576.96	495.00	547.29	533.88	529.99	504.17	1027.83	1180.46
	Dry soil + tare (g)	476.67	414.59	445.62	450.09	483.20	455.75	918.60	1044.24
	Tare (g)	175.75	177.30	160.91	177.93	224.68	179.41	288.42	299.65
Moisture Content, w (%)		**33.3**	**33.9**	**35.7**	**30.8**	**18.1**	**17.5**	**17.3**	**18.3**
Dry Unit Wt., γ_d (pcf)		**81.2**	**81.5**	**83.9**	**91.8**	**94.9**	**88.9**		**103.8**

Entered by:_____

Reviewed:_____

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Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/9/2010
By: BRR

Sample Info.	Boring No.	B-2	B-2	B-2	B-2				
	Sample:								
	Depth:	40'	60'	80'	100'				
Unit Weight Info.	Sample height, H (in)	6.000	5.000	3.000					
	Sample diameter, D (in)	2.416	2.416	2.416					
	Sample volume, V (ft^3)	0.0159	0.0133	0.0080					
	Wt. rings + wet soil (g)	1109.41	951.63	536.26					
	Wt. rings/tare (g)	264.09	225.31	176.48					
	Moist soil, Ws (g)	845.32	726.32	359.78					
	Moist unit wt., γ_m (pcf)	117.07	120.71	99.66					
Moisture	Wet soil + tare (g)	1143.64	1020.45	350.93	727.73				
	Dry soil + tare (g)	946.80	877.47	297.75	583.72				
	Tare (g)	288.79	294.54	140.48	219.86				
Moisture Content, w (%)		**29.9**	**24.5**	**33.8**	**39.6**				
Dry Unit Wt., γ_d (pcf)		**90.1**	**96.9**	**74.5**					

Entered by:_____

Reviewed:_____

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/13/2010
By: JA

Boring No.: B-1
Sample:
Depth: 15'
Description: Tan fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

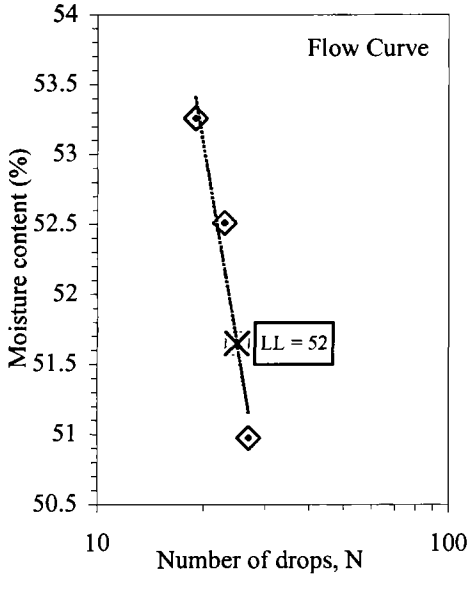
Plastic Limit

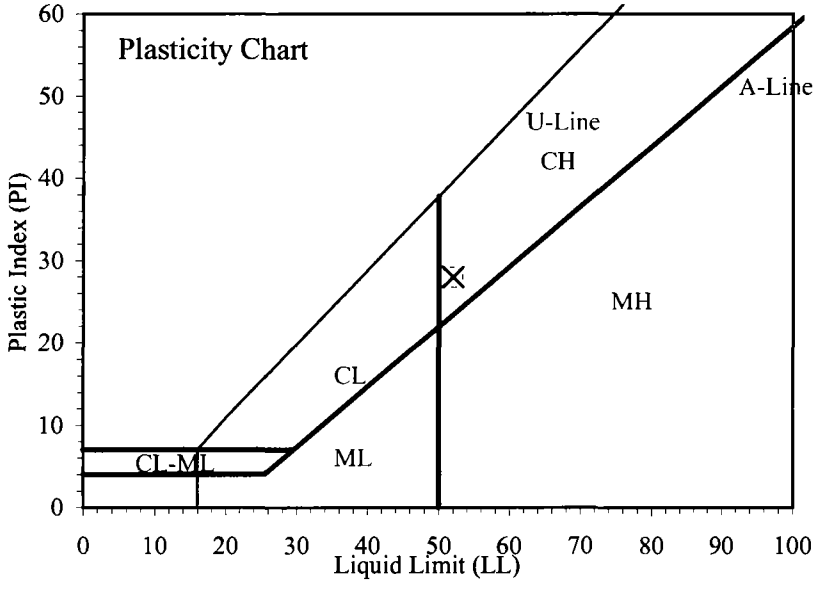
Determination No	1	2				
Wet Soil + Tare (g)	6.14	6.62				
Dry Soil + Tare (g)	5.21	5.62				
Moisture Loss (g)	0.93	1.00				
Tare (g)	1.39	1.33				
Dry Soil (g)	3.82	4.29				
Moisture Content, w (%)	24.35	23.31				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	27	23	19			
Wet Soil + Tare (g)	9.89	10.78	12.43			
Dry Soil + Tare (g)	7.02	7.54	8.59			
Moisture Loss (g)	2.87	3.24	3.84			
Tare (g)	1.39	1.37	1.38			
Dry Soil (g)	5.63	6.17	7.21			
Moisture Content, w (%)	50.98	52.51	53.26			
One-Point LL (%)	51	52				

Liquid Limit, LL (%)	**52**
Plastic Limit, PL (%)	**24**
Plasticity Index, PI (%)	**28**





Entered by:_____
Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/13/2010
By: JA

Boring No.: B-1
Sample:
Depth: 60'
Description: Grey clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

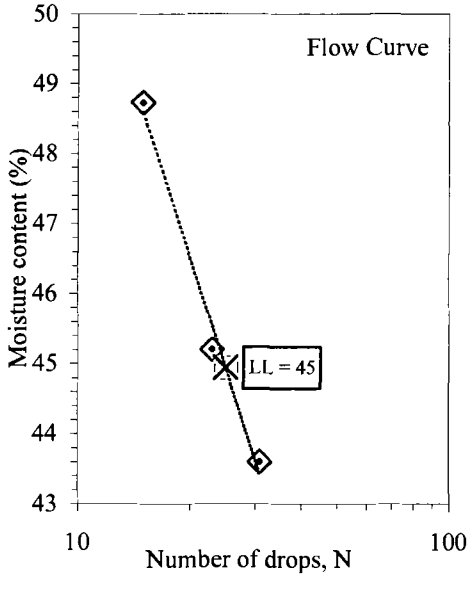
Plastic Limit

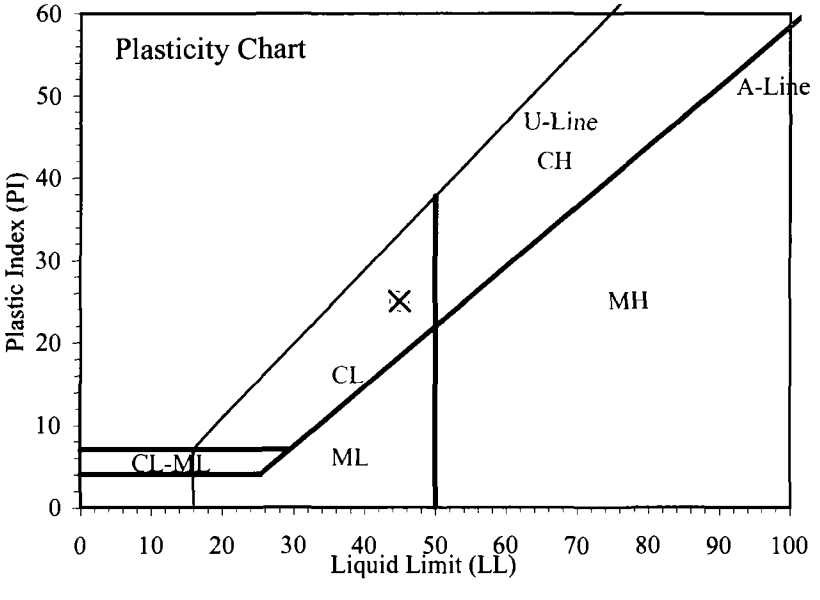
Determination No	1	2				
Wet Soil + Tare (g)	6.72	7.04				
Dry Soil + Tare (g)	5.80	6.09				
Moisture Loss (g)	0.92	0.95				
Tare (g)	1.38	1.38				
Dry Soil (g)	4.42	4.71				
Moisture Content, w (%)	20.81	20.17				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	31	23	15			
Wet Soil + Tare (g)	11.04	11.54	13.13			
Dry Soil + Tare (g)	8.11	8.38	9.28			
Moisture Loss (g)	2.93	3.16	3.85			
Tare (g)	1.39	1.39	1.38			
Dry Soil (g)	6.72	6.99	7.90			
Moisture Content, w (%)	43.60	45.21	48.73			
One-Point LL (%)		45				

Liquid Limit, LL (%)	**45**
Plastic Limit, PL (%)	**20**
Plasticity Index, PI (%)	**25**





Entered by:_____
Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

© IGES 2004

Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/13/2010
By: JA

Boring No.: B-1
Sample:
Depth: 70'
Description: Grey clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

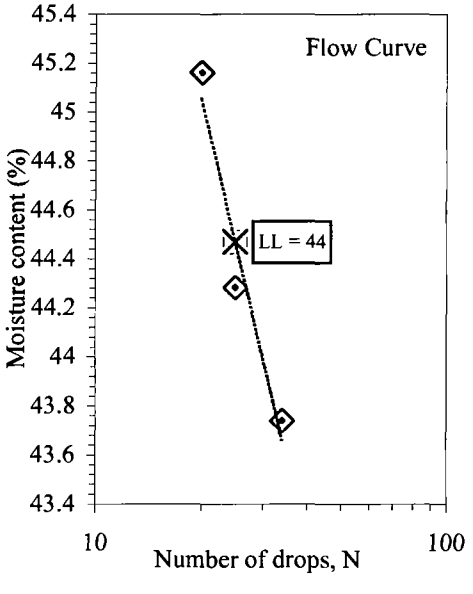
Plastic Limit

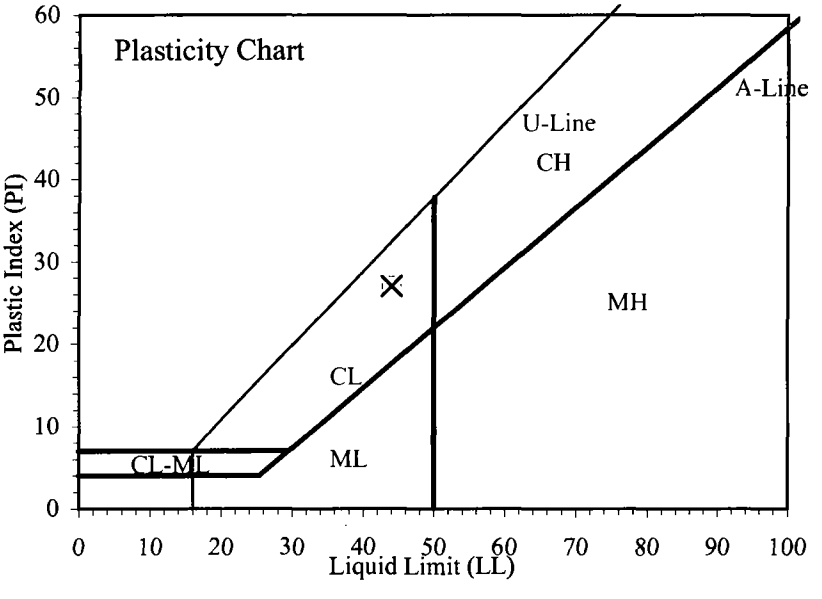
Determination No	1	2				
Wet Soil + Tare (g)	5.39	5.54				
Dry Soil + Tare (g)	4.79	4.92				
Moisture Loss (g)	0.60	0.62				
Tare (g)	1.33	1.38				
Dry Soil (g)	3.46	3.54				
Moisture Content, w (%)	17.34	17.51				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	25	20			
Wet Soil + Tare (g)	10.69	11.35	13.08			
Dry Soil + Tare (g)	7.86	8.29	9.44			
Moisture Loss (g)	2.83	3.06	3.64			
Tare (g)	1.39	1.38	1.38			
Dry Soil (g)	6.47	6.91	8.06			
Moisture Content, w (%)	43.74	44.28	45.16			
One-Point LL (%)		44	44			

Liquid Limit, LL (%)	**44**
Plastic Limit, PL (%)	**17**
Plasticity Index, PI (%)	**27**





Entered by:_____
*Reviewed:*_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/13/2010
By: JA

Boring No.: B-2
Sample:
Depth: 90'
Description: Grey fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

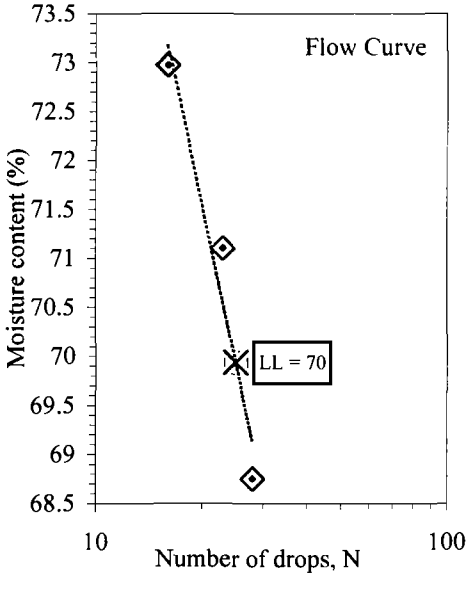
Plastic Limit

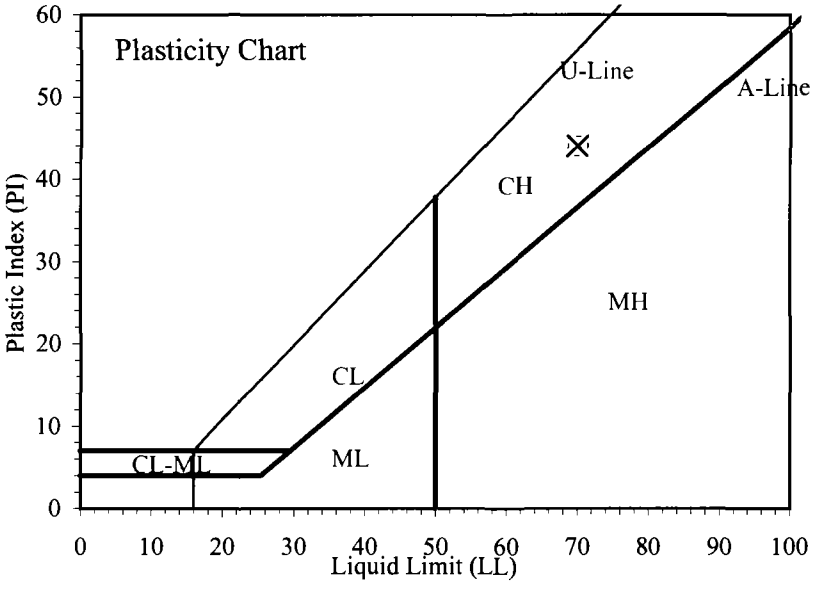
Determination No	1	2				
Wet Soil + Tare (g)	5.50	5.66				
Dry Soil + Tare (g)	4.63	4.77				
Moisture Loss (g)	0.87	0.89				
Tare (g)	1.34	1.39				
Dry Soil (g)	3.29	3.38				
Moisture Content, w (%)	26.44	26.33				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	28	23	16			
Wet Soil + Tare (g)	10.28	10.34	11.62			
Dry Soil + Tare (g)	6.65	6.60	7.30			
Moisture Loss (g)	3.63	3.74	4.32			
Tare (g)	1.37	1.34	1.38			
Dry Soil (g)	5.28	5.26	5.92			
Moisture Content, w (%)	68.75	71.10	72.97			
One-Point LL (%)	70	70				

Liquid Limit, LL (%)	**70**
Plastic Limit, PL (%)	**26**
Plasticity Index, PI (%)	**44**





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Reviewed:_____

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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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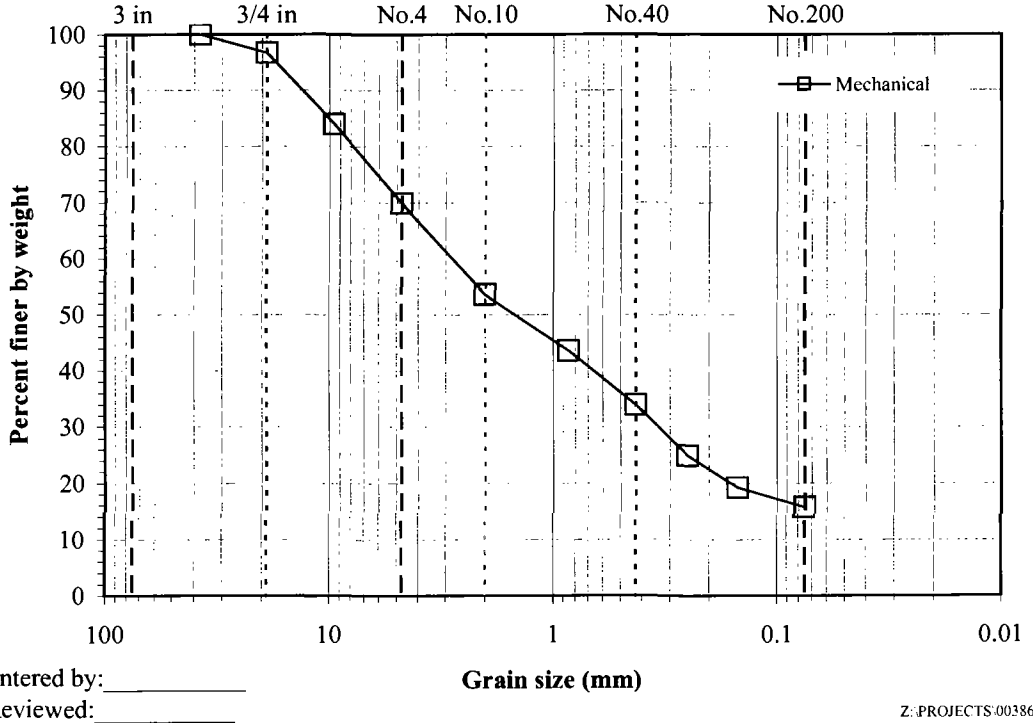
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-1
Sample:
Depth: 10'
Description: Brown silty sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	584.60	536.1
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	763.18
Dry soil + tare (g):	-	714.64
Tare (g):	-	178.58
Moisture content (%):	0.0	9.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	17.66	19	96.7
3/8"	86.01	9.5	84.0
No.4	161.54	4.75	69.9
No.10	248.44	2	53.7
No.20	302.76	0.85	43.5
No.40	354.51	0.425	33.9
No.60	402.90	0.25	24.8
No.100	433.16	0.15	19.2
No.200	452.27	0.075	15.6



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Reviewed:_____

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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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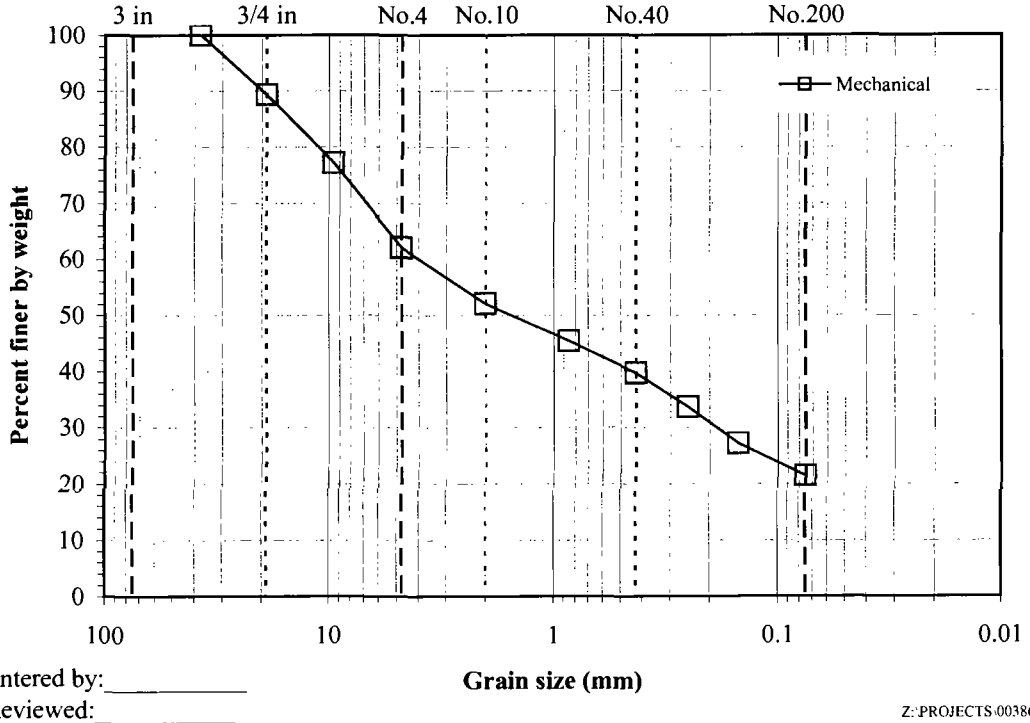
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-1
Sample:
Depth: 30'
Description: Brown clayey sand with gravel

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	719.25	646.6
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	899.50
Dry soil + tare (g):	-	826.89
Tare (g):	-	180.25
Moisture content (%):	0.0	11.2

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	68.97	19	89.3
3/8"	147.16	9.5	77.2
No.4	245.00	4.75	62.1
No.10	310.07	2	52.0
No.20	353.22	0.85	45.4
No.40	389.66	0.425	39.7
No.60	428.78	0.25	33.7
No.100	470.70	0.15	27.2
No.200	508.73	0.075	21.3



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Particle-Size Analysis of Soils

(ASTM D422)

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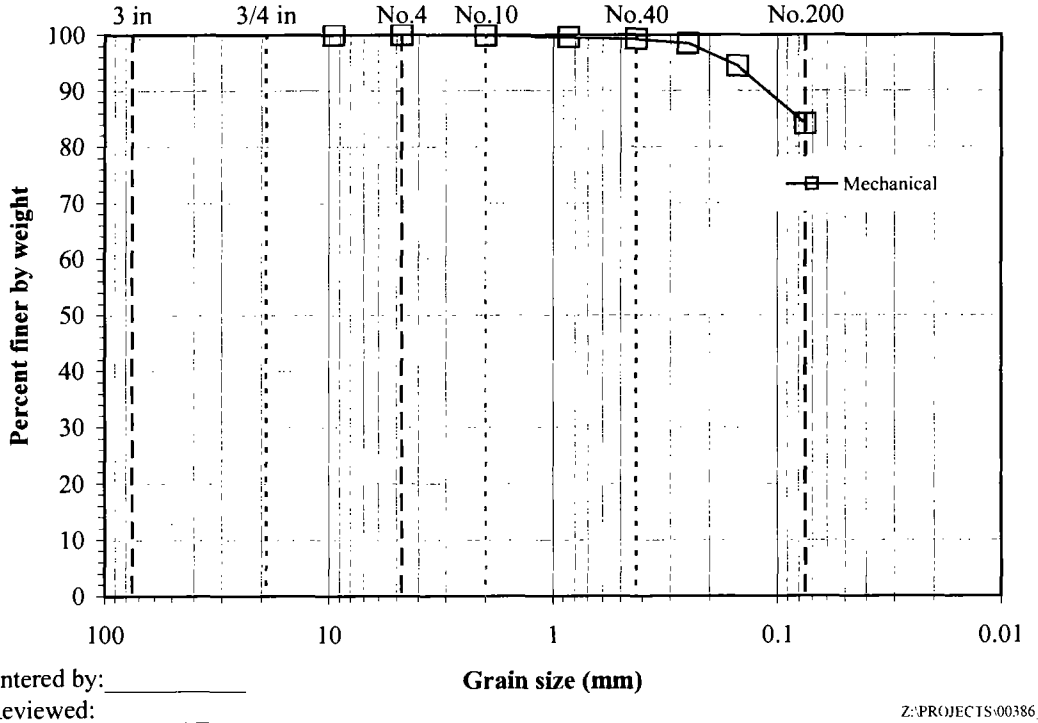
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-1
Sample:
Depth: 40'
Description: Brown sandy clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	386.38	284.7
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	547.29
Dry soil + tare (g):	-	445.62
Tare (g):	-	160.91
Moisture content (%):	0.0	35.7

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	100.0
No.4	0.05	4.75	100.0
No.10	0.32	2	99.9
No.20	1.14	0.85	99.6
No.40	2.13	0.425	99.3
No.60	4.41	0.25	98.5
No.100	15.94	0.15	94.4
No.200	45.36	0.075	84.1



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Reviewed:_____

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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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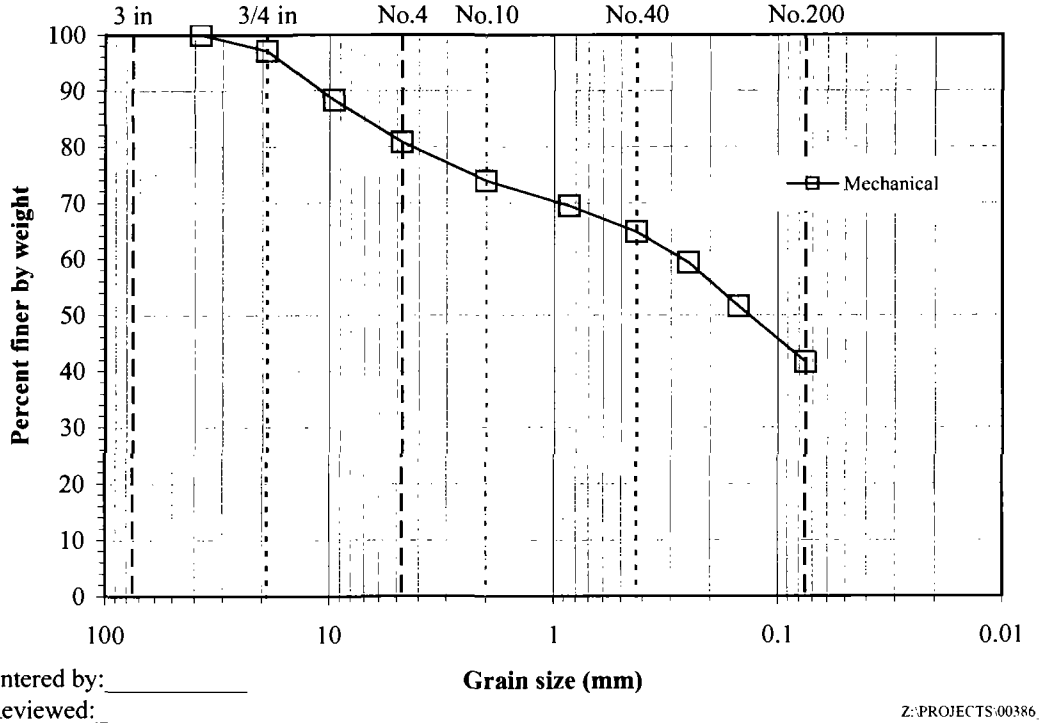
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-2
Sample:
Depth: 7.5'
Description: Brown silty sand with gravel

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	511.10	445.3
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	706.66
Dry soil + tare (g):	-	640.90
Tare (g):	-	195.56
Moisture content (%):	0.0	14.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	12.78	19	97.1
3/8"	52.15	9.5	88.3
No.4	85.49	4.75	80.8
No.10	116.17	2	73.9
No.20	136.40	0.85	69.4
No.40	156.69	0.425	64.8
No.60	181.16	0.25	59.3
No.100	216.05	0.15	51.5
No.200	260.34	0.075	41.5



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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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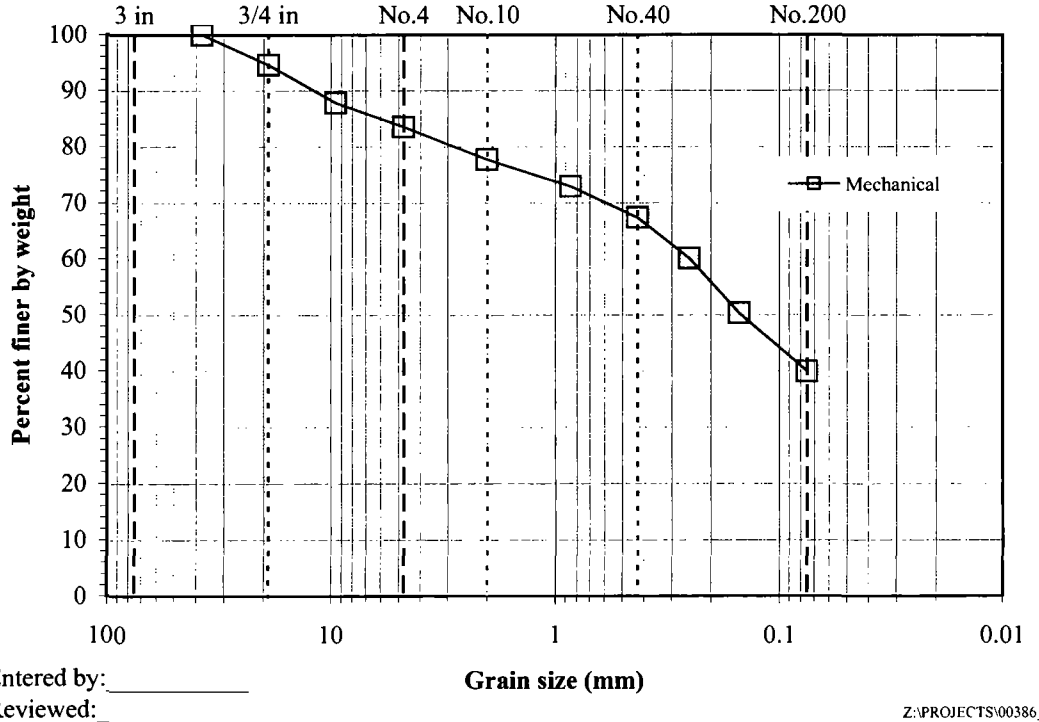
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-2
Sample:
Depth: 20'
Description: Brown silty sand with gravel

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	880.81	745.1
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	1180.46
Dry soil + tare (g):	-	1044.74
Tare (g):	-	299.65
Moisture content (%):	0.0	18.2

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	100.0
3/4"	40.00	19	94.6
3/8"	90.69	9.5	87.8
No.4	122.90	4.75	83.5
No.10	165.92	2	77.7
No.20	202.02	0.85	72.9
No.40	243.40	0.425	67.3
No.60	297.48	0.25	60.1
No.100	369.81	0.15	50.4
No.200	447.66	0.075	39.9



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Particle-Size Analysis of Soils

(ASTM D422)

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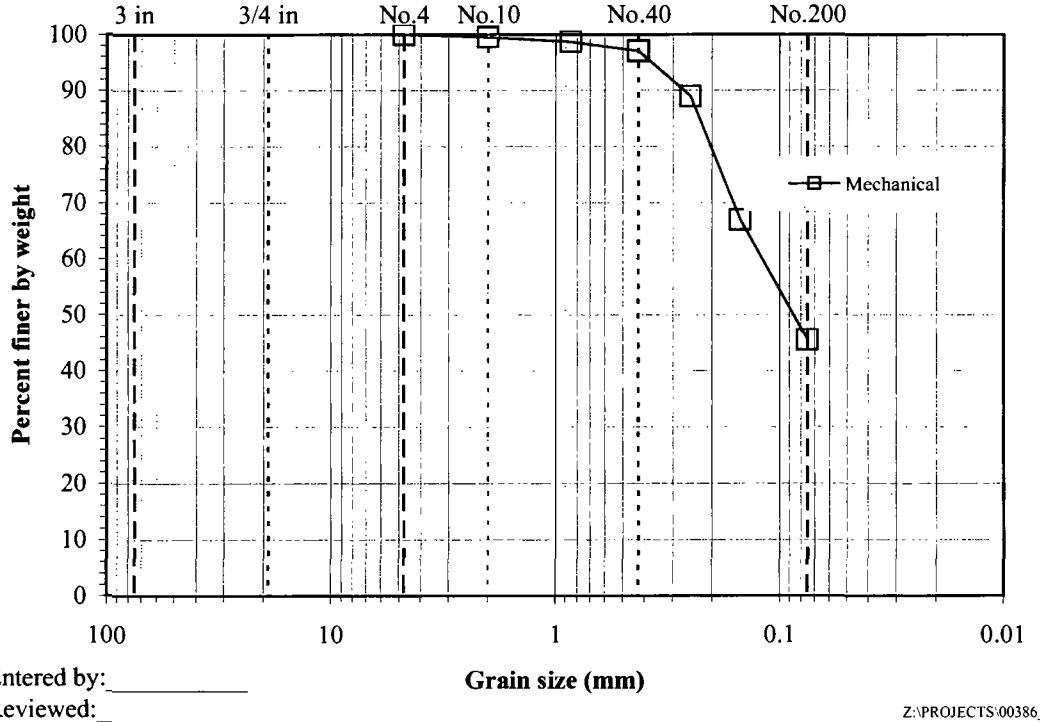
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-2
Sample:
Depth: 40'
Description: Brown silty sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	854.85	658.0
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	1143.64
Dry soil + tare (g):	-	946.80
Tare (g):	-	288.79
Moisture content (%):	0.0	29.9

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	2.60	2	99.6
No.20	8.49	0.85	98.7
No.40	19.42	0.425	97.0
No.60	73.05	0.25	88.9
No.100	217.70	0.15	66.9
No.200	358.83	0.075	45.5



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Particle-Size Analysis of Soils

(ASTM D422)

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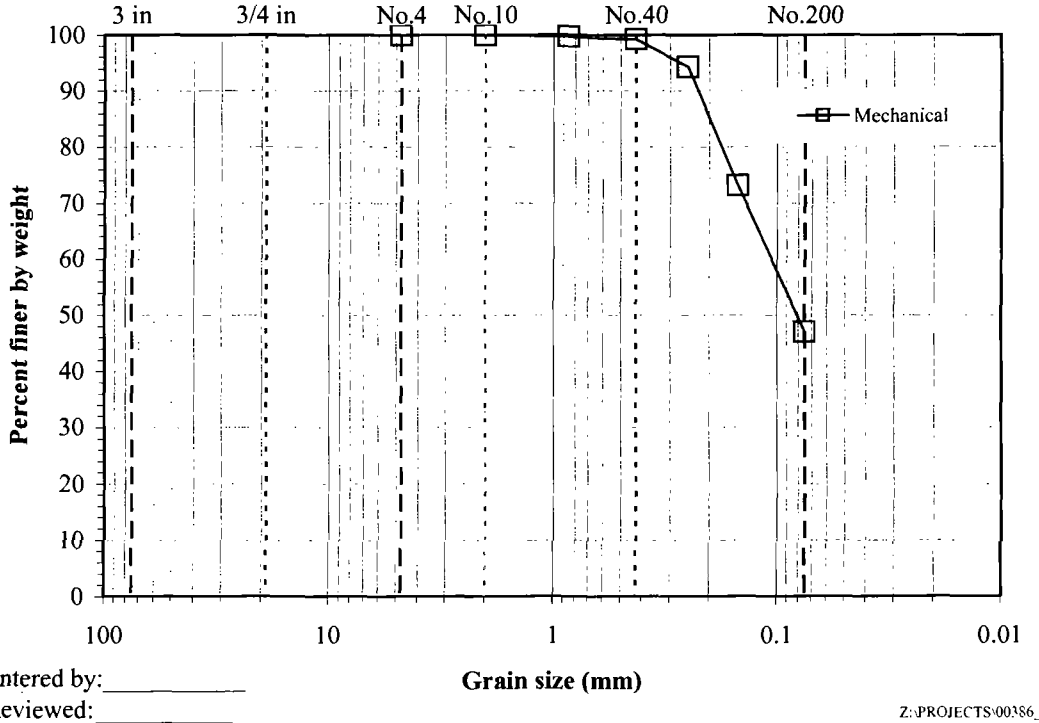
Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/14/2010
By: BRR

Boring No.: B-2
Sample:
Depth: 60'
Description: Gray silty sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	725.91	582.9
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	1020.45
Dry soil + tare (g):	-	877.47
Tare (g):	-	294.54
Moisture content (%):	0.0	24.5

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.17	2	100.0
No.20	2.07	0.85	99.6
No.40	4.54	0.425	99.2
No.60	33.31	0.25	94.3
No.100	156.47	0.15	73.2
No.200	308.56	0.075	47.1



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Reviewed:_____

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Amount of Material in Soil Finer than the No. 200 (75µm) Sieve

(ASTM D1140)

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Project: **Logan City Landfill**
No: **00386-014**
Location: Cache County, UT
Date: 9/10/2010
By: BRR

Sample Info.	Boring No.	B-1	B-1	B-1	B-2	B-2	B-2		
	Sample								
	Depth	7.5'	20'	50'	15'	50'	100'		
	Split	No	No	No	No	No	No		
	Split Sieve*								
	Moist total sample wt. (g)	401.21	317.70	933.28	739.41	1076.59	507.87		
	Moist coarse fraction (g)								
	Moist split fraction + tare (g)								
	Split fraction tare (g)								
	Dry split fraction (g)								
	Dry retained No. 200 + tare (g)	206.82	228.82	944.20	548.68	368.00	220.76		
	Wash tare (g)	175.75	177.30	273.31	288.42	311.22	219.86		
	No. 200 Dry wt. retained (g)	31.07	51.52	670.89	260.26	56.78	0.90		
	Split sieve* Dry wt. retained (g)								
	Dry total sample wt. (g)	300.92	237.29	817.61	630.18	839.31	363.86		
Coarse Fraction	Moist soil + tare (g)								
	Dry soil + tare (g)								
	Tare (g)								
	Moisture content (%)								
Split Fraction	Moist soil + tare (g)	576.96	495.00	1206.59	1027.83	1387.81	727.73		
	Dry soil + tare (g)	476.67	414.59	1090.92	918.60	1150.53	583.72		
	Tare (g)	175.75	177.30	273.31	288.42	311.22	219.86		
	Moisture content (%)	33.33	33.89	14.15	17.33	28.27	39.58		
Percent passing split sieve* (%)									
Percent passing No. 200 sieve (%)		**89.7**	**78.3**	**17.9**	**58.7**	**93.2**	**99.8**		

Entered by:_____

Reviewed:_____

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One-Dimensional Consolidation Properties of Soils
(ASTM D2435)

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/10/2010
By: BRR

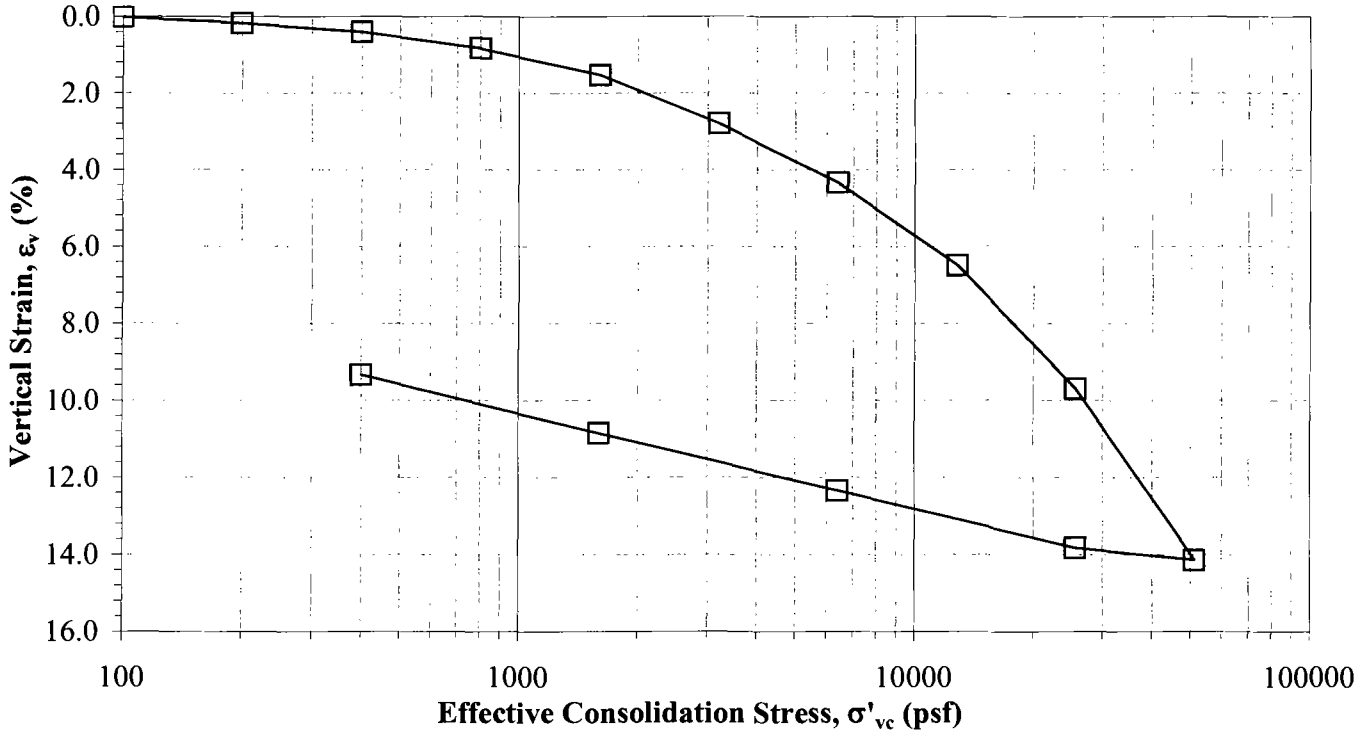
Boring No.: B-1
Sample:
Depth: 60'
Sample Description: Gray clay
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from ring

Test method:	A	
Inundation stress (psf), timing:	Seating	Beginning
Specific gravity, G_s	2.67	Assumed

	Initial (o)	Final (f)
Sample height, H (in.)	1.000	0.9066
Sample diameter, D (in.)	2.416	2.416
Wt. rings + wet soil (g)	178.77	173.67
Wt. rings/tare (g)	43.25	43.25
Moist unit wt., γ_m (pcf)	112.6	119.5
Wet soil + tare (g)	533.88	
Dry soil + tare (g)	450.09	
Tare (g)	177.93	
Moisture content, w (%)	30.8	25.9
Dry unit wt., γ_d (pcf)	86.1	95.0
Saturation	0.88	0.91

*Note: C_v, C_c, C_r, and σ_p' to be determined by Geotechnical Engineer.

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.0000	0.00	1.0000	0.9358
100	0.0002	0.02	0.9998	0.9354
200	0.0018	0.18	0.9982	0.9323
400	0.0041	0.41	0.9959	0.9278
800	0.0084	0.84	0.9916	0.9196
1600	0.0154	1.54	0.9847	0.9061
3200	0.0280	2.80	0.9720	0.8816
6400	0.0434	4.34	0.9566	0.8519
12800	0.0650	6.50	0.9350	0.8100
25600	0.0970	9.70	0.9030	0.7480
51200	0.1415	14.15	0.8585	0.6619
25600	0.1383	13.83	0.8617	0.6681
6400	0.1234	12.34	0.8766	0.6969
1600	0.1085	10.85	0.8915	0.7258
400	0.0934	9.34	0.9066	0.7550



Entered: _____
Reviewed: _____

One-Dimensional Consolidation Properties of Soils
(ASTM D2435)

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Project: Logan City Landfill
No: 00386-014
Location: Cache County, UT
Date: 9/10/2010
By: BRR

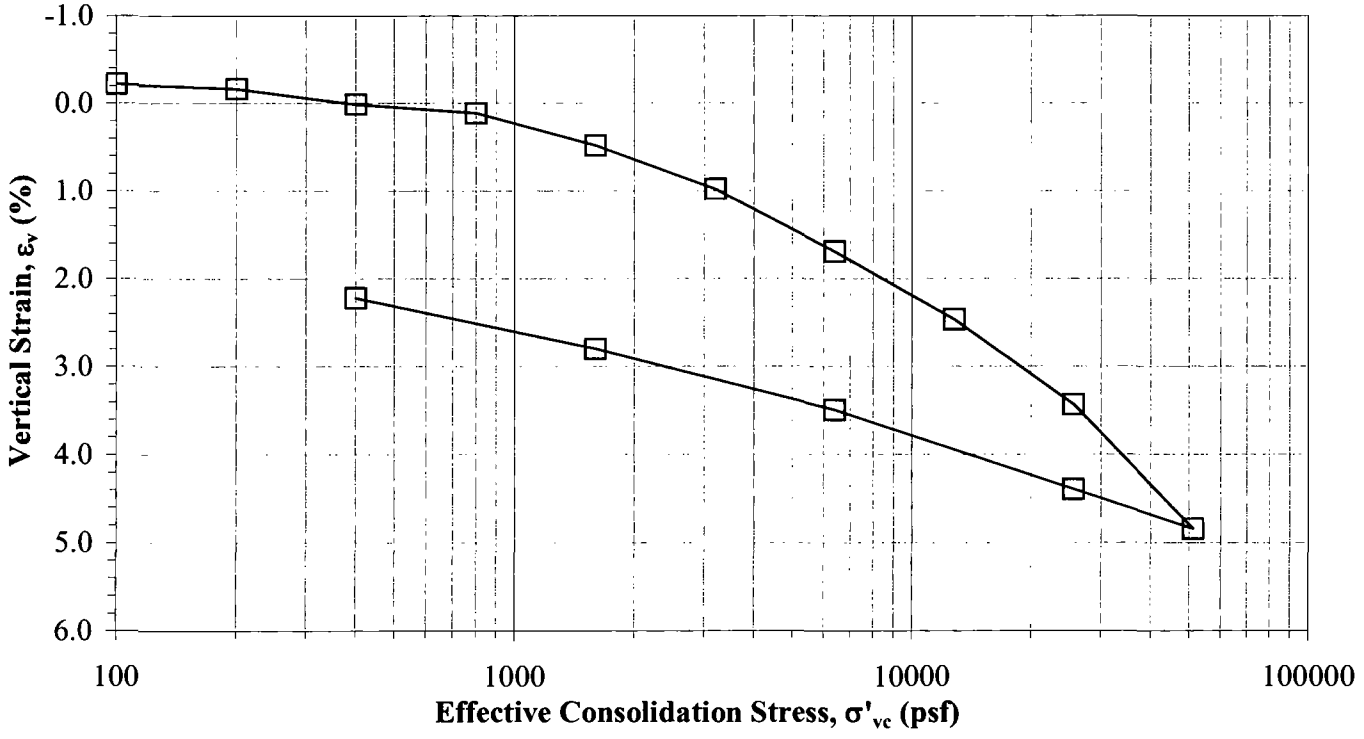
Boring No.: B-2
Sample:
Depth: 80'
Sample Description: Gray clay
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from ring

Test method:	A	
Inundation stress (psf), timing:	Seating	Beginning
Specific gravity, G_s	2.67	Assumed

	Initial (o)	Final (f)
Sample height, H (in.)	1.000	0.9778
Sample diameter, D (in.)	2.416	2.416
Wt. rings + wet soil (g)	178.88	180.37
Wt. rings/tare (g)	42.20	42.20
Moist unit wt., γ_m (pcf)	113.6	117.4
Wet soil + tare (g)	350.93	
Dry soil + tare (g)	297.75	
Tare (g)	140.48	
Moisture content, w (%)	33.8	35.3
Dry unit wt., γ_d (pcf)	84.9	86.8
Saturation	0.94	1.00

*Note: C_v, C_c, C_r, and σ_p' to be determined by Geotechnical Engineer.

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.0000	0.00	1.0000	0.9638
100	-0.0022	-0.22	1.0022	0.9681
200	-0.0017	-0.17	1.0017	0.9671
400	0.0001	0.01	0.9999	0.9636
800	0.0012	0.12	0.9988	0.9615
1600	0.0048	0.48	0.9952	0.9543
3200	0.0098	0.98	0.9902	0.9445
6400	0.0169	1.69	0.9831	0.9306
12800	0.0247	2.47	0.9754	0.9154
25600	0.0343	3.43	0.9657	0.8963
51200	0.0484	4.84	0.9516	0.8687
25600	0.0439	4.39	0.9561	0.8775
6400	0.0350	3.50	0.9651	0.8952
1600	0.0280	2.80	0.9720	0.9088
400	0.0222	2.22	0.9778	0.9202



Comments: Sample swelled at 100 psf and 200 psf.

Entered: _____
Reviewed: _____

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Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

IGES

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/10/2010
By: MP

							Well 4	Well 4	Well 4
Sample Info.	Boring No.	B-3	B-3	B-3	B-3	B-3	B-5	B-5	B-5
	Sample:								
	Depth:	10'	20'	30'	40'	60'	10'	20'	40'
Unit Weight Info.	Sample height, H (in)			4.000				4.000	
	Sample diameter, D (in)			2.416				2.416	
	Sample volume, V (ft^3)			0.0106				0.0106	
	Wt. rings + wet soil (g)			725.02				718.56	
	Wt. rings/tare (g)			177.57				174.03	
	Moist soil, Ws (g)			547.45				544.53	
	Moist unit wt., γ_m (pcf)			113.73				113.12	
Moisture	Wet soil + tare (g)	611.37	674.35	641.56	646.83	592.65	629.61	679.27	765.28
	Dry soil + tare (g)	502.08	554.37	505.02	506.31	453.61	509.07	537.63	585.78
	Tare (g)	152.71	152.35	151.98	139.98	140.99	151.55	152.71	180.29
Moisture Content, w (%)		**31.3**	**29.8**	**38.7**	**38.4**	**44.5**	**33.7**	**36.8**	**44.3**
Dry Unit Wt., γ_d (pcf)				**82.0**				**82.7**	

Entered by:_____

Reviewed:_____

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/10/2010
By: MP

		Well 4	Well 4	Well 5	Well 5	Well 5	Well 5		
Sample Info.	Boring No.	B-5	B-5	B-6	B-6	B-6	B-6		
	Sample:								
	Depth:	60'	80'	10'	30'	50'	70'		
Unit Weight Info.	Sample height, H (in)								
	Sample diameter, D (in)								
	Sample volume, V (ft^3)								
	Wt. rings + wet soil (g)								
	Wt. rings/tare (g)								
	Moist soil, Ws (g)								
	Moist unit wt., γ_m (pcf)								
Moisture	Wet soil + tare (g)	654.87	771.26	337.37	713.88	517.89	727.91		
	Dry soil + tare (g)	480.35	571.87	297.89	562.50	407.76	567.05		
	Tare (g)	127.74	154.04	140.32	127.02	128.76	151.73		
Moisture Content, w (%)		**49.5**	**47.7**	**25.1**	**34.8**	**39.5**	**38.7**		
Dry Unit Wt., γ_d (pcf)									

Entered by:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/12/2010
By: JA

Boring No.: B-3
Sample:
Depth: 10'
Description: Tan silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

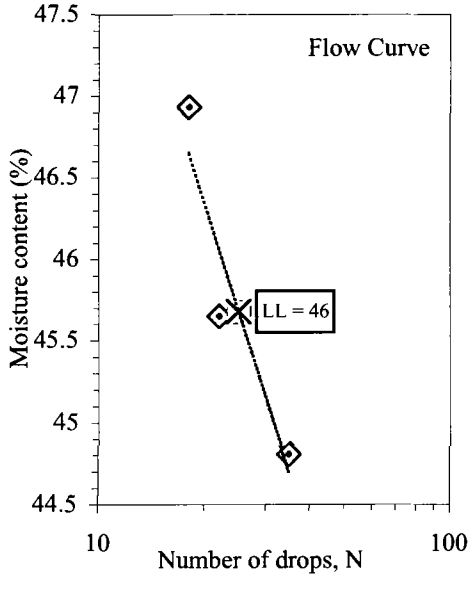
Plastic Limit

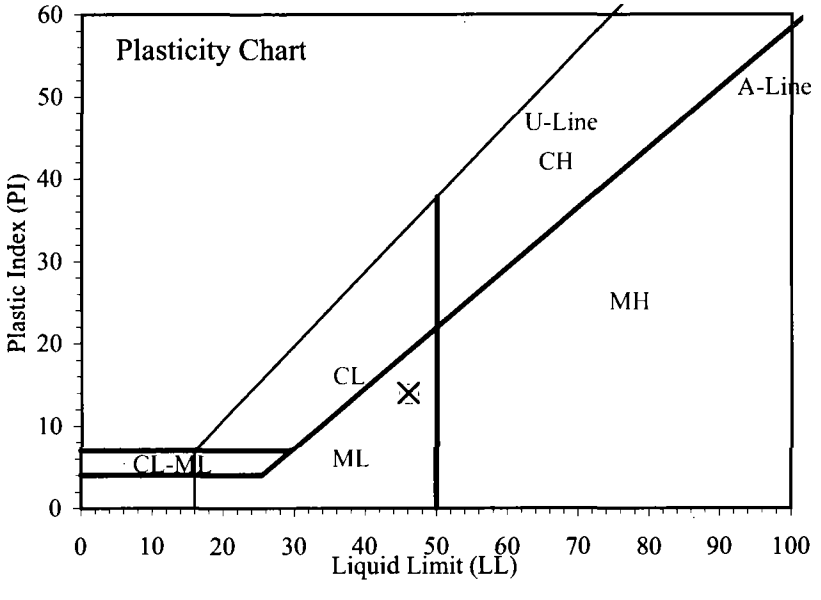
Determination No	1	2				
Wet Soil + Tare (g)	7.10	7.42				
Dry Soil + Tare (g)	5.71	5.95				
Moisture Loss (g)	1.39	1.47				
Tare (g)	1.38	1.40				
Dry Soil (g)	4.33	4.55				
Moisture Content, w (%)	32.10	32.31				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	22	18			
Wet Soil + Tare (g)	8.90	10.73	10.25			
Dry Soil + Tare (g)	6.57	7.79	7.42			
Moisture Loss (g)	2.33	2.94	2.83			
Tare (g)	1.37	1.35	1.39			
Dry Soil (g)	5.20	6.44	6.03			
Moisture Content, w (%)	44.81	45.65	46.93			
One-Point LL (%)		45				

Liquid Limit, LL (%)	**46**
Plastic Limit, PL (%)	**32**
Plasticity Index, PI (%)	**14**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/12/2010
By: JA

Boring No.: B-3
Sample:
Depth: 30'
Description: Tan fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

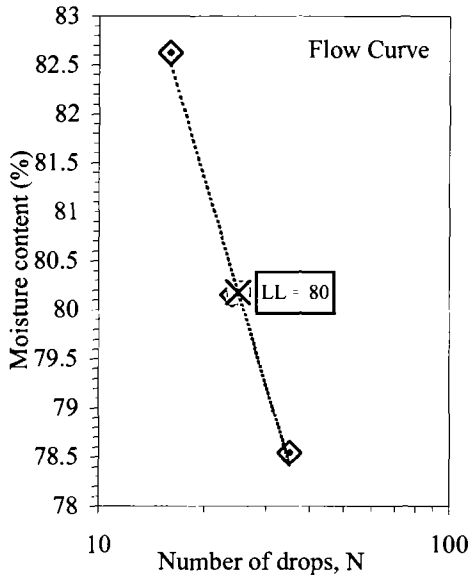
Plastic Limit

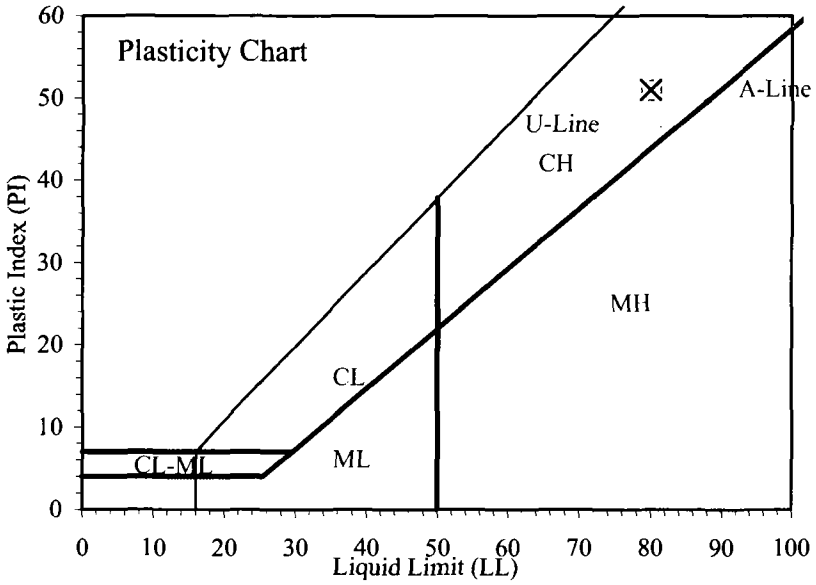
Determination No	1	2				
Wet Soil + Tare (g)	6.85	6.39				
Dry Soil + Tare (g)	5.60	5.28				
Moisture Loss (g)	1.25	1.11				
Tare (g)	1.35	1.38				
Dry Soil (g)	4.25	3.90				
Moisture Content, w (%)	29.41	28.46				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	24	16			
Wet Soil + Tare (g)	10.15	10.99	11.26			
Dry Soil + Tare (g)	6.27	6.71	6.79			
Moisture Loss (g)	3.88	4.28	4.47			
Tare (g)	1.33	1.37	1.38			
Dry Soil (g)	4.94	5.34	5.41			
Moisture Content, w (%)	78.54	80.15	82.62			
One-Point LL (%)		80				

Liquid Limit, LL (%)	**80**
Plastic Limit, PL (%)	**29**
Plasticity Index, PI (%)	**51**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/12/2010
By: JA

Boring No.: B-3
Sample:
Depth: 60'
Description: Grey fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

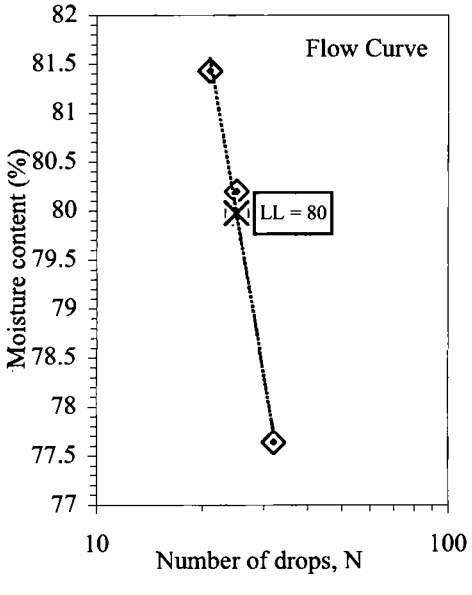
Plastic Limit

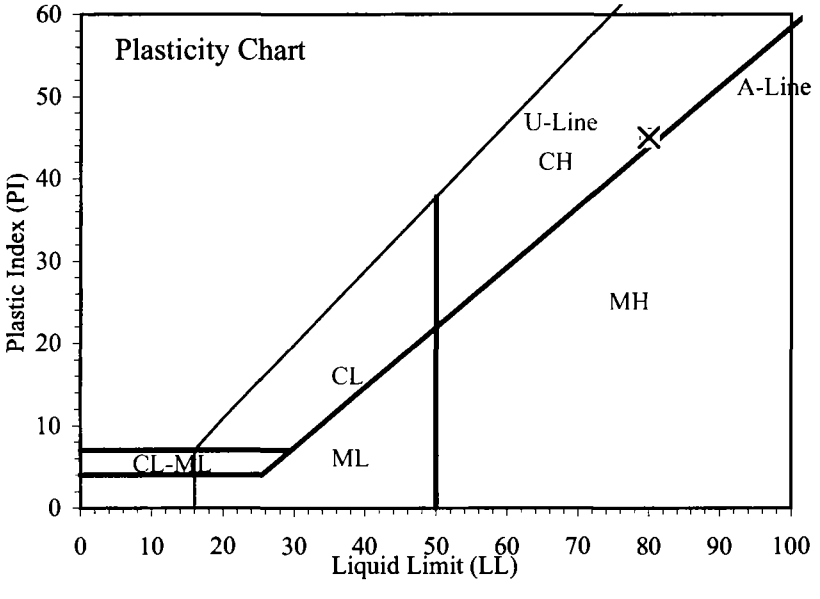
Determination No	1	2				
Wet Soil + Tare (g)	5.77	5.85				
Dry Soil + Tare (g)	4.65	4.68				
Moisture Loss (g)	1.12	1.17				
Tare (g)	1.37	1.34				
Dry Soil (g)	3.28	3.34				
Moisture Content, w (%)	34.15	35.03				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	25	21			
Wet Soil + Tare (g)	8.61	10.49	10.70			
Dry Soil + Tare (g)	5.45	6.44	6.49			
Moisture Loss (g)	3.16	4.05	4.21			
Tare (g)	1.38	1.39	1.32			
Dry Soil (g)	4.07	5.05	5.17			
Moisture Content, w (%)	77.64	80.20	81.43			
One-Point LL (%)		80	80			

Liquid Limit, LL (%)	**80**
Plastic Limit, PL (%)	**35**
Plasticity Index, PI (%)	**45**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/12/2010
By: JA

Boring No.: B-5 Well 4
Sample:
Depth: 20'
Description: Grey fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

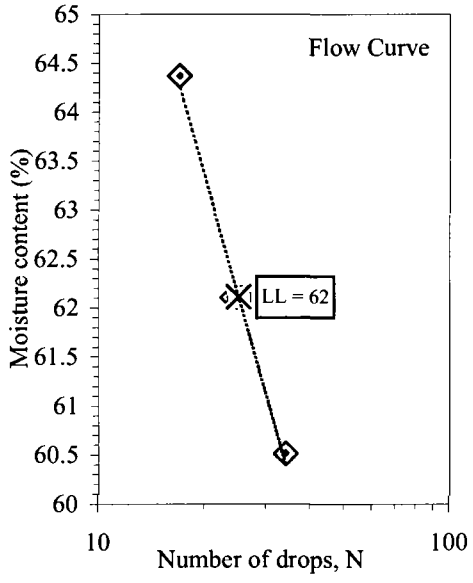
Plastic Limit

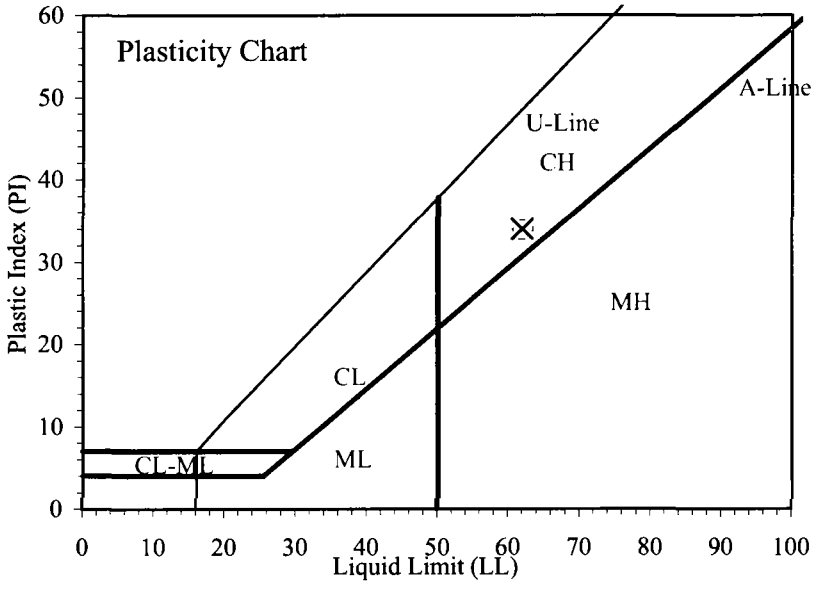
Determination No	1	2				
Wet Soil + Tare (g)	5.63	5.92				
Dry Soil + Tare (g)	4.70	4.92				
Moisture Loss (g)	0.93	1.00				
Tare (g)	1.39	1.39				
Dry Soil (g)	3.31	3.53				
Moisture Content, w (%)	28.10	28.33				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	24	17			
Wet Soil + Tare (g)	11.30	11.71	12.36			
Dry Soil + Tare (g)	7.56	7.76	8.06			
Moisture Loss (g)	3.74	3.95	4.30			
Tare (g)	1.38	1.40	1.38			
Dry Soil (g)	6.18	6.36	6.68			
Moisture Content, w (%)	60.52	62.11	64.37			
One-Point LL (%)		62				

Liquid Limit, LL (%)	**62**
Plastic Limit, PL (%)	**28**
Plasticity Index, PI (%)	**34**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: *11/15/2010*
By: JA

Boring No.: B-5 Well 4
Sample:
Depth: 60'
Description: Grey elastic silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

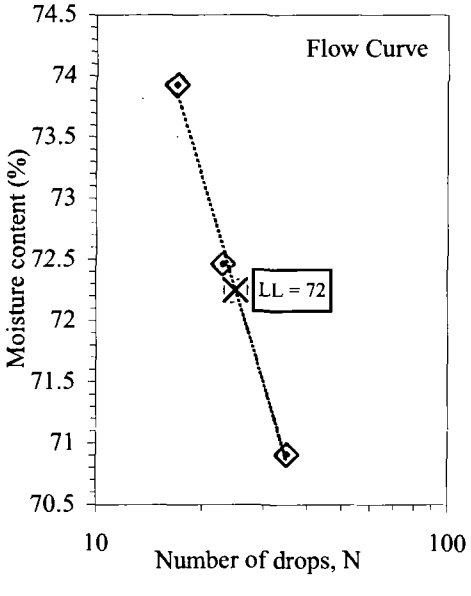
Plastic Limit

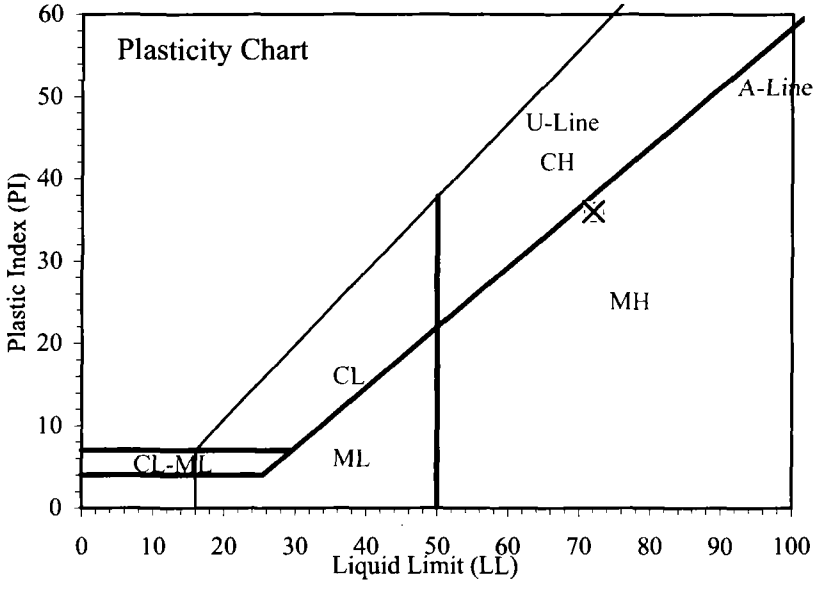
Determination No	1	2				
Wet Soil + Tare (g)	6.74	7.39				
Dry Soil + Tare (g)	5.34	5.79				
Moisture Loss (g)	1.40	1.60				
Tare (g)	1.38	1.34				
Dry Soil (g)	3.96	4.45				
Moisture Content, w (%)	35.35	35.96				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	23	17			
Wet Soil + Tare (g)	10.72	10.88	12.66			
Dry Soil + Tare (g)	6.82	6.88	7.84			
Moisture Loss (g)	3.90	4.00	4.82			
Tare (g)	1.32	1.36	1.32			
Dry Soil (g)	5.50	5.52	6.52			
Moisture Content, w (%)	70.91	72.46	73.93			
One-Point LL (%)		72				

Liquid Limit, LL (%)	**72**
Plastic Limit, PL (%)	**36**
Plasticity Index, PI (%)	**36**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/15/2010
By: JA

Boring No.: B-6 Well 5
Sample:
Depth: 10'
Description: Grey silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

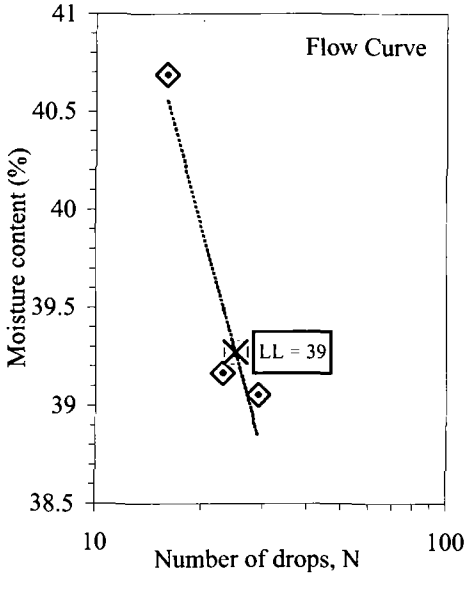
Plastic Limit

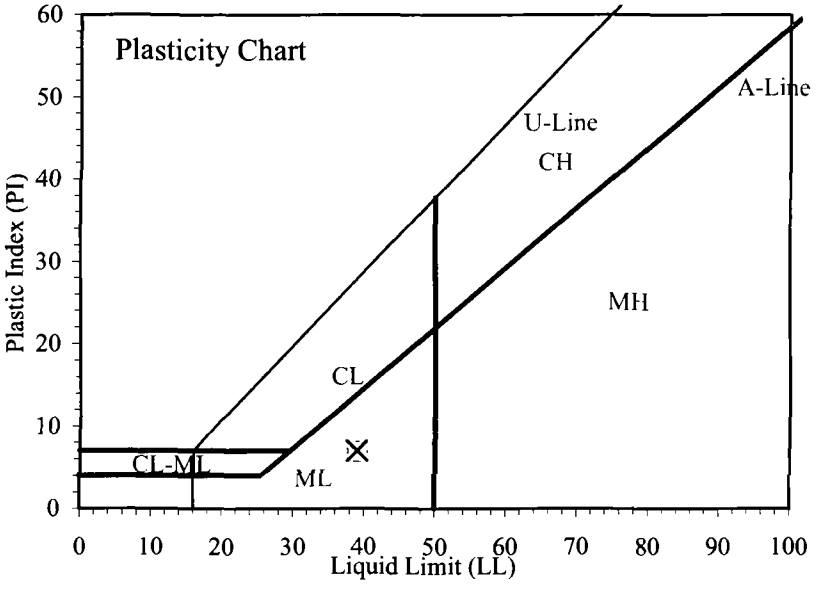
Determination No	1	2				
Wet Soil + Tare (g)	7.58	7.95				
Dry Soil + Tare (g)	6.07	6.34				
Moisture Loss (g)	1.51	1.61				
Tare (g)	1.39	1.33				
Dry Soil (g)	4.68	5.01				
Moisture Content, w (%)	32.26	32.14				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	29	23	16			
Wet Soil + Tare (g)	9.31	10.05	10.31			
Dry Soil + Tare (g)	7.08	7.61	7.71			
Moisture Loss (g)	2.23	2.44	2.60			
Tare (g)	1.37	1.38	1.32			
Dry Soil (g)	5.71	6.23	6.39			
Moisture Content, w (%)	39.05	39.17	40.69			
One-Point LL (%)	40	39				

Liquid Limit, LL (%)	**39**
Plastic Limit, PL (%)	**32**
Plasticity Index, PI (%)	**7**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/15/2010
By: JA

Boring No.: B-6 Well 5
Sample:
Depth: 50'
Description: Grey fat clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

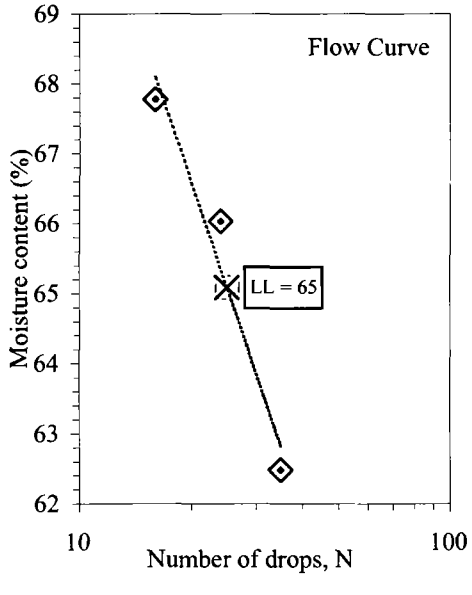
Plastic Limit

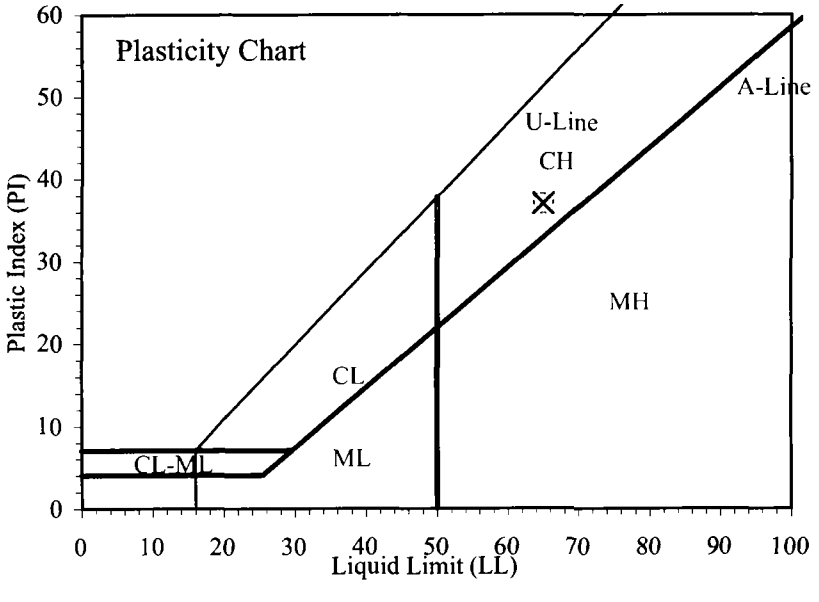
Determination No	1	2				
Wet Soil + Tare (g)	6.90	7.00				
Dry Soil + Tare (g)	5.72	5.73				
Moisture Loss (g)	1.18	1.27				
Tare (g)	1.38	1.38				
Dry Soil (g)	4.34	4.35				
Moisture Content, w (%)	27.19	29.20				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	24	16			
Wet Soil + Tare (g)	10.31	10.86	12.52			
Dry Soil + Tare (g)	6.88	7.07	8.02			
Moisture Loss (g)	3.43	3.79	4.50			
Tare (g)	1.39	1.33	1.38			
Dry Soil (g)	5.49	5.74	6.64			
Moisture Content, w (%)	62.48	66.03	67.77			
One-Point LL (%)		66				

Liquid Limit, LL (%)	**65**
Plastic Limit, PL (%)	**28**
Plasticity Index, PI (%)	**37**





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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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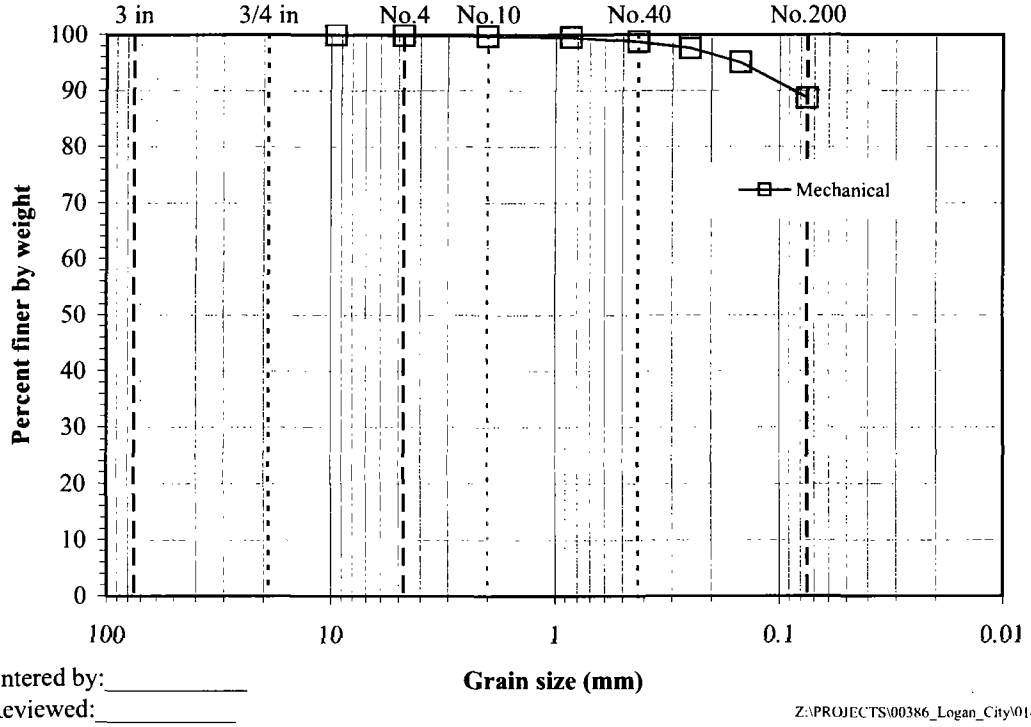
Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/11/2010
By: MP

Boring No.: B-3
Sample:
Depth: 20'
Description: Gray clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	522.00	402.0
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	674.35
Dry soil + tare (g):	-	554.37
Tare (g):	-	152.35
Moisture content (%):	0.0	29.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	100.0
No.4	0.30	4.75	99.9
No.10	0.80	2	99.8
No.20	1.61	0.85	99.6
No.40	5.12	0.425	98.7
No.60	9.55	0.25	97.6
No.100	19.99	0.15	95.0
No.200	45.21	0.075	88.8



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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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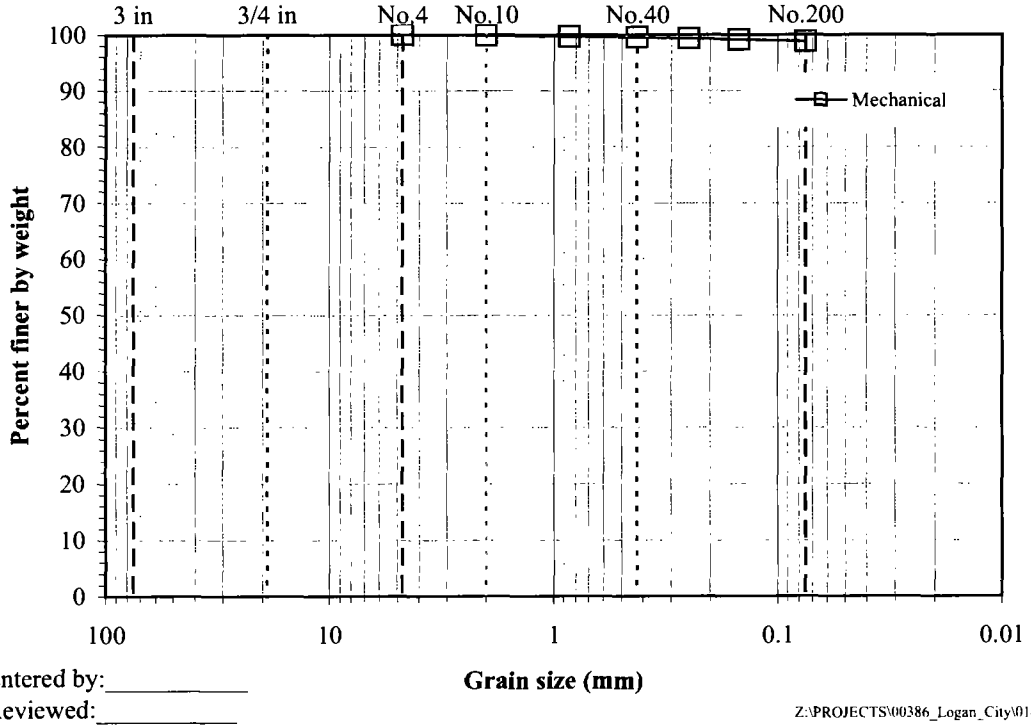
Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/11/2010
By: MP

Boring No.: B-3
Sample:
Depth: 60'
Description: Gray clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	451.66	312.6
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	592.65
Dry soil + tare (g):	-	453.61
Tare (g):	-	140.99
Moisture content (%):	0.0	44.5

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.24	2	99.9
No.20	0.88	0.85	99.7
No.40	1.54	0.425	99.5
No.60	2.00	0.25	99.4
No.100	2.72	0.15	99.1
No.200	3.72	0.075	98.8



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Particle-Size Analysis of Soils

(ASTM D422)

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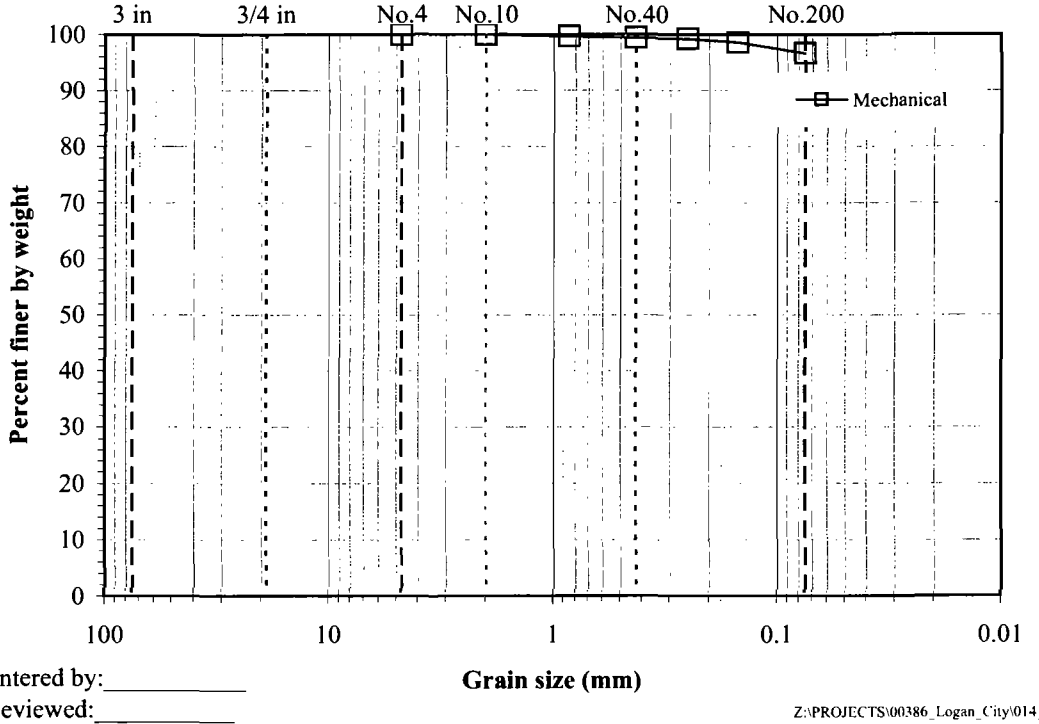
Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/11/2010
By: MP

Boring No.: B-5 Well 4
Sample:
Depth: 40'
Description: Gray clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	584.99	405.5
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	765.28
Dry soil + tare (g):	-	585.78
Tare (g):	-	180.29
Moisture content (%):	0.0	44.3

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.09	2	100.0
No.20	1.26	0.85	99.7
No.40	2.33	0.425	99.4
No.60	3.20	0.25	99.2
No.100	5.71	0.15	98.6
No.200	13.68	0.075	96.6



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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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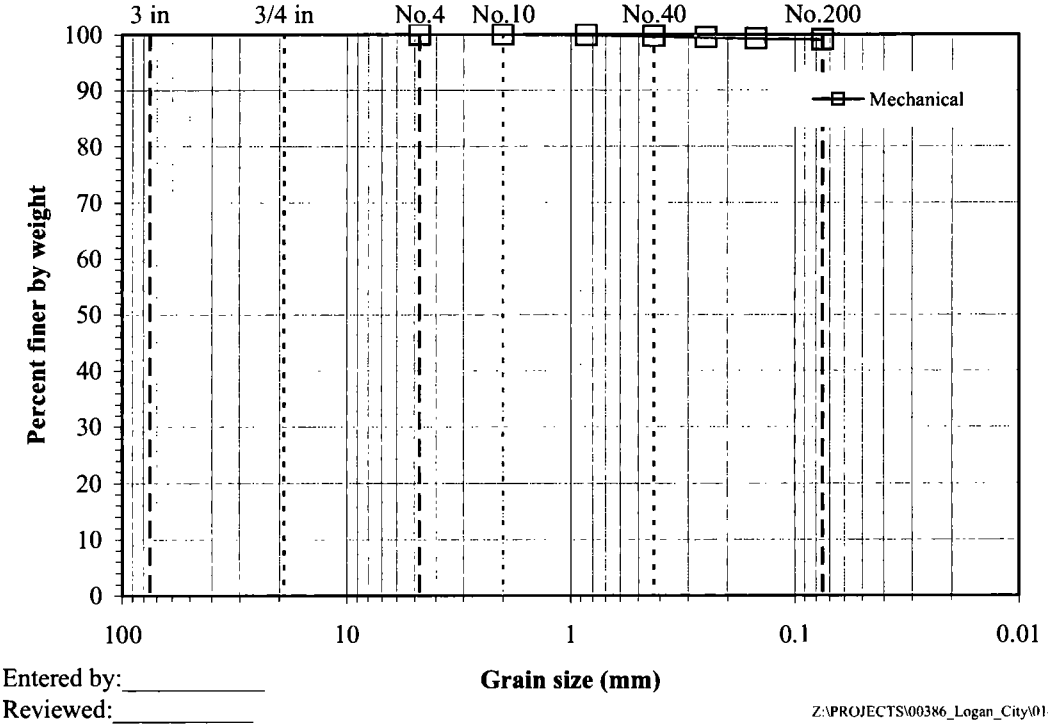
Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/11/2010
By: MP

Boring No.: B-6 Well 5
Sample:
Depth: 50'
Description: Gray clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	389.13	279.0
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	517.89
Dry soil + tare (g):	-	407.76
Tare (g):	-	128.76
Moisture content (%):	0.0	39.5

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.02	2	100.0
No.20	0.38	0.85	99.9
No.40	1.03	0.425	99.6
No.60	1.47	0.25	99.5
No.100	2.04	0.15	99.3
No.200	2.86	0.075	99.0



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Amount of Material in Soil Finer than the No. 200 (75µm) Sieve

(ASTM D1140)

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Project: North Valley Landfill
No: 00386-014
Location: Clarkston, UT
Date: 11/11/2010
By: MP

				Well 4	Well 4	Well 4	Well 5	Well 5	
Sample Info.	Boring No.	B-3	B-3	B-5	B-5	B-5	B-6	B-6	
	Sample								
	Depth	10'	40'	10'	20'	80'	30'	70'	
	Split	No	No	No	No	No	No	No	
	Split Sieve*								
	Moist total sample wt. (g)	458.66	506.85	478.06	526.56	617.22	586.86	576.18	
	Moist coarse fraction (g)								
	Moist split fraction + tare (g)								
	Split fraction tare (g)								
	Dry split fraction (g)								
	Dry retained No. 200 + tare (g)	169.11	140.83	162.44	165.32	160.92	153.18	154.42	
	Wash tare (g)	152.71	139.98	151.55	152.71	154.04	127.02	151.73	
	No. 200 Dry wt. retained (g)	16.40	0.85	10.89	12.61	6.88	26.16	2.69	
	Split sieve* Dry wt. retained (g)								
	Dry total sample wt. (g)	349.37	366.33	357.52	384.92	417.83	435.48	415.32	
Coarse Fraction	Moist soil + tare (g)								
	Dry soil + tare (g)								
	Tare (g)								
	Moisture content (%)								
Split Fraction	Moist soil + tare (g)	611.37	646.83	629.61	679.27	771.26	713.88	727.91	
	Dry soil + tare (g)	502.08	506.31	509.07	537.63	571.87	562.50	567.05	
	Tare (g)	152.71	139.98	151.55	152.71	154.04	127.02	151.73	
	Moisture content (%)	31.28	38.36	33.72	36.80	47.72	34.76	38.73	
Percent passing split sieve* (%)									
Percent passing No. 200 sieve (%)		**95.3**	**99.8**	**97.0**	**96.7**	**98.4**	**94.0**	**99.4**	

Entered by:_____

Reviewed:_____

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: BRR

Sample Info.	Boring No.	Well 6	Well 6	Well 6	Well 6	Well 6	Well 6	Well 6	Well 6
	Sample:								
	Depth:	5.5'	15'	20'	50'	70'	80'	100'	120'
Unit Weight Info.	Sample height, H (in)	3.000			3.000	4.000			
	Sample diameter, D (in)	2.416			2.416	2.416			
	Sample volume, V (ft^3)	0.0080			0.0080	0.0106			
	Wt. rings + wet soil (g)	543.09			511.80	699.35			
	Wt. rings/tare (g)	134.75			131.08	172.98			
	Moist soil, Ws (g)	408.34			380.72	526.37			
	Moist unit wt., γ_m (pcf)	113.11			105.46	109.35			
Moisture	Wet soil + tare (g)	1046.27	1354.57	356.40	613.39	802.26	744.47	764.97	883.26
	Dry soil + tare (g)	977.89	1335.96	343.50	510.77	643.03	621.46	630.94	721.72
	Tare (g)	224.64	221.76	177.30	160.86	195.58	215.01	179.40	178.59
Moisture Content, w (%)		**9.1**	**1.7**	**7.8**	**29.3**	**35.6**	**30.3**	**29.7**	**29.7**
Dry Unit Wt., γ_d (pcf)		**103.7**			**81.5**	**80.7**			

Entered by:_____

Reviewed:_____

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: BRR

Sample Info.	Boring No.	Well 6	Well 6	Well 6	Well 6	Well 7	Well 7	Well 7	Well 7
	Sample:								
	Depth:	140'	160'	200'	250'	5'	15'	30'	40'
Unit Weight Info.	Sample height, H (in)					4.000	5.000	4.000	5.000
	Sample diameter, D (in)					2.416	2.416	2.416	2.416
	Sample volume, V (ft^3)					0.0106	0.0133	0.0106	0.0133
	Wt. rings + wet soil (g)					676.19	903.42	718.27	803.06
	Wt. rings/tare (g)					172.76	217.54	173.47	219.61
	Moist soil, Ws (g)					503.43	685.88	544.80	583.45
	Moist unit wt., γ_m (pcf)					104.59	113.99	113.18	96.97
Moisture	Wet soil + tare (g)	736.92	328.13	735.38	365.76	682.23	561.85	684.50	550.18
	Dry soil + tare (g)	606.00	306.91	614.21	314.83	609.20	465.16	550.15	465.72
	Tare (g)	175.72	224.07	190.09	160.20	181.19	139.98	140.48	151.68
Moisture Content, w (%)		**30.4**	**25.6**	**28.6**	**32.9**	**17.1**	**29.7**	**32.8**	**26.9**
Dry Unit Wt., γ_d (pcf)						**89.3**	**87.9**	**85.2**	**76.4**

Entered by:_____

Reviewed:_____

Moisture Content and Unit Weight of Soil

(In General Accordance with ASTM D2937 and D2216)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: BRR

Sample Info.	Boring No.	Well 7	Well 7	Well 7	Well 7	Well 7	Well 7	Well 7	Well 7
	Sample:								
	Depth:	50'	70'	90'	100'	140'	180'	220'	250'
Unit Weight Info.	Sample height, H (in)	4.000	4.000	4.000	6.000			3.000	
	Sample diameter, D (in)	2.416	2.416	2.416	2.416			2.416	
	Sample volume, V (ft^3)	0.0106	0.0106	0.0106	0.0159			0.0080	
	Wt. rings + wet soil (g)	645.71	677.24	633.79	1113.87			549.49	
	Wt. rings/tare (g)	174.21	170.61	180.53	271.42			131.62	
	Moist soil, Ws (g)	471.50	506.63	453.26	842.45			417.87	
	Moist unit wt., γ_m (pcf)	97.95	105.25	94.16	116.68			115.75	
Moisture	Wet soil + tare (g)	621.28	788.47	336.61	527.22	659.59	198.05	567.07	449.46
	Dry soil + tare (g)	510.28	704.77	290.77	443.24	512.36	187.21	460.48	387.00
	Tare (g)	150.75	185.03	139.87	139.73	127.68	151.55	151.53	141.74
Moisture Content, w (%)		**30.9**	**16.1**	**30.4**	**27.7**	**38.3**	**30.4**	**34.5**	**25.5**
Dry Unit Wt., γ_d (pcf)		**74.8**	**90.7**	**72.2**	**91.4**			**86.1**	

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Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: JA

Boring No.: Well 6
Sample:
Depth: 160'
Description: Grey fine sand

Preparation method: Air Dry
Liquid Limit: Could not be determined (N.P.)

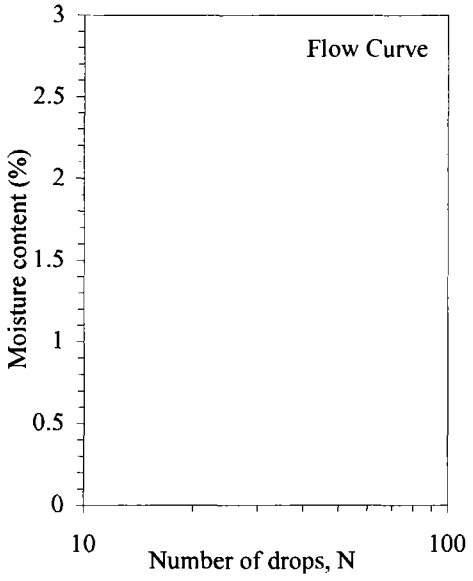
Plastic Limit

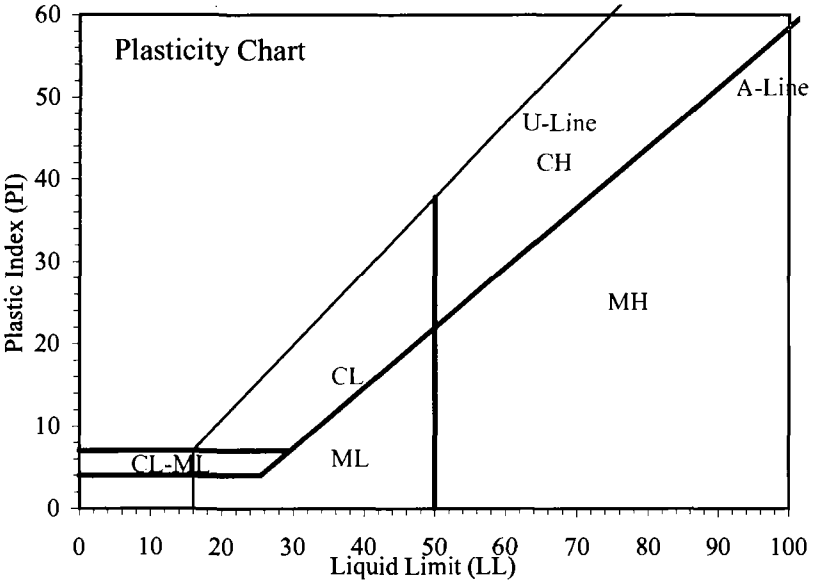
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: JA

Boring No.: Well 6
Sample:
Depth: 220'
Description: Grey elastic silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

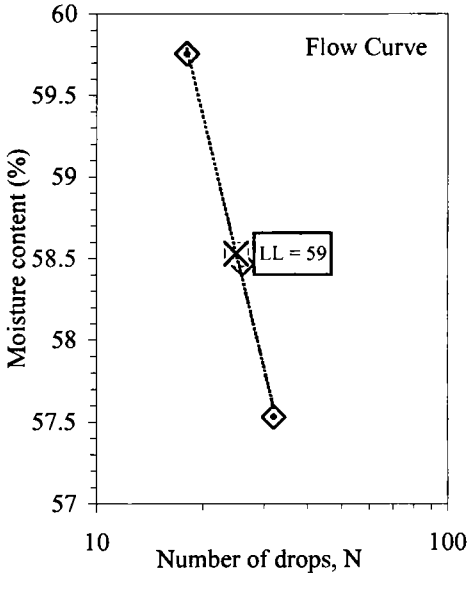
Plastic Limit

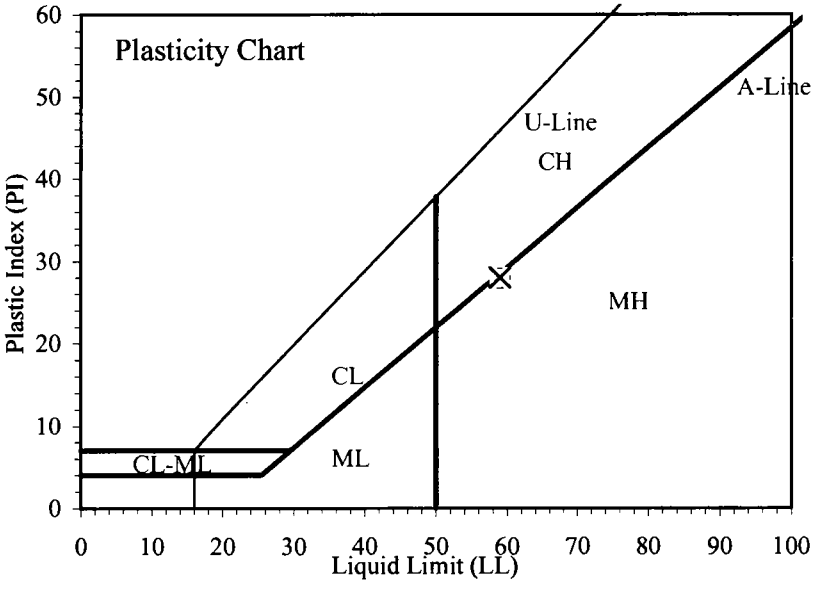
Determination No	1	2				
Wet Soil + Tare (g)	26.37	27.17				
Dry Soil + Tare (g)	25.10	25.80				
Moisture Loss (g)	1.27	1.37				
Tare (g)	20.98	21.42				
Dry Soil (g)	4.12	4.38				
Moisture Content, w (%)	30.83	31.28				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	26	18			
Wet Soil + Tare (g)	32.66	33.18	34.12			
Dry Soil + Tare (g)	28.42	28.83	29.25			
Moisture Loss (g)	4.24	4.35	4.87			
Tare (g)	21.05	21.39	21.10			
Dry Soil (g)	7.37	7.44	8.15			
Moisture Content, w (%)	57.53	58.47	59.75			
One-Point LL (%)		59				

Liquid Limit, LL (%)	**59**
Plastic Limit, PL (%)	**31**
Plasticity Index, PI (%)	**28**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: JA

Boring No.: Well 6
Sample:
Depth: 250'
Description: Grey elastic silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

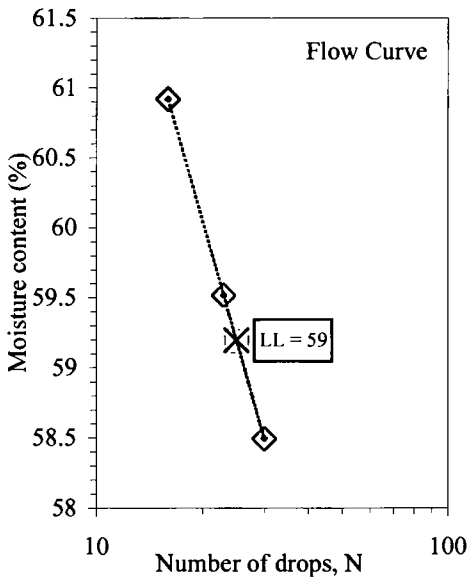
Plastic Limit

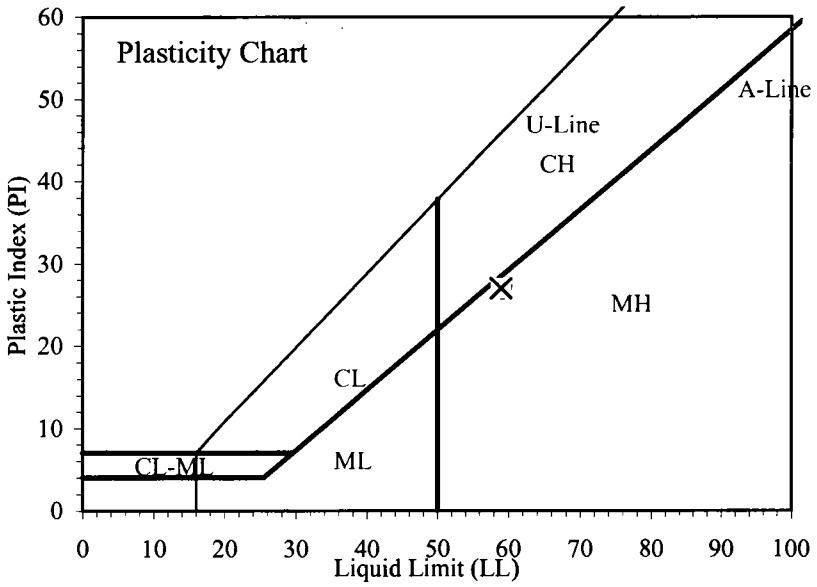
Determination No	1	2				
Wet Soil + Tare (g)	27.50	26.63				
Dry Soil + Tare (g)	26.00	25.37				
Moisture Loss (g)	1.50	1.26				
Tare (g)	21.23	21.44				
Dry Soil (g)	4.77	3.93				
Moisture Content, w (%)	31.45	32.06				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	30	23	16			
Wet Soil + Tare (g)	30.93	32.46	32.31			
Dry Soil + Tare (g)	27.28	28.27	28.07			
Moisture Loss (g)	3.65	4.19	4.24			
Tare (g)	21.04	21.23	21.11			
Dry Soil (g)	6.24	7.04	6.96			
Moisture Content, w (%)	58.49	59.52	60.92			
One-Point LL (%)	60	59				

Liquid Limit, LL (%)	**59**
Plastic Limit, PL (%)	**32**
Plasticity Index, PI (%)	**27**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/19/2011
By: BRR

Boring No.: Well 7
Sample:
Depth: 15'
Description: Brown silt

Preparation method: Air Dry
Liquid Limit: Could not be determined (N.P.)

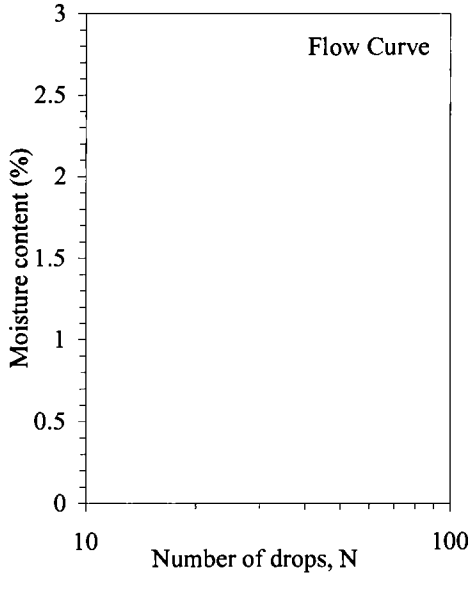
Plastic Limit

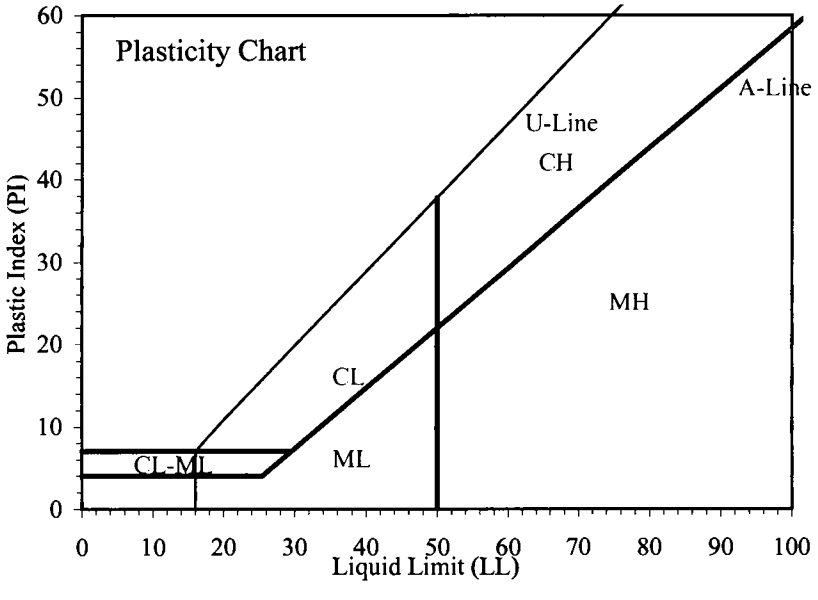
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/19/2011
By: BRR

Boring No.: Well 7
Sample:
Depth: 40'
Description: Brown silt

Preparation method: Air Dry
Liquid Limit: Could not be determined (N.P.)

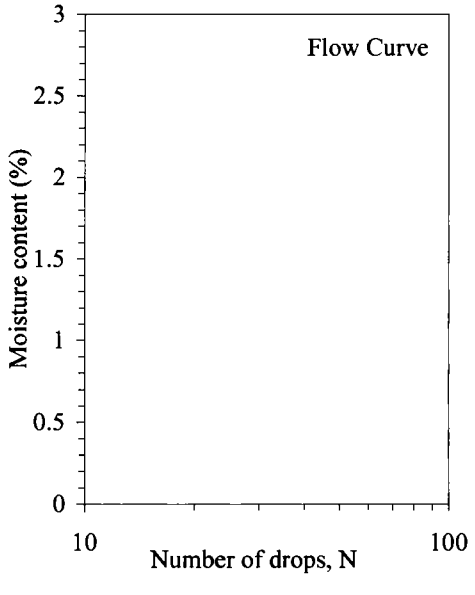
Plastic Limit

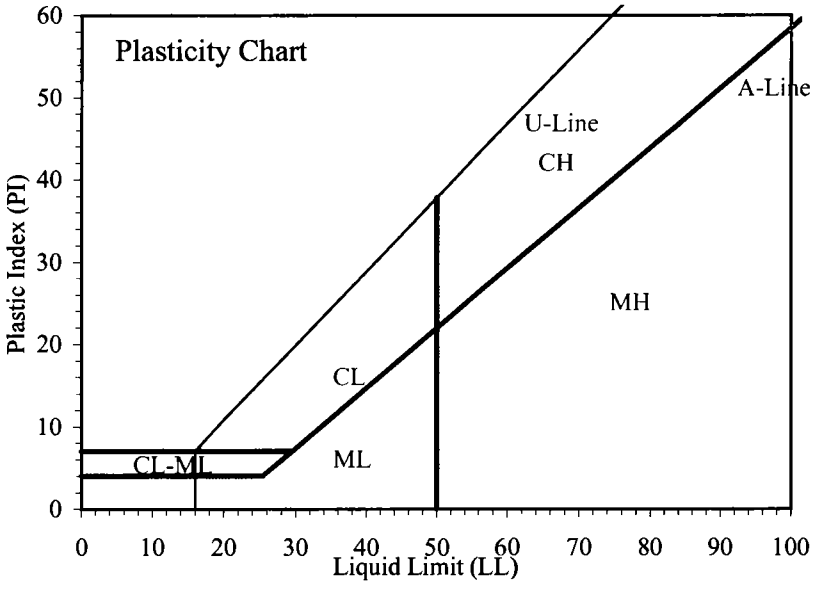
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Moisture Loss (g)						
Tare (g)						
Dry Soil (g)						
Moisture Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/19/2011
By: BRR

Boring No.: Well 7
Sample:
Depth: 60'
Description: Tan/brown silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

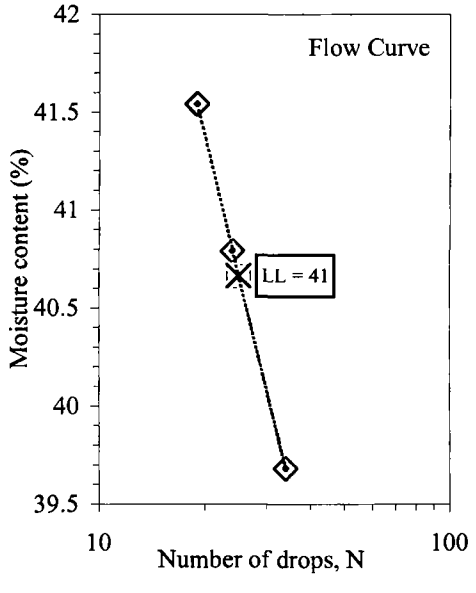
Plastic Limit

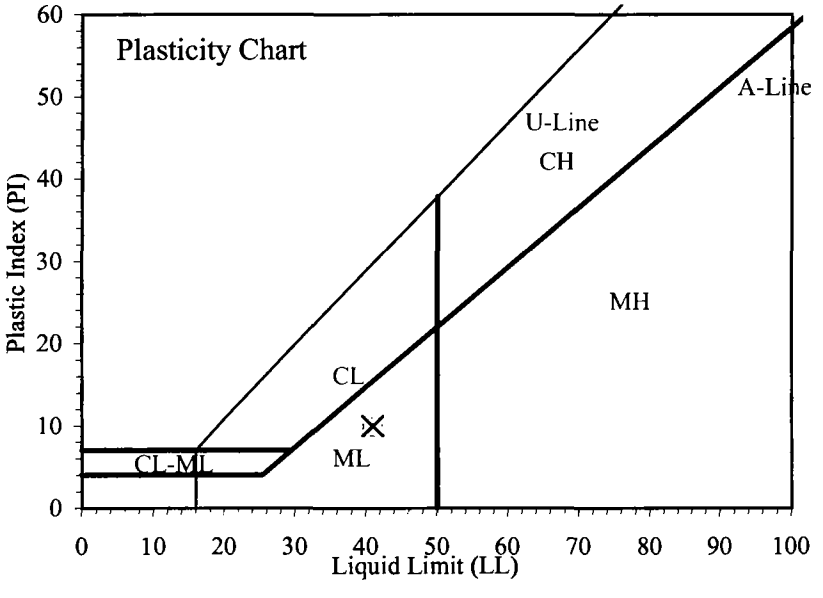
Determination No	1	2				
Wet Soil + Tare (g)	30.98	29.20				
Dry Soil + Tare (g)	28.63	27.33				
Moisture Loss (g)	2.35	1.87				
Tare (g)	21.13	21.27				
Dry Soil (g)	7.50	6.06				
Moisture Content, w (%)	31.33	30.86				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	34	24	19			
Wet Soil + Tare (g)	31.01	32.95	33.15			
Dry Soil + Tare (g)	28.26	29.65	29.54			
Moisture Loss (g)	2.75	3.30	3.61			
Tare (g)	21.33	21.56	20.85			
Dry Soil (g)	6.93	8.09	8.69			
Moisture Content, w (%)	39.68	40.79	41.54			
One-Point LL (%)		41				

Liquid Limit, LL (%)	**41**
Plastic Limit, PL (%)	**31**
Plasticity Index, PI (%)	**10**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: JA

Boring No.: Well 7
Sample:
Depth: 90'
Description: Tan brown silt

Preparation method: Air Dry
Liquid limit test method: Multipoint

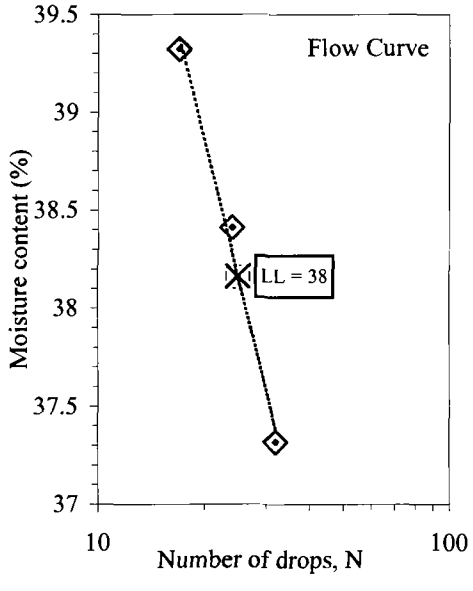
Plastic Limit

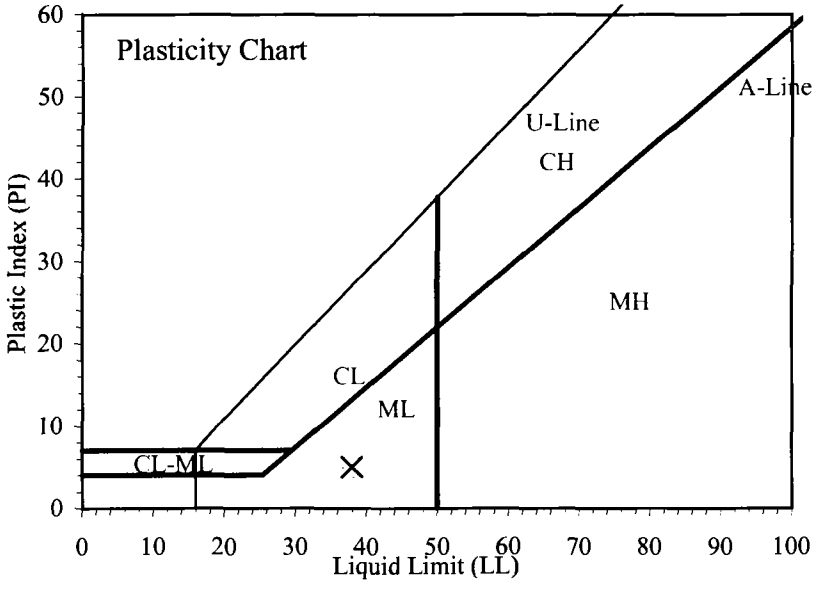
Determination No	1	2				
Wet Soil + Tare (g)	28.01	28.35				
Dry Soil + Tare (g)	26.38	26.62				
Moisture Loss (g)	1.63	1.73				
Tare (g)	21.33	21.36				
Dry Soil (g)	5.05	5.26				
Moisture Content, w (%)	32.28	32.89				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	32	24	17			
Wet Soil + Tare (g)	30.39	31.69	31.97			
Dry Soil + Tare (g)	27.83	28.79	28.95			
Moisture Loss (g)	2.56	2.90	3.02			
Tare (g)	20.97	21.24	21.27			
Dry Soil (g)	6.86	7.55	7.68			
Moisture Content, w (%)	37.32	38.41	39.32			
One-Point LL (%)		38				

Liquid Limit, LL (%)	**38**
Plastic Limit, PL (%)	**33**
Plasticity Index, PI (%)	**5**





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Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/19/2011
By: JA

Boring No.: Well 7
Sample:
Depth: 180'
Description: Grey clay

Preparation method: Air Dry
Liquid limit test method: Multipoint

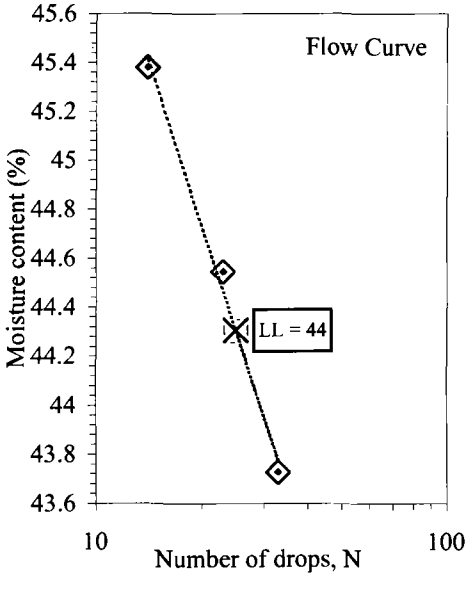
Plastic Limit

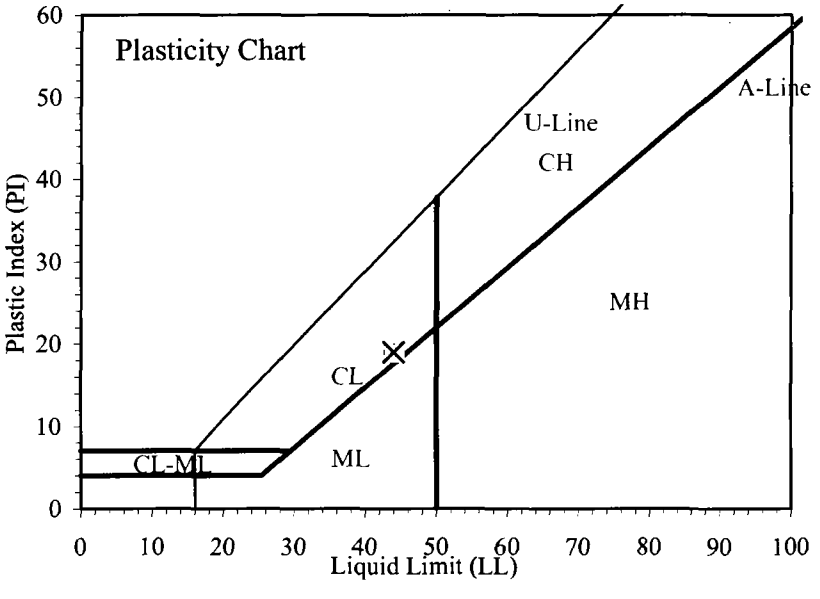
Determination No	1	2				
Wet Soil + Tare (g)	31.40	29.94				
Dry Soil + Tare (g)	29.40	28.22				
Moisture Loss (g)	2.00	1.72				
Tare (g)	21.37	21.34				
Dry Soil (g)	8.03	6.88				
Moisture Content, w (%)	24.91	25.00				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	23	14			
Wet Soil + Tare (g)	33.41	32.45	32.07			
Dry Soil + Tare (g)	29.68	29.02	28.73			
Moisture Loss (g)	3.73	3.43	3.34			
Tare (g)	21.15	21.32	21.37			
Dry Soil (g)	8.53	7.70	7.36			
Moisture Content, w (%)	43.73	44.55	45.38			
One-Point LL (%)		44				

Liquid Limit, LL (%)	**44**
Plastic Limit, PL (%)	**25**
Plasticity Index, PI (%)	**19**





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Reviewed:_____

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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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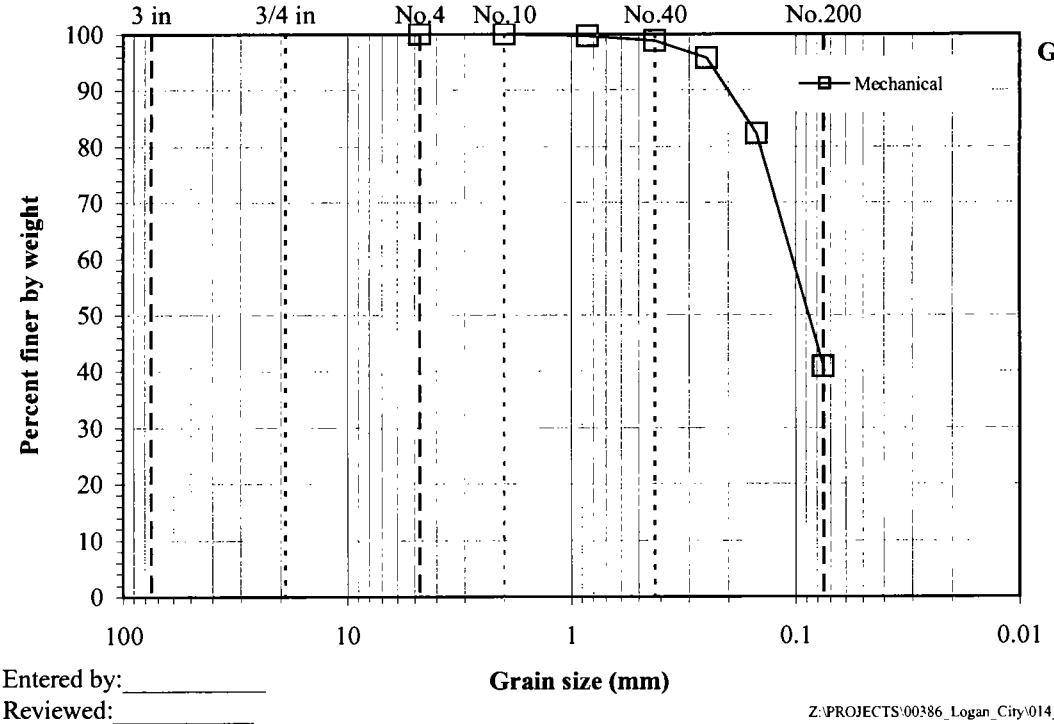
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: MP

Boring No.: Well 6
Sample: 9
Depth: 70'
Description: Grey/brown clayey sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	606.68	447.5
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	802.26
Dry soil + tare (g):	-	643.03
Tare (g):	-	195.58
Moisture content (%):	0.0	35.6

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.18	2	100.0
No.20	1.37	0.85	99.7
No.40	5.39	0.425	98.8
No.60	18.86	0.25	95.8
No.100	79.31	0.15	82.3
No.200	265.00	0.075	40.8



Gravel (%): 0.0
Sand (%): 59.2
Fines (%): 40.8

Entered by:_____
Reviewed:_____

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Particle-Size Analysis of Soils

(ASTM D422)

IGES

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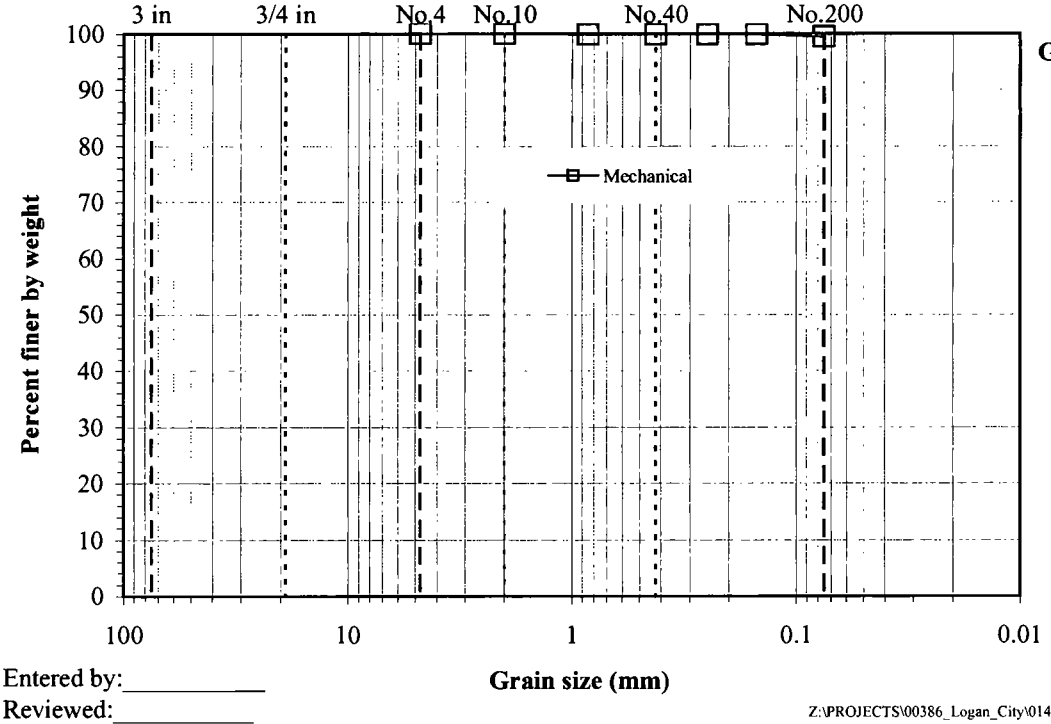
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: BRR

Boring No.: Well 7
Sample:
Depth: 30'
Description: Brown clay

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	544.02	409.7
Split fraction:	1.000	

Moisture data		
Moist soil + tare (g):	-	684.50
Dry soil + tare (g):	-	550.15
Tare (g):	-	140.48
Moisture content (%):	0.0	32.8

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
12"	-	300	-
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.12	2	100.0
No.20	0.33	0.85	99.9
No.40	0.46	0.425	99.9
No.60	0.50	0.25	99.9
No.100	0.59	0.15	99.9
No.200	2.29	0.075	99.4



Gravel (%): 0.0
Sand (%): 0.6
Fines (%): 99.4

Entered by:_____
Reviewed:_____

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Amount of Material in Soil Finer than the No. 200 (75µm) Sieve

(ASTM D1140)

IGES

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Project: **North Valley Landfill**
No: **00386-014 (III)**
Location: Clarkston, UT
Date: 11/16/2011
By: BRR

Sample Info.	Boring No.	Well 6	Well 6	Well 6	Well 7	Well 7			
	Sample								
	Depth	100'	140'	200'	50'	70'			
	Split	No	No	No	No	No			
	Split Sieve*								
	Moist total sample wt. (g)	585.57	561.20	545.29	470.53	603.44			
	Moist coarse fraction (g)								
	Moist split fraction + tare (g)								
	Split fraction tare (g)								
	Dry split fraction (g)								
	Dry retained No. 200 + tare (g)	364.74	216.73	317.76	152.05	561.26			
	Wash tare (g)	179.40	175.72	190.09	150.75	185.03			
	No. 200 Dry wt. retained (g)	185.34	41.01	127.67	1.30	376.23			
	Split sieve* Dry wt. retained (g)								
	Dry total sample wt. (g)	451.54	430.28	424.12	359.83	519.74			
Coarse Fraction	Moist soil + tare (g)								
	Dry soil + tare (g)								
	Tare (g)								
	Moisture content (%)								
Split Fraction	Moist soil + tare (g)	764.97	736.92	735.38	621.28	788.47			
	Dry soil + tare (g)	630.94	606.00	614.21	510.58	704.77			
	Tare (g)	179.40	175.72	190.09	150.75	185.03			
	Moisture content (%)	29.68	30.43	28.57	30.76	16.10			
Percent passing split sieve* (%)									
Percent passing No. 200 sieve (%)		**59.0**	**90.5**	**69.9**	**99.6**	**27.6**			

Entered by:_____

Reviewed:_____

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One-Dimensional Consolidation Properties of Soils
(ASTM D2435)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: MP

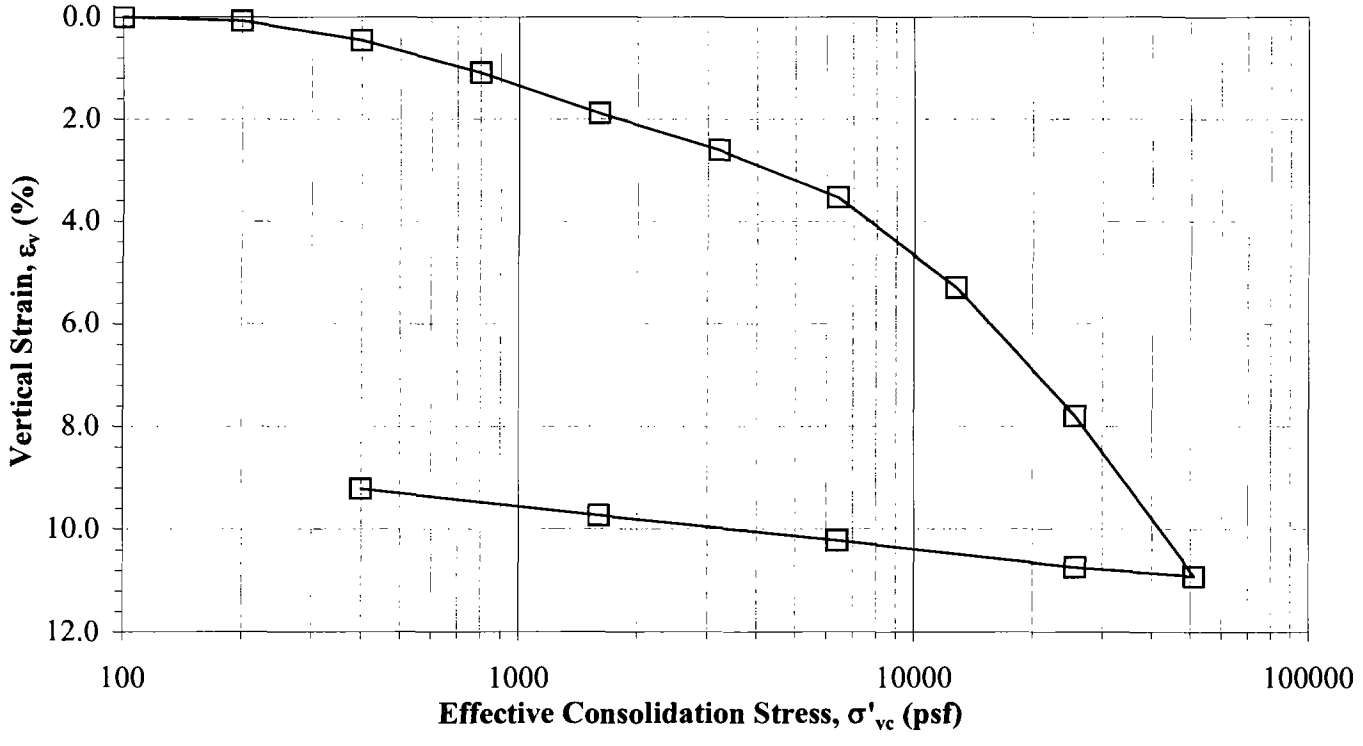
Boring No.: Well 6
Sample: 9
Depth: 70'
Sample Description: Grey/brown sand
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from ring

Test method:	A	
Inundation stress (psf), timing:	Seating	Beginning
Specific gravity, G_s	2.65	Assumed

	Initial (o)	Final (f)
Sample height, H (in.)	1.000	0.9079
Sample diameter, D (in.)	2.416	2.416
Wt. rings + wet soil (g)	172.92	169.75
Wt. rings/tare (g)	43.01	43.01
Moist unit wt., γ_m (pcf)	108.0	116.0
Wet soil + tare (g)	802.26	
Dry soil + tare (g)	643.03	
Tare (g)	195.58	
Moisture content, w (%)	35.6	32.3
Dry unit wt., γ_d (pcf)	79.6	87.7
Saturation	0.87	0.97

*Note: C_v, C_c, C_r, and σ_p' to be determined by Geotechnical Engineer.

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.0000	0.00	1.0000	1.0778
100	0.0000	0.00	1.0000	1.0778
200	0.0008	0.08	0.9992	1.0762
400	0.0046	0.46	0.9954	1.0682
800	0.0110	1.10	0.9890	1.0550
1600	0.0189	1.89	0.9811	1.0384
3200	0.0261	2.61	0.9739	1.0235
6400	0.0354	3.54	0.9646	1.0043
12800	0.0530	5.30	0.9470	0.9677
25600	0.0780	7.80	0.9220	0.9157
51200	0.1092	10.92	0.8908	0.8509
25600	0.1074	10.74	0.8926	0.8546
6400	0.1022	10.22	0.8978	0.8654
1600	0.0974	9.74	0.9027	0.8755
400	0.0921	9.21	0.9079	0.8863



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One-Dimensional Consolidation Properties of Soils
(ASTM D2435)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: MP

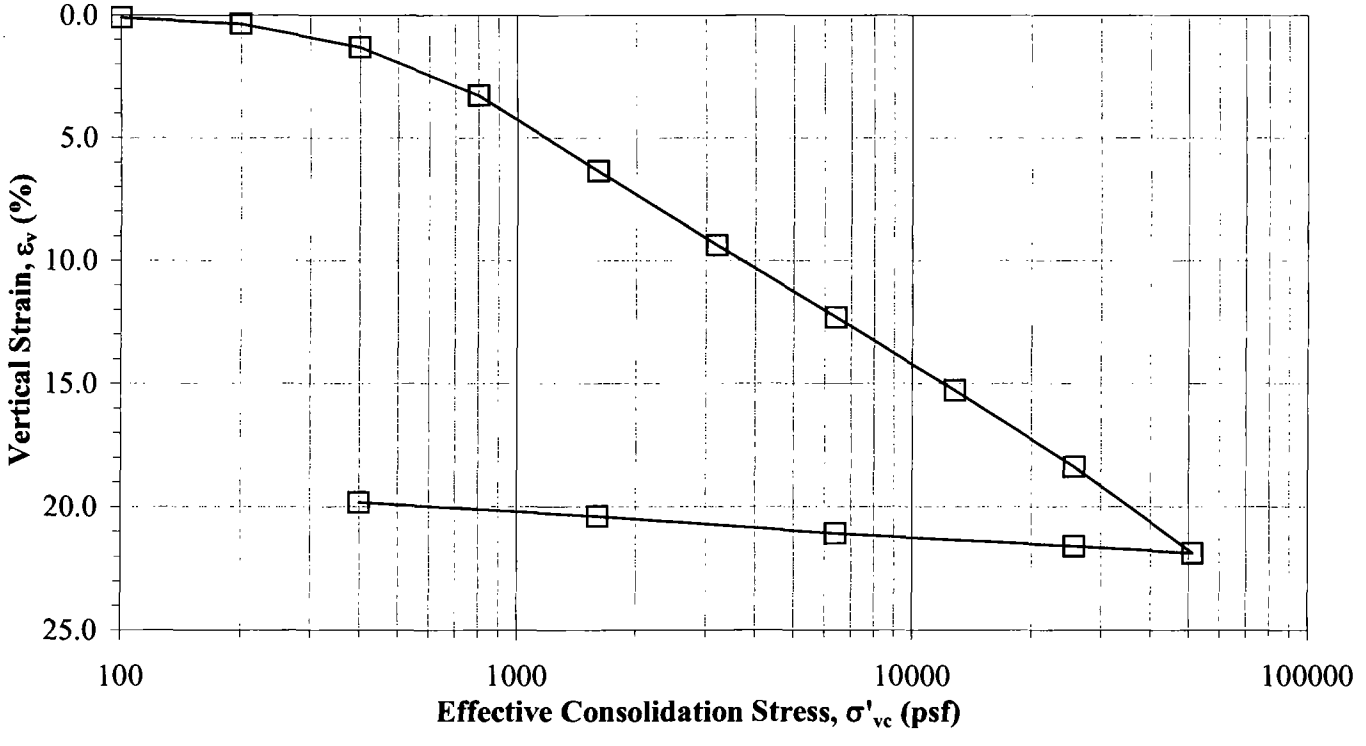
Boring No.: Well 7
Sample: 11
Depth: 90'
Sample Description: Grey silt
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from ring

Test method:	A	
Inundation stress (psf), timing:	Seating	Beginning
Specific gravity, G_s	2.65	Assumed

	Initial (o)	Final (f)
Sample height, H (in.)	1.000	0.8018
Sample diameter, D (in.)	2.416	2.416
Wt. rings + wet soil (g)	159.27	160.80
Wt. rings/tare (g)	46.29	46.29
Moist unit wt., γ_m (pcf)	93.9	118.7
Wet soil + tare (g)	336.61	
Dry soil + tare (g)	290.77	
Tare (g)	139.87	
Moisture content, w (%)	30.4	32.1
Dry unit wt., γ_d (pcf)	72.0	89.8
Saturation	0.62	1.00

*Note: C_v, C_c, C_r, and σ_p' to be determined by Geotechnical Engineer.

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.0000	0.00	1.0000	1.2974
100	0.0010	0.10	0.9990	1.2951
200	0.0036	0.36	0.9964	1.2892
400	0.0133	1.33	0.9868	1.2669
800	0.0329	3.29	0.9671	1.2219
1600	0.0636	6.36	0.9364	1.1513
3200	0.0939	9.39	0.9061	1.0816
6400	0.1231	12.31	0.8769	1.0146
12800	0.1528	15.28	0.8472	0.9463
25600	0.1837	18.37	0.8163	0.8754
51200	0.2188	21.88	0.7812	0.7947
25600	0.2160	21.60	0.7840	0.8011
6400	0.2108	21.08	0.7892	0.8131
1600	0.2039	20.39	0.7961	0.8289
400	0.1982	19.82	0.8018	0.8420



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One-Dimensional Consolidation Properties of Soils
(ASTM D2435)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: MP

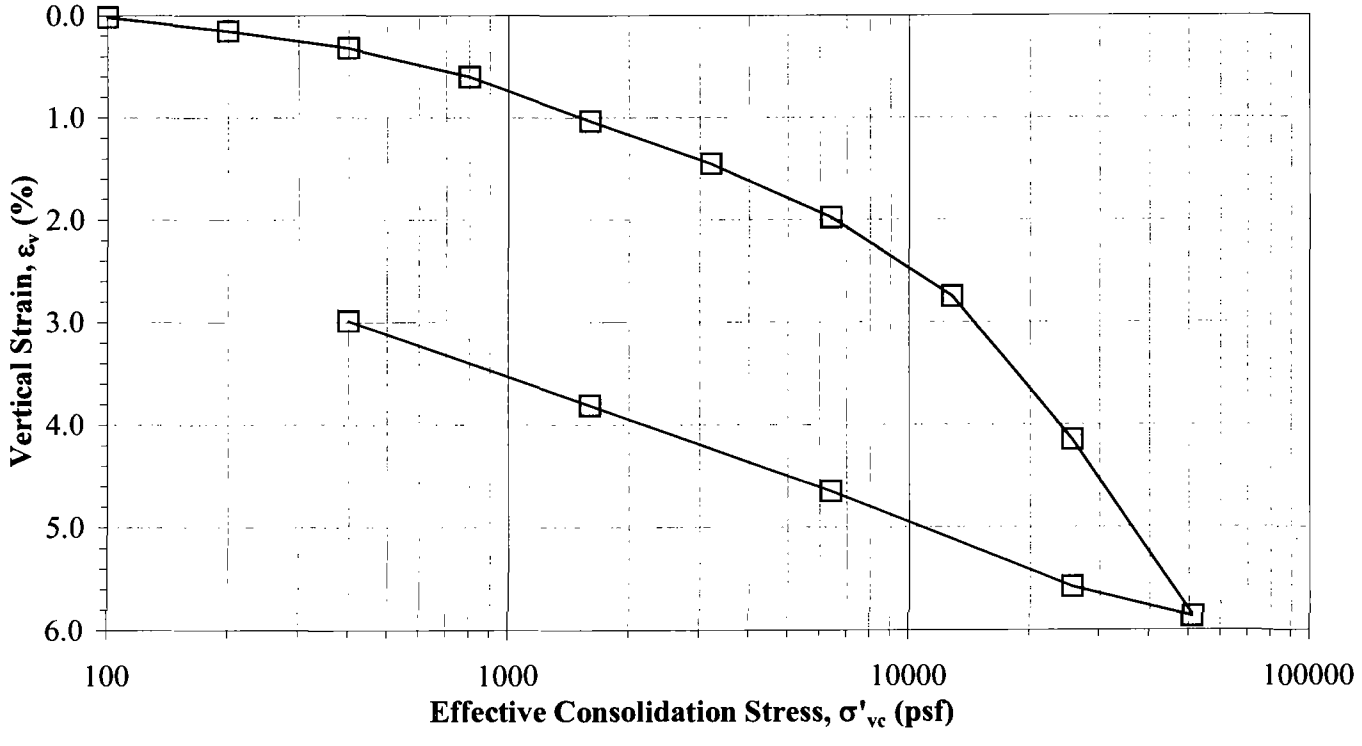
Boring No.: Well 7
Sample: 18
Depth: 200'
Sample Description: Grey clay
Engineering Classification: Not requested
Sample type: Undisturbed-trimmed from ring

Test method:	A	
Inundation stress (psf), timing:	Seating	Beginning
Specific gravity, G_s	2.65	Assumed

	Initial (o)	Final (f)
Sample height, H (in.)	1.000	0.9701
Sample diameter, D (in.)	2.416	2.416
Wt. rings + wet soil (g)	180.09	181.12
Wt. rings/tare (g)	44.41	44.41
Moist unit wt., γ_m (pcf)	112.7	117.1
Wet soil + tare (g)	447.20	
Dry soil + tare (g)	377.40	
Tare (g)	182.21	
Moisture content, w (%)	35.8	36.8
Dry unit wt., γ_d (pcf)	83.0	85.6
Saturation	0.96	1.00

*Note: C_v, C_c, C_r, and σ_p' to be determined by Geotechnical Engineer.

Stress (psf)	Dial (in.)	1-D ε_v (%)	H_c (in.)	e
Seating	0.0000	0.00	1.0000	0.9920
100	0.0002	0.02	0.9998	0.9916
200	0.0016	0.16	0.9984	0.9889
400	0.0032	0.32	0.9968	0.9856
800	0.0060	0.60	0.9940	0.9800
1600	0.0104	1.04	0.9896	0.9713
3200	0.0146	1.46	0.9855	0.9630
6400	0.0198	1.98	0.9802	0.9525
12800	0.0275	2.75	0.9725	0.9372
25600	0.0415	4.15	0.9585	0.9093
51200	0.0587	5.87	0.9413	0.8751
25600	0.0558	5.58	0.9442	0.8808
6400	0.0465	4.65	0.9535	0.8993
1600	0.0381	3.81	0.9619	0.9160
400	0.0299	2.99	0.9701	0.9325



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Reviewed: _____

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

IGES

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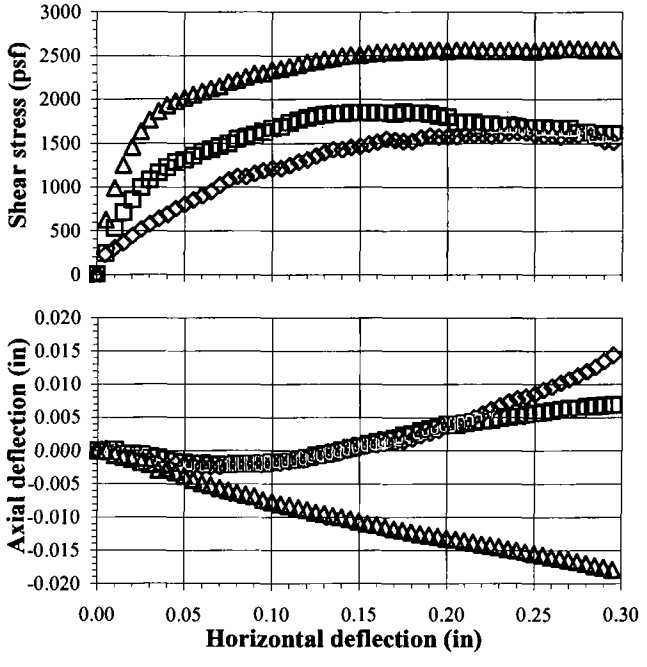
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/16/2011
By: JDF

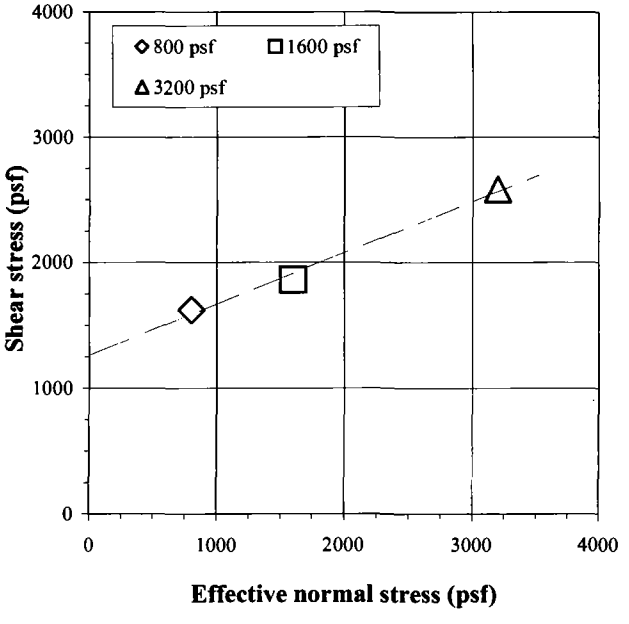
Boring No.: Well 6
Sample:
Depth: 30'
Sample Description: Brown clay
Sample type: Undisturbed-trimmed from ring

Test type: Inundated
Horizontal deformation (in.): 0.3
Shear rate (in./min): 0.0028

	Sample 1		Sample 2		Sample 3	
Effective normal stress (psf)	800		1600		3200	
Peak shear stress (psf)	1620		1860		2580	
Horizontal deformation at peak(in)	0.235		0.175		0.265	
	Initial	Final	Initial	Final	Initial	Final
Sample height (in)	1.0000	2.0000	1.0000	2.0000	1.0000	1.9821
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	162.77	169.68	172.21	177.78	169.89	175.19
Wt. rings (g)	42.57	42.57	46.46	46.46	42.37	42.37
Wet soil + tare (g)	395.39	147.14	395.39	150.89	395.39	152.50
Dry soil + tare (g)	334.53	111.86	334.53	115.64	334.53	117.36
Tare (g)	140.13	21.06	140.13	20.68	140.13	21.78
Water content (%)	31.3	38.9	31.3	37.1	31.3	36.8
Dry unit weight (pcf)	76.1	38.0	79.6	39.8	80.7	40.7

ϕ' (deg)	22	Average of 3 samples	Initial	Final
c' (psf)	1260	Water content (%)	31.3	37.6
		Dry unit weight (pcf)	78.8	39.5





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Reviewed:_____

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Effective normal stress = 800 psf			Effective normal stress = 1600 psf			Effective normal stress = 3200 psf		
Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.005	228	0.000	0.005	240	0.000	0.005	624	0.000
0.010	300	0.000	0.010	528	0.000	0.010	984	-0.001
0.015	360	-0.001	0.015	708	-0.001	0.015	1248	-0.001
0.020	444	-0.001	0.020	852	-0.001	0.020	1452	-0.001
0.025	516	-0.001	0.025	996	-0.001	0.025	1632	-0.002
0.030	576	-0.002	0.030	1080	-0.001	0.030	1764	-0.002
0.035	636	-0.002	0.035	1164	-0.001	0.035	1860	-0.003
0.040	684	-0.002	0.040	1224	-0.001	0.040	1932	-0.003
0.045	756	-0.002	0.045	1284	-0.002	0.045	1980	-0.003
0.050	804	-0.002	0.050	1308	-0.002	0.050	2016	-0.004
0.055	852	-0.002	0.055	1356	-0.002	0.055	2052	-0.004
0.060	900	-0.002	0.060	1404	-0.002	0.060	2088	-0.005
0.065	948	-0.002	0.065	1428	-0.002	0.065	2124	-0.005
0.070	1020	-0.002	0.070	1464	-0.002	0.070	2148	-0.006
0.075	1080	-0.002	0.075	1500	-0.002	0.075	2196	-0.006
0.080	1116	-0.002	0.080	1548	-0.002	0.080	2220	-0.006
0.085	1116	-0.002	0.085	1572	-0.002	0.085	2256	-0.007
0.090	1152	-0.002	0.090	1596	-0.002	0.090	2292	-0.007
0.095	1188	-0.002	0.095	1632	-0.002	0.095	2304	-0.007
0.100	1212	-0.002	0.100	1668	-0.002	0.100	2340	-0.008
0.105	1212	-0.002	0.105	1692	-0.002	0.105	2352	-0.008
0.110	1248	-0.002	0.110	1728	-0.001	0.110	2376	-0.008
0.115	1284	-0.001	0.115	1764	-0.001	0.115	2400	-0.009
0.120	1308	-0.001	0.120	1788	-0.001	0.120	2424	-0.009
0.125	1356	-0.001	0.125	1812	-0.001	0.125	2436	-0.009
0.130	1392	-0.001	0.130	1824	-0.001	0.130	2460	-0.010
0.135	1428	-0.001	0.135	1836	0.000	0.135	2472	-0.010
0.140	1428	0.000	0.140	1836	0.000	0.140	2496	-0.010
0.145	1452	0.000	0.145	1848	0.000	0.145	2508	-0.010
0.150	1464	0.001	0.150	1848	0.001	0.150	2508	-0.011
0.155	1488	0.001	0.155	1848	0.001	0.155	2520	-0.011
0.160	1512	0.001	0.160	1848	0.001	0.160	2532	-0.011
0.165	1548	0.001	0.165	1848	0.002	0.165	2544	-0.012
0.170	1536	0.001	0.170	1836	0.002	0.170	2544	-0.012
0.175	1524	0.001	0.175	1860	0.002	0.175	2556	-0.012
0.180	1524	0.002	0.180	1848	0.003	0.180	2556	-0.012
0.185	1560	0.002	0.185	1848	0.003	0.185	2556	-0.013
0.190	1584	0.003	0.190	1836	0.003	0.190	2568	-0.013
0.195	1572	0.003	0.195	1812	0.004	0.195	2568	-0.013
0.200	1572	0.004	0.200	1800	0.004	0.200	2556	-0.013
0.205	1572	0.004	0.205	1740	0.004	0.205	2568	-0.013
0.210	1596	0.004	0.210	1740	0.004	0.210	2568	-0.014
0.215	1596	0.005	0.215	1740	0.004	0.215	2568	-0.014
0.220	1596	0.006	0.220	1716	0.005	0.220	2556	-0.014
0.225	1584	0.006	0.225	1716	0.005	0.225	2556	-0.014
0.230	1596	0.007	0.230	1704	0.005	0.230	2556	-0.015
0.235	1620	0.007	0.235	1704	0.005	0.235	2556	-0.015
0.240	1620	0.008	0.240	1692	0.005	0.240	2556	-0.015
0.245	1620	0.008	0.245	1680	0.006	0.245	2556	-0.015
0.250	1596	0.009	0.250	1680	0.006	0.250	2556	-0.016
0.255	1584	0.009	0.255	1680	0.006	0.255	2568	-0.016
0.260	1584	0.010	0.260	1668	0.006	0.260	2568	-0.016
0.265	1572	0.010	0.265	1668	0.006	0.265	2580	-0.016
0.270	1584	0.011	0.270	1668	0.006	0.270	2580	-0.017
0.275	1596	0.011	0.275	1620	0.006	0.275	2580	-0.017
0.280	1620	0.012	0.280	1620	0.007	0.280	2568	-0.017
0.285	1560	0.013	0.285	1608	0.007	0.285	2568	-0.017
0.290	1524	0.014	0.290	1608	0.007	0.290	2568	-0.018
0.295	1512	0.014	0.295	1608	0.007	0.295	2568	-0.018
0.300	1500	0.015	0.300	1596	0.007	0.300	2568	-0.018

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

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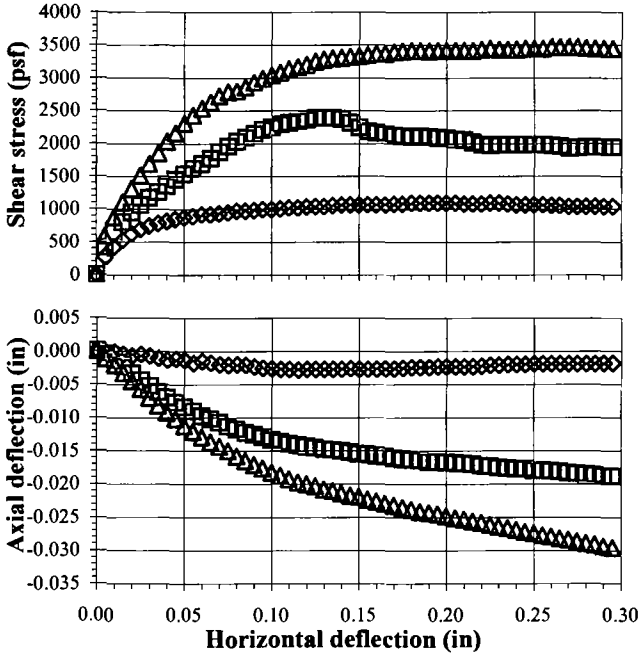
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/17/2011
By: JDF

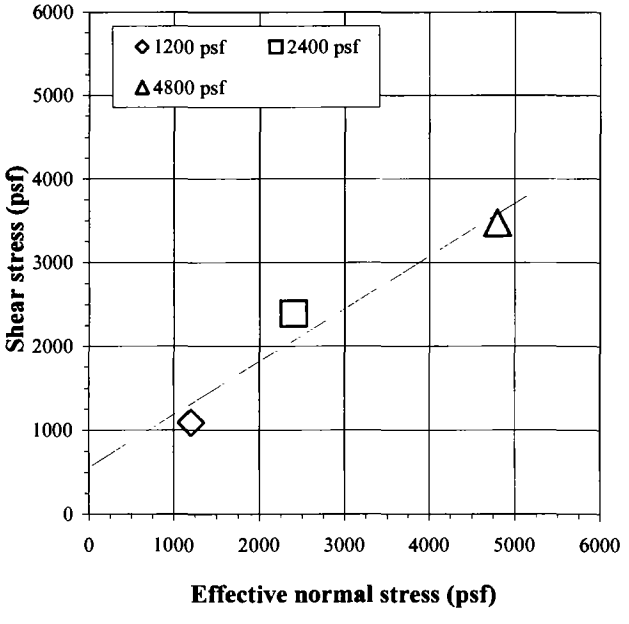
Boring No.: Well 6
Sample:
Depth: 60'
Sample Description: Brown silty sand
Sample type: Undisturbed-trimmed from ring

Test type: Inundated
Horizontal deformation (in.): 0.3
Shear rate (in./min): 0.0042

	Sample 1		Sample 2		Sample 3	
Effective normal stress (psf)	1200		2400		4800	
Peak shear stress (psf)	1092		2388		3468	
Horizontal deformation at peak(in)	0.180		0.125		0.260	
	Initial	Final	Initial	Final	Initial	Final
Sample height (in)	1.0000	0.9755	1.0000	0.9478	1.0000	0.9125
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	159.42	168.91	162.41	170.26	161.33	168.18
Wt. rings (g)	42.98	42.98	45.42	45.42	42.56	42.56
Wet soil + tare (g)	454.41	145.33	454.41	144.62	454.41	145.77
Dry soil + tare (g)	389.51	111.20	389.51	112.00	389.51	113.97
Tare (g)	152.80	20.91	152.80	21.30	152.80	22.49
Water content (%)	27.4	37.8	27.4	36.0	27.4	34.8
Dry unit weight (pcf)	75.9	77.8	76.3	80.5	77.5	84.9

ϕ' (deg)	32	Average of 3 samples	Initial	Final
c' (psf)	552	Water content (%)	27.4	36.2
		Dry unit weight (pcf)	76.6	81.1





Entered by:_____
Reviewed:_____

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Effective normal stress = 1200 psf			Effective normal stress = 2400 psf			Effective normal stress = 4800 psf		
Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.005	264	0.000	0.005	408	0.000	0.005	588	-0.001
0.010	420	0.000	0.010	648	-0.001	0.010	876	-0.002
0.015	528	0.000	0.015	804	-0.002	0.015	1104	-0.003
0.020	624	-0.001	0.020	948	-0.003	0.020	1308	-0.005
0.025	696	0.000	0.025	1068	-0.004	0.025	1512	-0.006
0.030	744	-0.001	0.030	1176	-0.005	0.030	1692	-0.007
0.035	780	-0.001	0.035	1260	-0.006	0.035	1848	-0.008
0.040	816	-0.001	0.040	1356	-0.007	0.040	2028	-0.009
0.045	852	-0.001	0.045	1452	-0.008	0.045	2160	-0.010
0.050	876	-0.001	0.050	1536	-0.008	0.050	2304	-0.011
0.055	888	-0.002	0.055	1620	-0.009	0.055	2424	-0.012
0.060	924	-0.002	0.060	1692	-0.010	0.060	2532	-0.013
0.065	924	-0.002	0.065	1776	-0.010	0.065	2628	-0.014
0.070	936	-0.002	0.070	1872	-0.011	0.070	2724	-0.014
0.075	948	-0.002	0.075	1956	-0.011	0.075	2784	-0.015
0.080	972	-0.002	0.080	2028	-0.012	0.080	2796	-0.016
0.085	972	-0.002	0.085	2088	-0.012	0.085	2856	-0.017
0.090	984	-0.002	0.090	2148	-0.013	0.090	2928	-0.017
0.095	996	-0.003	0.095	2208	-0.013	0.095	2988	-0.018
0.100	996	-0.003	0.100	2244	-0.013	0.100	3036	-0.018
0.105	1008	-0.003	0.105	2292	-0.014	0.105	3084	-0.019
0.110	1020	-0.003	0.110	2316	-0.014	0.110	3132	-0.019
0.115	1020	-0.003	0.115	2340	-0.014	0.115	3168	-0.020
0.120	1032	-0.003	0.120	2364	-0.014	0.120	3204	-0.020
0.125	1044	-0.003	0.125	2388	-0.015	0.125	3252	-0.020
0.130	1044	-0.003	0.130	2388	-0.015	0.130	3276	-0.021
0.135	1056	-0.003	0.135	2388	-0.015	0.135	3300	-0.021
0.140	1068	-0.003	0.140	2376	-0.015	0.140	3312	-0.021
0.145	1068	-0.003	0.145	2316	-0.015	0.145	3324	-0.022
0.150	1068	-0.003	0.150	2244	-0.015	0.150	3336	-0.022
0.155	1068	-0.003	0.155	2184	-0.016	0.155	3348	-0.022
0.160	1068	-0.003	0.160	2160	-0.016	0.160	3372	-0.023
0.165	1068	-0.003	0.165	2148	-0.016	0.165	3372	-0.023
0.170	1080	-0.003	0.170	2124	-0.016	0.170	3396	-0.023
0.175	1080	-0.003	0.175	2112	-0.016	0.175	3408	-0.024
0.180	1092	-0.002	0.180	2100	-0.016	0.180	3420	-0.024
0.185	1092	-0.002	0.185	2112	-0.016	0.185	3420	-0.024
0.190	1092	-0.002	0.190	2100	-0.017	0.190	3408	-0.024
0.195	1092	-0.002	0.195	2088	-0.017	0.195	3420	-0.025
0.200	1092	-0.002	0.200	2076	-0.017	0.200	3420	-0.025
0.205	1092	-0.002	0.205	2064	-0.017	0.205	3420	-0.025
0.210	1080	-0.002	0.210	2052	-0.017	0.210	3420	-0.025
0.215	1080	-0.002	0.215	2016	-0.017	0.215	3420	-0.026
0.220	1080	-0.002	0.220	1980	-0.017	0.220	3432	-0.026
0.225	1092	-0.002	0.225	1968	-0.017	0.225	3444	-0.026
0.230	1092	-0.002	0.230	1980	-0.018	0.230	3432	-0.026
0.235	1080	-0.002	0.235	1980	-0.018	0.235	3432	-0.027
0.240	1068	-0.002	0.240	1980	-0.018	0.240	3432	-0.027
0.245	1068	-0.002	0.245	1980	-0.018	0.245	3444	-0.027
0.250	1068	-0.002	0.250	1980	-0.018	0.250	3444	-0.027
0.255	1068	-0.002	0.255	1980	-0.018	0.255	3444	-0.028
0.260	1056	-0.002	0.260	1968	-0.018	0.260	3468	-0.028
0.265	1056	-0.002	0.265	1956	-0.018	0.265	3468	-0.028
0.270	1044	-0.002	0.270	1932	-0.018	0.270	3468	-0.028
0.275	1044	-0.002	0.275	1932	-0.018	0.275	3468	-0.029
0.280	1044	-0.002	0.280	1944	-0.019	0.280	3456	-0.029
0.285	1044	-0.002	0.285	1944	-0.019	0.285	3444	-0.029
0.290	1044	-0.002	0.290	1944	-0.019	0.290	3444	-0.029
0.295	1044	-0.002	0.295	1944	-0.019	0.295	3444	-0.030
0.300	1044	-0.002	0.300	1956	-0.019	0.300	3444	-0.030

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

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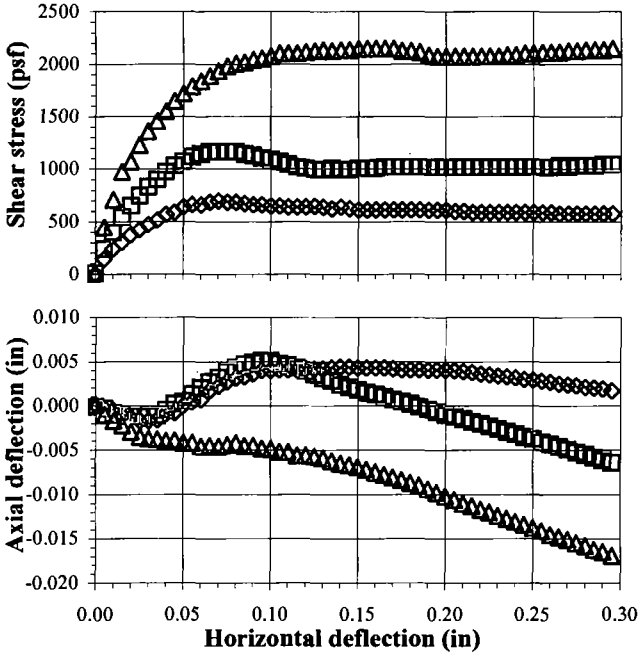
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/18/2011
By: JDF

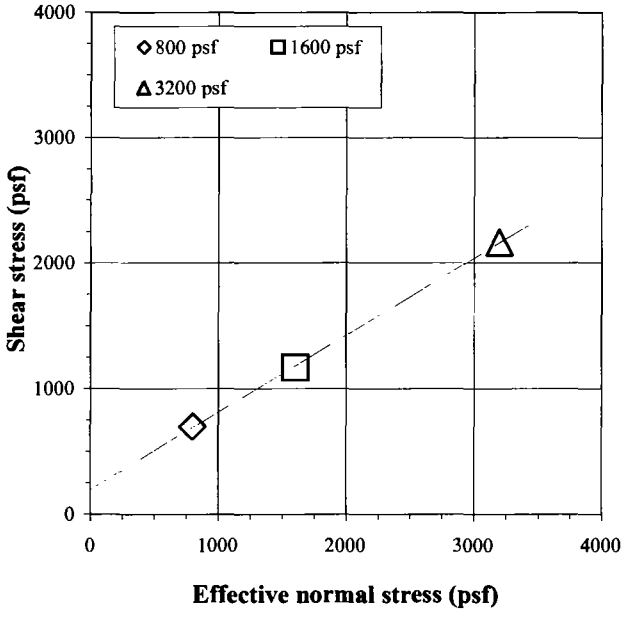
Boring No.: Well 7
Sample:
Depth: 10.5'
Sample Description: Brown silty sand
Sample type: Undisturbed-trimmed from ring

Test type: Inundated
Horizontal deformation (in.): 0.3
Shear rate (in./min): 0.0042

	Sample 1		Sample 2		Sample 3	
Effective normal stress (psf)	800		1600		3200	
Peak shear stress (psf)	696		1164		2160	
Horizontal deformation at peak(in)	0.070		0.065		0.300	
	Initial	Final	Initial	Final	Initial	Final
Sample height (in)	1.0000	0.9748	1.0000	0.9751	1.0000	0.9572
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	171.20	188.15	170.54	190.31	164.83	183.40
Wt. rings (g)	46.07	46.07	43.28	43.28	43.26	43.26
Wet soil + tare (g)	518.41	153.20	518.41	154.66	518.41	149.93
Dry soil + tare (g)	480.88	125.89	480.88	125.14	480.88	121.92
Tare (g)	140.01	21.06	140.01	20.68	140.01	21.77
Water content (%)	11.0	26.1	11.0	28.3	11.0	28.0
Dry unit weight (pcf)	93.7	96.1	95.3	97.7	91.0	95.1

ϕ' (deg)	31	Average of 3 samples	Initial	Final
c' (psf)	198	Water content (%)	11.0	27.4
		Dry unit weight (pcf)	93.3	96.3





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Reviewed:_____

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Effective normal stress = 800 psf			Effective normal stress = 1600 psf			Effective normal stress = 3200 psf		
Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)
0.000	0	0.000	0.000	12	0.000	0.000	0	0.000
0.005	144	0.000	0.005	240	0.000	0.005	444	-0.001
0.010	240	-0.001	0.010	396	-0.001	0.010	708	-0.002
0.015	300	-0.001	0.015	540	-0.001	0.015	972	-0.002
0.020	372	-0.001	0.020	648	-0.001	0.020	1068	-0.003
0.025	420	-0.002	0.025	744	-0.001	0.025	1224	-0.004
0.030	468	-0.002	0.030	828	-0.001	0.030	1356	-0.004
0.035	516	-0.002	0.035	900	-0.001	0.035	1452	-0.004
0.040	564	-0.001	0.040	972	-0.001	0.040	1548	-0.004
0.045	588	-0.001	0.045	1032	0.000	0.045	1644	-0.004
0.050	636	0.000	0.050	1068	0.001	0.050	1716	-0.004
0.055	660	0.000	0.055	1116	0.001	0.055	1788	-0.004
0.060	660	0.001	0.060	1140	0.002	0.060	1836	-0.005
0.065	684	0.002	0.065	1164	0.003	0.065	1884	-0.005
0.070	696	0.002	0.070	1164	0.003	0.070	1932	-0.005
0.075	684	0.003	0.075	1164	0.004	0.075	1980	-0.004
0.080	684	0.003	0.080	1164	0.004	0.080	2004	-0.004
0.085	672	0.003	0.085	1140	0.005	0.085	2016	-0.005
0.090	660	0.004	0.090	1128	0.005	0.090	2040	-0.005
0.095	660	0.004	0.095	1104	0.005	0.095	2052	-0.005
0.100	648	0.004	0.100	1092	0.005	0.100	2076	-0.005
0.105	648	0.004	0.105	1068	0.005	0.105	2100	-0.005
0.110	636	0.004	0.110	1044	0.005	0.110	2100	-0.005
0.115	636	0.004	0.115	1020	0.004	0.115	2100	-0.006
0.120	636	0.004	0.120	1008	0.004	0.120	2112	-0.006
0.125	648	0.004	0.125	996	0.004	0.125	2124	-0.006
0.130	636	0.004	0.130	996	0.003	0.130	2136	-0.006
0.135	624	0.004	0.135	1008	0.003	0.135	2124	-0.006
0.140	636	0.004	0.140	996	0.002	0.140	2136	-0.007
0.145	624	0.004	0.145	996	0.002	0.145	2136	-0.007
0.150	612	0.004	0.150	1008	0.002	0.150	2148	-0.007
0.155	612	0.004	0.155	1008	0.002	0.155	2148	-0.007
0.160	612	0.004	0.160	1008	0.001	0.160	2148	-0.008
0.165	612	0.004	0.165	1020	0.001	0.165	2148	-0.008
0.170	612	0.004	0.170	1020	0.001	0.170	2148	-0.008
0.175	612	0.004	0.175	1020	0.001	0.175	2124	-0.008
0.180	612	0.004	0.180	1020	0.000	0.180	2124	-0.009
0.185	612	0.004	0.185	1020	0.000	0.185	2112	-0.009
0.190	612	0.004	0.190	1020	0.000	0.190	2088	-0.009
0.195	612	0.004	0.195	1020	-0.001	0.195	2076	-0.010
0.200	612	0.004	0.200	1020	-0.001	0.200	2076	-0.010
0.205	600	0.004	0.205	1020	-0.001	0.205	2076	-0.011
0.210	600	0.004	0.210	1020	-0.002	0.210	2076	-0.011
0.215	588	0.004	0.215	1020	-0.002	0.215	2076	-0.011
0.220	588	0.004	0.220	1020	-0.002	0.220	2076	-0.012
0.225	588	0.004	0.225	1020	-0.002	0.225	2076	-0.012
0.230	588	0.003	0.230	1020	-0.003	0.230	2076	-0.012
0.235	588	0.003	0.235	1020	-0.003	0.235	2088	-0.013
0.240	588	0.003	0.240	1020	-0.003	0.240	2088	-0.013
0.245	588	0.003	0.245	1020	-0.004	0.245	2100	-0.013
0.250	588	0.003	0.250	1020	-0.004	0.250	2100	-0.014
0.255	588	0.003	0.255	1020	-0.004	0.255	2112	-0.014
0.260	588	0.003	0.260	1020	-0.004	0.260	2112	-0.015
0.265	576	0.003	0.265	1032	-0.005	0.265	2112	-0.015
0.270	576	0.002	0.270	1020	-0.005	0.270	2124	-0.015
0.275	576	0.002	0.275	1032	-0.005	0.275	2124	-0.016
0.280	576	0.002	0.280	1032	-0.006	0.280	2136	-0.016
0.285	576	0.002	0.285	1032	-0.006	0.285	2136	-0.016
0.290	576	0.002	0.290	1044	-0.006	0.290	2136	-0.017
0.295	576	0.002	0.295	1044	-0.006	0.295	2148	-0.017
0.300	576	0.002	0.300	1044	-0.007	0.300	2160	-0.017

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

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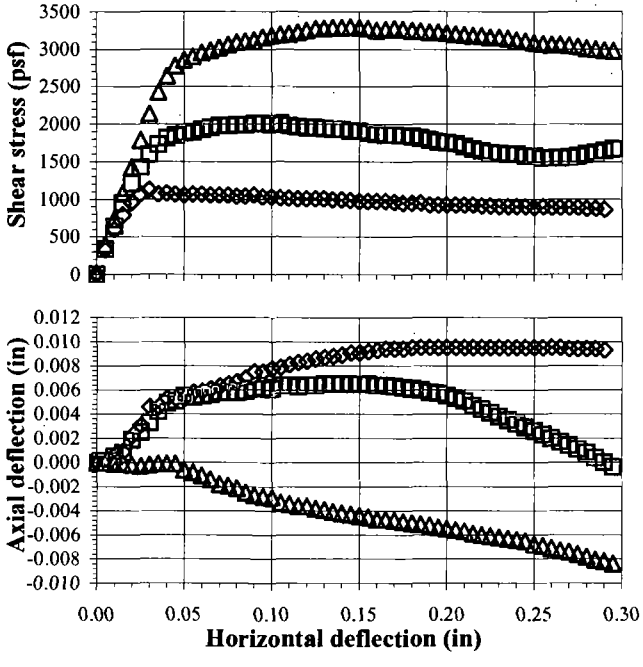
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/21/2011
By: MP

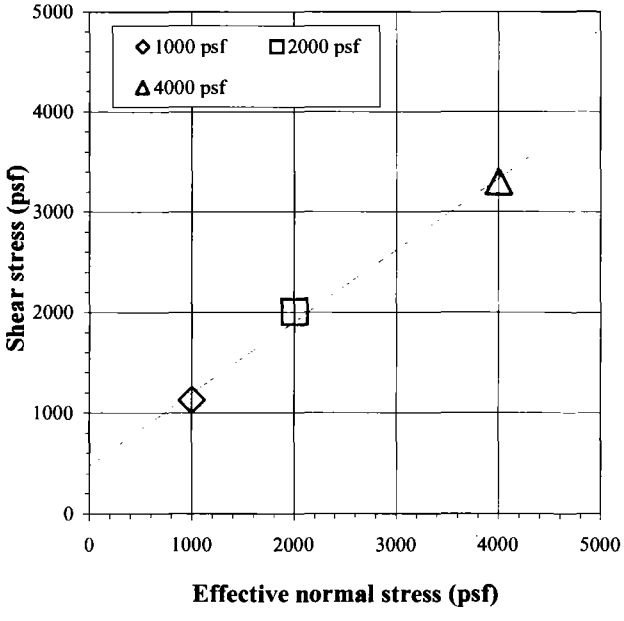
Boring No.: Well 7
Sample:
Depth: 20'
Sample Description: Brown clay
Sample type: Undisturbed-trimmed from ring

Test type: Inundated
Horizontal deformation (in.): 0.1
Shear rate (in./min): 0.0042

	Sample 1		Sample 2		Sample 3	
Effective normal stress (psf)	1000		2000		4000	
Peak shear stress (psf)	1128		2004		3300	
Horizontal deformation at peak(in)	0.030		0.090		0.145	
	Initial	Final	Initial	Final	Initial	Final
Sample height (in)	1.0000	1.0019	1.0000	0.9820	1.0000	0.9736
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	179.40	184.21	178.47	183.75	175.55	180.59
Wt. rings (g)	43.32	43.32	45.70	45.70	42.90	42.90
Wet soil + tare (g)	517.05	364.02	517.05	294.43	517.05	310.85
Dry soil + tare (g)	427.48	328.46	427.48	259.52	427.48	275.88
Tare (g)	128.69	225.61	128.69	160.19	128.69	175.72
Water content (%)	30.0	34.6	30.0	35.1	30.0	34.9
Dry unit weight (pcf)	87.0	86.8	84.9	86.4	84.8	87.1

		Average of 3 samples	Initial	Final
ϕ' (deg)	35	Water content (%)	30.0	34.9
c' (psf)	480	Dry unit weight (pcf)	85.6	86.8





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Effective normal stress = 1000 psf			Effective normal stress = 2000 psf			Effective normal stress = 4000 psf		
Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.000	12	0.000	0.005	336	0.000	0.005	396	0.000
0.005	324	0.000	0.010	636	0.001	0.010	732	0.000
0.010	600	0.001	0.015	948	0.001	0.015	1080	0.000
0.015	792	0.001	0.020	1212	0.002	0.020	1428	0.000
0.020	960	0.002	0.025	1428	0.003	0.025	1788	0.000
0.025	1068	0.003	0.030	1596	0.003	0.030	2136	0.000
0.030	1128	0.005	0.035	1728	0.004	0.035	2424	0.000
0.035	1068	0.005	0.040	1812	0.005	0.040	2640	0.000
0.040	1080	0.005	0.045	1848	0.005	0.045	2784	0.000
0.045	1068	0.005	0.050	1884	0.006	0.050	2856	-0.001
0.050	1056	0.005	0.055	1896	0.005	0.055	2904	-0.001
0.055	1068	0.006	0.060	1932	0.006	0.060	2952	-0.001
0.060	1068	0.006	0.065	1956	0.006	0.065	2988	-0.001
0.065	1056	0.006	0.070	1980	0.006	0.070	3024	-0.002
0.070	1056	0.006	0.075	1980	0.006	0.075	3060	-0.002
0.075	1056	0.007	0.080	1992	0.006	0.080	3096	-0.002
0.080	1044	0.007	0.085	1992	0.006	0.085	3108	-0.003
0.085	1044	0.007	0.090	2004	0.006	0.090	3120	-0.003
0.090	1056	0.008	0.095	2004	0.006	0.095	3156	-0.003
0.095	1032	0.008	0.100	1992	0.006	0.100	3180	-0.003
0.100	1032	0.008	0.105	2004	0.006	0.105	3192	-0.003
0.105	1020	0.008	0.110	1980	0.006	0.110	3204	-0.003
0.110	1020	0.008	0.115	1968	0.006	0.115	3228	-0.004
0.115	1008	0.008	0.120	1956	0.006	0.120	3252	-0.004
0.120	1008	0.008	0.125	1956	0.006	0.125	3276	-0.004
0.125	1008	0.009	0.130	1944	0.007	0.130	3276	-0.004
0.130	1008	0.009	0.135	1932	0.007	0.135	3288	-0.004
0.135	996	0.009	0.140	1932	0.007	0.140	3288	-0.004
0.140	996	0.009	0.145	1908	0.007	0.145	3300	-0.004
0.145	984	0.009	0.150	1908	0.007	0.150	3288	-0.004
0.150	972	0.009	0.155	1884	0.007	0.155	3276	-0.005
0.155	972	0.009	0.160	1872	0.006	0.160	3252	-0.005
0.160	972	0.009	0.165	1860	0.006	0.165	3264	-0.005
0.165	972	0.009	0.170	1860	0.006	0.170	3276	-0.005
0.170	960	0.009	0.175	1848	0.006	0.175	3264	-0.005
0.175	948	0.009	0.180	1836	0.006	0.180	3252	-0.005
0.180	948	0.010	0.185	1812	0.006	0.185	3240	-0.005
0.185	948	0.010	0.190	1788	0.006	0.190	3228	-0.005
0.190	924	0.010	0.195	1764	0.006	0.195	3228	-0.005
0.195	924	0.010	0.200	1752	0.006	0.200	3216	-0.006
0.200	924	0.010	0.205	1740	0.005	0.205	3204	-0.006
0.205	924	0.010	0.210	1704	0.005	0.210	3192	-0.006
0.210	924	0.010	0.215	1668	0.005	0.215	3180	-0.006
0.215	924	0.010	0.220	1644	0.004	0.220	3180	-0.006
0.220	912	0.010	0.225	1620	0.004	0.225	3156	-0.006
0.225	912	0.010	0.230	1608	0.004	0.230	3156	-0.006
0.230	900	0.010	0.235	1596	0.004	0.235	3144	-0.006
0.235	900	0.010	0.240	1596	0.003	0.240	3120	-0.006
0.240	900	0.010	0.245	1572	0.003	0.245	3108	-0.007
0.245	900	0.010	0.250	1572	0.003	0.250	3084	-0.007
0.250	888	0.010	0.255	1548	0.002	0.255	3072	-0.007
0.255	900	0.010	0.260	1548	0.002	0.260	3060	-0.007
0.260	888	0.010	0.265	1548	0.002	0.265	3060	-0.007
0.265	888	0.010	0.270	1560	0.001	0.270	3048	-0.007
0.270	888	0.009	0.275	1572	0.001	0.275	3036	-0.008
0.275	888	0.009	0.280	1596	0.001	0.280	3012	-0.008
0.280	876	0.009	0.285	1620	0.000	0.285	3000	-0.008
0.285	876	0.009	0.290	1644	0.000	0.290	2988	-0.008
0.290	864	0.009	0.295	1668	0.000	0.295	2976	-0.008
0.295	876	0.009	0.300	1692	-0.001	0.300	2964	-0.009

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

IGES

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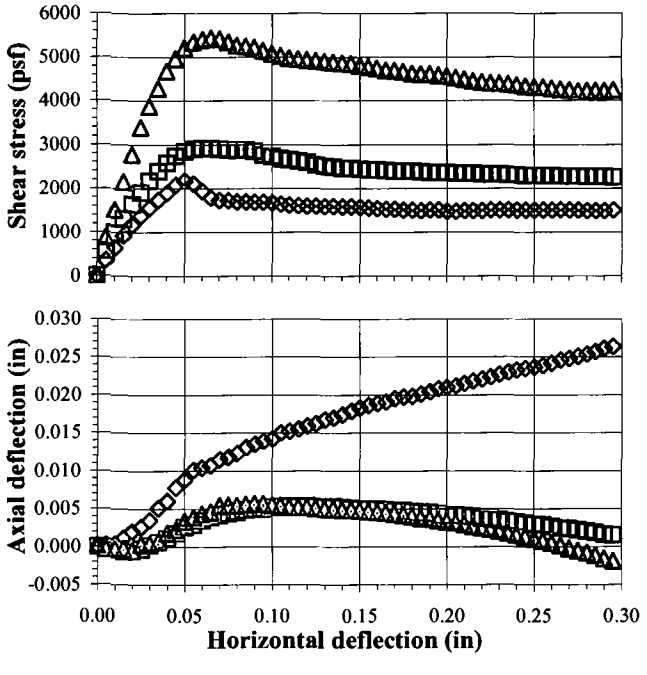
Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/22/2011
By: JDF

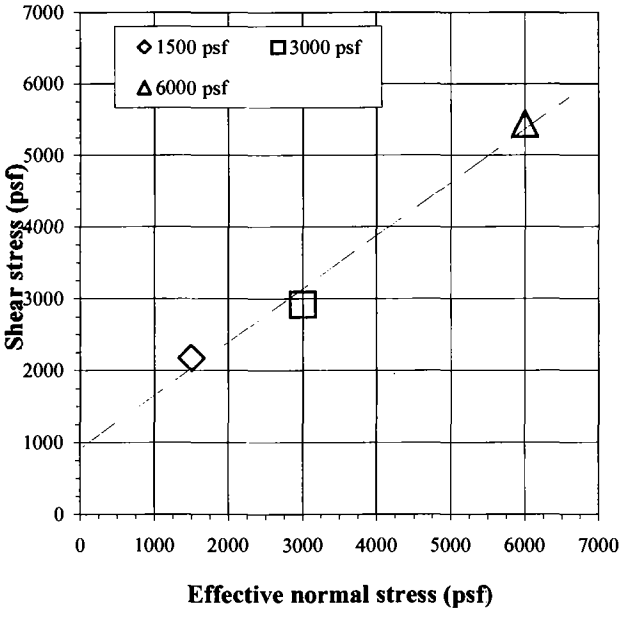
Boring No.: Well 7
Sample:
Depth: 80'
Sample Description: Brown sandy clay
Sample type: Undisturbed-trimmed from ring

Test type: Inundated
Horizontal deformation (in.): 0.1
Shear rate (in./min): 0.0033

	Sample 1		Sample 2		Sample 3	
Effective normal stress (psf)	1500		3000		6000	
Peak shear stress (psf)	2172		2916		5436	
Horizontal deformation at peak(in)	0.050		0.060		0.065	
	Initial	Final	Initial	Final	Initial	Final
Sample height (in)	1.0000	0.9991	1.0000	0.9779	1.0000	0.9722
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	185.32	192.94	176.96	186.42	180.14	186.48
Wt. rings (g)	46.62	46.62	42.79	42.79	42.95	42.95
Wet soil + tare (g)	527.21	281.53	527.21	276.04	527.21	288.82
Dry soil + tare (g)	454.05	247.92	454.05	242.16	454.05	256.95
Tare (g)	153.63	140.13	153.63	139.86	153.63	151.08
Water content (%)	24.4	31.2	24.4	33.1	24.4	30.1
Dry unit weight (pcf)	92.7	92.8	89.7	91.7	91.7	94.3

ϕ' (deg)	37	Average of 3 samples	Initial	Final
c' (psf)	912	Water content (%)	24.4	31.5
		Dry unit weight (pcf)	91.3	92.9





Entered by:_____
Reviewed:_____

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Effective normal stress = 1500 psf			Effective normal stress = 3000 psf			Effective normal stress = 6000 psf		
Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)	Horizontal Deflection (in)	Shear Stress (psf)	Axial deflection (in)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.005	348	0.000	0.005	564	0.000	0.005	888	0.000
0.010	636	0.000	0.010	972	0.000	0.010	1512	0.000
0.015	912	0.001	0.015	1308	-0.001	0.015	2148	0.000
0.020	1164	0.002	0.020	1632	0.000	0.020	2772	-0.001
0.025	1368	0.003	0.025	1908	0.000	0.025	3396	0.000
0.030	1548	0.004	0.030	2172	0.000	0.030	3876	0.000
0.035	1740	0.005	0.035	2388	0.001	0.035	4284	0.001
0.040	1896	0.006	0.040	2580	0.001	0.040	4680	0.002
0.045	2076	0.008	0.045	2736	0.002	0.045	4968	0.002
0.050	2172	0.009	0.050	2844	0.003	0.050	5208	0.003
0.055	2112	0.010	0.055	2892	0.003	0.055	5340	0.004
0.060	1932	0.010	0.060	2916	0.004	0.060	5400	0.004
0.065	1788	0.011	0.065	2904	0.004	0.065	5436	0.005
0.070	1728	0.012	0.070	2892	0.004	0.070	5412	0.005
0.075	1716	0.012	0.075	2880	0.004	0.075	5340	0.006
0.080	1692	0.012	0.080	2868	0.005	0.080	5268	0.005
0.085	1692	0.013	0.085	2868	0.005	0.085	5244	0.006
0.090	1680	0.014	0.090	2844	0.005	0.090	5220	0.006
0.095	1680	0.014	0.095	2760	0.005	0.095	5148	0.006
0.100	1668	0.014	0.100	2724	0.005	0.100	5076	0.006
0.105	1644	0.015	0.105	2676	0.005	0.105	5028	0.005
0.110	1620	0.015	0.110	2652	0.005	0.110	4980	0.005
0.115	1608	0.016	0.115	2628	0.005	0.115	4956	0.005
0.120	1596	0.016	0.120	2592	0.005	0.120	4932	0.005
0.125	1596	0.016	0.125	2532	0.005	0.125	4908	0.005
0.130	1596	0.017	0.130	2508	0.005	0.130	4896	0.005
0.135	1596	0.017	0.135	2484	0.005	0.135	4884	0.005
0.140	1584	0.017	0.140	2460	0.005	0.140	4860	0.005
0.145	1584	0.018	0.145	2460	0.005	0.145	4848	0.005
0.150	1572	0.018	0.150	2436	0.005	0.150	4812	0.005
0.155	1548	0.019	0.155	2424	0.005	0.155	4776	0.005
0.160	1536	0.019	0.160	2424	0.005	0.160	4740	0.005
0.165	1524	0.019	0.165	2400	0.005	0.165	4704	0.005
0.170	1524	0.020	0.170	2388	0.005	0.170	4692	0.004
0.175	1500	0.020	0.175	2388	0.005	0.175	4668	0.004
0.180	1500	0.020	0.180	2388	0.005	0.180	4632	0.004
0.185	1488	0.020	0.185	2376	0.005	0.185	4620	0.004
0.190	1500	0.020	0.190	2364	0.005	0.190	4620	0.004
0.195	1500	0.021	0.195	2364	0.004	0.195	4584	0.004
0.200	1476	0.021	0.200	2352	0.004	0.200	4560	0.003
0.205	1476	0.021	0.205	2340	0.004	0.205	4524	0.003
0.210	1488	0.022	0.210	2340	0.004	0.210	4488	0.003
0.215	1488	0.022	0.215	2340	0.004	0.215	4452	0.003
0.220	1488	0.022	0.220	2328	0.004	0.220	4428	0.003
0.225	1500	0.022	0.225	2316	0.004	0.225	4404	0.002
0.230	1500	0.023	0.230	2316	0.004	0.230	4392	0.002
0.235	1500	0.023	0.235	2304	0.003	0.235	4380	0.002
0.240	1500	0.023	0.240	2304	0.003	0.240	4356	0.002
0.245	1500	0.024	0.245	2292	0.003	0.245	4332	0.001
0.250	1500	0.024	0.250	2292	0.003	0.250	4320	0.001
0.255	1500	0.024	0.255	2292	0.003	0.255	4308	0.001
0.260	1500	0.024	0.260	2292	0.003	0.260	4284	0.001
0.265	1512	0.025	0.265	2280	0.003	0.265	4260	0.000
0.270	1500	0.025	0.270	2280	0.002	0.270	4248	0.000
0.275	1500	0.025	0.275	2280	0.002	0.275	4212	-0.001
0.280	1488	0.025	0.280	2268	0.002	0.280	4224	-0.001
0.285	1488	0.026	0.285	2268	0.002	0.285	4236	-0.001
0.290	1488	0.026	0.290	2268	0.002	0.290	4236	-0.002
0.295	1500	0.026	0.295	2256	0.002	0.295	4248	-0.002
0.300	1500	0.027	0.300	2244	0.001	0.300	4248	-0.002

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/21/2011
By: MP

Boring No.: Well 6
Sample:
Depth: 40'
Sample Description: Brown silty sand
Sample Type: Undisturbed

	Initial (o)	Final (f)
Sample Height, H (in)	2.449	2.404
Sample Diameter, D (in)	2.401	2.31
Sample Length, L (cm)	6.220	6.105
Sample Area, A (cm^2)	29.211	27.064
Sample Volume, V (cm^3)	181.70	165.23
Wt. Rings + Wet Soil (g)	604.94	300.09
Wt. Rings (g)	320.39	0
Wet Unit Wt., γ_m (pcf)	97.8	113.4
Wet Soil + Tare (g)	392.02	479.82
Dry Soil + Tare (g)	333.46	397.92
Tare (g)	140.55	179.38
Weight of solids, Ws (g)	218.29	218.29
Moisture Content, w (%)	30.36	37.48
Dry Unit Wt, γ_d (pcf)	75.0	82.5
Void ratio, e, for assumed Gs	1.22	1.00
Saturation (%), for assumed Gs	66.3	100 [a]
Average k[b] (cm/sec)	**1.7E-05**	

[a] Saturation set to 100% for phase calculations
[b] k corrected to 20°C

Gs	2.67	Assumed
Cell No.	T1	
Station No.	T1	
Permeant liquid used	De-aired water	
Total backpressure (psi)	35	
Effective horiz. consolidation stress (psi)	35	
Effective vert. consolidation stress (psi)	30	

	Initial (o)	Final (f)
B value	0.90	0.98
Volume reading (cm^3)	5.10	21.60
Cell Pressure (psi)	0.0	65.0

System volume coefficient (cm^3/psi)	0.119
System volume change (cm^3)	7.74
Net sample volume change (cm^3)	-16.47
M_1	0.0302
M_2	1.0410
S	0.2256

☒ Pipet
☐ Annulus
☐ Pipet and Annulus

Start Date and Time: 11/17/11 15:06 Equilibrium reading, R_{eq} (cm) 1.9

Elapsed time (sec)	z_1 (cm)	z_2 (cm)	Temp (°C)	δ	Gradient i	C	T	k (cm/sec)	k[b] (cm/sec)
15.0	10.10	2.90	23.9	12.55	9.84	5.4E-04	0.1031	2.0E-05	1.8E-05
15.0	10.13	2.95	23.9	12.55	9.93	5.4E-04	0.1028	2.0E-05	1.8E-05
15.0	9.99	2.88	23.9	12.55	9.70	5.4E-04	0.1042	2.0E-05	1.8E-05
15.0	9.90	2.80	23.9	12.55	9.52	5.4E-04	0.1051	2.0E-05	1.8E-05
20.0	22.69	4.30	22.4	12.55	24.81	5.4E-04	0.0459	1.7E-05	1.6E-05
20.0	23.30	4.51	22.4	12.55	25.68	5.4E-04	0.0447	1.7E-05	1.6E-05

Entered by:_____
Reviewed:_____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/21/2011
By: JDF

Boring No.: Well 7
Sample:
Depth: 100'
Sample Description: Brown silty sand
Sample Type: Undisturbed

	Initial (o)	Final (f)
Sample Height, H (in)	3.022	2.982
Sample Diameter, D (in)	2.397	2.31
Sample Length, L (cm)	7.676	7.574
Sample Area, A (cm^2)	29.113	27.145
Sample Volume, V (cm^3)	223.47	205.60
Wt. Rings + Wet Soil (g)	421.38	431.27
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	117.7	130.9
Wet Soil + Tare (g)	527.22	550.28
Dry Soil + Tare (g)	443.24	451.10
Tare (g)	139.73	127.68
Weight of solids, Ws (g)	330.06	330.06
Moisture Content, w (%)	27.67	30.67
Dry Unit Wt, γ_d (pcf)	92.2	100.2
Void ratio, e, for assumed Gs	0.81	0.82
Saturation (%), for assumed Gs	91.5	100 [a]
Average k[b] (cm/sec)	**1.3E-05**	

[a] Saturation set to 100% for phase calculations
[b] k corrected to 20°C

Gs	2.67	Assumed
Cell No.	T2	
Station No.	T2	
Permeant liquid used	De-aired water	
Total backpressure (psi)	35	
Effective horiz. consolidation stress (psi)	35	
Effective vert. consolidation stress (psi)	60	

	Initial (o)	Final (f)
B value	0.80	0.98
Volume reading (cm^3)	5.50	23.40
Cell Pressure (psi)	0.0	95.0

System volume coefficient (cm^3/psi)	0.108
System volume change (cm^3)	10.29
Net sample volume change (cm^3)	-17.87
M_1	0.0302
M_2	1.0410
S	0.2790

☒ Pipet
☐ Annulus
☐ Pipet and Annulus

Start Date and Time: 11/17/11 14:27 Equilibrium reading, R_{eq} (cm) 1.9

Elapsed time (sec)	z_1 (cm)	z_2 (cm)	Temp (°C)	δ	Gradient i	C	T	k (cm/sec)	k[b] (cm/sec)
30.0	19.84	5.78	23.8	12.55	18.82	6.7E-04	0.0525	1.2E-05	1.1E-05
30.0	20.10	5.80	23.8	12.55	19.06	6.7E-04	0.0518	1.2E-05	1.1E-05
20.0	9.99	4.60	23.8	12.55	9.30	6.7E-04	0.1042	1.5E-05	1.4E-05
20.0	10.35	4.75	23.8	12.55	9.74	6.7E-04	0.1006	1.5E-05	1.4E-05
20.0	10.28	4.70	23.8	12.55	9.64	6.7E-04	0.1013	1.5E-05	1.4E-05
20.0	10.20	4.71	23.8	12.55	9.58	6.7E-04	0.1021	1.5E-05	1.4E-05

Entered by:_____
Reviewed:_____

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

IGES

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Project: North Valley Landfill
No: 00386-014 (III)
Location: Clarkston, UT
Date: 11/21/2011
By: MP

Boring No.: Well 7
Sample:
Depth: 180'
Sample Description: Grey clay
Sample Type: Undisturbed

	Initial (o)	Final (f)
Sample Height, H (in)	2.937	2.898
Sample Diameter, D (in)	2.411	2.33
Sample Length, L (cm)	7.460	7.361
Sample Area, A (cm^2)	29.455	27.519
Sample Volume, V (cm^3)	219.73	202.56
Wt. Rings + Wet Soil (g)	415.4	414.90
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	118.0	127.9
Wet Soil + Tare (g)	198.05	556.16
Dry Soil + Tare (g)	187.21	459.57
Tare (g)	151.55	140.17
Weight of solids, Ws (g)	318.56	318.56
Moisture Content, w (%)	30.40	30.24
Dry Unit Wt, γ_d (pcf)	90.5	98.2
Void ratio, e, for assumed Gs	0.84	0.81
Saturation (%), for assumed Gs	96.4	100 [a]
Average k[b] (cm/sec)	**3.8E-08**	

[a] Saturation set to 100% for phase calculations
[b] k corrected to 20°C

Gs	2.67	Assumed
Cell No.	T3	
Station No.	T3	
Permeant liquid used	De-aired water	
Total backpressure (psi)	35	
Effective horiz. consolidation stress (psi)	35	
Effective vert. consolidation stress (psi)	60	

	Initial (o)	Final (f)
B value	0.74	0.98
Volume reading (cm^3)	4.70	21.90
Cell Pressure (psi)	0.0	95.0

System volume coefficient (cm^3/psi)	0.105
System volume change (cm^3)	10.00
Net sample volume change (cm^3)	-17.17
M_1	0.0302
M_2	1.0410
S	0.2675

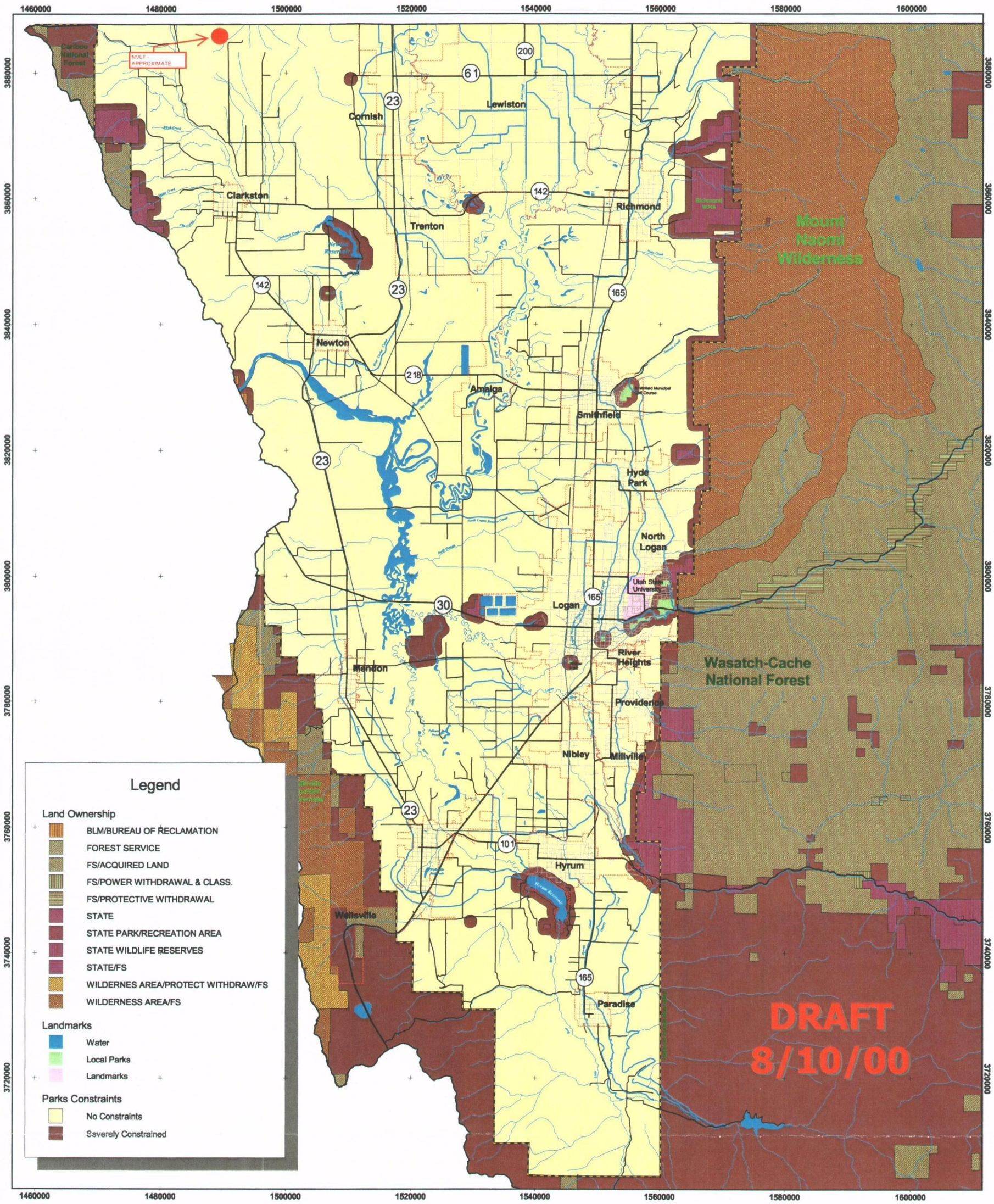
- [x] Pipet
- [ ] Annulus
- [ ] Pipet and Annulus

Start Date and Time: 11/17/11 11:33 Equilibrium reading, R_{eq} (cm) 1.9

Elapsed time (sec)	z_1 (cm)	z_2 (cm)	Temp (°C)	δ	Gradient i	C	T	k (cm/sec)	k^b (cm/sec)
1380.0	19.05	17.30	23.5	12.55	28.88	6.4E-04	0.0546	4.3E-08	3.9E-08
1860.0	17.30	15.15	23.7	12.55	25.42	6.4E-04	0.0602	4.2E-08	3.8E-08
1800.0	15.15	13.40	23.7	12.55	21.96	6.4E-04	0.0687	4.1E-08	3.7E-08
1800.0	13.40	11.88	23.7	12.55	19.06	6.4E-04	0.0777	4.0E-08	3.6E-08

Entered by:_____
Reviewed:_____

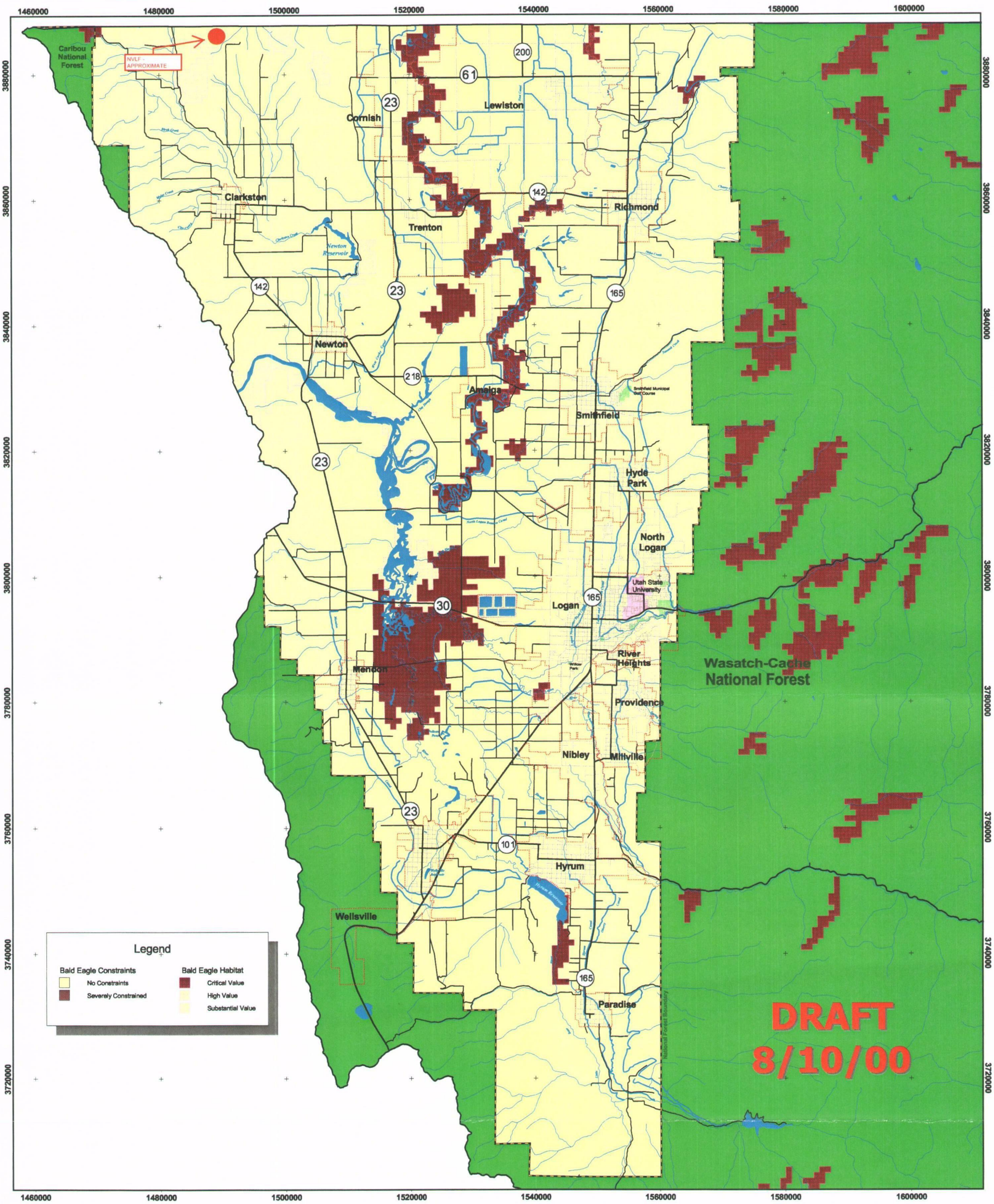
Appendix K



0 2 4 6 Miles

Cache County Landfill Siting Study Parks & Recreation Areas

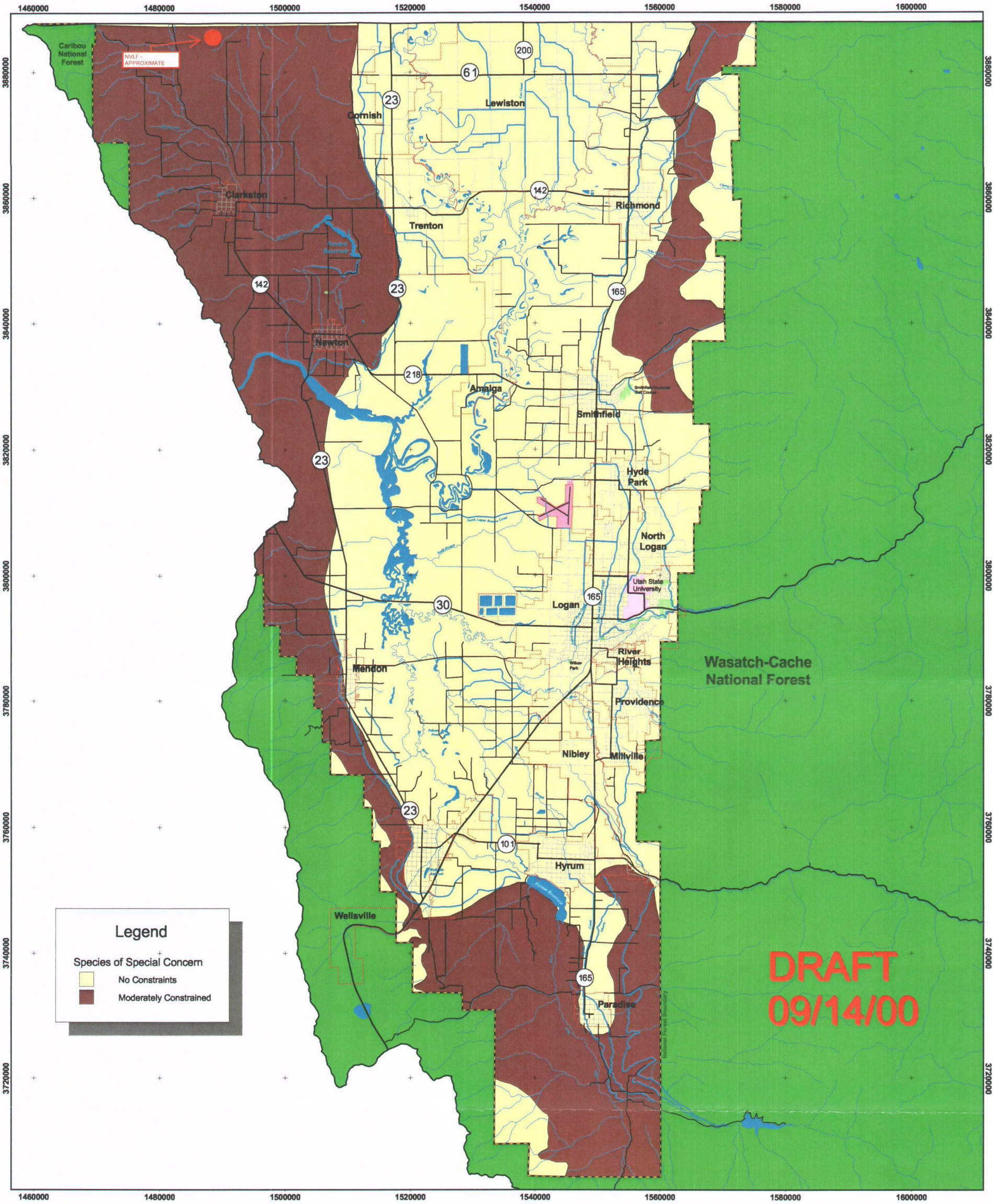
LCLS.APR, Size E - Parks, 8/7/00, 19:15



0 2 4 6 Miles

Cache County Landfill Siting Study Bald Eagle Habitat

LCLS.APR, Size E - Bald Eagle Habitat, 8/8/00, 16:19



0 2 4 6 Miles

Cache County Landfill Siting Study Species of Special Concern

LCLS.APR, Size E - Species, 09/14/00, 14:12

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor

Robert L. Morgan
Executive Director

Kevin Conway
Division Director

Northern Region
515 East 5300 South
Ogden, Utah 84405-4502
(801) 476-2740 telephone
(801) 479-4010 fax
www.nr.utah.gov

MAR 2 9 2003

March 26, 2003

Terry Warner
HDR Engineering
3995 South 700 East #100
Salt Lake City, UT 84107

Subject: Cache County Landfill

Dear Mr. Warner:

The Utah Division of Wildlife Resources would like to thank you for allowing us the opportunity to assist you with the planning process of the Cache county landfill. From the information contained in your handouts the Utah Division of Wildlife Resources would not require you to obtain a permit but we recommend you mitigate for unavoidable impacts to wildlife and wildlife habitat as a result of the construction and operation of a Cache co. landfill. We provide the following comments for your consideration in order of sites visited.

Site I (Near Cache Junction)

This site is within two miles of several known Utah Sensitive Species, including American white Pelican, Long-billed Curlew, and Short-eared Owl. Site I is also within 2 miles of a known Bald Eagle wintering area, a Federally listed threatened species. We feel the direct and indirect disturbances created by a landfill, loss of habitat to the landfill and it's service roads, fragmentation of available habitat, wind blown debris, noise generated by landfill operations and traffic, and the attraction of Gulls and Ravens, may negatively impact the above sensitive and threatened species and all efforts should be taken to minimize disturbances to this wildlife.

Our biggest concern with site I is the possible effect a landfill on this site may have on the Bear River water quality by petroleum and other runoff, as well as wind blown debris settling in the river. If this site is selected we request that you work with the Utah Department of Environmental Quality, Division of Water Quality to address the issue of possible contamination of the Bear River. In addition we recommend the landfill operator be required to implement steps to assure wind blown debris is contained on site.

Site G (North of Newton)

This site is within 1 mile of several known Utah Sensitive Species, including Grasshopper Sparrow and Short-eared Owl. Site G is also within 1 mile of a reported Ferruginous Hawk Natural Heritage Program Database, Element Occurrence Record. The Ferruginous Hawk is a State Threatened species. We feel the direct and indirect disturbances created by a landfill, loss of habitat to the landfill and it's service roads, fragmentation of available habitat, wind blown debris, noise generated by landfill operations and traffic, and the attraction of Gulls and Ravens, may negatively impact the above sensitive and threatened species and all efforts should be taken to minimize disturbances to wildlife.

Our biggest concern with site G is the possible effect a landfill on this site may have on the water quality of Newton Reservoir by petroleum and other chemical runoff, as well as wind blown debris settling in the water. If this site is selected we request that you work with the Utah Department of Environmental Quality, Division of Water Quality to address the issue of possible contamination of Newton Reservoir. In addition we recommend the landfill operator be required to implement steps to assure wind blown debris is contained on site.

Site C (North of Clarkston)

This site is within 1 mile of several known Utah Sensitive Species, including Grasshopper Sparrow, Short-eared Owl, and Columbian Sharp-tailed Grouse. I addition the Clarkston Mountain range is important deer and elk habitat that would be severely impacted if this site were to be used. The Columbian Sharp-tailed Grouse is listed as a Utah Sensitive Species due to its limited distribution and has been petitioned to be federally listed. If a landfill were to be developed on this site we request a multi year survey to determine the population of Columbian Sharp-tailed Grouse that would be impacted or displaced. In addition we request mitigation in the form of restoration and/or acquisition of Columbian Sharp-tailed Grouse habitat equal to or greater than the acreage impacted by the landfill and landfill support network and operations. We will be glad to provide information regarding study design and suggest appropriate mitigation.

We appreciate the opportunity to review and comment on the proposed Cache County Landfill sites. Regardless of the site selected we would be interested in meeting with all interested parties to develop strategies to minimize impacts to wildlife as result of the construction and operation of the new landfill.

If you have any questions or would like additional information from the Utah Division of Wildlife Resources, please contact David Hernandez (801) 710-7324 of the Northern Region Habitat Program.

Sincerely,

R Hasen

Robert Hasenyager,
Northern Regional Supervisor

GARY R. HERBERT
Governor

GREGORY S. BELL
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Wildlife Resources

JAMES F. KARPOWITZ
Division Director

January 23, 2012

Jared Hawes
IGES, Inc.
4153 South Commerce Drive
Salt Lake City, Utah 84107

Subject: Species of Concern Near the Clarkston Landfill Site

Dear Jared Hawes:

I am writing in response to your email dated January 11, 2012 regarding information on species of special concern proximal to the proposed Clarkston Landfill Site located in Sections 3 and 4 of Township 14 North, Range 2 West and Sections 34 and 35 of Township 15 North, Range 2 West in Cache County, Utah.

Within a ½-mile radius of the project area noted above, the Utah Division of Wildlife Resources (UDWR) has recent records of occurrence for sharp-tailed grouse and grasshopper sparrow. In addition, within a 2-mile radius there are recent records of occurrence for short-eared owl and historical records of occurrence pygmy rabbit. All of the aforementioned species are included on the *Utah Sensitive Species List.*

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 habitat manager for the northern region, Scott Walker, at (801) 476-2776 if you have any questions.

Please contact our office at (801) 538-4759 if you require further assistance.

Sincerely,

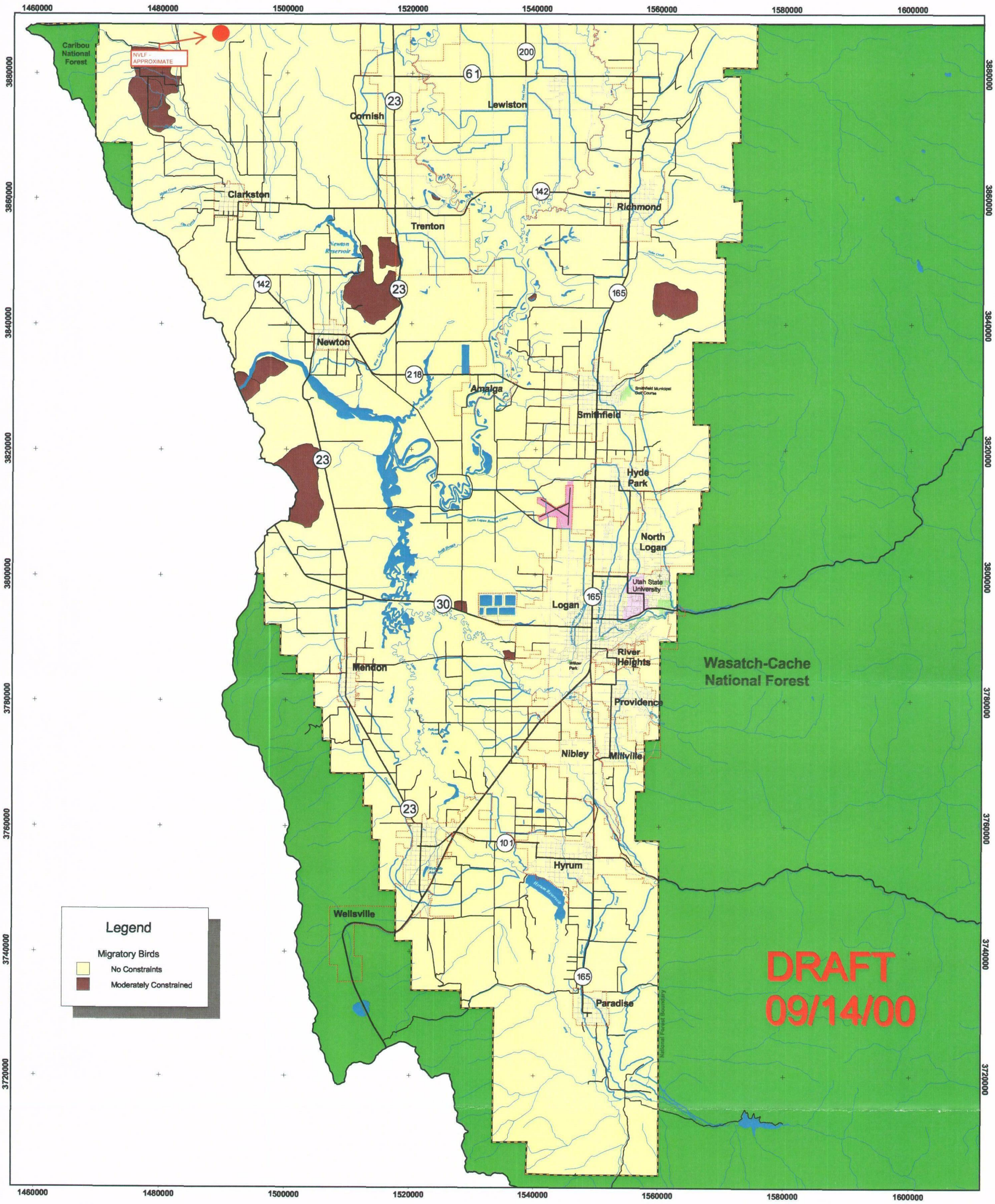
Sarah Lindsey

Sarah Lindsey
Information Manager
Utah Natural Heritage Program

cc: Scott Walker

1594 West North Temple, Suite 2110, PO Box 146301, Salt Lake City, UT 84114-6301
telephone (801) 538-4700 • facsimile (801) 538-4709 • TTY (801) 538-7458 • *www.wildlife.utah.gov*

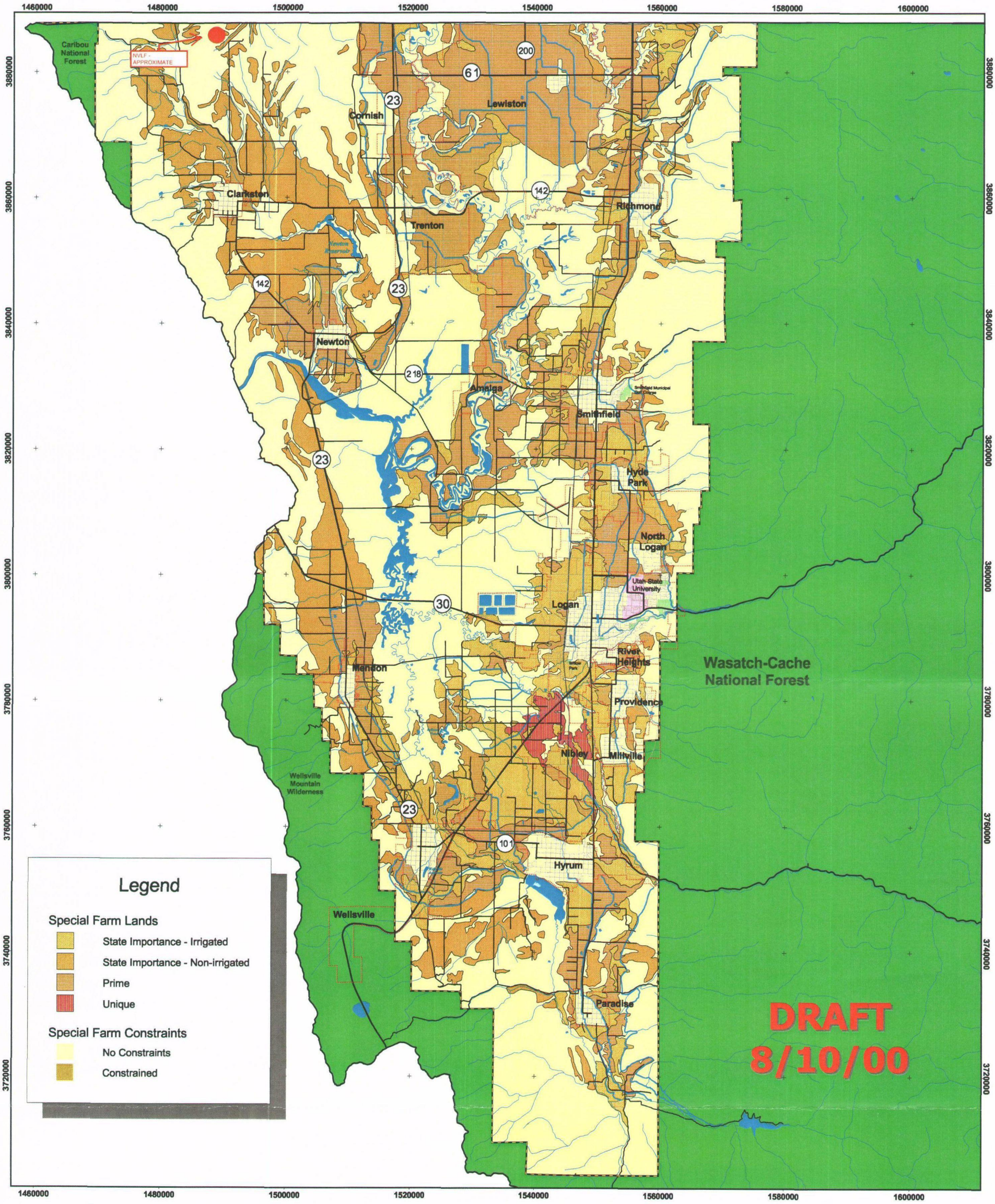
UTAH DNR WILDLIFE



0 2 4 6 Miles

Cache County Landfill Siting Study Migratory Birds

LCLS.APR, Size E - Migratory Birds, 09/14/00, 13:52



0 2 4 6 Miles

Cache County Landfill Siting Study Special Farm Areas

LCLS.APR, Size E - Farms, 8/7/00, 14:06

North Cache Conservation District
1860 North 100 East
North Logan, UT 84341
(435) 753-6029

Jared Hawes, P.E.
IGES, Inc.
4153 South Commerce Drive
Salt Lake City, Utah 84107

November 30, 2011

Dear Jared,

Thank you for contacting the North Cache Conservation District regarding the soils given the "Statewide Important" designation at the proposed landfill site near Clarkson, Utah. We applaud your efforts to research and become informed regarding soils designations. These designations are given to recognize soils with characteristics conducive to growing quality crops or that are otherwise key to the local agricultural operations. We feel these designations are an important part of agricultural sustainability.

The "Statewide Important" soils designation does not have any stipulations that would impact a site being considered for a landfill. In our review of your request we did find some characteristics of the soils on the proposed site that could pose challenges to landfill suitability. Enclosed you will find a soils report from the Natural Resources Conservation Service Web Soil Survey. The report was generated with the request for landfill suitability of the soils on the proposed site. We note in the report that it lists these soils as having severe limitations due mainly to slope and infiltration rate. As stewards of the natural resources in the northern part of Cache County, we encourage you to consider these limitations carefully. We recognize the need for sanitary landfill facilities, yet issue an additional recommendation of caution and careful consideration to long-term consequences of landfill placement.

As you know well, the proposed site drains toward nearby Weston Creek and the town of Weston, Idaho. If leakage from sanitary facilities were to occur, as the enclosed soil report shows as a potential risk, water quality as well as human health could be detrimentally impacted. Therefore, we request a complete site study be conducted to determine what steps would be needed to ensure integrity of the site against future leakage.

Sincerely,

S. Bruce Karren
Chairman, North Cache Conservation District

cc. Lynn Lemon, Cache County Executive

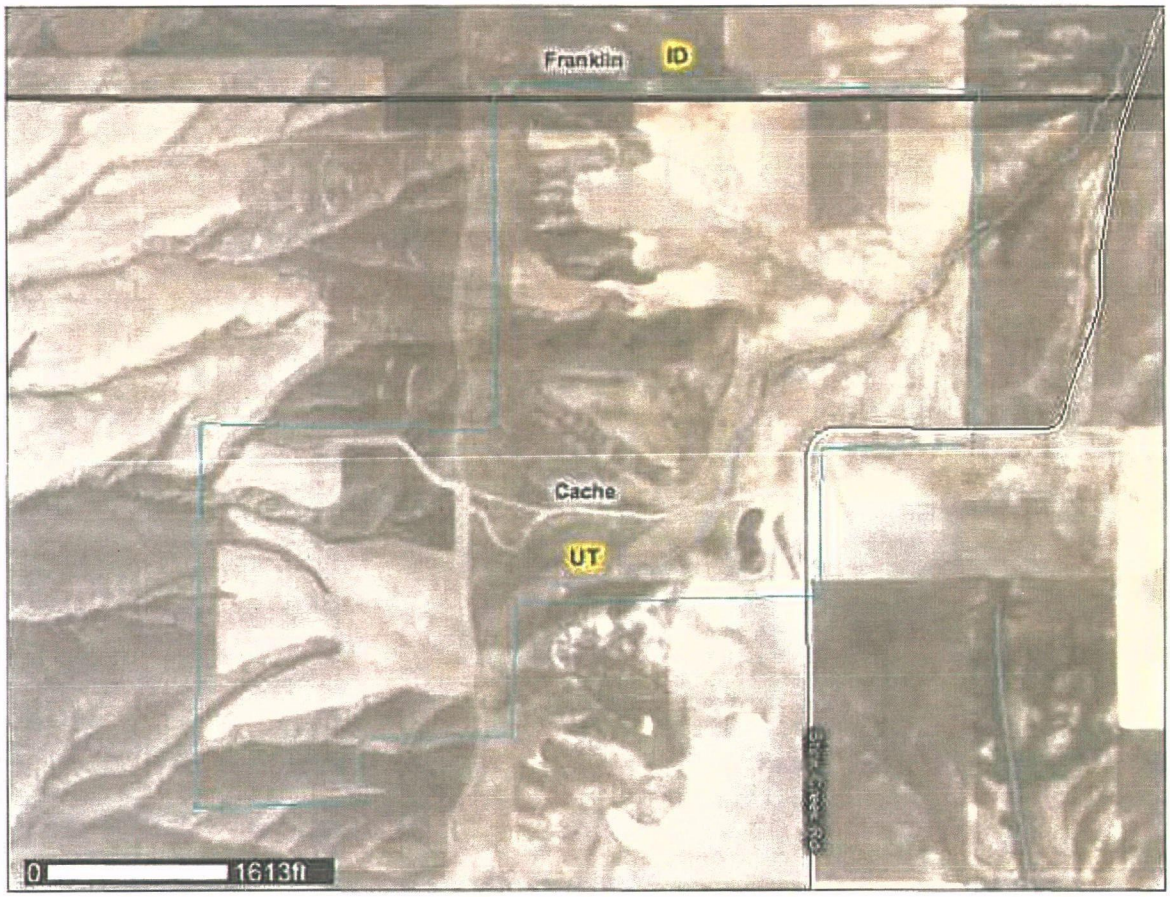
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Cache Valley Area, Parts of Cache and Box Elder Counties, Utah; and Franklin County Area, Idaho



December 1, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Sanitary Facilities

Sanitary Facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Sanitary Landfill (Area) (Proposed Landfill Site)

In an "area sanitary landfill," solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. A landfill must be able to bear heavy vehicular traffic. It can result in the pollution of ground water. Ease of excavation and revegetation should be considered.

The ratings are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, slope, and depth to bedrock or a cemented pan. Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If Ksat is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat

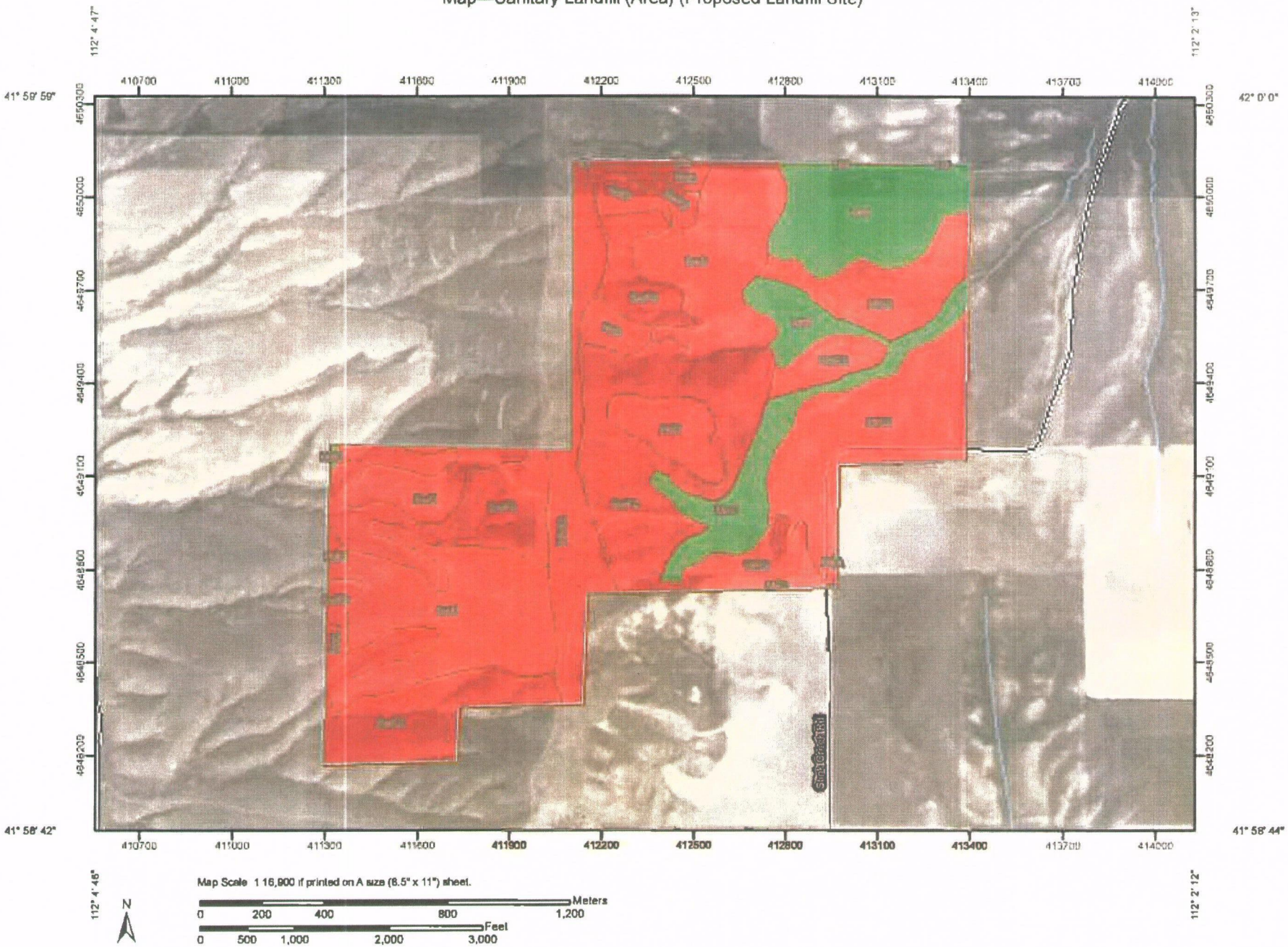
limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Sanitary Landfill (Area) (Proposed Landfill Site)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

Very limited

Somewhat limited

Not limited

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:16,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cache Valley Area, Parts of Cache and Box Elder Counties, Utah
Survey Area Data: Version 6, May 24, 2011

Soil Survey Area: Franklin County Area, Idaho
Survey Area Data: Version 7, Sep 10, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 8/9/2006; 7/12/2004

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.

Tables—Sanitary Landfill (Area) (Proposed Landfill Site)

Sanitary Landfill (Area)— Summary by Map Unit — Cache Valley Area, Parts of Cache and Box Elder Counties, Utah (UT603)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	Very limited	Collinston (90%)	Too steep (1.00)	10.4	1.8%
HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES	Not limited	Hendricks (95%)		0.6	0.1%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES	Very limited	Hendricks (95%)	Too steep (1.00)	36.1	6.2%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	Not limited	Mendon (95%)		0.4	0.1%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	Not limited	Mendon (95%)		32.1	5.5%
MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	Not limited	Mendon (45%)		57.9	9.9%
			Collinston (45%)			
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	Very limited	Collinston (40%)	Too steep (1.00)	87.4	14.9%
			Wheelon (20%)	Too steep (1.00)		
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	Very limited	Sterling (95%)	Seepage (1.00)	125.4	21.4%
				Too steep (1.00)		
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED	Very limited	Sterling (95%)	Too steep (1.00)	176.9	30.1%
				Seepage (1.00)		
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED	Very limited	Wheelon (95%)	Too steep (1.00)	39.7	6.8%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	Very limited	Wheelon (55%)	Too steep (1.00)	16.1	2.8%
			Collinston (40%)	Too steep (1.00)		
Subtotals for Soil Survey Area					**583.0**	**99.3%**
Totals for Area of Interest					**587.0**	**100.0%**

Sanitary Landfill (Area)— Summary by Map Unit — Franklin County Area, Idaho (ID714)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
83	Lizdale-Searla complex, 12 to 30 percent slopes	Very limited	Lizdale (55%)	Slope (1.00)	0.4	0.1%
				Seepage (1.00)		
			Searla (35%)	Slope (1.00)		
135	Sterling gravelly loam, 10 to 20 percent slopes	Very limited	Sterling (95%)	Slope (1.00)	2.2	0.4%
150	Wheelon-Collinston complex, 12 to 20 percent slopes	Very limited	Wheelon (45%)	Slope (1.00)	0.2	0.0%
			Collinston (40%)	Slope (1.00)		

Sanitary Landfill (Area)— Summary by Map Unit — Franklin County Area, Idaho (ID714)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
155	Winwell-Collinston complex, 2 to 8 percent slopes	Not limited	Winwell (50%)		1.1	0.2%
			Collinston (35%)			
Subtotals for Soil Survey Area					4.0	0.7%
Totals for Area of Interest					587.0	100.0%

Sanitary Landfill (Area)— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	495.0	84.3%
Not limited	92.0	15.7%
Totals for Area of Interest	587.0	100.0%

Rating Options—Sanitary Landfill (Area) (Proposed Landfill Site)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Daily Cover for Landfill (Proposed Landfill Site)

Daily cover for landfill is the soil material that is used to cover compacted solid waste in a sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid. After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. Some damage to the borrow area is expected, however, and plant growth may not be optimum.

This information is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the ratings. Local ordinances and regulations should be considered in planning, in site selection, and in design.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Daily Cover for Landfill (Proposed Landfill Site)

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

Very limited

Somewhat limited

Not limited

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:16,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cache Valley Area, Parts of Cache and Box Elder Counties, Utah
Survey Area Data: Version 6, May 24, 2011

Soil Survey Area: Franklin County Area, Idaho
Survey Area Data: Version 7, Sep 10, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 8/9/2006; 7/12/2004

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.

Tables—Daily Cover for Landfill (Proposed Landfill Site)

Daily Cover for Landfill— Summary by Map Unit — Cache Valley Area, Parts of Cache and Box Elder Counties, Utah (UT603)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	Very limited	Collinston (90%)	Too steep (1.00)	10.4	1.8%
HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES	Somewhat limited	Hendricks (95%)	Too clayey (0.50)	0.6	0.1%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES	Very limited	Hendricks (95%)	Too steep (1.00) Too clayey (0.50)	36.1	6.2%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	Not limited	Mendon (95%)		0.4	0.1%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	Not limited	Mendon (95%)		32.1	5.5%
MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	Not limited	Mendon (45%) Collinston (45%)		57.9	9.9%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	Very limited	Collinston (40%) Wheelon (20%)	Too steep (1.00) Too steep (1.00)	87.4	14.9%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	Very limited	Sterling (95%)	Seepage (1.00) Gravel content (1.00) Too steep (1.00) Too sandy (0.50)	125.4	21.4%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED	Very limited	Sterling (95%)	Too steep (1.00) Seepage (1.00) Gravel content (1.00) Too sandy (0.50)	176.9	30.1%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED	Very limited	Wheelon (95%)	Too steep (1.00)	39.7	6.8%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	Very limited	Wheelon (56%) Collinston (40%)	Too steep (1.00) Too steep (1.00)	16.1	2.8%
Subtotals for Soil Survey Area					583.0	99.3%
Totals for Area of Interest					587.0	100.0%

Daily Cover for Landfill— Summary by Map Unit — Franklin County Area, Idaho (ID714)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
83	Lizdale-Searla complex, 12 to 30 percent slopes	Very limited	Lizdale (55%)	Slope (1.00)	0.4	0.1%
				Carbonate content (1.00)		
				Gravel content (0.81)		
				Seepage (0.22)		
			Searla (35%)	Gravel content (1.00)		
				Slope (1.00)		
135	Sterling gravelly loam, 10 to 20 percent slopes	Very limited	Sterling (95%)	Gravel content (1.00)	2.2	0.4%
				Slope (1.00)		
150	Wheelon-Collinston complex, 12 to 20 percent slopes	Very limited	Wheelon (45%)	Slope (1.00)	0.2	0.0%
			Collinston (40%)	Slope (1.00)		
155	Winwell-Collinston complex, 2 to 8 percent slopes	Somewhat limited	Winwell (50%)	Too clayey (0.50)	1.1	0.2%
Subtotals for Soil Survey Area					**4.0**	**0.7%**
Totals for Area of Interest					**587.0**	**100.0%**

Daily Cover for Landfill— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	495.0	84.3%
Not limited	90.3	15.4%
Somewhat limited	1.7	0.3%
Totals for Area of Interest	**587.0**	**100.0%**

Rating Options—Daily Cover for Landfill (Proposed Landfill Site)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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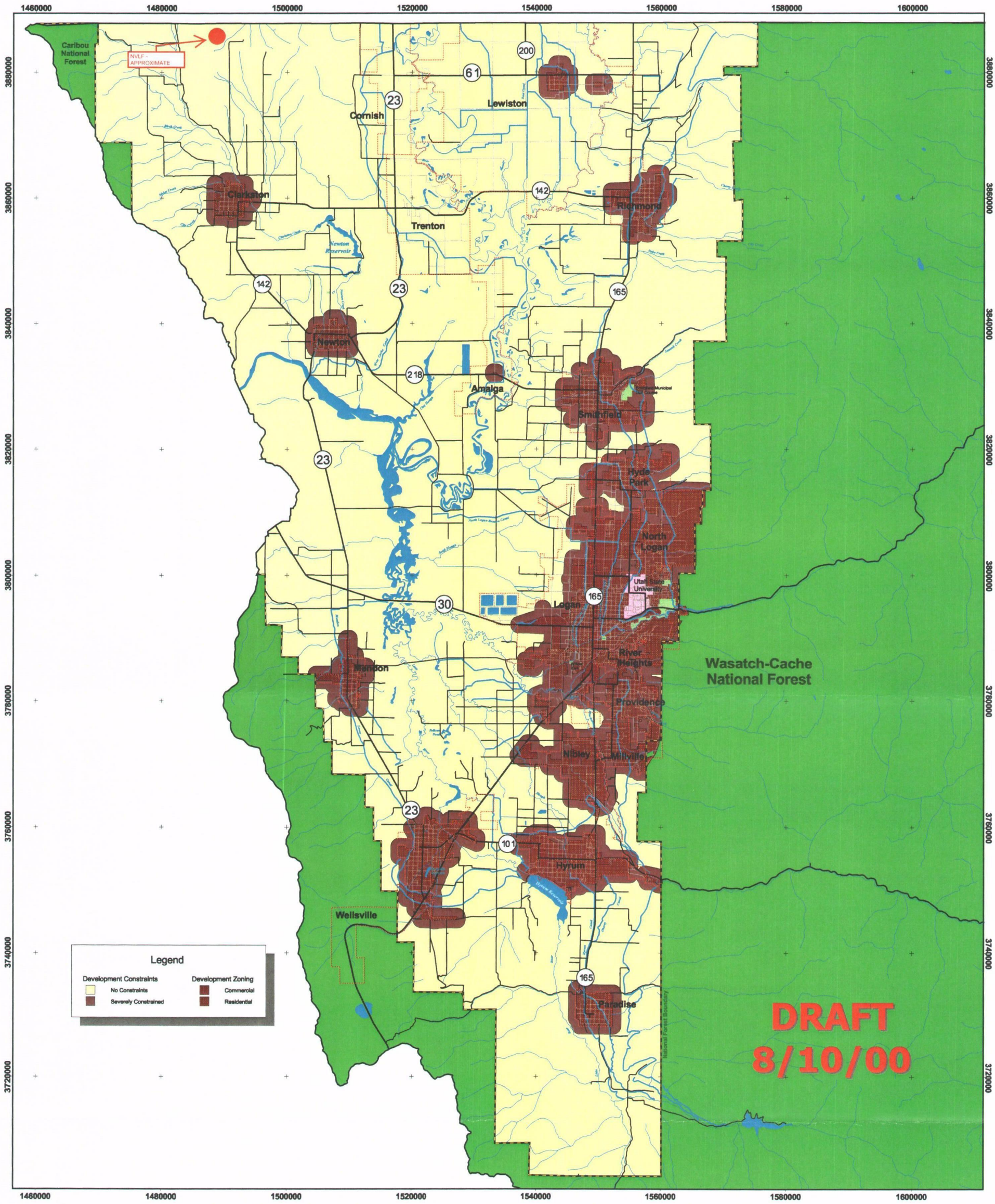

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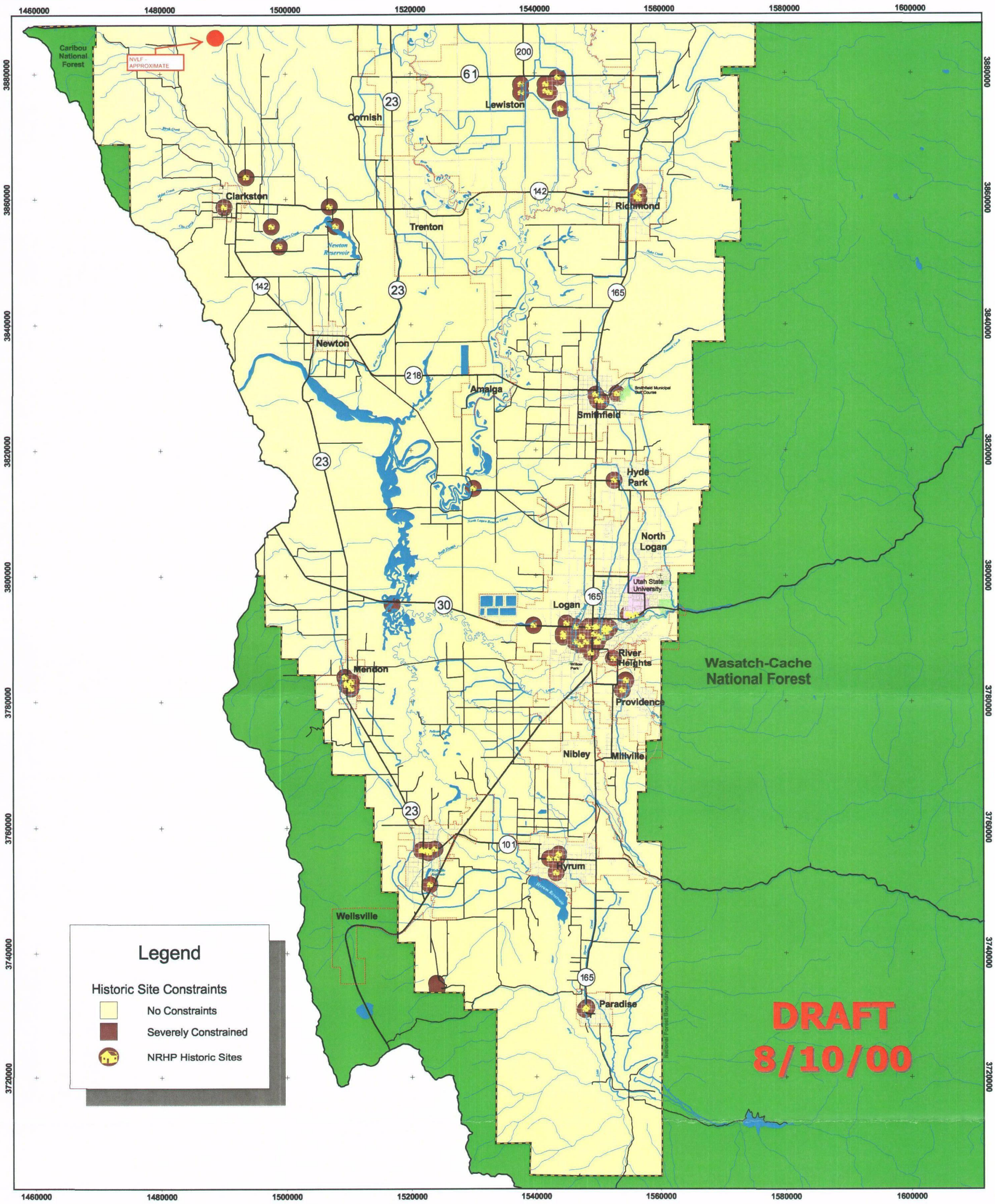
Cache County Landfill Siting Study Development Constraints

LCLS.APR, Size E - Development Constraints, 8/8/00, 17:04



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Cache County Landfill Siting Study Historic Sites

LCLS.APR, Size E - Historic Sites, 8/8/00, 15:33

LOGAN
CITY UNITED IN SERVICE
ENVIRONMENTAL DEPARTMENT

February 24, 2012

Jim Dykman
300 Rio Grande St.
Salt Lake City, UT 84101

RE: North Valley Landfill – Class I Landfill in Cache County

Dear Mr. Dykman,

Logan City is responsible for the collection and disposal for the solid waste generated in Cache County. Logan city is in the process of applying for a permit (with the State of Utah Department of Environmental Quality Division of Solid and Hazardous Waste) to operate a Class I landfill (North Valley Landfill) in northwestern Cache County (see attached Figure 1).

State of Utah Solid Waste Rules (R315-302-1(2)(b)) specify that the site cannot be located within 1/4 mile of historic structures or properties listed or eligible to be listed in the State or National Register of Historic Places. The site is not located within 1/4 mile of any dwelling, incompatible or historic structures. The nearest historic property to the site is the Clarkston Cemetery located approximately 4 miles south of the site.

State of Utah Solid Waste Rules, specifically Section R315-302-1(2)(f) also have requirements of an historic preservation survey. The State of Utah regulations state:

(i) Each new facility or expansion of an existing facility shall:

(A) Have a notice of concurrence issued by the state historic preservation officer as provided for in Subsection 9-8-404(3)(a)(i); or

(B) Show that the state historic preservation officer did not respond within 30 days to the submittal, to the officer, of an evaluation; or

(C) Have received a joint analysis conducted as required by Subsection 9-8-404(2).

450 North 1000 West • Logan, Utah 84321 • tel: 435.716.9755 • fax: 435.716.9754 www.logancity.com

(ii) Each existing facility shall, for all areas of the site that have not been disturbed:

(A) Have a notice of concurrence issued by the state historic preservation officer as provided for in Subsection 9-8-404(3)(a)(i); or

(B) Show that the state historic preservation officer did not respond within 30 days to the submittal, to the officer, of an evaluation; or

(C) Have received a joint analysis conducted as required by Subsection 9-8-404(2).

Previous siting studies conducted by HDR, Inc. for the North Valley Landfill site (previously designated as Site C east of the ridge) stated:

> *"Site C has a low probability for containing historic sites. Its rugged terrain and remote location do not make it a strong candidate for habitation sites. Today some of it is farmed, but most appears to be undeveloped. Because little information exists on the specific prehistoric and Native American settlement-subsistence patterns in the valley, site rankings assume a correlation between human occupation and use and proximity to major waterways. Give this assumption Site C has the least potential for substantial prehistoric or historic Native American sites because it is farthest from the major rivers."*

Parts of the North Valley Landfill site that are not overly steep or in washes are currently being farmed. Based on site observations and the previous studies conducted for the city and the criteria required to be listed in the State or National Register of Historic Places; it is very unlikely that any archeological sites will be located proximate to this project.

We have reviewed the requirements of the National Historic Preservation Act, specifically Section 106. Since the State of Utah has been granted primacy from the EPA with regard to RCRA Subtitle D (managing municipal and solid waste); the requirements of Section 106 do not appear to apply in this instance. IGES (City of Logan consultant) contacted the State of Utah Department of Environmental Quality Division of Solid and Hazardous Waste (DSHW) to get clarification on the State rules pertaining to historic structures or properties and any additional

requirements that they may have similar to Section 106 of the National Historic Preservation Act. The DSHW indicated that the State of Utah did in fact have primacy granted by the EPA with regard to regulations concerning the permitting of landfills in Utah and that Section 106 was not applicable since this project does not have Federal funding, Federal permit requirements, nor is it located on Federal lands.

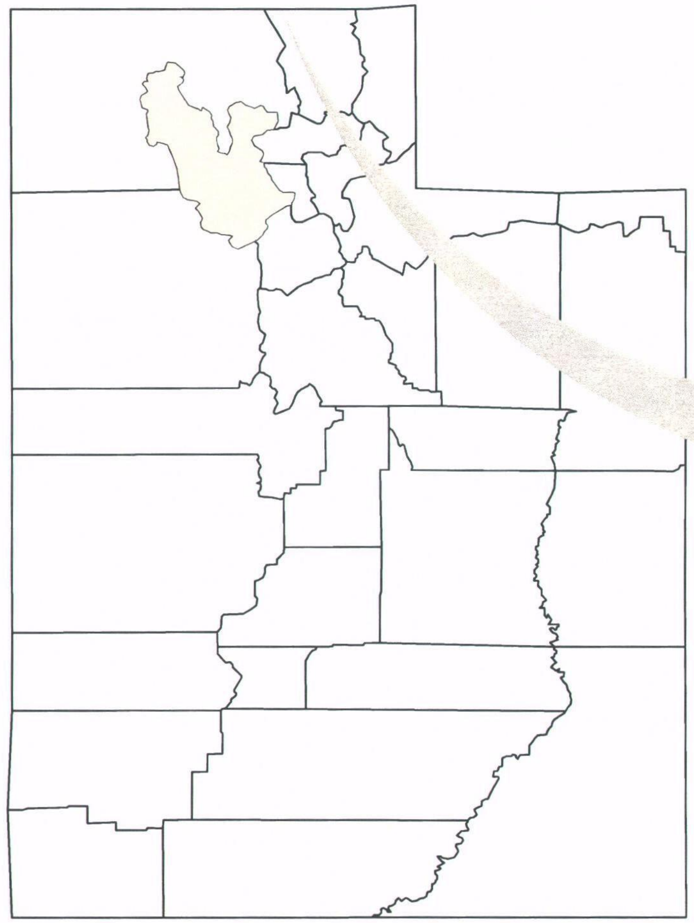
The DSHW indicated that the DSHW requirements are; 1) have a letter from the State Historic Preservation Officer (SHPO) that indicates concurrence, 2) show that the SHPO did not respond in 30 days to the submittal requesting concurrence, or 3) have received a joint analysis conducted as required by Subsection 9-8-404 (2).

If, in your estimation; our assessment of no potential impact to cultural resources associated with the project is accurate, could you please write a letter indicating your concurrence with this opinion to satisfy the State DSHW requirements?

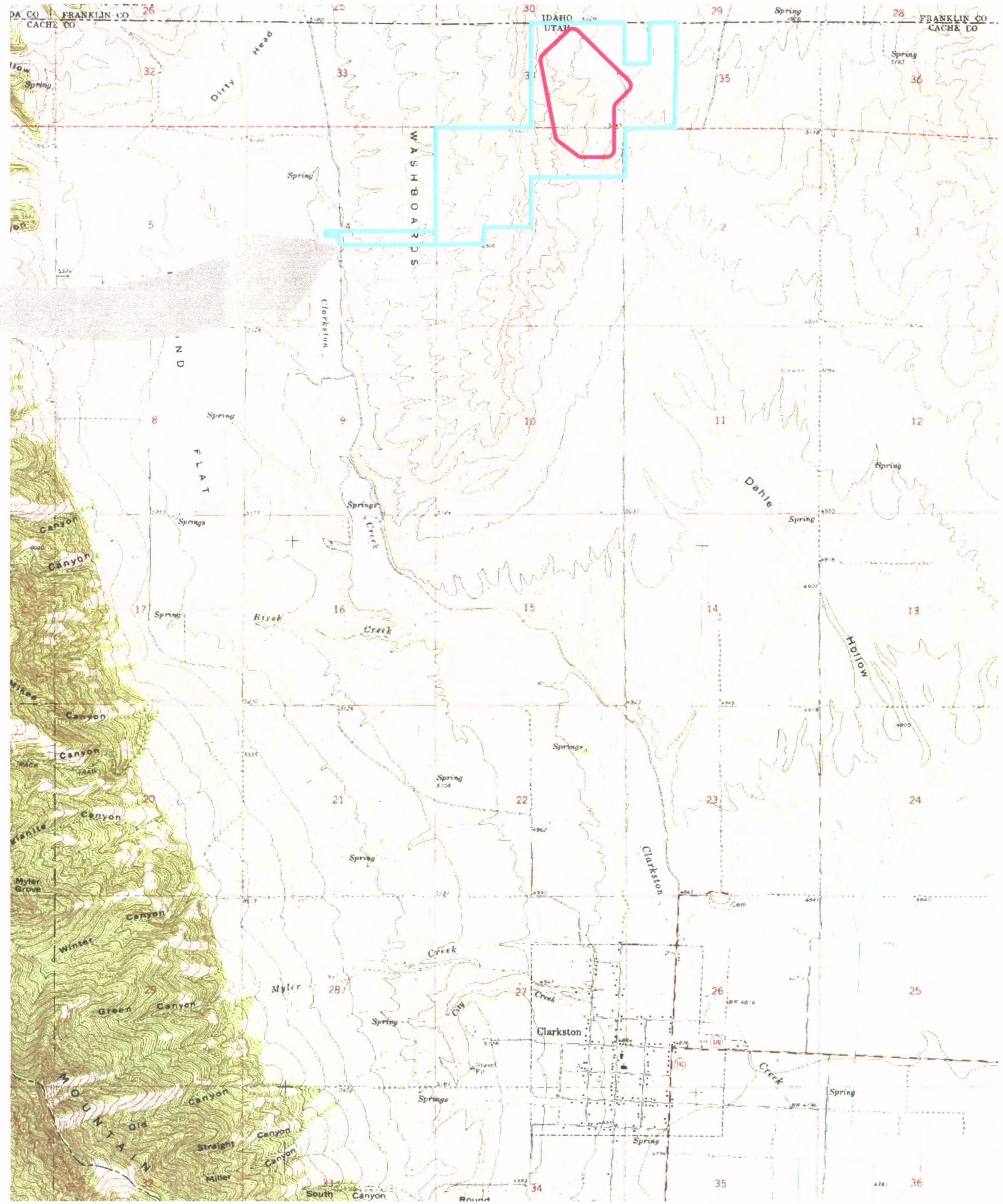
If you have any questions about the proposed landfill project, would like to discuss the project further, or disagree with our assessment, please call me at your earliest convenience.

Respectfully submitted,

Issa A Hamud, P.E.
City of Logan
Environmental Director

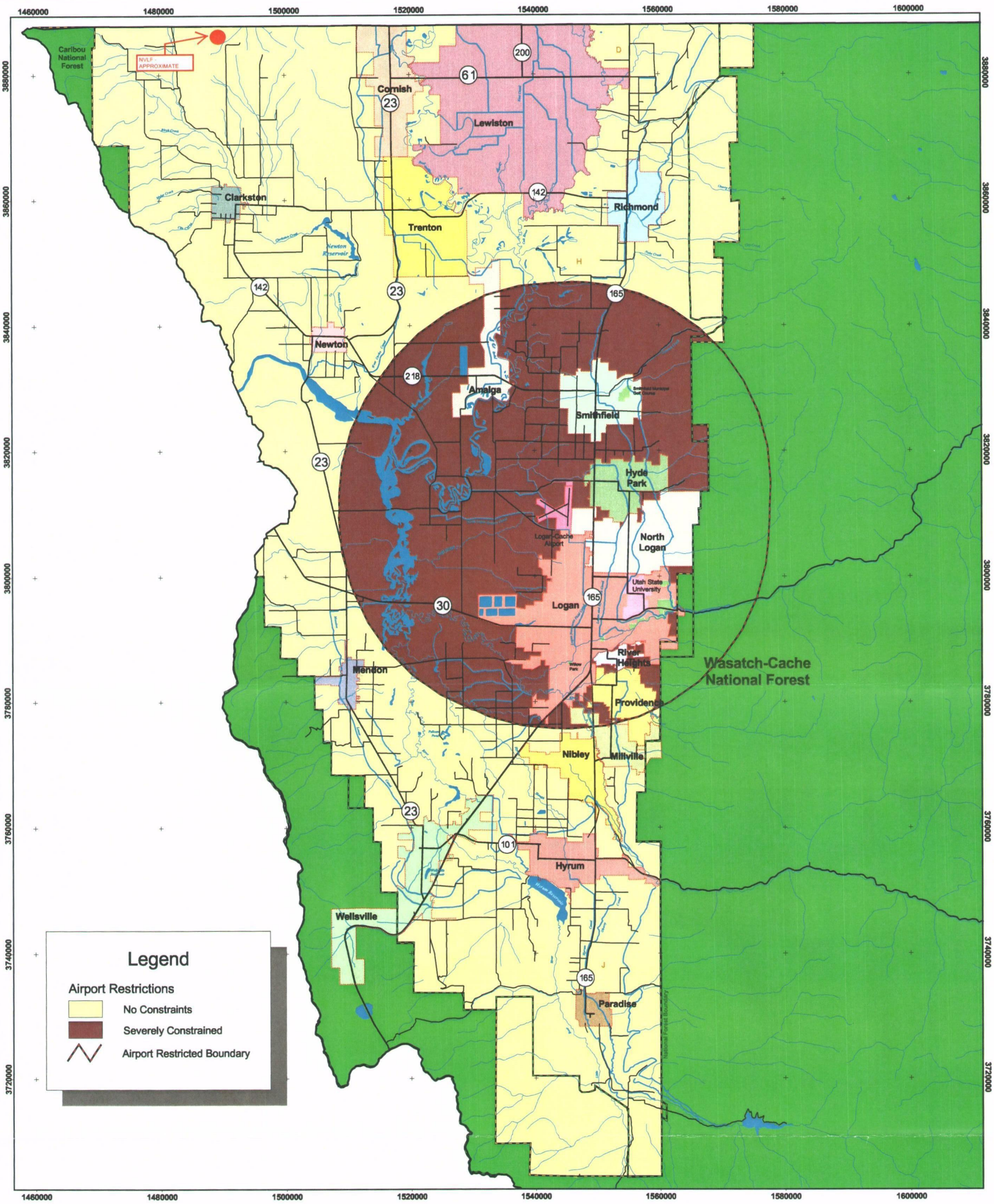


SITE LOCATION MAP



SITE VICINITY MAP

Figure
1



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Cache County Landfill Siting Study Airport Restrictions

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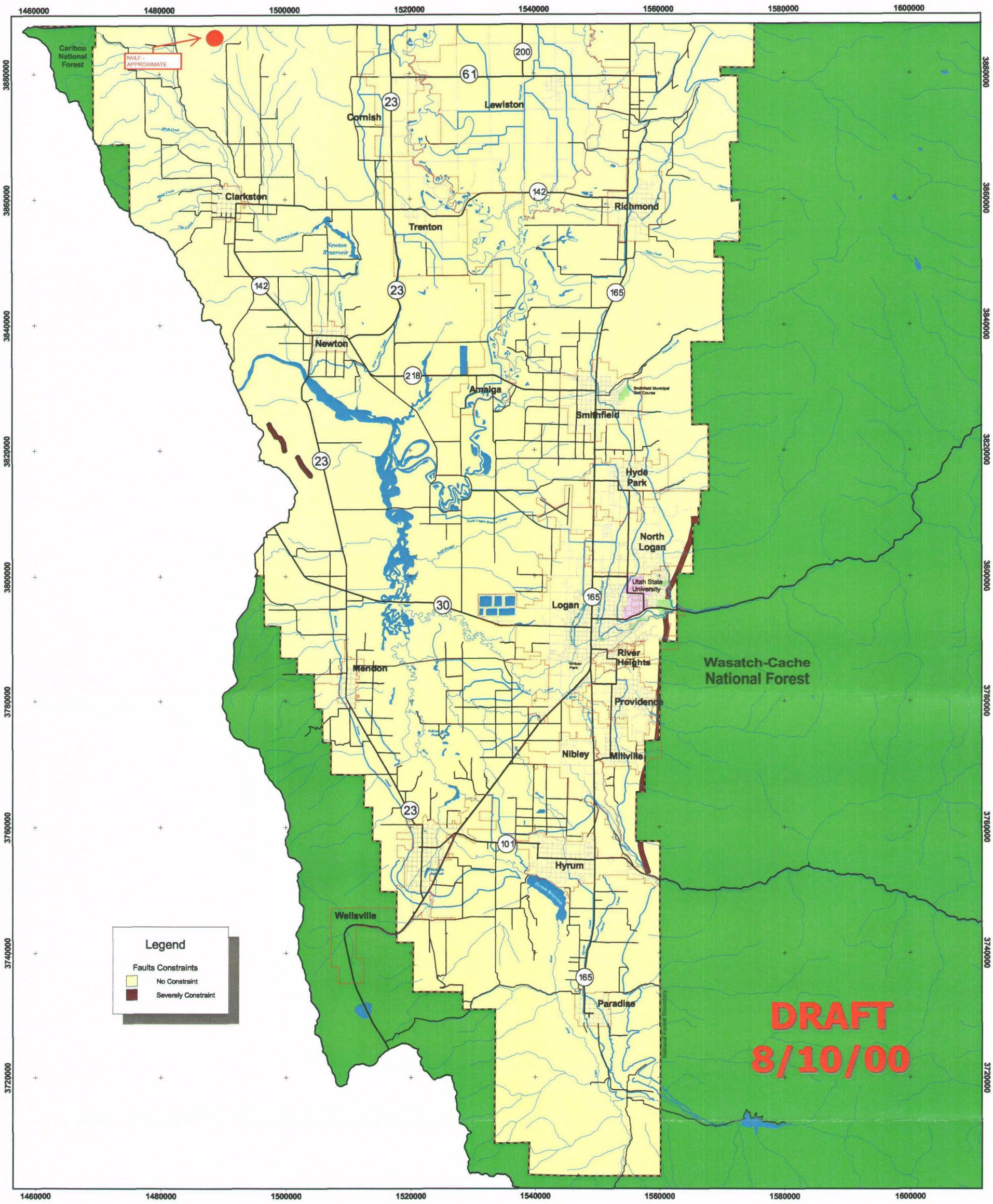

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Cache County Landfill Siting Study Faults

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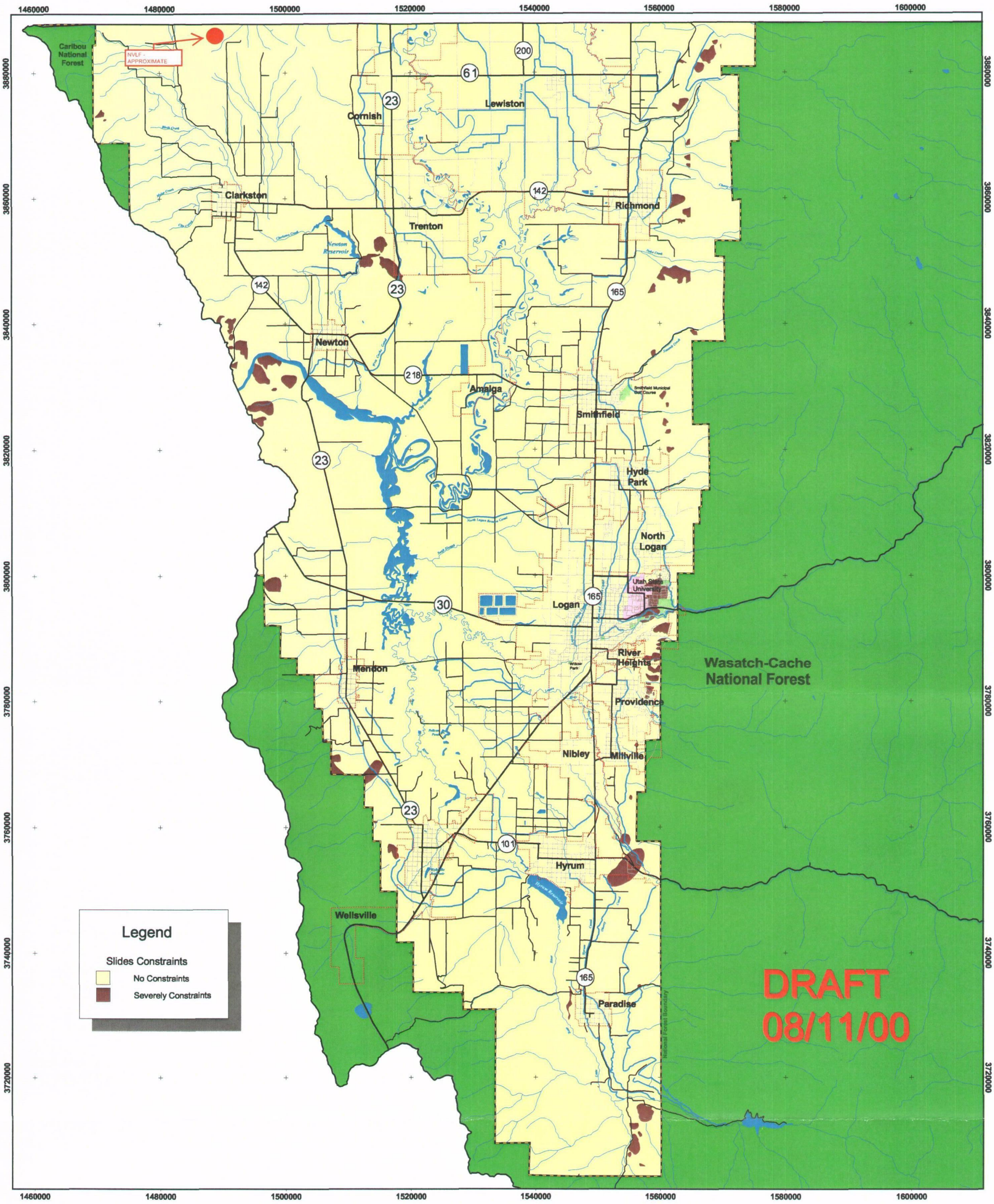

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Cache County Landfill Siting Study Landslides

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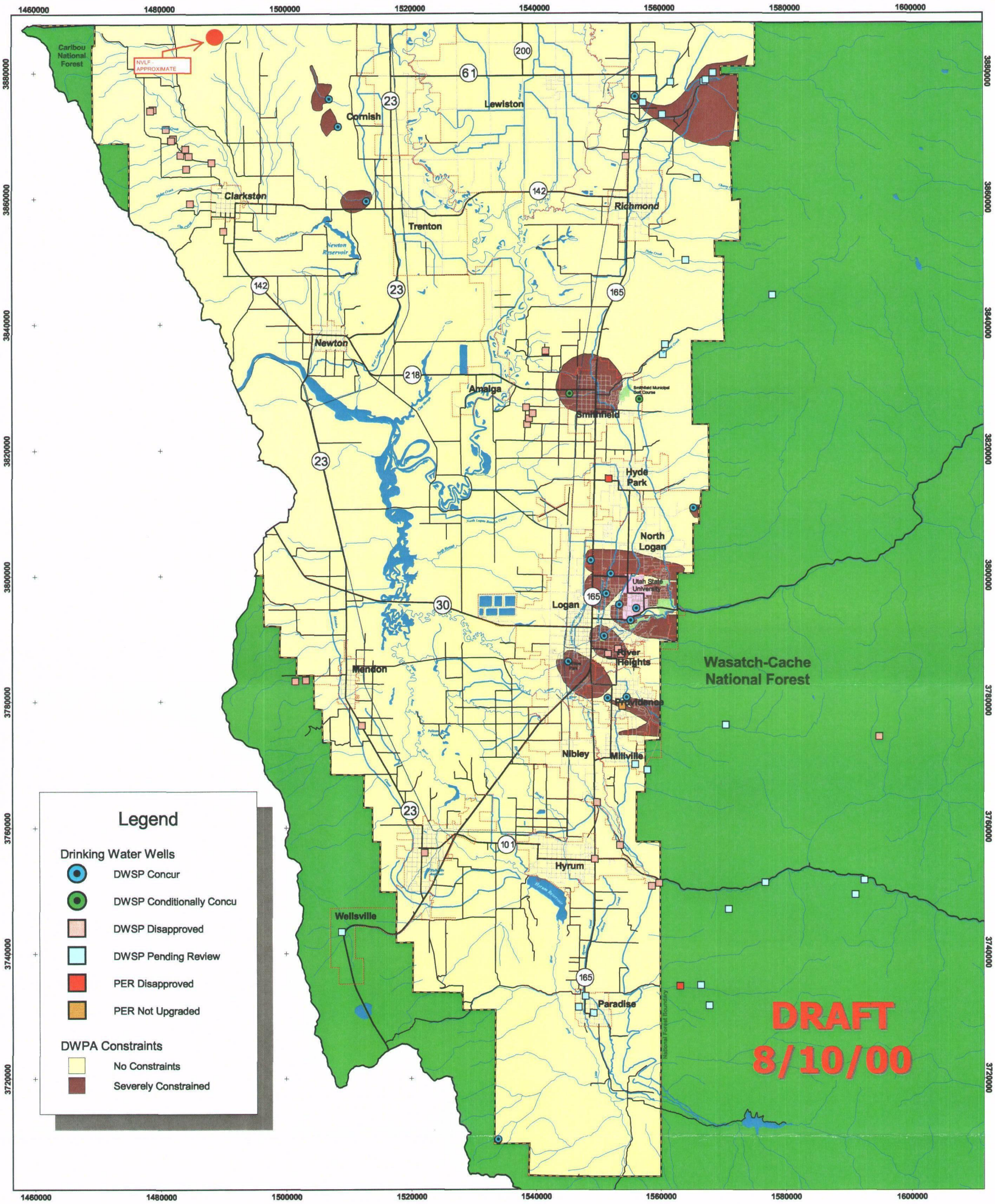

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Cache County Landfill Siting Study Drinking Water Protection Areas

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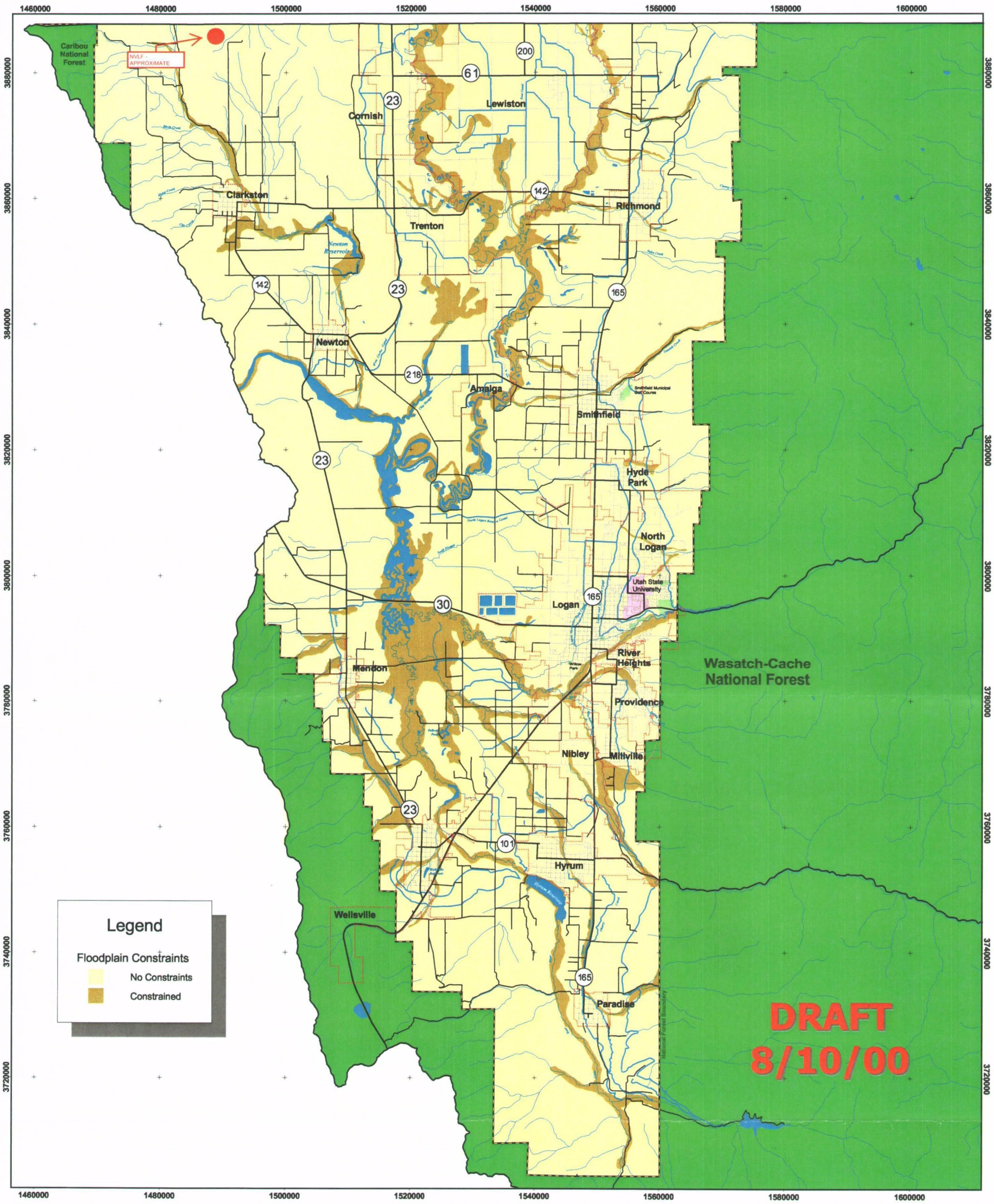

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Cache County Landfill Siting Study Floodplains

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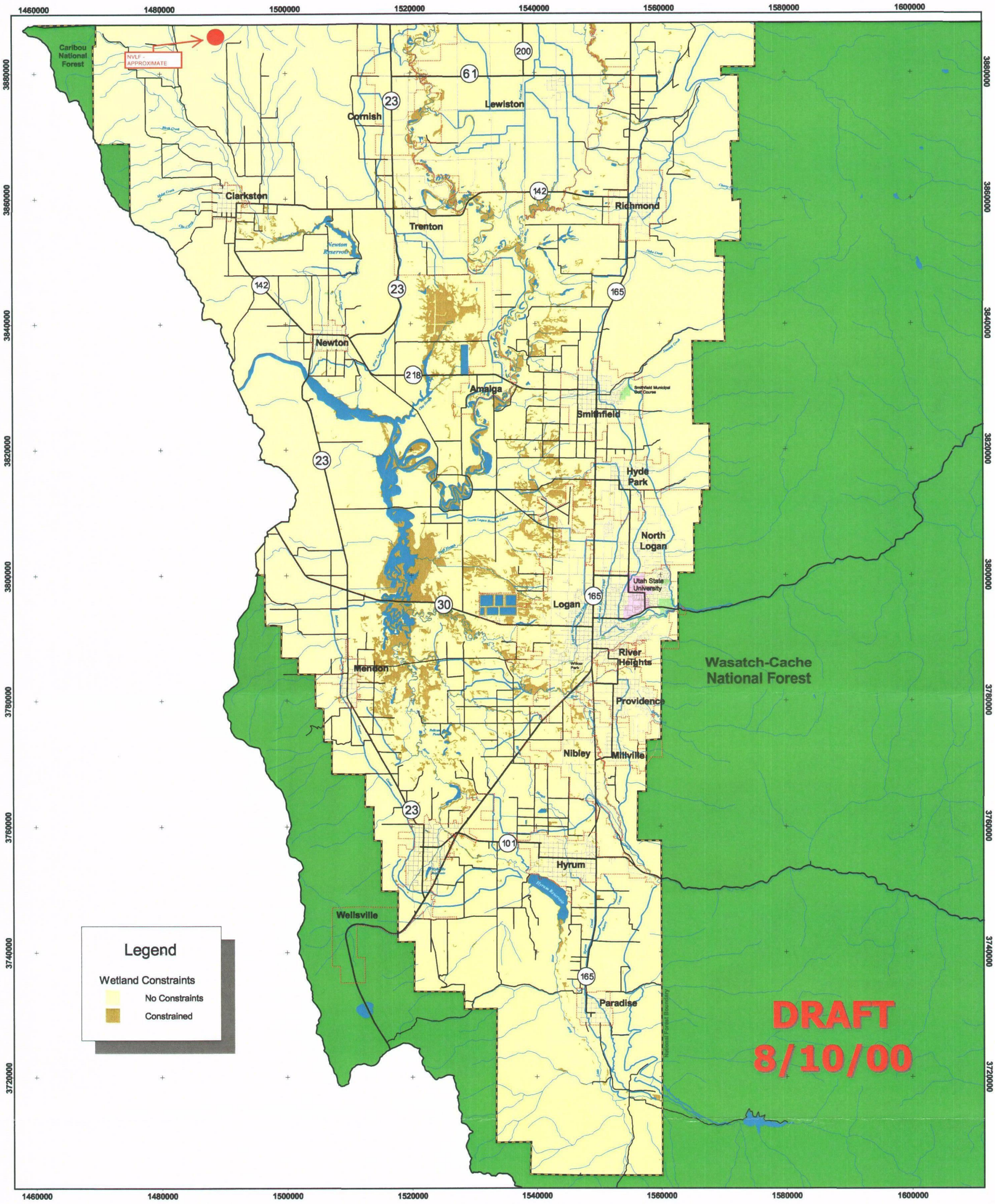

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Cache County Landfill Siting Study Wetlands

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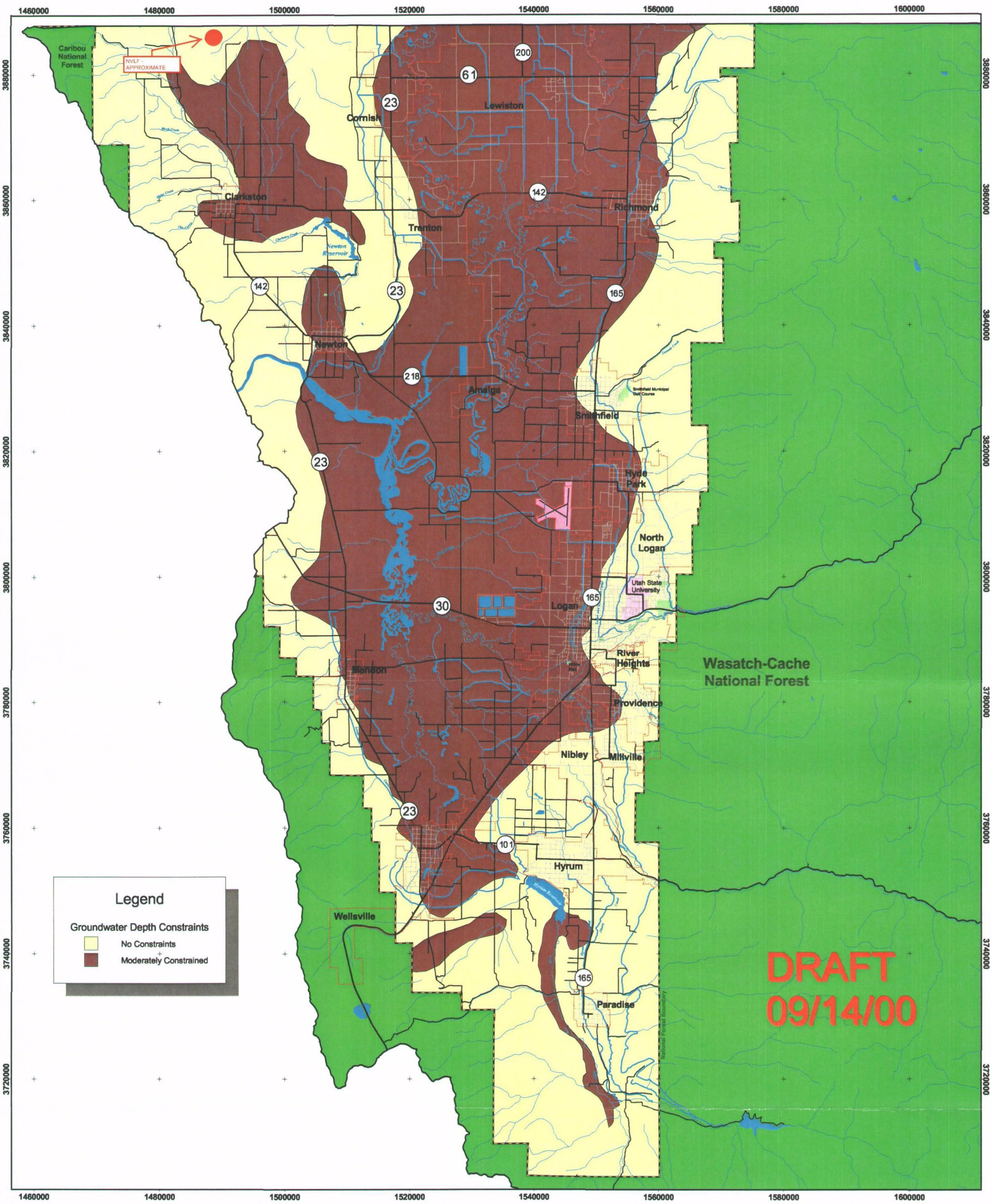

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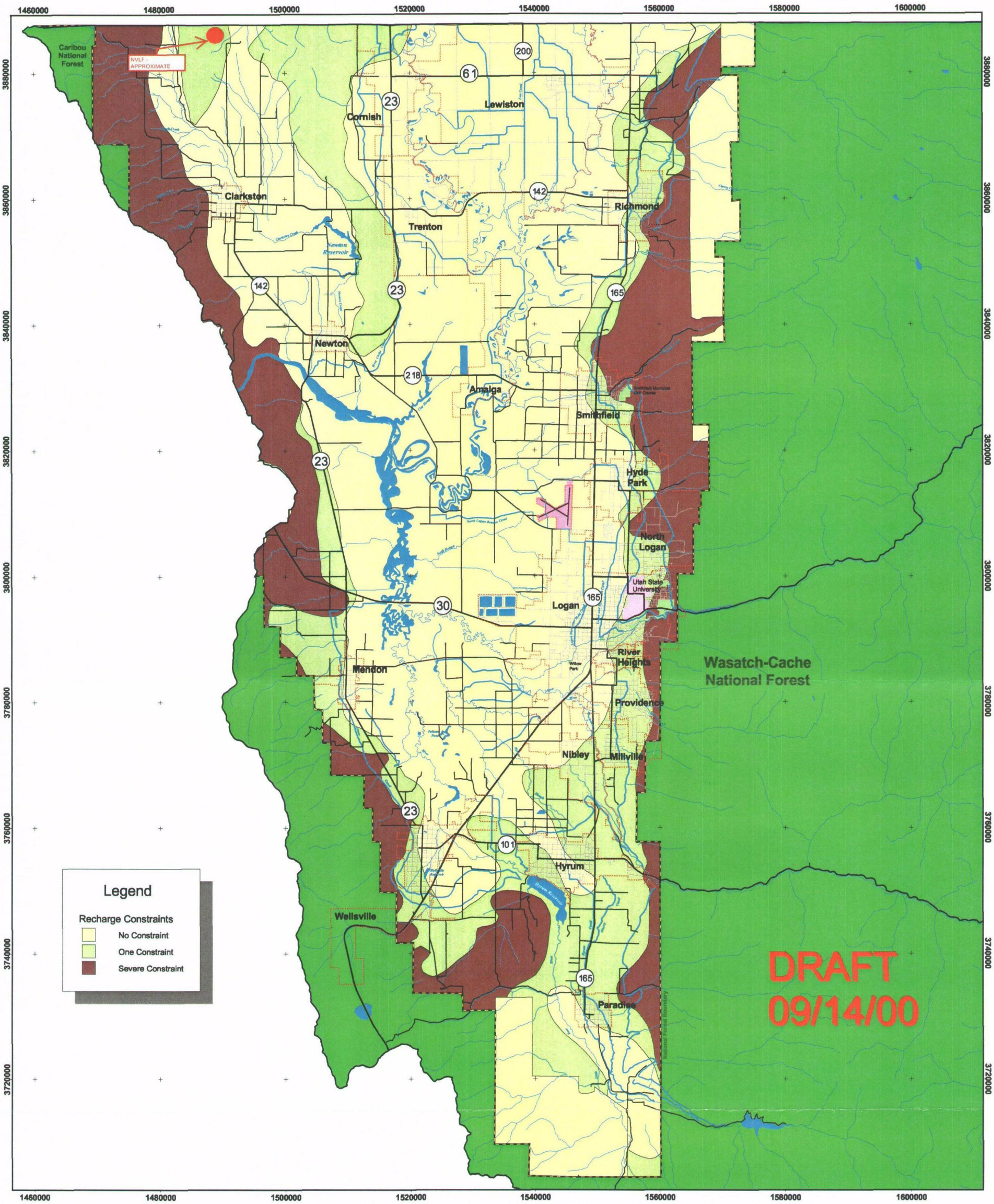
Cache County Landfill Siting Study Groundwater Depth

LCLS.APR, Size E - Groundwater, 9/14/00, 12:55



0 2 4 6 Miles

Cache County Landfill Siting Study Groundwater Recharge Areas

LCLS.APR, Size E - Recharge, 09/14/00, 2:24

Appendix L

utah.gov | Online Services | Agency List | Business

Search

Utah Division of Water Rights

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 01/12/2012

WATER RIGHT: 25-2792 APPLICATION/CLAIM NO.: U13330 CERT. NO.:

OWNERSHIP

NAME: City of Logan (Public Water Supplier)
ADDR: c/o City Engineer
290 North 100 West
Logan, UT 84321
INTEREST: 100% REMARKS:

DATES, ETC.

LAND OWNED BY APPLICANT? COUNTY TAX ID#:

FILED:	PRIORITY: 00/00/1929	PUB BEGAN:	PUB ENDED:	NEWSPAPER:	
ProtestEnd:	PROTESTED: [No]	HEARNG HLD:	SE ACTION: [ ]	ActionDate:	PROOF DUE:
EXTENSION:	ELEC/PROOF: [ ]	ELEC/PROOF:	CERT/NUC:	LAP, ETC:	LAPS LETTER:
RUSH LETTR:	RENOVATE:	RECON REQ:	TYPE: [ ]		
PD BOOK: [25-5]	MAP: [sd]	PUB DATE:			

*TYPE -- DOCUMENT -- STATUS

Type of Right: Underground Water Claim Source of Info: Proposed Determination Status:

LOCATION OF WATER RIGHT*** [Points of Diversion: Click on Location to access PLAT Program.]*********MAP VIEWER***GOOGLE VIEW*

FLOW: 0.003 cfs SOURCE: Underground Water Well
COUNTY: Cache COMMON DESCRIPTION:

POINT OF DIVERSION -- UNDERGROUND: [Click Well ID# link for more well data.]
(1) N 1644 ft E 1320 ft from SW cor, Sec 35, T 15N, R 2W, SLBM
DIAMETER OF WELL: ins. DEPTH: to ft. YEAR DRILLED: WELL LOG? No WELL ID#:

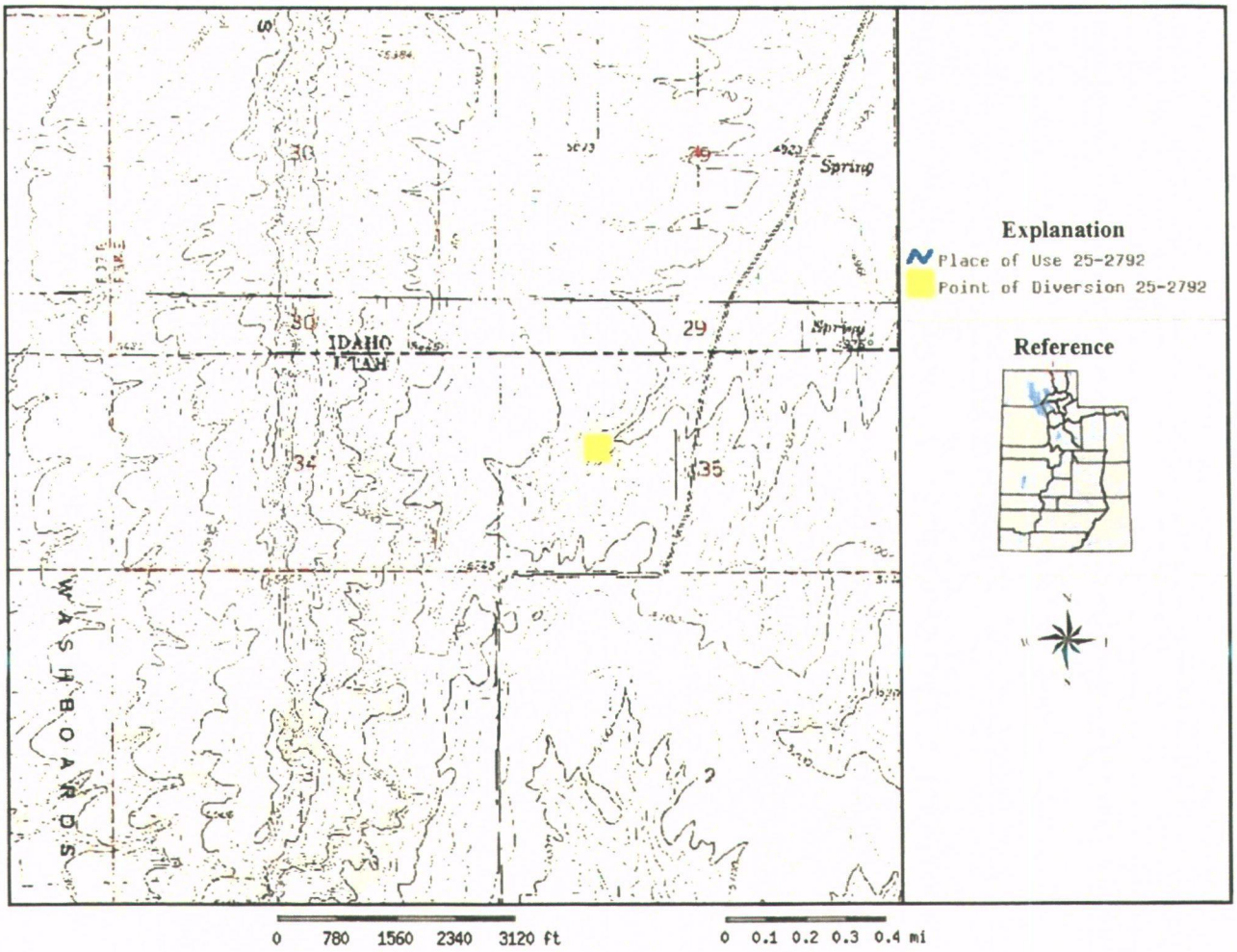
USES OF WATER RIGHT******** ELU -- Equivalent Livestock Unit (cow, horse, etc.) ******** EDU -- Equivalent Domestic Unit or 1 Family

SUPPLEMENTAL GROUP NO.: 19196.

STOCKWATER: 55.0000 Stock Units Div Limit: PERIOD OF USE: 01/01 TO 12/31

**********END OF DATA**********

Utah Division of Water Rights



IGES
Intermountain GeoEnvironmental Services, Inc
4153 South Commerce Drive - Salt Lake City, Utah 84107 - T (801) 270-9400 - F (801) 270-9401

July 29, 2011

State of Idaho
Source Water Program Coordinator
Ms. Amy Williams
DEQ State Office
Water Quality Division
1410 N. Hilton
Boise, ID 83706

RE: City of Weston Drinking Water Source

Dear Ms. Williams,

IGES, Inc is a consulting engineering firm researching the drinking water sources in the area near the City of Weston, Idaho. We have perused the State of Idaho website, in particular the "Source Water Assessments in Idaho" page in an effort to identify drinking water sources near the City of Weston. We did download the "City of Weston (PSW 6210019) Source Water Assessment Final Report" dated February 21, 2003.

Is the City of Weston Source Water Assessment finalized in 2003 for the most current state document that summarizes the drinking water sources for Weston or has this document been updated? Also, is there any other data on drinking water sources near Weston that exist separately from the 2003 assessment?

Thank you in advance for your time and my complements to the State of Idaho for a very useful Department of Environmental Quality website. If you have any questions, please call at your earliest convenience.

Respectfully submitted,

Brett Mickelson

Brett Mickelson, P.E.
Principal

Cc: Issa Hamud, P.E., Logan City

CITY OF WESTON (PWS 6210019)
SOURCE WATER ASSESSMENT FINAL REPORT

February 21, 2003

State of Idaho
Department of Environmental Quality

Disclaimer: This publication has been developed as part of an informational service for the source water assessments of public water systems in Idaho and is based on data available at the time and the professional judgement of the staff. Although reasonable efforts have been made to present accurate information, no guarantees, including expressed or implied warranties of any kind, are made with respect to this publication by the State of Idaho or any of its agencies, employees, or agents, who also assume no legal responsibility for the accuracy of presentations, comments, or other information in this publication. The assessment is subject to modification if new data is produced.

Executive Summary

Under the Safe Drinking Water Act Amendments of 1996, all states are required by the U.S. Environmental Protection Agency (EPA) to assess every source of public drinking water for its relative sensitivity to contaminants regulated by the act. This assessment is based on a land use inventory of the designated assessment areas and sensitivity factors associated with the wells, the springs, and the aquifer characteristics.

This report, *Source Water Assessment for the City of Weston, Idaho*, describes the public water system (PWS), the boundaries of the zones of water contribution, and the associated potential contaminant sources located within these boundaries. This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. **The results should not be used as an absolute measure of risk and they should not be used to undermine public confidence in the water system.**

The City of Weston PWS (# 6210019) is a community drinking water system located in Franklin County. The water system includes two wells and two springs. Both wells are located in a field of hay and weeds near Weston Creek in Weston Canyon approximately four miles west of the City of Weston. Well #1 is a backup well, constructed in 1988 and produces approximately 90 gallons per minute (gpm) of water. Well #2 is the main well for the system and is located approximately 110 yards west of Well #1. It was also constructed in 1988 and produces 200 gpm of water. The springs of the system are approximately 175 feet apart and are located next to Weston Creek. Spring #1 produces 100 gpm and Spring #2 produces 125 gpm. The water from the wells and the springs are stored in two buried, concrete reservoirs located about two miles west of Weston. This water is treated manually by adding 2 gallons (12%) of sodium hypochlorite to the reservoirs once a month. The water system for the City of Weston serves approximately 390 persons through 134 connections.

The potential contaminant sources within the delineation capture zones of the wells and the springs include the field in which the wells are located, a dairy, Weston Creek, Weston Canyon Road (Highway 36), an unimproved road, and livestock near the wells. If an accidental spill occurred on the highway or on the unimproved road or into the creek, inorganic chemical (IOC) contaminants, volatile organic chemical (VOC) contaminants, synthetic organic chemical (SOC) contaminants, or microbial contaminants could be added to the aquifer systems. Depending on the chemicals used in and on the hay grown in the field, IOCs, VOCs, SOCs, and microbial contaminants could leach down into the aquifer systems, contaminating the drinking water of the wells. Livestock and the dairy can add IOCs and microbial contaminants to the aquifer. These potential contaminant sources identified within the delineated areas of the Weston wells and springs may contribute to the overall vulnerability of the water sources.

Final spring susceptibility scores are derived from heavily weighted potential contaminant inventory/land use scores and adding them with system construction scores. Final well susceptibility scores are derived similarly from equally weighted potential contaminant inventory/land use scores and adding them with the hydrologic sensitivity of the well area as well as with the system construction scores. Therefore, a low rating in one category coupled with a higher rating in another category results in a final rating of low, moderate, or high susceptibility. Potential contaminants are divided into four categories: IOCs (i.e., nitrates, arsenic), VOCs (i.e., petroleum products), SOCs (i.e., pesticides), and microbial contaminants (i.e., bacteria). As a spring or a well can be subject to various contamination settings, separate scores are given for each type of contaminant.

For the assessment, a review of laboratory tests was conducted using the State Drinking Water Information System (SDWIS). The last detection of total coliform bacteria in the distribution system was recorded in August 1998. However, no bacteria have been detected at either the wells or springs. No SOCs or VOCs have been detected in the City of Weston water. The IOCs barium, nitrate, selenium, and fluoride have been detected at the sample location for the springs and wells, but were at concentrations below the maximum contaminant level (MCL) for each chemical, as established by the EPA.

Nitrate was detected at the sample location for the springs and wells in November 1997 at 6 milligrams per liter (mg/L), a level greater than half the MCL of 10 mg/L. However, the average nitrate level from 1988 to 2002 is 2.65 mg/L, with the most recent nitrate level (October 2002) being at 1.8 mg/L.

To determine if the City of Weston springs are influenced by surface water, two Microscopic Particulate Analyses (MPAs) are conducted. One MPA was completed in October 2001 during a low water table period. The relative risk rating of this test was zero, indicating that the springs are not influenced by surface water during a low water table period. A second MPA needs to be completed during a period of high water table. If the relative risk rating of the second test also is zero, then the springs are not influenced by surface water.

In terms of total susceptibility, the springs and the wells rated automatically high for IOCs, VOCs, SOCs, and microbial contaminants. Weston Creek flows within 100 feet of both springs, resulting in an automatic high susceptibility to contaminants. The wells are located in a hay field that may be irrigated and sprayed with pesticides or herbicides, contributing to the vulnerability of the wells to contamination and ultimately to the high susceptibility scores. Hydrologic sensitivity and system construction scores for the wells were rated moderate. System construction for the springs was also moderate. Potential contaminant land use scores for all of the drinking water sources rated high for VOCs and SOCs. The potential contaminant land use score for IOCs was high for the wells and springs. The potential contaminant land use score for microbial contaminants was low for Well #1, and moderate for Well #2 and the springs. The high SOC and VOC scores of the wells can be reduced to moderate scores if no chemicals are used on the hay field or the area within 50 feet of the wellheads is fenced. Also, the land where the wells reside is not owned by the City of Weston. The City may want to look into purchasing the land for the wells. Likewise, the high scores of the springs can be reduced to moderate susceptibility if the springs are reconstructed in such a way as to fully protect the sources from the influences of Weston Creek or if the creek is diverted to more than 100 feet from the springs.

This assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what ranking a source receives, protection is always important. Whether the source is currently located in a "pristine" area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources. If the system should need to expand in the future, new well or spring sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

An effective drinking water protection program is tailored to the particular local drinking water protection area. A community with a fully developed drinking water protection program will incorporate many strategies. For the City of Weston, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey (an inspection conducted every five years with the purpose of determining the physical condition of a water system's components and its capacity). The system should assure that no chemicals are used on the field where the wells are located. Additionally, the wells should be protected from access or flooding by installing a fence at least 50 feet from the wellheads to establish the perimeter of the well lot or placing a wellhouse over the wells. The springs should be fenced, establishing a radius of at least 100 feet from the spring sources and they should be properly protected from surface flooding from the creek. As land uses within most of the source water assessment areas are outside the direct jurisdiction of the City of Weston, collaboration and partnerships with state and local agencies and industry groups should be established and are critical to success. Educating city employees and the public about source water will further assist the system in its monitoring and protection efforts.

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan. Public education topics could include household hazardous waste disposal methods and the importance of water conservation. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Franklin County Soil Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (e.g. zoning, permitting) or non-regulatory in nature (i.e. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Pocatello Regional Office of the Idaho Department of Environmental Quality or the Idaho Rural Water Association.

SOURCE WATER ASSESSMENT FOR CITY OF WESTON, IDAHO

Section 1. Introduction - Basis for Assessment

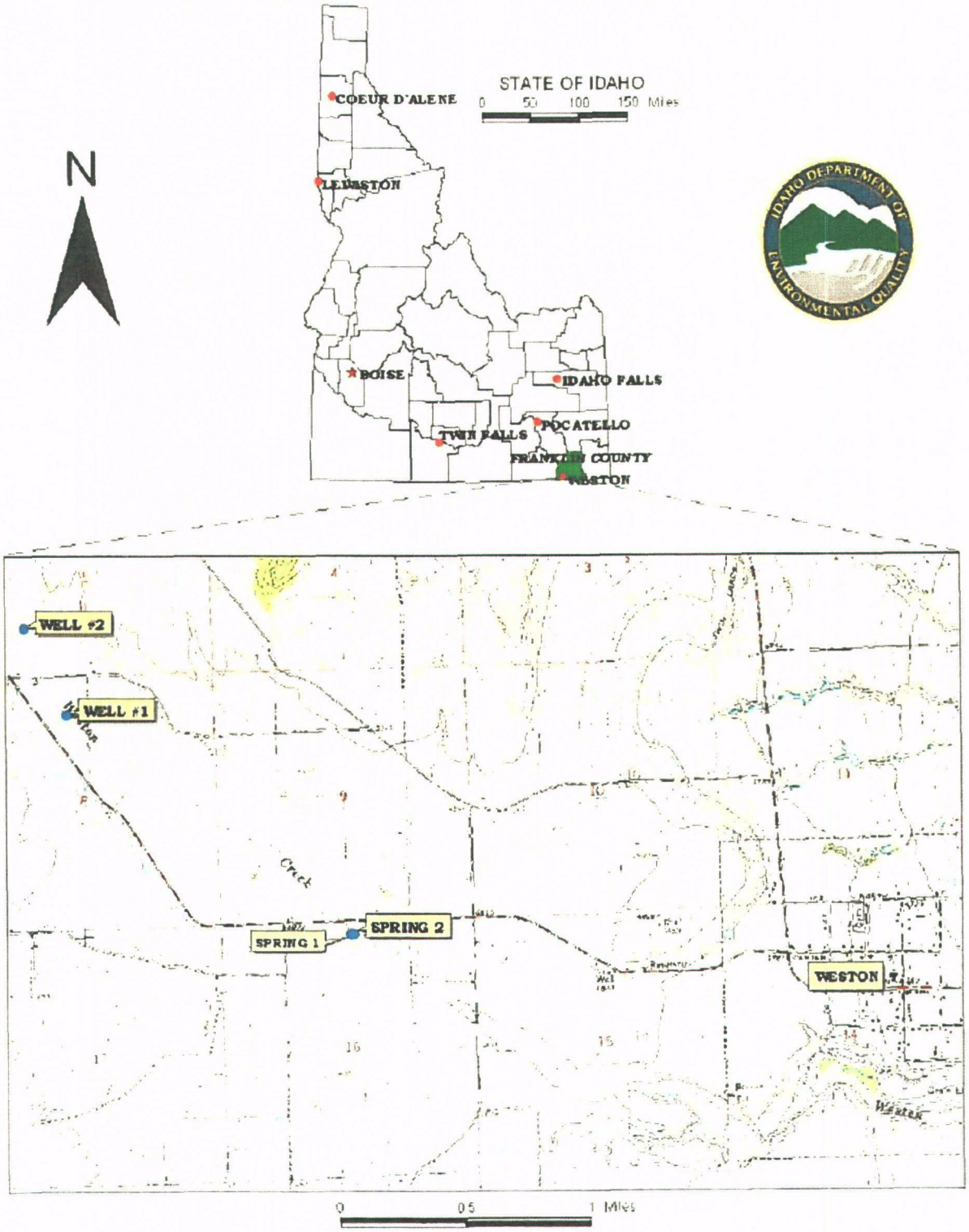
The following sections contain information necessary to understand how and why this assessment was conducted. **It is important to review this information to understand what the ranking of this assessment means.** Maps showing the delineated source water assessment area and the inventory of significant potential sources of contamination identified within that area are included. The list of significant potential contaminant source categories and their rankings used to develop the assessment also is included.

Level of Accuracy and Purpose of the Assessment

The Idaho Department of Environmental Quality (DEQ) is required by the U.S. Environmental Protection Agency (EPA) to assess over 2,900 public drinking water sources in Idaho for their relative susceptibility to contaminants regulated by the Safe Drinking Water Act. This assessment is based on a land use inventory of the delineated assessment area, sensitivity factors associated with the wells, the springs, and aquifer characteristics. All assessments must be completed by May of 2003. The resources and time available to accomplish assessments are limited. Therefore, an in-depth, site-specific investigation to identify each significant potential source of contamination for every public water supply system is not possible. **This assessment should be used as a planning tool, taken into account with local knowledge and concerns, to develop and implement appropriate protection measures for this source. The results should not be used as an absolute measure of risk and they should not be used to undermine pubhc confidence in the public water system (PWS).**

The ultimate goal of the assessment is to provide data to local communities to develop a protection strategy for their drinking water supply system. DEQ recognizes that pollution prevention activities generally require less time and money to implement than treatment of a public water supply system once it has been contaminated. DEQ encourages communities to balance resource protection with economic growth and development. The decision as to the amount and types of information necessary to develop a drinking water protection program should be determined by the local community based on its own needs and limitations. Wellhead or drinking water protection is one facet of a comprehensive growth plan, and it can complement ongoing local planning efforts.

FIGURE 1. Geographic Location of City of Weston



Section 2. Conducting the Assessment

General Description of the Source Water Quality

The City of Weston PWS (# 6210019) is a community drinking water system located in Franklin County (Figure 1). The water system includes two wells and two springs. Both wells are located in a field of hay and weeds near Weston Creek in Weston Canyon approximately four miles west of the town of Weston. Well #1 is a backup well, constructed in 1988 and produces approximately 90 gallons per minute (gpm) of water. Well #2 is the main well of the system is located approximately 110 yards west of Well #1. It was also constructed in 1988 and produces 200 gpm of water. The springs for the PWS are approximately 175 feet apart and are located next to Weston Creek. Spring #1 produces 100 gpm and Spring #2 produces 125 gpm. The water from the wells and the springs are stored in two buried, concrete reservoirs located about two miles west of Weston. This water is treated manually by adding 2 gallons (12%) of sodium hypochlorite to the reservoirs once a month. The water system for the City of Weston serves approximately 390 persons through 134 connections.

The last detection of total coliform bacteria in the distribution system was recorded in August 1998. However, no bacteria have been detected at either well or either spring. No synthetic organic chemicals (SOCs) or volatile organic chemicals (VOCs) have been detected in the Weston City water. The inorganic chemicals (IOCs) barium, nitrate, selenium, and fluoride have been detected in the spring and well water but at concentrations below the maximum contaminant level (MCL) for each chemical, as established by the EPA.

Nitrate was detected at the springs and the wells in November 1997 at 6 milligrams per liter (mg/L), a level greater than half the MCL of 10 mg/L. However, the average nitrate level from 1988 to 2002 is 2.65 mg/L, with the most recent nitrate level (October 2002) being at 1.8 mg/L.

To determine if the City of Weston springs are influenced by surface water, two Microscopic Particulate Analyses (MPAs) are conducted. One MPA was completed in October 2001 during a low water table period. The relative risk rating of this test was zero, indicating that the springs are not influenced by surface water during a low water table period. A second MPA needs to be completed during a period of high water table. If the relative risk rating of the second test also is zero, then the springs are not influenced by surface water.

Defining the Zones of Contribution – Delineation

The delineation process establishes the physical area around a spring or well that will become the focal point of the assessment. The process includes mapping the boundaries of the zone of contribution into time-of-travel (TOT) zones (zones indicating the number of years necessary for a particle of water to reach a flowing spring) for water in the aquifer. Washington Group International (WGI) was contracted by DEQ to define the PWS's zones of contribution. WGI used a refined method approved by the Source Water Assessment Plan (DEQ, 1999) in determining the 3-year (Zone 1B), 6-year (Zone 2), and 10-year (Zone 3) TOT zones for water associated with the "None" hydrologic province and the "Cache Valley" hydrologic province in the vicinity of the City of Weston. The springs are in the "None" hydrologic province and the wells are in the "Cache Valley" hydrologic province. The computer model used site specific data, assimilated by WGI from a variety of sources including operator records and hydrogeologic reports. A summary of the hydrogeologic information from the WGI is provided below.

"Cache Valley" Hydrogeologic Conceptual Model

The Bear River Basin includes four hydrologic provinces within Idaho: Bear River – Dingle Swamp, Soda Springs, Gem Valley – Gentile Valley, and Cache Valley. The Bear River originates in the Uinta Mountains of northern Utah and winds its way through over 500 miles of Wyoming, Idaho, and Utah to terminate in a freshwater bay of the Great Salt Lake just 90 miles west of its source (Dion, 1969, p. 6). The Bear River enters Idaho near Border, Wyoming and flows along the north edge of the Bear River Plateau. Flowing north through the Bear River – Dingle Swamp hydrologic province, it passes into the Soda Springs hydrologic province east of the Bear River Range. Upon entering the Gem Valley –Gentile Valley hydrologic province, it swings south. Now west of the Bear River Range, the river passes through the Oneida Narrows into the Cache Valley hydrologic province. Over most of its course through Idaho, the Bear River is gaining and in direct hydraulic communication with the major aquifer systems of the four hydrologic provinces. The exception is a small reach between the cities of Alexander and Grace where it is generally losing and is perched over the regional fractured basalt aquifer (Dion, 1969, p. 30).

Ground water in the Bear River Basin is found in Holocene alluvium, Pleistocene basalt, and rocks of the "Pliocene (?)" [sic] Salt Lake Formation, pre-Tertiary undifferentiated bedrock, and possibly the "Eocene (?)" [sic] Wasatch Formation (Dion, 1969, pp. 15 and 16). Rocks of the Salt Lake Formation, which include freshwater limestone, tuffaceous sandstone, rhyolite tuff and poorly-consolidated conglomerate, outcrop along the major valley margins and may underlie the valley-fill alluvium (Dion, 1969, pp. 16 and 17). Many of the wells drilled into this formation do not yield water. The few wells that do produce water yield as much as 1,800 gpm from beds of sandstone and conglomerate.

The Wasatch Formation is restricted to the Bear Lake Plateau and small areas northwest of Bear Lake (Dion, 1969, p. 17 and Figure 6). The formation is composed largely of tightly cemented conglomerate and sandstone with smaller amounts of shale, limestone, and tuff. The primary pore space is typically impermeable. Water movement may occur through joints and fractures or more permeable zones that are thought to exist along the relatively flat-lying formation (Dion, 1969, p. 17). Springs occur at the margins of the formation.

Precipitation in the basin ranges from 10 inches per year (in./yr.) on the floor of Bear Lake Valley to over 45 in./yr. on the Bear River Range (Dion, 1969, pp. VII and 11). Applied over the entire basin, precipitation amounts to approximately 2.3 million acre-feet annually. Precipitation is also the principal source of recharge to the basin's aquifers in conjunction with spring snowmelt and runoff, irrigation seepage, and canal losses.

Natural ground water discharge is by flow to the Bear River, springs, seeps along riverbanks, and evapotranspiration in large marshy areas (Dion, 1969, p. VIII). Some discharge may also occur by way of underflow to the Portneuf River drainage through basalt flows at Tenmile pass and near Soda Point.

Ground water is obtained from both springs and wells in the Bear River Basin. Hundreds of springs issue primarily from fractures and solution openings in the bedrock on the margins of the basin (Dion, 1969, p. 47). Water production from wells in the four hydrologic provinces is primarily from alluvial and basalt aquifers; however, some wells tap conglomerate, sandstone, limestone and shale aquifers of the Salt Lake and possibly the Wasatch formations (Dion, 1969, p. VII).

Cache Valley is a complex graben covering about 310 square miles in southeastern Idaho and 350 square miles in northeastern Utah. It was once a bay of ancient Lake Bonneville resulting in lake terraces along the margins of the valley (Dion, 1969, p. 7). The related topographic features and deposits of ancient lakes affect the occurrence and movement of ground water (Bjorklund and McGreevy, 1971, p. 14).

The valley floor consists of unconsolidated valley-fill sediments of Quaternary age from the former Lake Bonneville and older lakes and streams, as well as younger alluvium. The sediments consist of silts and gravel of the Alpine and Bonneville formations, overlain by interfingering beds of gravel, sand, silt, and clay. Alluvial fan and landslide deposits are exposed along the margins of the valley. There is a general coarsening of sediments from lower elevations in the center of the valley to the higher elevations at the valley margins (Johnson et al., 1996). The surrounding mountain ranges consist of highly faulted Tertiary Salt Lake and "Wasatch (?)" [sic] formation rocks and Permian through Precambrian rocks (Bjorklund and McGreevy, 1971, Plate 1).

The major aquifers are composed of sand and gravel in fans and deltas; interbedded layers of lake-bottom clays and silts confine the aquifers and cause artesian conditions throughout the valley (Bjorklund and McGreevy, 1971, p.14). Deltas and fans from streams entering the valley generally contain a high percentage of gravel and are considered good aquifers (Bjorklund and McGreevy, 1971, p.15). The exception is the Bear River delta, which is composed mostly of fine sand and silt, contains poor aquifers.

Aquifer recharge occurs mainly by infiltration of water from precipitation, streams, canals, ditches, and irrigated lands and by subsurface inflow. A large volume of recharge originates in the Bear River Range where 30 to 50 inches of precipitation fall in most years. Average annual precipitation on the valley floor is approximately 15.5 inches (Bjorklund and McGreevy, 1971, pp. 5 and 18). The principal recharge area is along the margins of the valley that are underlain by permeable unconsolidated materials (Bjorklund and McGreevy, 1971, p. 18). In the lower parts of the valley, some water is recharged to shallow unconfined aquifers, but infiltrated water does not reach the confined aquifers in Idaho because of the upward artesian gradient.

Ground water is discharged by springs, seeps, drains, evapotranspiration, and wells. Many streams in Cache Valley originate at springs and seeps within the valley, and other streams gain in flow as they traverse the valley floor. Potentiometric levels range in elevation from about 4,850 feet mean sea level (ft msl) near Oxford to about 4,500 feet near the Idaho-Utah border. Generally, the ground water flow direction is locally toward the Bear River and regionally south toward Utah. The Bear River in the Idaho part of Cache Valley is gaining (Bjorklund and McGreevy, 1971, p. 19).

Artesian conditions exist in a large part of the lower valley. Heads of most flowing wells are less than 40 feet above land surface, but heads as high as 62 feet above land surface have been measured (Bjorklund and McGreevy, 1971, p. 22). Water table conditions exist near the edge of the valley beneath alluvial slopes and benchlands. The depth to water is as much as 300 feet below ground surface (bgs) along the margin of the upper valley.

Most wells in the valley produce water from the unconsolidated basin deposits. Driller's logs indicate that the alluvium may contain several aquifers separated by silt and clay (Dion, 1969, p. 19). The most productive aquifer systems in the Idaho part of Cache Valley are in the area of Weston Creek and in fan deposits along the north and west sides of the valley. Aquifer tests near Weston indicate an average transmissivity of about 30,000 square feet per day (ft^2/day) (Bjorklund and McGreevy, 1971, p. 2). Transmissivity values of 5,000 and 40,000 ft^2/day were reported from two tests conducted north of Clifton, Idaho (Johnson et al., 1996, p. 21). For a computer-aided analysis of the resulting test data, the contact at the valley margin was conceptualized as a low- permeability boundary and simulated as a no-flow boundary (Johnson et al., 1996, p .11). All of the Cache Valley PWS wells addressed in this report are located within a couple of miles of the bedrock/valley-fill contact or other near-surface geologic contact.

"None" Hydrogeologic Conceptual Model

Graham and Campbell (1981) identified and described 70 regional ground water systems throughout Idaho. Thirty-four of these fall within the southeastern part of the state. The "None" hydrologic province, as defined in this report, includes all the area outside of the 34 regional systems in southeast Idaho. The smaller and more localized aquifers in the "None" province typically are situated in the foothills and mountains that surround and recharge the regional ground water systems.

The mountains and valleys within the "None" hydrologic province were formed during two events separated by approximately 50 to 70 million years (Alt and Hyndman, 1989, pp. 329 and 336). The overthrust belt of the northern Rocky Mountains was formed roughly 70 to 90 million years ago through the intrusion of granitic magma and a massive eastward movement of large slabs of layered sedimentary rocks along faults that dip shallowly westward (Alt and Hyndman, 1989, p. 329). This movement caused extreme folding and fracturing of the sedimentary and granitic rocks and, in many cases, left older formations lying on top of younger ones. Later Basin and Range block faulting broke up the largely eroded Rocky Mountains into large uplifted and downthrown blocks resulting in the present day northwest trending mountains and valleys seen throughout southeast Idaho. Paleozoic and Precambrian limestone, dolomite, sandstone, shale, siltstone, and quartzite are the predominant materials forming the mountains and probably compose the bedrock underlying the valleys between Salmon, Idaho on the north side of the Snake River Plain and Franklin, Idaho near the Utah/Idaho border (Dion, 1969, p.18; Kariya et al., 1994, p. 6; Bjorklund and McGreevy, 1971, p. 12; and Parliman, 1982, p. 9).

Ground water movement in the mountains is primarily through a system of solution channels, fractures and joints that commonly transmit water independently of surface topography (Bjorklund and McGreevy, 1971, p. 15; Dion, 1969, p. 18). Ralston and others (1979, pp. 128-129) state that the geologic structural features also can contribute to the development of cross-basin ground water flow systems. Ground water entering a geologic formation tends to follow the formation because hydraulic conductivities are greater parallel to the bedding planes than across them. Synclines and anticlines provide structural avenues for ground water flow under ridges from one valley to another.

The average annual precipitation in the mountains of southeast Idaho ranges from 20 inches on ridges near Soda Springs to over 45 inches on the Bear River Range (Ralston and Trihey, 1975, p. 7, and Dion, 1969, p. 11). The valleys receive an average of 7 to 10 inches annually (Donato, 1998, p. 3, and Dion, 1969, p. 11). Precipitation and seepage from streams are the primary source of recharge to the mountain aquifers (Kariya, et al., 1994, p. 18, and Parliman, 1982, p. 13).

Ground water discharge occurs as springs and seeps issuing from faults, fractures, and solution channels and as underflow to regional aquifers. The Bear River Basin in the far southeast corner of the state contains hundreds of springs issuing primarily from fractures and solution openings in the bedrock mountains (Dion, 1969, p. 47, and Bjorklund and McGreevy, 1971, pp. 34-35). Within Cache Valley many springs discharge from the valley-fill deposits (Kariya et al., 1994, p. 32).

There is little available information on the distribution of hydraulic head and the hydraulic properties of the aquifers in the "None" hydrologic province. No U.S. Geological Survey (2001) or Idaho Statewide Monitoring Network (Neely, 2001) wells are located in the areas of concern to provide information on ground water flow direction and hydraulic gradient or to aid in model calibration. The information that is available indicates that the hydraulic properties are quite variable, even within a specific rock type. Ralston and others (1979, p. 31), for example, present hydraulic conductivity estimates for fractured chert ranging from 2.2 to 75 feet per day (ft/day). Estimates for phosphatic shale are as low as 0.07 ft/day (unfractured) and as high as 25 ft/day (fractured).

Springs and Spring Delineation Methods

A spring is defined as a concentrated discharge of ground water appearing at the ground surface as flowing water (Todd, 1980). The discharge of a spring depends on the hydraulic conductivity of the aquifer, the area of contributing recharge to the aquifer, and the rate of aquifer recharge. PWS springs are generally perennial. Large seasonal changes in the discharge rates are an indication of a relatively shallow flow system. While most springs fluctuate in their rate of discharge, springs in volcanic rock (e.g., basalt) are noted for their nearly constant discharge (Todd, 1980).

Delineation of the drinking water protection area for a spring involves special consideration. Hydrogeologic setting is foremost among the factors that control the shape and extent of the capture zone. A spring resulting from the presence of a high permeability fracture extending to great depth will have a much different capture zone than a depression spring formed where the ground surface intersects the water table in a unconsolidated aquifer.

Refined Delineation Method

Capture zones for the City of Weston wells were delineated using the Cache 1 WhAEM ground water flow model. The method is based on well completion data, proximity of the well to the bedrock/valley-fill contact and/or faults, and knowledge of ground water flow direction based on water table contour maps ((Bjorklund and McGreevy, 1971, Plates I and 4, and Kariya et al., 1994, Plate 2). The Cache 1 model includes two wells located along Weston Creek where the flow direction and gradient are known, a number of test points wells are located, and aquifer homogeneity is a reasonably valid assumption.

To maintain conservatism in the delineation of capture zones for Weston, the pumping rate for Well #2 is half the average PWS water usage of 289,400 gallons per day (gal/day) because the springs are considered the primary PWS water source and are assumed to produce at least 50 percent of the water supply. Well #1 was treated as a backup well and pumped at the same rate as Well #2 in a separate simulation. The geometric mean of hydraulic conductivity estimates presented by Bjorklund and McGreevy (112 ft/day; 1971, Table 5) was used to simulate base case conditions. The effective porosity is 0.3, which is the default value presented in Table F-3 of the Idaho Wellhead Protection Plan for unconsolidated alluvium (IDEQ, 1997, p. F-6). Aquifer base elevation was set at 4,467 ft msl (approximately 31 feet below the Bear River stage near the Idaho-Utah Border). The aquifer thickness is the average perforated interval for the Weston wells (31 feet).

Areal recharge to the aquifer was set to zero, because precipitation does not recharge the confined aquifers due to the upward hydraulic gradient. Constant-head boundary conditions were used upgradient and downgradient of the PWS wells to establish the observed hydraulic gradient and flow direction. A constant-flux line sink backed by a no-flow boundary was used to simulate recharge along the valley margins. The placement of constant-head line sinks and assignment of head values was based on a published potentiometric surface map (Bjorklund and McGreevy, 1971, Plate 4) and adjusted during model calibration to obtain the best fit using the least squares method (Macneal, 1992, p. 175, and Rafai et al., 1998, p. 98.).

Previously constructed WhAEM ground water flow models were used to evaluate PWS springs producing water for the City of Weston. This approach assumes that the springs produce from the same aquifers that were simulated with Cache 1 model. Source areas for the Weston springs were delineated using the Cache 1 model, (WGI, 2002b). The springs were placed in the model at the appropriate locations and simulated as constant-rate pumping wells. Because of the location of the City of Weston springs adjacent to one of the original Cache 1 model boundaries, it was necessary to relocate the boundary and add two additional constant-head boundaries to maintain the proper hydraulic gradients. The model input remained consistent with the original model and calibration was performed by adjusting the head along the constant-head boundaries.

The delineated source water assessment areas for the City of Weston wells and springs can be described as northwest-trending corridors following Weston Creek and the Weston Canyon Road. The average total area is 5,053 acres for the City of Weston wells; the total area of the Weston spring #1 is 1,445 acres and the total area of the Weston spring #2 is approximately 1,990 acres (Figure 2, 3, 4, 5 in Appendix A). The actual data used by WGI in determining the source water assessment delineation areas is available from DEQ upon request.

Identifying Potential Sources of Contamination

A potential source of contamination is defined as any facility or activity that stores, uses, or produces, as a product or by-product, the contaminants regulated under the Safe Drinking Water Act. Furthermore, these sources have a sufficient likellhood of releasing such contaminants into the environment at levels that could pose a concern relative to drinking water sources. The goal of the inventory process is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of ground water contamination. Field surveys conducted by DEQ and reviews of available databases identified potential contaminant sources within the delineated areas.

It is important to understand that a release may never occur from a potential source of contamination provided they are using best management practices. Many potential sources of contamination are regulated at the federal level, state level, or both, to reduce the risk of release. Therefore, when a business, facility, or property is identified as a potential contaminant source, this should not be interpreted to mean that this business, facility, or property is in violation of any local, state, or federal environmental law or regulation. What it does mean is that the potential for contamination exists due to the nature of the business, industry, or operation. There are a number of methods that water systems can use to work cooperatively with potential sources of contamination, including educational visits and inspections of stored materials. Many owners of such facilities may not even be aware that they are located near a public water supply source.

Contaminant Source Inventory Process

A two-phased contaminant inventory of the study area was conducted in 2002. The first phase involved identifying and documenting potential contaminant sources within the City of Weston source water assessment area through the use of computer databases and Geographic Information System (GIS) maps developed by DEQ. The second, or enhanced, phase of the contaminant inventory involved contacting the operator to identify and add any additional potential contaminant sources in the delineated areas. The enhanced inventory was completed with the assistance of Mr. Rick Nielsen. The potential contaminants within the delineation areas of the springs and wells include a dairy, Weston Creek, Weston Canyon Road (Highway 36), and a dirt road. The potential contaminants for each source are listed in the Tables 2, 3, 4, and 5 in Appendix A. The 2001 sanitary survey indicates that the wells are located in a field of hay and weeds and livestock are near. Though these sources are not included in the tables in Appendix A, they were used to assess the susceptibility of the wells. Maps with the spring and well locations, delineated areas, and potential contaminant sources are provided with this report (Figure 2, Figure 3, Figure 4, and Figure 5 in Appendix A).

Section 3. Susceptibility Analyses

The springs' susceptibility to contamination were ranked as high, moderate, or low risk according to the following considerations: construction, land use characteristics, and potentially significant contaminant sources. Similarly, the wells' susceptibility to contamination were ranked as high, moderate, or low risk according to the following considerations: hydrologic sensitivity, system construction, land use characteristics, and potentially significant contaminant sources. The susceptibility rankings are specific to a particular potential contaminant or category of contaminants. Therefore, a high susceptibility rating relative to one potential contaminant does not mean that the water system is at the same risk for all other potential contaminants. The relative ranking that is derived for the springs or the wells is a qualitative, screening-level step that, in many cases, uses generalized assumptions and best professional judgement. Appendix B contains the susceptibility analysis worksheets. The following summaries describe the rationale for the susceptibility ranking.

Hydrologic Sensitivity

The hydrologic sensitivity of a well is dependent upon four factors. These factors are surface soil composition, the material in the vadose zone (between the land surface and the water table), the depth to first ground water, and the presence of a 50-foot thick fine-grained zone (aquitard) above the producing zone of the well. Slowly draining soils such as silt and clay have better filtration capabilities and therefore are typically more protective of ground water than coarse-grained soils such as sand and gravel. Similarly, fine-grained sediments in the subsurface and a water depth of more than 300 feet protect the ground water from contamination.

Hydrologic sensitivity was rated moderate for both wells (Table 1). This is based upon moderate to well drained soil classes as defined by the National Resource Conservation Service (NRCS). Well logs for both wells were unavailable, limiting the information concerning the composition of the vadose zone and the location of the producing zone of the wells. However, the 2001 sanitary survey indicates both wells penetrate about 130 feet of clay, suggesting the existence of an aquitard, a zone that may reduce the downward movement of contaminants to the aquifer.

Well Construction

Well construction directly affects the ability of the well to protect the aquifer from contaminants. System construction scores are reduced when information shows that potential contaminants will have a more difficult time reaching the intake of the well. Lower scores imply a system is less vulnerable to contamination. For example, if the well casing and annular seal both extend into a low permeability unit, then the possibility of contamination is reduced and the system construction score goes down. If the highest production interval is more than 100 feet below the water table, then the system is considered to have better buffering capacity. If the wellhead and surface seal are maintained to standards, as outlined in sanitary surveys, then contamination down the well bore is less likely. If the well is protected from surface flooding and is outside the 100-year floodplain, then contamination from surface events is reduced.

Both wells were drilled in 1988 in a hay field near Weston Creek in Weston Canyon. Both wells penetrate about 130 feet of clay and then about 30 feet of sand and gravel. Well #1 produces approximately 90 gpm and Well #2 produces about 200 gpm. The well logs were unavailable.

The system construction scores were rated as moderately susceptible for both wells (Table 1). Both wellheads are located outside of the 100-year floodplain and the 2001 sanitary survey (conducted by DEQ) indicates that the wellhead and surface seals are maintained and in good condition. The scores were increased because the well logs were unavailable, limiting the information concerning the construction of the wells and whether the wells met current construction standards.

The Idaho Department of Water Resources (IDWR) *Well Construction Standards Rules (1993)* require all PWSs to follow DEQ standards. IDAPA 58.01.08.550 requires that PWSs follow the *Recommended Standards for Water Works (1997)* during construction. Under current standards, all PWS wells are required to have a 50-foot buffer around the wellhead and if the well is designed to yield greater than 50 gpm a minimum of a 6-hour pump test is required. These standards are used to rate the system construction for the well by evaluating items such as condition of wellhead and surface seal, whether the casing and annular space is within consolidated material or 18 feet below the surface, the thickness of the casing, etc. If all criteria are not met, the public water source does not meet the IDWR Well Construction Standards. In this case, there was insufficient information available to determine if the wells meet all the criteria outlined in the IDWR Well Construction Standards.

Spring Construction

Spring construction scores are determined by evaluating whether the spring has been constructed according to Idaho Code (IDAPA 58.01.08.04) and if the spring's water is exposed to any potential contaminants from the time it exits the bedrock to when it enters the distribution system. If the spring's intake structure, infiltration gallery, and housing are located and constructed in such a manner as to be permanent and protect it from all potential contaminants, is contained within a fenced area of at least 100 feet in radius, and is protected from all surface water by diversions, berms, etc., then Idaho Code is being met and the score will be lower. If the spring's water comes in contact with the open atmosphere before it enters the distribution system, it receives a higher score. Likewise, if the spring's water is piped directly from the bedrock to the distribution system or is collected in a protected spring box without any contact to potential surface-related contaminants, the score is lower.

The springs are approximately 175 feet apart and are located next to Weston Creek. Water is collected by perforated collection pipes and discharged directly into the transmission line. A diversion ditch runs along the western side of the adjacent field to collect and carry off any surface runoff water. According to the 2001 sanitary survey (conducted by DEQ), roots could be seen growing into one of the collection boxes.

Both City of Weston springs rated moderately susceptible for system construction (Table 1). The intake structure (the perforated collection pipe) is properly constructed. However, according to a 1994 sanitary survey checklist, the spring areas are not fenced and roots were seen growing into one of the collection boxes, exposing the collected water to potential contaminants. Therefore, although the water is never exposed to the atmosphere, the springs are not constructed in such a way as to minimize the impacts of contamination.

Potential Contaminant Source and Land Use

The potential contaminant source and land use of the wells rated high susceptibility for IOCs (i.e., nitrates, arsenic), and moderate susceptibility for VOCs (i.e., petroleum products), SOCs (i.e., pesticides), and microbial contaminants (i.e., bacteria). The springs rated moderate susceptibility for IOCs, VOCs, and SOCs and low susceptibility to microbial contaminants. The predominant agricultural land use of the area, the dairy near the wells, and the transportation and water corridors that run through the delineations contributed to the potential contaminant/land use scores.

Final Susceptibility Ranking

A detection above a drinking water standard MCL, any detection of a VOC or SOC, or a confirmed microbial detection at the wellhead will automatically give a high susceptibility rating to the springs or the wells, despite the land use of the area, because a pathway for contamination already exists. Additionally, potential contaminant sources within 100 feet of a spring and within 50 feet of a wellhead will automatically lead to a high susceptibility rating. In this case, Weston Creek is within 100 feet of both springs and the wells are located in a hay field that may be sprayed with pesticides or herbicides, resulting in automatically high susceptibility for all of the City of Weston drinking water sources. Having multiple potential contaminant sources in the 0- to 3-year TOT zone (Zone 1B) contribute greatly to the overall ranking.

Table 1. Summary of City of Weston Susceptibility Evaluation

Drinking Water Source	Susceptibility Scores[1]									
	Hydrologic Sensitivity	Potential Contaminant Inventory and Land Use				System Construction	Final Susceptibility Ranking			
		IOC	VOC	SOC	Microbials		IOC	VOC	SOC	Microbials
Well #1	M	H	H	H	L	M	H(*)	H*	H*	H*
Well #2	M	H	H	H	M	M	H(*)	H*	H*	H(*)
Spring #1	–	H	H	H	M	M	H*	H*	H*	H*
Spring #2	–	H	H	H	M	M	H*	H*	H*	H*

[1]H = High Susceptibility, M = Moderate Susceptibility, L = Low Susceptibility,
IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical
H* = Automatic high score due to the location of the wells in a hay field and Weston Creek within 100 feet of the springs
H(*) = High number of points and location of the wells in a hay field

Susceptibility Summary

In terms of total susceptibility, the springs and the wells rated automatically high for IOCs, VOCs, SOCs, and microbial contaminants. Weston Creek flows within 100 feet of both springs, resulting in an automatic high susceptibility to contaminants. The wells are located in a hay field that may be irrigated and sprayed with pesticides or herbicides, contributing to the vulnerability of the wells to contamination and ultimately to the high susceptibility scores. Hydrologic sensitivity and system construction scores for the wells were rated moderate. System construction for the springs was also moderate. Potential contaminant land use scores for all of the drinking water sources rated moderate for VOCs and SOCs. The potential contaminant land use score for IOCs was high for the wells and springs. The potential contaminant land use score for microbial contaminants was low for Well #1, and moderate for Well #2 and the springs. The high SOC and VOC scores of the wells can be reduced to moderate scores if no chemicals are used on the hay field and the well's are properly

fenced. Also, the land the wells reside is not owned by the City of Weston. The City may want to look into purchasing the land for the wells. Likewise, the high scores of the springs can be reduced to moderate susceptibility if the springs are reconstructed in such a way as to fully protect the sources from the influences of Weston Creek or if the creek is diverted from the springs.

The last detection of total coliform bacteria in the distribution system was recorded in August 1998. However, no bacteria have been detected at either wells or springs. No SOCs or VOCs have been detected in the Weston City water. The IOCs barium, nitrate, selenium, and fluoride have been detected at the sample location for the springs and wells, but at concentrations below the MCL for each chemical, as established by the EPA.

Nitrate was detected at the sample location for the springs and wells in November 1997 at 6 mg/L, a level greater than half the MCL of 10 mg/L. However, the average nitrate level from 1988 to 2002 is 2.65 mg/L, with the most recent nitrate level (October 2002) being at 1.8 mg/L.

Section 4. Options for Drinking Water Protection

This assessment should be used as a basis for determining appropriate new protection measures or re-evaluating existing protection efforts. No matter what ranking a source receives, protection is always important. Whether the source is currently located in a "pristine" area or an area with numerous industrial and/or agricultural land uses that require surveillance, the way to ensure good water quality in the future is to act now to protect valuable water supply resources. If the system should need to expand in the future, new well or spring sites should be located in areas with as few potential sources of contamination as possible, and the site should be reserved and protected for this specific use.

An effective drinking water protection program is tailored to the particular local drinking water protection area. A community with a fully developed drinking water protection program will incorporate many strategies. For the City of Weston, drinking water protection activities should first focus on correcting any deficiencies outlined in the sanitary survey. The system should assure that no chemicals are used on the field where the wells are located. Additionally, the wells should be protected from access or flooding by installing a fence at least 50 feet from the wellheads to establish the perimeter of the well lot or placing a wellhouse over the wells. The springs should be fenced, establishing a radius of at least 100 feet from the spring sources and they should be properly protected from surface flooding from the creek. As land uses within most of the source water assessment areas are outside the direct jurisdiction of the City of Weston, collaboration and partnerships with state and local agencies and industry groups should be established and are critical to success. Educating city employees and the public about source water will further assist the system in its monitoring and protection efforts.

Due to the time involved with the movement of ground water, drinking water protection activities should be aimed at long-term management strategies even though these strategies may not yield results in the near term. A strong public education program should be a primary focus of any drinking water protection plan. Public education topics could include household hazardous waste disposal methods and the importance of water conservation. There are multiple resources available to help communities implement protection programs, including the Drinking Water Academy of the EPA. Drinking water protection activities for agriculture should be coordinated with the Idaho State Department of Agriculture, the Franklin County Soil Conservation District, and the Natural Resources Conservation Service.

A community must incorporate a variety of strategies in order to develop a comprehensive drinking water protection plan, be they regulatory in nature (e.g., zoning, permitting) or non-regulatory in nature (e.g. good housekeeping, public education, specific best management practices). For assistance in developing protection strategies please contact the Pocatello Regional Office of the DEQ or the Idaho Rural Water Association.

Assistance

Public water supplies and others may call the following DEQ offices with questions about this assessment and to request assistance with developing and implementing a local protection plan. In addition, draft protection plans may be submitted to the DEQ office for preliminary review and comments.

Pocatello Regional DEQ Office	(208) 236-6160
State DEQ Office	(208) 373-0502

Website: http://www.deq.state.id.us

Water suppliers serving fewer than 10,000 persons may contact Melinda Harper (mlharper@idahoruralwater.com), Idaho Rural Water Association, at (208) 343-7001 for assistance with drinking water protection (formerly wellhead protection) strategies.

POTENTIAL CONTAMINANT INVENTORY LIST OF ACRONYMS AND DEFINITIONS

AST (Aboveground Storage Tanks) – Sites with aboveground storage tanks.

Business Mailing List – This list contains potential contaminant sites identified through a yellow pages database search of standard industry codes (SIC).

CERCLA – This includes sites considered for listing under the **Comprehensive Environmental Response Compensation and Liability Act (CERCLA)**. CERCLA, more commonly known as Superfund is designed to clean up hazardous waste sites that are on the national priority list (NPL).

Cyanide Site – DEQ permitted and known historical sites/facilities using cyanide.

Dairy – Sites included in the primary contaminant source inventory represent those facilities regulated by Idaho State Department of Agriculture (ISDA) and may range from a few head to several thousand head of milking cows.

Deep Injection Well – Injection wells regulated under the Idaho Department of Water Resources generally for the disposal of stormwater runoff or agricultural field drainage.

Enhanced Inventory – Enhanced inventory locations are potential contaminant source sites added by the water system. These can include new sites not captured during the primary contaminant inventory, or corrected locations for sites not properly located during the primary contaminant inventory. Enhanced inventory sites can also include miscellaneous sites added by the Idaho Department of Environmental Quality (DEQ) during the primary contaminant inventory.

Floodplain – This is a coverage of the 100-year floodplains.

Group I Sites – These are sites that show elevated levels of contaminants and are not within the priority one areas.

Inorganic Priority Area – Priority one areas where greater than 25% of the wells/springs show constituents higher than primary standards or other health standards.

Landfill – Areas of open and closed municipal and non-municipal landfills.

LUST (Leaking Underground Storage Tank) – Potential contaminant source sites associated with leaking underground storage tanks as regulated under RCRA.

Mines and Quarries – Mines and quarries permitted through the Idaho Department of Lands.)

Nitrate Priority Area – Area where greater than 25% of wells/springs show nitrate values above 5mg/l.

NPDES (National Pollutant Discharge Elimination System) – Sites with NPDES permits. The Clean Water Act requires that any discharge of a pollutant to waters of the United States from a point source must be authorized by an NPDES permit.

Organic Priority Areas – These are any areas where greater than 25% of wells/springs show levels greater than 1% of the primary standard or other health standards.

Recharge Point – This includes active, proposed, and possible recharge sites on the Snake River Plain.

RCRA – Site regulated under **Resource Conservation Recovery Act (RCRA)**. RCRA is commonly associated with the cradle to grave management approach for generation, storage, and disposal of hazardous wastes.

SARA Tier II (Superfund Amendments and Reauthorization Act Tier II Facilities) – These sites store certain types and amounts of hazardous materials and must be identified under the Community Right to Know Act.

Toxic Release Inventory (TRI) – The toxic release inventory list was developed as part of the Emergency Planning and Community Right to Know (Community Right to Know) Act passed in 1986. The Community Right to Know Act requires the reporting of any release of a chemical found on the TRI list.

UST (Underground Storage Tank) – Potential contaminant source sites associated with underground storage tanks regulated as regulated under RCRA.

Wastewater Land Applications Sites – These are areas where the land application of municipal or industrial wastewater is permitted by DEQ.

Wellheads – These are drinking water well locations regulated under the Safe Drinking Water Act. They are not treated as potential contaminant sources.

NOTE: Many of the potential contaminant sources were located using a geocoding program where mailing addresses are used to locate a facility. Field verification of potential contaminant sources is an important element of an enhanced inventory.

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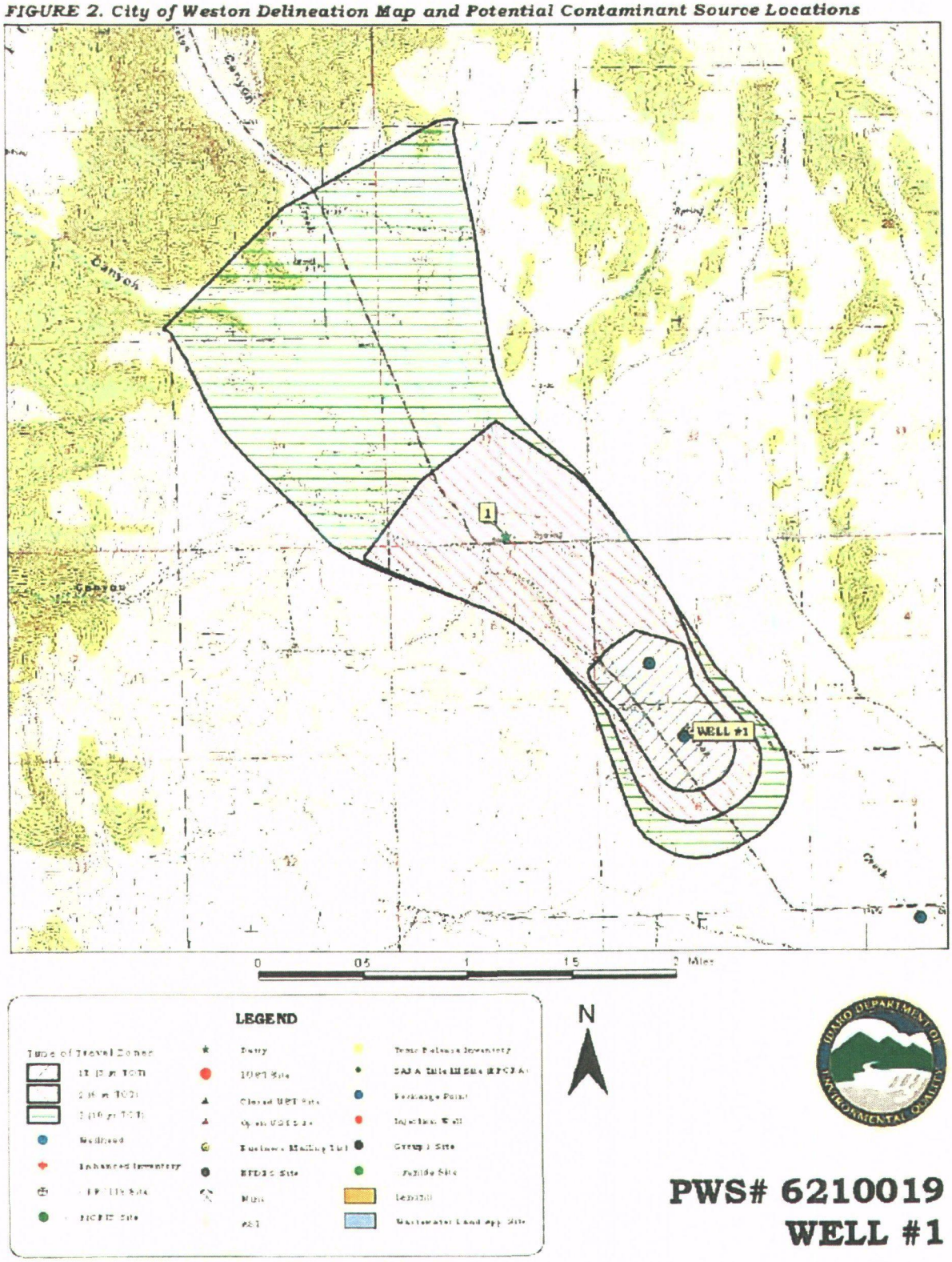
Appendix A

City of Weston
Potential Contaminant Inventory

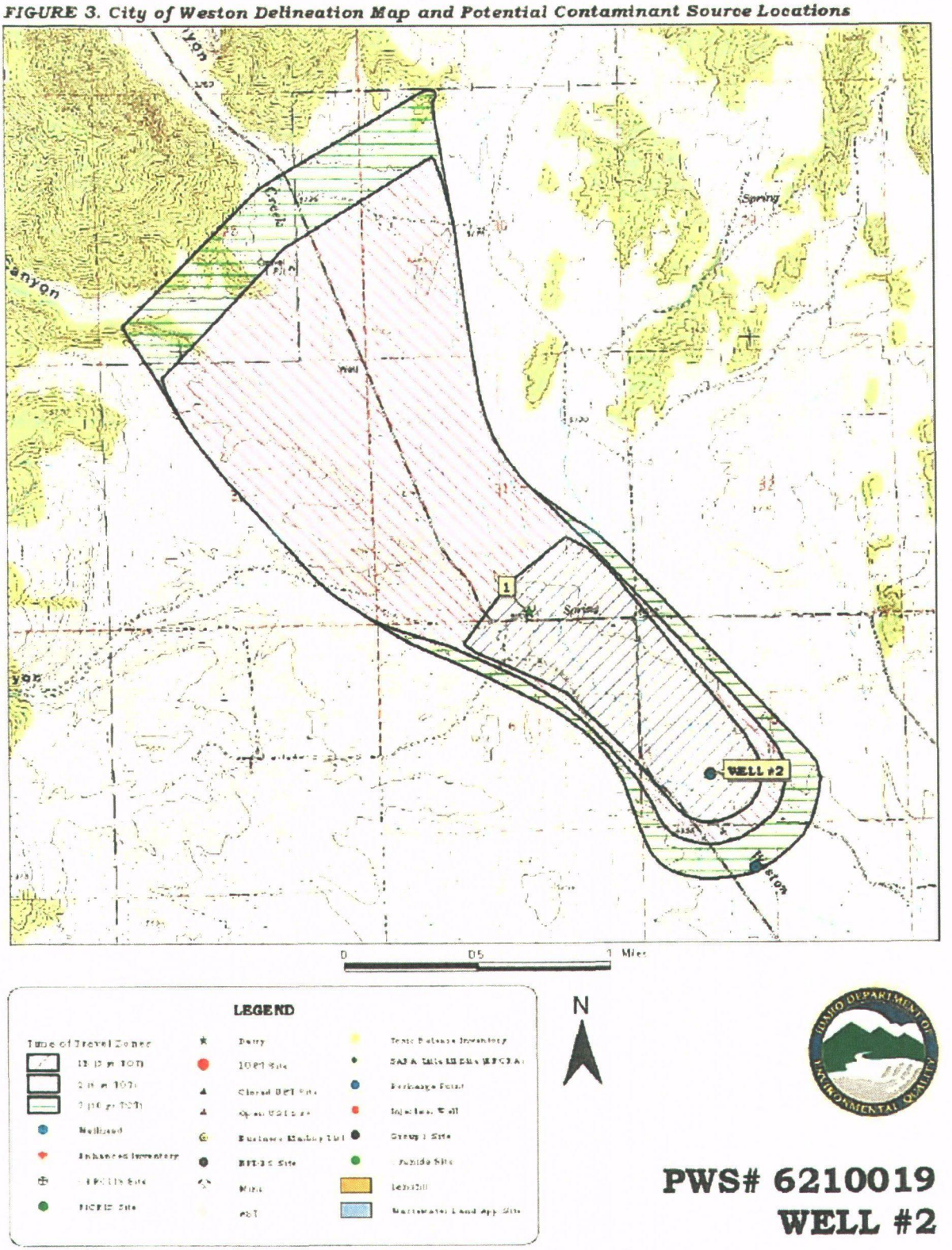
Figures 2, 3, 4, and 5
Tables 2, 3, 4, and 5

FIGURE 2. City of Weston Delineation Map and Potential Contaminant Source Locations



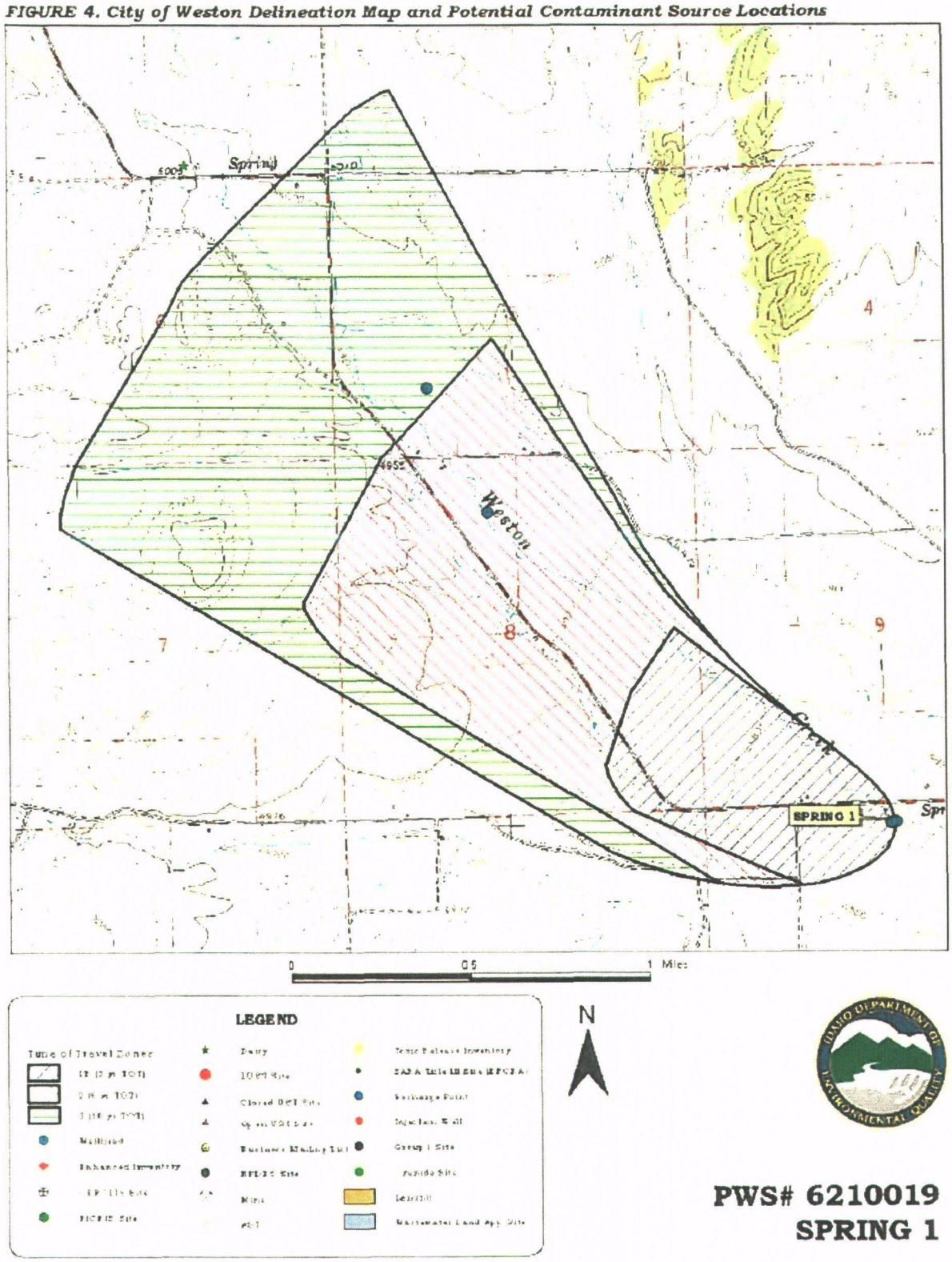
PWS# 6210019
WELL #1

FIGURE 3. City of Weston Delineation Map and Potential Contaminant Source Locations



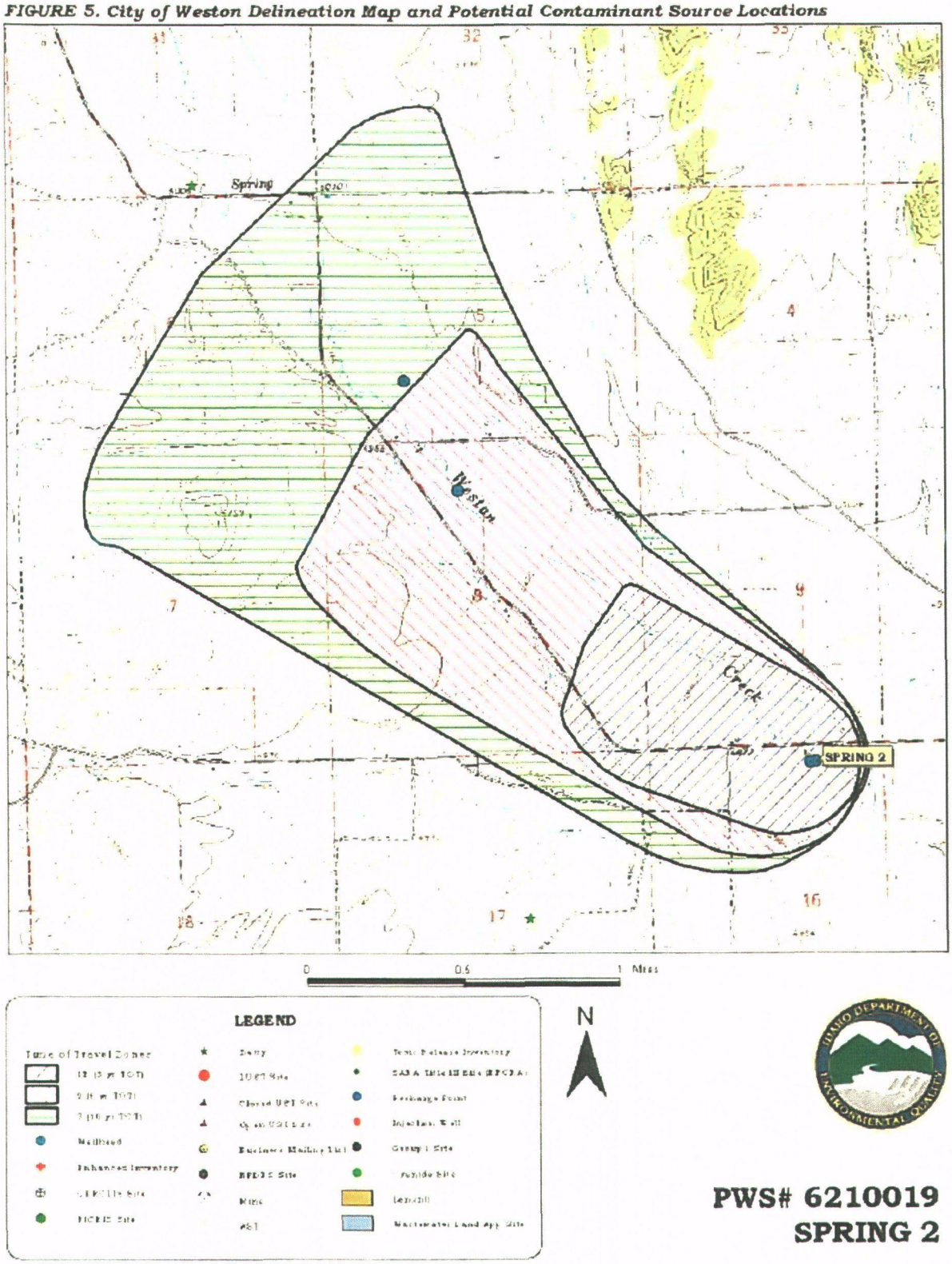
PWS# 6210019
WELL #2

FIGURE 4. City of Weston Delineation Map and Potential Contaminant Source Locations



PWS# 6210019
SPRING 1

FIGURE 5. City of Weston Delineation Map and Potential Contaminant Source Locations



PWS# 6210019
SPRING 2

Table 2. City of Weston, Well #1, Potential Contaminant Inventory

Site #	Source Description	TOT Zone[1] (years)	Source of Information	Potential Contaminants[2]
1	Dairy <=200 Cows	3-6	Database Inventory	IOC, Microbials
	Weston Creek	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Creek	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Weston Canyon Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Canyon Road	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Unimproved Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Unimproved Road	3-6	GIS Map	IOC, VOC, SOC

[1] TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead
[2] IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Table 3. City of Weston, Well #2, Potential Contaminant Inventory

Site #	Source Description	TOT Zone[1] (years)	Source of Information	Potential Contaminants[2]
1	Dairy <=200 Cows	0-3	Database Inventory	IOC, Microbials
	Weston Creek	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Creek	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Weston Canyon Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Canyon Road	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Unimproved Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Unimproved Road	3-6	GIS Map	IOC, VOC, SOC

[1] TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead
[2] IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Table 4. City of Weston, Spring #1, Potential Contaminant Inventory

Site #	Source Description	TOT Zone[1] (years)	Source of Information	Potential Contaminants[2]
	Weston Creek	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Creek	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Weston Canyon Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Canyon Road	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Unimproved Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Unimproved Road	3-6	GIS Map	IOC, VOC, SOC

[1] TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead
[2] IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Table 5. City of Weston, Spring #2, Potential Contaminant Inventory

Site #	Source Description	TOT Zone[1] (years)	Source of Information	Potential Contaminants[2]
	Weston Creek	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Creek	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Weston Canyon Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Weston Canyon Road	3-6, 6-10	GIS Map	IOC, VOC, SOC
	Unimproved Road	0-3	GIS Map	IOC, VOC, SOC, Microbials
	Unimproved Road	3-6	GIS Map	IOC, VOC, SOC

[1]TOT = time-of-travel (in years) for a potential contaminant to reach the wellhead

[2] IOC = inorganic chemical, VOC = volatile organic chemical, SOC = synthetic organic chemical

Appendix B

City of Weston

Susceptibility Analysis Worksheets

Susceptibility Analysis Formulas

Formula for Spring Sources

The final spring scores for the susceptibility analysis were determined using the following formulas:

1. VOC/SOC/IOC/ Final Score = (Potential Contaminant/Land Use X 0.60) + System Construction

2. Microbial Final Score = (Potential Contaminant/Land Use X 1.125) + System Construction

Final Susceptibility Scoring:

0 - 7 Low Susceptibility
8 - 15 Moderate Susceptibility
≥ 16 High Susceptibility

Formula for Well Sources

The final scores for the susceptibility analysis were determined using the following formulas:

1. VOC/SOC/IOC Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.2)

2. Microbial Final Score = Hydrologic Sensitivity + System Construction + (Potential Contaminant/Land Use x 0.375)

Final Susceptibility Scoring:

0 - 5 Low Susceptibility
6 - 12 Moderate Susceptibility
≥ 13 High Susceptibility

Ground Water Susceptibility Report Public Water System Name : WESTON CITY OF Source : WELL #1

Public Water System Number: 6210019 11/21/02 11:37:54 AM

1. System Construction		SCORE
Drill Date	1988	
Driller Log Available	NO	
Sanitary Survey (if yes, indicate date of last survey)	YES	2001
Well meets IDWR construction standards	NO	1
Wellhead and surface seal maintained	YES	0
Casing and annular seal extend to low permeability unit	NO	2
Highest production 100 feet below static water level	NO	1
Well located outside the 100 year flood plain	YES	0
	Total System Construction Score	4

2. Hydrologic Sensitivity		
Soils are poorly to moderately drained	NO	2
Vadose zone composed of gravel, fractured rock or unknown	YES	1
Depth to first water > 300 feet	NO	1
Aquitard present with > 50 feet cumulative thickness	YES	0
	Total Hydrologic Score	4

3. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
Land Use Zone 1A	IRRIGATED PASTURE	1	1	1	1
Farm chemical use high	NO	0	0	0	
IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	YES	YES	YES	YES
Total Potential Contaminant Source/Land Use Score - Zone 1A		1	1	1	1
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	3	3	3	3
(Score = # Sources X 2) 8 Points Maximum		6	6	6	6
Sources of Class II or III leacheable contaminants or	YES	7	3	3	
4 Points Maximum		4	3	3	
Zone 1B contains or intercepts a Group 1 Area	NO	0	0	0	0
Land use Zone 1B	Greater Than 50% Irrigated Agricultural	4	4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		14	13	13	10
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	YES	2	2	2	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Land Use Zone II	Greater Than 50% Irrigated Agricultural	2	2	2	
Potential Contaminant Source / Land Use Score - Zone II		5	5	5	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	YES (86% undetermined Ag.	2	2	2	
Total Potential Contaminant Source / Land Use Score - Zone III		4	4	4	0

Cumulative Potential Contaminant / Land Use Score	23	21	21	10
4. Final Susceptibility Source Score	13	12	12	12
5. Final Well Ranking	High	High	High	High

Ground Water Susceptibility Report Public Water System Name : WESTON CITY OF Source: WELL #2

Public Water System Number: 6210019 11/21/02 11:37:24 AM

1. System Construction		SCORE
Drill Date	1988	
Driller Log Available	NO	
Sanitary Survey (if yes, indicate date of last survey)	YES	2001
Well meets IDWR construction standards	NO	1
Wellhead and surface seal maintained	YES	0
Casing and annular seal extend to low permeability unit	NO	2
Highest production 100 feet below static water level	NO	1
Well located outside the 100 year flood plain	YES	0
	Total System Construction Score	4

2. Hydrologic Sensitivity		
Soils are poorly to moderately drained	NO	2
Vadose zone composed of gravel, fractured rock or unknown	YES	1
Depth to first water > 300 feet	NO	1
Aquitard present with > 50 feet cumulative thickness	YES	0
	Total Hydrologic Score	4

3. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
Land Use Zone 1A	IRRIGATED PASTURE	1	1	1	1
Farm chemical use high	NO	0	0	0	
IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	YES	YES	YES	YES
Total Potential Contaminant Source/Land Use Score - Zone 1A		1	1	1	1
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	4	3	3	4
(Score = # Sources X 2) 8 Points Maximum		8	6	6	8
Sources of Class II or III leacheable contaminants or	YES	8	3	3	
4 Points Maximum		4	3	3	
Zone 1B contains or intercepts a Group 1 Area	NO	0	0	0	0
Land use Zone 1B	Greater Than 50% Irrigated Agricultural	4	4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		16	13	13	12
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	YES	2	2	2	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Land Use Zone II	Greater Than 50% Irrigated Agricultural	2	2	2	
Potential Contaminant Source / Land Use Score - Zone II		5	5	5	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	YES (91% undeter. Ag.)	2	2		
Total Potential Contaminant Source / Land Use Score - Zone III		4	4	4	0

Cumulative Potential Contaminant / Land Use Score	26	21	21	13
4. Final Susceptibility Source Score	13	12	12	13
5. Final Well Ranking	High	High	High	High

Spring Water Susceptibility Report Public Water System Name : WESTON CITY OF Source: SPRING 1

Public Water System Number: 6210019 11/18/02 4:09:25 PM

1. System Construction		SCORE
Intake structure properly constructed	NO	1
Is the water first collected from an underground source? Yes=spring developed to collect water from beneath the ground; lower score No=water collected after it contacts the atmosphere or unknown; higher score	YES	0
Total System Construction Score		1

2. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
Land Use Zone 1A	IRRIGATED PASTURE	1	1	1	1
Farm chemical use high	NO	0	0	0	
IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	YES	YES	YES	YES
Total Potential Contaminant Source/Land Use Score - Zone 1A		1	1	1	1
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	3	3	3	3
(Score = # Sources X 2) 8 Points Maximum		6	6	6	6
Sources of Class II or III leacheable contaminants or	YES	7	2	2	
4 Points Maximum		4	2	2	
Zone 1B contains or intercepts a Group 1 Area	NO	0	0	0	0
Land use Zone 1B	Greater Than 50% Irrigated Agricultural	4	4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		14	12	12	10
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	YES	2	2	2	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Land Use Zone II	Greater Than 50% Irrigated Agricultural	2	2	2	
Potential Contaminant Source / Land Use Score - Zone II		5	5	5	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	NO	0	0	0	
Total Potential Contaminant Source / Land Use Score - Zone III		2	2	2	0
Cumulative Potential Contaminant / Land Use Score		22	20	20	11
3. Final Susceptibility Source Score		11	10	10	9
4. Final Well Ranking		High	High	High	High

Spring Water Susceptibility Report

Public Water System Name: WESTON CITY OF
Public Water System Number: 6210019

Source: SPRING 2

11/18/02 4:09:48 PM

1. System Construction		SCORE
Intake structure properly constructred	NO	1
Is the water first collected from an underground source?	YES	0
Yes=spring developed to collect water from beneath the ground; lower score		
No=water collected after it contacts the atmosphere or unknown; higher score		
Total System Construction Score		1

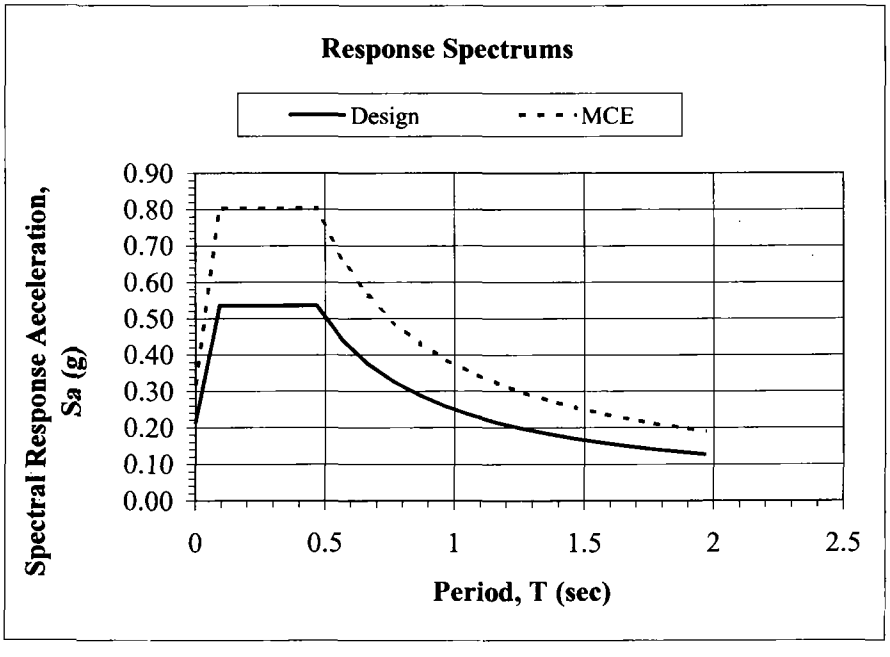
2. Potential Contaminant / Land Use - ZONE 1A		IOC Score	VOC Score	SOC Score	Microbial Score
Land Use Zone 1A	IRRIGATED PASTURE	1	1	1	1
Farm chemical use high	NO	0	0	0	
IOC, VOC, SOC, or Microbial sources in Zone 1A	YES	YES	YES	YES	YES
Total Potential Contaminant Source/Land Use Score - Zone 1A		1	1	1	1
Potential Contaminant / Land Use - ZONE 1B					
Contaminant sources present (Number of Sources)	YES	3	3	3	3
(Score = # Sources X 2) 8 Points Maximum		6	6	6	4
Sources of Class II or III leacheable contaminants or	YES	7	3	3	
4 Points Maximum		4	3	3	
Zone 1B contains or intercepts a Group 1 Area	NO	0	0	0	0
Land use Zone 1B	Greater Than 50% Irrigated Agricultural	4	4	4	4
Total Potential Contaminant Source / Land Use Score - Zone 1B		14	13	13	10
Potential Contaminant / Land Use - ZONE II					
Contaminant Sources Present	YES	2	2	2	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Land Use Zone II	Greater Than 50% Irrigated Agricultural	2	2	2	
Potential Contaminant Source / Land Use Score - Zone II		5	5	5	0
Potential Contaminant / Land Use - ZONE III					
Contaminant Source Present	YES	1	1	1	
Sources of Class II or III leacheable contaminants or	YES	1	1	1	
Is there irrigated agricultural lands that occupy > 50% of	NO	0	0	0	
Total Potential Contaminant Source / Land Use Score - Zone III		2	2	2	0
Cumulative Potential Contaminant / Land Use Score		22	20	20	11
3. Final Susceptibility Source Score		11	10	10	9
4. Final Well Ranking		High	High	High	High

Appendix M

SITE GROUND MOTION [IBC SECTION 1615]

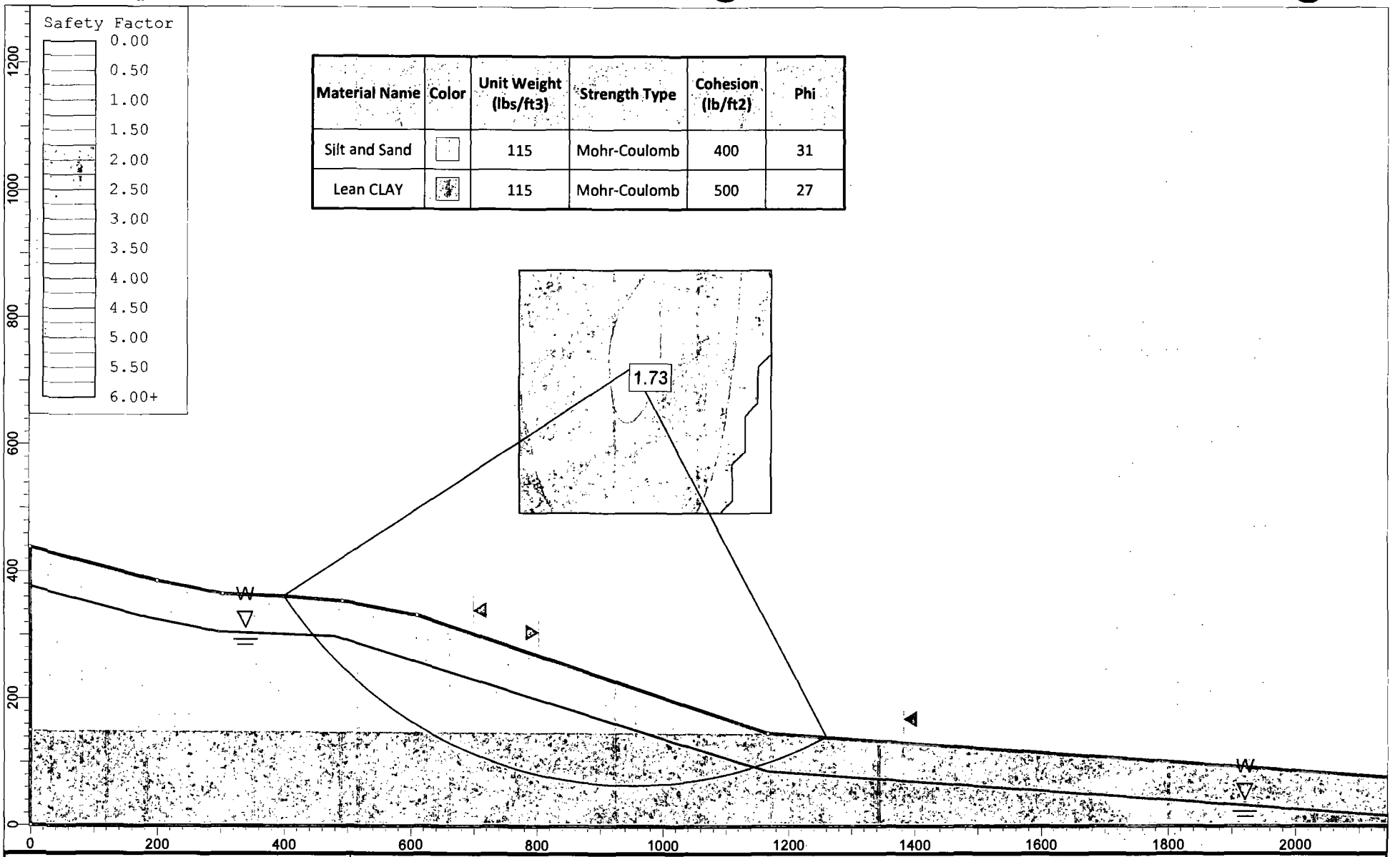
Project:	**North Cache Vally Landfill**	**Number:**	**00386-014**
Latitude =	**41.992958**	**Date:**	**12/13/11**
Longitude =	**-112.05218**	**By:**	**JMG**

S_S =	0.723 (g)	The mapped spectral accleration for short periods	[1615.1]
S_1 =	0.240 (g)	The mapped spectral accleration for a 1-second period	
Site Class =	C	Table 16.15.1.1	
Fa =	1.11	Table 1615.1.2(1)	
Fv =	1.56	Table 1615.1.2(2)	
S_{MS} =	0.803	S_{MS} = Fa*Ss	*The maximum considered E.Q. spectral resonse accelerations
S_{M1} =	0.374	S_{M1} = Fv*S_1	for short and 1-second periods [1615.1.2]
MCE/PGA =	**0.321**	**0.4*S_{MS} [Equation 16-42 in accordance with 1802.2.7 and 1615.2.1]**	
S_{DS} =	0.535	S_{DS} = 2/3*S_{MS}	*The design spectral response acceleration
S_{D1} =	0.250	S_{D1} = 2/3*S_{M1}	at short and 1-second periods
T_0 =	0.093	T_0 = 0.2*S_{D1}/S_{DS}	
T_s =	0.466	T_s = S_{D1}/S_{DS}	
ΔT =	0.1	Time step for diagram	



T (sec)	Sa (g)	Sa (MCE) (g)
0	0.21	0.32
0.09	0.54	0.80
0.47	0.54	0.80
0.57	0.44	0.66
0.67	0.37	0.56
0.77	0.33	0.49
0.87	0.29	0.43
0.97	0.26	0.39
1.07	0.23	0.35
1.17	0.21	0.32
1.27	0.20	0.30
1.37	0.18	0.27
1.47	0.17	0.26
1.57	0.16	0.24
1.67	0.15	0.22
1.77	0.14	0.21
1.87	0.13	0.20
1.97	0.13	0.19

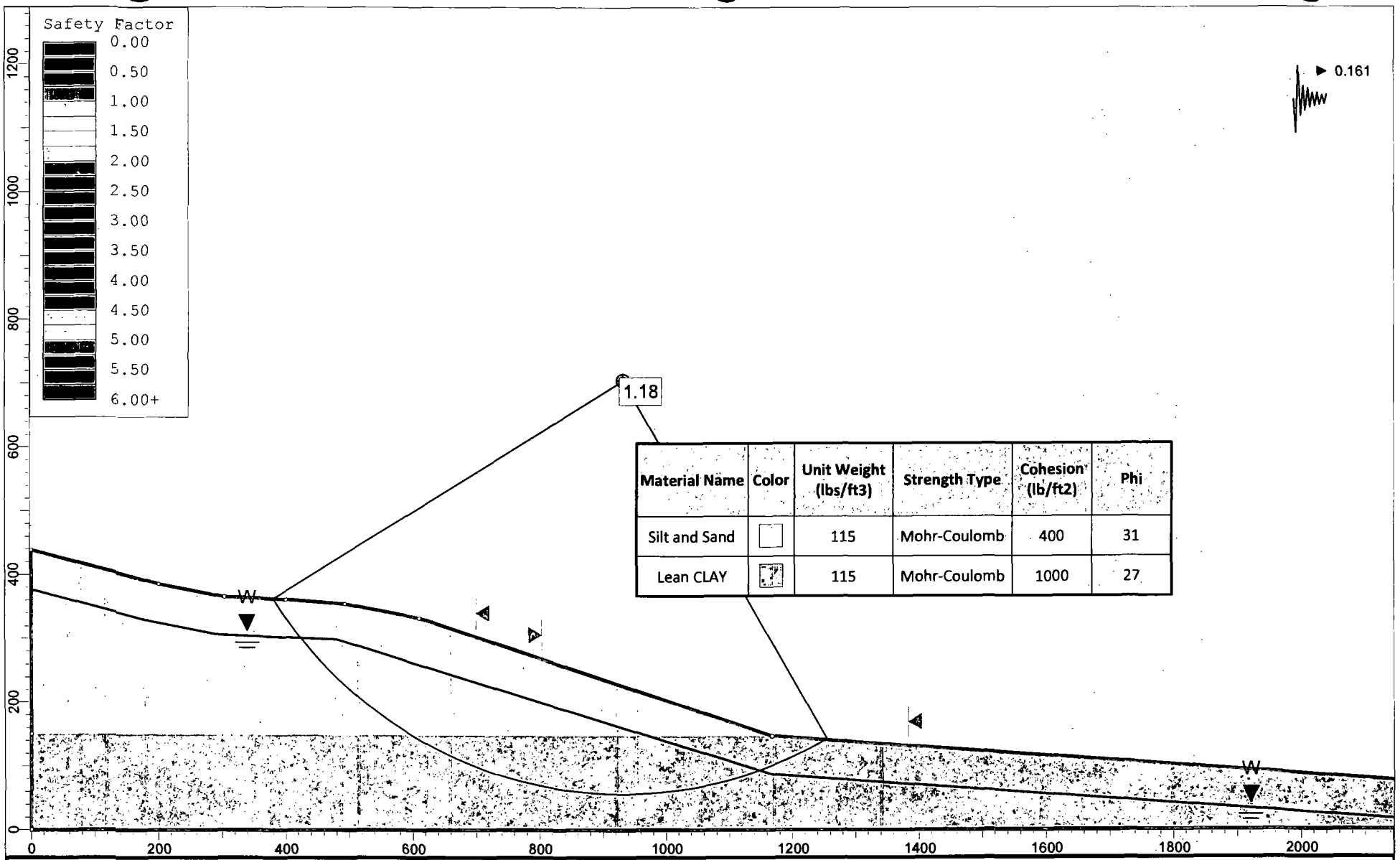
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	500	27



Project	North Cache Valley Landfill		
Analysis Description	Cut Slope - before MSW is placed - temporary case - static		
Drawn By	JMG	Scale 1:2500	Company IGES, Inc
Date	01/09/12		File Name SS-1.slim

IGES®

SLIDEINTERPRET 6.014



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27

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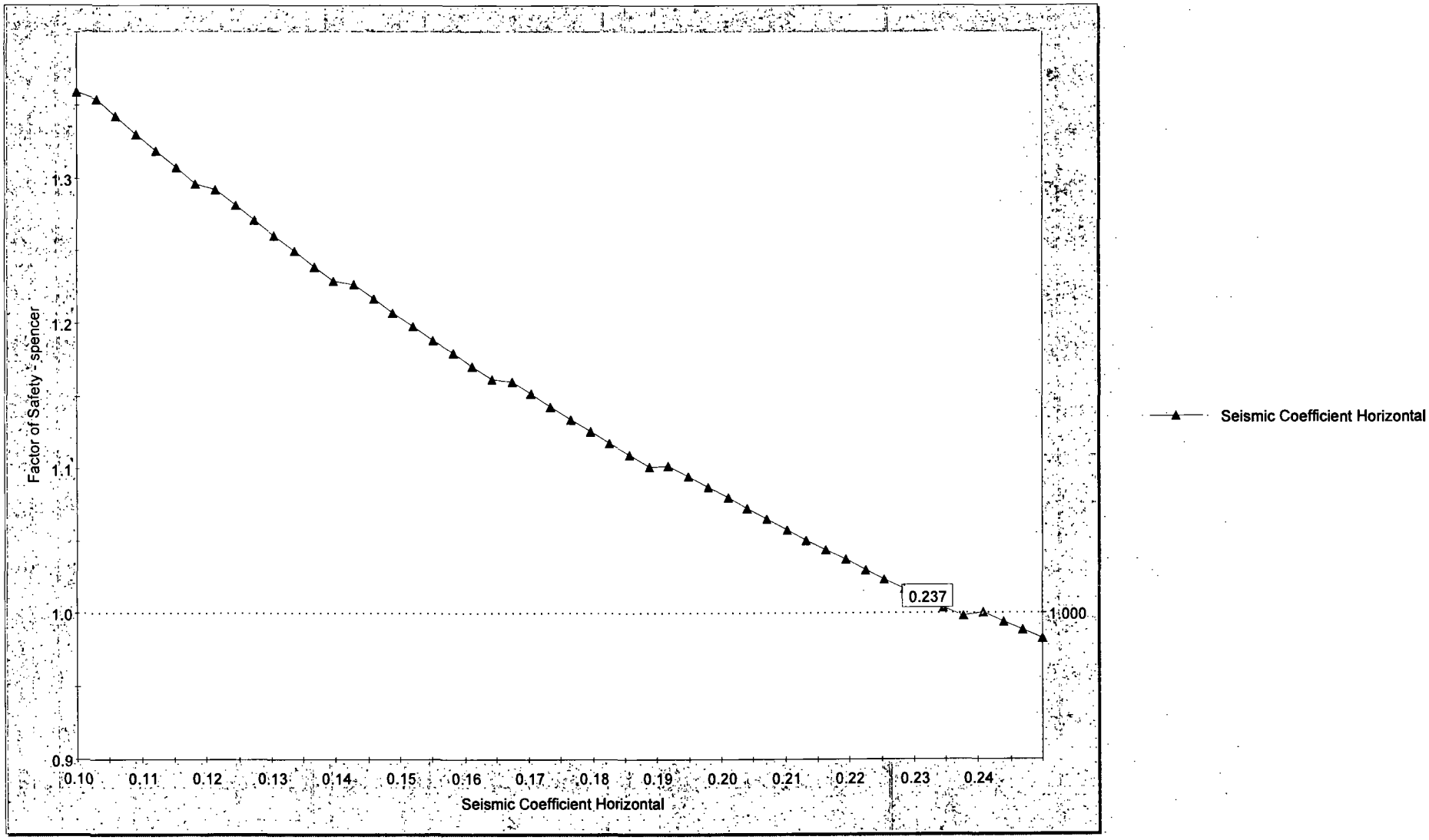
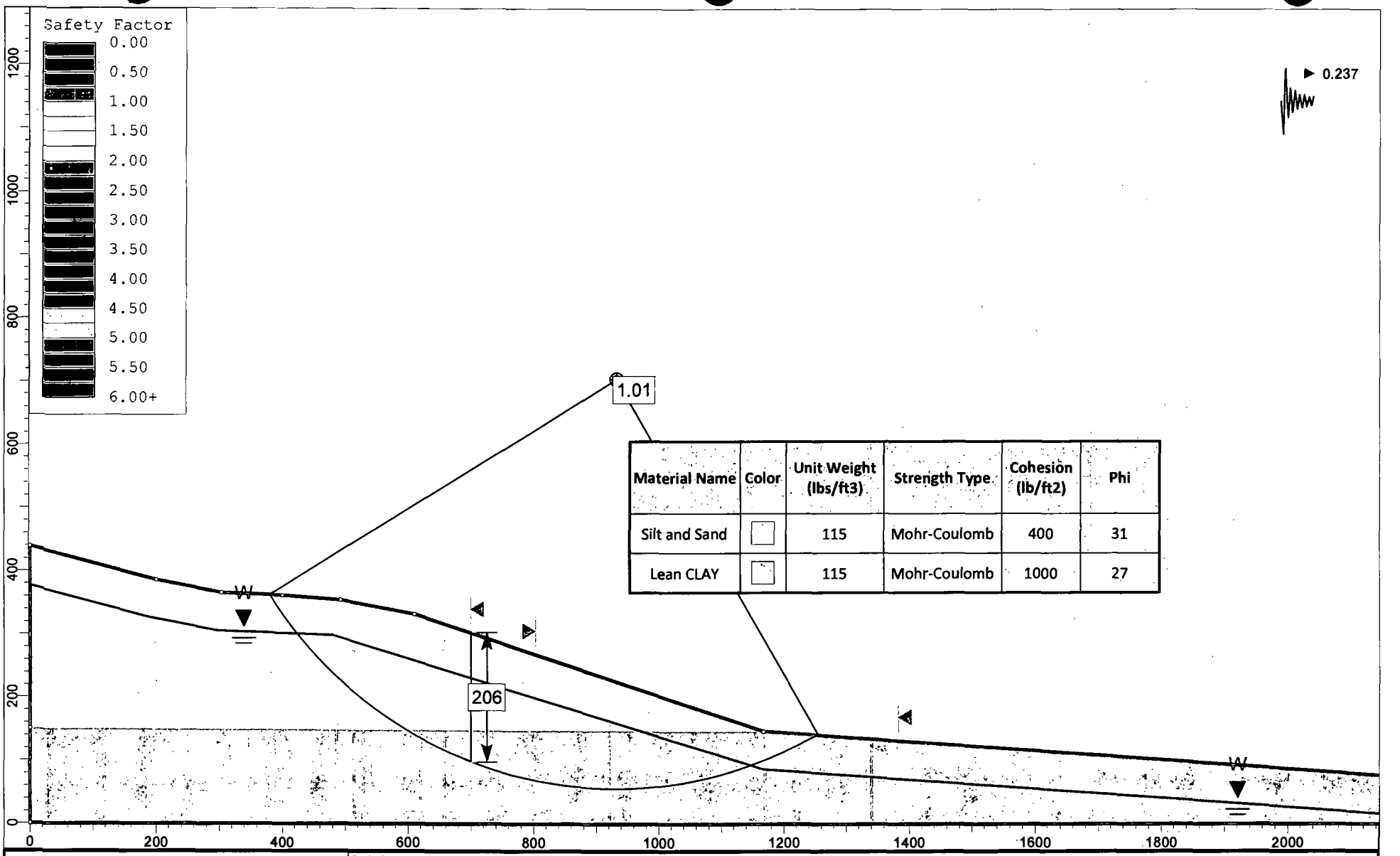
Project	North Cache Valley Landfill		
Analysis Description	Cut Slope - before MSW is placed - temporary case - pseudostatic		
Drawn By	JMG	Scale	1:2500
Company	IGES, Inc		
Date	01/09/12	File Name	SS-1 pseudostatic.slim



IGES®	Project	North Cache Valley Landfill	
	Analysis Description	Cut Slope - before MSW is placed - temporary case - pseudostatic at yield	
	Drawn By: JMG	Scale	Company: IGES, Inc
SLIDEINTERPRET 6.014	Date: 01/09/12		File Name: SS-1 pseudostatic at yield.slim

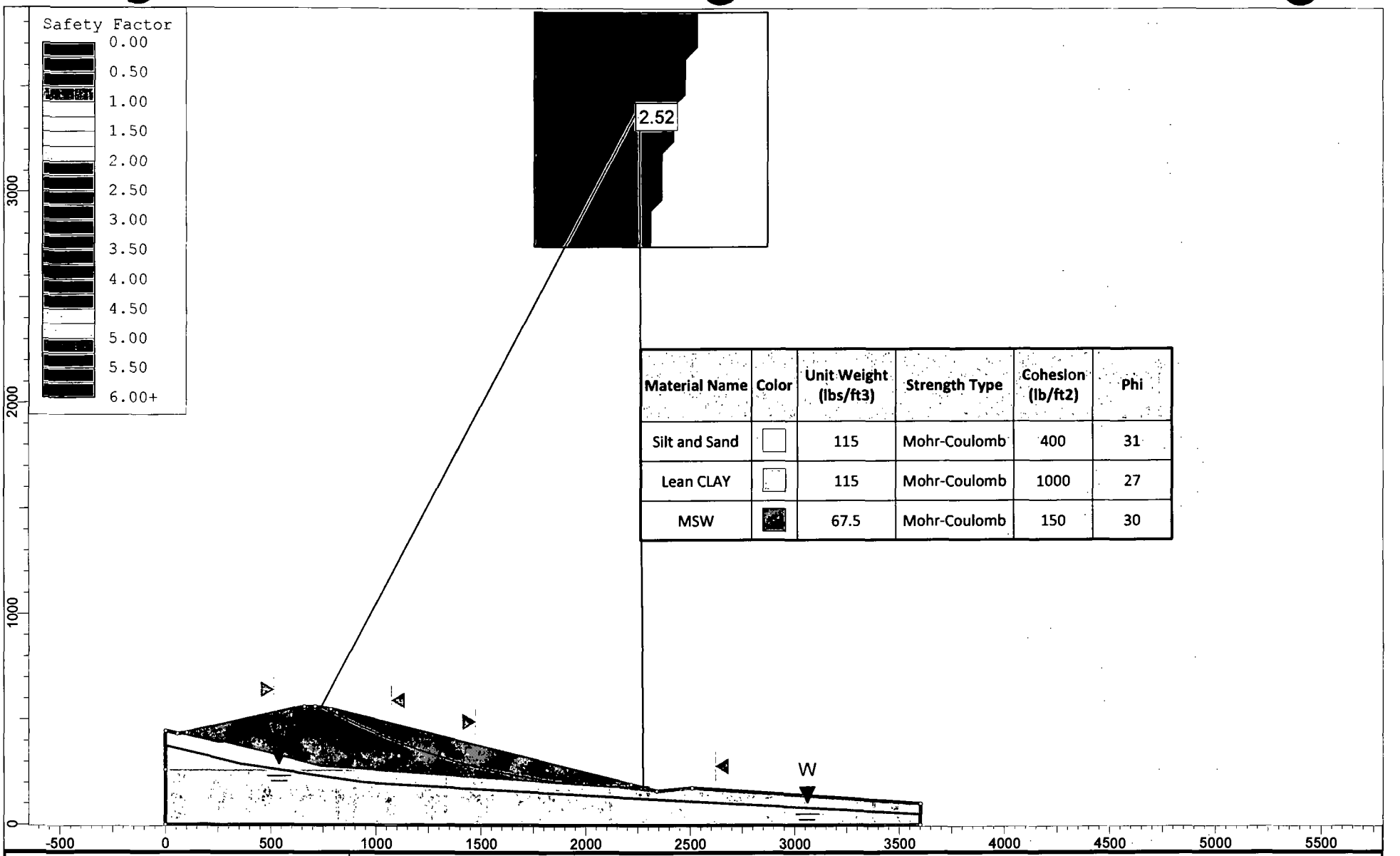


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27

IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill		
Analysis Description	Cut Slope - before MSW is placed - temporary case - pseudostatic at yield		
Drawn By	JMG	Scale 1:2500	Company IGES, Inc
Date	01/09/12		File Name SS-1 pseudostatic at yield.slim

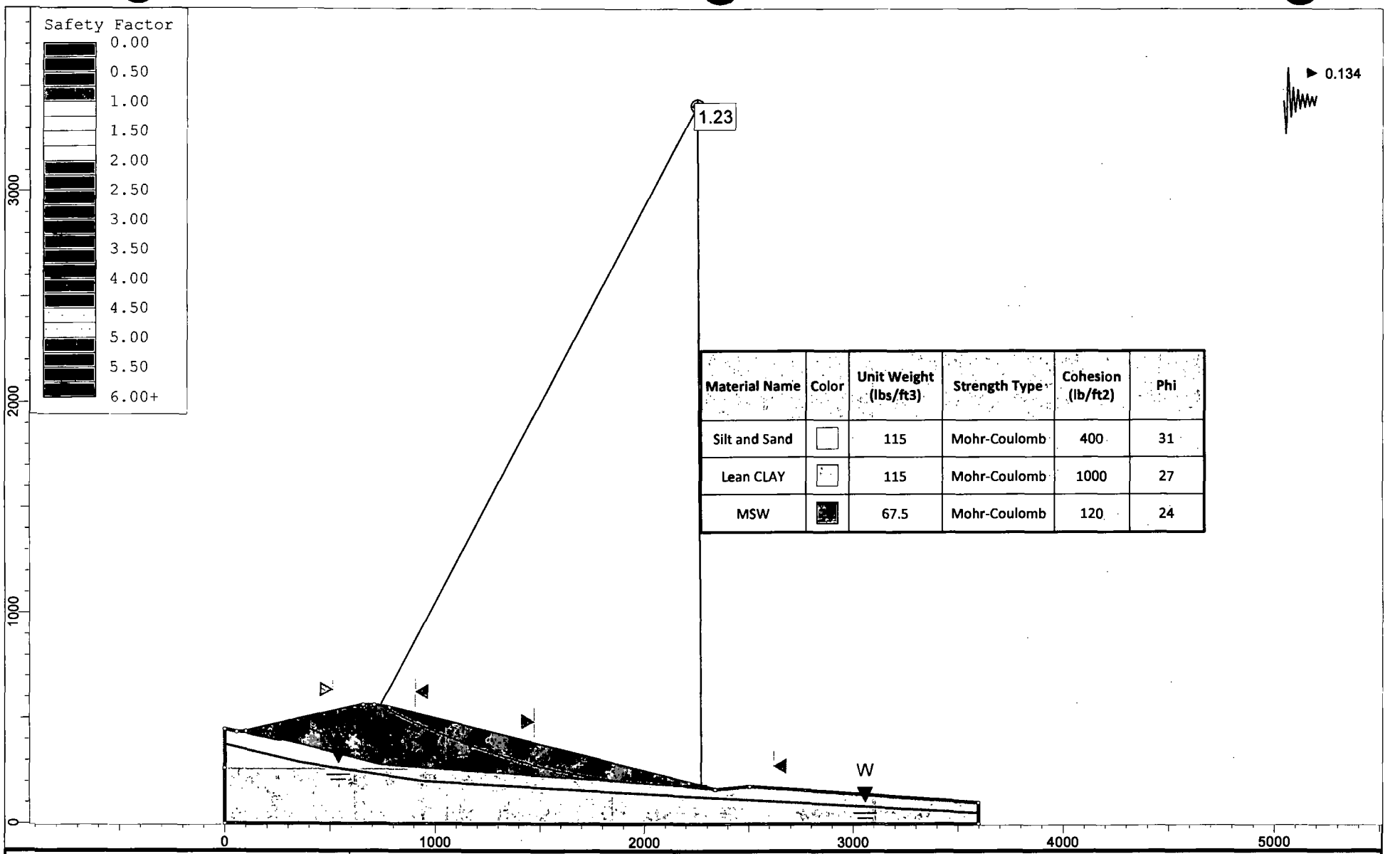


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	150	30

IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill		
Analysis Description	Final Fill Slope - after MSW and permanent cap is placed - static		
Drawn By	JMG	Scale 1:7500	Company IGES, Inc
Date	01/09/12		File Name SS-2.slim

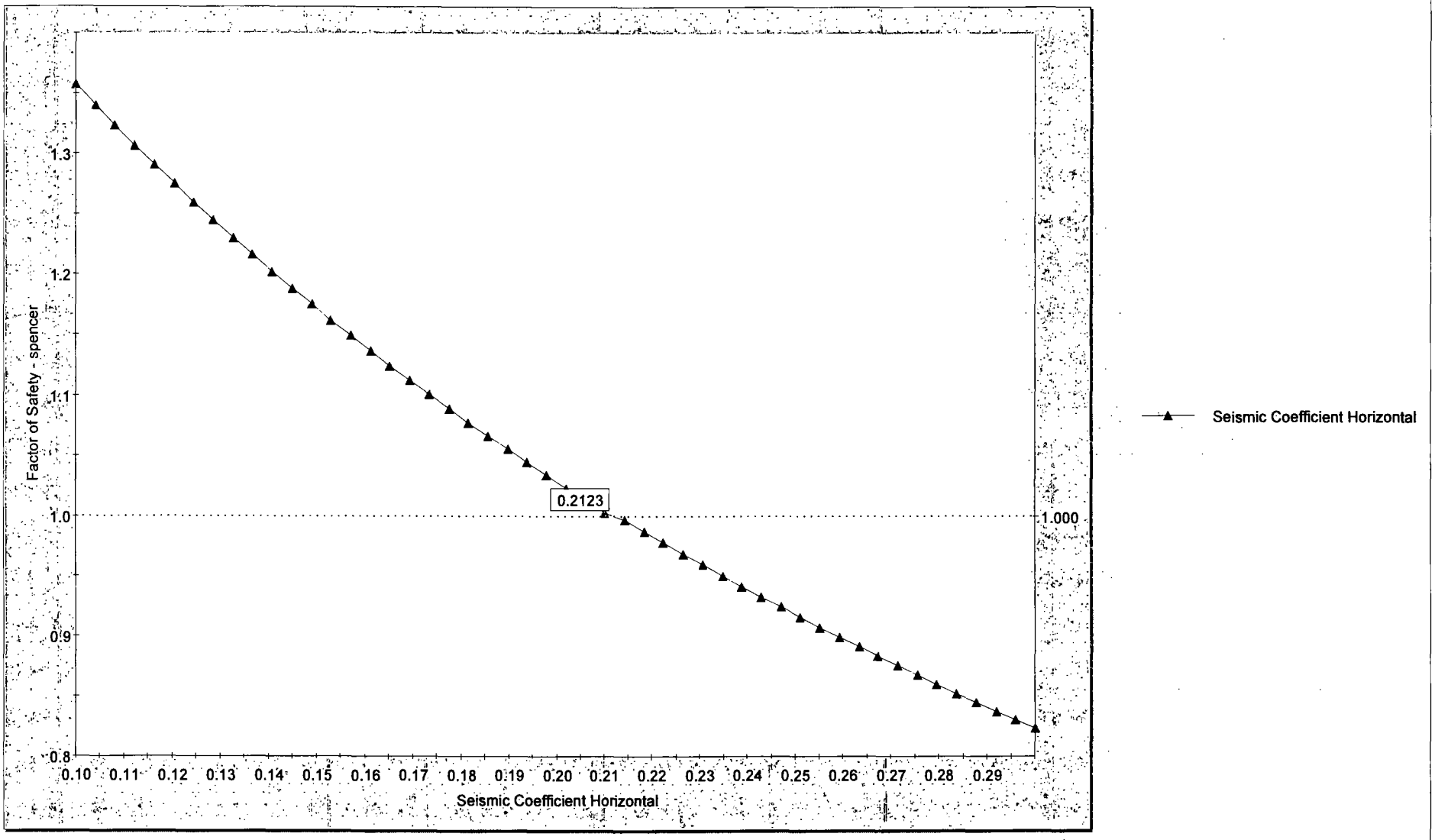


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	120	24

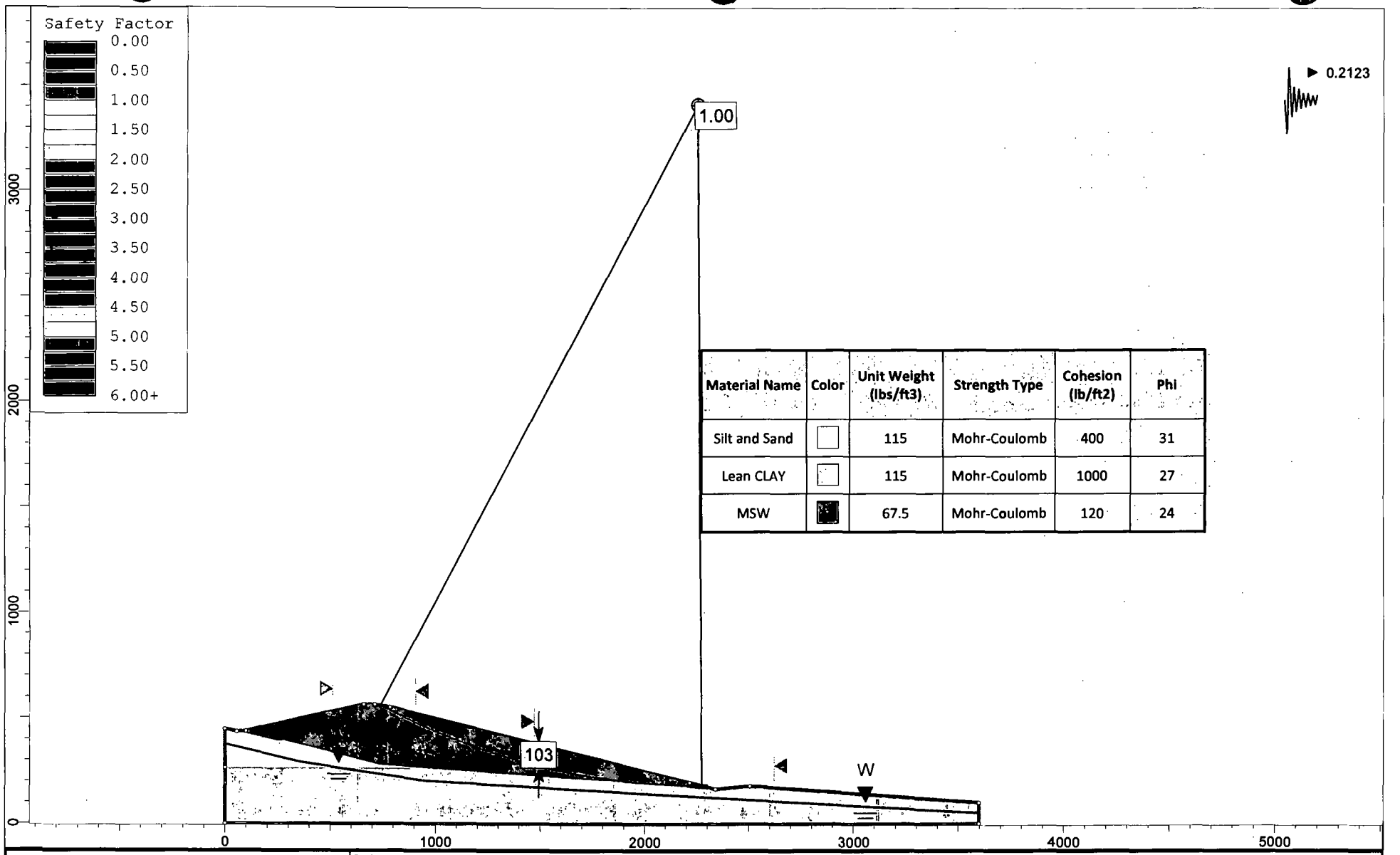
IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill		
Analysis Description	Final Fill Slope - after MSW and permanent cap is placed - pseudostatic w/ 20% reduction in strength		
Drawn By	JMG	Scale 1:7500	Company IGES, Inc
Date	01/09/12		File Name SS-2 pseudostatic.slim



IGES®	Project	North Cache Valley Landfill	
	Analysis Description	Final Fill Slope - after MSW and permanent cap is placed - pseudostatic w/ 20% reduction in strength	
	Drawn By: JMG	Scale	Company: IGES, Inc
SLIDEINTERPRET 6.014	Date: 01/09/12		File Name: SS-2 pseudostatic.slim

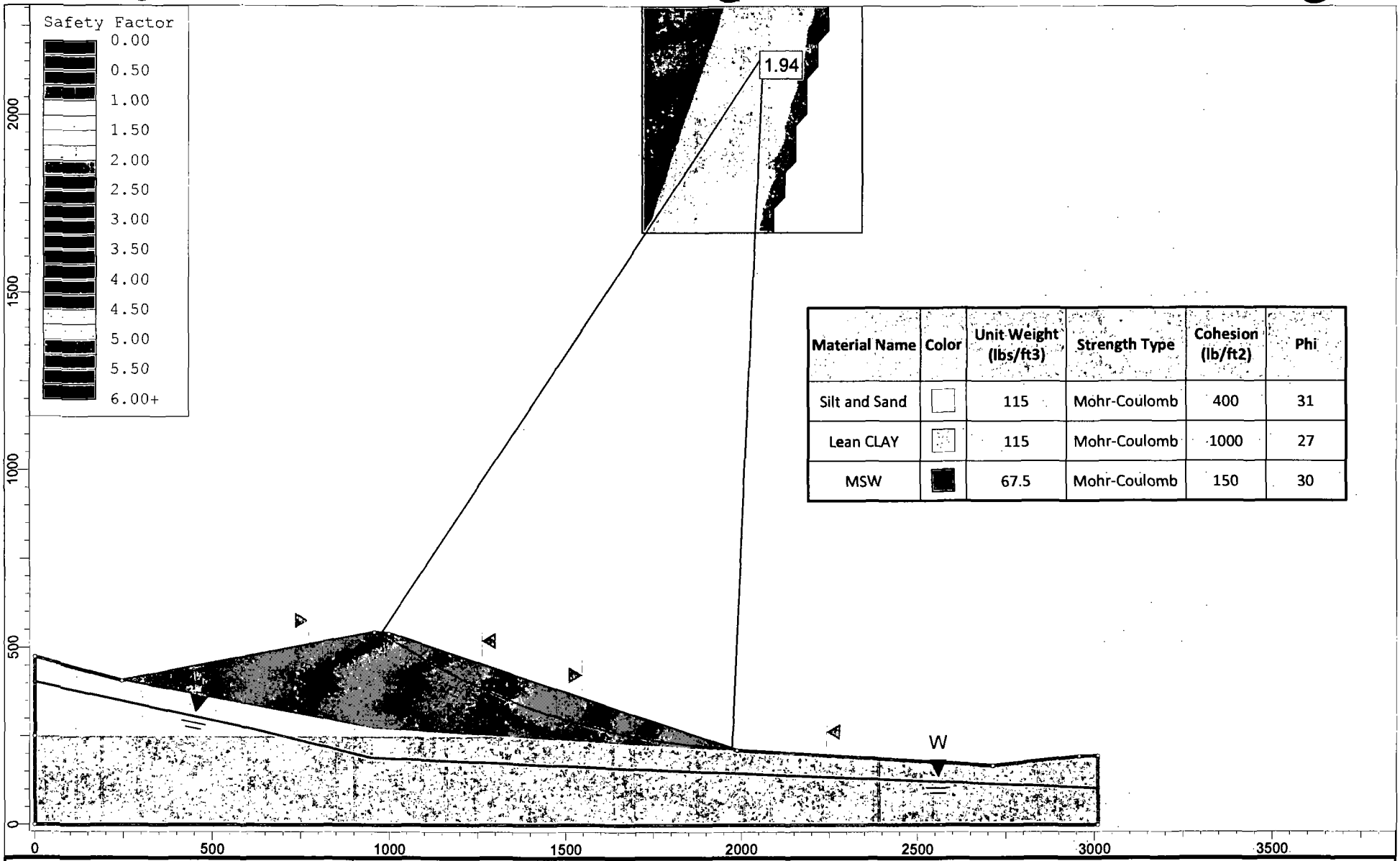


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	120	24

IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill
Analysis Description	Final Fill Slope - after MSW and permanent cap is placed - yield acceleration
Drawn By	JMG
Scale	1:7500
Company	IGES, Inc
Date	01/09/12
File Name	SS-2 pseudostatic at yield.slim

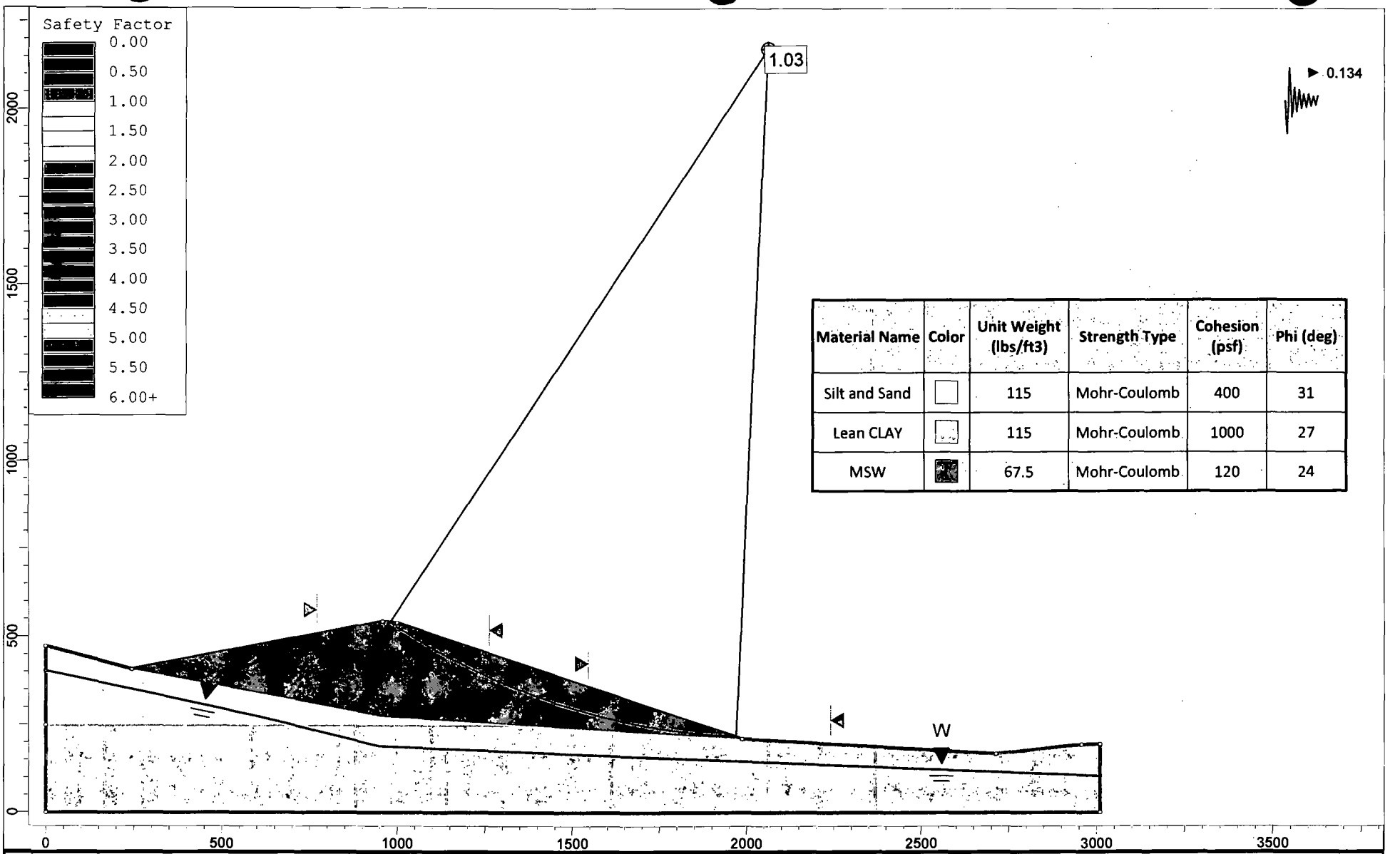


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	150	30

IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill		
Analysis Description	Intermediate Fill Slope - after some MSW is placed - static		
Drawn By	JMG	Scale	1:4500
Company	IGES, Inc		
Date	01/09/12	File Name	SS-3.slim

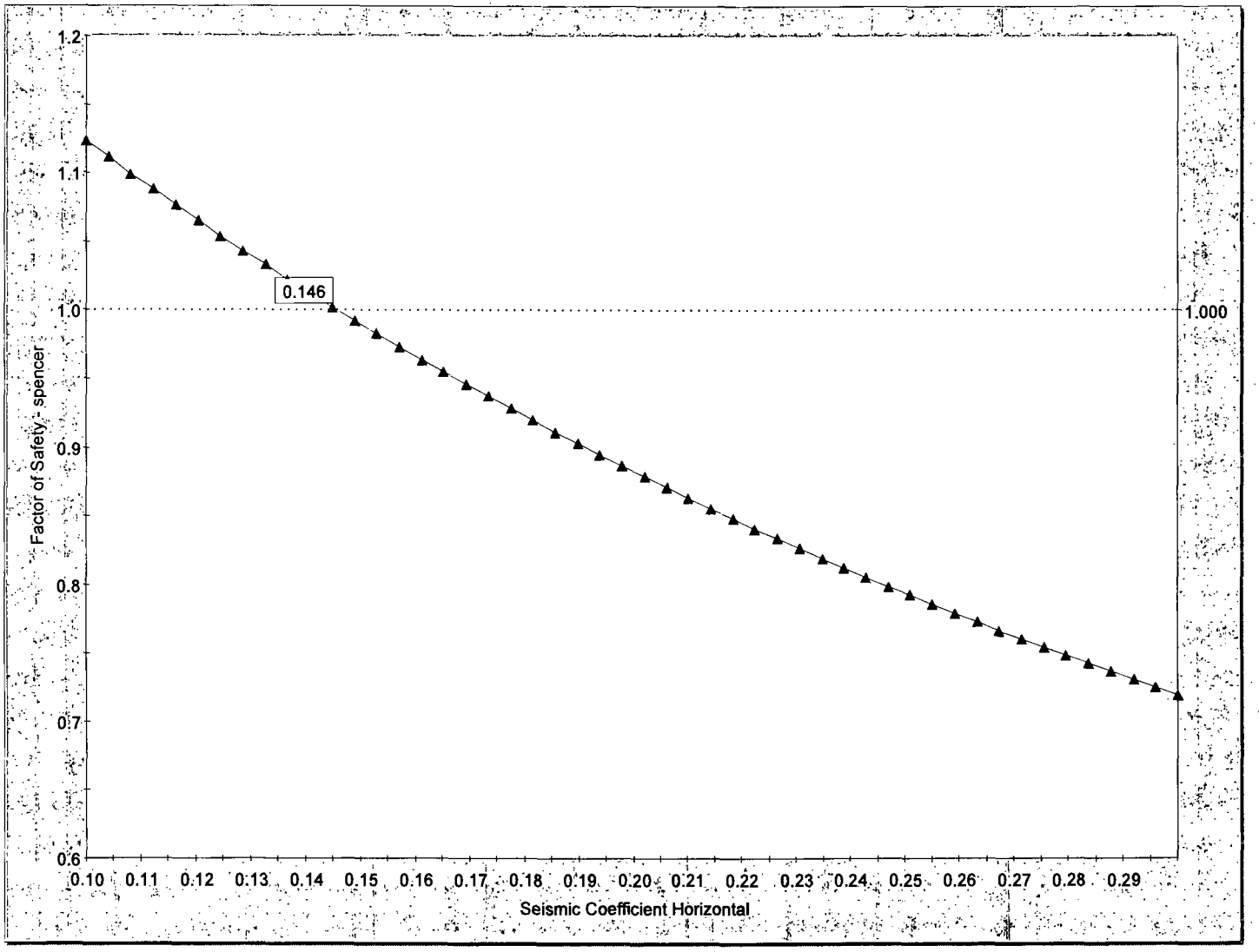


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	120	24

IGES®

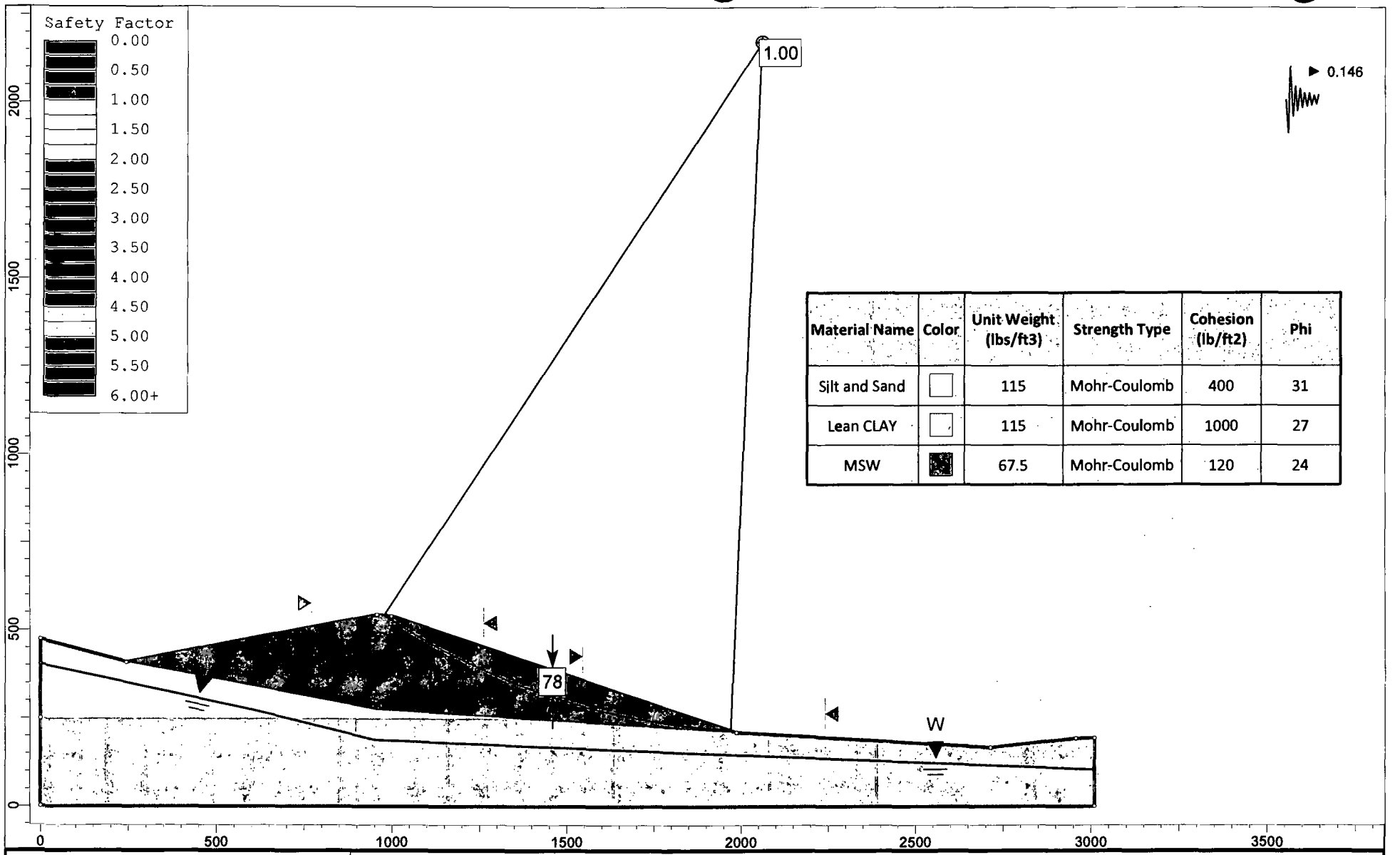
SLIDEINTERPRET 6.015

Project	North Cache Valley Landfill		
Analysis Description	Intermediate Fill Slope - after some MSW is placed - pseudostatic with 20% reduction in strength		
Drawn By: JMG	Scale: 1:4500	Company: IGES, Inc	
Date: 01/09/12		File Name: SS-3 pseudostatic.slim	



IGES®	Project	North Cache Valley Landfill		
	Analysis Description	Intermediate Fill Slope - after some MSW is placed - pseudostatic with 20% reduction in strength		
	Drawn By. JMG	Scale	Company	IGES, Inc
	Date 01/09/12		File Name	SS-3 pseudostatic.slim

SLIDEINTERPRET 6.014



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Silt and Sand		115	Mohr-Coulomb	400	31
Lean CLAY		115	Mohr-Coulomb	1000	27
MSW		67.5	Mohr-Coulomb	120	24

IGES®

SLIDEINTERPRET 6.014

Project	North Cache Valley Landfill
Analysis Description	Intermediate Fill Slope - after some MSW is placed - pseudostatic at yield acceleration
Drawn By	JMG
Scale	1:4500
Company	IGES, Inc
Date	01/09/12
File Name	SS-3 pseudostatic at yield.slim

Simplified Seismic Slope Displacement

after Bray et al. (1998) and referenced in SCEC (2002) with sliding length modification option suggested by Rathje & Bray (2006) unpublished

Project: **North Valley Landfill**
Number: **00386-014**

Model:	SS-1 - Cut slope	SS-2 - Final Cover
Mw =	6.7	6.7
MHA (g) =	0.32	0.32
r (km) =	3.61	3.61
(D5-95)med, (sec) =	10.76	10.76
Slope deformation analysis		
Shear wave velocity, Vs (ft/sec) =	1160	700
Maximum vertical distance, H (ft) =	206	103
Yield acceleration, ky (g) =	0.237	0.212
Period of sliding mass, Ts (sec) =	0.71	0.59
Mean period of eq, Tm (sec) =	0.477	0.477
Ts/Tm =	1.489	1.234
MHEA/(MHAr*NRF)mean =	0.392	0.455
Bray et al. (1998)		
MHEA or MHEA red. = Kmax =	0.1	0.11
Ky/Kmax =	2.39	1.94
Norm. disp. (mm/sec) =	0	0
U median (mm) =	0.00	0.00
U median (cm) =	**0.00**	**0.00**
U median (in.) =	0.00	0.00

Fault name/ID = West Cache fault zone,
Clarkston section/2521a

Reference:

Bray et al. (1998). "Simplified seismic design procedures for geosynthetic-lined solid-waste landfills" Geotynthetics International Vol. 5, NO.1-2

SCEC (2002). Recommended procedures for implementation of analyzing and mitigating landslide hazards in California

Infininte Slope Yield Acceleration Determination

Project: **North Valley Landfill**
Number: **00386-014**

Model:	Mulch/soil interface	Soil/drain net interface	Drain net/HDPE interface	HDPE/GCL interface	GCL	GCL/soil interface	Total cover/MSW interface
Thickness, H (ft) =	0.52	2.05	2.07	2.08	2.09	2.11	3.65
Unit weight, γ (pcf) =	65.0	102.5	101.3	101.2	100.6	100.4	106.3
Friction angle, ϕ (deg) =	25.0	30.0	25.0	25.0	34.0	30.0	24.0
Cohesion intercept, c (psf) =	150.0	100.0	60.0	60.0	120.0	100.0	120.0
Slope angle, β (deg) =	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Static factor of safety, FS =	20.726	4.332	3.081	3.077	5.123	4.316	3.096

$$FS = \frac{\tan\phi}{\tan\beta} + \frac{c}{\gamma H \cos\beta \sin\beta}$$

Yield acceleration, k_y (g) =	**4.417**	**0.728**	**0.466**	**0.465**	**0.882**	**0.724**	**0.471**

$$k_y = \tan(\phi - \beta) + \frac{c}{\gamma H \cos^2\beta(1 + \tan\phi \tan\beta)}$$

Simplified Seismic Slope Displacement

after Bray et al. (1998) and referenced in SCEC (2002) with sliding length modification option suggested by Rathje & Bray (2006) unpublished

Project: **North Valley Landfill**
Number: **00386-014**

Model:	Mulch/soil interface	Soil/drain net interface	Drain net/HDPE interface	HDPE/GCL interface	GCL	GCL/soil interface	Total cover/MSW interface
Mw =	6.7	6.7	6.7	6.7	6.7	6.7	6.7
MHA (g) =	0.32	0.32	0.32	0.32	0.32	0.32	0.32
r (km) =	3.61	3.61	3.61	3.61	3.61	3.61	3.61
(D5-95)med, (sec) =	10.76	10.76	10.76	10.76	10.76	10.76	10.76
Slope deformation analysis							
Shear wave velocity, Vs (ft/sec) =	700	700	700	700	700	700	700
Maximum vertical distance, H (ft) =	0.52	2.05	2.07	2.08	2.09	2.11	3.65
Yield acceleration, ky (g) =	4.417	0.728	0.466	0.465	0.882	0.724	0.471
Period of sliding mass, Ts (sec) =	0	0.01	0.01	0.01	0.01	0.01	0.02
Mean period of eq, Tm (sec) =	0.477	0.477	0.477	0.477	0.477	0.477	0.477
Ts/Tm =	0.006	0.025	0.025	0.025	0.025	0.025	0.044
MHEA/(MHAr*NRF)mean =	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bray et al. (1998)							
MHEA or MHEA red. = Kmax =	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Ky/Kmax =	18.4	3.03	1.94	1.93	3.67	3.01	1.96
Norm. disp. (mm/sec) =	0	0	0	0	0	0	0
U median (mm) =	0.00	0.00	0.00	0.00	0.00	0.00	0.00
U median (cm) =	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
U median (in.) =	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Fault name/ID = West Cache fault zone,
Clarkston section/2521a

Reference:

Bray et al. (1998). "Simplified seismic design procedures for geosynthetic-lined solid-waste landfills" Geotynthetics International Vol. 5, NO.1-2

SCEC (2002). Recommended procedures for implementation of analyzing and mitigating landslide hazards in California

Appendix N

North Valley Landfill Operational Life (2% annual growth)

ACTIVE PHASE	YEAR	ESTIMATED DAILY MSW WASTE (Tons)	DAYS OF OPERATION	ESTIMATED YEARLY MSW WASTE (Tons)	ESTIMATED YEARLY MSW WASTE (Cu. Yds.)	CUMULATIVE MSW WASTE (Cu.Yards)	REMAINING WASTE CAPACITY (Cu. Yds.)	REMAINING LANDFILL CAPACITY (Percent)
							21,352,800	100.0%
I	2012	243.00	310	75,330	107,614	107,614	21,245,186	99.5%
I	2013	247.86	310	76,837	109,767	217,381	21,135,419	99.0%
I	2014	252.82	310	78,373	111,962	329,343	21,023,457	98.5%
I	2015	257.87	310	79,941	114,201	443,544	20,909,256	97.9%
I	2016	263.03	310	81,540	116,485	560,029	20,792,771	97.4%
I	2017	268.29	310	83,170	118.815	678,844	20,673,956	96.8%
I	2018	273.66	310	84,834	121,191	800,035	20,552,765	96.3%
I	2019	279.13	310	86,530	123,615	923,650	20,429,150	95.7%
I	2020	284.71	310	88,261	126,087	1,049,737	20,303,063	95.1%
I	2021	290.41	310	90,026	128,609	1,178,346	20,174,454	94.5%
I	2022	296.22	310	91,827	131,181	1,309,528	20,043,272	93.9%
I	2023	302.14	310	93,663	133,805	1,443,332	19,909,468	93.2%
I	2024	308.18	310	95,537	136,481	1,579,813	19,772,987	92.6%
I	2025	314.35	310	97,447	139,211	1,719,024	19,633,776	91.9%
I	2026	320.63	310	99,396	141,995	1,861,019	19,491,781	91.3%
I	2027	327.05	310	101,384	144,835	2,005,853	19,346,947	90.6%
I	2028	333.59	310	103,412	147,731	2,153,585	19,199,215	89.9%
I	2029	340.26	310	105,480	150,686	2,304,271	19,048.529	89.2%
I	2030	347.06	310	107,590	153,700	2,457,970	18,894,830	88.5%
I	2031	354.01	310	109,742	156,774	2,614,744	18,738,056	87.8%
I	2032	361.09	310	111,936	159,909	2,774,653	18,578.147	87.0%
I	2033	368.31	310	114,175	163,107	2,937,761	18,415,039	86.2%
I	2034	375.67	310	116,459	166,369	3,104,130	18,248,670	85.5%
I	2035	383.19	310	118,788	169,697	3,273,827	18,078,973	84.7%
II	2036	390.85	310	121,164	173,091	3,446,918	17,905,882	83.9%
II	2037	398.67	310	123,587	176,553	3,623,470	17,729,330	83.0%
II	2038	406.64	310	126,059	180,084	3,803,554	17,549,246	82.2%
II	2039	414.77	310	128,580	183,685	3,987,240	17,365,560	81.3%
II	2040	423.07	310	131,151	187,359	4,174,599	17,178,201	80.4%
II	2041	431.53	310	133,774	191,106	4,365,705	16,987,095	79.6%
II	2042	440.16	310	136,450	194,928	4,560,633	16,792,167	78.6%
II	2043	448.96	310	139,179	198,827	4,759,460	16,593,340	77.7%
II	2044	457.94	310	141,962	202,803	4,962,264	16,390,536	76.8%
II	2045	467.10	310	144,802	206,860	5,169,123	16,183,677	75.8%
II	2046	476.44	310	147,698	210,997	5,380,120	15,972,680	74.8%
II	2047	485.97	310	150,652	215,217	5,595,337	15,757,463	73.8%
II	2048	495.69	310	153,665	219,521	5,814,858	15,537,942	72.8%
II	2049	505.61	310	156,738	223,911	6,038,769	15,314,031	71.7%
II	2050	515.72	310	159,873	228,390	6,267,159	15,085,641	70.6%
II	2051	526.03	310	163,070	232,957	6,500,116	14,852,684	69.6%
II	2052	536.55	310	166,332	237,617	6,737,733	14,615,067	68.4%
II	2053	547.28	310	169,658	242,369	6,980,102	14,372,698	67.3%
II	2054	558.23	310	173,051	247,216	7,227,318	14,125,482	66.2%
II	2055	569.40	310	176,512	252,161	7,479,479	13,873,321	65.0%
II	2056	580.78	310	180,043	257,204	7,736,683	13,616,117	63.8%
II	2057	592.40	310	183,644	262,348	7,999,031	13,353,769	62.5%
II	2058	604.25	310	187,316	267,595	8,266,625	13,086,175	61.3%
II	2059	616.33	310	191,063	272,947	8,539,572	12,813,228	60.0%
II	2060	628.66	310	194,884	278.406	8.817,978	12,534,822	58.7%
II	2061	641.23	310	198.782	283,974	9,101,952	12,250,848	57.4%
II	2062	654.06	310	202,757	289,653	9,391,605	11,961,195	56.0%
II	2063	667.14	310	206,812	295,446	9,687,052	11,665,748	54.6%
II	2064	680.48	310	210,949	301,355	9,988,407	11,364,393	53.2%
II	2065	694.09	310	215,168	307,382	10,295,789	11,057,011	51.8%
III	2066	707.97	310	219,471	313,530	10,609,319	10,743,481	50.3%
III	2067	722.13	310	223,860	319,801	10,929,120	10,423,680	48.8%
III	2068	736.57	310	228.338	326,197	11,255,317	10,097,483	47.3%
III	2069	751.30	310	232,904	332,721	11,588,037	9,764,763	45.7%
III	2070	766.33	310	237,563	339,375	11,927,412	9,425,388	44.1%
III	2071	781.66	310	242,314	346,163	12,273,575	9,079,225	42.5%
III	2072	797.29	310	247,160	353,086	12,626,661	8,726,139	40.9%
III	2073	813.24	310	252,103	360,148	12,986,808	8,365,992	39.2%
III	2074	829.50	310	257,145	367,350	13,354,159	7,998.641	37.5%
III	2075	846.09	310	262,288	374,697	13,728,856	7,623,944	35.7%
III	2076	863.01	310	267,534	382,191	14,111,048	7,241,752	33.9%
III	2077	880.27	310	272,885	389,835	14,500,883	6,851,917	32.1%
III	2078	897.88	310	278,342	397,632	14,898.515	6,454,285	30.2%
III	2079	915.84	310	283,909	405,585	15,304,099	6,048.701	28.3%
III	2080	934.15	310	289,587	413,696	15,717,796	5,635,004	26.4%
III	2081	952.84	310	295,379	421,970	16,139,766	5,213,034	24.4%
III	2082	971.89	310	301,287	430,410	16,570,175	4,782,625	22.4%
III	2083	991.33	310	307,312	439,018	17,009,193	4,343,607	20.3%
III	2084	1011.16	310	313,459	447.798	17,456,991	3,895,809	18.2%
III	2085	1031.38	310	319,728	456,754	17,913,745	3,439,055	16.1%
III	2086	1052.01	310	326,122	465,889	18.379,635	2,973,165	13.9%
III	2087	1073.05	310	332,645	475,207	18.854,842	2,497,958	11.7%
III	2088	1094.51	310	339,298	484,711	19,339,553	2,013,247	9.4%
III	2089	1116.40	310	346,084	494,405	19,833,958	1,518.842	7.1%
III	2090	1138.73	310	353,005	504,293	20,338,252	1,014,548	4.8%
III	2091	1161.50	310	360,066	514,379	20,852,631	500,169	2.3%
0	2092	1184.73	296	350,118	500,169	21,352,800	0	0.0%

81 yr operational life

Approximate Gross Air Space (Cubic Yards) = 26,691,000

Net Air Space based upon a 20% reduction to allow for cover soils

Approximate Net Air Space (Cubic Yards) = 21,352,800

Conversion of tons of waste to Cubic Yards of waste is based upon an estimated conversion rate of 1200 pounds per one Cubic Yard of MSW waste.

Appendix O

CLOSURE COSTS (IMMEDIATE CLOSURE)

Section 1.0 - Engineering **Closure Stage J**

ESTIMATED DATE OF CLOSURE =

APPROXIMATE CLOSURE AREA = 607,500

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	**Topographic Survey**	LS	$7,500	1	$7,500
1.2	**Boundary Survey for Closure**	NA			
1.3	**Site Evaluation**	LS	$2,500	1	$2,500
1.4	**Development of Plans**	LS	$25,000	1	$25,000
1.5	**Contract Administration -** (Bidding and Award)	LA	$7,500	1	$7,500
1.6	(Certification of Final Cover and Closure Notice)	LS	$10,000	1	$10,000
1.7	**Project Management -** (Construction Observation and Testing)	LS	$40,000	1	$40,000
1.8	**Monitor Well Consultant Cost**	NA			$0
1.9	**Other Environmental Permit Co**	NA			$0
				Engineering Subtotal	$92,500

Section 2.0 - Construction **CLOSURE NOW**

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Final Cover System**				
2.1.1	***Site Preparation/ Site Regrading***	ACRE	$1,500	13.9	$20,919
2.1.2	*Gas Collection Layer/Pipes*	NA			$0
2.1.3	*Low permeability Layer (Soil - If Applicable)*				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	33,750	$33,750
c	Soil Transportation	CY	$2.00	33,750	$67,500
d	Soil Placement	CY	$1.00	33,750	$33,750
e	Soil Amendment (compact)	CY	$7.00	33,750	$236,250
2.1.4	***Low permeability Layer (Synthetic - If Applicable)***				
a	Geotextile	SF	$0.12	607,500	$72,900
b	GCL	SF	$0.47	607,500	$285,525
c	Geomembrane	SF	$0.27	607,500	$164,025
2.1.5	***Drainage Layer (Soil - If Applicable)***				
a	Geotextile	NA			$0
b	Sand/Gravel	NA			$0
2.1.6	***Drainage Layer (Synthetic - If Applicable)***				
a	Geotextile	NA			$0
b	Geonet/Geocomposite	NA			$0
2.1.7	***Erosion Protection Soil Layer***				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	33,750	$33,750
c	Soil Transportation	CY	$2.00	33,750	$67,500
d	Soil Placement	CY	$1.00	33,750	$33,750
e	Soil Amendment (compact)	CY			$0
2.1.8	***Topsiol Layer***				
a	Soil Purchase	NA			$0
b	Soil Processing (load)	CY	$1.00	11,250	$11,250
c	Soil Transportation	CY	$2.00	11,250	$22,500
d	Soil Placement	CY	$1.00	11,250	$11,250
e	Soil Amendment	NA			$0
2.1.9	***Revegetation***				
a	Seeding	ACRE	$1,200	13.9	$16,736
b	Fertilizing	ACRE	$500	13.9	$6,973
c	Mulch	ACRE	$200	13.9	$2,789
d	Tacifier	ACRE	$200	13.9	$2,789
2.2	**Stormwater Protection Structures**				
a	Culverts	EA	$1,500	1	$1,500
b	Pipes	EA		0	$0
c	Ditches/Berms	FT	$5	5,000	$25,000
d	Detention Basins	NA			$0
2.3	**Gas Collection System**				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.4	**Leachate Collection System**				
a	Design	NA			$0
b	Additional Equipment / Installation	NA			$0
2.5	**Groundwater Monitoring System**				
a	Monitor Well Installation	NA			$0
b	Monitor Well Abandonment	NA			$0
2.6	**Site Security**				
a	Lighting, signs, etc.	NA			$0
b	Fencing and Gates	NA			$0
2.7	**Miscellaneous**				
a	Performance Bonds	LS	$10,000	1	$10,000
b	Contract/Legal fees	LS	$5,000	1	$5,000
				Construction Subtotal	$1,165,407

LS - LUMP SUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET

Total	$1,257,907
10% Contingency	$125,791
Subtotal Closure Cost	$1,383,697

CLOSURE COSTS (Worst Case PHASE I, II & III)

Section 1.0 - Engineering

	PHASE I	PHASE II	PHASE III
Start Year	2013	2035	2066
ESTIMATED DATE OF CLOSURE =	2025	2050	2080
APPROXIMATE CLOSURE AREA =	1,371,000	1,606,400	2,416,300

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	Topographic Survey	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000
1.2	Boundary Survey for Closure	NA				NA				NA			
1.3	Site Evaluation	LS	$2,500	1	$2,500	LS	$2,500	1	$2,500	LS	$2,500	1	$2,500
1.4	Development of Plans	LS	$15,000	1	$15,000	LS	$15,000	1	$15,000	LS	$15,000	1	$15,000
1.5	Contract Administration - (Bidding and Award)	LA	$7,500	1	$7,500	LA	$7,500	1	$7,500	LA	$7,500	1	$7,500
1.6	Administrative Costs - (Certification of Final Cover and Closure Notice)	LS	$7,500	1	$7,500	LS	$7,500	1	$7,500	LS	$7,500	1	$7,500
1.7	Project Management - (Construction Observation and Testing)	LS	$25,000	1	$25,000	LS	$25,000	1	$25,000	LS	$25,000	1	$25,000
1.8	Monitor Well Consultant Cost	NA			$0	NA			$0	NA			$0
1.9	Other Environmental Permit Costs	NA			$0	NA			$0	NA			$0
				Engineering Subtotal	$62,500			Engineering Subtotal	$62,500			Engineering Subtotal	$62,500

Section 2.0 - Construction

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost	Unit Measure	Cost/Unit	No. Units	Total Cost
	PHASE I					**PHASE II**				**PHASE III**			
2.1	**Final Cover System**												
2.1.1	***Site Preparation/ Site Regrading***	ACRE	$1,500	31.5	$47,211	ACRE	$1,500	36.9	$55,317	ACRE	$1,500	55.5	$83,206
2.1.2	*Gas Collection Layer Pipes*	NA			$0	NA			$0	NA			$0
2.1.3	*Low permeability Layer (Soil - If Applicable)*												
a	Soil Purchase	NA			$0	NA			$0	NA			$0
b	Soil Processing (load)	CY	$1.00	76,167	$76,167	CY	$1.00	89,244	$89,244	CY	$1.00	134,239	$134,239
c	Soil Transportation	CY	$2.00	76,167	$152,333	CY	$2.00	89,244	$178,489	CY	$2.00	134,239	$268,478
d	Soil Placement	CY	$1.00	76,167	$76,167	CY	$1.00	89,244	$89,244	CY	$1.00	134,239	$134,239
e	Soil Amendment (compact)	CY	$7.00	76,167	$533,167	CY	$7.00	89,244	$624,711	CY	$7.00	134,239	$939,672
2.1.4	***Low permeability Layer (Synthetic - If Applicable)***												
a	Geotextile	SF	$0.12	1,371,000	$164,520	SF	$0.12	1,606,400	$192,768	SF	$0.12	1,606,400	$192,768
b	GCL	SF	$0.47	1,371,000	$644,370	SF	$0.47	1,606,400	$755,008	SF	$0.47	1,606,400	$755,008
c	Geomembrane (HDPE,PVC LLDPE,etc.)	SF	$0.27	1,371,000	$370,170	SF	$0.27	1,606,400	$433,728	SF	$0.27	1,606,400	$433,728
2.1.5	***Drainage Layer (Soil - If Applicable)***												
a	Geotextile	NA			$0	NA			$0	NA			$0
b	Sand/Gravel	NA			$0	NA			$0	NA			$0
2.1.6	***Drainage Layer (Synthetic - If Applicable)***												
a	Geotextile	NA			$0	NA			$0	NA			$0
b	Geonet/Geocomposite	NA			$0	NA			$0	NA			$0
2.1.7	***Erosion Protection Soil Layer***												
a	Soil Purchase	NA			$0	NA			$0	NA			$0
b	Soil Processing (load)	CY	$1.00	76,167	$76,167	CY	$1.00	89,244	$89,244	CY	$1.00	134,239	$134,239
c	Soil Transportation	CY	$2.00	76,167	$152,333	CY	$2.00	89,244	$178,489	CY	$2.00	134,239	$268,478
d	Soil Placement	CY	$1.00	76,167	$76,167	CY	$1.00	89,244	$89,244	CY	$1.00	134,239	$134,239
e	Soil Amendment (compact)	CY			$0	CY			$0	CY			$0
2.1.8	***Topsiol Layer***												
a	Soil Purchase	NA			$0	NA			$0	NA			$0
b	Soil Processing (load)	CY	$1.00	25,389	$25,389	CY	$1.00	29,748	$29,748	CY	$1.00	44,746	$44,746
c	Soil Transportation	CY	$2.00	25,389	$50,778	CY	$2.00	29,748	$59,496	CY	$2.00	44,746	$89,493
d	Soil Placement	CY	$1.00	25,389	$25,389	CY	$1.00	29,748	$29,748	CY	$1.00	44,746	$44,746
e	Soil Amendment	NA			$0	NA			$0	NA			$0
2.1.9	***Revegetation***												
a	Seeding	ACRE	$1,200	31.5	$37,769	ACRE	$1,200	36.9	$44,253	ACRE	$1,200	55.5	$66,565
b	Fertilizing	ACRE	$500	31.5	$15,737	ACRE	$500	36.9	$18,439	ACRE	$500	55.5	$27,735
c	Mulch	ACRE	$200	31.5	$6,295	ACRE	$200	36.9	$7,376	ACRE	$200	55.5	$11,094
d	Tacifier	ACRE	$200	31.5	$6,295	ACRE	$200	36.9	$7,376	ACRE	$200	55.5	$11,094
2.2	**Stormwater Protection Structures**												
a	Culverts	EA	$1,500	1	$1,500	EA	$1,500	0	$0	EA	$1,500	0	$0
b	Pipes	EA		5	$0	EA		10	$0	EA		10	$0
c	Ditches/Berms	FT	$5	3,100	$15,500	FT	$5	2,550	$12,750	FT	$5	2,550	$12,750
d	Detention Basins	NA			$0	NA			$0	NA			$0
2.3	**Gas Collection System**												
a	Design	NA				NA			$0	NA			$0
b	Additional Equipment / Installation	NA				NA			$0	NA			$0
2.4	**Leachate Collection System**												
a	Design	NA			$0	NA			$0	NA			$0
b	*Additional Equipment / Installation*	NA			$0	NA			$0	NA			$0
2.5	**Groundwater Monitoring System**												
a	Monitor Well Installation	NA			$0	NA			$0	NA			$0
b	Monitor Well Abandonment	NA			$0	NA			$0	NA			$0
2.6	**Site Security**												
a	Lighting, signs, etc.	NA			$0	NA			$0	NA			$0
b	Fencing and Gates	NA			$0	NA			$0	NA			$0
2.7	**Miscellaneous**												
a	Performance Bonds	LS	$10,000	1	$10,000	LS	$10,000	1	$10,000	LS	$10,000	1	$10,000
b	Contract/Legal fees	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000	LS	$5,000	1	$5,000
				Construction Subtotal	$2,568,421			Construction Subtotal	$2,999,674			Construction Subtotal	$3,801,517
				Total	$2,630,921			Total	$3,062,174			Total	$3,864,017
				10% Contingency	$263,092			10% Contingency	$306,217			10% Contingency	$386,402
				Subtotal Closure Cost	$2,894,013			Subtotal Closure Cost	$3,368,391			Subtotal Closure Cost	$4,250,418

LS - LUMP SUM
NA - NOT APPLICABLE
EA - EACH
CY - CUBIC YARD
FT - FEET

POST-CLOSURE COSTS (30 YEARS)

Section 1.0 - Engineering

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
1.1	**Post-Closure Plan**	LS	$5,000	1	$5,000
1.2	**Annual Report** (including results from gas, leachate, and ground water sampling - details of maintenance performed)	LS	$5,000	30	$150,000
a	Semiannual Site Inspections	LS	$400	60	$24,000
b	Plan Update	LS	$200	30	$6,000
				Engineering Subtotal	$185,000

Section 2.0 - Gas Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Sample Collection**	LS	$250	120	$30,000
2.2	**Sample Analysis**	NA			$0
2.3	**Report** (Part of Annual Report)				
				Gas Collection System - Sampling Subtotal	$30,000

Section 3.0 - Leachate Collection System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
2.1	**Sample Collection**	LS	$400	120	$48,000
2.2	**Sample Analysis**	LS	$1,200	120	$144,000
2.3	**Report** (Part of Annual Report)	NA			
				Leachate Collection System - Sampling Subtotal	$192,000

Section 4.0 - Ground Water Monitoring System - Sampling

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
3.1	**Sample Collection**	LS	$1,200	60	$72,000
3.2	**Sample Analysis**	LS	$7,000	60	$420,000
3.3	**Report** (Part of Annual Report)				
				Ground Water Collection System - Sampling Subtotal	$492,000

Section 5.0 - Facility Operations and Maintenance

Item	Description	Unit Measure	Cost/Unit	No. Units	Total Cost
4.1	**Cover**				
a	Soil Replacement	LS	$1,000	30	$30,000
b	Vegetation/Reseeding	LS	$500	30	$15,000
4.2	**Storm Water Protection Structures**				
a	Ditch and Culvert Maintenance	LS	$500	30	$15,000
b	Berm and Basin Maintenance	LS	$500	30	$15,000
4.3	**Gas Collection System**				
a	System Operation	NA		30	$0
b	System Repair	LS	$200	30	$6,000
4.4	**Leachate Collection System**				
a	System Operation	LS	$0	30	$0
b	System Repair	LS	$500	30	$15,000
4.5	**Ground Water Monitoring System**				
a	System Operation	NA		30	$0
b	System Repair	LS	$500	30	$15,000
4.6	**Site Security**				
a	Lighting, signs, etc ..	LS	$500	30	$15,000
b	Fencing and Gates	LS	$500	30	$15,000
4.7	**Miscellaneous**				
a					
b					
				Facility Operations and Maintenance Subtotal	$141,000

Total	$1,040,000
10% Contingency	$104,000
Total Post-Closure Cost	$1,144,000