SW 392

Division of
Solid and Hazardous Waste

MAY 2 2 2014

2014-007789

INTEGRATED
WATER MANAGEMENT & LAND FARM

SOUND ENVIRONMENTAL SOLUTIONS FOR A
NEEDED AND NECESSARY ENERGY RESOURCE

Revised Landfill Permit Application

GeoStrata Job No. 751-013

May 22nd, 2014

Prepared for:

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

Attention: Scott T. Anderson, Director

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Attention: Scott T. Anderson, Director

GeoStrata Engineering & Geosciences 14425 South Center Point Way Bluffdale, Utah 84065
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Prepared for:

Scott T Anderson, Director
Permit Manager
Division of Solid and Hazardous Waste
Utah Department of Environmental Quality
PO Box 144880
Salt Lake City, Utah 84114-4880

Revised Landfill Permit Application

GeoStrata Job No. 751-013

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May 22nd, 2014

PERMIT APPLICATION TO OPERATE AN E&P LANDFILL

FOR

INTEGRATED WATER MANAGEMENT

DUCHESNE COUNTY, UTAH

Submitted by:

14425 SOUTH CENTER POINT WAY

BLUFFDALE, UTAH 84065

May 22, 2014

INTRODUCTION

This application and technical report is an application to permit and operate an Exploration & Production (E&P) landfill on land owned and operated by Integrated Water Management (IWM). The landfill is to be created in an area that is currently being used as an evaporation pond for produced water from the oil and gas industry. The pond and associated liners were constructed in 2010 and have been in operation since that time.

The facility is located approximately 7 miles north of Duchesne City, just east of Highway 87. The area to be permitted is located in Section 30, Township 2 South, Range 4 West of the Uintah Special Base and Meridian in Duchesne County, Utah. The location of the facility in relation to surrounding areas is presented on Plate A-1 in Appendix A.

This permit application is segregated into 3 distinct parts, Part I outlines the general information pertaining to the site. Part II is a general report that includes a facility description and proposed landfill operations and activities. Part III is an engineering technical report that provides details on the design of the facility, design of the site closure, describes details of closure and post closure activities and financial assurances as required by State Code.

PERMIT APPLICATION TO OPERATE AN E&P LANDFILL

FOR

INTEGRATED WATER MANAGEMENT

DUCHESNE COUNTY, UTAH

PART I – GENERAL INFORMATION

Part I **General Information**	APPLICANT: PLEASE COMPLETE ALL SECTIONS.	
I. **Application Type**	☒ New Application ☐ Renewal Application	☐ Facility Expansion ☐ Modification

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

II. Facility Name and Location

Legal Name of Facility *Integrated Water Management*				
Site Address (street or directions to site) 20250 W 2000 S				County Duchesne
City Duchesne		Zip Code 84021		Telephone 435-454-4646
Township 2 S	Range 4 W	Section(s) 30	Quarter/Quarter Section SE	Quarter Section SE
Main Gate Latitude degrees 40 minutes 16 seconds 16.5			Longitude degrees 110 minutes 22 seconds 28.1	

III. Facility Owner(s) Information

Legal Name of Facility Owner Integrated Water Management			
Address (mailing) 90 S 400 W STE 360			
City Salt Lake City	State UT	Zip Code 84101	Telephone 801-456-4140

IV. Facility Operator(s) Information

Legal Name of Facility Operator Integrated Water Management			
Address (mailing) 90 S 400 W STE 360			
City Salt Lake City	State UT	Zip Code 84101	Telephone 801-456-4140

V. Property Owner(s) Information

Legal Name of Property Owner Integrated Water Management			
Address (mailing) PO Box 433			
City Altamont	State UT	Zip Code 84001	Telephone 435-454-4646

VI. Contact Information

Owner Contact JT Martin		Title Owner	
Address (mailing) 90 S 400 W STE 360			
City Salt Lake City	State UT	Zip Code 84101	Telephone 801-456-4140
Email Address jt@ie-cos.com		Alternative Telephone (cell or other)	
Operator Contact Nate Robinson		Title Operations Manager	
Address (mailing) PO Box 433			
City Altamont	State UT	Zip Code 84001	Telephone 435-454-4646
Email Address nrobinson@ie-cos.com		Alternative Telephone (cell or other)	
Property Owner Contact JT Martin		Title Owner	
Address (mailing) 90 S 400 W STE 360			
City Salt Lake City	State UT	Zip Code 84101	Telephone 801-456-4140
Email Address jt@ie-cos.com		Alternative Telephone (cell or other)	

Part I General Information (Continued)

VII. Facility Area

Facility Area.....	89.1	acres
Disposal Area.....	4.7	acres
Design Capacity		
Years.....	4	
Cubic Yards.....	152000	
Tons.....	259000	

VIII. Fee and Application Documents

Indicate Documents Attached To This Application

☐ Application Fee: $750.00

Review fees of $90.00 per hour apply to application review

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

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

Signature of Authorized Owner Representative Nate Robinson Name typed or printed	Title General Manager Address PO Box 433 Altamont, UT 84001	Date 05-28-2014
Signature of Authorized Land Owner Representative (if applicable) Nate Robinson Name typed or printed	Title General Manager Address PO Box 433 Altamont, UT 84001	Date 05-28-2014
Signature of Authorized Operator Representative (if applicable) Nate Robinson Name typed or printed	Title General Manager Address PO Box 433 Altamont, UT 84001	Date 05-28-2014

Part II

***I.* Facility General Information**	
Description of Item	Location In Document
Ia. General Information For All Facilities	
Completed Part I General information	Part I
General description of the facility (R315-310-3(1)(b))	Part II 1.1
Legal description of property (R315-310-3(1)(c))	Part II 2.0
Proof of ownership, lease agreement, or other mechanism (R315-310-3(1)(c))	Appendix F
A demonstration that the landfill is not a commercial facility (see Utah Code Annotated 19-6-102(3) for definition of Commercial). A statement that the facility will accept only E&P waste will meet this requirement.	Part II 1.2, 1.3, 1.7
Waste type and anticipated daily volume (R315-310-3(1)(d))	Part II 3.1, Appendix E
Intended schedule of construction (R315-302-2(2)(a))	Part II 3.1
Ib. General Information - New Or Laterally Expanding Class III Landfills	
Documentation that the facility has meet the historical survey requirement of R315-302-1(2)(f) (R315-304-4(1)(a) or R315-304-4(2)(a)(iv))	Part II 1.8
Name and address of all property owners within 1000 feet of the facility boundary (R315-310-3(2)(i))	Appendix I
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 I
Name of the local government with jurisdiction over the facility site (R315-310-3(2)(iii))	Part II 1.9
Ic. Location Standards for New E&P Landfills	
Geology	Part III 1.1, 2.2 Appendix A
Geologic maps showing significant geologic features, faults, and unstable areas	Part III 1.1 Plate A-3
Maps showing site soils	Plate A-3, A-4
Surface water	Part III 1.2, 2.2.5, 2.5, Appendix F
Magnitude of 24 hour 25 year and 100 year storm events	Part III 1.2, 2.4, Appendix F
Average annual rainfall	Part III 1.2
Maximum elevation of flood waters proximate to the facility	Part III 1.3, Appendix F
Maximum elevation of flood water from 100 year flood for waters proximate to the facility	Appendix F
Floodplains as specified in R315-302-1(2)(c)(ii)	Part III 1.3
Wetlands as specified in R35-302-1(2)(d)	Part III 1.4

***I.* Facility General Information**	
Description of Item	Location In Document
The landfill is located so that the lowest level of waste is at least ten feet above the historical high level of ground water or the lowest liner is at least five above the historical high level of ground water	Part III 2.2.4 Plate A-4
Land use compatibility	
Maps showing the existing land use, topography, residences, parks, monuments, recreation areas or wilderness areas within 1000 feet of the site boundary	Part III 1.5, Plate A-7
Certifications that no ecologically or scientifically significant areas or endangered species are present in site area	Part III 1.6, Appendix G
Id. Geohydrological Assessment for All E & P Landfills	
Local and regional geology and hydrology including faults, unstable slopes and subsidence areas on and surrounding the site (R315-310-4(2)(b)(i))	Part III 2.2.1, 2.2.2
Evaluation of bedrock and soil types and properties including permeability rates (R315-310-4(2)(b)(ii))	Part III 2.2.3
Depth to ground water(R315-310-4(2)(b)(iii))	Part III 2.2.4
Direction and estimated flow rate of ground water (R315-310-4(2)(b)(iv))	Part III 2.2.4, Plate A-10
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 1.5, Plate A-6
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 2.2.5
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 2.2.6
Ground Water Monitoring system design (R315-303-3(7)(b) and R315-308) or a demonstration meeting the requirements of R315-308-1(3)	Part III 2.2.6
Statistical method to be used to evaluate ground water monitoring data (R315-308-2(8))	Part III 2.2.6
Ie. Engineering Report - Plans, Specifications, and Calculations for All E & P Landfills	
Documentation that the facility will meet all of the performance standards of R315-303-2	Part III
Engineering reports required to meet the standards of *Ib, Ic, and Id* above	Part III

***I.* Facility General Information**	
Description of Item	Location In Document
Cell design to include liner design meeting the requirements of R315-303-3(3)(a), (b), or (c), cover design meeting R315-303-3(4)(a) or (c), 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)	Appendix F
Leachate collection system design and calculations showing system meets the requirements of R315-303-3(2)	Appendix F
Run-On and run-off diversion designs (R315-303-3(1)(c), (d) and (e))	Appendix F
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))	Appendix F
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 2.2.6
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 2.3
Design and location of run-on and run-off control systems (R315-310-4(2)(c)(viii))	Appendix F
If. Plan of Operations for All All E & P Landfills (R315-310-3(1)(e) and R315-302-2(2))	
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 3.2, Appendix D
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 3.3 Appendix D
Contingency plans in the event of a fire or explosion (R315-302-2(2)(d))	Part II 3.3.3
Plan to control fugitive dust generated from roads, construction, general operations, and covering the waste (R315-302-2(2)(g))	Part II 3.3.1
Plan for letter control and collection (R315-302-2(2)(h))	Part II 3.3.2
Procedures for excluding the receipt of non-E & P Waste (R315-302-2(2)(j))	Part II 3.2.4
A plan for alternative waste handling (R315-302-2(2)(l))	Part II 3.3.4
A general training plan for site operations (R315-302-2(2)(o))	Part II 3.3.5
Any other site specific information pertaining to the plan of operation required by the Director (R315-302-2(2)(p))	NA
***II* Facility Technical Information**	
IIa. Maps for All All E & P Landfills	

***I.* Facility General Information**	
Description of Item	Location In Document
Topographic map drawn to the required scale with contours showing the boundaries of the landfill unit, ground water monitoring well locations (if required), and the borrow and fill areas (R315-310-4(2)(a)(i))	Appendix A, Appendix I
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))	Plate A-1,
IIb. Closure Requirements for All All E & P Landfills	
Closure plan (R315-310-3(1)(h))	Part III 3.0
Closure schedule (R315-310-4(2)(d)(i))	Part III 3.1
Design of final cover (R315-310-4(2)(c)(iii))	Part III 3.2
Capacity of site in volume and tonnage (R315-310-4(2)(d)(ii))	Part III 3.3
Final inspection by regulatory agencies (R315-310-4(2)(d)(iii))	Part III 3.4
IIc. Post-Closure Care Requirements for All E & P Landfills	
Post-closure care plan (R315-310-3(1)(h))	Part III 4.0
Changes to record of title, land use, and zoning restrictions (R315-310-4(2)(e)(v))	Part III 4.2
Maintenance activities to maintain cover and run-on/run-off control systems (R315-310-4(2)(e)(iii))	Part III 4.1
List the name, address, and telephone number of the person or office to contact about the facility during the post-closure care period (R315-310-4(2)(e)(vi))	Part III 4.3
IId. Financial Assurance Requirements for All All E & P Landfills	
Identification of closure costs including cost calculations (R315-310-4(2)(d)(iv))	Part III 5.1, Appendix H
Identification of post-closure care costs including cost calculations (R315-310-4(2)(e)(iv))	Part III 5.2, Appendix H
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) and R315-310-3(1)(j))	Part III 5.3

PERMIT APPLICATION TO OPERATE AN E&P LANDFILL
FOR
INTEGRATED WATER MANAGEMENT
DUCHESNE COUNTY, UTAH

PART II – GENERAL REPORT

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1.0 FACILITY DESCRIPTION

1.1 FACILITY GENERAL DESCRIPTION

The IWM facility is located on 89.1 acres of land approximately 7 miles north of Duchesne City, just east of Highway 87. The area to be permitted is located in Section 30, Township 2 South, Range 4 West of the Uintah Special Base and Meridian in Duchesne County, Utah. The location of the facility in relation to surrounding areas is presented on Plate A-1 in Appendix A. The facility is currently being used to dispose of produced water from the oil and gas industry.

The IWM facility has 9 buildings that are actively being used to support the various waste disposal purposes. These buildings consist of main office building, Driver Shack, Tank building, Water Well House, Injection Well House, Triplex building and three Workshops. On site there is also at least 26 oil and water storage tanks used for processing the waste water. IWM also a waste water injection well located inside the Injection Well House. The injection well is used to dispose of waste water approximately 1 mile beneath the ground surface. On the northern part of IWM property is an approximately 3.6 acres landfarm. The landfarm is used to bio remediate hydrocarbon contaminated solids. A map with each of these features identified and also other waste processing components is provided in Appendix A as plate A-8.

Plate A-1 identifies structures within a quarter mile of the facility, drainages within a quarter mile, and the prevailing wind direction. The prevailing wind direction is from the west.

1.2 AREA SERVED

IWM currently manages a produced water facility with clients throughout the Uintah Basin, Colorado and Wyoming. IWM plans to provide additional services to existing clients including RCRA exempt E&P wastes as defined by the Division of Solid and Hazardous Waste. As noted, the area to be served will generally be within the Uintah Basin, Colorado and Wyoming areas.

1.3 WASTE TYPES

The facility will receive and treat RCRA exempt E&P waste. This waste includes but is not limited to E&P produced water, frac sands and drill cuttings, soils saturated with hydrocarbons and other E&P solid wastes. As required by the division's standards for design the operator must minimize liquids admitted in to the landfill by prohibiting waste that contains free liquids (R315-303-3(1)). All of the waste will need to pass the paint filter test (EPA Method 9095B) to be accepted and deposited into the landfill.

1.4 FACILITY HOURS

The IWM facility is an active water treatment facility that is manned 24 hours a day and 365 days a year. The proposed landfill will be available to accommodate waste from IWM clients/customers at their convenience.

1.5 LANDFILL EQUIPMENT

The IWM facility currently has equipment to support the existing water disposal operation. This equipment includes a Komatsu 42N-54 backhoe/front loader, a Komatsu 37A-54-A110 skid steer, and a filter press. Additional equipment will be acquired to facilitate the operation of the proposed E&P landfill. This equipment may include a conveyor system to distribute and place the E&P waste across the landfill area.

1.6 LANDFILL PERSONNEL

IWM facility is managed by Mr. Nate Robinson who has more than 10 years of experience managing waste disposal facilities. The IWM staff currently has more than 15 full time employees. The following table lists the current managing staff at the facility and the additional duties relating to the landfill that will be incorporated into assigned tasks. Other IWM employees assigned to work in the landfill portion of the IWM facility will receive direction from the managing staff.

Employee Name	Current Title	Years of Experience	Current Duties	Landfill Duties
JT Martin	Managing Director	2 years	Directs and oversees work at IWM	
Nate Robinson	General Manager	10 years	Manages all IWM facility operations	Managing the operation of the landfill
Robert Meeks	HS&E	4 years	Relief Management & Safety	Safety over landfill facility
Collin Roach	Operator	3 Years	Landfarm operator maintenance	Land fill operator and Maintenance
Russell Sorensen	Operations Manager	6 Years	Landfarm manager, peak well services & cleanup crew supervisor	Landfill duties manager

1.7 NON COMMERCIAL EXCLUSION

The proposed landfill will only accept RCRA exempt E&P waste as defined in Section 1.3 of this application. Verbal discussions with UDSHW personnel indicate that the facility will be considered a non-commercial facility if and only if E&P waste as defined in Section 1.3 of this document is accepted into the landfill. The operational plan will define quality control steps to ensure the acceptance of only approved E&P waste in order to meet the requirements of a non-commercial facility.

1.8 HISTORICAL PRESERVATION SURVEY

GeoStrata conducted a review of the landfill construction site and prepared a letter for the State Historical Preservation Officer (SHPO). Based on our evaluation of the site and area of potential effects from the permitting of the new landfill, we found that the site has no historical properties or structures. We provided our findings to the SHPO and we received a response indicating that they concur with our determination. A copy of the letter from the SHPO is provided in this permit application in Appendix G.

1.9 LOCAL GOVERNMENT WITH JURISDICTION

The local government with jurisdiction over the IWM facility is Duchesne County. The mailing address is provided below:

734 North Center Street
PO Box 910
Duchesne, Utah 84021

2.0 LEGAL DESCRIPTION

A legal description of the proposed landfill is provided below. IWM is the owner of this property and proof of this ownership is provided in Appendix F. Proof documents presented in the Appendix F include a Plat map, tax records and a warranty deed.

A PARCEL OF LAND LOCATED IN THE SOUTHEAST QUARTER OF SECTION 30, TOWNSHIP 2 SOUTH; RANGE 1 WEST, UINTAH SPECIAL BASE AND MERIDIAN. BETTER DESCRIBED AS, BEGINNING AT A POINT LOCATED NORTH 89°57'15" WEST 552.56 FEET AND NORTH 553.38 FEET FROM THE SOUTHEAST CORNER OF SAID SECTION 30; AND RUNNING THENCE NORTH 49°26'56" WEST 929.42 FEET; THENCE NORTH 40°33'04" EAST 219.94 FEET; THENCE SOUTH 49°26'56" EAST 929.42 FEET; THENCE SOUTH 40°33'04" 219.94 FEET TO THE POINT OF BEGINNING.

CONTAINS APPROXIMATELY 204,419 SQFT
(Gilson Engineering)

3.0 OPERATIONS PLAN

3.1 SCHEDULE OF CONSTRUCTION

Prior to the IWM facility the subject site was originally constructed as a waste water disposal site in the 1980s. The original waste water disposal facility was closed in 1994. In 2010 the original facility ponds were completely removed and hauled way to clear the site for the construction of three new ponds currently used by IWM. The ponds were constructed and lined in 2010. IWM began accepting waste water in 2010.

Ponds 1-3 at the IWM facility have a 60 mil HDPE primary liner a 200 mil GEONET and a 40 mil HDPE secondary liner. Pond 3 of the IWM facility is the proposed location for the E&P landfill cell and has been operating as a waste water pond since it was constructed. Pond 3 is currently drained of all waste water and its current configuration will remain intact for the operational use of the landfill. A set of plans for the landfill cell is provided in appendix F.

At the start of landfill operation IWM anticipates that approximately 5 truckloads of E&P waste will be transported to the facility per day. Each truck load will have a volume of approximately 15 cubic yards. IWM anticipates that some processing will be required to allow the imported waste to pass the paint filter test. At this time IWM is considering using several different techniques and processes to getting waste to pass the paint filter test. Some of the techniques IWM plans to utilize include but are not limited to a filter press, mixing of the waste with sawdust, flyash, native soils or other components. Waste acceptance procedures and quality control of waste being disposed in the landfill are out line in sections 3.2.1 and 3.2.2 of this report.

Once the final process is defined adjustments to the design life of the landfill will be made. At this point the life duration of the landfill is defined assuming that half of the waste arriving at the landfill will be mixed with native soil material and the remaining waste will be processed using other equipment (drying, filter press) and then placed directly into the landfill. Waste that will be mixed with additional material will need to reach a moisture content that corresponds with passing the paint filter test. In order to obtain an estimate for the mixing ratio, a preliminary waste assessment was conducted using samples of anticipated types of waste material and native soils that will be disposed in the IWM landfill under this permit application. During this assessment it was

determined that mixing of native soils with waste will be done at a ratio of approximately 1.5:1 respectively in order to reach a waste moisture content that will pass the paint filter test. In other words for every 1 ton of waste there will be approximately 1.5 tons of native soils added to reach a moisture content that will pass the paint filter. Calculations used to estimate the mixing ratio are provided in appendix E as plate E-1 and E-2

Based on waste mixing assumptions described above and assuming waste will be accepted 5 days per week and a 10% growth rate over the life of the landfill, the projected life of the landfill is approximately 4 years (3 years & 9 months). However, the projected life may increase or decrease based on the type of processing and or mixing methods utilized. A copy of the spreadsheet used to calculate this estimated life is included in Appendix E. All of the assumptions presented in the previous paragraphs were used in the spreadsheet calculations.

3.2 DESCRIPTION OF WASTE HANDLING PROCEDURES

The following section describe the general procedures that will be followed under this permit application for accepting, disposing, recording and excluding landfill waste at the IWM facility.

3.2.1 General Procedures

All waste will be hauled to the IWM facility using commercial or independently owned trucks. All trucks will enter at the main gate and check in with the landfill office. Every truck load of waste will be inspected prior to disposal and a paint filter test will be performed on each load of waste unless it obviously won't pass the paint filter test. Waste in this category may be processed first and will be tested previous to placement in the landfill. Waste needing additional processing to pass the paint filter test will be placed in a temporary storage area for further processing. Plate shows the proposed location of the temporary storage tank where waste will be stored before processing. The tank will be approximately 36 x 140 x 2 ft and will be located on top of an existing HDPE liner and adjacent to the proposed landfill cell (Plate A-9). The tank will be constructed out of 35 lb modular blocks each of which is approximately 4ft long 2ft high and 1ft wide. Previous to tank construction a layer of felt will be placed on top of the existing HDPE liner over the entire footprint of the temporary storage tank. Blocks will then be arranged in the shape of a rectangle approximately 36 ft x 140 ft. Adjacent blocks will be interlocked using 6 in PVC pins. To further stabilize the tank, cables attached to the top

and bottom of the tank will stretch across to the top and bottom of the opposite side the tank. In addition HDPE blocks will be welded to the liner to prevent the base of the tank from moving. The modular tank will also be lined with a 40 mil liner to isolate waste. Photos in Appendix J show the blocks in various stages of construction. IWM will utilize different types of containment for waste depending on if it needs to be processed to pass the paint filter test and how it will be processed. Most waste arriving at the site to be processed will be placed in storage tanks. The storage tanks will feed directly into the filter press unit which will dewater the waste. Waste that will not go through the filter press will be placed in a storage area that will be constructed so as to ensure that the waste will be isolate from the underlying soils. The liner material for the storage area will be composed of either concrete, clay, or an HDPE liner. This storage area will be constructed as a staging area that could also be used to mix or dry waste if desired.

An additional paint filter test will be conducted on every 15 cubic yards of waste that requires processing prior to being transported into the landfill. Waste that fails the second paint filter test will remain in the temporary storage area and will be reprocessed by mixing with native soils. Paint filter test procedures are attached to this application in appendix D.

After passing the paint filter test waste will be placed in the landfill using a conveyor system. Waste will then be placed in a uniform layer in the bottom of the landfill as described in section 3.2.3 Waste Disposal.

3.2.2 Waste Shipment Records

The landfill manager will maintain and store waste shipment records as part of the daily records of disposal activities. Each truck load of E&P waste delivered to the IWM facility will have a waste shipment ticket completed. The waste shipment ticket will be completed by the truck driver and then verified by the landfill operating staff. An example of the waste shipment ticket is included in Appendix D. The waste shipment ticket will include the following data for record keeping:

- Date and time of arrival
- Load ID number
- Quantity in cubic yards and estimated tons based on unit weight
- Type of waste
- Origin and generator of waste
- Name of trucking company and truck number

- Truck drivers name and signature

3.2.3 Waste Disposal

The E&P waste will be transported into the landfill cell by means of a conveyor system. Waste will be deposited at the bottom of the will be placed in 1ft thick lifts. Lifts will be distributed by use of the Komatsu 37A-54-A110 skid steer and then wheel rolled with heavy compaction equipment. Waste will be wheel rolled to reach a firm and unyielding surface to maximize landfill capacity.

Waste deposited in the landfill will not come in contact with the HDPE liner. A protective 12 inch layer of fill material will be in place between the waste and HDPE liner. The 12 inch fill layer will be placed on all surfaces of the HDPE liner. All equipment moving in or on the landfill will not have contact with the liner and will remain on the fill layer. Waste will also be placed in such a way as to avoid puncturing liner during the compaction process.

3.2.4 Plans for Excluding Waste

Non E&P waste and non RCRA exempt waste will not be accepted at the IWM landfill. In an effort to ensure that waste meets this requirement, all potential waste generators that wish to dispose waste at the IWM facility must first complete an initial waste profile assessment. This assessment will include completion of a waste characterization form and also providing samples for testing and assessment. This assessment will determine the acceptability of the waste that is generated to be disposed under this permit application.

Representative samples of each type of waste that will be provided to IWM by the generator for testing will be subjected to a paint filter test when applicable. Generators will be required to complete a waste characterization form and provided a letter of certification for each type of waste that the waste meets the requirements of disposal. Generators will be required to characterize the waste from each of the various sources. Generators will also be required to inform IWM when waste composition changes and then resubmit a waste characterization form with samples. An example of this form is provided at the end of this application in Appendix D.

3.3 WASTE FACILITY INSPECTION AND MONITORING

IWM personnel will inspect the facility to prevent malfunctions and deterioration, operator errors, and discharges which may cause or lead to the release of wastes to the environment or to a threat to human health. Facility inspections will be conducted weekly and will be recorded using the weekly inspection log. Some items will be monitored on a daily basis. An example of these inspection logs is provided in this permit application in Appendix D.

3.3.1 Fugitive Dust Control

As required in Utah Administrative Code R315-302-2(2)(g) IWM has prepared a plan for controlling fugitive dust as part of this permit application. As part of the daily operations of the IWM facility, fugitive dust will be monitored and controls will be put in place as deemed necessary by the landfill operations manager.

During the construction and operational phases of the landfill, sources of dust within the landfill cell will be identified by the landfill operations manager. These sources of dust will be controlled by watering and proper placement of waste in the landfill. The IWM will have staff on site that are certified in monitoring opacity and will periodically check the facility for dust control issues. When opacity of the dust exceeds 10% watering controls will be put in place.

The landfill operations manager will also monitor dust on all haul roads on IWM property. Haul roads leading form the main gate to the landfill cell are all unpaved. Proper maintenance of haul roads, speed limit controls and watering when dust opacity exceeds 10% will aid in reducing fugitive dust emissions.

3.3.2 Plan for Litter Control

IWM does not anticipate accepting waste materials that will cause a wind-blown litter problem. IWM will complete a daily inspection of the landfill and surrounding area and identify any potential waste material that may escape the facility.

3.3.3 Contingency Plan for Fire or Explosion

In the event of a fire or explosion at the IWM facility, the landfill operations manager will be notified. The landfill operations manager will then contact local emergency authorities to initiate emergency response. A list of the local emergency responders is provided in Appendix D of this permit application.

3.3.4 Alternative Waste Handling Plan

In the event of a landfill closure due to an emergency or repairs, IWM will make arrangements to have the waste transported to the Duchesne County Landfill located at 20550 W and 2000 S. The Duchesne County Landfill is approximately 0.5 miles south east of the IWM facility. This close proximity will allow a quick transition to the alternative facility if needed.

3.3.5 General Training Plan

IWM currently has a training program that educates their employees on how to handle E&P waste and how to operate the existing components of the waste facility. As required in R315-302-2(2), each permitted landfill must have a detailed training program. Prior to working in the landfill portion of the IWM facility, all employees are required to complete the following training program. This training program will consist of three parts including health and safety training, E&P waste handling, and landfill operations specific training. The training of each employee will be supervised and conducted by the IWM operations manager.

Health and Safety Training:

Prior to completing the IWM health and safety training portion of the education program, each employee will complete a 10 hour safety course provided by OSHA. In addition to the safety training provided by OSHA, IWM will educate the employees on the following safety procedures:

- Facility safety controls
- Emergency procedures and equipment

- Contingency plan procedures
- Fire prevention and control
- Spill prevention and control
- Proper safety equipment and personal protection equipment
- Waste loading and unloading procedures
- Waste disposal equipment handling procedures and safety
- H2S safety training
- Chemical Hazards

E&P Waste Handling Training:

The IWM operations manager will instruct all employees on proper handling of E&P waste based on current government regulations. This training will cover RCRA exempt E&P, produced water and crude oil. This portion of the training will educate the employees with the following items:

- Overview of E&P waste production and disposal
- Identification of E&P waste types
- Review of regulations relating to E&P waste
- Prohibited waste
- Proper handling and disposal of each waste type
- Proper recordkeeping of accepted waste

Landfill Operations Specific Training

Employees that will be involved in any portion of the Landfill operations will receive landfill specific training. Each employee will also receive hands-on training from the operations manager specific to the employee's assigned duties. This portion of the training will cover the following items:

- Overview of landfill design, construction and components
- Waste identification and characterization
- Documentation of accepted waste
- Landfill hazards and safety
- On-site waste transportation
- Waste loading and unloading procedures
- Waste sampling procedures
- Waste inspection, processing and testing procedures
- Recordkeeping

- Landfill inspection and general maintenance
- Emergency procedures and contingency plan
- Proper transportation and placement of waste in landfill
- Spill prevention and containment

All personnel that will be working on the landfill will be required to participate in weekly safety meetings and morning tailgate safety meetings held on site at IWM. All employees are to read and review semiannually this landfill permit. Annual refresher training of the above mentioned training program will be conducted for all employees involved with the permitted landfill. Any new information relevant to the permitted landfill will also be covered in the annual refresher training. New employees that are assigned to work associated with the landfill will receive training during the first month of employment and will be trained by a supervisor that has completed the required training. Records of this training will be kept in the IWM database.

3.4 RECORD KEEPING

During the operation of the landfill, the operator will maintain records of landfill activities as required by the division (315-302-2-(3). These records will be stored electronically in the IWM database at their facility.

3.4.1 Daily Permanent Record

The landfill manager will record the following data daily and maintain the data in a permanent file:

- Waste shipment records as described in section 3.2.2
- The estimated weight in tons and volume in cubic yards of E&P waste received for the day
- The estimated weight in tons and volume in cubic yards of E&P waste that required treatment prior to disposal in the landfill cell.
- The estimated weight in tons and volume in cubic yards of material added to treat the waste and the total weight and volume of treated waste
- Number of trucks visiting the Landfill
- Type of E&P waste received
- Paint filter test results
- Deviations from the UDSHW approve Operations Plan

- Staff training records
- Status of groundwater, leachate and gas monitoring
- A written report of daily activities at the landfill site

3.4.2 Other Records

The landfill manager will also include the following data in the permanent records:

- Design documentation of the placement or recirculation of leachate or gas condensate into the landfill
- Closure and post closure care plans and activities
- Cost estimates and financial assurance documentation
- Safety training and landfill specific training for all employees associated with the landfill

PERMIT APPLICATION TO OPERATE AN E&P LANDFILL
FOR
INTEGRATED WATER MANAGEMENT
DUCHESNE COUNTY, UTAH

PART III
ENGINEERING TECHNICAL REPORT

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1.0 LOCATION STANDARDS

1.1 GEOLOGIC FAULTS AND UNSTABLE AREAS

An engineering geologist with GeoStrata reviewed geologic maps and identified that the nearest Holocene fault is the Strawberry fault located approximately 39 mile west of the IWM facility (Quarternary Fault and Fold Database of the United States, 2006). The proposed IWM landfill cell is not 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. Further details of the geologic setting are provided in the Engineering Report. A geologic map of the IWM facility and surrounding area is provided in this report in Appendix A as plate A-3.

1.2 SURFACE WATER

The magnitudes of the 24 hour 25 year and 100 year storm events are 1.66 inches and 2.13 inches respectively. The average annual precipitation in the vicinity of the IWM facility is approximately 9.5 inches (NOAA Atlas 14 – Duchesne Station).

1.3 FLOODPLAINS

The proposed IWM facility is not located in a floodplain. FEMA has no available Flood hazard maps that cover the area of the IWM facility. Numerous ephemeral drainages are located near the Landfill cell. None of the ephemeral or intermittent drainages are restricted or significantly impacted by the existing landfill cell. Please refer to the drainage study located in Appendix F for further details of the Flood Hazard potential of the IWM facility.

1.4 WETLANDS

A search of the National Wetland Inventory of the U.S. Fish and Wildlife Service indicated that there is no wetland areas located on the IWM facility (National Wetlands Inventory, 2013). Based on a review of the maps, the proposed IWM Landfill cell is not located in a wetland. Further investigation into wetlands was also conducted during the Biological Assessment of the facility and determined that the IWM property contains no

permanent water or wetlands. More details of this assessment are described in section 1.6 of the Engineering Technical Report and the complete report in Appendix G .

1.5 LAND USE COMPATIBILITY

Plate A-7 shows the location standards requested for this permit application including existing land use, topography, residences, parks, monuments, recreation areas or wilderness areas within 1000 feet of the facility boundary. No residences, parks, monuments, recreation areas or wilderness areas were identified within 1000 ft of the facility boundary. Plate A-6 Identifies the location of all public a private wells within 2000 feet of the facility.

1.6 ECOLOGICALLY SENSITIVE AREAS

A survey of the IWM facility was conducted by Dr. Lindsey Nesbit in January 2014 to assess the ecological attributes of the facility and surrounding area. Dr. Nesbit's letter is included in Appendix G of this permit application. The results of this survey revealed that there is no critical habitat for threatened or endangered species on the IWM facility. A summary table of federally listed, proposed, candidate species and USGS rare plants is also included in the report. If any of the listed species in this summary table is encountered on the facility in the future, IWM will contact the Utah Ecological Services Field Office for species identification and preservation.

2.0 ENGINEERING REPORT

2.1 CELL DESIGN

The IWM E & P landfill will consist of a single cell located in the existing Pond 3. The permit drawings show the proposed location in relation to the remaining site and surrounding land features. The pond has historically been used as a produced water evaporation pond. The pond is approximately 820 feet long and 106 feet wide across the bottom. The pond is also approximately 20 feet deep with 3:1 (horizontal:vertical) interior slopes and 2:1 (horizontal:vertical) exterior slopes.

Based on our engineering assessment, many of the pond features can be used to meet the E&P landfill requirements as presented in R315-303. Details of the existing features will be presented in subsequent sections of this report.

2.2 GEOHYDROLOGICAL ASSESSMENT

2.2.1 Regional Geology

As noted previously, the IWM facility is located approximately 7.7 Miles north of Duchesne, Utah on the south flanks of the Uinta Mountains. The Uinta Mountains began uplifting in the Cretaceous, about 66 million years ago (Ma) and continued till the Eocene about 37 Ma (Hintze, 1988). Topographic basins formed on the north and south of the Uinta Mountains eventually accumulating up to 15,000 ft of sediment (Bradley, 1925: Fouch, 1985).

During the early Tertiary, these basins filled with sediments from alluvial, fluvial, and lacustrine deposits. The strata deposited in these alluvial (floodplain and delta) and inter fingered lacustrine (lake) deposits, are referred to as the Colton and Wasatch Formations. During this same time large freshwater lakes (Lake Flagstaff and Lake Uinta) occupied the Uintah basin. The depositional environment in and around these lakes consisted of open to marginal lacustrine and the rocks deposited in these environments are referred to as the Green River Formation. The Uinta and Duchesne formations are largely alluvial deposits that overlie the Green River formation and were in place by the end of the Oligocene (Hintze, 1988). The landscape during the Holocene has continued to be

incised by streams as well as some glacial outwash deposits from the Uinta Mountains (Bryant, 1992).

2.2.2 Local Geology

The IWM facility is located in the north western portion of the Uinta basin. The facility is underlain by both glacial outwash and the Uinta Formation (Plate A-3). The subject site is located near the mapped geologic boundary between the Brennan Basin Member (Tdb) on top and the Upper member of the Uinta formation (Tuu) below. The Tdb is an Oligocene to upper Eocene unit that consists of varicolored siltstone and sandstone and the Tuu is an Eocene age gray colored mudstone with thin sandstone and limestone beds. The Tdb formation was identified during our field investigation and was found to underlay the existing Pond 3 that is purposed for the landfill permit. The Glacial outwash unit (Ogpb) consists of poorly sorted gravels and sand layers (Bryant, 1992). This unit was identified in our observation of the soils encountered surrounding the north eastern portions of the proposed landfill.

2.2.3 Evaluation of Bedrock

The proposed landfill cell is underlain primarily by the Brennan Basin Member (Tdb) of the Duchesne Formation and also by Quaternary glacial outwash deposits (Qgpb) in the northern part of the cell. The Tdb formation consists of 1-2 meter thick discontinuous fluvial sandstone lenses inter-fingered with dark green and purplish red siltstone and shale (Bryant, 1992). Plate A-4 in Appendix A of this report contains geologic cross sections of the IWM facility.

GeoStrata advanced four borings and excavated two test pits in the vicinity of the proposed Landfill impoundment (Plate A-2) in an effort to characterize the geology of the site. Bedrock consisted of thinly bedded varicolored sandstones, siltstones, and shale (Plate B-1 through B-9).

Geostrata preformed backpressure permeability tests on a sample from test pit 1. The sample was a slightly fractured tight sandstone. The permeability was 1.01x10-9 cm/sec.

2.2.4 Ground Water

Four monitor wells have been installed in close proximity of the proposed landfill cell. Plate A-5 shows the locations of the monitor wells. There is one up gradient well and three down gradient monitoring wells. Water levels have been measured several times and were measured most recently on May 7, 2014. Ground water elevation data are included in table 2.2.4.a.

Table 2.2.4.a

			8/8/2013	9/11/2013	5/7/2014
Well No.	**Surface Elevation (ft)**	**Well Bottom Elevation (ft)**	**Water Elevation (ft)**	**Water Elevation (ft)**	**Water Elevation (ft)**
TW-1	6121.4	6101.0	6101.2	6101.2	6101.2
TW-2	6121.9	6103.9	DRY	DRY	DRY
MW 1	6122.1	6075.4	DRY	DRY	DRY
MW-3	6122.1	6035.7	NA	NA	6083.5
MW-4	6156.0	6109.6	NA	NA	6124.1

Plates B-11 to B-16 shows the boring logs and completion details for each of the monitoring wells. Plate A-2 and A-5 show the location these borings and monitoring wells. Water elevation data collected on May 7, 2014 was used to determine the direction of ground water flow at the subject site. Ground water flows to the south west towards the Duchesne River (see Plate A-10). A geologic cross section of the proposed landfill also identifies the elevation of the potentiometric surface of the groundwater (Plate A-4).

On May 7th, 2014 slug tests were performed in the field on wells MW-3 and MW-4 in order to determine hydraulic conductivity and the Transmissivity of the aquifer. In order to measure groundwater fluctuations a pressure transducer was lowered into the monitoring well. Once water level and temperature readings stabilized a six ft. long PVC slug filled with sand was submerged in each of the wells. The resultant fluctuations in ground water levels were then measured at 15 second intervals by the pressure transducer. To reduce the slug test data GeoStrata used the Bouwer and Rice method to determine the hydraulic conductivity and Transmisivities of the aquifers (Bouwer, and Rice, 1976). Table 2.2.4.b below shows the aquifer properties measured from wells MW-3 and MW-4.

Table 2.2.4.b

	5/7/2014	5/7/2014
Well No.	**Hydraulic conductivity (ft/day)**	**Transmissivity (ft2/day)**
MW-3	0.0079	0.51
MW-4	0.033	2.2

Based on our finding of groundwater at the IWM facility, groundwater is measured as being greater than 20 feet below the lowest portion of the proposed landfill. Plate A-4 of this report contains geologic cross sections of the proposed landfill and identifies the types of bedrock, soils and inferred elevations of ground water under the IWM facility. The data used to create these cross sections was obtained from the geologic map (plate A-3), subsurface exploration data (section 2.3.1) and ground water data provided in the table above.

On May 7th, 2014 Groundwater samples were obtained from wells MW-3, and MW-4 and tested for several analytes, the results of which are included in table 2.2.4.c. It should be noted that background water will formally be defined following the methodology outlined in section 2.2.6 of this report. The preliminary groundwater data included in table 2.2.4.c shows that water from MW-3 generally has higher concentrations of the analytes tested with the exception of Iron, Nitrate, and Alkalinity. The TDS, sodium, and chloride concentrations in MW-3 are higher than the concentrations found in MW-4. The elevation of water in MW-3 is approximately 40 ft. lower than water in MW-4.

Table 2.2.4.c

Well	Iron (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Alkalinity (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	pH (pH Units)	Sulfate (mg/L)	TDS (ppm)
MW-3	0.534	76.2	11.8	925	131	1720	0.732	7.96	183	3460
MW-4	8.76	38.7	4.47	115	220	74.4	0.0185	7.58	124	640

2.2.5 Surface Water

There are no surface waters at the site within 1 mile of the IWM facility. The closest surface water locality is the Duchesne River approximately 2.6 miles to the southeast. There are numerous ephemeral drainages that are identified near the facility. A map locating these drainages is provided in Appendix A as plate A-7. Landfill related activities are not expected to impact these drainages.

2.2.6 Groundwater and Surface Water Monitoring Plan

Groundwater was encountered at the subject site in wells TW-1, MW-2, MW-3 and at MW-4. The groundwater resides in alluvial aquifers overlying bedrock and permeable sandstone beds within the bedrock. IWM proposes to utilize MW-4 as an up gradient monitoring well and that wells TW-1 and MW-3 be used as the down gradient monitoring wells. IWM proposes to sample groundwater from TW-1 and MW-3, MW-4 semiannually. Water will be analyzed for the following analytes as required in R315-308-4:

- Heavy Metals including Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc

- Inorganic Constituents including Ammonia, Carbonate/Bicarbonate, Calcium, Chemical Oxygen Demand (COD), Chloride, Iron, Magnesium, Manganese, Nitrate, pH, Potassium, Sodium, Sulfate, Total Dissolved Solids (TDS), Total Organic Carbon (TOC)

- Gasoline Range Organics (Method SW-846 8260C)

As required in R315-308-2(8) IWM will use a statistical method for determining whether a significant change has occurred as compared to background. In order to establish a background range of groundwater constituents, at least three rounds of sampling prior to landfill operations will occur at each monitoring well. Based on the sampling results for each constituent the 95% upper confidence interval will be calculated and will assume homoscedathicity. During operations of the landfill semiannual samples will be collected and results of each constituent will be compared using a parametric analysis of variance. If concentrations of a constituent are greater than the 95% confidence interval, it will be considered and outlier and will be further evaluated to determine if it is a normal fluctuation in the groundwater or if it is a result of possible leachate or other contaminated water from the water disposal facility. A report of the data and outliers will be provided to the division and an appropriate response will be determined.

There are no surface waters at the site within 1 mile of the IWM facility. The closest surface water locality is the Duchesne River approximately 2.6 miles to the southeast. There are numerous ephemeral drainages that are identified near the facility. A map locating these drainages is provided in Appendix A as plate A-7. No landfill related activities will impact these drainages.

2.3 SLOPE STABILITY

2.3.1 Subsurface Investigation

As part of this investigation, subsurface soil conditions were explored by advancing six borings in the area of the proposed land fill. Four borings were drilled at the top of the landfill embankment/slope. Two additional borings were drilled at the site, one was drilled at the toe of the embankment and one boring approximately 500 feet to the southwest. These two borings were drilled to allow installation of monitor wells. The boreholes were advanced to depths ranging from 16 to 48½ feet below the existing site grade. The approximate locations of the explorations are shown on the Exploration Location Map, Plate A-2. Boring and test pit locations were selected to provide a representative cross section of the subsurface soils conditions throughout the embankments. Subsurface soil conditions as encountered in the explorations were logged at the time of our investigation by a qualified geotechnical engineer and are presented on the enclosed Borehole Logs, Plates B-1 to B-9 in Appendix B. A Key to USCS Soil Symbols and Terminology is presented on Plate B-10.

The boreholes were advanced using a truck-mounted CME-75 hollow-stem auger drill rig. Bulk soil samples were obtained in the borehole explorations using a standard 2-inch diameter split spoon sampler as well as a 3-inch diameter California sampler, both of which were driven 18 inches using an automatic hammer. All samples were transported to our laboratory for testing to evaluate engineering properties of the various earth materials observed. The soils were classified according to the Unified Soil Classification System (USCS) by the Geotechnical Engineer. Classifications for the individual soil units are shown on the attached Borehole Logs.

2.3.2 Laboratory Testing

Geotechnical laboratory tests were conducted on samples obtained during our field investigation. The laboratory testing program was designed to evaluate the engineering characteristics of onsite earth materials. Laboratory tests conducted during this investigation include:

- Natural Moisture and Unit Weight
- Grain Size Distribution Analysis (ASTM D422)
- Atterberg Limits (ASTM D4318)
- Consolidated Undrained Triaxial Compression Test (ASTM D4767)

Triaxial testing indicates that the embankment soils have an effective shear strength consisting of an angle of internal friction of 33 to 34 degrees and a cohesion of 20 to 60 psf. The results of all laboratory tests are presented on the Borehole Logs in Appendix B (Plates B-1 to B-6), the Laboratory Summary Table and the test result plates presented in Appendix C (Plates C-1 to C-6).

2.3.3 Subsurface Conditions

Based on the explorations drilled at the site, the embankment material generally consists of Silty SAND (SM) and Silty SAND with gravel (SM). Underlying the embankment was Silty SAND (SM) and Sandy SILT (ML) overlying Sandstone bedrock. The stratification lines shown on the enclosed boring logs represent an approximate boundary between soil types. The actual in situ transition may be more gradual.

No groundwater was encountered in the six borings drilled for this investigation; however, groundwater has been measured in Temporary well 1 at 23½ feet below the existing grade. Given the depth of groundwater, we do not anticipate groundwater adversely affecting the stability of the embankments/slopes of the landfill.

2.3.4 Pond Embankment Stability

GeoStrata has evaluated the stability of the proposed landfill cell embankments and slopes using SLIDE, a computer application incorporating (among others) Bishop's Simplified Method of analysis. Calculations for stability were developed by searching for the minimum factor of safety for a circular-type failure. Stability analyses were conducted at two representative cross-sections drawn through the embankment/slope as shown on Plate A-2. The inside landfill slopes were modeled with the landfill empty. The exterior landfill slope at Profile A was modeled with the landfill empty of waste and with the landfill full of waste. The waste was assumed to be near the top of the embankment. The exterior slope at Profile B was not assessed due to the distance to the interior slope. The stability of the embankments was assessed under static and pseudo static conditions. The pseudo static condition is used to assess stability of slopes during seismic events. The peak ground acceleration for the Maximum Credible Earthquake (MCE) was estimated using the site's approximate latitude and longitude and the United States Geological Survey 2009 ground motion calculator version 5.1.0 which correlates the MCE to a 2 percent probability of exceedance in 50 years. Using this procedure the peak ground acceleration is estimated to be 0.38g. In accordance with Hynes-Griffin (1984), half of this value was used in our analyses. This methodology assumes that no greater than 3 meters of deformation will occur if the calculated factor of safety is greater than 1.0.

The strength value for the embankment soils was based on the lower value obtained from our laboratory testing, an angle of internal friction of 29 degrees and cohesion of 200 psf. Bedrock was assumed to have a cohesive strength of 2,000 psf. The landfill waste material was assumed to have an angle of internal friction of 20 degrees and a cohesion value of 100 psf. Due to the depth of groundwater at the site (23½ feet), groundwater was assumed to have no influence in the stability analyses. We understand that the landfill will incorporate a geosynthetic liner. We therefore assumed no seepage from the landfill cell.

The results of our stability modeling indicate the following factors of safety for embankment slope failure:

Stability Assessment	Factor of Safety
Profile A - Exterior Slope Static	1.98
Profile A - Exterior Slope Pseudo Static	1.26
Profile A - Exterior Slope with Waste Static	1.98
Profile A - Exterior Slope with Waste Pseudo Static	1.26
Profile A - Interior Slope Static	2.22
Profile A - Interior Slope Pseudo Static	1.35
Profile B - Interior Slope Static	2.36
Profile B - Interior Slope Pseudo Static	1.42

Results of the slope stability modeling are presented in Appendix E as Plates E-3 to E-10 attached to this letter. Slopes with factors of safety greater than 1.5 and 1.1 for the static and pseudo static conditions respectively are typically considered stable. As indicated above the embankments have factors of safety for the static and pseudo static conditions greater than 1.5 and 1.1, respectively. It is therefore our opinion that the existing embankments are suitable for use for the planned landfill.

2.4 EMBANKMENT AND LINER CONSTRUCTION

As previously discussed the existing embankments and liner were constructed in 2011. The quality of the construction of the embankments was documented and recorded by the Civco Engineering, the original designer of the ponds. We have included their

documentation of the construction of the embankment and liner in Appendix I of this permit application. Also included in Appendix I is previous correspondence with the Division regarding this construction data.

2.5 STORM WATER MANAGMENT

In order to minimize liquids admitted into the active areas of the landfill and run-off waters from the active areas of the land fill as required by R315-303-3(c) and (d), the landfill has been designed to prevent run-on of surface waters into the active landfill and and control run-off waters from the active area of the landfill resulting from a maximum flow of a 25-year storm. Potential run-on storm water is diverted around the existing ponds. Run-off water from the landfill is diverted into the secondary containment pond that has a capacity of over 2.5 million cubic feet. The total anticipated volume of run-off volume of water in a 25 year storm event is approximately 5021 cubic feet. Calculations used to estimate the 25 storm event volumes are included in this permit application in Appendix F.

3.0 CLOSURE PLAN

3.1 CLOSURE SCHEDULE

The IWM landfill will be closed in a single operation that includes the final grading of the waste material and the placement of the final cover. The expected duration of the land fill operation is approximately 4 years at a 10% growth rate. Sixty days prior to the expected final receipt of waste, IWM will notify the division of their intent to begin closure operations. IWM will begin its closure operations after the final receipt of waste is obtained. It is anticipated that the closure operation will take place over an anticipated duration of 90 to 120 days. During this period of time the landfill cell will be graded, covered and surveyed. As-built plans will be generated for reference for the final inspection by the division.

3.2 DESIGN OF FINAL COVER

The final cover plans are included in this permit application in Appendix F. The final cover will consist of two soil layers and a geomembrane liner. The waste will be covered with 24 inches of compacted soil with a permeability of 1x10-5 cm/sec. The compacted soil will be overlain by a 40 MIL HDPE geomembrane liner. It is our opinion that soils that meet the permeability criteria are readily available on site. The compacted soil and geomembrane will work together to minimize the infiltration of water. This liner will then be covered with 24 inches of topsoil to prevent erosion. The top soil layer will consist of a minimum of 10% organics in the upper 6 inches of the topsoil layer. The lower 18 inches of this layer will consist of native soils.

The final cover will be graded to no steeper than a 4:1 slope around the outer perimeter of the landfill cell. The inner portion of the landfill will have a 2% slope starting from the center of the landfill and sloping in all directions to the outer perimeter of the landfill cell. To control the run-off of the final cover material, the topsoil layer will be seeded with native grasses and will be reseeded as needed during the post closure phase of the landfill.

3.3 CAPACITY OF LANDFILL

The estimated capacity of the landfill cell up to the final cover is 152,000 cubic yards. With an estimated dry density of 97.2 lb/cu-ft. based on the assumption of half the waste

being mixed with additional material, the landfill will have an estimated total of 259,000 tons of waste at the time of closure. A table with the projected life of at 0, 2, 3, 5, and 10 percent growth rate for the landfill is provided in appendix E as Plate E-1. The growth rate is defined as the number of trucks delivered to the site on an average daily basis. With an increase in the growth rate, the life of the landfill will be reduced.

3.4 FINAL INSPECTION

After the completion of the final cover, the final inspection of the landfill cell will be conducted by officials from UDSHW. IWM will notify the division of the anticipated date of completion and make arrangements for scheduling the inspection.

4.0 POST CLOSURE CARE

Immediately after the completion of construction for the final cover of the landfill cell, the post closure care plan will be implemented. As required in R315-302-3(5) the post closure care activities will take place for 30 years or as long as the Director determines is necessary for the facility or unit to become stabilized and to protect human health and the environment. A licensed engineer with the state of Utah will direct the post-closure care of the facility and will provide IWM with recommendations to properly maintain the landfill site and prevent any release of harmful substances. The engineer will also provide the division with documentation if he determines that the site is safe to reduce or discontinue site monitoring prior to the end of the 30 year period.

4.1 POST CLOSURE CARE PLANS

During the post closure period the following activities will take place:

Site Monitoring: Portions of the IWM facility is operated 24 hours a day 7 days a week. IWM personnel will be onsite every day to monitor activities at the facility and restrict access to the landfill. Access to the landfill will be restricted with fencing and locked gates at the roadway entrance. Signs will be posted advising of the potential dangers associated with the landfill. Only authorized personnel of IWM will have access to the landfill site.

On a quarterly basis the landfill cover will be inspected to check for rutting and depressions that could result in rapid erosion. If rutting or depressions in the cover are identified they will be repaired by grading and seeding the surface. Slopes of the final cover will also be inspected and maintained. IWM will insure that a 2% slope will be maintained on the top of the cover and a 4:1 slope will be maintained around the perimeter of the landfill.

Run-off water from the final cover will be directed into the existing drainages to the south and east of the landfill. IWM will on a Quarterly basis inspect the run-off collection system and ensure that they are properly diverting water into the existing storm water drainages. Repairs will be made as needed.

Surface and Ground Water Monitoring: Samples will be collected of groundwater from the monitoring wells on site. No samples of surface waters will be collected

because there are no observed streams, springs or other surface waters at the site of the proposed landfill. All sampling will be completed by a Utah certified groundwater sampler. Sampling will take place every six months during the closure and post-closure care period. The water will be field tested for pH, water temperature, and water conductivity. Samples will also be collected for lab analysis, testing for heavy metals and organic constituents will be conducted as required in R315-308-4. The results of the water sample testing will be recorded and statistically analyzed for significant changes in concentrations of constituents utilizing a parametric analysis of variance (ANOVA). If significant changes are detected, then IWM will follow the guidelines in R315-308-2(13).

4.2 RECORD OF TITLE, LAND USE, ZONING

The Duchesne County Recorder will be notified during the closure period of the completion of the disposal site. The county recorder will be provided with documentation and plats of the location of the disposal site. Notification of the closure, and location of the land fill will also be sent to the county recorder and zoning changes will be made if necessary. Documentation of the history of the landfill will permanently appended to the title of record and land use restrictions will be put in place.

4.3 POST CLOSURE CONTACTS

The point of contact during the post closure care period for this facility is JT Martin. His contact information is provided below:

JT Martin

90 S 400 W STE 360

Salt Lake City, UT 84101

Telephone: 801-456-4140

5.0 FINANCIAL ASSURANCES

5.1 CLOSURE COSTS

The IWM landfill is planned to close in a single operation when the waste reaches final design grade. The closure costs for the IWM landfill are based on the cost to construct the final cover. The final cover construction is to include the placement and grading of the 24 inch clay cover, HDPE liner installation, 24 inch topsoil layer and seeding of topsoil. Detailed financial assurance costs are presented in Appendix H of this permit application.

5.2 POST CLOSURE CARE COSTS

Post closure care of inactive sections of the landfill will consist of maintaining the integrity of the final and vegetative covers. Any areas subject to erosion will be corrected and appropriate measures will be implemented to identify and eliminate the run on source. No active or technical devices are proposed for at the IWM E&P Landfill. Best management practices will be implemented to minimize the infiltration and assure the integrity of the run-on/run-off system. Evaluation of the system will be made during the quarterly inspections and corrective measures if any will be implemented. All run-on and run-off from events smaller than the 25 year storm will be controlled through drainage design.

Leachate collection devices are proposed for the facility. The closed landfill will be inspected as part of the quarterly reviews performed by the landfill operator. The closed landfill will also be inspected as a part of the in-depth annual inspection. Any deficiencies will be repaired as soon as practical. For those failures which jeopardize the environmental integrity of the facility or permit, the uncontrolled infiltration of significant amounts of moisture, corrective measures will be initiated immediately.

Ground water monitoring is also proposed for the post closure care. Ground water will be sampled biannually and tested for the listed constituents provided in section 2.2.6 of this report. The results of this testing will be included in the in-depth annual inspections report.

Post closure care costs are estimated by the cost of maintaining the previously described activities for a 30 year period. A detailed financial assurance cost is provided in Appendix H.

5.3 FINANCIAL ASSURANCE

This section of the permit describes compliance with Subsection R315-309, Financial Assurance of the Administrative Rules for Solid Waste Permitting and Management. Cost estimates consider the most expensive option during the period and are based on in house personnel performing closure and post closure care.

The IWM team complies with financial assurance test requirements for private entities based on 1) acceptable bond ratings, 2) financial statements prepared in conformity with generally accepted accounting principles for private entities audited by independent CPA's

WORKS CITED

Bryant, B. (1992). Geologic map of the east half of the Salt Lake City 1 x 2 quadrangle (Duchesne and Kings Peak 30 x 60 quadrangles), Duchesne, Summit, and Wasatch Counties, Utah, and Uinta County, Wyoming. USGS.

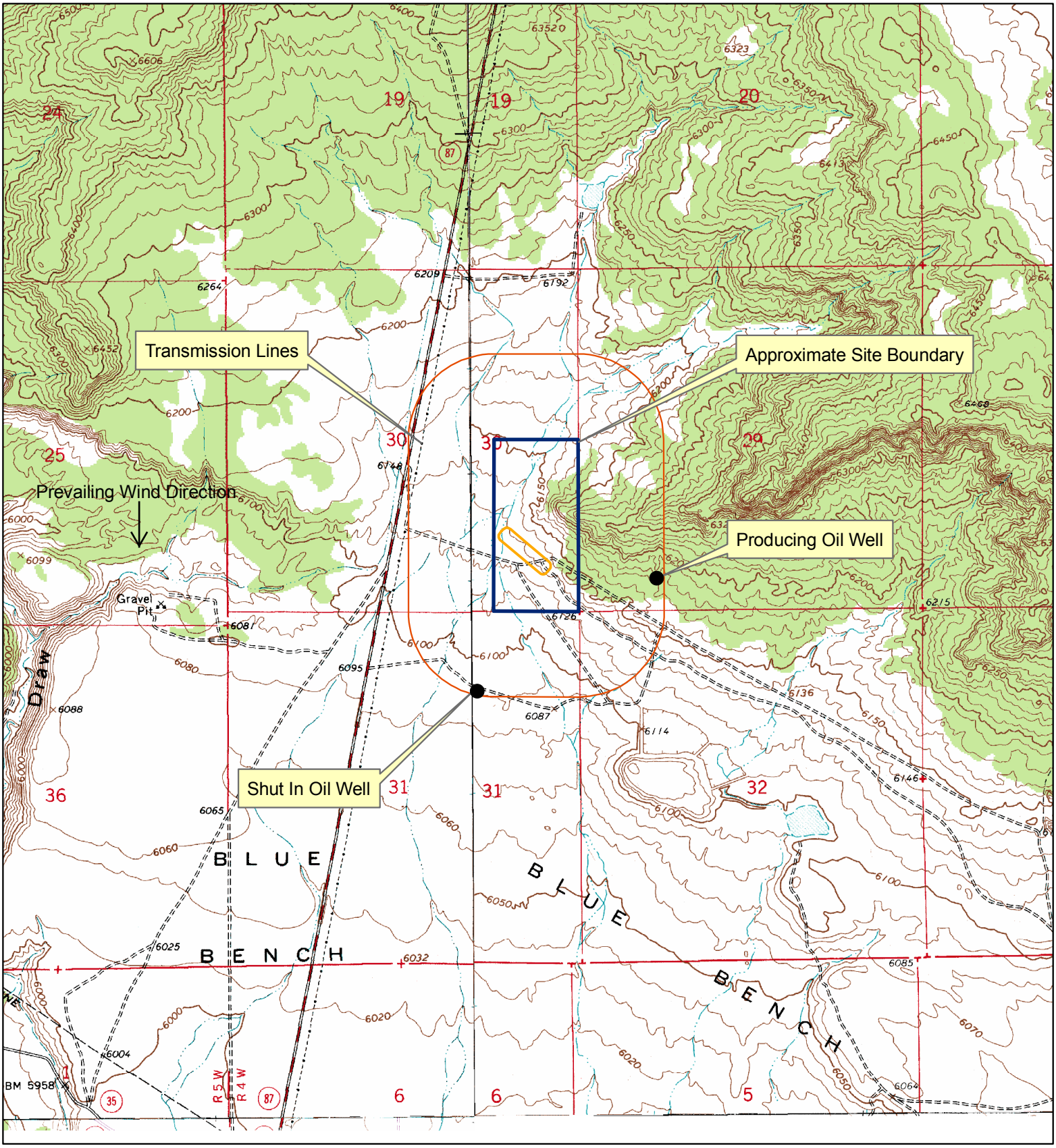
Bouwer, H. and R.C. Rice, 1976, A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetratings wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

Hintze, L. F. (1988). *Geologic History of Utah.* Brigham Young University.

National Wetlands Inventory. (2013). Retrieved 2013, from U.S. Fish and Wildlife Service: http://www.fws.gov/wetlands/Data/Mapper.html

Quarternary Fault and Fold Database of the United States. (2006). Retrieved 2013, from USGS: http//earthquake.usgs.gov/hazards/qfaults/

APPENDIX A



0 500 1,000 2,000 3,000 4,000 Feet

1:24,000

Base Map: USGS 7.5 Minute Topographic map, Talmage and Altamont Quadrangles obtained from the State of Utah AGRC

N

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Legend

- Approximate Landfill Boundary
- 0.25 Mile Buffer

Permit Application for E&P Landfill
Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Landfill Location Map

Plate A-1

0 100 200 400 600 800 Feet

1:3,000

N

GeoStrata

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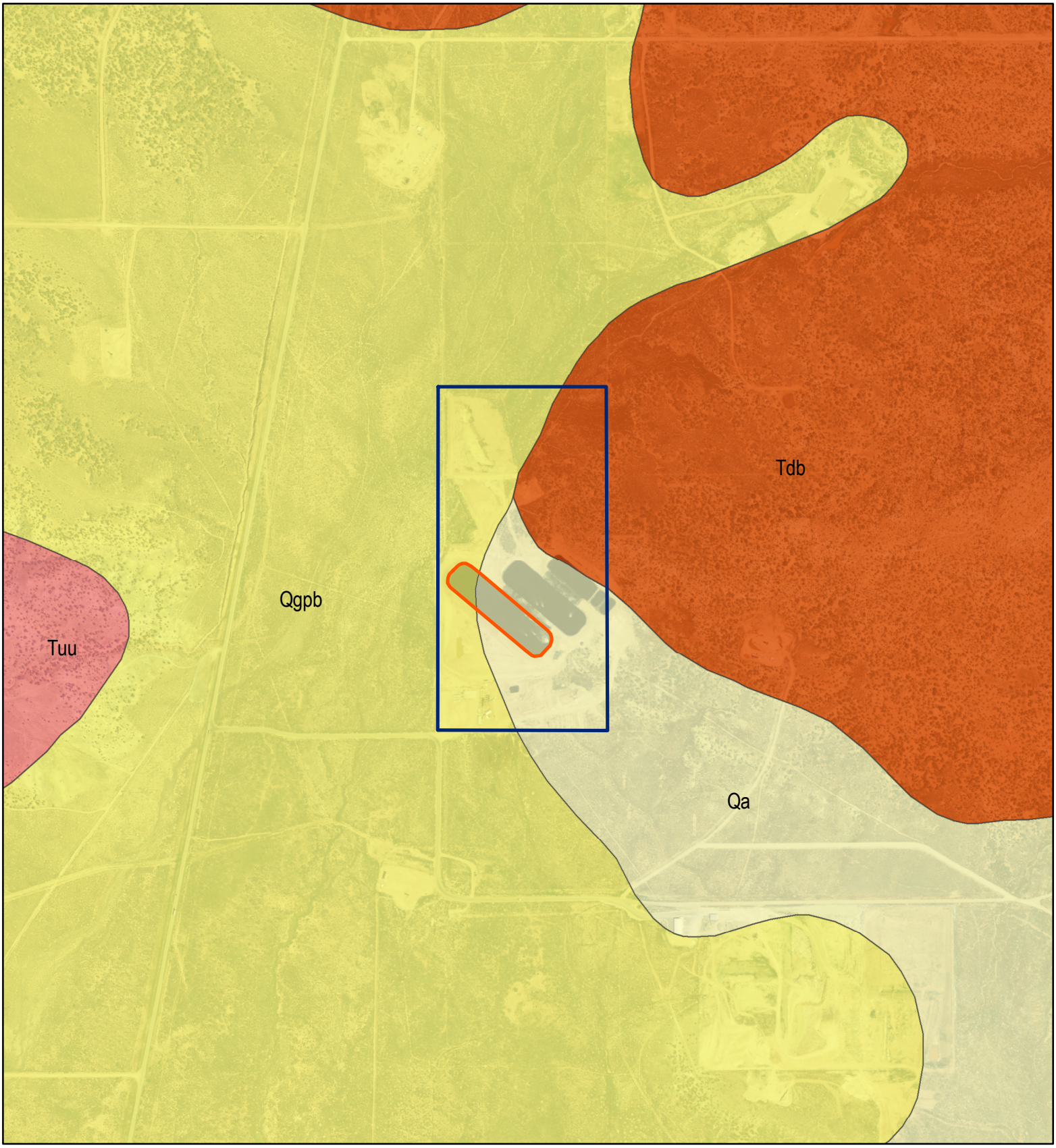
Legend

- Approximate Boring Location
- Approximate Temporary Monitoring Well Location
- Geologic Line of Section
- Slope Stability Line of Section
- Approximate Property Boundary

Permit Application for E&P Landfill
Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Exploration Location Map

Plate A-2



Legend

- Approximate Property Boundary
- Approximate Land Fill Boundary

Geologic Units

- Qa - Alluvium
- Qgpb - Glacial outwash deposits of pre-Bull Lake age
- Tdb - Brennan Basin Member of the Duchesne River Formation
- Tuu - Upper member of the Uinta Formation
- Contact

0 250 500 1,000 1,500 2,000 Feet

1:12,000

Geologic map of the east half of the Salt Lake City 1 x 2 quadrangle(Duchesne and Kings Peak 30 x 60 quadrangles), Duchesne, Summit, and Wasatch Counties, Utah, and Uinta County, Wyoming

N

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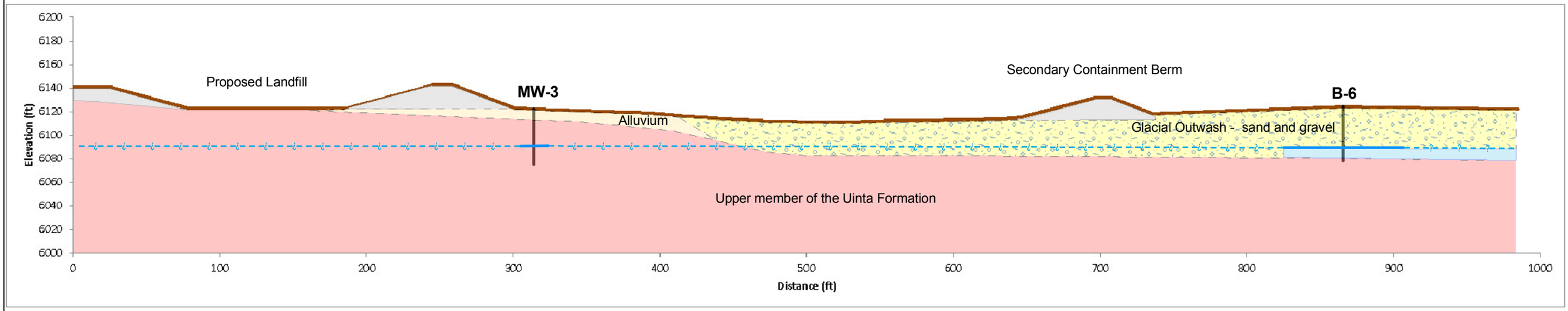
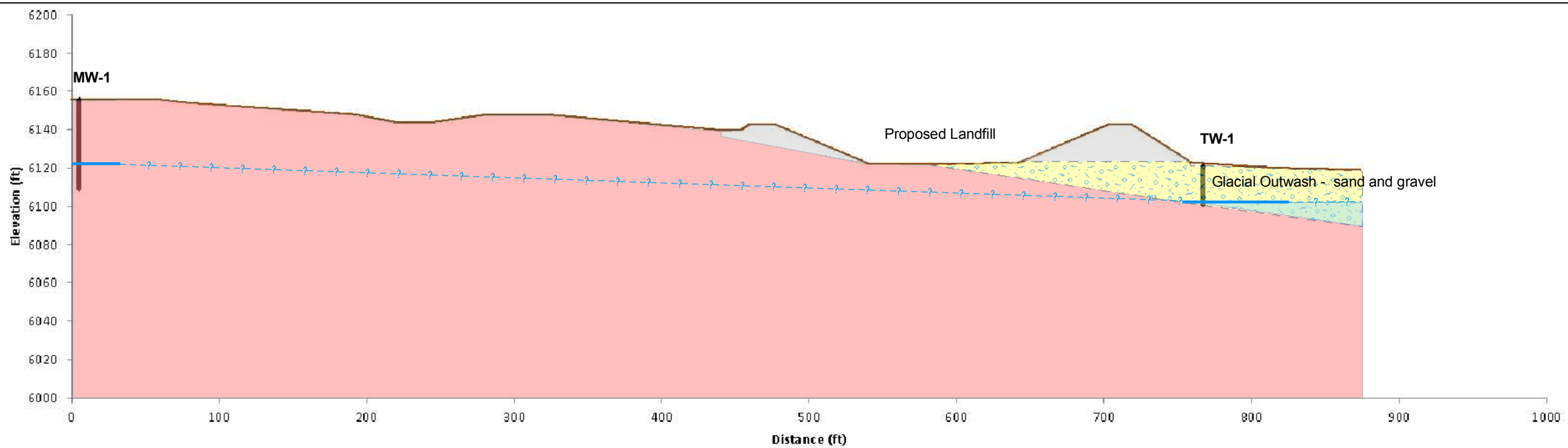
Intergrated Water Management
Land Fill Permit
Project Number: 751-013

Local Geology of IWM Facility

Plate A-3





Legend

Ground Water

- Measured
- Inferred Potentiometric Surface
- Saturated Soils
- Embankment
- Qa - Alluvium
- Qgpb - Glacial outwash deposits of pre-Bull Lake age
- Bedrock

N

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Intergrated Water Management
Landfill Permit
Project Number: 751-013

Geologic Cross Section

Plate A-4

0 100 200 400 600 800 Feet

1:3,600

N

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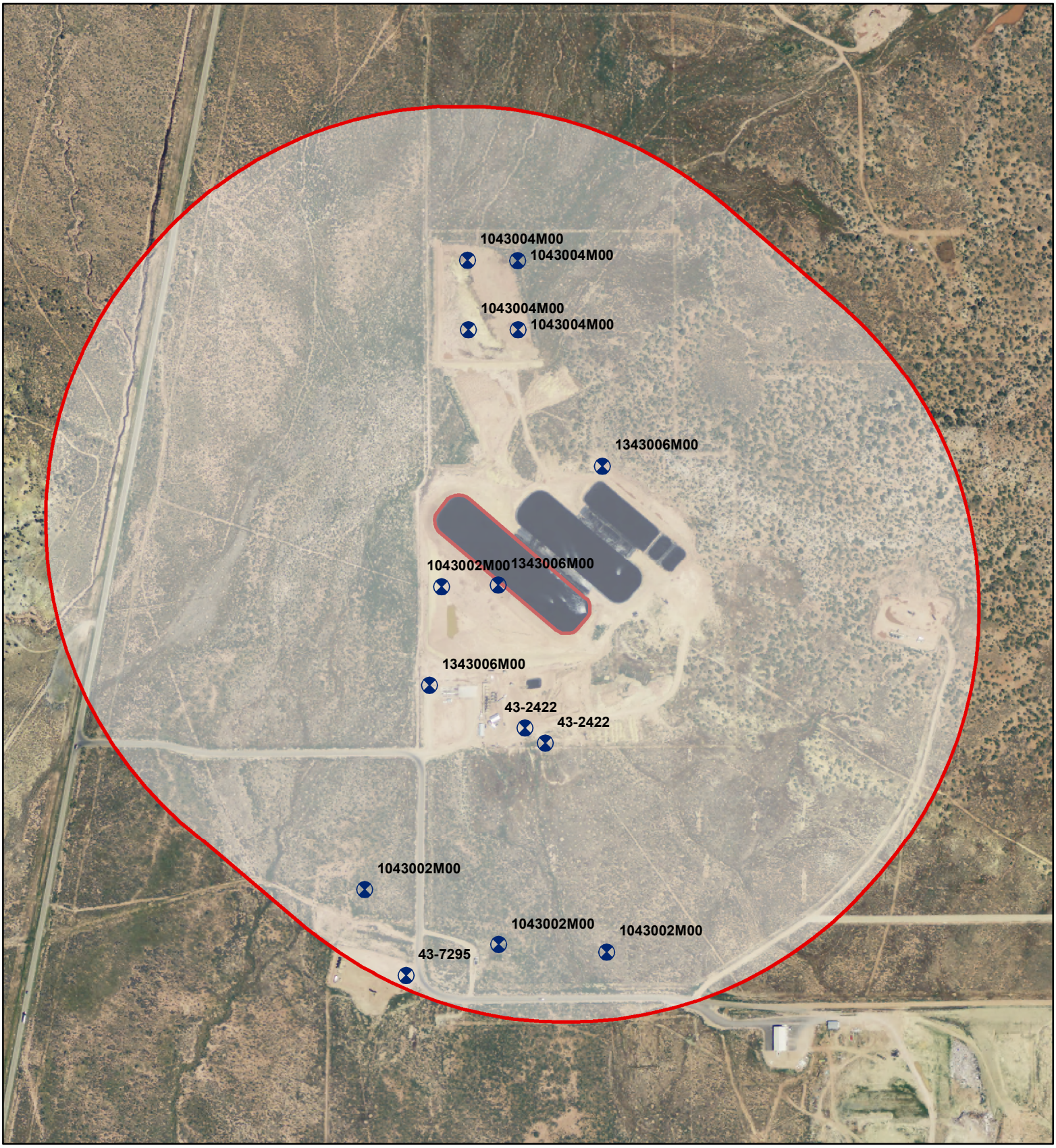
Legend

- Monitoring Well
- Approximate Property Boundary

Permit Application for E&P Landfill
Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Monitoring Well Location Map

Plate A-5



0 250 500 1,000 1,500 2,000 Feet

1:8,000

Base Map: 2011 NAIP 1 Meter Orthophotography obtained from the State of Utah AGRC.

All Locations are Approximate

N

GeoStrata
Engineering & Geosciences

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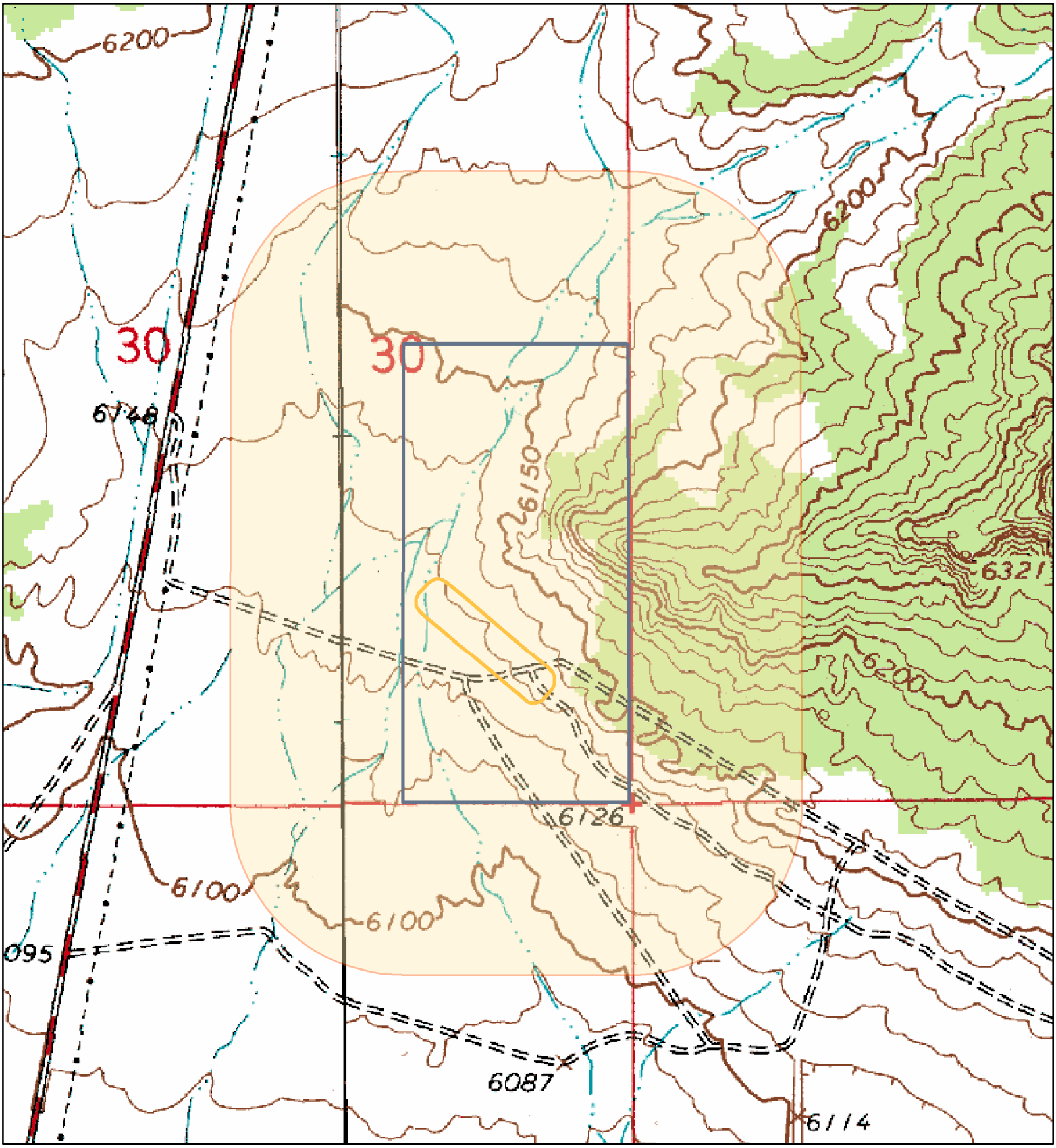
Legend

- Public/Private Wells
- 2000 ft
- Landfill Location

Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Public and Private Well Location Map

Plate A-6



0 310 620 1,240 1,860 2,480 Feet

1:9,000

N

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Legend

- 1000 ft Radius of IWM facility
- Approximate Property Boundary
- Land Fill

Permit Application for E&P Landfill
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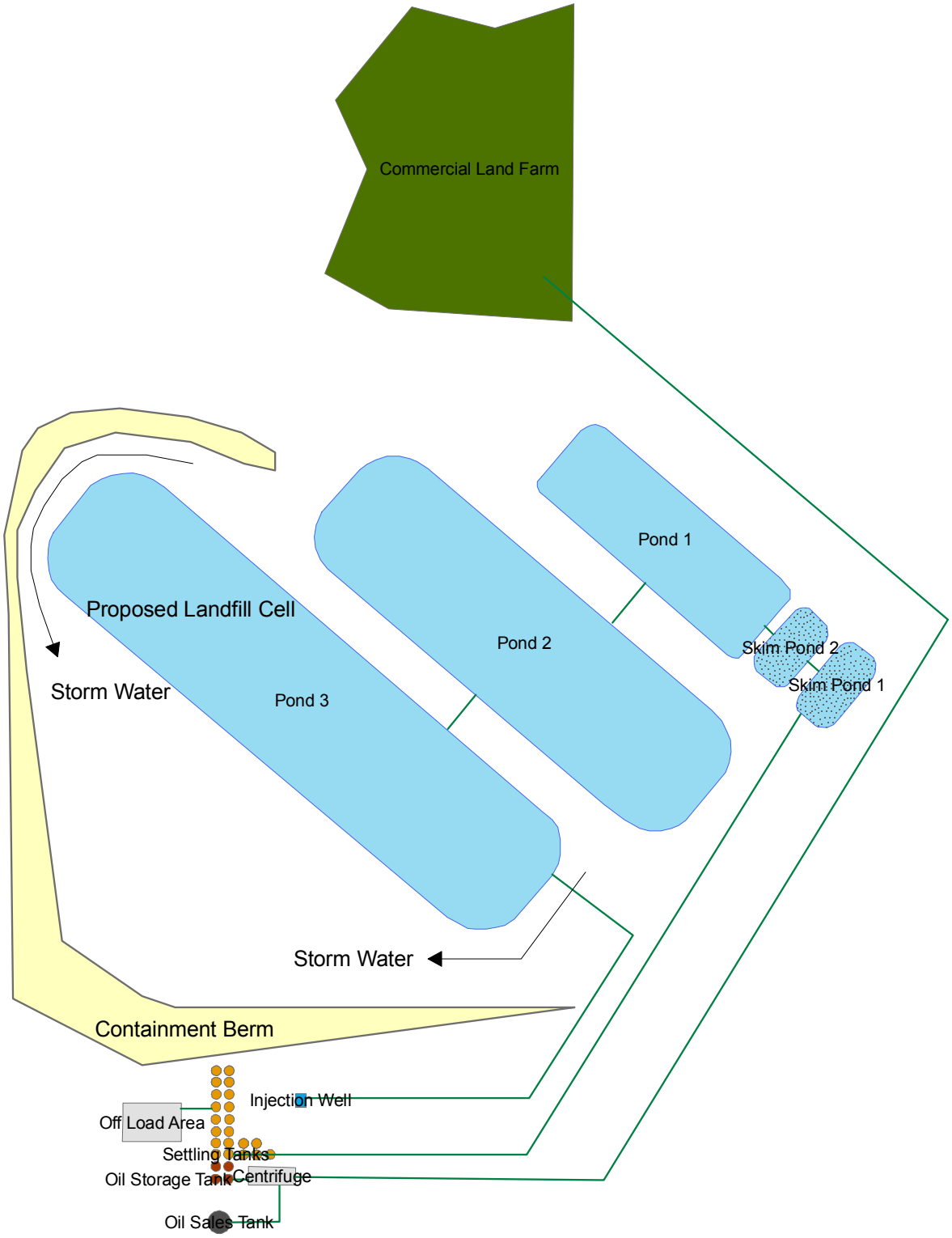
Duchesne, Utah
Project Number: 751-013

Land Use Map

Plate A-7



N

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Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Facility Diagram

Plate A-8

0 50 100 200 300 400 Feet

1:2,400

N

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Duchesne, Utah
Project Number: 751-013

Temporary Waste Storage Location Map

Plate A-9

Legend

Temporary Storage (32x72x4 ft)

0 120 240 480 720 960 Feet

1:3,600

N

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Legend

- Flow Direction
- Dry Well
- Monitoring well
- Approximate Property Boundary

Permit Application for E&P Landfill
Intergrated Water Management
Duchesne, Utah
Project Number: 751-013

Exploration Location Map

Plate A-10

APPENDIX B

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management Landfill Permit Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-1**

Sheet 1 of 1

LOCATION: STATION / OFFSET / 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					FILL; Silty SAND - medium brown, moist, with red mudstone chunks, small pieces of gravel, clay lenses	33	65							
1							50-5	100							
	5						24	40				42.6	17	3	
2							29	42							
3							50	57		101.1	9.5	74.4	20	7	
	10					BEDROCK; Sandstone - red-brown, weathered, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	50-5	100							
4							50-4	100							
	15						50-4	100							
5							50-4	100							
6	20					Bottom of Boring @ 18 Feet									
7															

N - OBSERVED UNCORRECTED BLOW COUNT

N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B - 1

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-2**

LOCATION: STATION / OFFSET / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0					FILL; Silty SAND with gravel - medium brown, purple, grey, orange, gravel observed up to 1/2" in diameter, mudstone chunks	15	30					
1							66	96	117.9	4.3	46.0	NP	NP
	5						54	90					
2						- chunks of medium brown to tan sandstone and purple mudstone	76	94	111.2	4.4			
							28	40					
3	10					- chunks of grey mudstone	37	40	118.2	9.7			
4							15	19					
	15				SM	Silty SAND - red-brown, moist, medium dense, minor organics in sample	21	23	102.3	4.2	28.3	NP	NP
5							5	6					
6	20						15	15	101.9	3.3	22.0		
7													

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* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
- MEASURED
- ESTIMATED

Plate

B - 2

DATE	
STARTED:	7/25/13
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BACKFILLED:	7/25/13

Integrated Water Management Landfill Permit Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-2**

LOCATION: STATION / OFFSET / 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
8	25						29	33							
9	30				ML	Sandy SILT - red-brown to brown, very moist, organics throughout	28	23		106.8	20.7	61.7	19	2	
10															
11	35					BEDROCK; Sandstone - tan to brown, very moist, interbedded layers of greyish blue Mudstone, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	37	37							
12						Bottom of Boring @ 37 Feet									
13	40														
14	45														
15															

N - OBSERVED UNCORRECTED BLOW COUNT

N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B - 3

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-3**

Sheet 1 of 1

LOCATION: STATION / OFFSET / ELEVATION

DEPTH METERS	DEPTH FEET	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0	FILL; Silty SAND - red-brown, moist, loose to medium dense	21	42					
		- minor organics and small sandstone chunks	14	20	107.5	2.2	32.8	NP	NP
1	5		16	27					
2			42	52	97.4	4.9			
		- loose	9	13					
3	10		11	12	99.8	5.3	37.5	NP	NP
4			16	20					
		TOPSOIL							
	15	BEDROCK; Sandstone - red-brown, moist, weathered, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	30	32	103.8	2.6			
5		Bottom of Boring @ 16 Feet							
6	20								
7									

SAMPLES | WATER LEVEL | GRAPHICAL LOG | UNIFIED SOIL CLASSIFICATION

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* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B - 4

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management Landfill Permit Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-4**

Sheet 1 of 1

LOCATION: STATION / OFFSET / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0					FILL; Silty SAND - red-brown, moist, loose	20	39					
						- gravel up to 1/2" in diameter	54	78	122.9	7.7			
1	5						32	50			40.8	NP	NP
2						- tan to brown, moist, medium dense to dense, pieces of tan sandstone throughout	70	86	127.4	6.7			
						- grey and tan pieces of mudstone	21	30					
3	10				SM	Silty SAND - red-brown, moist, medium dense, roots	50-5	100	10.0	4.0	27.2		
4							41	52					
	15					BEDROCK; Mudstone - black to dark grey, highly weathered, thin layers of sandstone throughout, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	50-4	100	21.0	10.6			
5							94	100					
6	20					Bottom of Boring @ 18 Feet							
7													

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* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B - 5

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management Landfill Permit Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-5**

LOCATION: STATION / OFFSET / 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					FILL; Silty SAND with gravel - slightly moist, dense									
1							64	100							
	5					BEDROCK; Mudstone - green to dark grey, weathered, thin layers of sandstone, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	50-4	100		110.7	9.5				
2							50-3	100							
3	10						50-4	100		101.6	14.8				
						BEDROCK; Mudstone - tan to brown, thin black layers									
4															
5	15						50-4	100							
						BEDROCK; Mudstone - dark grey, thin interbedded layers of tan silt/sand									
6	20						50-3	100							
7															

N - OBSERVED UNCORRECTED BLOW COUNT

N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate

B - 6

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: B-5
Sheet 2 of 2

LOCATION: STATION / OFFSET / 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
	25					- small white crystals in sample	50-5	100							
8															
9	30						50-3	100							
10															
	35						50-3	100							
11															
12	40						50-5	100							
13															
	45						50-4	100							
14						Bottom of Boring @ 46.5 Feet									
15															

N - OBSERVED UNCORRECTED BLOW COUNT

N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

GeoStrata

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
- MEASURED
- ESTIMATED

Plate
B - 7

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management Landfill Permit Duchesne, UT

Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: **B-6**

LOCATION: STATION / OFFSET / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*	Dry Density (pcf)	Moisture Content %	Percent minus 200	Liquid Limit	Plasticity Index
0	0				SM	Silty SAND - red-brown, slightly moist, very loose							
1							5	9					
	5				SC	Clayey SAND - red-brown, slightly moist, loose, roots and organics throughout	13	18					
2					SM	Silty SAND - red-brown, slightly moist, very loose, small pieces of sandstone	8	13					
3	10						34	44					
4													
	15					- interbedded 1" layers of Silty SAND and Sandy Lean CLAY	11	18					
5													
6	20					- minor gravel	42	58					
7													

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* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
- MEASURED
- ESTIMATED

Plate

B - 8

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75
Boring Type: Hollow Stem Auger

BORING NO: B-6
Sheet 2 of 2

LOCATION: STATION / OFFSET / ELEVATION

DEPTH METERS	DEPTH FEET	SAMPLES	WATER LEVEL	GRAPHICAL LOG	UNIFIED SOIL CLASSIFICATION	MATERIAL DESCRIPTION	N	N*
8	25						25	40
9	30				SC	Clayey SAND - red-brown, moist, medium dense, roots and organics throughout	13	16
10								
11	35		▼		SM	Silty SAND - red-brown, wet, medium dense	25	37
12	40					BEDROCK; Mudstone - grey to green, white and orange mottling, likely Tdb (Brennan Basin Member of the Duchesne River Fromation)	50-5	100
13								
14	45						50-1	100
							50-0	100
15						Bottom of Boring @ 48.5 Feet		

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

N - OBSERVED UNCORRECTED BLOW COUNT

N* - CORRECTED N1(60) EQUIVALENT SPT BLOW COUNT

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SAMPLE TYPE
- 2" O.D./1.38" I.D. SPLIT SPOON SAMPLER
- 3" O.D./2.48" I.D. SAMPLER
- 3" O.D. THIN-WALLED SHELBY SAMPLER
- GRAB SAMPLE
- Modified California Sampler

NOTES:

WATER LEVEL
▼ - MEASURED ▽ - ESTIMATED

Plate
B - 9

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	GRAVELS (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
			SC	CLAYEY SANDS SAND-GRAVEL-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	INORGANIC SILTS & VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

LOG KEY SYMBOLS

BORING SAMPLE LOCATION

TEST-PIT SAMPLE LOCATION

WATER LEVEL (level after completion)

WATER LEVEL (level where first encountered)

CEMENTATION

DESCRIPTION	DESCRIPTION
WEAKELY	CRUMBLES OR BREAKS WITH HANDLING OR SLIGHT FINGER PRESSURE
MODERATELY	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE
STRONGLY	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE

OTHER TESTS KEY

C	CONSOLIDATION	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	DS	DIRECT SHEAR
UC	UNCONFINED COMPRESSION	T	TRIAXIAL
S	SOLUBILITY	R	RESISTIVITY
O	ORGANIC CONTENT	RV	R-VALUE
CBR	CALIFORNIA BEARING RATIO	SU	SOLUBLE SULFATES
COMP	MOISTURE/DENSITY RELATIONSHIP	PM	PERMEABILITY
CI	CALIFORNIA IMPACT	-200	% FINER THAN #200
COL	COLLAPSE POTENTIAL	Gs	SPECIFIC GRAVITY
SS	SHRINK SWELL	SL	SWELL LOAD

MODIFIERS

DESCRIPTION	%
TRACE	<5
SOME	5 - 12
WITH	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER, USUALLY SOIL BELOW WATER TABLE

STRATIFICATION

DESCRIPTION	THICKNESS	DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2"	OCCASIONAL	ONE OR LESS PER FOOT OF THICKNESS
LAYER	1/2 - 12"	FREQUENT	MORE THAN ONE PER FOOT OF THICKNESS

GENERAL NOTES

1. Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
2. No warranty is provided as to the continuity of soil conditions between individual sample locations.
3. Logs represent general soil conditions observed at the point of exploration on the date indicated.
4. In general, Unified Soil Classification designations presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory tests) may vary.

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT (blows/ft)	MODIFIED CA. SAMPLER (blows/ft)	CALIFORNIA SAMPLER (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
VERY LOOSE	<4	<4	<5	0 - 15	EASILY PENETRATED WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
LOOSE	4 - 10	5 - 12	5 - 15	15 - 35	DIFFICULT TO PENETRATE WITH 1/2-INCH REINFORCING ROD PUSHED BY HAND
MEDIUM DENSE	10 - 30	12 - 35	15 - 40	35 - 65	EASILY PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
DENSE	30 - 50	35 - 60	40 - 70	65 - 85	DIFFICULT TO PENETRATED A FOOT WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER
VERY DENSE	>50	>60	>70	85 - 100	PENETRATED ONLY A FEW INCHES WITH 1/2-INCH REINFORCING ROD DRIVEN WITH 5-LB HAMMER

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNTRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
VERY SOFT	<2	<0.125	<0.25	EASILY PENETRATED SEVERAL INCHES BY THUMB. EXUDES BETWEEN THUMB AND FINGERS WHEN SQUEEZED BY HAND.
SOFT	2 - 4	0.125 - 0.25	0.25 - 0.5	EASILY PENETRATED ONE INCH BY THUMB. MOLDED BY LIGHT FINGER PRESSURE.
MEDIUM STIFF	4 - 8	0.25 - 0.5	0.5 - 1.0	PENETRATED OVER 1/2 INCH BY THUMB WITH MODERATE EFFORT. MOLDED BY STRONG FINGER PRESSURE.
STIFF	8 - 15	0.5 - 1.0	1.0 - 2.0	INDENTED ABOUT 1/2 INCH BY THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.
VERY STIFF	15 - 30	1.0 - 2.0	2.0 - 4.0	READILY INDENTED BY THUMBNAIL.
HARD	>30	>2.0	>4.0	INDENTED WITH DIFFICULTY BY THUMBNAIL.

GeoStrata

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Soil Symbols Description Key

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate B-10

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75

BORING NO:
MW-1
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

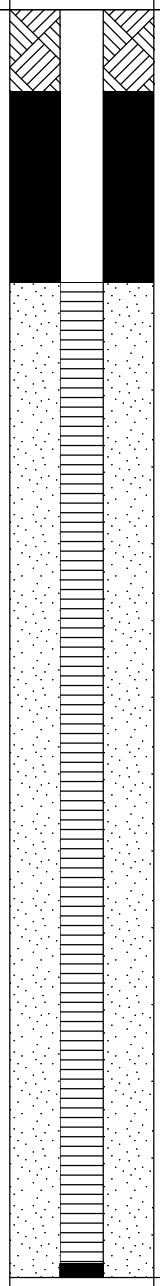
Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

DEPTH: METERS / FEET | SAMPLES | GRAPHICAL WELL LOG

WELL DESCRIPTION

2.5 inch OD well casing.

Bottom of Boring @ 46.5 Feet



GeoStrata

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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

NOTES:
Cuttings, Bentonite, 10-20 Silica Sand, 20 Slot Screen, Pipe Cap

WATER LEVEL
- MEASURED - ESTIMATED

Plate
B-11

DATE	
STARTED:	7/25/13
COMPLETED:	7/25/13
BACKFILLED:	7/25/13

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep: J. Mattson
Rig Type: CME 75

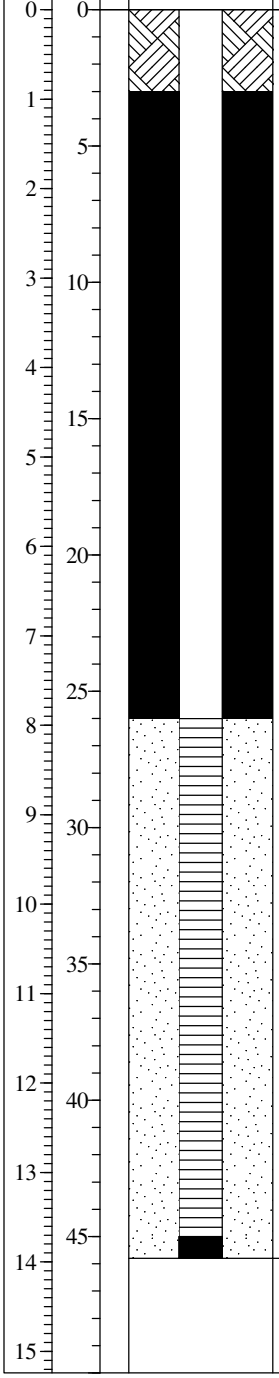
BORING NO: MW-2
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

DEPTH: METERS / FEET | SAMPLES | GRAPHICAL WELL LOG

WELL DESCRIPTION



2.5 inch OD well casing.

Bottom of Boring @ 45.8 Feet

GeoStrata

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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

NOTES:
Cuttings, Bentonite, 10-20 Silica Sand, 20 Slot Screen, Pipe Cap

WATER LEVEL
- MEASURED - ESTIMATED

Plate B-12

DATE	
STARTED:	
COMPLETED:	
BACKFILLED:	

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep:
Rig Type:

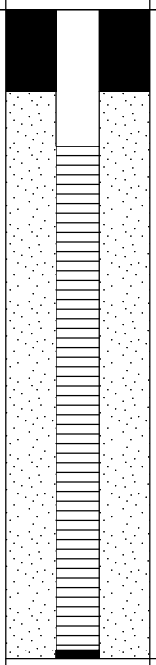
BORING NO:
TW-1
Sheet 1 of 1

LOCATION
NORTHING EASTING ELEVATION

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

DEPTH: METERS / FEET | SAMPLES | GRAPHICAL WELL LOG

WELL DESCRIPTION



2 inch OD Well Casing

Bottom of Boring @ 23.8 Feet

GeoStrata

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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

NOTES:
Cuttings, Bentonite, 10-20 Silica Sand, 20 Slot Screen, Pipe Cap

WATER LEVEL
- MEASURED - ESTIMATED

Plate
B-13

DATE	
STARTED:	
COMPLETED:	
BACKFILLED:	

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number 751-013

GeoStrata Rep:
Rig Type:

BORING NO:
TW-2
Sheet 1 of 1

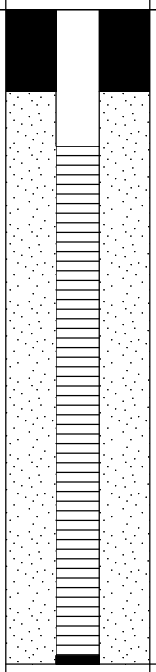
LOCATION
NORTHING EASTING ELEVATION

Moisture Content and Atterberg Limits
Plastic Limit — Moisture Content — Liquid Limit
10 20 30 40 50 60 70 80 90

DEPTH
METERS: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
FEET: 0 5 10 15 20 25 30 35 40 45

SAMPLES | GRAPHICAL WELL LOG

WELL DESCRIPTION



2 inch OD Well Casing

Bottom of Boring @ 24 Feet

GeoStrata

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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

NOTES:
Cuttings, Bentonite, 10-20 Silica Sand, 20 Slot Screen, Pipe Cap

WATER LEVEL
- MEASURED - ESTIMATED

Plate
B-14

DATE	
STARTED:	5/1/14
COMPLETED:	5/1/14
BACKFILLED:	5/1/14

Landfill Permit
Landfill Permit
Duchesne, UT
Project Number 751-013

IGES Rep: M. Vorkink
Rig Type: Mobile Drill
Boring Type: ODEX

WELL NO: **MW-3**

Sheet 1 of 1

LOCATION: NORTHING / EASTING / ELEVATION

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
0	0					FILL; Silty SAND with gravel - slightly moist, dense							
1	5					SANDSTONE - yellow brown							
3	10					MUDSTONE - Alternating layers of tan to grey mudstone and sandstone.							
6	20					SANDSTONE - yellow to white							
8	25					MUDSTONE - Alternating layers of grey, red and white sandstone and mudstone.							
11	35												
15	50					SILTSTONE - grey							
18	60					MUDSTONE - grey, occasional thin beds of red siltstone							
24	80					MUDSTONE - grey to brown, minor amount of water.							
26	85												
27	90					Bottom of Boring @ 86 Feet							
29	95												
30													

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

GeoStrata

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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, Pipe Cap

WATER LEVEL: ▼ - MEASURED ▽ - ESTIMATED

Plate

B-15

DATE	
STARTED:	5/1/14
COMPLETED:	5/1/14
BACKFILLED:	5/1/14

Landfill Permit
Landfill Permit
Duchesne, UT
Project Number 751-013

IGES Rep: M. Vorkink
Rig Type: Mobile Drill
Boring Type: ODEX

WELL NO: **MW-4**

Sheet 1 of 1

LOCATION: NORTHING / EASTING / ELEVATION

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
0	0				SM	Silty SAND - red-brown, slightly moist, very loose							
1	5					SANDSTONE - yellow							
3	10					SANDSTONE - white, thin beds of Mudstone							
6	20					MUDSTONE - red							
8	25					SANDSTONE - tan to white, thin beds of white mudstone							
9	30					SANDSTONE - white to yellow, beds of tan siltstone							
12	40					SANDSTONE							
14	45					MUDSTONE - red, white, and grey							
17	55												
18	60					Bottom of Boring @ 56 Feet							

N - OBSERVED UNCORRECTED BLOW COUNT

* N - UNCORRECTED, EQUIVALENT SPT BLOW COUNT

GeoStrata

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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 | Pipe Cap

WATER LEVEL
- MEASURED
- ESTIMATED

Plate

B-16

APPENDIX C

Boring No.	Sample Depth (feet)	USCS Soil Classification	Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limits		Triax CU	
					Gravel (%)	Sand (%)	Fines (%)	Liquid Limit	Plasticity Index	Effective Cohesion (psf)	Internal Friction Angle (°)
B-1	4.5	SM			5.3	52.1	42.6	17	3		
B-1	8.0	CL-ML	9.5	101.1	0.8	24.8	74.4	20	7	20	35
B-2	2.0	SM	4.3	117.9	1.1	52.9	46	NP	NP		
B-2	6.0	SM	4.4	111.2							
B-2	10.0	SM	9.7	118.2							
B-2	14.0	SM	4.2	102.3	0.0	71.7	28.3	NP	NP		
B-2	18.0	SM	3.3	101.9	0.9	77.1	22.0				
B-2	30.0	ML	20.7	106.8	3.0	35.3	61.7	19	2		
B-3	2.0	SM	2.2	107.5	0.9	66.3	32.8	NP	NP		
B-3	6.0	SM	4.9	97.4							
B-3	10.0	SM	5.3	99.8	0.6	61.9	37.5	NP	NP	80	29
B-3	14.0	SM	2.6	103.8							
B-4	2.0	SM	7.7	122.9							
B-4	4.0	SM			5.1	54.1	40.8	NP	NP		
B-4	6.0	SM	6.7	127.4							
B-4	10.0	SM	4.0	110.0	2.1	70.7	27.2				
B-4	14.0	Mudstone	10.6	121.0							
B-5	5.0	Mudstone	9.5	110.7							
B-5	10.0	Mudstone	14.8	101.6							

GeoStrata

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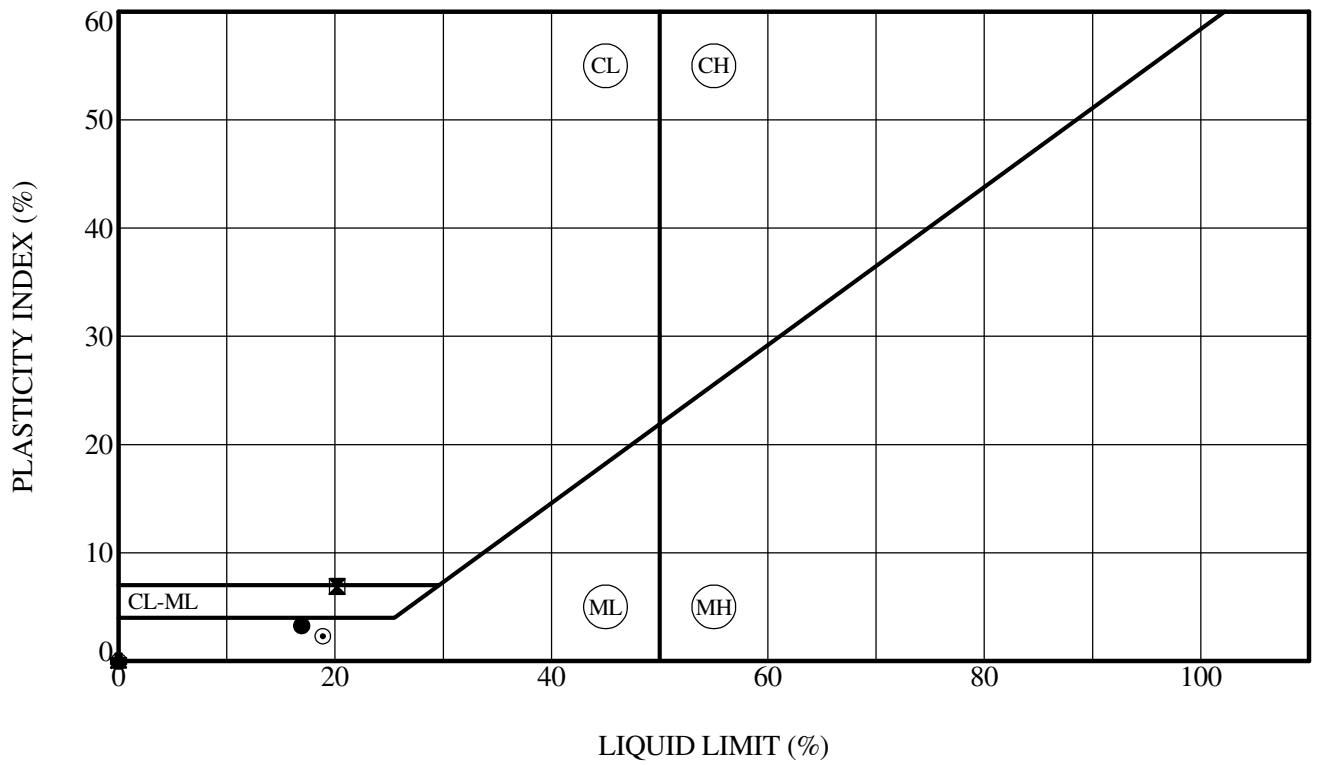
Lab Summary Report

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate C-1



	Sample Location	Depth (ft)	LL (%)	PL (%)	PI (%)	Fines (%)	Classification
●	**B-1**	**4.5**	**17**	**14**	**3**		**Silty SAND**
⊠	**B-1**	**8.0**	**20**	**13**	**7**		**Silty CLAY with sand**
▲	**B-2**	**2.0**	**NP**	**NP**	**NP**		**Silty SAND**
★	**B-2**	**14.0**	**NP**	**NP**	**NP**		**Silty SAND**
⊙	**B-2**	**30.0**	**19**	**17**	**2**		**Sandy SILT**
✿	**B-3**	**2.0**	**NP**	**NP**	**NP**		**Silty SAND**
○	**B-3**	**10.0**	**NP**	**NP**	**NP**		**Silty SAND**
△	**B-4**	**4.0**	**NP**	**NP**	**NP**		**Silty SAND**

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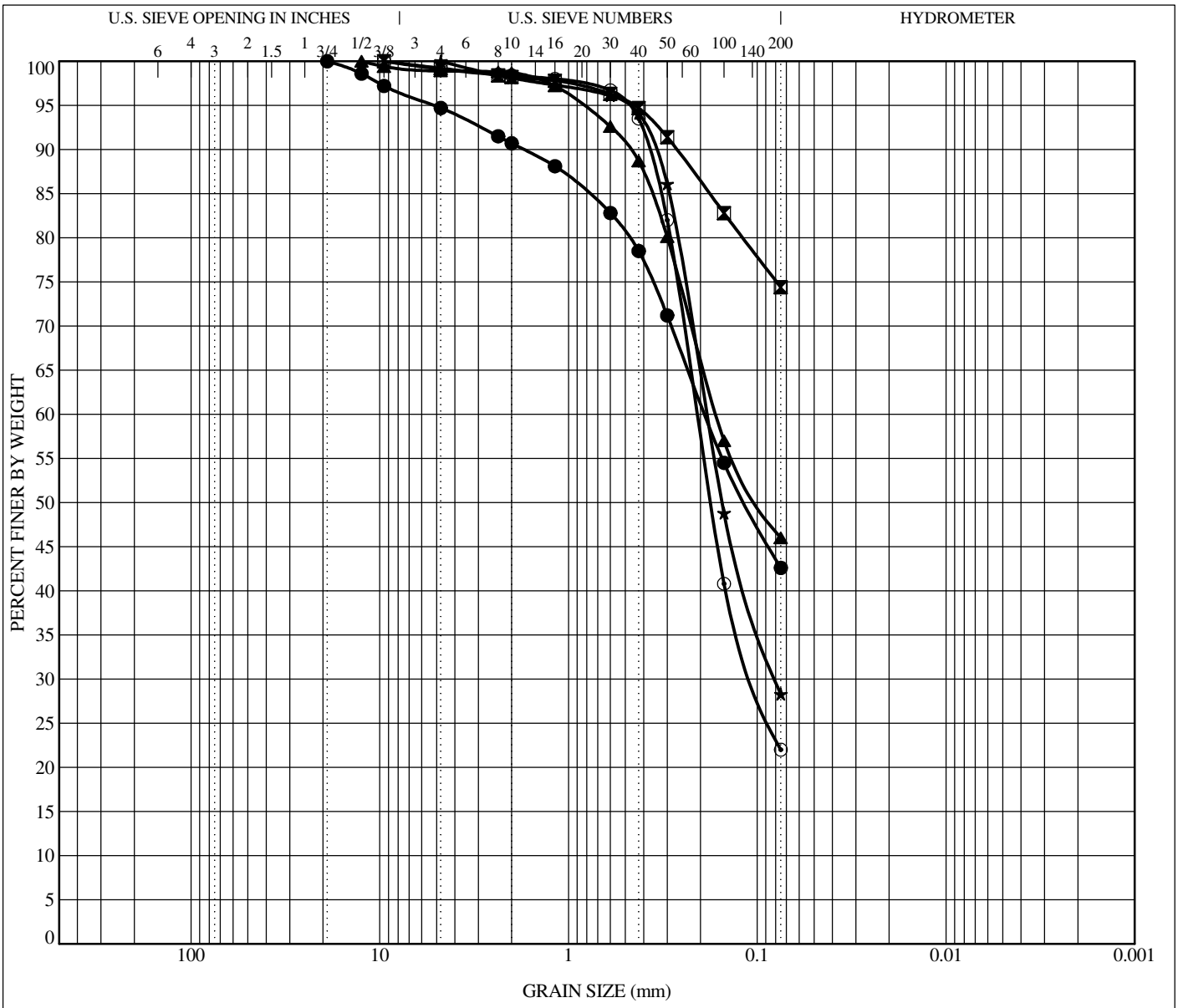
ATTERBERG LIMITS' RESULTS - ASTM D 4318

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate

C - 2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
●	**B-1**	**4.5**	**Silty SAND**	**17**	**14**	**3**		
⊠	**B-1**	**8.0**	**Silty CLAY with sand**	**20**	**13**	**7**		
▲	**B-2**	**2.0**	**Silty SAND**	**NP**	**NP**	**NP**		
★	**B-2**	**14.0**	**Silty SAND**	**NP**	**NP**	**NP**		
⊙	**B-2**	**18.0**	**Silty SAND**					

	Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-1**	**4.5**	**19**	**0.188**			**5.3**	**52.1**	**42.6**	
⊠	**B-1**	**8.0**	**9.5**				**0.8**	**24.8**	**74.4**	
▲	**B-2**	**2.0**	**12.5**	**0.164**			**1.1**	**52.9**	**46.0**	
★	**B-2**	**14.0**	**4.75**	**0.185**	**0.079**		**0.0**	**71.7**	**28.3**	
⊙	**B-2**	**18.0**	**9.5**	**0.207**	**0.101**		**0.9**	**77.1**	**22.0**	

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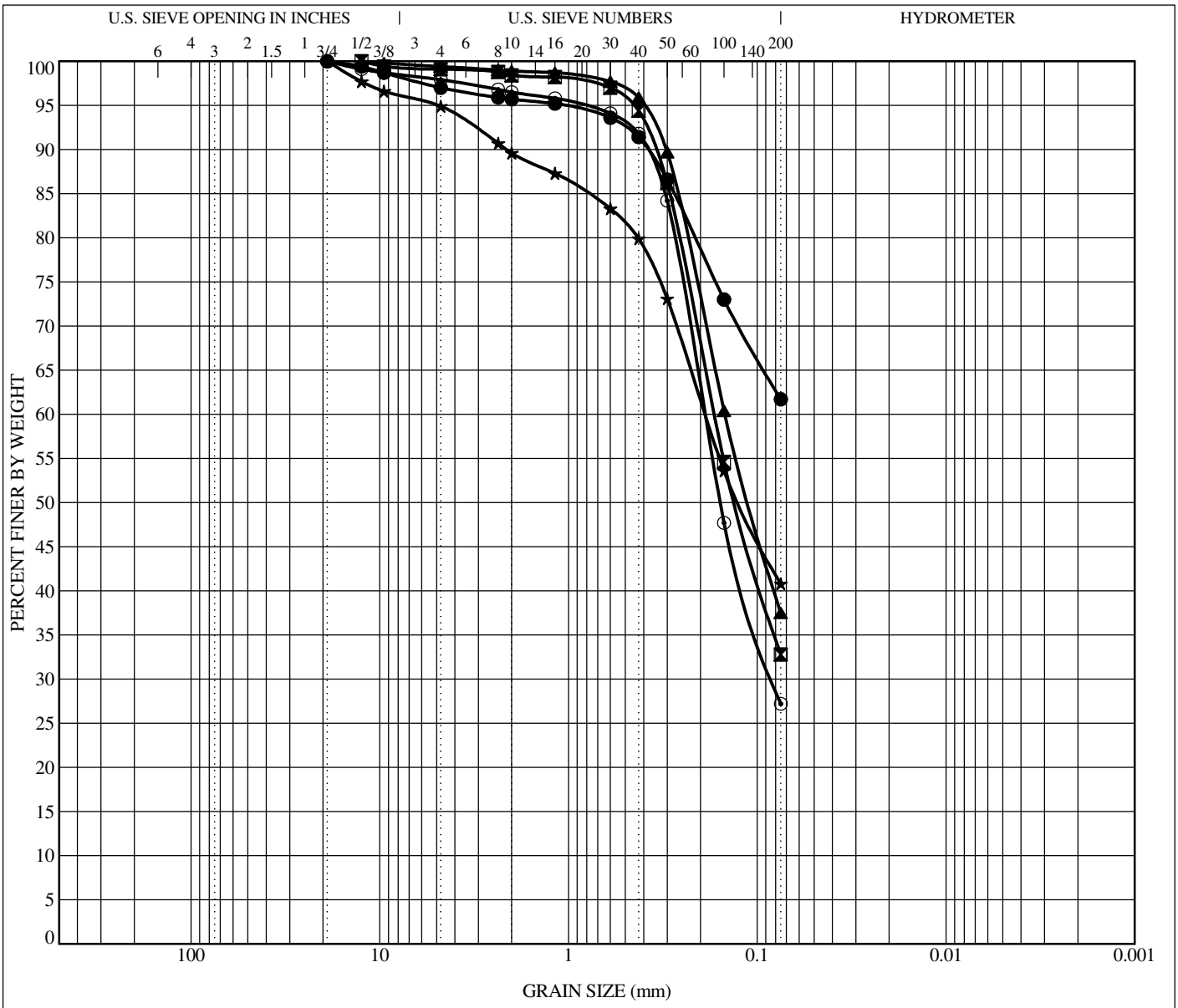
GRAIN SIZE DISTRIBUTION - ASTM D422

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate

C - 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Location	Depth	Classification	LL	PL	PI	Cc	Cu
●	**B-2**	**30.0**	**Sandy SILT**	**19**	**17**	**2**		
⊠	**B-3**	**2.0**	**Silty SAND**	**NP**	**NP**	**NP**		
▲	**B-3**	**10.0**	**Silty SAND**	**NP**	**NP**	**NP**		
★	**B-4**	**4.0**	**Silty SAND**	**NP**	**NP**	**NP**		
⊙	**B-4**	**10.0**	**Silty SAND**					

	Sample Loctaion	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-2**	**30.0**	**19**				**3.0**	**35.3**	**61.7**	
⊠	**B-3**	**2.0**	**12.5**	**0.169**			**0.9**	**66.3**	**32.8**	
▲	**B-3**	**10.0**	**12.5**	**0.148**			**0.6**	**61.9**	**37.5**	
★	**B-4**	**4.0**	**19**	**0.188**			**5.1**	**54.1**	**40.8**	
⊙	**B-4**	**10.0**	**19**	**0.189**	**0.082**		**2.1**	**70.7**	**27.2**	

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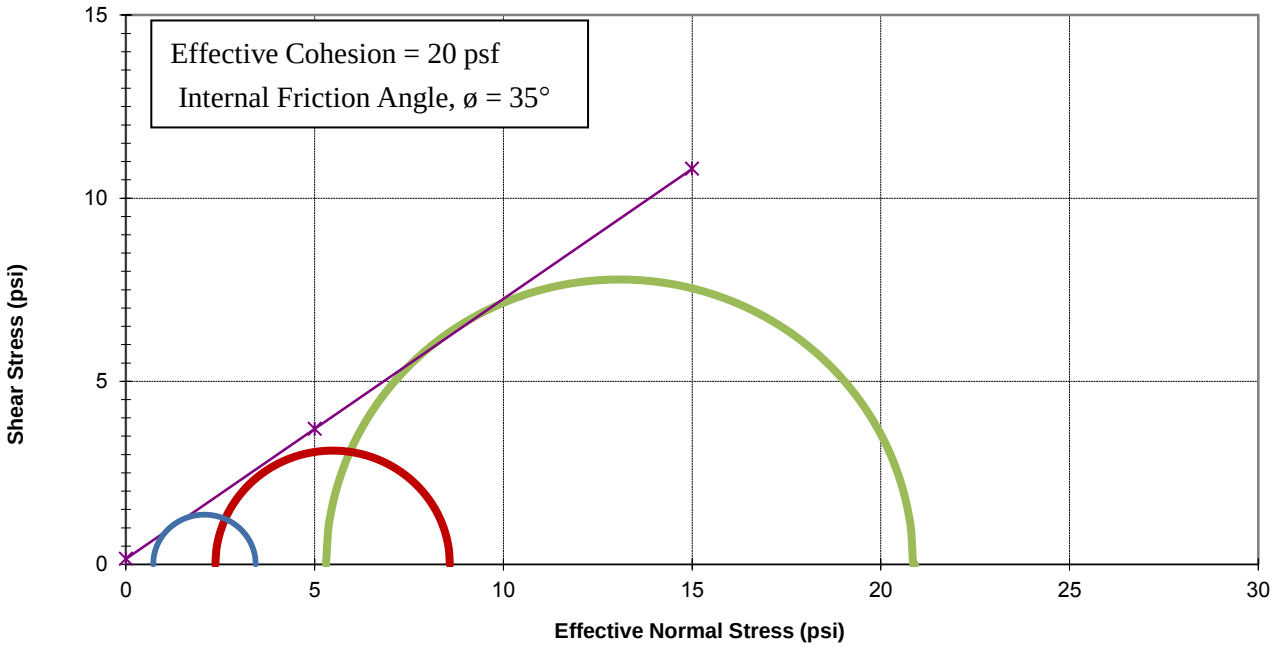
GRAIN SIZE DISTRIBUTION - ASTM D422

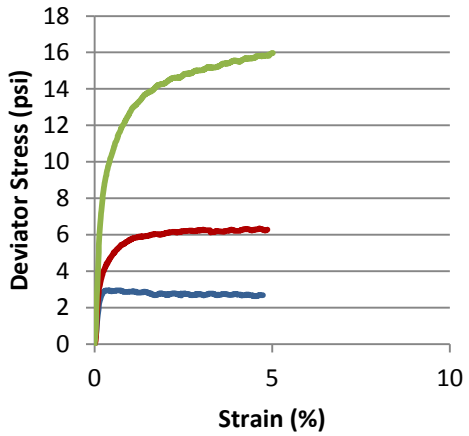
Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

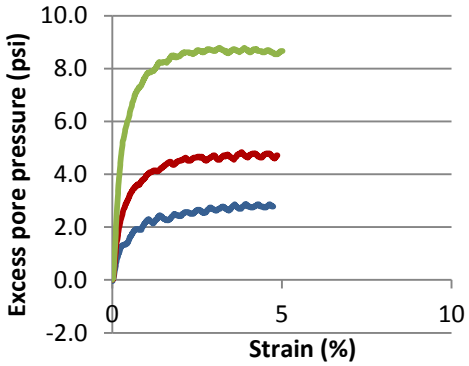
Plate

C - 4

Consolidated Undrained Triaxial Test
Effective Stress



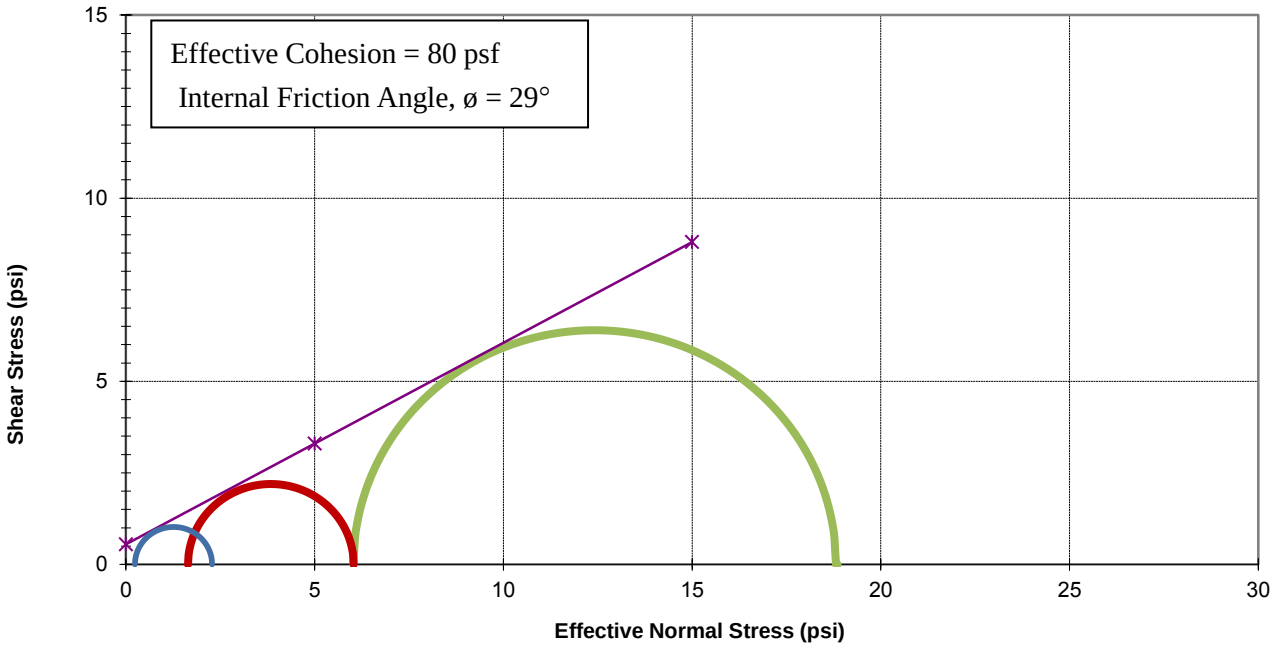


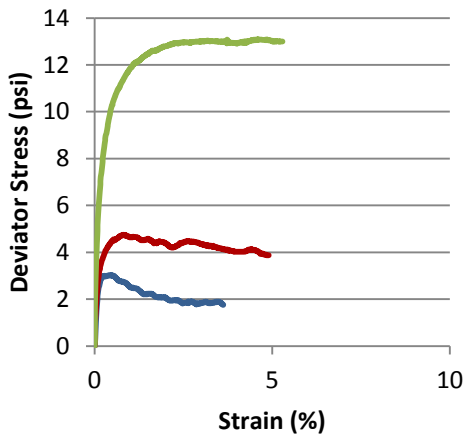


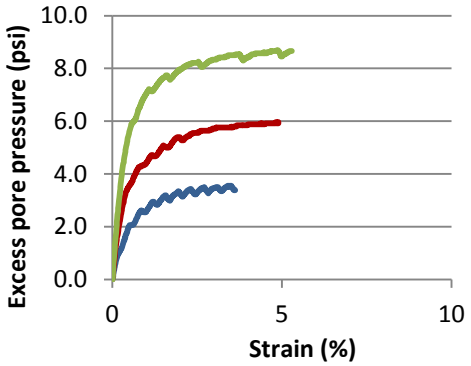
Sample Location	B-1 @ 8 ft		
Sample Type	Remolded		
Test Type	Consolidated Undrained		
Length (in)	5.54	NA	NA
Diameter (in)	2.87	NA	NA
Dry Density (pcf)	101.1	NA	NA
Moisture (%)	9.5	NA	NA
Consolidation Press (psf)	504	1008	2016
"B" Parameter	0.95	0.95	0.95
Total Confining Stress σ_3 (psi)	3.5	7.0	14.0
Total Axial Stress σ_1 (psi)	6.2	13.2	29.6
Deviator Stress σ_1-σ_3 (psi)	2.7	6.2	15.6
Effective Confining Stress σ_3' (psi)	0.7	2.4	5.3
Effective Axial Stress σ_1' (psi)	3.4	8.6	20.9
Pore Pressure μ (psi)	2.8	4.6	8.7
Strain (%)	5.0	5.0	5.0

Project No.: 751-013	GeoStrata	**Plate C-5**

Consolidated Undrained Triaxial Test
Effective Stress







Sample Location	B-3 @ 10 ft		
Sample Type	Remolded		
Test Type	Consolidated Undrained		
Length (in)	5.75	NA	NA
Diameter (in)	2.86	NA	NA
Dry Density (pcf)	99.8	NA	NA
Moisture (%)	5.3	NA	NA
Consolidation Press (psf)	504	1008	2016
"B" Parameter	0.95	0.95	0.95
Total Confining Stress σ_3 (psi)	3.5	7.0	14.0
Total Axial Stress σ_1 (psi)	5.5	11.4	26.8
Deviator Stress σ_1-σ_3 (psi)	2.0	4.4	12.8
Effective Confining Stress σ_3' (psi)	0.2	1.6	6.0
Effective Axial Stress σ_1' (psi)	2.3	6.0	18.8
Pore Pressure μ (psi)	3.3	5.4	8.0
Strain (%)	5.0	5.0	5.0

APPENDIX D

WASTE SHIPMENT RECORD

Date: _____

Departure Time from Origin: _____

Load ID No.: _____

Arrival Time at Landfill: _____

Generator of Waste: _____

Origin: _____

Quantity (cubic yards):	Name of Trucking Company:
Estimated Tons (based on unit weight):	Truck Number:
Type of Waste:	Truck Driver's Name:
Description of Waste:	Truck Driver's Signature:

COMMENTS:

_____

_____

_____

_____

_____

DATE: _____ **TIME:** _____

DAILY PERMANENT RECORD

ITEM	YES	NO	COMMENTS
SITE SECURITY			
Perimeter fence and security gate are in good condition?			
Lock functioning and in place?			
ROADS			
Do roads require watering? If so, record in the operator's log the volume of water used and the section of road watered.			
OPERATIONS			
Collect daily landfill gas monitoring levels and compare to Integrated Water Management Health and Safety Plan Action levels. Upgrade PPE if necessary.			
Estimated Weight in Tons of E&P waste received today			
Estimated Volume in Cubic Yards of E&P waste received today			
Estimated Weight in Tons of E&P waste that required treatment prior to disposal in the landfill cell			
Estimated Volume in Cubic Yards of E&P waste that required treatment prior to disposal in the landfill cell			
Estimated Weight in Tons of material added to treat the waste			
Estimated Volume of material added to treat the waste			
Estimated Total Weight in Tons of treated waste			
Estimated Volume in Cubic Yards of treated waste			
Record daily volumes and weights of wastes received, solidified, and placed in the landfill cell.			
Record volume and weight of solidification material used each day.			
Are slopes at which the waste is placed in accordance with the guidance provided by the Project Geotechnical Engineer? If not, contact the Waste Disposal Facility Manager.			
INSPECTION OF GEOCOMPOSITE AND HDPE LINER UNTIL FULLY COVERED			
Are geocomposite and HDPE anchors in place and in good condition?			
Is the geocomposite and/or HDPE systems free of rips, excessive weathering, or excessive tension?. Monitor daily until the geocomposite layer is completely covered with waste or a protective layer of soil.			
SURFACE WATER MONITORING			
Check daily during March, April and May of each year. Is there water flowing in the ephemial stream near monitoring wells XXXX and YYYYY? If so, call the Waste Disposal Facility Manager by the end of the day to make arrangements for annual surface water sampling.			
EMBANKMENT			
Inboard Slope			
Has the geofabric material been covered by soil or water within two weeks of placement? If not, cover with at least 4 inches of soil by the end of the day.			

NOTES:
(Record any other significant issues below. Fill out additional pages and attach if necessary.)

If any checks appear in the "No" column, provide a detailed description of what you observed, including: accurate location, extent of affected area, and a description of the condition.
Refer to the Operations Manual, initiate the prescribed corrective action and estimate time of completion.
Inform the appropriate Integrated Water Management personnel (Supervisor, and/or Environmental Manager) per the Operations Manual and document the corrective action taken (notes, photos, etc.)

Completed By:

_____ _____
Name **Signature**

DATE: _____ **TIME:** _____

WEEKLY PERMANENT RECORD

ITEM	YES	NO	COMMENTS
SITE SECURITY			
Fire extinguisher is charged, not exceeding inspection deadline?			
Spill kits are stocked on site?			
Emergency eyewash stations are functioning properly and well stocked?			
Signage visible and in good condition?			
Warning signage every 250 feet of exterior fencing and at closest approach of gravel road?			
OPERATIONS			
If there is water in the leachate collection system? If so, remove and record volume transferred to Evaporation Pond 1.			
If there is water in the leak detection sump? If so, remove and record volume transferred to Evaporation Pond 1. Call the landfill Supervisor to inform him.			
Estimated Weight in Tons of E&P waste received this week Estimated Volume in Cubic Yards of E&P waste received this week Estimated Weight in Tons of E&P waste that required treatment prior to disposal in the landfill cell this week Estimated Volume in Cubic Yards of E&P waste that required treatment prior to disposal in the landfill cell this week Estimated Weight in Tons of material added to treat the waste this week Estimated Volume of material added to treat the waste this week Estimated Total Weight in Tons of treated waste this week Estimated Volume in Cubic Yards of treated waste this week Record weekly volumes and weights of wastes received, solidified, and placed in the landfill cell. Record volume and weight of solidification material used each week.			
GROUNDWATER MONITORING			
Check depth to groundwater from top of well casing weekly during March, April and May. Is there groundwater present in wells XXXX, YYYYY and ZZZZ?. If so, call the Waste Disposal Facility Manager by the end of the day to arrange for annual groundwater sampling. (Once sampling is completed, monitoring of groundwater levels can be discontinued for the year. Measure water levels from the top of well casing to the nearest 1/100 th of a foot)			
EMBANKMENT			
Crest			
Are there any signs of erosion gullies greater than 6 inches deep?			
Are there any signs of settlement, cracks slides, slumps, boils, sinkholes or other?			
Outboard Slope to 10 feet past the Toe			
Are there any signs of erosion gullies greater than 6 inches deep?			
Are there any signs of settlement, cracks slides, slumps, boils, sinkholes or other?			
Are ther any debris or weeds that prevent the inspection?			
Are there new signs of seepage (ie: flows of water, wet spots, or ponding?			
Is there evidence of burrowing animals?			
Are the diversion channels serviceable and unobstructed?			

NOTES:
(Record any other significant issues below. Fill out additional pages and attach if necessary.)

If any checks appear in the "No" column, provide a detailed description of what you observed, including: accurate location, extent of affected area, and a description of the condition.
Refer to the Operations Manual, initiate the prescribed corrective action and estimate time of completion.
Inform the appropriate Integrated Water Management personnel (Supervisor, and/or Environmental Manager) per the Operations Manual and document the corrective action taken (notes, photos, etc.)

Completed By:

_____ _____
Name **Signature**

IWM Emergency Response	
IWM Incicent Manger	Phone Number
Nate Robinson	435-832-0800

Local Emergency Contacts		
Local Reponders	Phone Number	Address
Emergency Dispatch	435-738-2424	24554 W 9000 S Duchesne, Ut 84021
Duchesne Fire Department	435-738-2424	21554 W 9000 S Duchesne, Ut 84021
Duchesne County Sheriff	435-738-2015	21554 W 9000 S Duchesne, Ut 84021
Uintah Basin Medical Center	435-722-4691	250 W 300 N Roosevelt, Ut 84066

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Emergency Contact Numbers

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate D-4

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 ^{o}C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

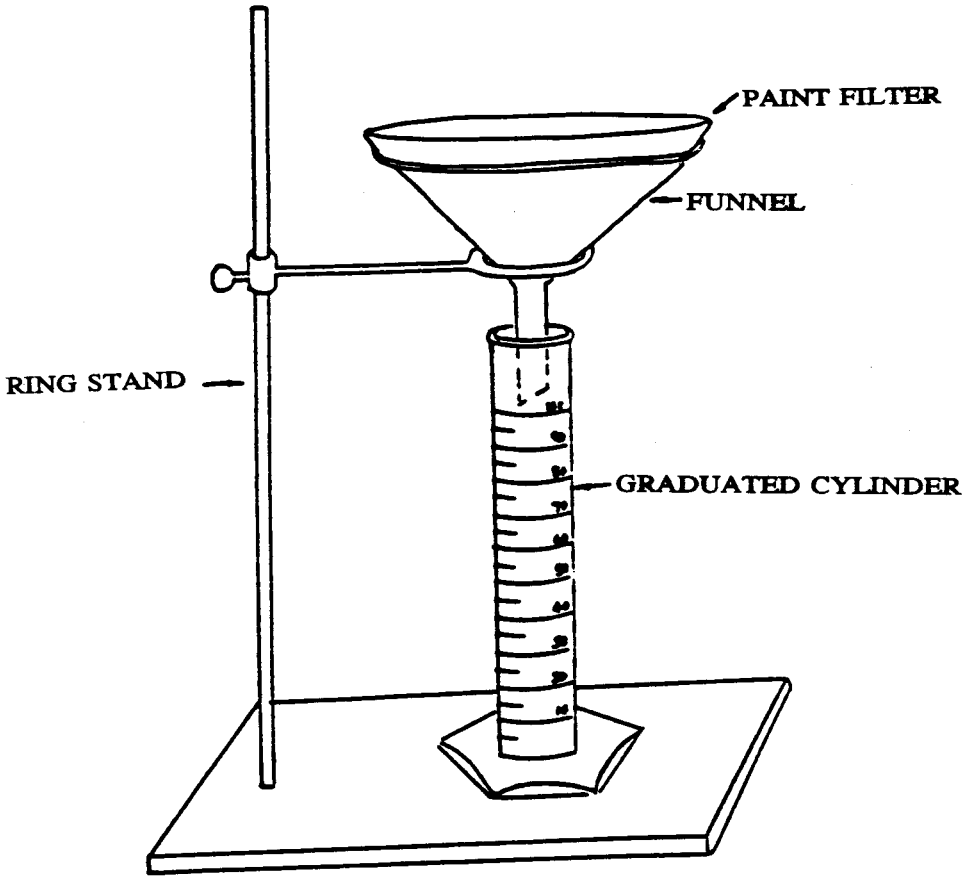
9.0 METHOD PERFORMANCE

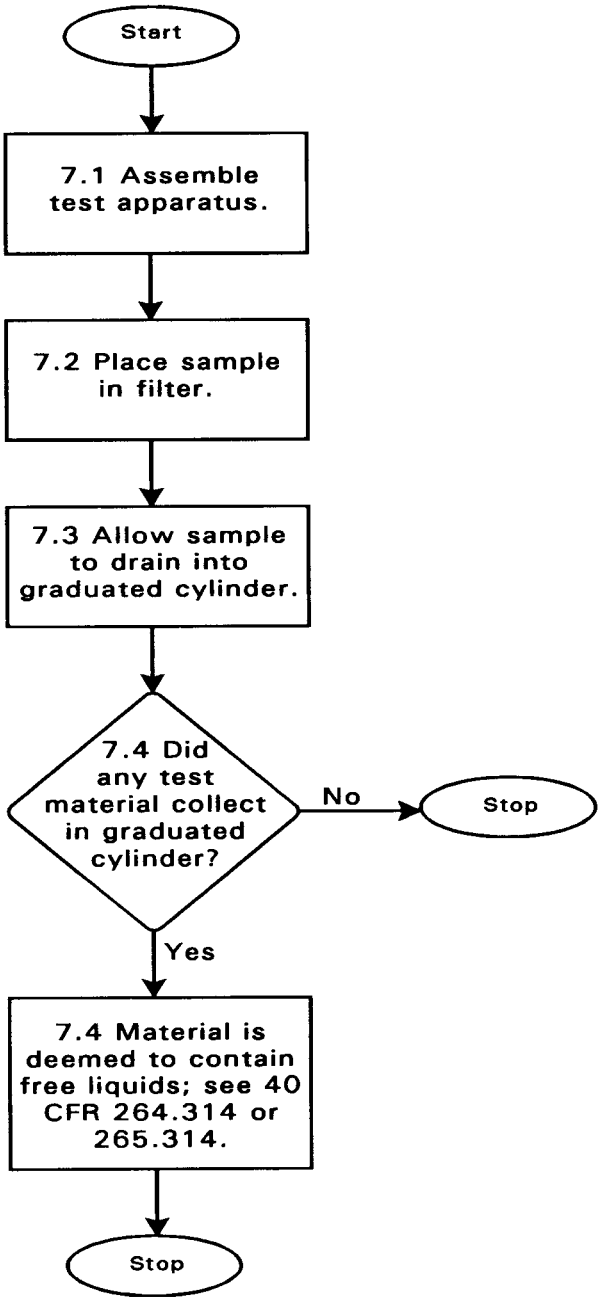
9.1 No data provided.

10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS




Start
7.1 Assemble test apparatus.
7.2 Place sample in filter.
7.3 Allow sample to drain into graduated cylinder.
7.4 Did any test material collect in graduated cylinder?
No
Stop
Yes
7.4 Material is deemed to contain free liquids; see 40 CFR 264.314 or 265.314.
Stop

APPENDIX E

Material	Moisture Content (%)	Mass (tons)	Dry Density (pcf)	Wet Density (pcf)	Volume (cu yd)
Native SM	5.2	1.5	110.3	116.0	0.97
Waste	67.6	1	77.3	129.6	0.57
Mix Target	30	2.5	97.2	126.4	1.48

Mixing Ratio: 1.5 tons of soil to 1 ton of waste

% Growth	Projected Landfill Life – Half Waste Mixed with Soil					
	5 Day Week			7 Day Week		
	Years	Months	Days	Years	Months	Days
0	4	4	1	3	1	6
2	4	2	12	3	0	14
3	4	1	19	3	0	3
5	4	1	15	2	11	13
10	3	9	8	2	9	28

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Projected Landfill Life – Soil/Waste Mix

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-1

Material	Moisture Content (%)	Mass (tons)	Dry Density (pcf)	Wet Density (pcf)	Volume (cu yd)
Native SM	5.2	1.5	110.3	116.0	0.97
Waste	67.6	1	77.3	129.6	0.57
Mix Target	30	2.5	97.2	126.4	1.48

Mixing Ratio: 1.5 tons of soil to 1 ton of waste

% Growth	Projected Landfill Life – All Waste Mixed with Soil					
	5 Day Week			7 Day Week		
	Years	Months	Days	Years	Months	Days
0	3	0	4	2	1	25
2	2	11	13	2	1	16
3	2	11	2	2	1	11
5	2	10	14	2	1	3
10	2	9	1	2	0	16

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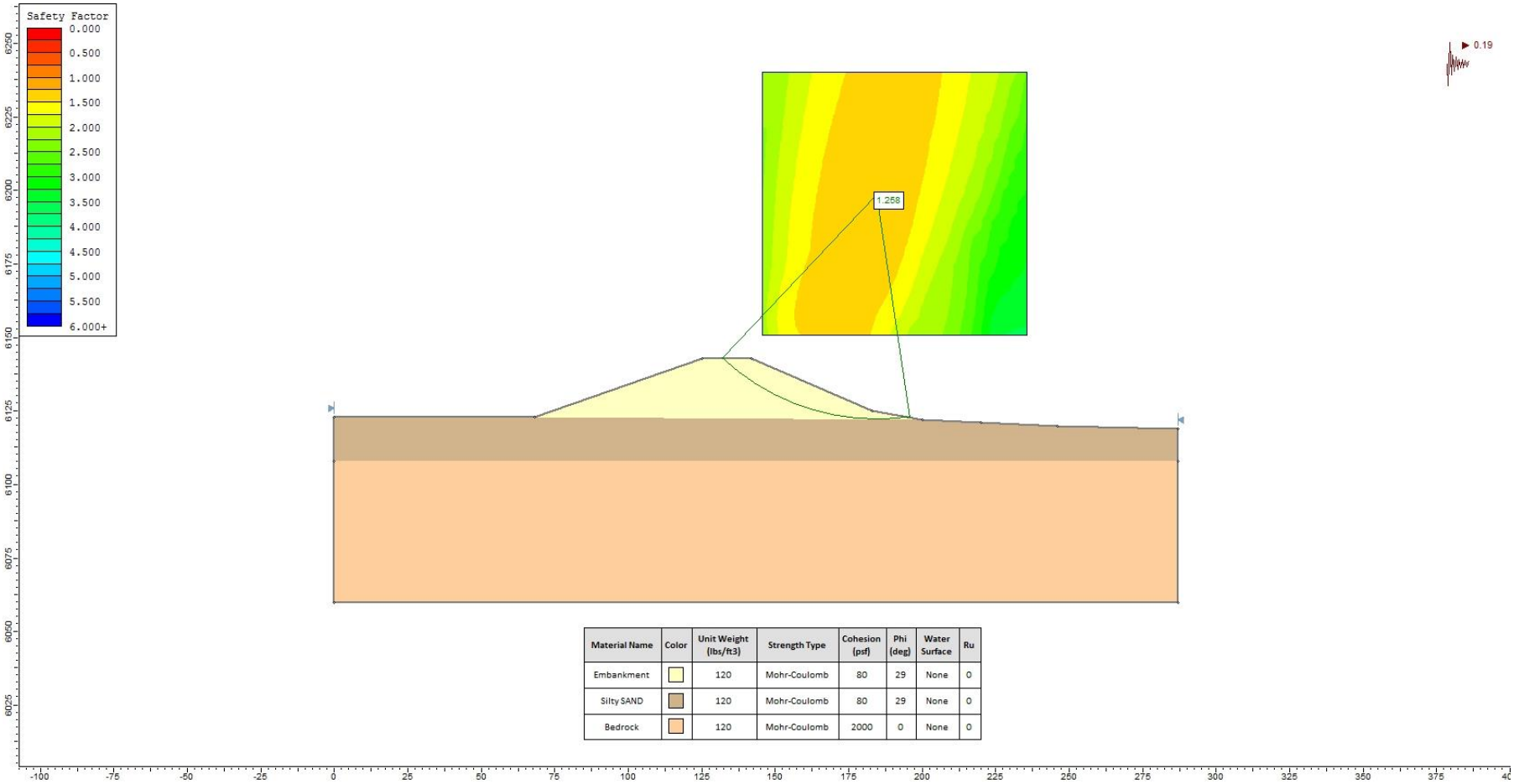
Projected Landfill Life – Soil/Waste Mix

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-2



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0

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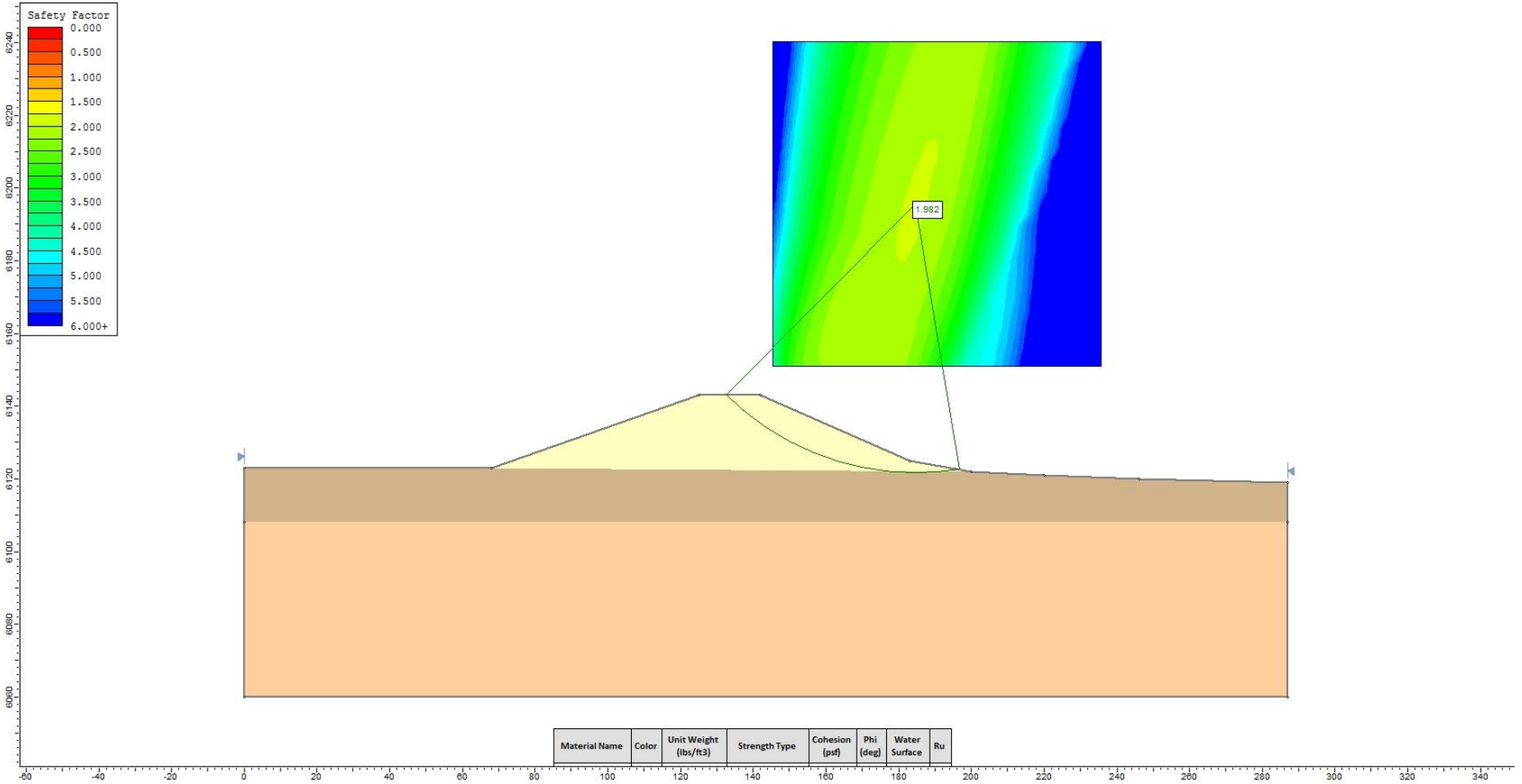
Profile A – Exterior Slope Pseudo Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-3



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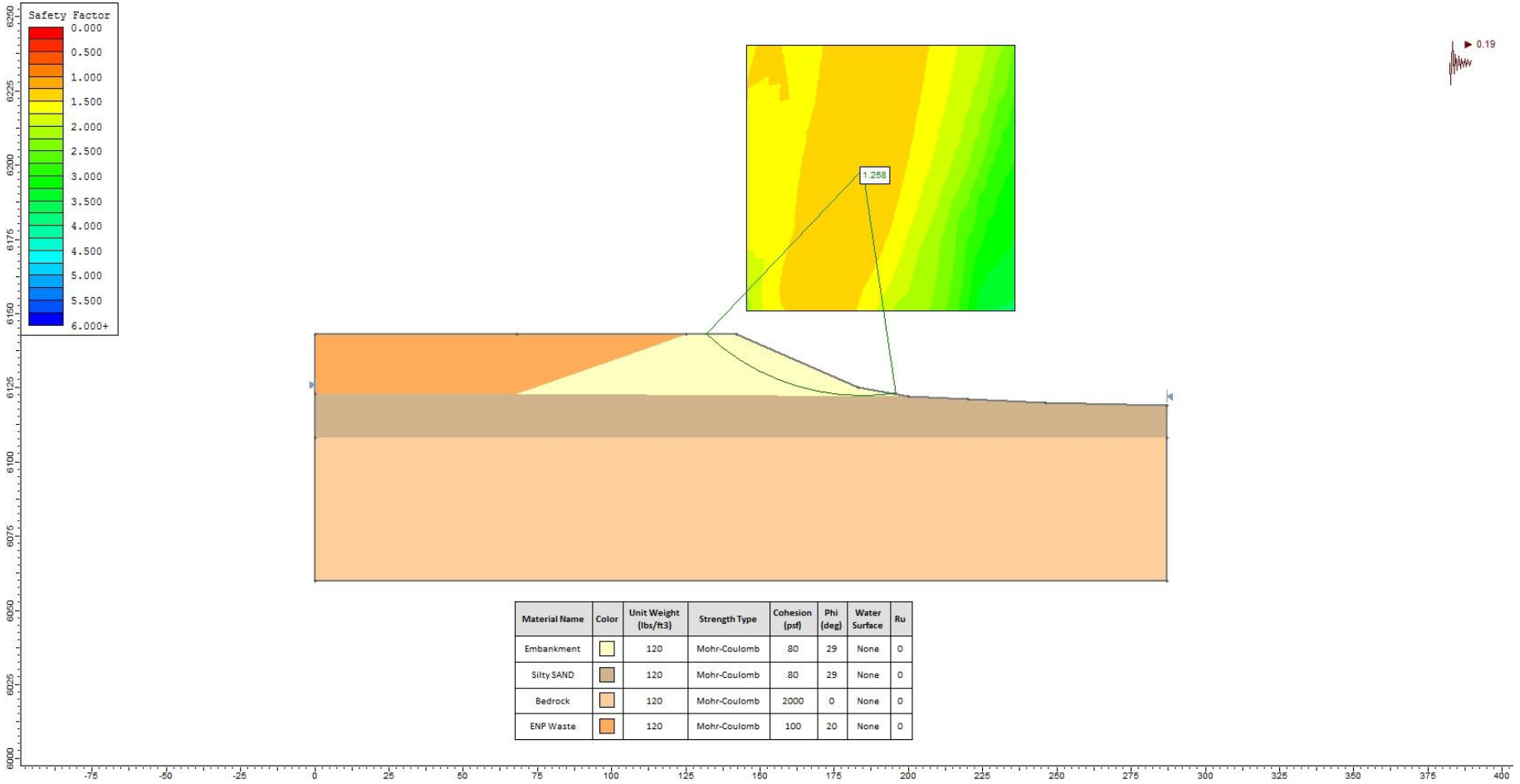
Profile A – Exterior Slope Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-4



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0
ENP Waste		120	Mohr-Coulomb	100	20	None	0

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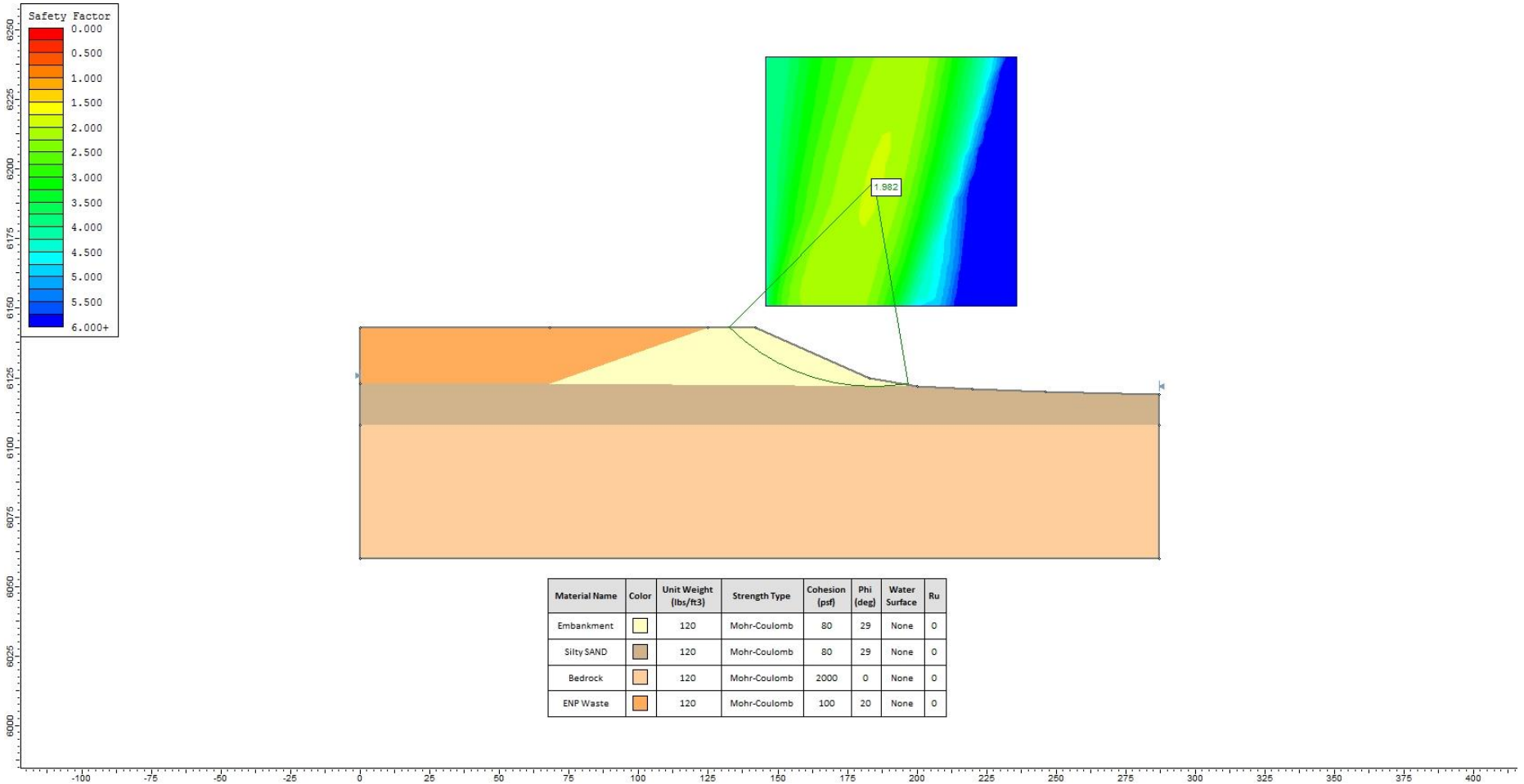
Profile A – Exterior Slope with Waste Pseudo Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-5



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0
ENP Waste		120	Mohr-Coulomb	100	20	None	0

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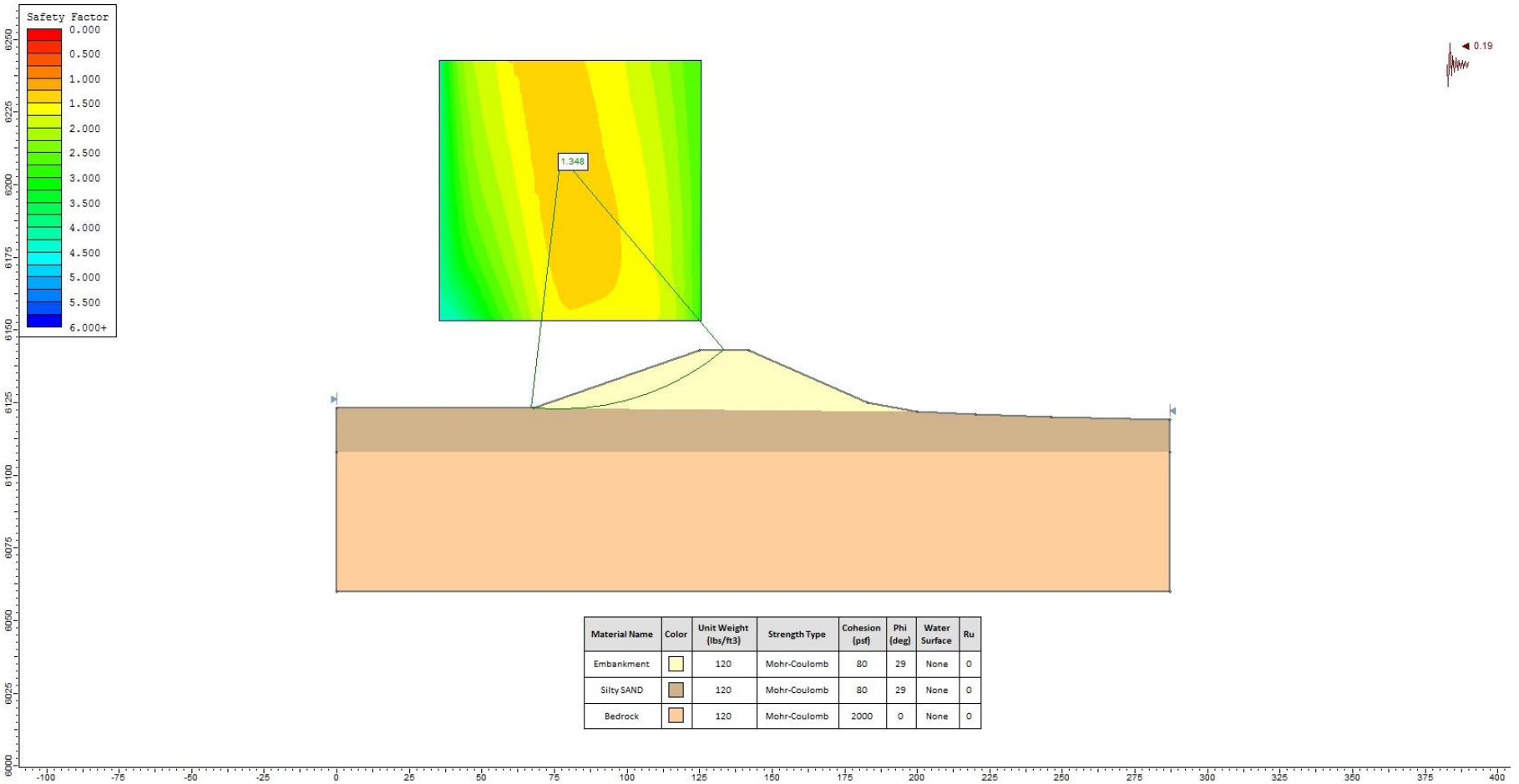
Profile A – Exterior Slope with Waste Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-6



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0

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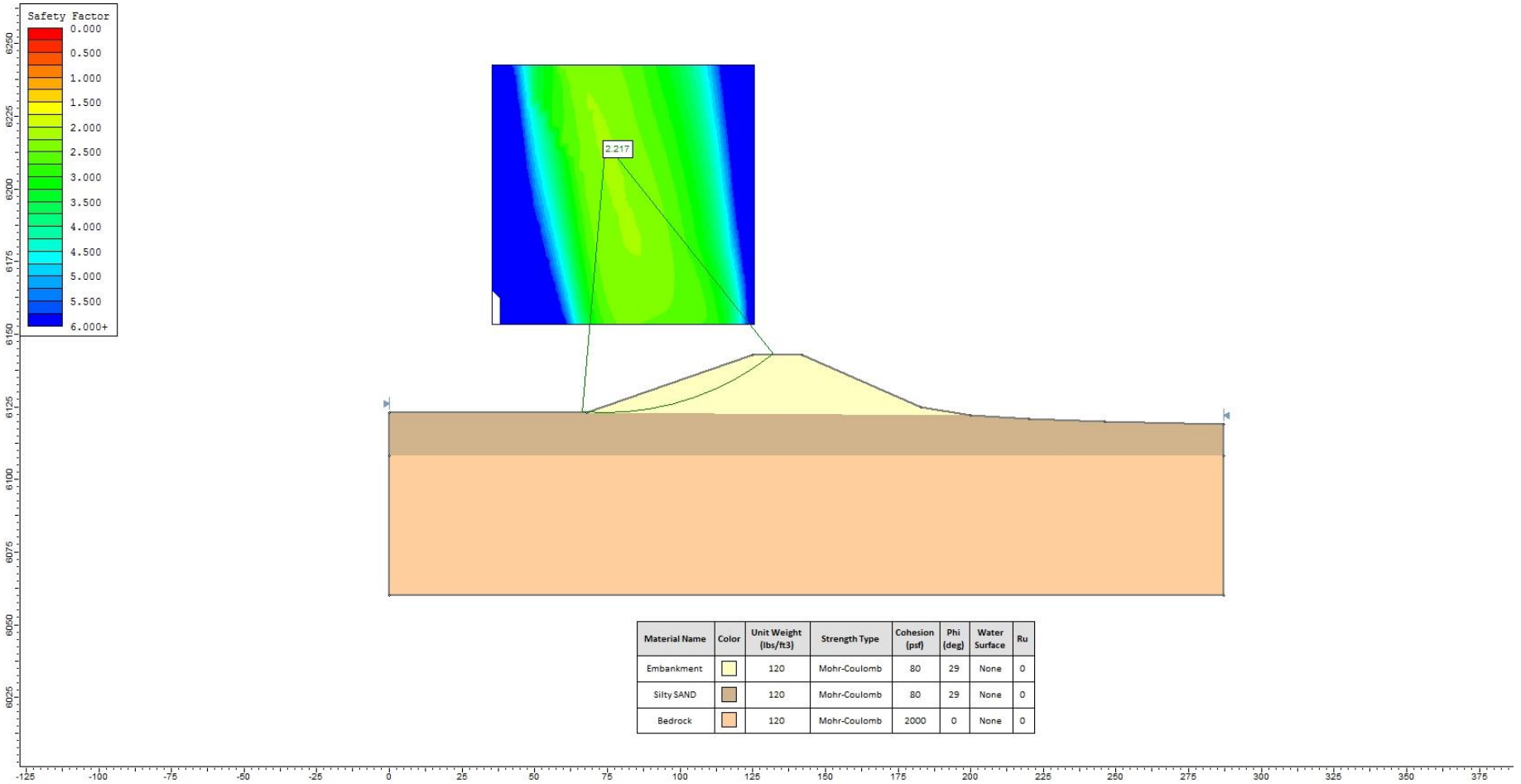
Profile A – Interior Slope Pseudo Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-7



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0

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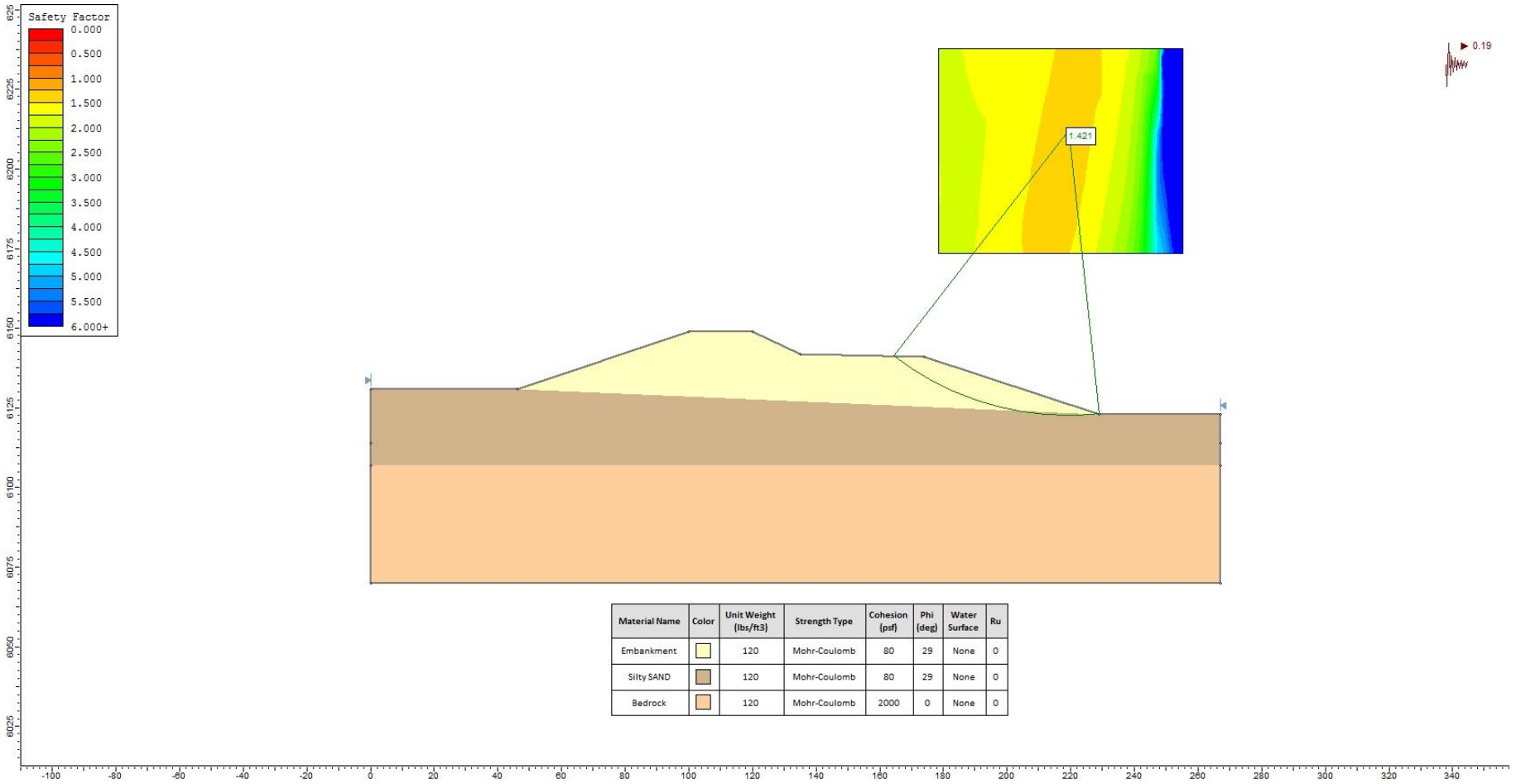
Profile A – Interior Slope Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-8



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0

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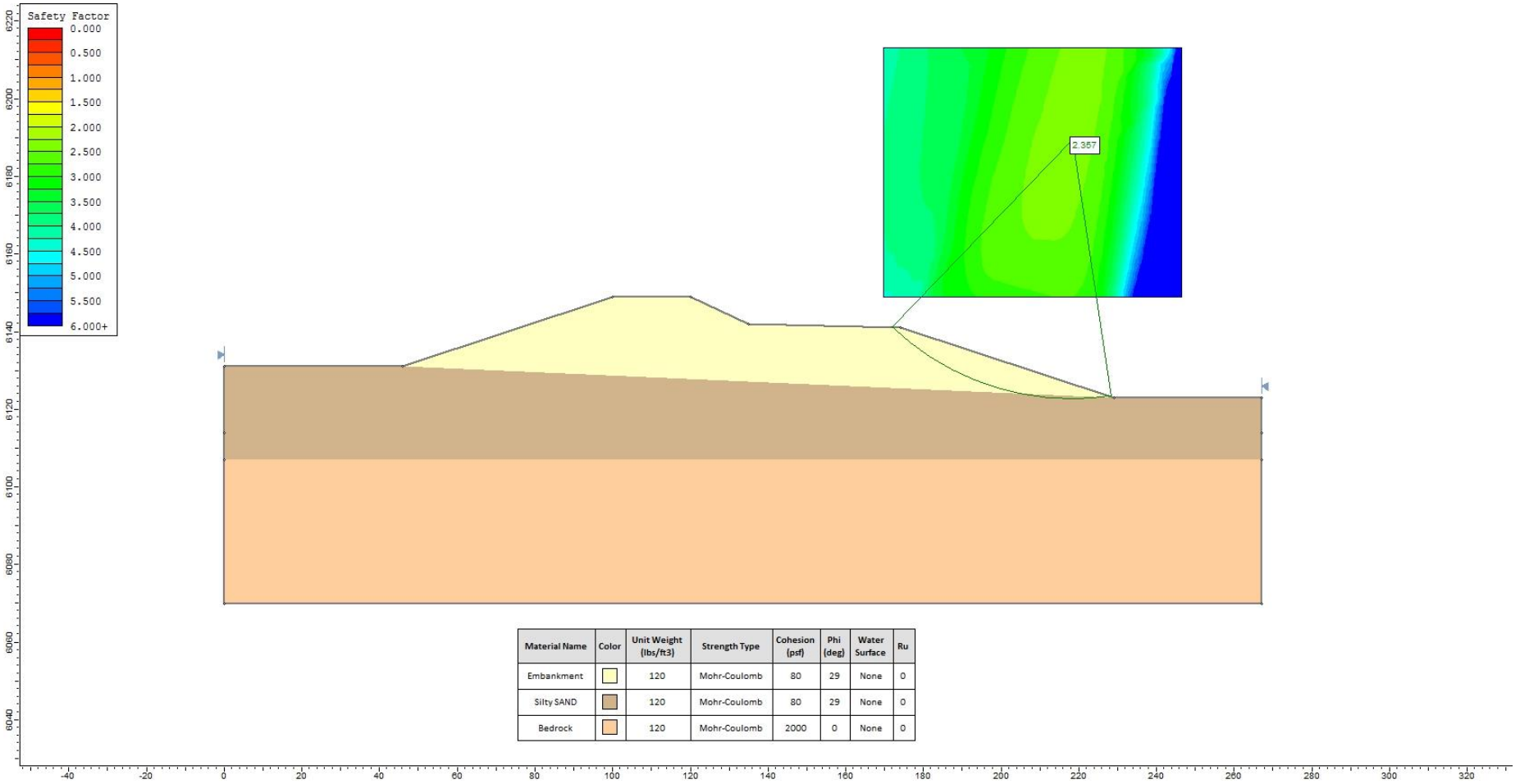
Profile B – Interior Slope Pseudo Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-9



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Embankment		120	Mohr-Coulomb	80	29	None	0
Silty SAND		120	Mohr-Coulomb	80	29	None	0
Bedrock		120	Mohr-Coulomb	2000	0	None	0

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Profile B – Interior Slope Static

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate E-10

APPENDIX F

INTEGRATED WATER MANAGEMENT - BLEAZARD DISPOSAL PITS

EAST LANDFARM - POND 3 - LANDFILL

SEPTEMBER 2013
GEO.015

PROFESSIONAL ENGINEER
3/13/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

SECTION 30, TOWNSHIP 2 SOUTH, RANGE 4 WEST, UINTAH SPECIAL BASE AND MERIDIAN

GILSON ENGINEERING, INC.

CONSULTING ENGINEERS AND SURVEYORS
12401 SOUTH 450 EAST DRAPER, UT. 84020
BUILDING C, UNIT 2
PHONE: (801) 571-9414
FAX: (801) 571-9449

GeoStrata
Engineering & Geosciences
14425 S. Center Point Way
Bluffdale, Utah 84065
801-501-0583
www.geostrata-llc.com

IWM
INTEGRATED
WATER MANAGEMENT & LAND FARM
SOUND ENVIRONMENTAL SOLUTIONS FOR A NEEDED AND NECESSARY ENERGY RESOURCE

PREPARED FOR:
Owner/Operator: Integrated Water Management
Robert L. Ballou
PO Box 816
Roosevelt, Utah 84066
435-722-3555

INTEGRATED WATER MANAGEMENT - BLEAZARD DISPOSAL PITS
GEO.015

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ABBREVIATIONS

ADJ	ADJUST
ADS	ADVANCE DRAINAGE SYSTEM
ARV	AIR RELEASE VALVE
BC	BAR AND CAP
BOW	BACK OF WALK
BVCE	BEGINNING VERTICAL CURVE ELEV.
BVCS	BEGINNING VERTICAL CURVE STATION
CB	CATCH BASIN
CBL	CABLE
CH	CHORD BEARING
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CONC	CONCRETE
COR.	SECTION CORNER
D	DELTA ANGLE
DET	DETAIL
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DWG	DRAWING
EG	EXISTING GRADE
ELEV	ELEVATION
EOC	EDGE OF CONCRETE
EP	EDGE OF PAVEMENT
EVCE	END VERTICAL CURVE ELEV.
EVCS	END VERTICAL CURVE STATION
EW	EACH WAY
EX	EXISTING
FFE	FINISHED FLOOR ELEVATION
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOW LINE
FO	FIBER OPTICS
FT	FOOT
GB	GRADE BREAK
HC	HANDICAP
HDPE	HIGH DENSITY POLY ETHYLENE
HP	HIGH POINT
INV.	INVERT
IRR	IRRIGATION
L.F.	LINEAR FEET
LIP	LIP OF CURB
LP	LOW POINT
LT.	LEFT
MAX.	MAXIMUM
MH	MANHOLE
MIN.	MINIMUM
MON	MONUMENT
NTS	NOT TO SCALE
OC	ON CENTER
OHP	OVER HEAD POWER
PC	POINT OF CURVE
PI	POINT OF INTERSECTION
PL	PROPERTY LINE
PP	POWER POLE
PRC	POINT OF REVERSE CURVE
PRV	PRESSURE REDUCING VALVE
PT	POINT OF TANGENCY
PUE	PUBLIC UTILITY EASEMENT
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS
ROW	RIGHT OF WAY
RT.	RIGHT
S	SEWER
SD	STORM DRAIN
SER	SOUTH END RADIUS
SSMH	SEWER MANHOLE
STA	STATION
STD	STANDARD
SW	SECONDARY WATER
TBC	TOP BACK OF CURB
TOA	TOP OF ASPHALT
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TOW	TOP OF WALL
TYP	TYPICAL
UG	UNDER GROUND POWER
VPC	VERTICAL POINT OF CURVE
VPI	VERTICAL POINT OF INTERSECTION
VPT	VERTICAL POINT OF TANGENCY
W	WATER
WM	WATER METER
WV	WATER VALVE

IDENTIFICATION SYSTEM

SEE DETAIL 5-C.1

TYPICAL DETAIL CALL OUT

DIRECTION OF VIEW — SECTION NUMBER — 1 / C.13 — *DRAWING SECTION IS REFERENCE TO

TYPICAL SECTION CUT

DESCRIPTION — DETAIL NUMBER — DETAIL — SCALE: N.T.S. — SCALE — 1 / C-1 — *DRAWING DETAIL IS REFERENCED TO

TYPICAL DETAIL IDENTIFICATION

DESCRIPTION — SECTION NUMBER — SECTION — SCALE: N.T.S. — SCALE — 1 / C-1 — *DRAWING WHICH SECTION IS TAKEN

TYPICAL SECTION IDENTIFICATION

*NOTE: IF DETAIL OR SECTION IS REFERENCED TO MULTIPLE SHEETS THE SHEET NUMBER WILL INDICATE 'VARIES'

LEGEND AND SYMBOLS

- SECTION CORNER & LINE (FOUND)
- BOUNDARY/PHASE LINE
- ADJACENT PL or LOT LINES
- RIGHT-OF-WAY LINE
- CENTERLINE of ROAD
- EASEMENT LINE
- CURB & GUTTER
- = EDGE OF ASPHALT
- FENCE
- DAYLIGHT- CUT
- DAYLIGHT- FILL
- PROPOSED INTERMEDIATE CONTOUR (4475)
- PROPOSED INDEX CONTOUR
- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- DRAINAGE / DITCH CENTERLINE
- SANITARY SEWER MANHOLE & PIPE
- STORM DRAIN CLEAN OUT & PIPE
- CATCH BASIN
- 4' COMBO BOX
- 4' INLET
- CULINARY WATER LINE & MANHOLE
- WATER VALVE
- = PROPOSED FIRE HYDRANT
- WATER METER
- SECONDARY WATER & STOP AND WASTE
- IRRIGATION BOX
- IRRIGATION VALVE
- POWER LINES & MANHOLE
- ELECTRIC METER
- UTIL-POLE
- ELECTRIC BOX
- POWERPOLE
- GUY WIRE
- TRAFFIC CONTROL BOX
- TRAFFIC SIGNAL
- GAS LINE & MANHOLE
- GAS-VALVE
- TELEPHONE LINE & MANHOLE
- TELEPHONE POLE
- TELEPHONE RISER
- TELEPHONE BOX
- CABLE BOX
- CABLE TELEVISION LINE & MANHOLE
- FIBER OPTIC LINE & MARKER
- STREET LIGHT
- STREET SIGN
- TEST PIT
- WELL
- MAIL BOX
- SEWER TAG
- SD-TAG
- SPOT ELEVATION (4400.00 TBC)
- = PROPOSED ASPHALT
- = PROPOSED CONCRETE
- EXISTING ELEVATION (4400)
- PROPOSED ELEVATION (4442)

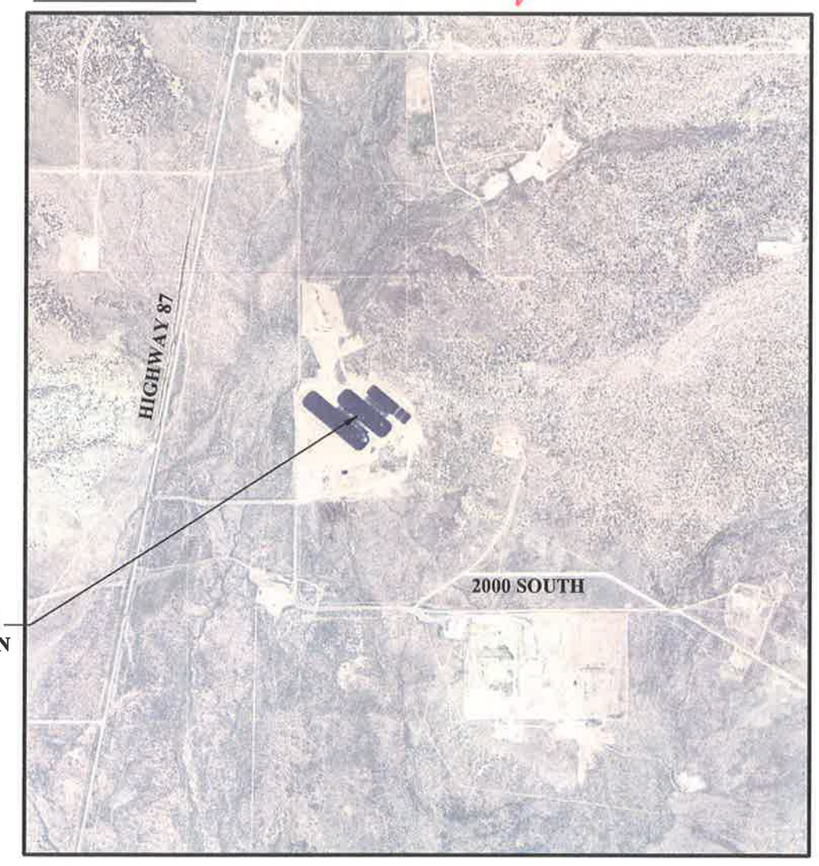
*NOTE: ALL EXISTING FEATURES WILL BE IN A SHADED LINE

SHEET INDEX

	COVER SHEET
G.101	INDEX AND LEGEND
G.102	GENERAL NOTES
C.101	OVERALL SITE PLAN
C.301	PLAN AND PROFILE A-A
C.302	PLAN AND PROFILE B-B
D.102	DETAILS
D.102	DETAILS

PROFESSIONAL ENGINEER
3/13/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

LOCATION MAP



PROJECT LOCATION

CONSULTING ENGINEERS AND SURVEYORS
GILSON
1465 SOUTH 400 EAST
OREM, UT 84058
PHONE: (801) 224-4044
FAX: (801) 224-4046
5440 SOUTH 1700 WEST
HURRICANE, UT 84737
PHONE: (435) 673-7191
FAX: (435) 673-8001
INTEGRATED
GeoStrata
Engineering & Geosciences

DATE	BY	DESCRIPTION

REVISIONS

1" SCALE MEASURES 1" ON FULL SIZE SHEETS
ADJUST ACCORDINGLY FOR HALF SIZE SHEETS

DATE: SEPT. 2013
DRAWING NAME: G 101
DESIGNED/DRAWN BY: AG
CHECKED
APPROVED

INDEX AND LEGEND

IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A
PROJ # GEO.015
G.101

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GENERAL NOTES

1. THIS DESIGN IS AN ORIGINAL UNPUBLISHED WORK AND MAY NOT BE DUPLICATED, PUBLISHED AND/OR USED WITHOUT THE WRITTEN CONSENT OF GILSON ENGINEERING, INC.

2. THESE SHEETS - LISTED BY DRAWING INDEX, ALL ACCOMPANYING SPECIFICATIONS FOR MATERIALS, WORKMANSHIP QUALITY, AND NOTES HAVE BEEN PREPARED SOLELY FOR THE CONSTRUCTION AND FINISH OF PROJECT IMPROVEMENTS, COMPLETE AND READY FOR USE.

3. ALL WORK IS TO BE PERFORMED IN ACCORDANCE WITH PERTINENT JURISDICTIONAL CODES, RESTRICTIONS, COVENANTS, AND/OR ORDINANCES. ANY CONFLICT BETWEEN DESIGN AND REQUIREMENT SHALL BE REPORTED TO GILSON ENGINEERING, INC. BEFORE PROCEEDING. FAILURE TO DO SO VOIDS THE DESIGN.

4. ANY AND ALL PROPOSED CHANGE, MODIFICATIONS AND/OR SUBSTITUTION SHALL BE REPORTED TO GILSON ENGINEERING, INC. BEFORE PROCEEDING. ANY DEVIATION FROM THE CONTRACT DOCUMENTS, WITHOUT THE EXPRESS WRITTEN AUTHORIZATION OF GILSON ENGINEERING, INC. VOIDS THE DESIGN.

5. IN THE EVENT OF CONFLICT BETWEEN THE DESIGN DOCUMENTS AND/OR JURISDICTIONAL REQUIREMENTS, THE MORE RESTRICTIVE FROM THE STANDPOINT OF SAFETY AND PHYSICAL SECURITY SHALL APPLY.

6. ANY INSTALLATION OR WORK NECESSARY TO THE FUNCTIONING, SAFETY AND/OR PHYSICAL SECURITY OF DESIGN THAT IS TO BE ENCAPSULATED OR OTHERWISE PERMANENTLY OBSCURED FROM INSPECTION SHALL BE REPORTED TO GILSON ENGINEERING, INC. A MINIMUM OF TWO (2) WORKING DAYS BEFORE ENCLOSURE.

7. ANY DAMAGE, DISRUPTION OR COMPROMISE OF AMBIENT RIGHTS-OF-WAY, UTILITIES, OR ENVIRONMENTAL QUALITY SHALL BE IMMEDIATELY RECTIFIED BY THE CONTRACTOR TO THE SATISFACTION OF GILSON ENGINEERING, INC. AT NO COST TO THE OWNER.

8. ALL WORK SHALL BE INSPECTED BY GOVERNING AGENCIES IN ACCORDANCE WITH THEIR REQUIREMENTS. JURISDICTIONAL APPROVAL SHALL BE SECURED BEFORE PROCEEDING WITH WORK

CONSTRUCTION NOTES

1. ALL WORK WITHIN THE SITE TO CONFORM TO THE CURRENT PERTINENT JURISDICTIONAL STANDARDS AND SPECIFICATIONS.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MEETING ALL OF THE REQUIREMENTS ESTABLISHED FOR SAFE TRENCHING. (SEE OSHA AND UOSHA REQUIREMENTS, LATEST EDITIONS).

3. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE EXCAVATING WITHIN 200 FEET OF SAID UTILITIES WHICH MAY BE EXPOSED, DAMAGED OR CROSSED AS SHOWN ON THE DRAWINGS OR AS "BLUE STAKED". THE CONTRACTOR WILL MAKE ARRANGEMENTS WITH THE UTILITY COMPANY TO MOVE THE UTILITY IF NECESSARY OR OBTAIN PERMISSION FROM THE PROJECT ENGINEER TO MODIFY GRADES OF PROJECT LINES IN ORDER TO GO AROUND EXISTING UTILITIES.

4. SEWER MAINS, WATER MAINS, GAS MAINS AND OTHER UTILITIES ARE SHOWN ON THE PLANS IN A GENERAL SCHEMATIC WAY ACCORDING TO INFORMATION RECEIVED FROM OTHERS AND SOMETIMES FROM FIELD MEASUREMENTS. THE ACCURACY OR COMPLETENESS OF THE LOCATIONS SHOWN IS APPROXIMATE ONLY. THE CONTRACTOR SHALL DETERMINE THE ACTUAL LOCATION OF EXISTING SERVICE CONNECTIONS AND UTILITIES, VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS AND TAKE THE NECESSARY STEPS TO AVOID THEM.

5. SPECIFIC INFORMATION PROVIDED IN THE CONTRACT DOCUMENTS SHALL SUPERSEDE ITEMS COVERED IN THESE DRAWINGS.

EROSION CONTROL NOTES

1. AT ALL TIMES DURING CONSTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREVENTING AND CONTROLLING EROSION DUE TO WIND AND RUNOFF. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR MAINTAINING THE EROSION CONTROL FACILITIES SHOWN ON THE PLAN.

2. CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING DRAINAGE AND EROSION CONTROL FACILITIES AS REQUIRED. STREETS SHALL BE KEPT CLEAN OF DEBRIS FROM TRAFFIC FROM THE SITE.

3. CONTRACTOR SHALL USE VEHICLE TRACKING CONTROL AT ALL LOCATIONS WHERE VEHICLES WILL ENTER OR EXIT THE SITE. CONTROL FACILITIES WILL BE MAINTAINED WHILE CONSTRUCTION IS IN PROGRESS, MOVED WHEN NECESSARY, AND REMOVED WHEN THE SITE IS PAVED.

4. FUGITIVE DUST AREAS SHALL BE CONTROLLED BY SPRAYING WATER ON THE DRY AREAS OF THE SITE.

5. NO RUBBISH, TRASH, GARBAGE OR OTHER SUCH MATERIALS SHALL BE DISCHARGED INTO DRAINAGE DITCHES OR WATERS OF THE STATE.

6. ALL MATERIALS SPILLED, DROPPED, WASHED OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.

7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING THE EROSION CONTROL MEASURES (SILT FENCES, STRAW BALES, ETC.) DUE TO GRADE CHANGES OR OTHER UNFORESEEN CONDITIONS DURING DEVELOPMENT OF THE PROJECT.

POND 3 LANDFILL STATISTICS

1. SURFACE AREA = 194,761.97 CUBIC YARDS

2. BOTTOM LINER ELEVATION = 6,122

3. FINAL GRADE ELEVATION = 6,158

4. DEPTH: TOP OF FINAL GRADE TO BOTTOM LINER = 36-FT

5. LANDFILL VOLUME (EXCLUDING BASE AND CAP MATERIAL) = 152,606.30 CUBIC YARDS

6. VOLUME OF 1/2" GRAVEL BASE = 9,863.64 CUBIC YARDS

7. VOLUME OF 24" TOP SOIL CAP = 16,323.14 CUBIC YARDS

8. VOLUME OF 24" CLAY CAP = 15,968.89 CUBIC YARDS

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IT'S FREE &
IT'S THE LAW.
(TOLL-FREE)
1-800-662-4111
208-2100
(SALT LAKE METRO)
205 WEST 700 SOUTH, SUITE 101
SALT LAKE CITY, UTAH 84101

CAUTION NOTICE TO CONTRACTOR

THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.

THE CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY: THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO THE NORMAL WORKING HOURS; AND THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

CONSULTING ENGINEERS AND SURVEYORS
GILSON ENGINEERING INC.
1247 SOUTH 450 EAST
SHARON, UT 84333
PHONE: (435) 571-8444
FAX: (435) 571-8446
946 SOUTH 1700 WEST
SALT LAKE CITY, UT 84104
PHONE: (801)973-7481
FAX: (801)973-8068
INTEGRATED
GeoStrata Engineering & Consultants

REV DATE	BY	COMMENTS

REVISIONS

1" SCALE MEASURES 1" ON FULL SIZE SHEETS
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DATE: SEPT. 2013
DRAWING NAME: G.102
DESIGNED/DRAWN BY: AG
CHECKED | APPROVED

GENERAL NOTES
IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A
PROJ. # GEO.015
G.102

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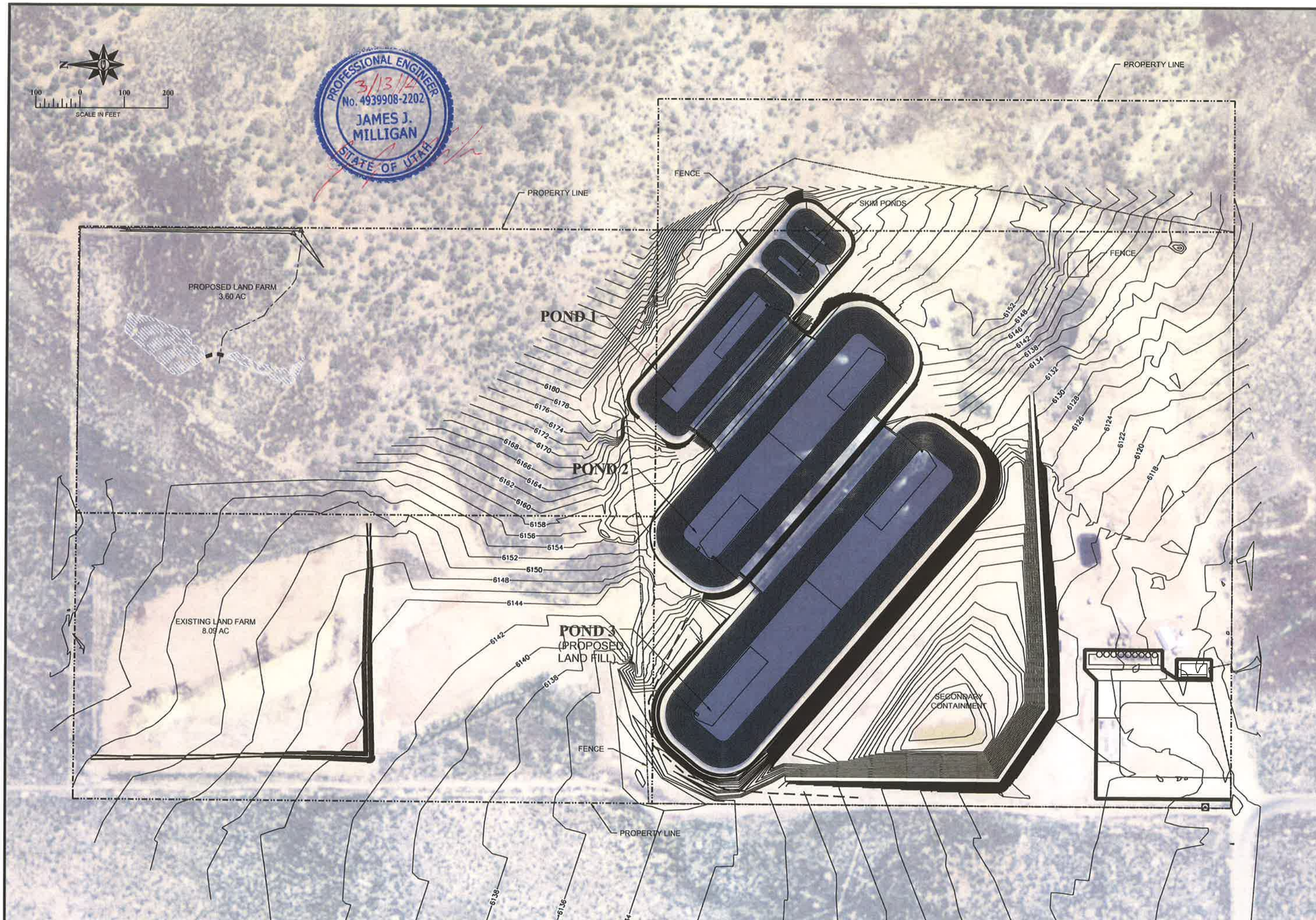

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DATE: SEPT. 2013
DRAWING NAME: C.101 (TEMPLATE)
DESIGNED/DRAWN BY: AG
CHECKED
APPROVED

OVERALL SITE PLAN

IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A

PROJ. # GEO.015

C.101

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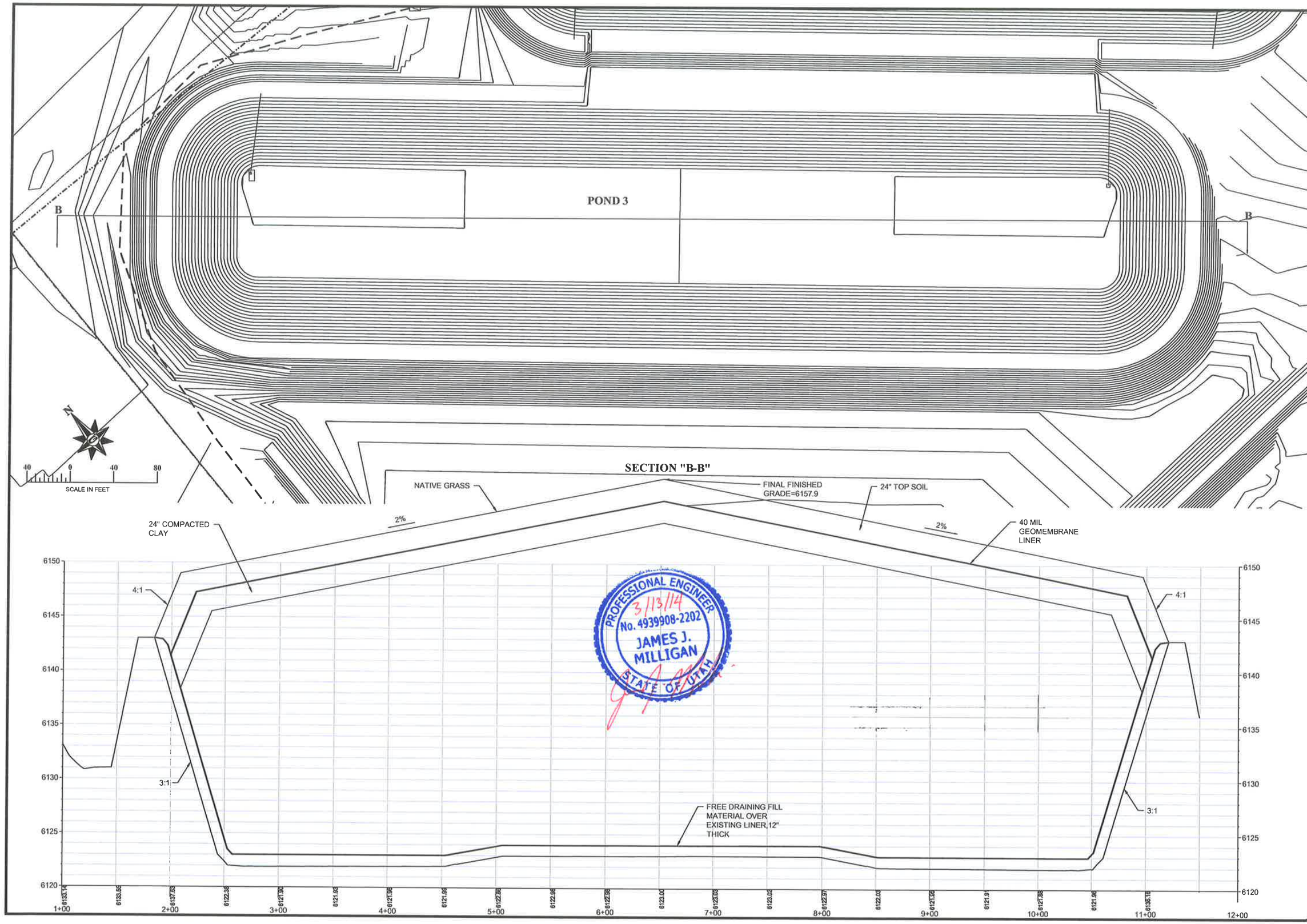

CONSULTING ENGINEERS AND SURVEYORS:

GILSON ENGINEERING INC.

12401 SOUTH 450 EAST
SUITE C-100
DRAPER, UT 84020
PHONE: (801) 571-1777
FAX: (801) 571-0444

5440 SOUTH 1700 WEST
HURRICANE, UT 84737
PHONE: (435) 879-1154
FAX: (801) 571-0444

INTEGRATED WASTE MANAGEMENT

GeoStrata
Engineering & Geosciences

REVISIONS

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1" SCALE MEASURES 1" ON FULL SIZE SHEETS
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DATE: SEPT. 2013
DRAWING NAME: C.301
DESIGNED: AG
DRAWN BY:
CHECKED:
APPROVED:

PLAN AND PROFILE

IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A

PROJ. # GEO.015

C.301

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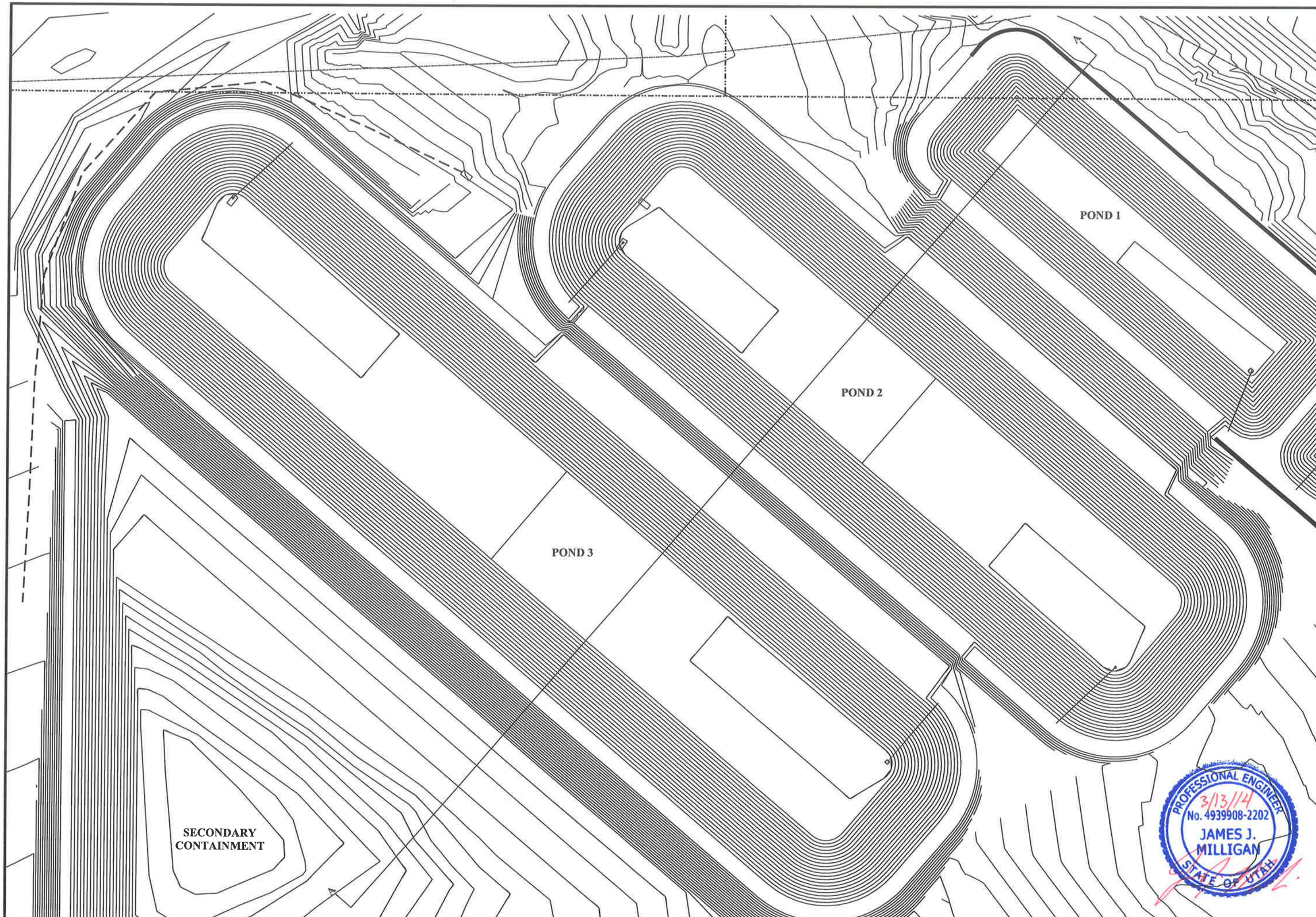

CONSULTING ENGINEERS AND SURVEYORS

GILSON ENGINEERING, INC.

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SPANISH FORK, UT 84660
PHONE: (801) 798-0555
FAX: (801) 798-0555

340 SOUTH 1700 WEST
SPANISH FORK, UT 84660
PHONE: (801) 798-1191
FAX: (801) 798-0555

INTEGRATED WASTE MANAGEMENT SOLUTIONS

GeoStrata
Engineering & Geosciences
1426 S. Lynn Parkway
Spanish Fork, UT 84660
801-491-0400
www.geostrata.com

REV	DATE	BY	COMMENTS

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DATE: SEPT. 2013
DRAWING NAME: C.302
FILE: C.302.DWG
DRAWN BY: AG
CHECKED
APPROVED

PLAN AND PROFILE

IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A

PROJ. # GEO.015

C.302

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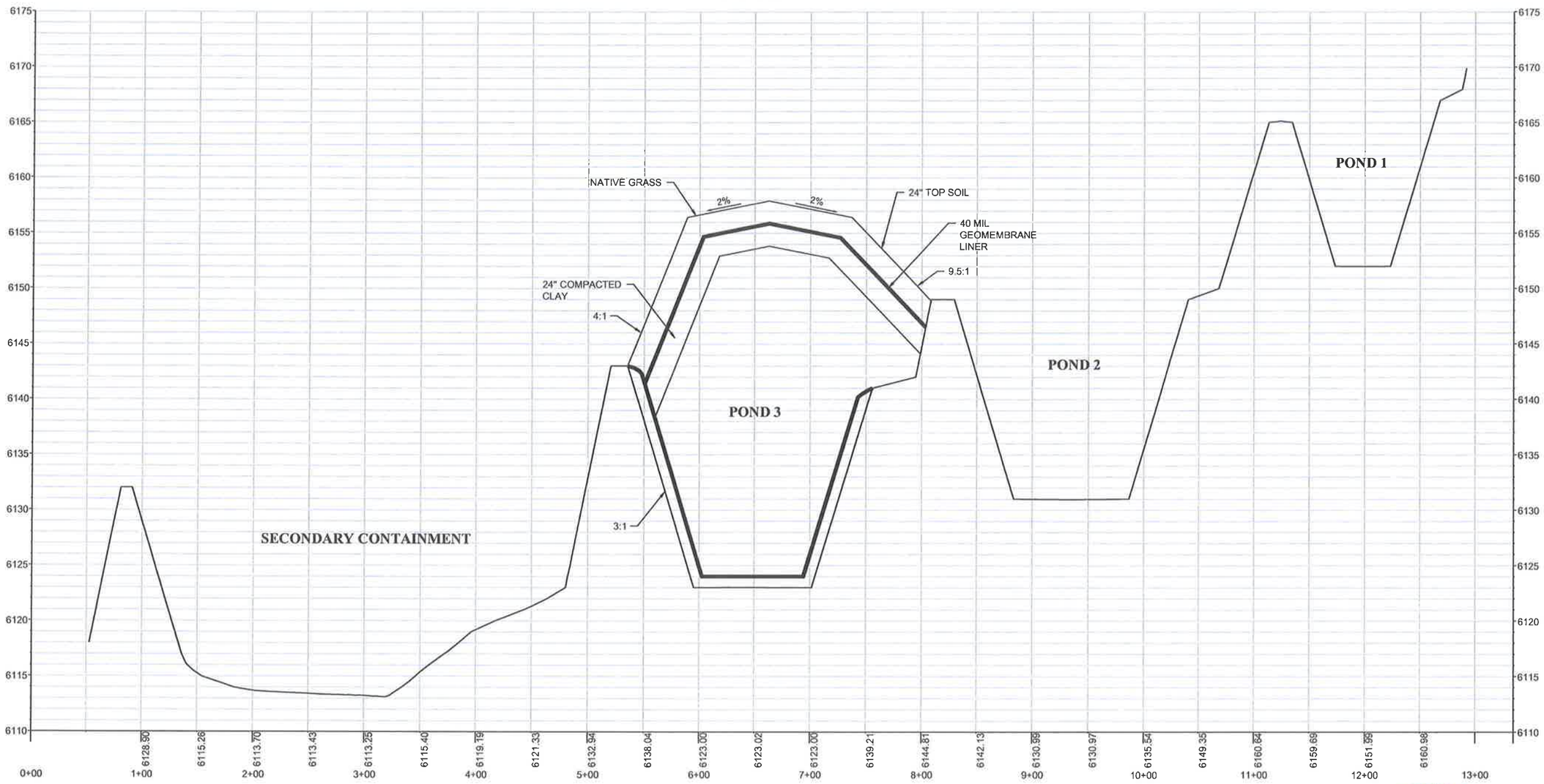
SECTION "A-A"



PROFESSIONAL ENGINEER
3/13/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

CONSULTING ENGINEERS AND SURVEYORS
GILSON ENGINEERING INC.
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DRAPER, UT 84020
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FAX: (801) 571-5418
5466 SOUTH 1700 WEST
TAYLORSVILLE, UT 84129
PHONE: (801)972-6159
FAX: (801)972-6689

INTEGRATED WASTE MANAGEMENT CONSULTANTS, INC.
INTEGRATED WASTE MANAGEMENT CONSULTANTS, INC. SALT LAKE CITY, UTAH
WORLD WIDE WEB ADDRESS: WWW.IWMC.COM

GeoStrata
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1765 S. Lumar Court Way
Salt Lake City, Utah 84108
801-487-0651
www.geostrata.com

REVISIONS

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1" SCALE MEASURES 1" ON FULL SIZE SHEETS
ADJUST ACCORDINGLY FOR HALF SIZE SHEETS

DATE: SEPT. 2013
DRAWING NAME: C.303
DWG: C.303
DESIGNED/DRAWN BY: AG
CHECKED
APPROVED

PLAN AND PROFILE
IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A
PROJ # GEO.015
C.303

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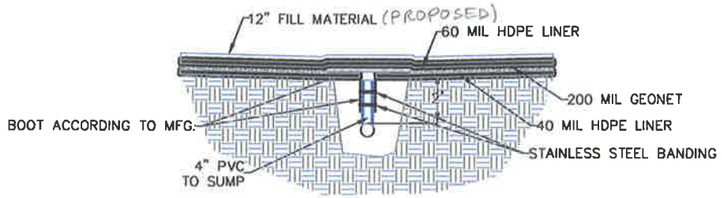

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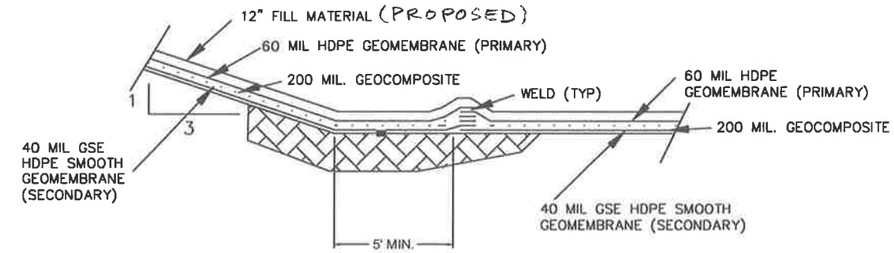
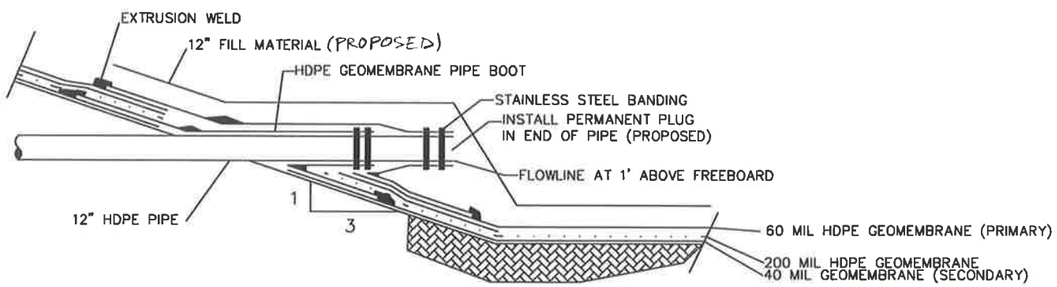
SCALE: N.T.S.
(VERTICAL OR HORIZONTAL)



EXISTING TOE OF SLOPE TRANSITION (3:1 SLOPE) (2 / -)
SCALE: N.T.S.
(DOUBLE LINER W/ DRAINAGE LAYER & CUSHION GEOTEXTILE)



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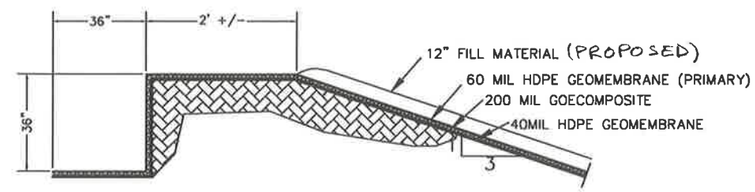
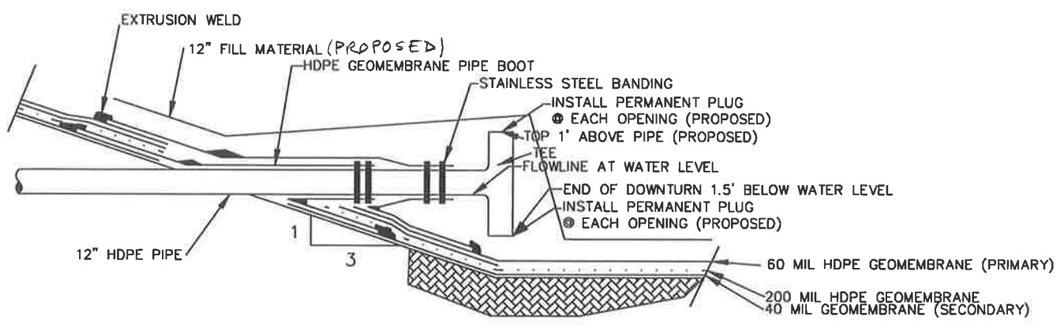
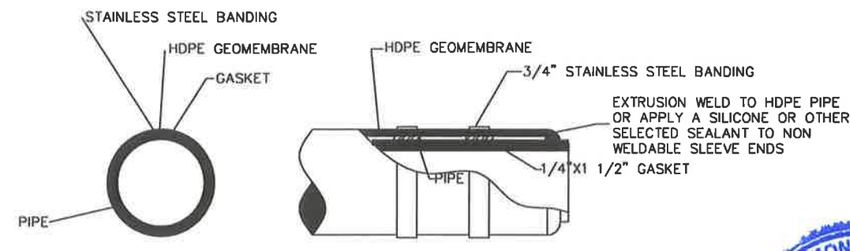
SCALE: N.T.S.



EXISTING TYPICAL ANCHOR TRENCH (3:1 SLOPE) (4 / -)
SCALE: N.T.S.
(DOUBLE LINER W/ DRAINAGE LAYER & CUSHION GEOTEXTILE)



EXISTING OUTLET PIPE PENETRATION (5 / -)
SCALE: N.T.S.



EXISTING PIPE PENETRATION SEAL (6 / -)
SCALE: N.T.S.
(VERTICAL OR HORIZONTAL)

NOTE:
ALL FEATURES SHOWN ON DETAILS ARE EXISTING UNLESS FOLLOWED BY "(PROPOSED)".

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DETAILS
IWM - BLEAZARD DISPOSAL PITS - LANDFILL
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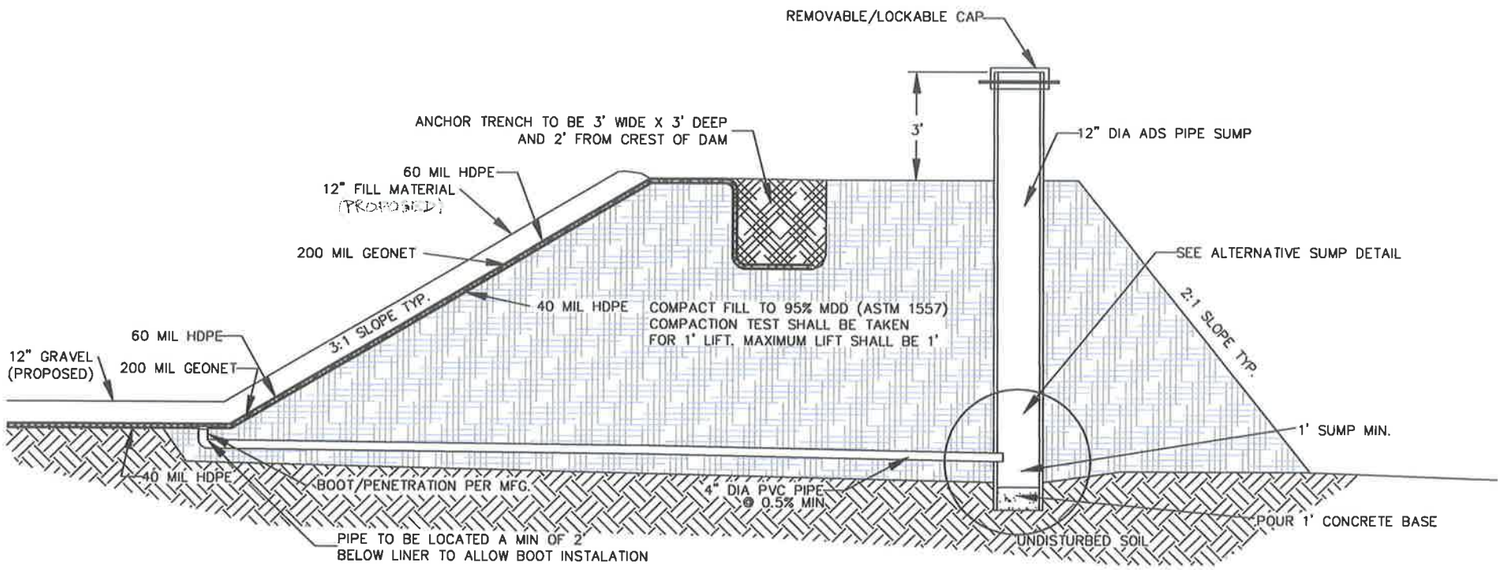

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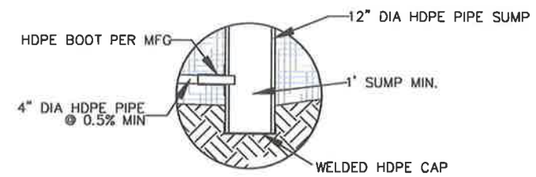
SCALE: N.T.S.
(VERTICAL OR HORIZONTAL)



EXISTING ALTERNATIVE SUMP DETAIL (2 / -)
SCALE: N.T.S.
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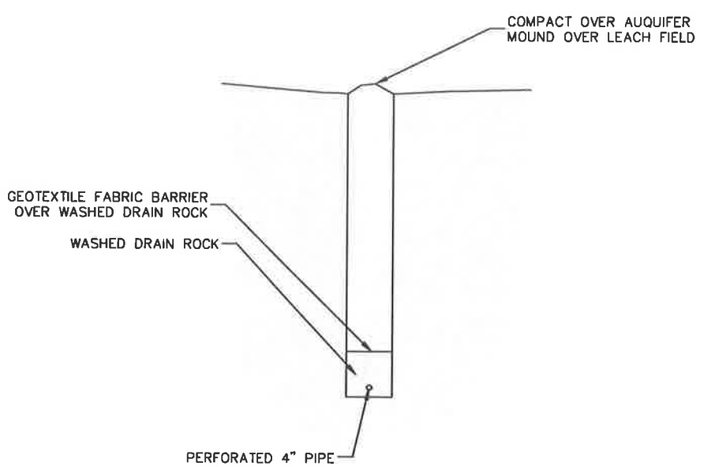

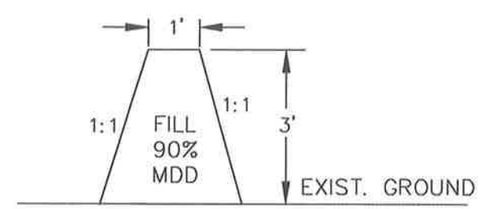

EXISTING BERM DETAIL (3 / -)
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DESIGNED/DRAWN BY: AG
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DETAILS
IWM - BLEAZARD DISPOSAL PITS - LANDFILL
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D.102

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EAST LANDFARM
POND 3 -LANDFILL
@ Integrated Water Management
Bleazard Disposal Pits

Drainage Study

PROFESSIONAL ENGINEER
10/4/13
No. 4939908-2202
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October 4, 2013
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Section - 1 Preface

1.1 Purpose of this Study

This drainage study was prepared to define drainage characteristics and calculate storm water run-on and run-off for the proposed East Land Farm – Pond 3 Landfill.

1.2 Information Included With This Study

This narrative communicates the following information:

1. General Location and Description
2. Drainage Basins and Sub Basins
3. Hydrology Run-on and Run-off Calculations

Section - 2 Project Location and Description

2.1 Site Location

The Pond 3 Landfill is located in Section 30, Township 2 South, Range 4 West, Uintah Special Base and Meridian in Duchesne County, Utah.

2.2 Site Description

2.2.1 Site Features

The Bleazard disposal pit site includes three large disposal pits (ponds) and two smaller skim ponds. Each pond is constructed with an earth embankment and includes an HDPE liner. A ridge to the East defines the drainage boundary. A storm water cut off channel has been constructed to intercept excess stormwater runoff from the area upstream of the ponds.

2.2.2 Existing Ground Cover

The existing ground cover of the Bleazard disposal pit site includes sparse vegetation and poor hydrologic soil conditions. Hydrologic soil condition data was not available for this location. A Type D soil was assumed. The surface of each pond with an HDPE liner is considered impervious.

2.2.3 Proposed Ground Cover

The landfill soil cap will consist of a 24-inch clay layer with an additional 24-inches of native topsoil.

Section - 3 Drainage Basins and Sub-Basins

3.1 Drainage Basin Hydrology Study

3.1.1 Storm Event Estimated Flow

A summary of estimated flows for the 10-year and 100-year or 10% and 1% chance storm events respectively are shown in Figure 2. Peak flows generated across the drainage basins were used to determine using the Rational Method.

3.2 Sub Basin Description

The Bleazard Disposal Pits Site consists of a single drainage basin that is bordered to the east by an existing ridge. This drainage basin is divided into sub-basins including one sub-basin for each pond, area around the ponds, and an

offsite area upstream from the ponds. The Pond 1 sub-basin includes the two smaller skim ponds. Pond 3 represents the proposed landfill. Drainage sub-basins are shown on Figure 1 characteristics or shown in Figure 2.

3.2.1 Historic Drainage Patterns

Historic drainage patterns within the drainage basin are controlled by the existing topography including a ridge to the East. The constructed ponds also define drainage patterns. Stormwater is contained within each pond. No runoff is expected from the ponds in typical storm events. When the Pond 3 landfill is capped there will be storm water runoff from the capped landfill. Due to these definite characteristics of the sub basin, historic drainage patterns within the drainage basin are confined to a predominantly northeast to southwest flow with.

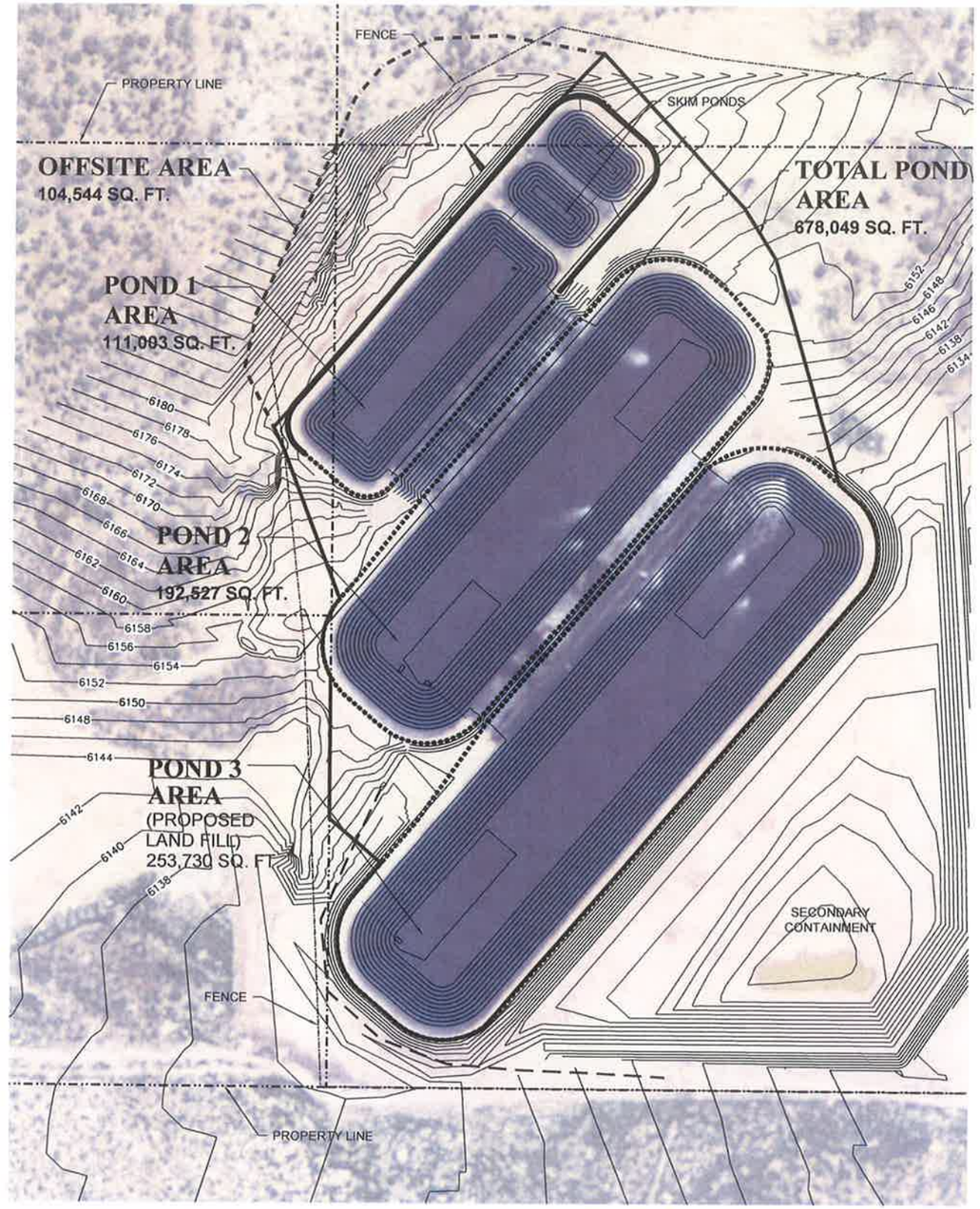
3.2.2 Hydrology Calculations

Hydrology calculations were calculated using the rational method. The rational method was used due to the minimal infrastructure incorporated in the proposed landfill design. Calculations were performed for the10-year and 100-year storm events. Results are shown on Figure 2.

3.2.3 Stormwater Quantity and Quality Management

Erosion control is most critical during and immediately after the construction process. Erosion should be controlled at its source to achieve greater levels of success. During construction erosion will be controlled utilizing silt barriers around any exposed earth. Revegetation will occur concurrent with the completion of the landfill cap.

Existing conveyance facilities such as drainage ditches, culverts and natural channels should accommodate the 10-year flood event without flooding or erosion. The conveyance facilities should also accommodate the 100-year event without flooding buildings.



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100 0 100 200

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DRAWING NAME: FIG. 1 SUB-BASINS
DESIGNED/DRAWN BY: AG
CHECKED
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DRAINAGE SUB-BASINS

IWM - BLEAZARD DISPOSAL PITS - LANDFILL
DUCHESNE, UTAH

REVISION: A

PROJ. # GEO.015

FIG.1

Z:\PROJECTS (misc.)\GEO 015 Landfill with GeoStrata\CADD\PLAN SET\EX-FIG1.dwg, 10/4/2013 12:02:20 PM, Aimie

Hydrology Calculations

Proj:	GEO.015
Prepared for:	IWM Landfill
Description:	Drainage Basin Calculation
Date:	10/24/2013
By:	JJM

Design Storm

10-yr 10-min Storm Intensity "i":	2.250	in/hr
100-yr 10-min Storm Intensity "i":	3.490	in/hr

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Runoff Coefficients "C"	Recurrence Interval		
Land Use	Less than 25	25 and greater	
Pasture, Soil Group D, 2-6%	0.40	*0.50*	
Pasture, Soil Group D, 6%	0.50	*0.62*	
Mountain Terrain, 10%	0.70	*0.70*	
Impervious	0.90	*0.90*	(pond with liner and road)
TOTAL			

OFFSITE DRAINAGE - Intercepted by Cutoff Channel

Basin	Pasture 2-6%	Pasture 6%	Mountain Terrain	Total Area		[1]Weighted "C"		"Q_{10}" = CiA	"Q_{100}" = CiA
	(sf)	(sf)	(sf)	(sf)	(acres)	10-year	100-year	(cfs)	(cfs)
Offsite	0	0	104,544	104,544	2.40	0.700	0.700	3.78	5.86

POND AREA DRAINAGE

Basin	Pasture 2-6%	Pasture 6%	Mountain Terrain	Total Area		[1]Weighted "C"		"Q_{10}" = CiA	"Q_{100}" = CiA
	(sf)	(sf)	(sf)	(sf)	(acres)	10-year	100-year	(cfs)	(cfs)
[2]Pond 1	0	0	0	111,003	2.55	0.900	0.900	5.16	8.00
[2]Pond 2	0	0	0	192,527	4.42	0.900	0.900	8.95	13.88
[2,3]Pond 3 (open)	0	0	0	253,730	5.82	0.900	0.900	11.80	18.30
[2,3]Pond 3 (capped)	0	0	253,730	253,730	5.82	0.700	0.700	9.17	14.23
Pond Area	109,280	0	1	109,281	2.51	0.400	0.500	2.26	4.38

1. Weighted "C" = S(CxAx)/Atotal

2. Stormwater is contained within each pond. No runoff is expected in typical storm events.

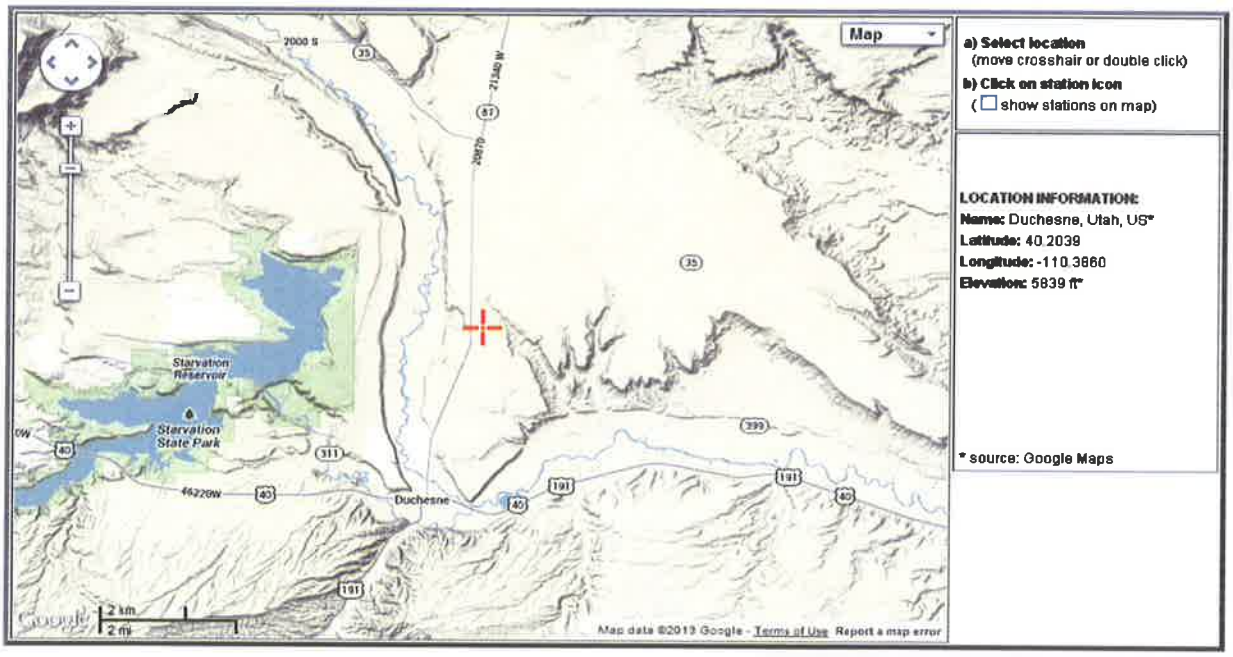
3. Pond 3 (open) represents conditions until pond is (capped). Capped flow represents runoff conditions.

Hydrology Calculations

Proj: GEO.015
Prepared for: IWM Landfill
Description: Rainfall Data
Date: 4/22/2014
By: JJM

Recurrance Interval	10-Yr Storm		25-Yr Storm		100-Yr Storm	
Time for storm event	Rainfall Accumulation	Rainfall Intensity	Rainfall Accumulation	Rainfall Intensity	Rainfall Accumulation	Rainfall Intensity
(min)	(in)	(in/hr)	(in)	(in/hr)	(in)	(in/hr)
0	0.00	0.00	0.00	0	0.00	0
5	0.23	2.76	0.31	3.67	0.46	5.48
10	0.35	2.10	0.47	2.79	0.70	4.17
15	0.43	1.74	0.58	2.30	0.86	3.45
30	0.58	1.17	0.78	1.55	1.16	2.32
60	0.72	0.72	0.96	0.96	1.44	1.44
120	0.82	0.41	1.08	0.54	1.60	0.80
180	0.89	0.30	1.14	0.38	1.62	0.54
360	1.07	0.18	1.30	0.22	1.75	0.29
720	1.25	0.10	1.49	0.12	1.91	0.16
1440	1.44	0.06	1.73	0.07	2.22	0.09

Location Map & Data Source - NTS



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION

NOAA Atlas 14, Volume 1, Version 5

PROFESSIONAL ENGINEER
4/22/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.103 (0.087-0.125)	0.132 (0.112-0.161)	0.183 (0.154-0.223)	0.23 (0.193-0.278)	0.306 (0.249-0.370)	0.376 (0.299-0.456)	0.457 (0.354-0.555)	0.551 (0.413-0.676)	0.701 (0.501-0.869)	0.833 (0.575-1.05)
10-min	0.157 (0.133-0.190)	0.201 (0.170-0.245)	0.278 (0.235-0.339)	0.35 (0.293-0.423)	0.465 (0.379-0.563)	0.572 (0.454-0.693)	0.695 (0.539-0.845)	0.839 (0.629-1.03)	1.07 (0.762-1.32)	1.27 (0.875-1.59)
15-min	0.194 (0.164-0.235)	0.25 (0.211-0.304)	0.345 (0.291-0.420)	0.434 (0.364-0.524)	0.576 (0.470-0.698)	0.708 (0.563-0.859)	0.862 (0.668-1.05)	1.04 (0.779-1.27)	1.32 (0.944-1.64)	1.57 (1.08-1.98)
30-min	0.262 (0.221-0.317)	0.336 (0.284-0.409)	0.465 (0.392-0.565)	0.584 (0.490-0.706)	0.776 (0.633-0.940)	0.954 (0.758-1.16)	1.16 (0.899-1.41)	1.4 (1.05-1.72)	1.78 (1.27-2.21)	2.12 (1.46-2.66)
60-min	0.324 (0.274-0.392)	0.416 (0.352-0.506)	0.575 (0.485-0.699)	0.722 (0.606-0.874)	0.96 (0.784-1.16)	1.18 (0.938-1.43)	1.44 (1.11-1.75)	1.73 (1.30-2.13)	2.2 (1.57-2.73)	2.62 (1.81-3.30)
2-hr	0.394 (0.340-0.468)	0.497 (0.429-0.592)	0.667 (0.573-0.794)	0.823 (0.699-0.977)	1.08 (0.897-1.28)	1.32 (1.06-1.57)	1.6 (1.25-1.92)	1.93 (1.46-2.34)	2.46 (1.77-3.05)	2.95 (2.04-3.71)
3-hr	0.442 (0.386-0.521)	0.555 (0.484-0.655)	0.727 (0.630-0.857)	0.886 (0.762-1.04)	1.14 (0.958-1.33)	1.36 (1.12-1.60)	1.62 (1.30-1.93)	1.94 (1.51-2.36)	2.47 (1.84-3.08)	2.98 (2.11-3.75)
6-hr	0.572 (0.505-0.662)	0.713 (0.630-0.827)	0.903 (0.795-1.04)	1.07 (0.933-1.23)	1.3 (1.12-1.51)	1.51 (1.28-1.75)	1.75 (1.46-2.05)	2.03 (1.65-2.40)	2.54 (2.00-3.11)	3.01 (2.31-3.78)
12-hr	0.702 (0.633-0.793)	0.87 (0.785-0.982)	1.07 (0.962-1.21)	1.25 (1.11-1.40)	1.49 (1.31-1.69)	1.7 (1.47-1.92)	1.91 (1.64-2.19)	2.16 (1.81-2.50)	2.58 (2.10-3.14)	3.04 (2.38-3.82)
24-hr	0.799 (0.739-0.868)	0.991 (0.917-1.08)	1.24 (1.14-1.34)	1.44 (1.33-1.56)	1.73 (1.58-1.87)	1.97 (1.79-2.13)	2.22 (2.01-2.40)	2.49 (2.23-2.69)	2.86 (2.54-3.17)	3.17 (2.77-3.86)
2-day	0.971 (0.901-1.05)	1.21 (1.13-1.31)	1.5 (1.39-1.62)	1.74 (1.61-1.88)	2.08 (1.91-2.24)	2.34 (2.15-2.52)	2.63 (2.40-2.83)	2.92 (2.64-3.15)	3.33 (2.98-3.60)	3.65 (3.24-3.97)
3-day	1.04 (0.966-1.13)	1.3 (1.20-1.40)	1.6 (1.49-1.73)	1.85 (1.72-2.00)	2.2 (2.03-2.37)	2.48 (2.27-2.67)	2.77 (2.52-2.98)	3.06 (2.77-3.30)	3.47 (3.11-3.75)	3.79 (3.37-4.11)
4-day	1.11 (1.03-1.21)	1.38 (1.28-1.49)	1.71 (1.58-1.84)	1.97 (1.82-2.12)	2.33 (2.14-2.50)	2.61 (2.39-2.81)	2.91 (2.65-3.12)	3.21 (2.90-3.45)	3.62 (3.24-3.90)	3.94 (3.50-4.25)
7-day	1.28 (1.19-1.39)	1.59 (1.47-1.72)	1.96 (1.81-2.12)	2.25 (2.08-2.43)	2.66 (2.45-2.87)	2.98 (2.73-3.21)	3.32 (3.03-3.58)	3.66 (3.32-3.95)	4.12 (3.71-4.46)	4.48 (3.99-4.87)
10-day	1.43 (1.32-1.55)	1.77 (1.65-1.92)	2.17 (2.02-2.36)	2.49 (2.31-2.70)	2.93 (2.71-3.16)	3.25 (3.00-3.51)	3.59 (3.29-3.87)	3.92 (3.58-4.25)	4.37 (3.96-4.73)	4.71 (4.24-5.12)
20-day	1.83 (1.70-1.97)	2.26 (2.10-2.45)	2.76 (2.56-2.99)	3.15 (2.92-3.41)	3.66 (3.38-3.95)	4.04 (3.72-4.37)	4.41 (4.05-4.77)	4.78 (4.37-5.18)	5.26 (4.78-5.71)	5.61 (5.07-6.12)
30-day	2.17 (2.02-2.33)	2.68 (2.49-2.89)	3.23 (3.01-3.48)	3.65 (3.40-3.93)	4.19 (3.89-4.50)	4.59 (4.25-4.94)	4.97 (4.59-5.35)	5.34 (4.92-5.75)	5.81 (5.31-6.25)	6.14 (5.60-6.63)
45-day	2.66 (2.47-2.85)	3.29 (3.06-3.53)	3.95 (3.68-4.23)	4.46 (4.14-4.76)	5.08 (4.73-5.43)	5.54 (5.14-5.91)	5.96 (5.53-6.37)	6.36 (5.88-6.80)	6.85 (6.32-7.33)	7.19 (6.63-7.71)
60-day	3.06 (2.85-3.28)	3.78 (3.52-4.05)	4.51 (4.20-4.83)	5.04 (4.69-5.38)	5.69 (5.29-6.08)	6.14 (5.70-6.56)	6.56 (6.08-7.02)	6.95 (6.43-7.43)	7.39 (6.83-7.91)	7.69 (7.10-8.25)

1 Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

Hydrology Calculations

Proj: GEO.015
Prepared for: IWM Landfill
Description: Drainage Basin Calculation
Date: 4/22/2014
By: JJM

Design Storm

10-yr 10-min Storm Intensity "i":	2.100	in/hr
25-yr 10-min Storm Intensity "i":	2.790	in/hr
100-yr 10-min Storm Intensity "i":	4.170	in/hr

Runoff Coefficients "C"	Recurrence Interval		
Land Use	Less than 25	25 and greater	
Pasture, Soil Group D, 2-6%	0.40	*0.50*	
Pasture, Soil Group D, 6%	0.50	*0.62*	
Mountain Terrain, 10%	0.70	*0.70*	
Impervious	0.90	*0.90*	(pond with liner and road)
TOTAL			

OFFSITE DRAINAGE - Intercepted by Cutoff Channel

Basin	Pasture 2-6%	Pasture 6%	Mountain Terrain	Total Area		[1]Weighted "C"		"Q_{10}" = CiA	"Q_{25}" = CiA	"Q_{100}" = CiA
	(sf)	(sf)	(sf)	(sf)	(acres)	10-year	25-year +	(cfs)	(cfs)	(cfs)
Offsite	0	0	104,544	104,544	2.40	0.700	0.700	3.53	4.69	7.01

POND AREA DRAINAGE

Basin	Pasture 2-6%	Pasture 6%	Mountain Terrain	Total Area		[1]Weighted "C"		"Q_{10}" = CiA	"Q_{25}" = CiA	"Q_{100}" = CiA
	(sf)	(sf)	(sf)	(sf)	(acres)	10-year	25-year +	(cfs)	(cfs)	(cfs)
[2]Pond 1	0	0	0	111,003	2.55	0.900	0.900	4.82	4.82	9.56
[2]Pond 2	0	0	0	192,527	4.42	0.900	0.900	8.35	8.35	16.59
[2,3]Pond 3 (open)	0	0	0	253,730	5.82	0.900	0.900	11.01	11.01	21.86
[2,3]Pond 3 (capped)	0	0	253,730	253,730	5.82	0.700	0.700	8.56	8.56	17.00
Pond Area	109,280	0	1	109,281	2.51	0.400	0.500	2.11	2.63	5.23

1. Weighted "C" = S(CxAx)/Atotal
2. Stormwater is contained within each pond. No runoff is expected in typical storm events.
3. Pond 3 (open) represents conditions until pond is (capped). Capped flow represents runoff conditions.

PROFESSIONAL ENGINEER
4/22/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

Hydrology Calculations

Proj: GEO.015
Prepared for: IWM Landfill
Description: Landfill Runoff Retention Calculation
Date: 4/22/2014
By: JJM

	"C" *		Area	
Basin	Pre-Project	Post Project	(sf)	(acres)
Pond 3 (capped)	0.90	0.70	253,730.00	1.15
Total	0.90	0.70 **	253,730	1.15

* Runoff Coefficient "C" *(See Sub-Basin Runoff Spreadsheet)*

** Weighted "C" = $\Sigma(C_xA_x)/A_{total}$

Note: See Sub Basin Delineation

	Total Area (acres)	Allowable Runoff (cfs/acre)	Allowable Runoff (cfs)
Total	1.15	0.00	0.00

Time for 25-year storm event (min)	Rainfall Accumulation (in)	Rainfall Intensity (in/hr)	Inflow Volume (cf)	Site Discharge (cf)	Req Storage (cf)	Req Storage (ac-ft)
0						
15	0.58	2.30	1,672	0	1,672	0.04
30	0.78	1.55	2,252	0	2,252	0.05
60	0.96	0.96	2,786	0	2,786	0.06
120	1.08	0.54	3,134	0	3,134	0.07
180	1.14	0.38	3,308	0	3,308	0.08
360	1.30	0.22	3,773	0	3,773	0.09
720	1.49	0.12	4,324	0	4,324	0.10
1440	1.73	0.07	5,021	0	5,021	0.12
				Required Storage:	5,021 cf	.12 ac-ft

PROFESSIONAL ENGINEER
4/22/14
No. 4939908-2202
JAMES J. MILLIGAN
STATE OF UTAH

MAIL TAX NOTICE TO GRANTEE AT:
90 South 400 West, Suite 360
Salt Lake City, Utah 84101

Ent [illegible]
Date: 13-SEP-2010 [illegible]
Fee: $11.00 Check
Filed By: CPM
CORLYNE HADSEN, Recorder
DUCHESNE COUNTY CORPORATION
For: CITY DEVELOPMENT

WARRANTY DEED

City Development, Inc., ("Grantor"), of Salt Lake City, State of Utah, hereby CONVEYS and WARRANTS to **Integrated Water Management, LLC, a Utah Limited Liability Company**, of Salt Lake City, Utah 84101, ("Grantee") For the sum of ---TEN and other good and valuable consideration--- DOLLARS, the following described tract of land in Duchesne county, State of Utah:

Parcel 1
SECTION 30, TOWNSHIP 2 SOUTH, RANGE 4 WEST, UINTAH SPECIAL BASE AND MERIDIAN: THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER.

PARCEL 2
SECTION 30, TOWNSHIP 2 SOUTH, RANGE 4 WEST, UINTAH SPECIAL BASE AND MERIDIAN: THE WEST HALF OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER.

The following pertains to both parcels no. 1 and no. 2:

TOGETHER WITH ALL IMPROVEMENTS AND APPURTENANCES THERETO BELONGING, INCLUDING BUT NOT LIMITED A WATER WELL LOCATED ON SUBJECT PROPERTY, WATER RIGHT NO.: 43-2422. EXCEPTING THEREFROM ALL OIL, GAS, AND MINERAL RIGHTS. SUBJECT TO ALL EXISTING EASEMENTS AND RIGHTS-OF-WAY.

WITNESS, the hand of said grantor, this 9 day of Septeb, 2010.

GRANTOR:

Walter J. Plumb, III, City Development, Inc.
Its: President

STATE OF UTAH)
:ss.
COUNTY OF SALT LAKE)

On this 9 day of September, 2010, personally appeared before me Walter J. PLUMB III, whose identity is personally known to me (or proven on the basis of satisfactory evidence) and who by me duly sworn/affirmed, did say that he/she is the PRESIDENT of City Development and that said document was signed by him/her in behalf of said *Corporation by Authority of its Bylaws, or (Resolution of its Board of Directors), and said Walter J. PLUMB III acknowledged to me that said *Corporation executed the same.

CONSTANCE MILLER
NOTARY PUBLIC - STATE OF UTAH
90 SOUTH 400 WEST, SUITE 330
SALT LAKE CITY, UT 84101
My Comm. Exp. 11/21/2011

NOTARY PUBLIC

SECTION 30 T2S R4W USM

36	31	32	33	34	35	36	31
1	6	5	4	3	2	1	6
12	7	8	9	10	11	12	7
13	18	17	16	15	14	13	18
24	19	20	21	22	23	24	19
25	30	29	28	27	26	25	30
36	31	32	33	34	35	36	31
1	6	5	4	3	2	1	6

NOTE THIS PLAT IS NOT A LEGAL DIVISION OF LAND. PLAT ACCURACY IS BASED ON THE ORIGINAL DOCUMENTS ON FILE IN THE EL PASO COUNTY RECORDER'S OFFICE. ALL OWNERSHIP, EASEMENT, OWNERSHIP, AND OTHER INFORMATION WHICH MAY AFFECT THE LEGAL STATUS OF THE PROPERTY MUST BE VERIFIED BY A QUALIFIED TITLE COMPANY.

NOT ALL THE ROADS SHOWN ON THIS PLAT ARE COUNTY ROADS

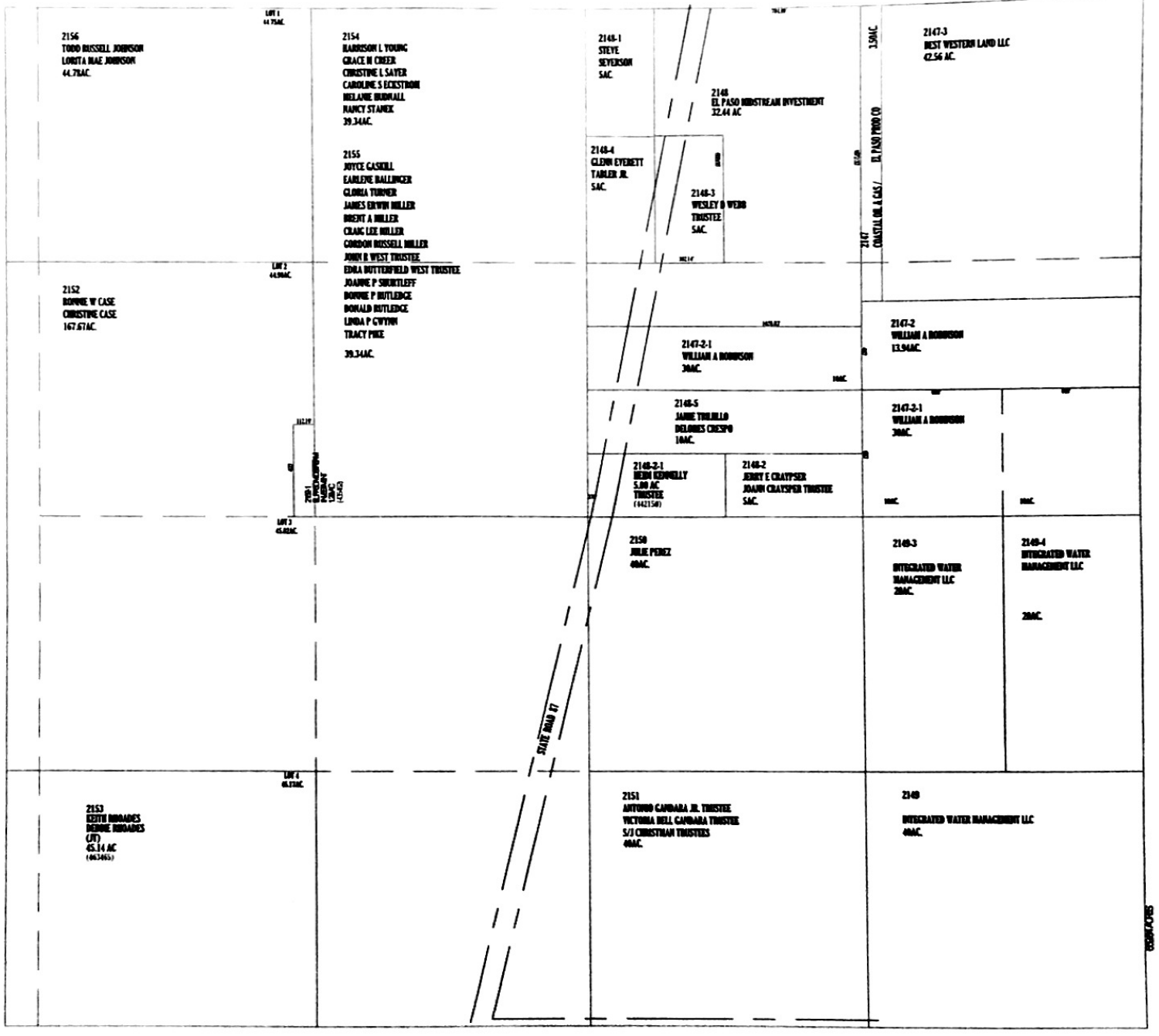
NOT ALL THE COUNTY ROADS ARE SHOWN ON THIS PLAT.

FOR A LIST OF APPROVED COUNTY ROADS CONTACT THE COUNTY ENGINEER'S DEPARTMENT.

LEGEND

- PARCEL BOUNDARY
- CREEKBELT LINES
- ROADS
- SECTION (FRACTIONS) LINES
- CREEKBELT CLAIMS
- 123 — BEARINGS FROM BASIS
- (- 123) — APPROXIMATE BEARINGS COMPUTED CALCULATED
- - 1000 [- — COUNTY ADDRESS GRID

SCALE: 1"=400'
DATE: 02.03.14



DUCHESNE COUNTY CORPORATION

April 23, 2014

Tax Roll Master Record

9:53:02AM

Parcel: 00-0006-5817 Serial #:2149 Entry:

Name: INTEGRATED WATER MANAGEMENT LL

c/o Name:

Address 1: PO BOX 430

Address 2:

City State Zip: ALTAMONT UT 84001-0430

Mortgage Co

Status: **Active** Year: **2014** District: **093 COUNTY 3** **0.011732**

Property Address:

20250 W 2000 S

DUCHESNE

Acres: 40.00

Owners	Interest	Entry	Date of Filing	Comment
INTEGRATED WATER MANAGEMENT LLC		427764	09/13/2010	(A0603/0164)

Property Information	2014 Values & Taxes				2013 Values & Taxes		
	Units/Acres	Market	Taxable	Taxes	Market	Taxable	Taxes
BC09 OIL FIELD BLDG/STRUCTURES	0.00	1,020,100	1,020,100	11,967.81	1,020,100	1,020,100	12,032.08
LA02 AG LAND UNIMP NON GREENBELT	39.50	15,800	15,800	185.37	15,800	15,800	186.36
LS01 SECONDARY LAND RESIDENTIAL	0.50	11,408	11,410	133.86	11,408	11,410	134.58
Totals:	40.00	1,047,308	1,047,310	12,287.04	1,047,308	1,047,310	12,353.02

****** SPECIAL NOTE ******

Tax Rates for 2014 have NOT been set or approved.
Any levied taxes or values shown on this printout for the year 2014 are subject to change!!

2014 Taxes:	12,287.04
Special Taxes:	0.00
Penalty:	0.00
Abatements:	(0.00)
Payments:	(0.00)
Amount Due:	12,287.04

2013 Taxes: 12,353.02

Review Date
02/15/2009

NO BACK TAXES!

Back Tax Summary

Year	Principal	Specials Total	Penalty	Interest Due	Interest Rate	Total Payments	Total Due
2011	0.00	0.00	0.00	0.00	7.00%	16,555.68	0.00
Totals:	0.00	0.00	0.00	0.00		16,555.68	0.00

Legal Description

SEC 30, T2S, R4W, USM, SE4SE4; 40.00 ACRE

History

ZONE A/R-1

APPENDIX G

BIOLOGICAL ASSESSMENT

for INTEGRATED WATER MANAGEMENT
E & P SOLID WASTE DEPOSITORY PERMIT

Lindsey C Nesbitt
February 10th, 2014

1.0 INTRODUCTION

This report documents the results of a biological resources survey conducted by Lindsey Nesbitt on behalf of Mike Vorkink, GeoStrata for an E & P solid waste depositories. The project is approximately 10 miles north of Duchesne, Utah, at 110.372166 W and 40.273304 N. It is on private land owned by Integrated Water Management (IWM).

IWM has proposed to convert an existing water pond, used to drain and filter wastewater from drilling sites, to an E & P solid waste depository. The area to be converted is a previously heavily managed area, and no new construction will occur. Therefore, the surrounding natural habitat located within the property will not be directly affected by the E & P solid waste conversion. The facility is at 1877 meters, map location T2S R4W section 30. The facility is approximately 89.5 acres.

2.0 METHODS

A data review was conducted for initial assessment of the Project site. This was completed prior to field work to gather existing information and assist in the evaluation of the occurrence of protected natural resources within the Project area. The data review entailed an evaluation of online resources and agency publications to determine the presence or potential occurrence of protected natural resources. These documents included:

- Identification of species that occur on the USFWS Federally Listed and Proposed Endangered, Threatened, and Candidate Species -Species List for Duchesne County;
- Identification of Critical Habitat in Utah;
- Review of Google Earth images and identification of habitat that could support species protected by the Bald and Golden Eagle Protection Act (BGEPA) (Fig 1).
- Phone discussions with lead botanist at USFWS for specific information regarding the Project site.

Nesbitt performed a field survey to document protected natural resources occurring, or having the potential to occur by ground disturbing activities, within the Project area. This was conducted to: document the general habitat occurring within the Project area, to identify species listed as threatened, endangered, candidate, or proposed (TECP) by the United States Fish and Wildlife Service (USFWS), BLM Vernal Field Office Sensitive Species, and to identify nests and nesting habitats of those species protected by the Bald and Golden Eagle Protection Act (BGEPA). This report documents the findings of both the data review and the biological resources survey conducted in January 2014.

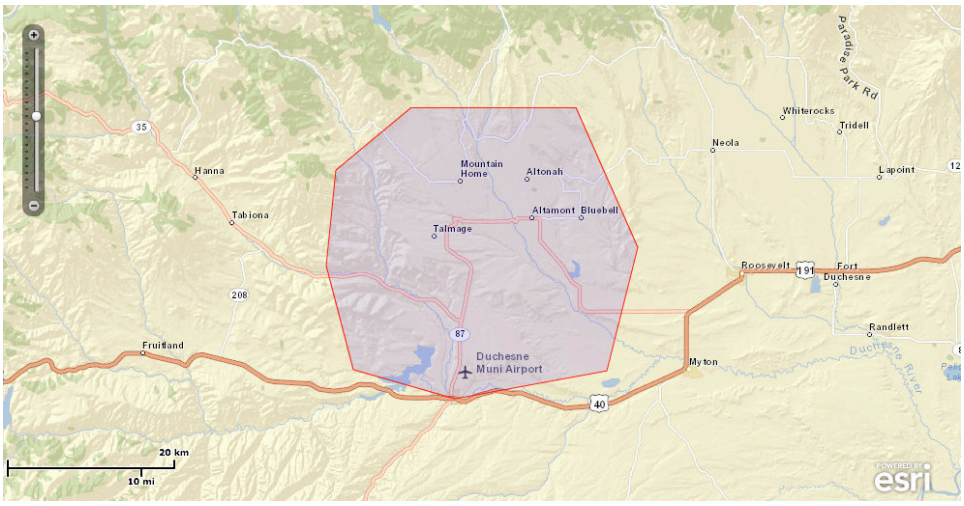


Fig. 1

3.0 RESULTS AND CONCLUSIONS

The Project is in Duchesne County, approximately 7 miles north of Duchesne on highway 87. It is located at a relatively high elevation site, 1877 m. The drainage pond to be filled is located on a gentle sloped area, with the peak above the upper active drainage ponds. There are drainage/spillways areas, manually created, at the downslope sides of the pond, on the north and northwest sides. This area can be viewed in section I and II of the Site Photos. A dirt road separates the pond from native habitat on the north, which will not be used in the transfer. The road on the south side of the pond, which also separates the pond from native habitat, will be used by heavy vehicles for dumping (refer to Site Photos, section III). The project areas is generally a uniform slope and habitat type, and contains no permanent water or wetlands.

Vegetation observed surrounding the proposed workspace (Site Photos section IV) include a sagebrush steppe community. While these areas could potentially be affected by dust, IWM conducts dust control on their roads, which reduces dust effect.
The list of Federally Listed, Proposed, and Candidate species, and USGS Rare Plants which may occur in Duchesne county are listed in Appendix A. Descriptions include status, habitat description, and the likelihood of occurrence. The Project site has been in operation over 30 years and there is no natural vegetation for the proposed area. All ten listed animals and plants species do not occur at the IWM E & P Solid Waste Project Site. Barneby ridge-cress (*Lepidium barnebyanum*) has the potential of occurrence near the Project Site. While field survey was completed during winter when leaf out is not occurring, it is highly unlikely this vegetation occurs at the Project site due to its previous/current use and no primary suitable habitat.

There is no defined USFWS critical habitat for threatened and endangered species at the Project site. Figure 2 represents map from the USFWS online mapper that specifies these results.

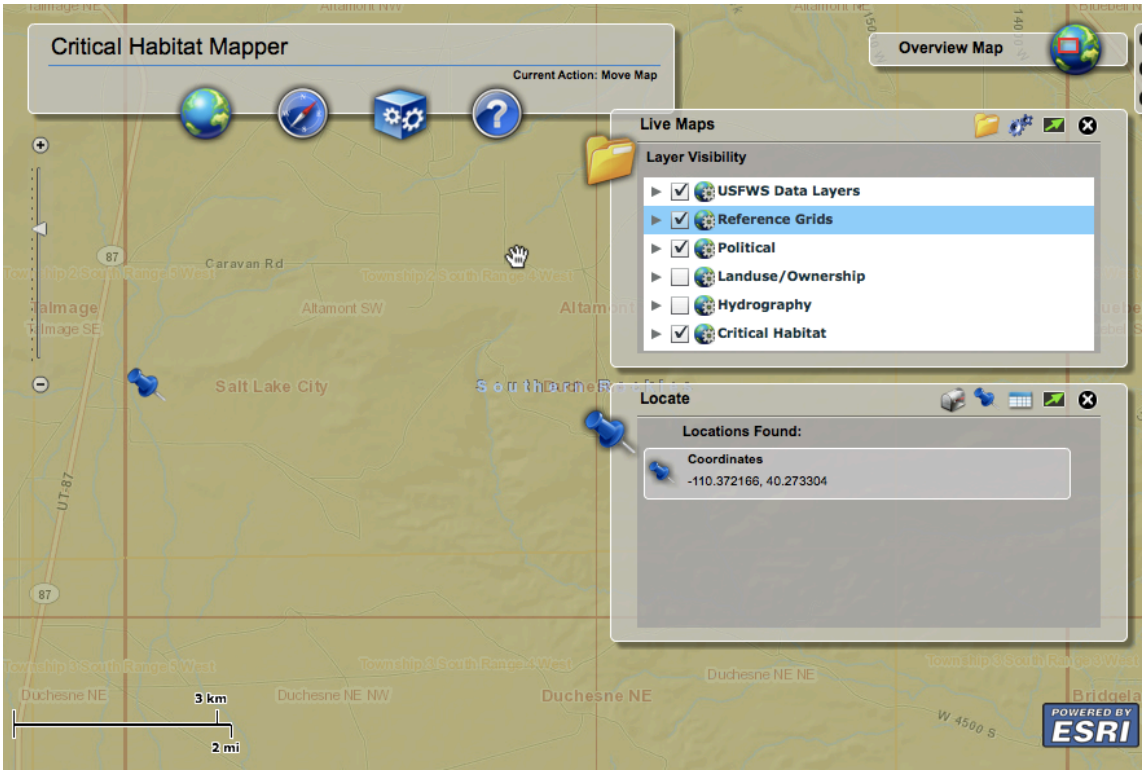


Fig. 2

Site Photos

I. Direct impact area from vehicles

#1 Unloading area, view north.

#2 Unloading area, view facing west.

#3 Fork in road, from backing in site

#4 area where trucks will drive up to before they back down to dump dirt.

II. Potential impact site, material waste spill area.

a) North side of fill site, facing west, b) west side of land fill site.

III. Direct impact site from solid material waste

a) South east side of land fill side, b) north east side of land fill site.

IV. Surrounding undisturbed areas potentially affected by dust from vehicles.

Area south of pond to be filled, on opposite side of road.

Area east of site, up on hill above upper evaporation ponds.

APPENDIX A

SUMMARY TABLE OF US FISH AND WILDLIFE SERVICE FEDERALLY LISTED, PROPOSED, AND CANDIDATE SPECIES, AND USGS RARE PLANTS WHICH MAY OCCUR WITHIN DUCHESNE, UTAH

Species	Status	Habitat Description	Likelihood of Occurrence
Mammal			
Canada Lynx (*Lynx canadensis)*	Threatened	Occurs in extensive tracts of dense coniferous forest, primarily Engelmann spruce and subalpine fir, with substantial understory with habitat for its prey, snowshoe hare.	None. Has Critical Habitat: Final designated, but it is not at site.
Bird			
Greater sage-grouse (*Centrocercus urophasianus)*	Candidate	Occurs throughout Utah where sagebrush is present. Suitable habitat consists of plant communities dominated by sagebrush and a diverse native grass and forb understory. Suitable winter habitat requires sagebrush above snow.	None. Designated habitat > 10 miles away.
Mexican Spotted owl (*Strix occidentalis lucida*)	Threatened	Spotted owls are residents of old-growth or mature forests that possess complex structural components (uneven aged stands, high canopy closure, multi-storied levels, high tree density). Canyons with riparian or conifer communities are also important components. Owls are also found in canyon habitat dominated by vertical-walled rocky cliffs within complex watersheds, including tributary side canyons. Rock walls with caves, ledges, and other areas provide protected nest and roost sites. Canyon habitat may include small isolated patches or stringers of forested vegetation including stands of mixed-conifer, ponderosa pine, pine-oak, pinyon-juniper, and/or riparian vegetation in which owls regularly roost and forage. Owls are usually found in areas with some type of water source (i.e., perennial stream, creeks, and springs, ephemeral water, small pools from runoff, reservoir emissions).	None. Designated habitat > 10 miles away.
Yellow-Billed Cuckoo (*Coccyzus americanus)*	Threatened	Inhabit large stands of cottonwood-willow habitat below 7,000 ft. Species is a riparian obligate and require low, dense, shrubby vegetation for nest sites, and restricted to closed-canopy, deciduous, riparian forests with a dense shrub understory.	None: No suitable habitat occurs within the Project. No streambanks occurs within the Project
Fish			

Species	Status	Habitat Description	Likelihood of Occurrence
Humpback chub (*Gila cypha*)	Endangered	Riverine habitat.	None: No suitable habitat occurs within the Project. No streams occurs within the Project
Bonytail chub (*Gila elegans)*	Endangered	Riverine habitat.	None: No suitable habitat occurs within the Project. No streams occurs within the Project
Colorado pikeminnow (*Ptychocheilus lucius)*	Endangered	Riverine habitat.	None: No suitable habitat occurs within the Project. No streams occurs within the Project
Razorback sucker (*Xyrauchen texanus)*	Endangered	Riverine habitat.	None: No suitable habitat occurs within the Project. No streams occurs within the Project
Plant			
Barneby ridge-cress (*Lepidium barnebyanum*)	Endangered	The species habitat occurs at an elevation of 6,200 to 6,500 feet on poorly developed soils derived from marly shales in a zone of interbedding geologic strata from the Uinta and Green River Formations (Reveal 1967; Welsh and Reveal 1977; Welsh 1978; Welsh et al. 1987; U.S. Fish and Wildlife Service 1989).	Not likely. Reproduction is sexual, with flowering occurring from April to May and fruiting occurs May to June. Site visit was in January.

Species	Status	Habitat Description	Likelihood of Occurrence
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Known primarily from moist meadows associated with perennial stream terraces, floodplains, and oxbows at elevations between 4300-6850 feet (1310-2090 meters). Surveys since 1992 have expanded the number of vegetation and hydrology types occupied by Ute ladies'-tresses to include seasonally flooded river terraces, subirrigated or spring-fed abandoned stream channels and valleys, and lakeshores. In addition, 26 populations have been discovered along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside barrow pits, reservoirs, and other human-modified wetlands. New surveys have also expanded the elevational range of the species from 720-1830 feet (220-558 meters) in Washington to 7000 feet (2134 meters) in northern Utah. Over one-third of all known Ute ladies'-tresses populations are found on alluvial banks, point bars, floodplains, or ox-bows associated with perennial streams.	Not likely. No primary suitable habitat occurs within the Project. There exists roadside barrow pits, but this is a dry site and not likely to have *S. diluvialis.* Site visit was in January when vegetation was not leafed.

18 February 2014

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

Re: Endangered Species/Scientifically Significant Areas Certification for the Proposed WMI E & P Solid Waste Landfill in Duchesne, Utah.

Dear Mr. Anderson:

The Utah Division of Sold and Hazardous Waste (UDSHW) requires certification for absence of ecologically or scientifically significant areas or threatened and endangered species at site areas. Integrated Water Management's (IWM) Project site for an E & P solid waste depositories is a previously heavily managed area. For the switch from an evaporation pond to a solid waste depository, there will be no new construction, thus no native vegetation areas occur. There is no critical habitat or scientifically significant areas at the Project site, defined by the U S Fish and Wildlife Service.

Duchesne county has ten Endangered, Threatened, and Candidate Species, but none of these species exist at the Project site. These species can be found in Appendix A. Based on a survey of the area and a data review, these species are not present at the Project site within the IWM property. Additionally, no critical habitat occurs at the Project site.

This survey was only for threatened and endangered species, and critical habitat. A reasonable certification can be made that the proposed site does not contain any endangered or threatened species or their habitats, nor scientifically significant areas.

Sincerely,

Lindsey Nesbitt
Ecologist, UofU
(801) 971-9545

State of Utah

GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of Heritage and Arts

Julie Fisher
Executive Director

State History

Wilson G. Martin
Director

April 3, 2013

Jon Peaden
GeoStrata, LLC
14425 South Center Point Way
Bluffdale, Utah 84065

RE: Integrated Water Management Waste Water Disposal Landfill Permit, 20250 W. 2000 So., Duchesne, Utah

For future correspondence, please reference Case No. 13-0318

Dear Mr. Peaden:

The Utah State Historic Preservation Office received your request for our comment on the above-referenced undertaking on March 27, 2013.

We concur with your determination of effect for this undertaking.

Please Note: All future report submissions need a letter from the state agency, as only they are legally responsible for making determinations.

Utah Code 9-8-4-4(1)(a) denotes that the state agency is responsible for all final decisions regarding cultural resources for this undertaking. Our comments here are provided as specified in U.C.A. 9-8-4-4(3)(a)(i). If you have questions, please contact me at 801-245-7263.

Sincerely,

Chris Merritt, Ph.D.
Senior Preservation Specialist

c: Ralph Bohn, Manager, Solid Waste Landfills, Utah Division of Solid and Hazardous Waste, P.O. Box 144880, Salt Lake City, UT

GeoStrata Engineering & Geosciences
14425 South Center Point Way, Bluffdale, Utah 84065 ~ T: (801) 501-0583 ~ F: (801) 501-0584

March 22, 2013

Chris Hansen, Preservation Planner
Utah State History
300 S. Rio Grande Street
Salt Lake City, Utah 84101

Subject: Historical Preservation Survey

Dear Mr. Hansen,

We are currently preparing a landfill permit on behalf of Integrated Water Management (IWM) to be submitted to the Utah Division of Solid and Hazardous Waste (DSHW). IWM is a waste water disposal company in the Uinta Basin that services the Oil and gas industry. IWM is located in Duchesne County approximately 8 miles north of the city of Duchesne. DSHW requires a Historical Preservation Survey when permitting a new Utah Exploration and Production Waste Landfill (R315-304-4(2)(a)(iv)). At the request of IWM we at GeoStrata conducted an evaluation of the proposed landfill site located on their property at 20250 W 2000 S, Duchesne, Utah. A USGS 7.5 Minute Topographic map with the location of IWM and the proposed landfill is attached to the end of this letter as Attachment 1.

IWM takes waste water extracted during oil and gas exploration and production processes and stores the water in evaporation ponds. IWM is considering converting one of their evaporation ponds into a landfill that will be used to dispose of drilling muds. There will be some minor alteration to the size and shape existing facility when the pond is converted to the landfill pit however none of these alterations will affect any existing structures. The pond that will be converted to a landfill was re-constructed in 2010. Prior to 2010 the site was also used as a waste disposal site under different ownership since the 1980's.

The Area of Potential Effects for the proposed landfill construction is confined to the location of the evaporation pond. This location has already been disturbed through previous construction on the site since 1980. Since the proposed landfill area is currently used for waste water disposal, we expect that the Area of Potential Effects will be limited to the area of the existing evaporation pond. The area of the pond to be converted to a landfill is approximately 4.9 Acres.

There are several buildings located on the IWM facility, none of which are older than 50 years and none of the structures are potentially eligible to be listed on the National Registry of Historic Places. A list of all structures on the subject IWM property and their respective construction dates are provided below:

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Building/Structure	Construction Date
Driver Shack	Fall of 2010
Office	Fall of 2010
Tank Building	Winter 2010 to 2011
Water Well House	Fall 2010
Triplex Building	Fall 2011
Injection Well House	Fall of 2011
Shop/Dryvac Building	Spring 2012
Old Shop #1	on site since 1980
Old Shop #2	on site since 1980

Based on our evaluation of the site and Area of Potential Effects from the permitting of the new landfill, the site has no historical properties or structures. None of the above mentioned buildings will be impacted by the construction of the proposed landfill. If you have any questions or need any other information about our historical evaluation of the IWM property, please contact us at (801) 501-0583.

Sincerely,

Jon Peaden
GeoStrata, LLC

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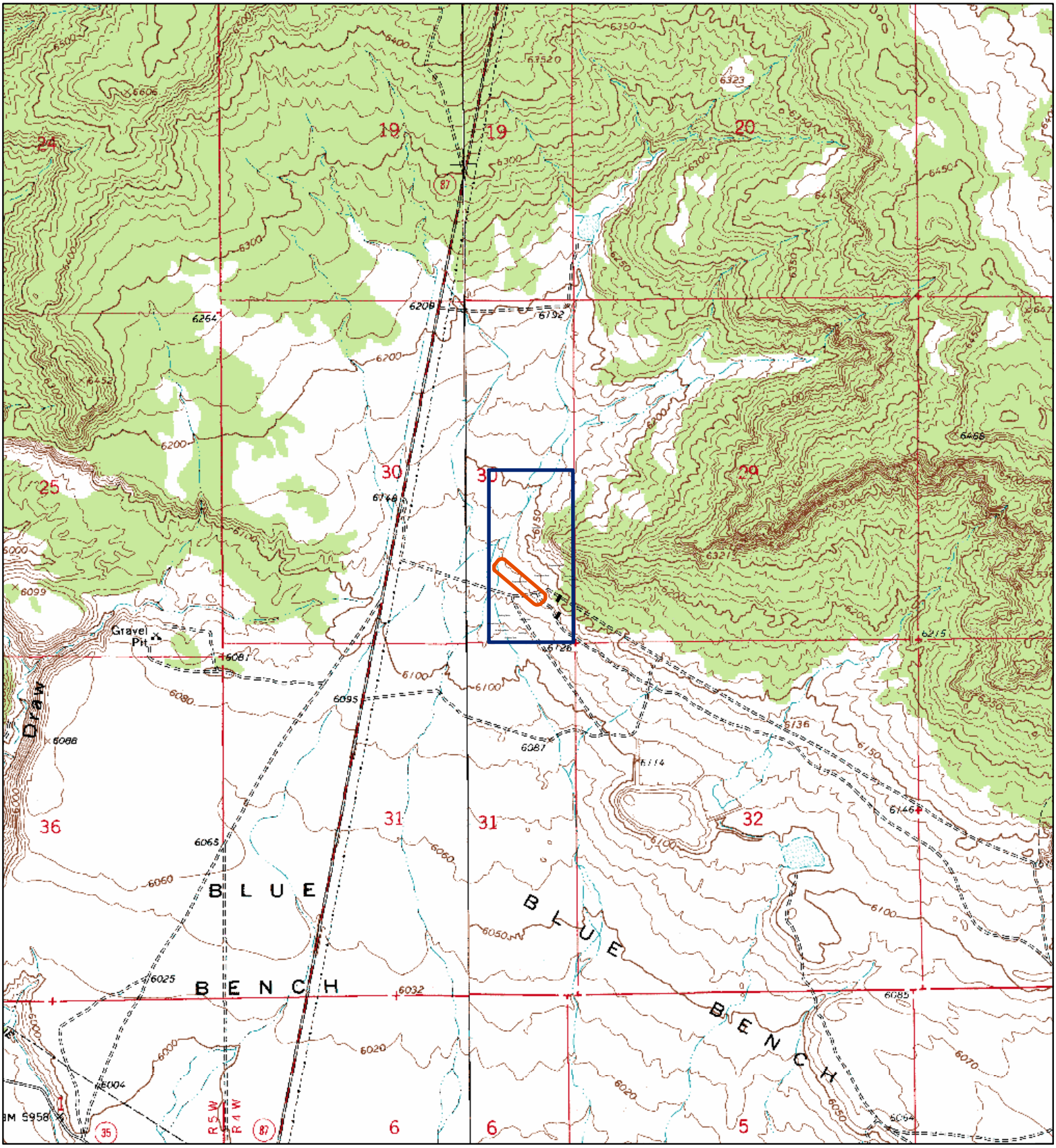

0 500 1,000 2,000 3,000 4,000 Feet

1:24,000

Base Map: USGS 7.5 Minute Topographic Map obtained from the State of Utah AGRC.

All Locations are Approximate

N

GeoStrata
Engineering & Geosciences

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Legend

- IWM Property Boundary
- Approximate Landfill Location

Intergrated Water Management
Duchesne, Utah
Project Number: 751-006

Site Exploration Map

Attachment 1

APPENDIX H

	Description	Unit Cost	No. Units	Unit Type	Total Cost	Details
Engineering	Laboratory/field Testing	15000.00	1	GS Estimate	15000.00	Density testing, lab testing, engineering support
	As built survey	1600.00	1	Gilson Estimate	1600.00	Gilson Engineering, As built survey and CAD drawing
	Letter of notification of closure	1200.00	1	GS Estimate	1200.00	Letter to DSHW and County
Construction	1x10-5 cm/sec. Material	0.00	15968	cy	0.00	IWM Stockpile material
	Topsoil Material	0.00	4081	cy	0.00	IWM Stockpile material
	1x10-5 cm/sec. Material Graded and Compacted	0.80	15968	cy	12774.40	RS Means
	Topsoil Graded	0.40	16323	cy	6529.20	RS Means
	Trucking	4.82	20049	cy	96636.18	RS Means
	Liner and Installation	0.50	234500	Sq Ft	117250.00	IWM Self Install Estimate
	Seeding	0.02	234500	Sq Ft	5780.43	RS Means
Contingency	10%	29334.61	1		29334.61	
TOTAL COST:					286104.82	

Engineers opinion of probable Costs

GeoStrata

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Closure Cost Summary

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate H-1

Task	Description	Unit Cost	No. Units	Unit Type	Total Cost	Total units 30 yrs.	Total cost 30 yrs.	Details/Source
Inspections	Quarterly 1st 2 years; Semiannually for 28 years	85	4	hours	340.00	64	21760.00	4 inspections/year for the first 2 years and then 2 inspections/year for 28 years
Report	Quarterly 1st 2 years; Semiannually for 28 years	85	2	hours	170.00	64	10880.00	4 reports/year for the first 2 years and then 2 reports/year for 28 years
TOTAL for 30 yrs							32640.00	

Groundwater Monitoring	Groundwater Sampling labor	85	6	hour	510.00	13	6630.00	Annual monitoring for first 5 years, biennial for next 10 years, then monitoring evey 5th year for final 15 years. Sampling from 2 monitoring wells for 13 rounds of sampling
	GRO	130	2	sample	260.00	13	3380.00	
	Heavy Metals	178	2	sample	356.00	13	4628.00	
	Inorganic Constituents/other	234	2	sample	468.00	13	6084.00	
	Groundwater sampling report	1200	1	report	1200.00	13	15600.00	
	Transport to lab	100	1	vehicle	100.00	13	1300.00	
TOTAL for 30 yrs							37622.00	

Maintenance	Re-grading	85	16	hour	1360.00	1	1360.00	Assumes 25% of topsoil of final cover will have to be replaced over 30 years
	Soil replacement	4	136	cy	544.00	1	544.00	
	Reseeding	0.02465	234500	Sq Ft	5780.43	1	5780.43	Assumes 1 total reseeding of final cover over 30 years
TOTAL for 30 yrs							7684.43	

TOTAL for all tasks 30 yrs		77946.43

Contingency	10% of total cost for all tasks	7794.64

TOTAL POST CLOSURE COST		**85741.07**

Engineers opinion of probable Costs

GeoStrata

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Post-Closure Care Cost Summary

Integrated Water Management
Landfill Permit
Duchesne, UT
Project Number: 751-013

Plate H-2

APPENDIX I

GeoStrata

MEMORANDUM

To: **Division of Solid and Hazardous Waste**
Doug Taylor, P.G.

From: **Mike Vorkink, P.G. /Hiram Alba, P.E., P.G.**

REGISTERED PROFESSIONAL ENGINEER
04/01/14
HIRAM
ALBA
175774
STATE OF UTAH

Date: **April 1, 2014**

Subject: **Additional data for IWM Exploration and Production Landfill Permit**

As requested by the Utah Division of Solid and Hazardous Waste (UDSHW), we are presenting additional information on behalf of Integrated Water Management (IWM) for the exploration and production landfill application submitted March 14, 2014. The attachments in this memo include the stamped construction plans, available construction quality control and assurance results for pond #3, construction and HDPE liner certification letters from supervising engineer, copies of letters of notification sent to the appropriate property owners and a map of surrounding property owner parcels.

Engineers from CIVCO Engineering designed the IWM waste water ponds and oversaw their construction. The QA/QC program is outlined on page 2 of the construction plans which is included in the attachments. QC Testing was hired to conduct compaction testing for pond #3, and results for 38 of the compaction tests are included in this letter as Attachment 19-30.

Pond #3 was lined using a 40 mil secondary liner and a 60 mil primary liner with a 200 mil geonet between liners. Non-destructive testing was performed on the liners. General specifications of the HDPE liners are provided in this letter as Attachment 31-32. A copy of the stamped construction plans that were used for the construction of the IWM facility is also attached to this letter as Attachments 1-16. Attached is a memo from John Wood S.E. of CIVCO Engineering dated March 27, 2014 in which he states that he reviewed the liner testing results as well as performed a visual inspection of the seams. In a memo to the Division of Oil and Gas and Mining dated May 25, 2011 John Wood S.E. declared that the ponds were constructed as presented on the plans and that all deficiencies had been addressed (Attachment 18).

Attachments 33-43 include copies of notice of intent letters sent to property owners within 1000 ft of the proposed landfill cell at IWM as per UDSHW regulation R315-310-32II. A map of the actual parcels is included as Attachment 44.

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It is GeoStrata's opinion based on the supervising engineer's certification and the approval of DOGM that pond#3 was constructed and lined as per the specifications outlined in the construction plans. If you have any questions regarding the data presented in this letter please feel free to contact our office at 801-501-0583.

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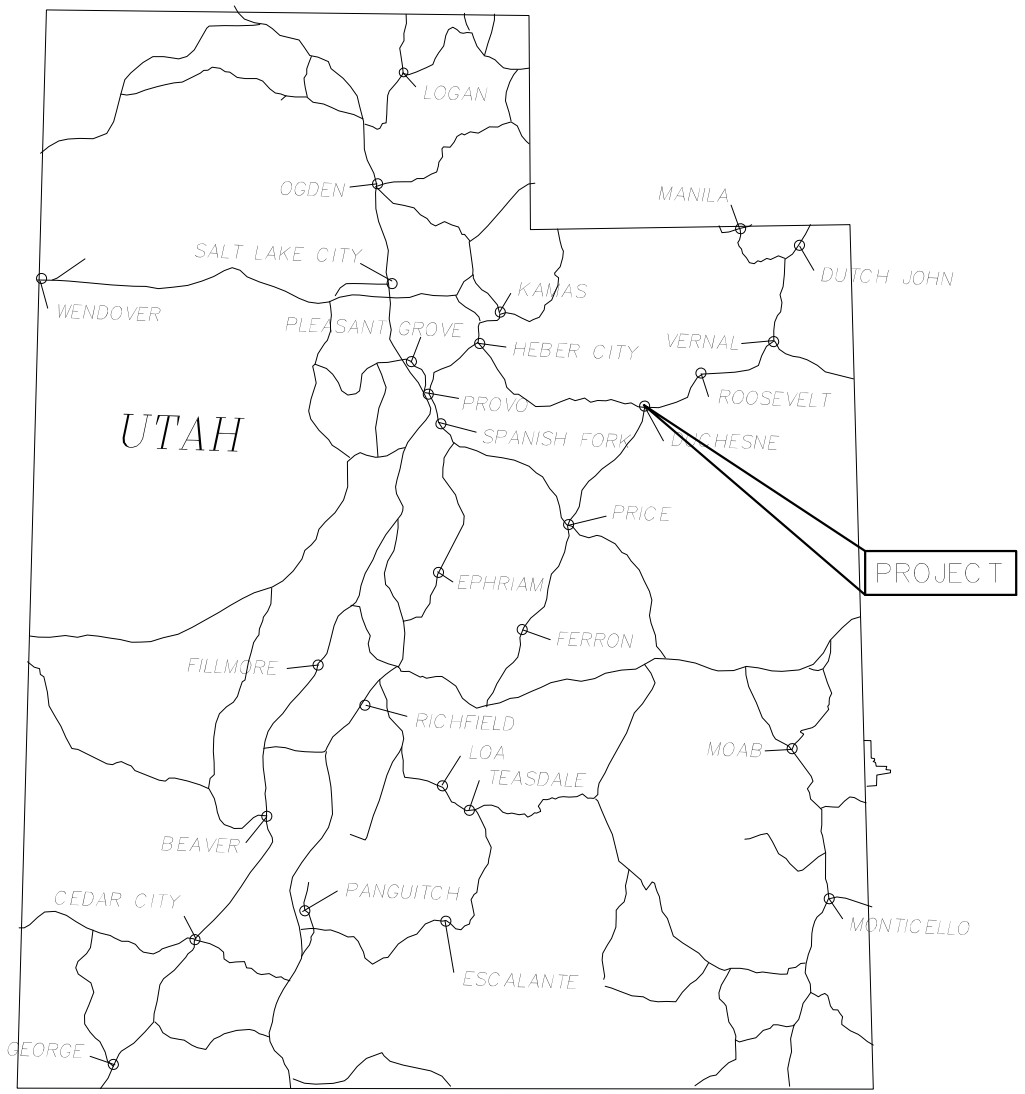
Attachment 1

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

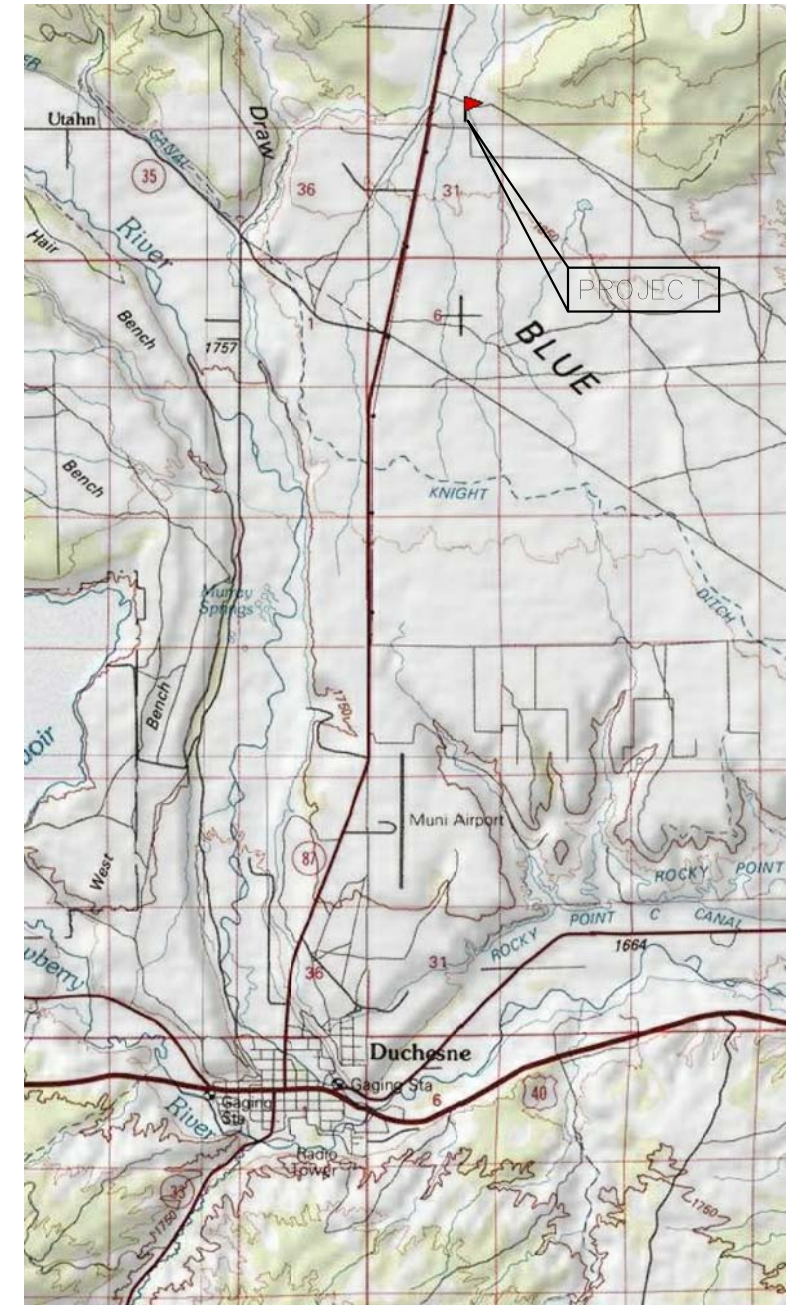
Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

SHEET INDEX

1 ..... TITLE SHEET
2 ..... NOTES
3 ..... OVERALL SITE PLAN
4 ..... UNLOADING FACILITIES
5 ..... POND LAYOUT
6 ..... SECONDARY CONTAINMENT LAYOUT
7 ..... SECTIONS
8 ..... SECTION 2
9 ..... SECTION 3
10 ..... SECTION 4
11 ..... LAND FARM SECTIONS
12 ..... DETAIL SHEET 1
13 ..... DETAIL SHEET 2
14 ..... DETAIL SHEET 3
15 ..... DETAIL SHEET 4



VICINITY MAP



0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 miles
0 1 2 3 4 5 km

No.174630
JOHN SHANE WOOD
LICENSED PROFESSIONAL STRUCTURAL ENGINEER
STATE OF UTAH
8-31-2010

PROJECT INFORMATION

Owner/Operator: Integrated Water Management
Robert L. Ballou
PO Box 816
Roosevelt, Utah 84066
435-722-3555

Project Location: Section 30, T2S, R4W, Uintah Special Base and Meridian

Engineer: John S. Wood, PE, (Utah 174630)
CIVCO Engineering
P. O. Box 1758
Vernal, Utah 84078
435-789-5448

DUCHESNE AIRPORT, UTAH (422252)

1971-2000 Monthly Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	29.9	36.1	46.3	58.0	68.5	80.4	87.8	84.7	76.4	63.1	43.6	33.2	59.2
Average Min. Temperature (F)	7.5	12.8	22.6	31.2	39.8	48.2	55.4	52.4	44.9	33.9	20.2	10.3	31.7
Average Total Precipitation (in.)	0.70	0.58	0.49	0.57	0.95	0.54	0.63	1.02	0.57	0.65	0.58	0.32	7.58

http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ut2252

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC YEAR
FORT DUCHESNE	1894-2005	0.00	0.00	0.00	5.16	7.41	8.61	9.06	7.98	5.57	3.25	0.00	0.00	47.04
VERNAL ARPT	1928-2005	0.00	0.00	0.00	5.07	6.41	7.48	6.64	6.34	4.89	2.92	0.00	0.00	39.75

http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#UTAH

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit, w/DOGM/extended pond 1 added dit. sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1 P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC
CHECKED BY
DATE
APPROVED
PROFESSIONAL ENGINEER

PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
TITLE SHEET

Attachment 2

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

G6 — SOIL SAMPLE LOCATION

PUMP

LIGHT POLE

WS — WATER SHUT OFF VALVE

W — WELL

MW — LEAK DETECTION SUMP

TP — BORE HOLE

PP — POWER POLE W/LIGHT

POWER METER

PP — POWER POLE

GM — GAS MAIN

THE PONDS WILL CONSIST OF A COMPACTED EARTH DAM, 60 MIL HDPE GEOMEMBRANE PRIMARY LINER, 200 MIL HDPE GEONET, 40 MIL HDPE GEOMEMBRANE SECONDARY LINER, AND LEAK DETECTION SYSTEM. THE CONTRACTOR SHALL ENSURE QUALITY CONSTRUCTION BY COMPACTING FILL TO 95% MDD. THREE COMACTION TESTS SHALL BE TAKEN FOR EVERY 1' LIFT. MAXIMUM LIFT SHALL BE 1'. FILL SHALL HAVE NO ROCKS LARGER THAN 6". ALL TESTING SHALL BE PERFORMED IN THE PRESENCE OF THE DESIGN ENGINEER OR HIS DESIGNATED REPRESENTATIVE.

THE CONTRACTOR SHALL COORDINATE ALL EARTHWORK AND PIPE WORK WITH THE LINING INSTALLER TO ENSURE OPTIMUM LINER INSTALLATION CONDITIONS.

ROCK WILL BE ENCOUNTERED IN EXCAVATION OF THE POND. ROCK SHALL BE OVER EXCAVATED 1' BELOW THE FINISH GRADE OF THE POND. CLEAN FILL SHALL BE INSTALLED IN OVER EXCAVATED AREAS TO THE FINISH GRADE. THE CONTRACTOR IS RESPONSIBLE FOR ASCERTAINING THE EXTENT OF ROCK LOCATED WITHIN THE POND.

THE CONTRACTOR SHALL BE RESPONIBLE SCHEDULING AND PAYING FOR ALL GRADE SETTING AND MATERIAL TESTING.

SECONDARY CONTAINMENT WILL BE UNLINED. THE CONTRACTOR SHALL ENSURE QUALITY CONSTRUCTION BY COMPACTING FILL TO 95% MDD. THREE COMACTION TESTS SHALL BE TAKEN FOR EVERY 1' LIFT. MAXIMUM LIFT SHALL BE 1'. ALL TESTING SHALL BE PERFORMED IN THE PRESENCE OF THE DESIGN ENGINEER OR HIS DESIGNATED REPRESENTATIVE.

SKIM PONDS 1 AND 2 WILL HAVE BIRD NETTING INSTALLED

SITE DATA

	CAPACITY	DIMENSIONS	MEASURED AREA
SKIM POND 1	6,809 bbl	80'x140'	10,436 sq ft
SKIM POND 2	6,986 bbl	80'x140'	10,436 sq ft
POND 1	78,935 bbl	140'x418'	57,771 sq ft
POND 2	344,593 bbl	217'x741'	159,727 sq ft
POND 3	455,105 bbl	226'x936'	228,550 sq ft
TOTAL	892,428 bbl		

SECONDARY CONTAINMENT POND 459,752 bbl

LINER	HDPE GEOTEXTILE 60 MIL (SQ FT)	GEONET 200 MIL (SQ FT)	HDPE GEOTEXTILE 40 MIL (SQ FT)	FABRIC 12 OZ. (SQ FT)
SKIM POND 1	15,132	15,132	15,132	
SKIM POND 2	15,132	15,132	15,132	
POND 1	82,480	82,480	82,480	
POND 2	231,604	231,604	231,604	
POND 3	299,218	299,218	299,218	
SPILLWAY	54,840			54,840
TOTAL	698,406	643,566	643,566	54,840

Note: These represent a neat line measurement that includes the pond, from the lip of the pond to the anchor trench, and the anchor trench. No adjustment has been made for waste material, overlaps, or other losses of material. Contractor shall make adjustments for loss of materials for overlaps, waste, etc.

GENERAL NOTE: The contractor shall be responsible to notify the owner and project engineer of any errors, change of site conditions, adverse site conditions, or any other problems immediately to be followed up with a written notification with 24 hours of discovery. Failure to do so will relieve the owner and project engineer of responsibility to pay for changes due to any of the above conditions.

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

EARTHWORK

Base Surface	Comparison Surface	Cut Cu. Yd.	Fill Cu. Yd.	Net Cu. Yd.	Cut Factor	Fill Factor	Cut (adjusted) Cu. Yd.	Fill (adjusted) Cu. Yd.	Net (adjusted) Cu. Yd.	
EXISTING PONDS	POND DESIGN	174165.02	51004.12	123160.90	1	1.2	174165.02	61204.95	112960.07	
EXISTING PONDS	POND 1 CLEAN UP	15860.12		15848.70	1	1	15860.12		15848.70	
EXISTING PONDS	POND 2 CLEAN UP	10164.70		10083.80	1	1	10164.70		10083.80	
		148140.20		97228.40			148140.20		87027.57	cut

Note: Pond 1 and Pond 2 clean up values are excavated from the original surface and are therefor subtracted from the earthwork volumes under this contract.

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM extended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S., STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
APPROVED
DATE
PROFESSIONAL ENGINEER

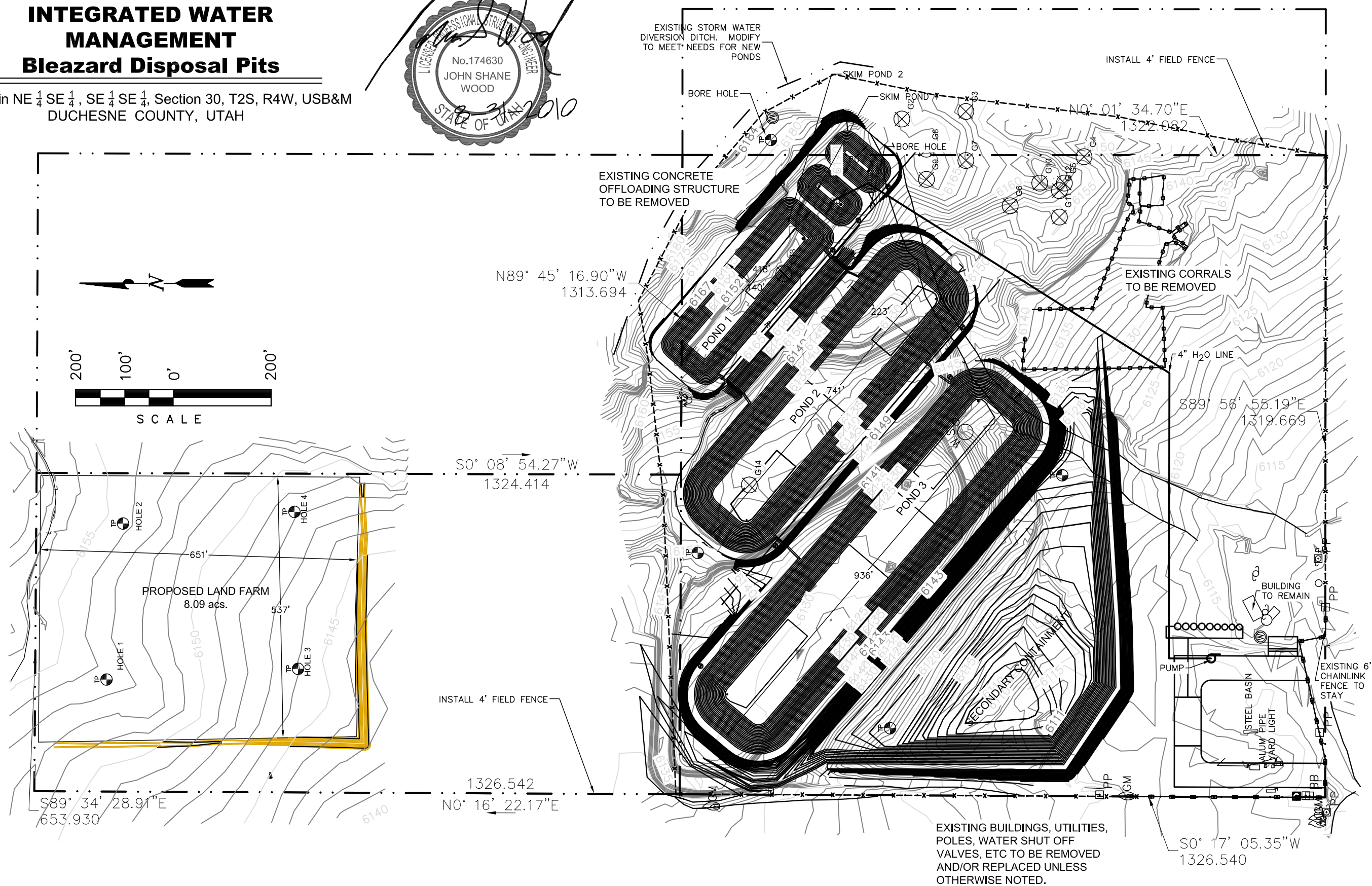
DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT
PROJECT NUMBER
NOTES

Attachment 3

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010



No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM&extended pond 1 added silt sump det.

REVISIONS

DRAWN BY JSW
QC
CHECKED BY
DATE
PROFESSIONAL ENGINEER
APPROVED

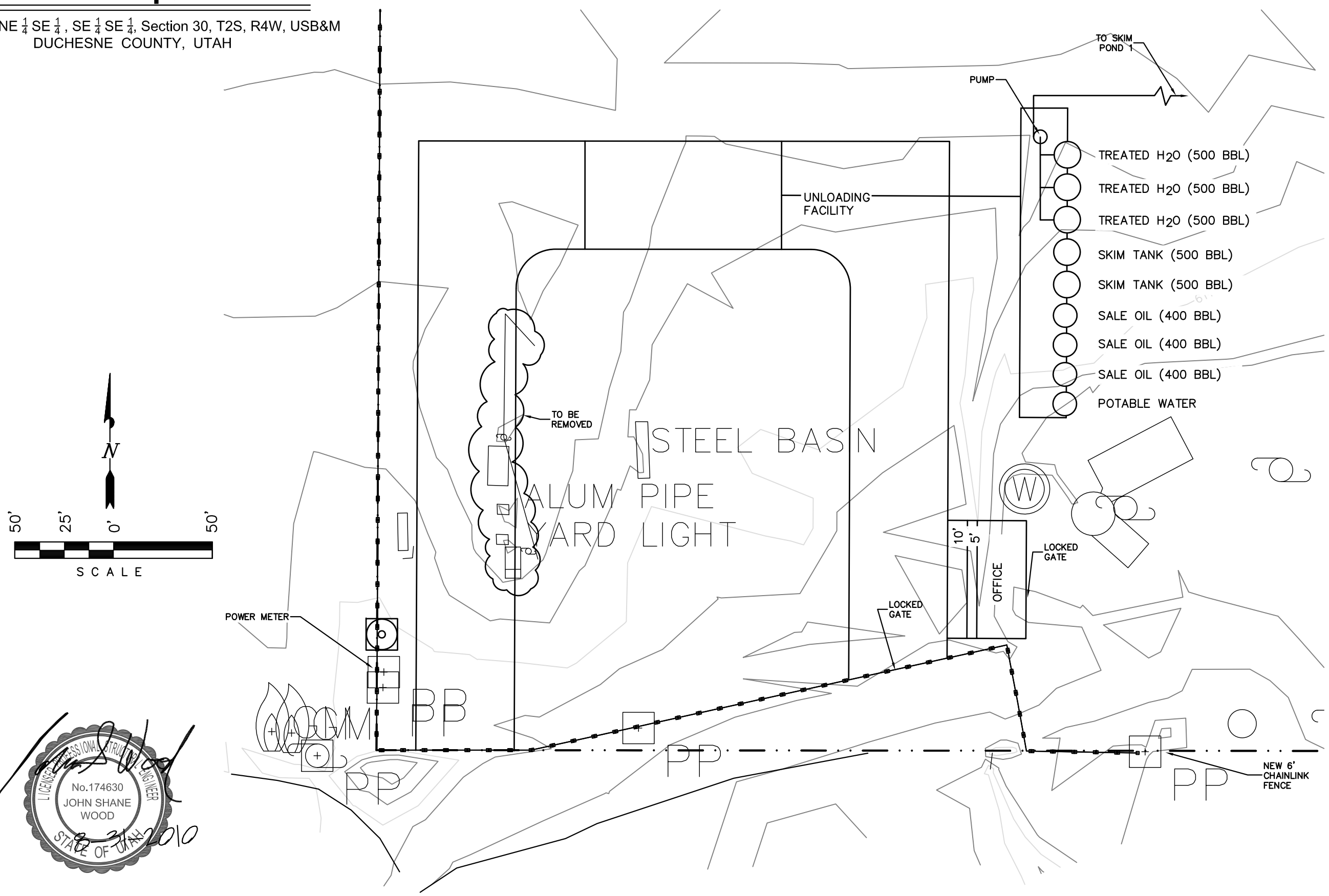
CIVCO Engineering, Inc.
1256 W. 400 S., STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
OVERALL SITE PLAN

Attachment 4

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM&extended pond 1 added elt. sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

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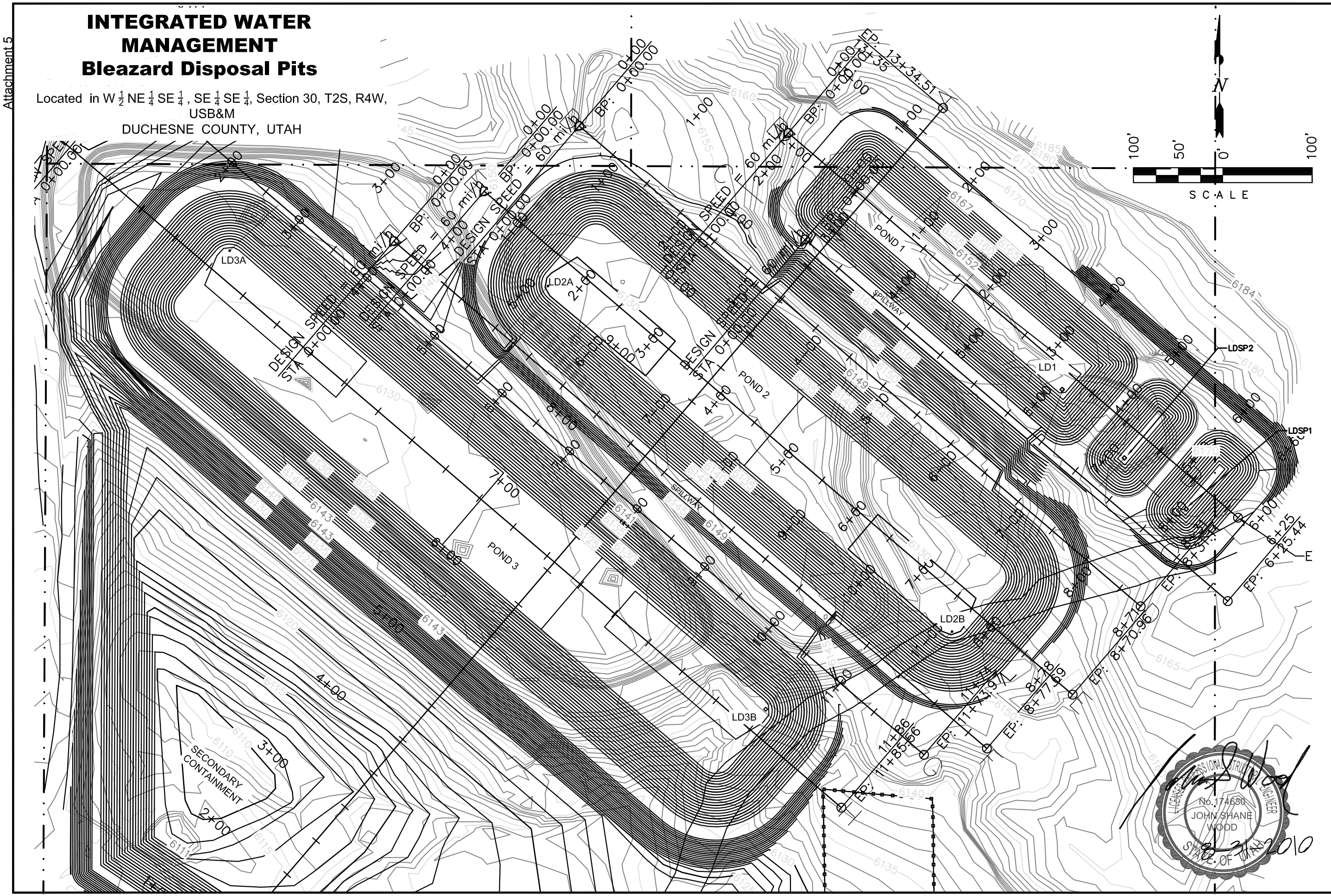
QC CHECKED BY
DATE
APPROVED
PROFESSIONAL ENGINEER
DATE

PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
UNLOADING FACILITIES

Attachment 5

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W ½ NE ¼ SE ¼ , SE ¼ SE ¼, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMtecended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY: JSW
QC CHECKED BY: ____ DATE ____
APPROVED
PROFESSIONAL ENGINEER

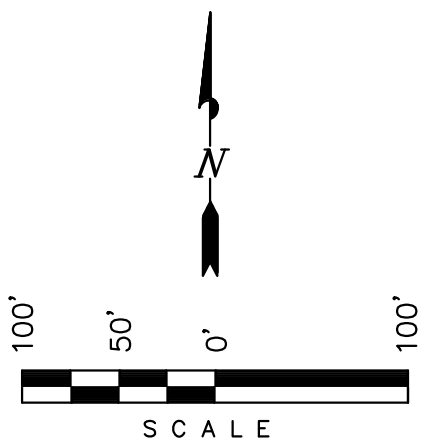
PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
POND LAYOUT

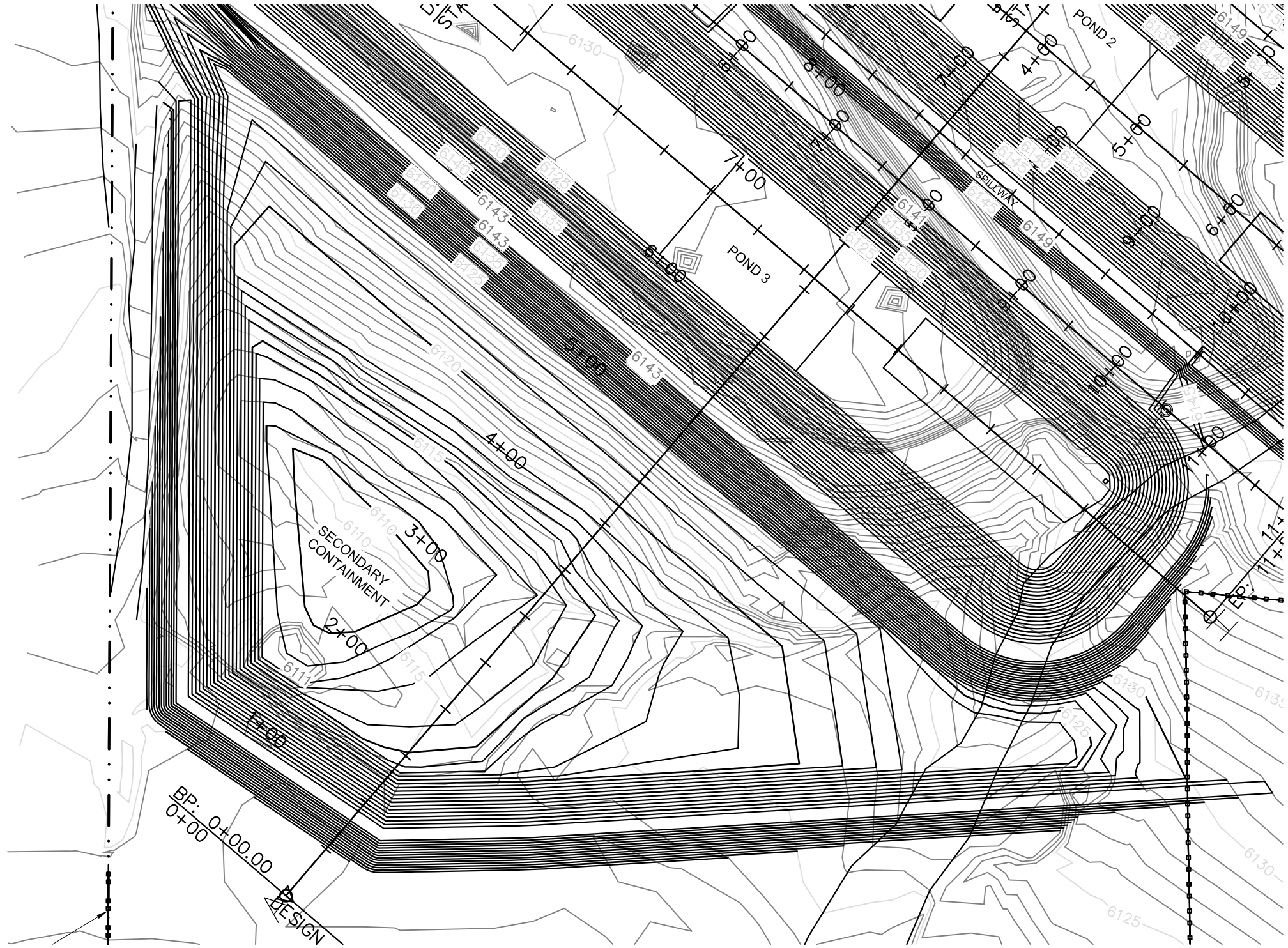
SHEET No. 5 of 15

Attachment 6

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH





LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMectended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
APPROVED
DATE
PROFESSIONAL ENGINEER

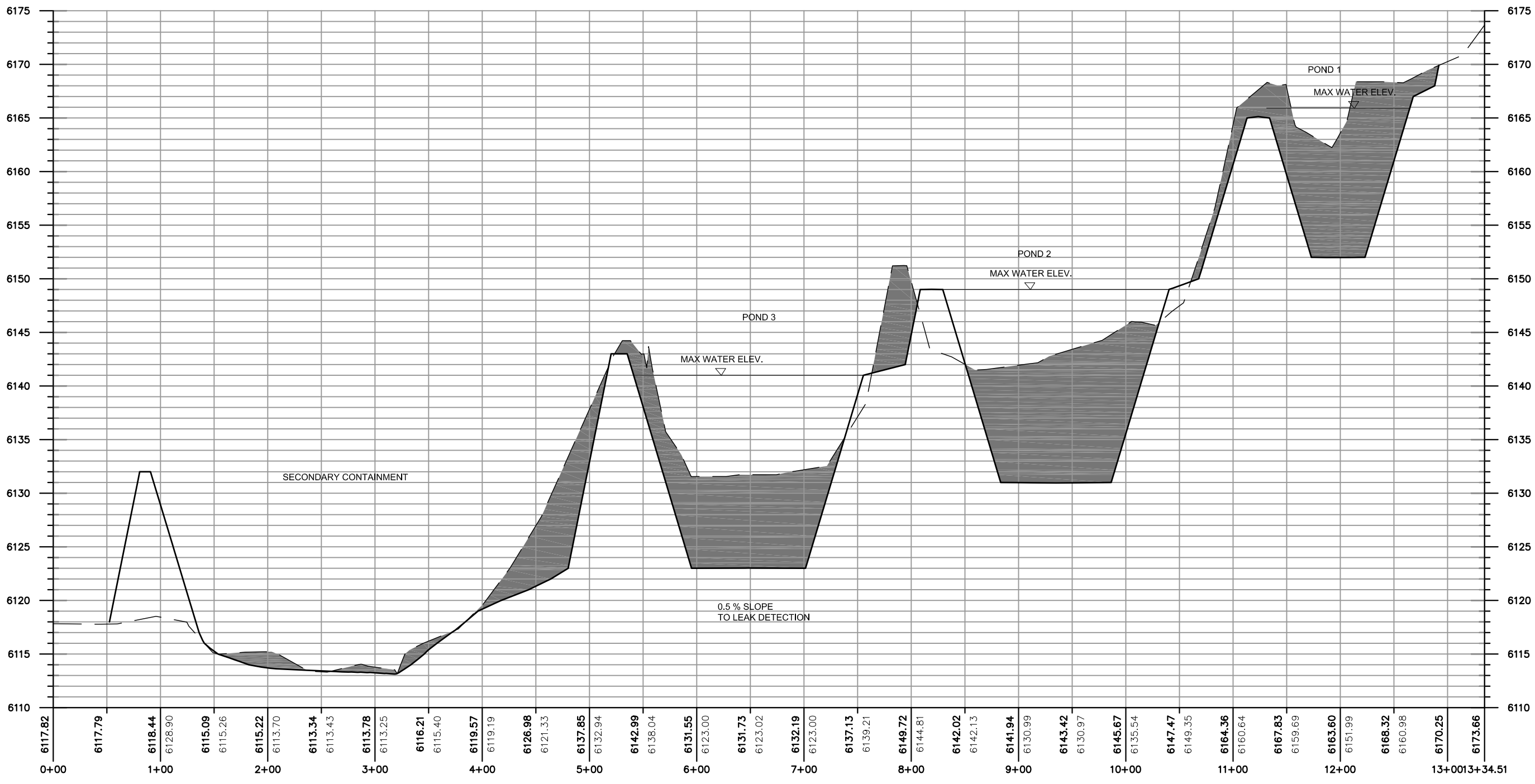
PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
SECONDARY CONTAINMENT LAYOUT

Attachment 7

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010



SECTION A - A

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMectended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

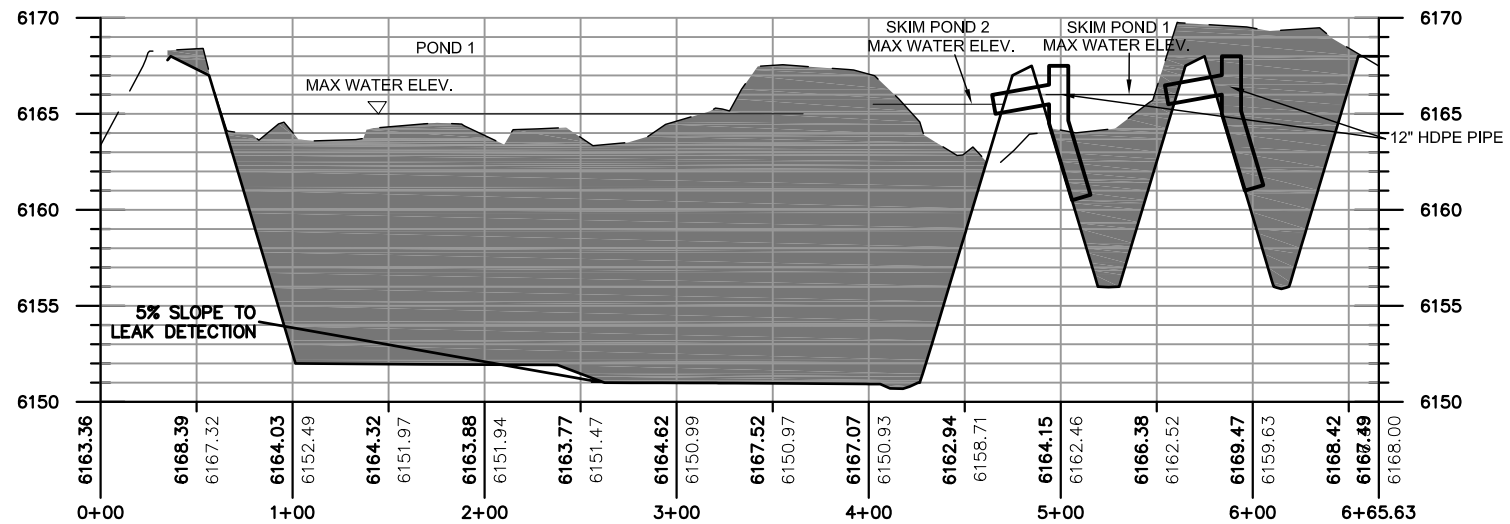
DRAWN BY JSW
QC CHECKED BY
APPROVED
DATE
PROFESSIONAL ENGINEER

PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
SECTIONS 1

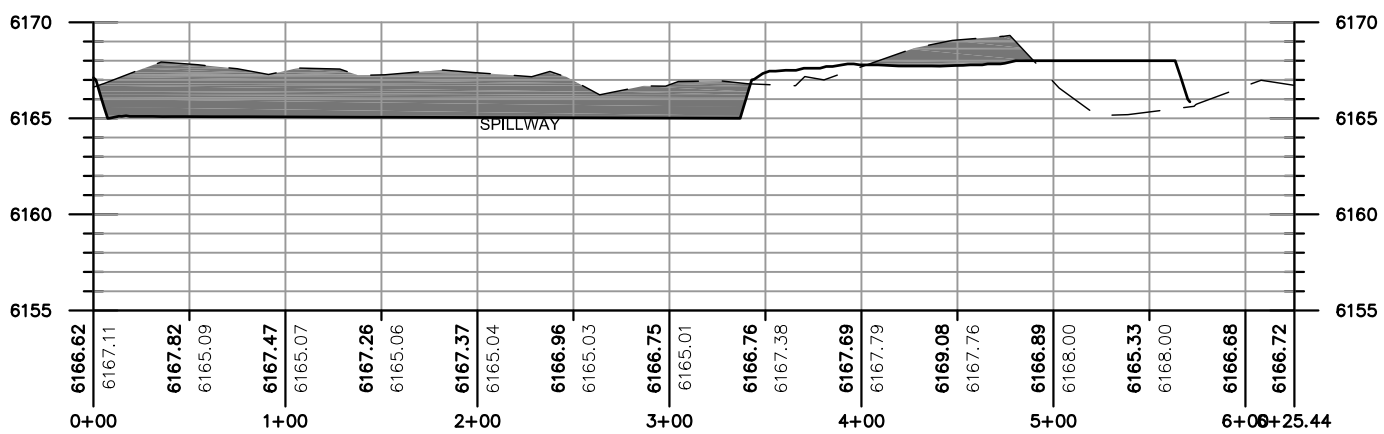
Attachment 8

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

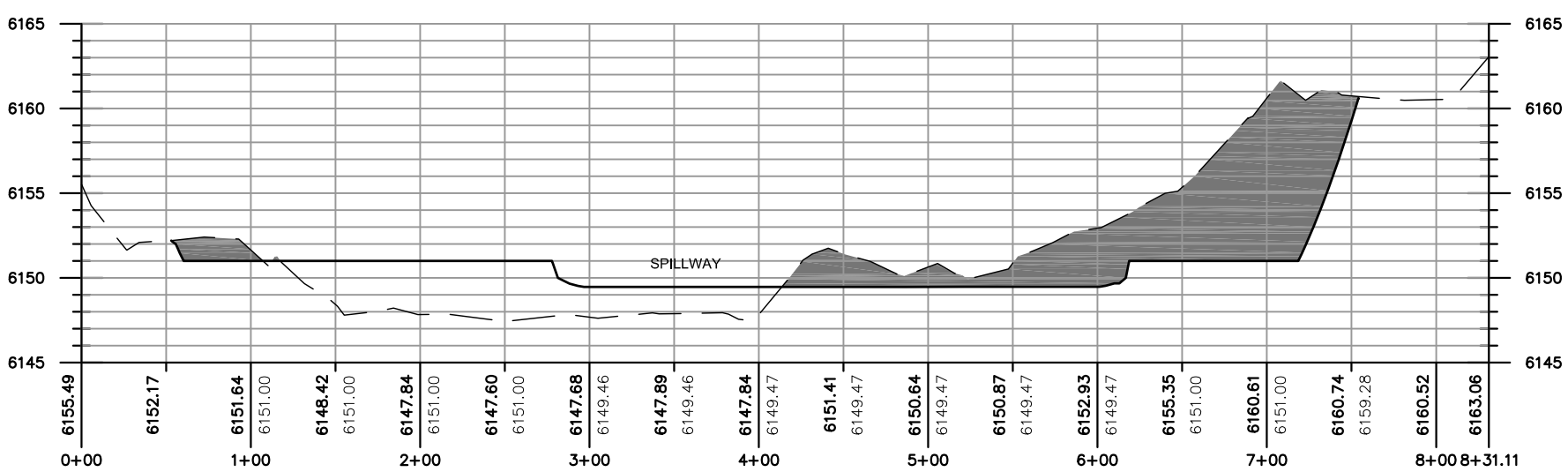
Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



SECTION B -B



SECTION C - C



SECTION D - D

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
8-31-2010
STATE OF UTAH

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM(extended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

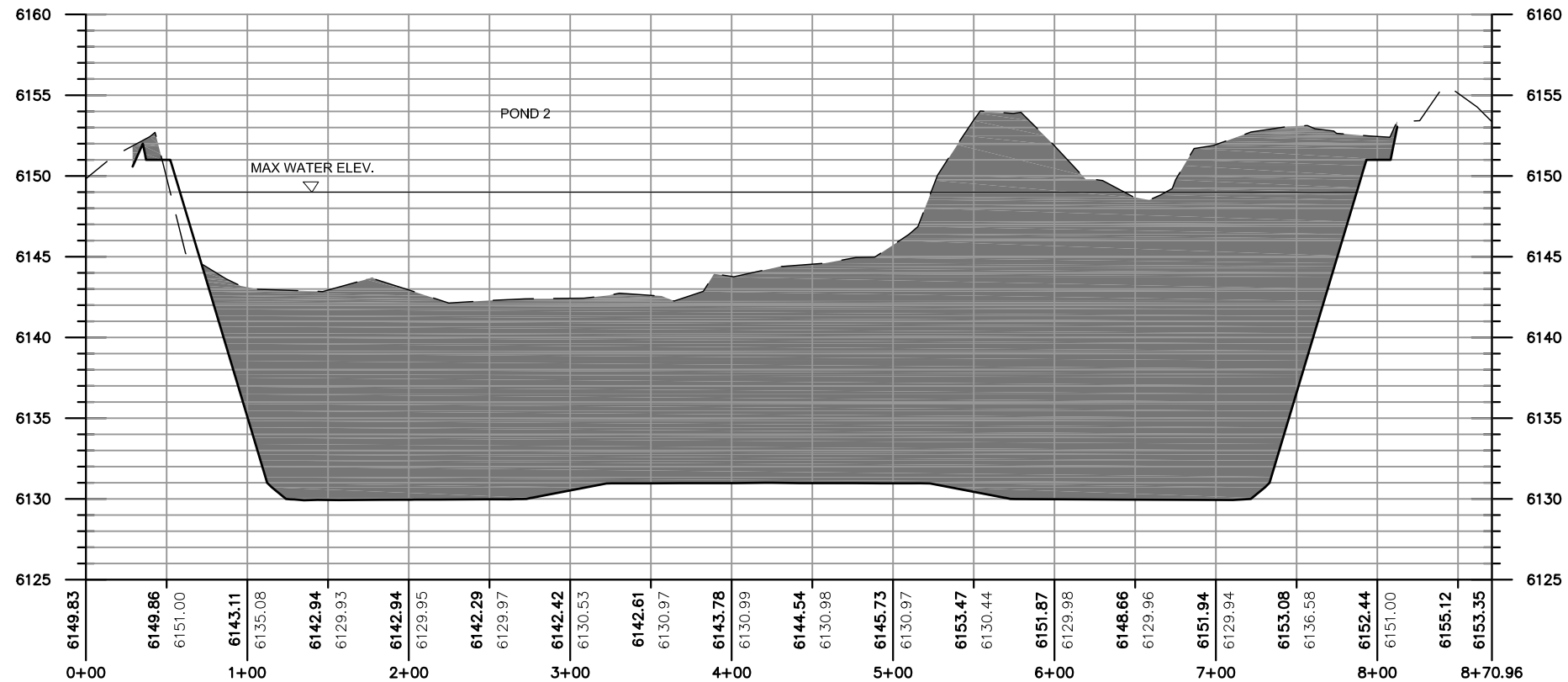
DRAWN BY JSW
QC CHECKED BY
DATE
APPROVED
PROFESSIONAL ENGINEER

PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
SECTIONS 2

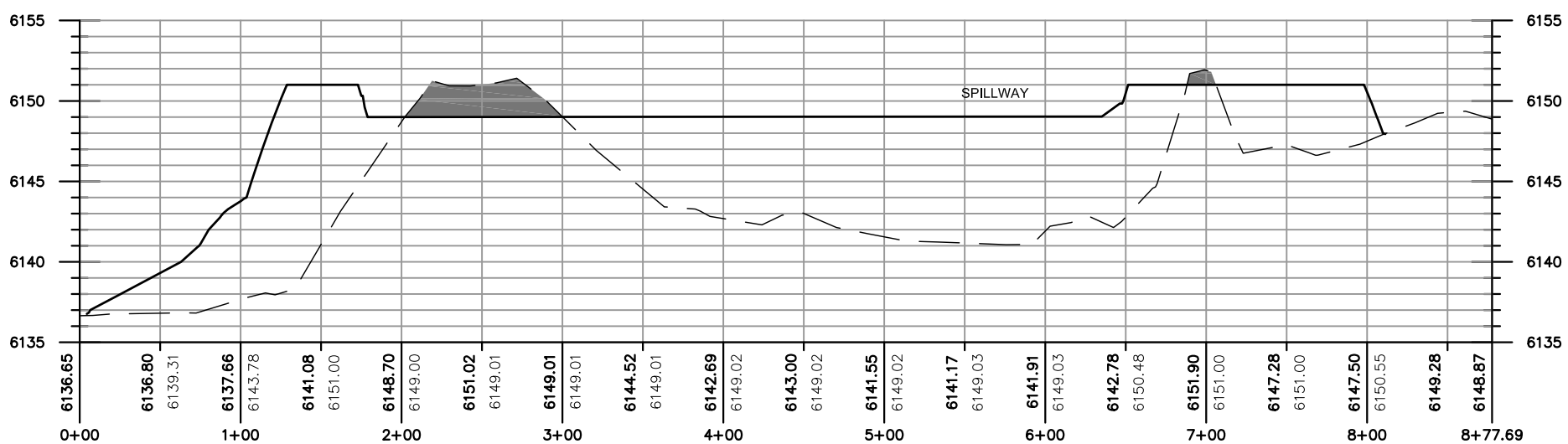
Attachment 9

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

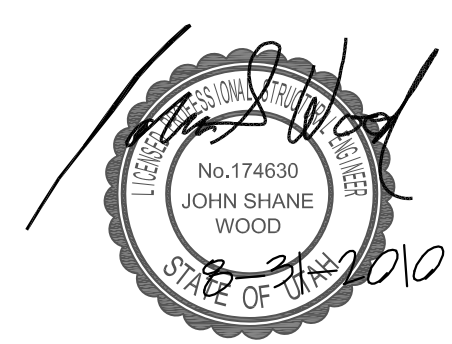
Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



SECTION E - E



SECTION F - F



No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMectended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
APPROVED
PROFESSIONAL ENGINEER
DATE

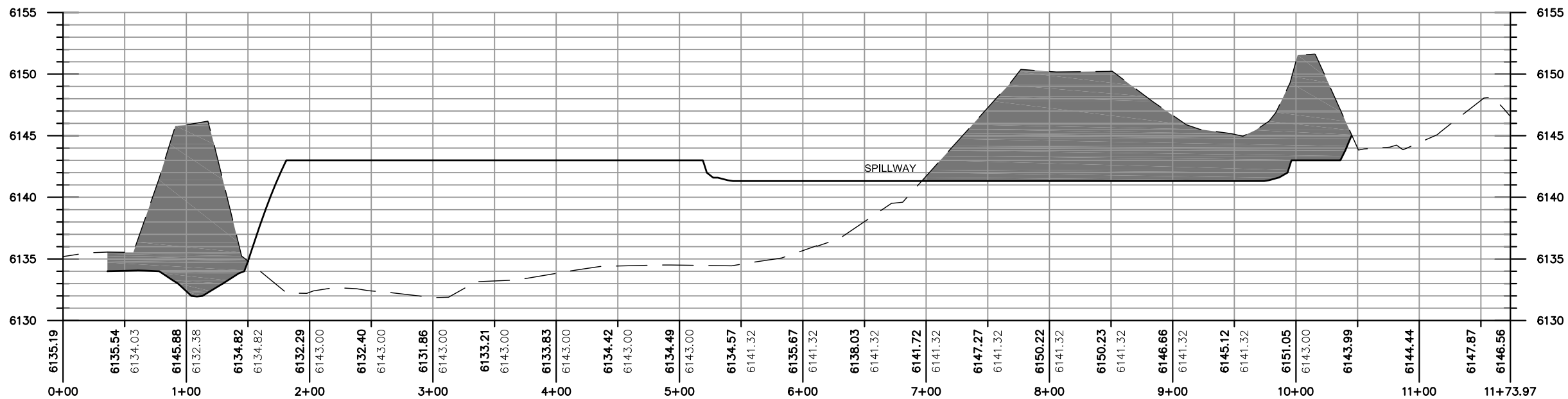
PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
SECTIONS 3

Attachment 10

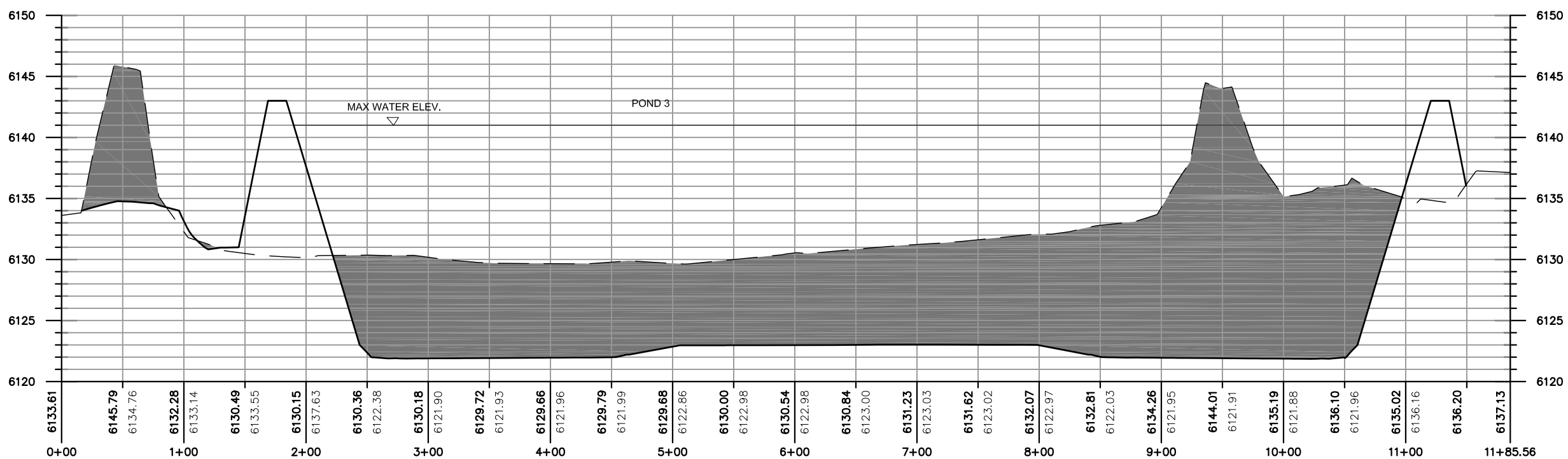
INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010



SECTION G - G



SECTION H - H

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMectended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
DATE
APPROVED
PROFESSIONAL ENGINEER

LAND FARM/CLEANUP
Integrated Water Management
SECTIONS 4

PROJECT
PROJECT NUMBER

SHEET No. 10 of 15

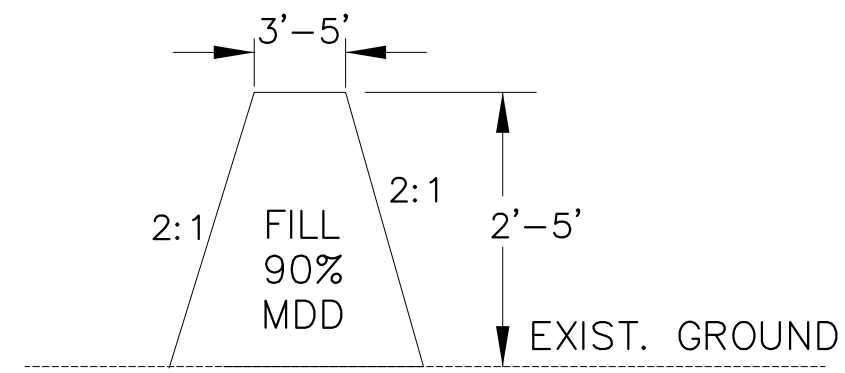
Attachment 11

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

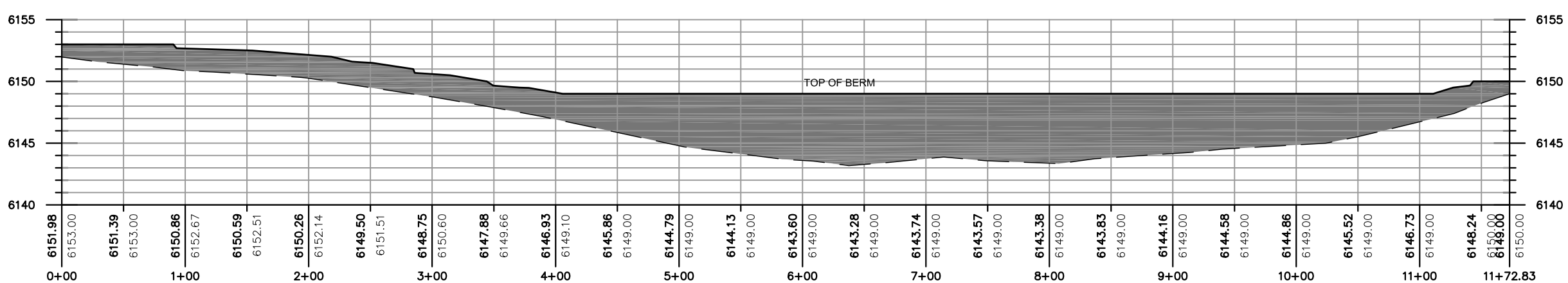
LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

100' 50' 0' 100'
SCALE



BERM DETAIL

(VERTICAL OR HORIZONTAL)
NOT TO SCALE



LAND FARM BERM PROFILE

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMectended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. J, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
APPROVED
PROFESSIONAL ENGINEER DATE

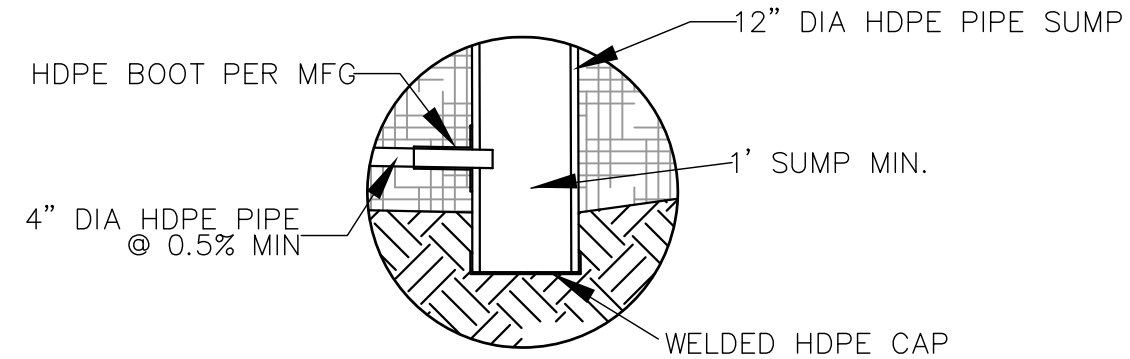
PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
BERM PROFILE

Attachment 12

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

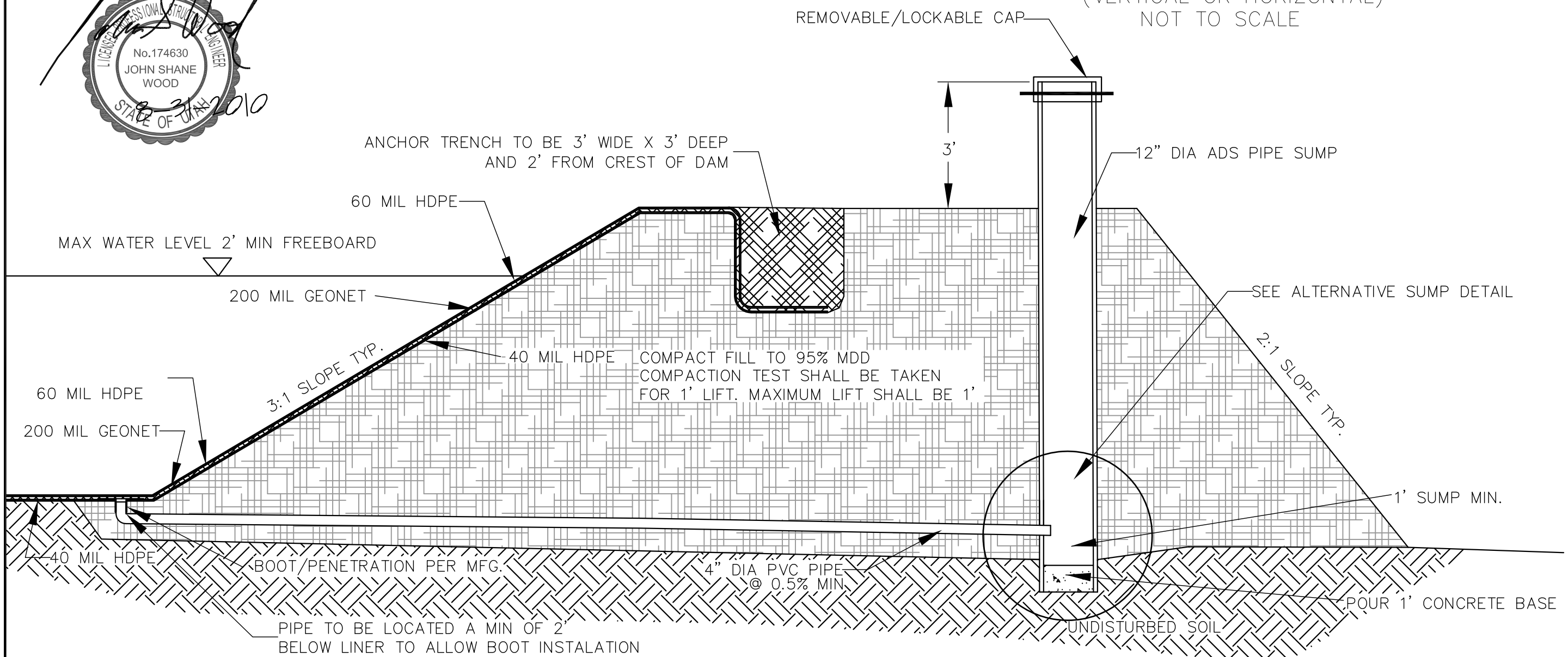
Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010



ALTERNATIVE SUMP DETAIL

(VERTICAL OR HORIZONTAL)
NOT TO SCALE



LEAK DETECTION DETAIL

(VERTICAL OR HORIZONTAL)
NOT TO SCALE

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM&extended pond 1 added alt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

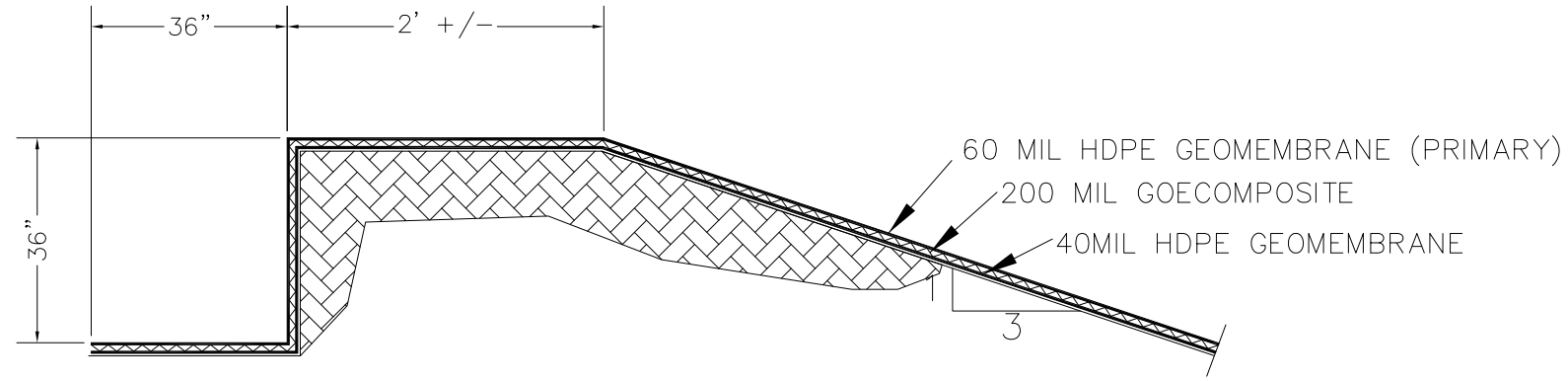
DRAWN BY: JSW
QC CHECKED BY:
APPROVED
PROFESSIONAL ENGINEER
DATE

PROJECT: DISPPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
DETAIL SHEET 1

Attachment 13

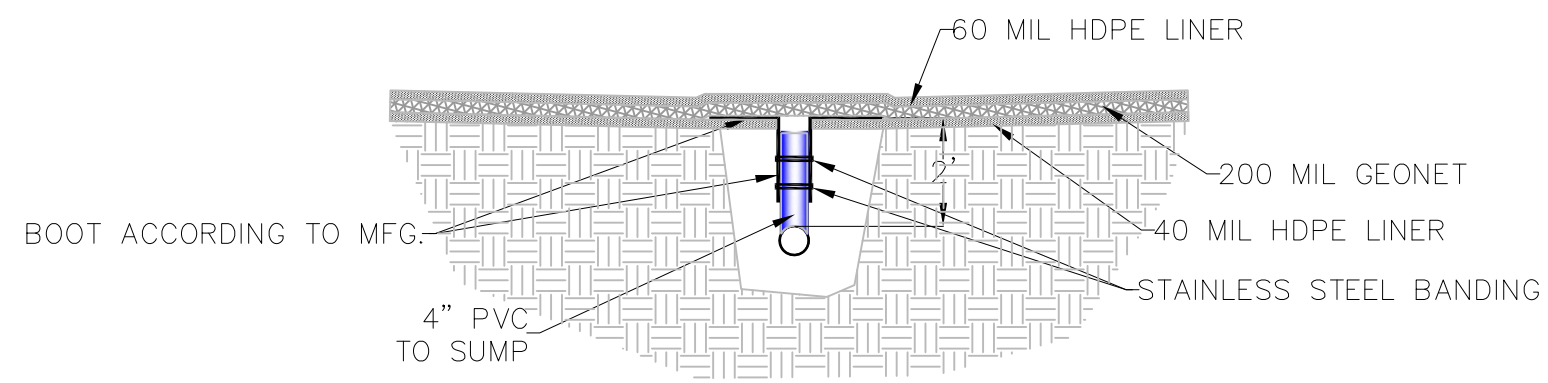
INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH

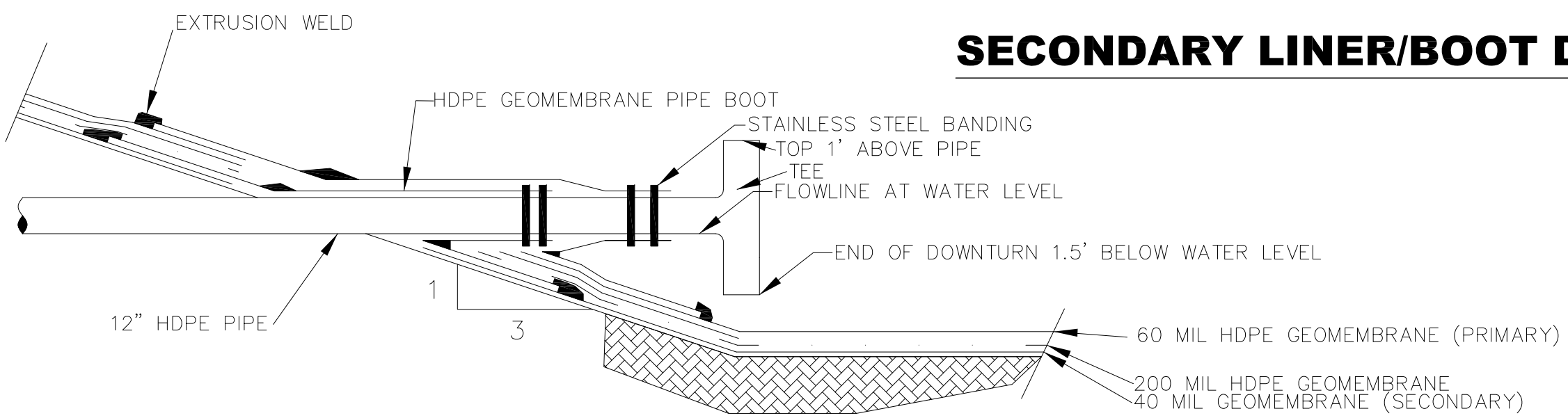


TYPICAL ANCHOR TRENCH (3:1 SLOPE)

(DOUBLE LINER W/DRAINAGE LAYER & CUSHION GEOTEXTILE)
NOT TO SCALE



SECONDARY LINER/BOOT DETAIL



OUTLET PIPE PENETRATION

NOT TO SCALE

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM&extended pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S., STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

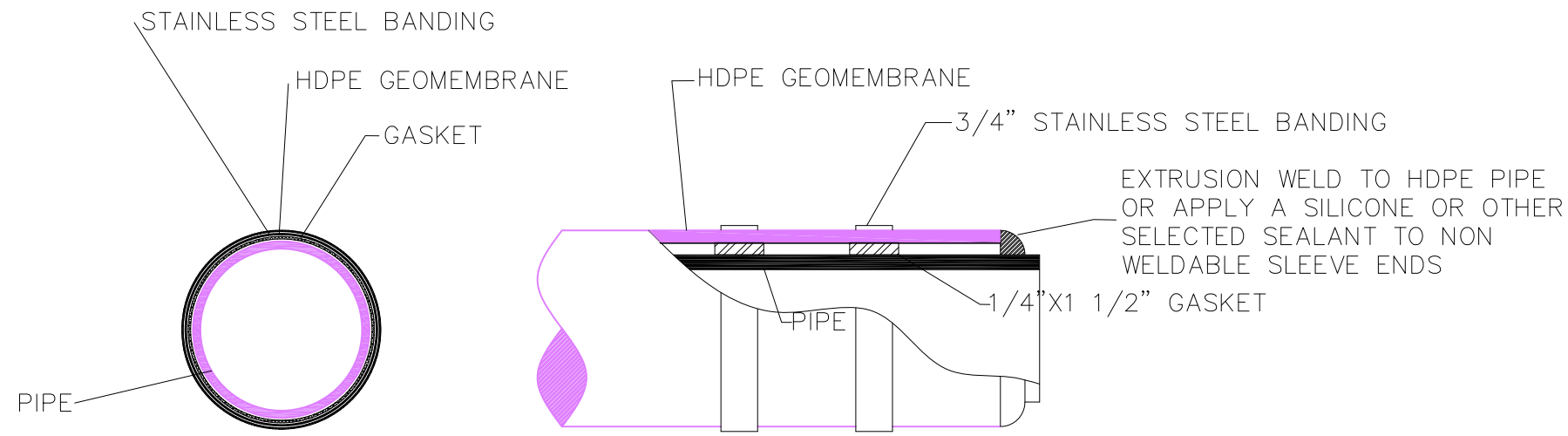
DRAWN BY JSW
QC CHECKED BY
DATE
APPROVED
PROFESSIONAL ENGINEER

PROJECT: DIPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
DETAIL SHEET 2

Attachment 14

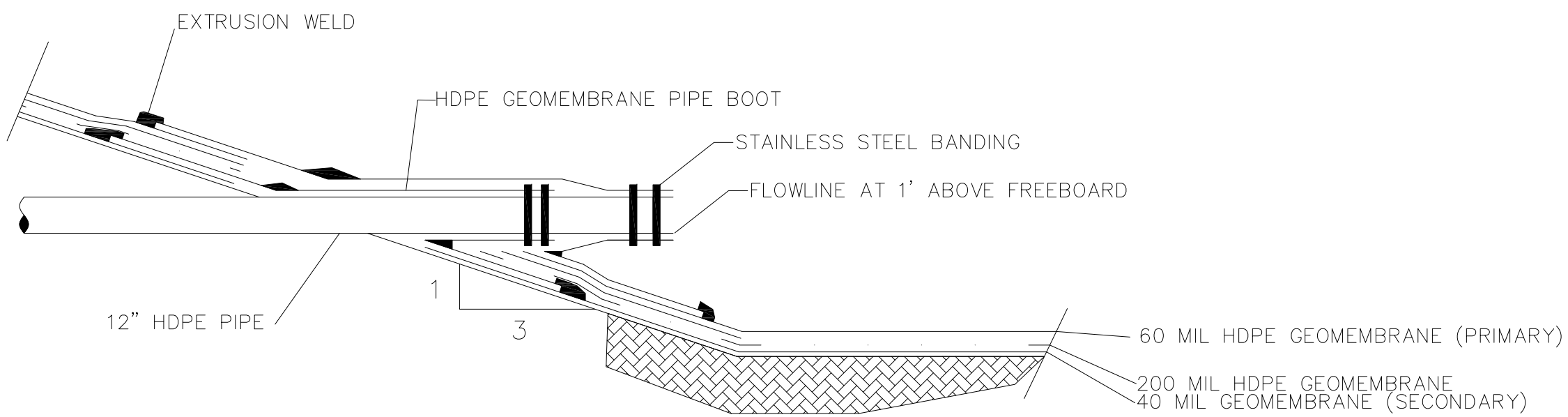
INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



PIPE PENETRATION SEAL

(VERTICAL OR HORIZONTAL)
NOT TO SCALE



INLET PIPE PENETRATION

NOT TO SCALE

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGMdecreased pond 1 added silt sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. I, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

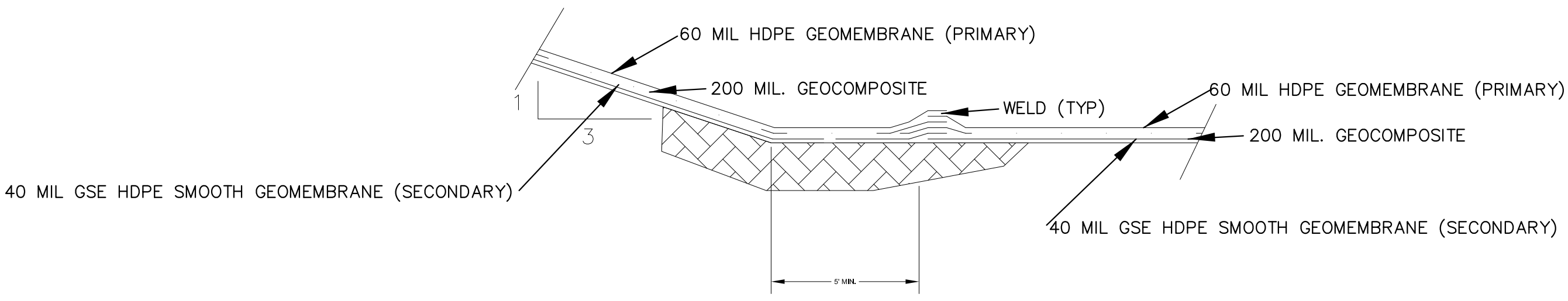
DRAWN BY JSW
QC CHECKED BY
APPROVED
PROFESSIONAL ENGINEER
DATE

PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
DETAIL SHEET 3

Attachment 15

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



TOE OF SLOPE TRANSITION (3:1 SLOPE)

(DOUBLE LINER W/DRAINAGE LAYER & CUSHION GEOTEXTILE)
NOT TO SCALE

LICENSED PROFESSIONAL CIVIL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
8-31-2010

No.	DATE	BY	REMARKS
1	8/31/10	JSW	Changes after site visit w/DOGM&extended pond 1 added alt. sump det.

REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

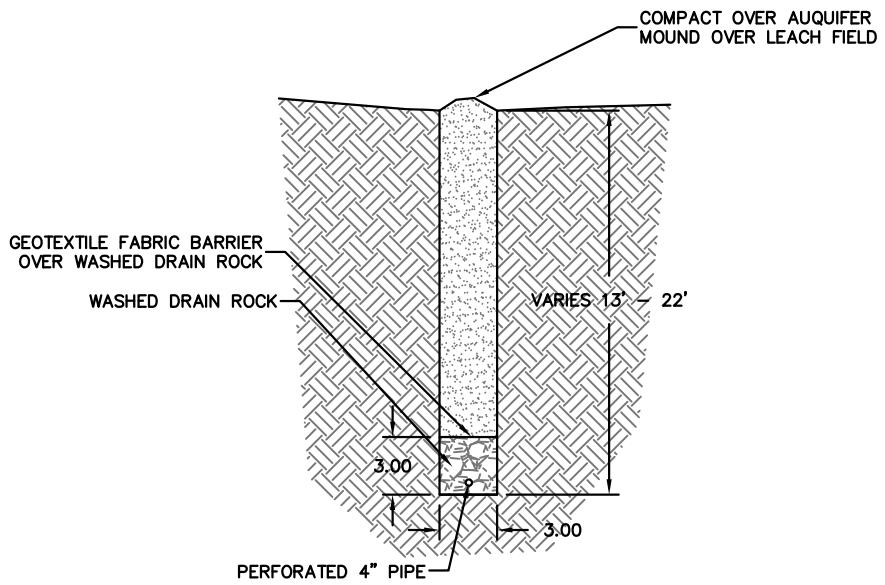
DRAWN BY JSW
QC CHECKED BY
APPROVED
PROFESSIONAL ENGINEER DATE

PROJECT: LAND FARM/CLEANUP
Integrated Water Management
PROJECT NUMBER
DETAIL SHEET 4

Attachment 16

INTEGRATED WATER MANAGEMENT
Bleazard Disposal Pits

Located in W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$, Section 30, T2S, R4W, USB&M
DUCHESNE COUNTY, UTAH



TRENCH DETAIL

NOTES

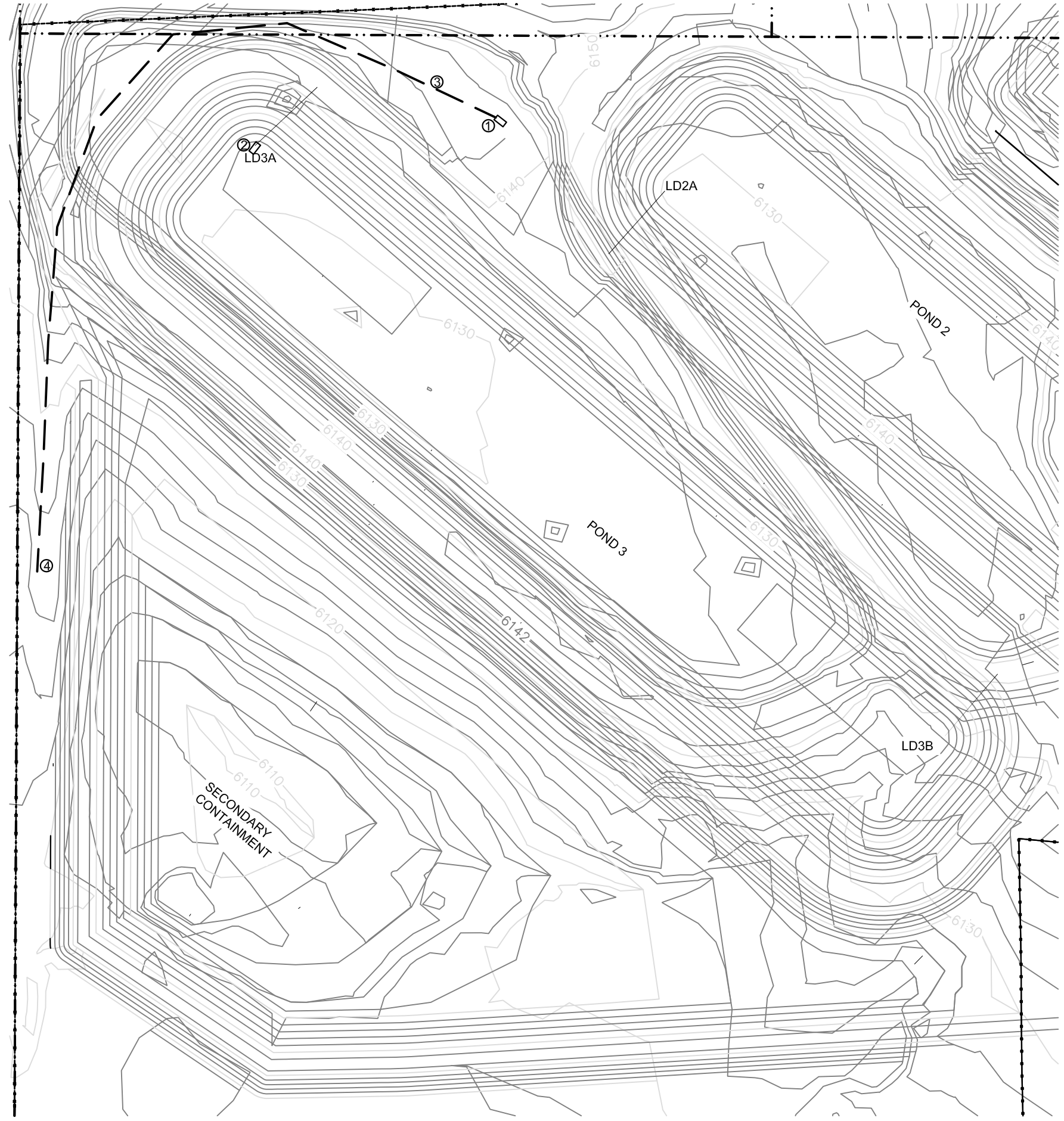
① TEST PIT 1 GROUND @ 6137.8, CURRENT BOTTOM @ 6125.2, FINISH EX @6119.2. END OF TRENCH.

② TEST PIT 2 CURRENT BOTTOM @ 6119.3. LOCATION OF LEAK DETECTION FOR POND 3.

③ 800 FEET OF 4" PERFORATED PIPE LAID @ -0.5% GRADE TO WEST. APPROXIMATELY 200-300 FEET IN AQUIFER. APPROXIMATELY 500-600 FEET IN LEACH FIELD. LENGTHS WILL BE DETERMINED AS THE EXCAVATION IS COMPLETED AND ADJUSTMENTS WILL BE MADE AS NEEDED. GRADE WILL BE @ 6117.0 AT TEST PIT 1 AND 6113.0 AT THE END OF THE SYSTEM.

④ INSTALL AN INSPECTION PORT SIMILAR TO THE LEAK DETECTION PORTS AS DESIGNED FOR THE PROJECT. THIS WILL CONSIST OF 12" ADS PIPE PERFORATED IN THE GRAVEL ZONE AND CAPPED.

LICENSED PROFESSIONAL STRUCTURAL ENGINEER
No.174630
JOHN SHANE WOOD
STATE OF UTAH
12/1/2010



No.	DATE	BY	REMARKS	REVISIONS

CIVCO Engineering, Inc.
1256 W. 400 S. STE. 1, P.O. Box 1758, Vernal, Utah 84078
Telephone: (435) 789-5448 Fax: (435) 789-4485

DRAWN BY JSW
QC CHECKED BY
APPROVED
PROFESSIONAL ENGINEER
DATE

PROJECT: DISPOSAL PONDS/LAND FARM
Integrated Water Management
PROJECT NUMBER
LAND DRAIN

SHEET No. 1 of 1

CIVCO Engineering, Inc.
Vernal, Utah

CIVCO Engineering, Inc.
Civil Engineering Consultants
PO Box 1758 * 1256 W 400 S, Suite 1
Vernal, Utah 84078

March 27, 2014

Attached are copies of plans, correspondence, compaction test, and liner tests for the Integrated Water Management ponds. I was present for many of the compaction tests that were performed and personally verified the results. I was not present for the liner tests but reviewed the results. However, I performed a visual inspection of the liners and seams, and noticed the locations of the tests and repairs made to the seams. I performed the final inspections for the ponds.

John S. Wood, SE

PROFESSIONAL STRUCTURAL ENGINEER
No. 174630
JOHN SHANE WOOD
STATE OF UTAH

Phone (435)789-5448 * Fax (435)789-4485
Email: civco@civcoengineering.com

CIVCO Engineering, Inc.
Civil Engineering Consultants
PO Box 1758 * 1256 W 400 S, Suite 1
Vernal, Utah 84078

May 25, 2011

RECEIVED
MAY 26 2011
DIV. OF OIL, GAS & MINING

Utah Division of Oil, Gas, and Mining
Attn: Lisha Cordova
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114

Lisha:

On May 17, 2011, I performed a final inspection for the facility at the Integrated Water Management facility located north of Duchesne, Utah. The construction is now complete and has been performed in accordance with the plans and specifications. All deficiencies have been addressed.

If you have any questions, please give me a phone call. Thank you.

John S. Wood, PSE

Phone (435)789-5448 * Fax (435)789-4485
Email: civco@civcoengineering.com

Attachment 19

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 11/8/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cut areas

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. X☐ 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
19	N dike elev 6111	Density	2038	1712	124.8	115.7	119.0		97.2
	N40.16.479 W110.22.447	Moisture	638	108	9.0	7.9	12.4		
20	N dike elev 6119	Density		1436	130.8	119.2	119.0		100.1
	N40.16.489 W110.22.434	Moisture		132	11.5	9.1	12.4		
21	N dike NE corner elev 6109	Density		1554	131.3	117.6	119.0		98.8
	N40.16.491 W110.22.410	Moisture		154	13.7	11.7	12.4		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By: Karl Lund Project Engineer

Attachment 20

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 11/9/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cut areas

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts — Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
22	N dike elev 6134	Density	2039	1674	127.6	116.5	119.0		97.9
	N40.16.479 W110.22.447	Moisture	639	134	11.2	9.5	12.4		
23	N dike elev 6123	Density		1629	129.3	117.3	119.0		98.6
	N40.16.465 W110.22.439	Moisture		151	12.1	10.2	12.4		
24	N dike elev 6122	Density		1640	129.6	117.1	119.0		98.4
	N40.16.487 W110.22.428	Moisture		169	12.9	10.7	12.4		
25	NE corner elev 6122	Density		1587	130.3	118	119.0		99.2
	N40.16.495 W110.22.423	Moisture		153	12.6	10.4	12.4		
26	E dike N end elev 6118	Density		1694	123.6	113.1	119.0		97.1
	N40.16.484 W110.22.400	Moisture		127	10.8	9.2	12.4		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By Karl Lund Project Engineer

Attachment 21

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 12/2/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐	6" D.T. ☐ 8" D.T. ☐		
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts — Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
32	W dike elev 6114	Density	2036	1482	132.1	121.1	124.6		97.2
	N40.16.374 W110.22.306	Moisture	639	95	10.4	9.1	9.6		
33	S dike elev 6115	Density		1411	133.6	124.0	124.6		99.5
	N40.16.375 W110.22.291	Moisture		79	8.6	7.8	9.6		
34	SW corner elev 6122	Density		1512	13	120.6	124.6		96.8
	N40.16.386 W110.22.282	Moisture		70	8.1	7.5	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks 11:00 AM

Tested By Karl Lund Project Engineer

Attachment 22

Q.C. Testing, Inc.
2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 12/2/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
35	W dike corner elev 6109	Density	2036	1401	134.7	123.6	124.6		99.2
	N40.16.374 W110.22.306	Moisture	639	95	11.2	9.0	9.6		
36	W dike tie into existing	Density		1418	134.3	123.0	124.6		98.7
	N40.16.377 W110.22.314	Moisture		98	11.4	9.2	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks 3:00 PM

Tested By: Karl Lund Project Engineer

Q.C. Testing, Inc.
2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 12/3/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐	6" D.T. ☐ 8" D.T. ☐		
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts

Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
37	S dike elev 6125	Density	2037	1584	131.0	120.7	124.6		96.9
	N40.16.384 W110.22.282	Moisture	638	89	9.8	8.5	9.6		
38	SW corner dike elev 6114	Density		1494	133.0	122.4	124.6		98.2
	N40.16.374 W110.22.296	Moisture		93	10.0	8.7	9.6		
39	W dike elev 6117	Density		1406	135.9	124.8	124.6		100.1
	N40.16.378 W110.22.313	Moisture		98	10.5	8.9	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By Karl Lund Project Engineer

Attachment 24

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 12/6/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
40	S dike elev 6107	Density	2039	1597	133.1	120.7	124.6		96.9
	N40.16.383 W110.22.283	Moisture	639	131	11.4	10.2	9.6		
41	S dike corner elev 6119	Density		1620	132.7	120.0	124.6		96.3
	N40.16.383 W110.22.296	Moisture		140	12.0	10.6	9.6		
42	W dike elev 6105	Density		1574	133.5	121.4	124.6		97.4
	N40.16.373 W110.22.296	Moisture		126	11.2	10	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By: Karl Lund Project Engineer

Q.C. Testing, Inc.
2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 12/7/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
43	W dike tie in to existing dike elev 6101	Density	2036	1434	133.5	122.4	124.6		98.2
	N40.16.379 W110.22.325	Moisture	638	112	10.5	9.1	9.6		
44	W dike W end elev 6107	Density		1421	134.7	123.0	124.6		98.7
	N40.16.376 W110.22.314	Moisture		120	11.1	9.5	9.6		
45	S dike SW corner elev 6106	Density		1409	135.2	123.4	124.6		99.0
	N40.16.376 W110.22.296	Moisture		123	11.2	9.6	9.6		
46	S dike center elev 6110	Density		1424	134.5	122.9	124.6		98.6
	N40.16.389 W110.22.280	Moisture		120	11.0	9.5	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By: Karl Lund Project Engineer

Q.C. Testing, Inc.
2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 12/8/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts — Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
47	S dike elev 6118	Density	2037	1431	133.0	122.0	124.6		97.9
	N40.16.398 W110.22.287	Moisture	637	109	10.4	9.0	9.6		
48	SW corner elev 6112	Density		1419	134.2	122.9	124.6		98.6
	N40.16.374 W110.22.309	Moisture		114	10.5	9.2	9.6		
49	W dike elev 6111	Density		1428	133.4	122.4	124.6		98.2
	N40.16.383 W110.22.328	Moisture		109	10.4	9	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By Karl Lund Project Engineer

Attachment 27

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 12/9/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐ 6" D.T. ☐ 8" D.T. ☐			
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
50	W dike elev 6120	Density	2037	1431	133.0	122.0	124.6		97.9
	N40.16.387 W110.22.233	Moisture	637	109	10.4	9.0	9.6		
51	W dike elev 6114	Density		1419	134.2	122.9	124.6		98.6
	N40.16.380 W110.22.230	Moisture		114	10.5	9.2	9.6		
52	SW corner elev 6111	Density		1428	133.4	122.4	124.6		98.2
	N40.16.375 W110.22.312	Moisture		109	10.4	9	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By: Karl Lund Project Engineer

Q.C. Testing, Inc.
2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name: Blue Bench Evaporation Ponds Date: 12/13/2010

Project Number: Pond #3 Charge ID:

Instrument Used and Number: TROXLER 3411-B Material Type: native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐	6" D.T. ☐ 8" D.T. ☐		
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
53	S dike elev 6120	Density	2039	1542	135.9	123.9	124.6		99.4
	N40.16.381 W110.22.286	Moisture	638	131	11.8	9.8	9.6		
54	S dike W corner elev 6136	Density		1565	134.5	123.5	124.6		99.0
	N40.16.378 W110.22.315	Moisture		120	11.4	9.0	9.6		
55	W dike elev 6125	Density		1594	133.2	122.7	124.6		98.5
	N40.16.382 W110.22.325	Moisture		111	9.9	8.5	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By: Karl Lund Project Engineer

Attachment 29

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 12/14/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐	6" D.T. ☐ 8" D.T. ☐		
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
56	S dike elev 6115	Density	2035	1457	134.6	122.2	124.6		98.1
	N40.16.382 W110.22.207	Moisture	637	138	12.7	10.1	9.6		
57	corner of S & W dike elev 6109	Density		1481	132.3	121.5	124.6		97.5
	N40.16.376 W110.22.297	Moisture		97	9.5	8.9	9.6		
58	W dike elev 6107	Density		1440	134.8	123.1	124.6		98.8
	N40.16.381 W110.22.3220	Moisture		122	10.9	9.5	9.6		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks

Tested By Karl Lund Project Engineer

Attachment 30

Q.C. Testing, Inc.

2550 W 500 N #2A
Vernal, UT 84078
(435) 789-0220

AASHTO T-238
AASHTO T-239
NUCLEAR MOISTURE - DENSITY DETERMINATION

Q. C. TESTING

Client: Hughes Construction

Project Name Blue Bench Evaporation Ponds Date 12/15/2010

Project Number Pond #3 Charge ID

Instrument Used and Number TROXLER 3411-B Material Type native fill from cuts

DENSITY		MOISTURE	
Back Scatter ☐ 2" D.T. 4" D.T. ☐	6" D.T. ☐ 8" D.T. ☐		
1	1	1	1
2	2	2	2
3	3	3	3
Total	Total	Total	Total
Average	Average	Average	Average

Day Average Standard Counts — Day Average Standard Counts

Test No.	Station Ft. Rt. or Lt. Of Line		Air Gap Read or Standard Counts	Direct Contact Reading	Wet Density Lbs. Ft.^{3}	Dry Density	Marshall or Proctor	T-99	% Comp
59	S dike elev 6116	Density	2041	1532	132.5	117.8	119.0		99.0
	N40.16.384 W110.22.283	Moisture	640	165	14.6	12.4	12.4		
60	W dike corner elev 6130	Density		1861	124.9	115.2	119.0		96.8
	N40.16.376 W110.22.314	Moisture		116	10.2	8.4	12.4		
61	W dike tie into existing dike	Density		1712	127.7	114.5	119.0		96.3
		Moisture		150	13.1	11.5	12.4		
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							
		Density							
		Moisture							

D.T = Direct Transmission

For Moisture: $\frac{\text{Contact Counts}}{\text{Standard Counts}}$ = Count Ratio

For Density Back Scatter or Depth Probe: _____ = Count Ratio

Remarks mixture of soils backfill

Tested By Karl Lund Project Engineer

COLORADO LINING INTERNATIONAL

CO:800.524.8672
TX: 888.546.4641
www.coloradolining.com

HDPE - HIGH DENSITY POLYETHYLENE

Polyethylene is the most commonly used liner in the industry due to its high strength, good chemical resistance, and proven track record. Polyethylene must be installed by certified technicians, but still manages to be a cost effective alternative.

Colorado Lining International is a certified installer of Polyethylene products. We maintain year roundfield crews capable of installing your next job. We want to work with you to make your job a success.

Product Features:

- Chemical Resistance
- Durable
- Cost Effective
- UV Stable
- Wide Product Range:
  - SMOOTH
  - TEXTURED
  - CONDUCTIVE
  - COLORS AVAILABLE
- Available In 20, 30, 40, 60, 80, & 100 Mils

Uses & Applications:

- Landfills
- Wastewater Treatment Plants
- Animal Waste Lagoons
- Golf Course Ponds
- Gas Collection Covers
- Pond & Lake Liners
- Irrigation Reservoirs

- ***Project Photo: Nevada Power in Las Vegas, NV***
- ***Overflow Pond Lining***
- ***43,875 SF 40 MIil HDPE***

COLORADO LINING INTERNATIONAL

HDPE
Product Data Sheet

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.)	D5199	nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density mg/l (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,00 lb
Tensile Properties *(1)* (min. ave.) • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	 63 lb/in. 114 lb/in. 12% 700%	 84 lb/in. 152 lb/in. 12% 700%	 105 lb/in. 190 lb/in. 12% 700%	 126 lb/in. 228 lb/in. 12% 700%	 168 lb/in. 304 lb/in. 12% 700%	 210 lb/in. 380 lb/in. 12% 700%	 252 lb/in. 456 lb/in. 12% 700%	20,000 lb
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	54 lb	72 lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	200,000 lb
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	GM 11 D 3895 D 5885	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.
(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

GeoStrata

Attachment 33

March 26, 2014

Alarik Myrin
HC 65 Box 30
Altamont, UT 84001

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Mr. & Mrs. Myrin:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 34

March 26, 2014

Lois Bleazard, Trustee
PO Box 510033
Mountain Home, UT 84051

Subject: **Notice of Intent – Exploration and Production Waste Landfill Permit Application**

Dear Mrs. Bleazard:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 35

March 26, 2014

Jerry E Craypser
84 East House Mountain Drive
Cottonwood, AZ 86326

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Mr. Craypser:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 36

March 26, 2014

Brent Farnsworth
PO Box 153
Duchesne, UT 84021

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Mr. Farnsworth:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 37

March 26, 2014

William A. Robinson, M.D.
243 South Escondido Blvd. #518
Escondido, CA 92025

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Dr. Robinson:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 38

March 26, 2014

El Paso Production
PO Box 4372
Houston, TX 77210

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Sirs:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 39

March 26, 2014

Jamie Trujillo
2659 South 8900 West
Magna, UT 84044

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Jamie:
:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 40

March 26, 2014

Julie Perez
4502 South Toulouse Circle
West Valley City, UT 84120

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Ms Perez:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 41

March 26, 2014

J. Christman, Trustee
146 Avenida Cota
San Clemente, CA 92672

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Sirs:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 42

March 26, 2014

Antonio Gandara, Jr Trustee
14808 E. Sabine Drive
La Mirada,CA 90638

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Mr. Gandara:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM

GeoStrata

Attachment 43

March 26, 2014

Duchesne/Wasatch Blue Bench Landfill
PO Box 356
Duchesne, UT 84021

Subject: Notice of Intent – Exploration and Production Waste Landfill Permit Application

Dear Sirs:

This letter is to inform you Integrated Water Management has applied for a permit to operate an Exploration and Production Waste Landfill at their Duchesne facility located approximately 7 miles north of Duchesne, Utah. You are receiving this letter of notification because your property is located within 1000 feet of the proposed landfill as required by Utah Regulation R315-310-3(2)(a)(ii). The landfill cell, which is in the process of being permitted, will be regulated by the Utah Division of Solid and Hazardous Waste (UDSHW).

Integrated Water Management (IWM) currently operates a production water disposal facility on the Industrial Zoned property located at 20250 W 2000 S Duchesne, Utah which occupies the SE1/4 of the SE1/4 of Section 30, Township 2 South, Range 4 West of the Uintah Baseline and Meridian. The application for a permit to operate a solid waste landfill under the UDSHW is in addition to its currently permitted operations to dispose production water under the Utah Division of Oil Gas and Mining (which was originally permitted in the 1970's and operated by a pervious owner).

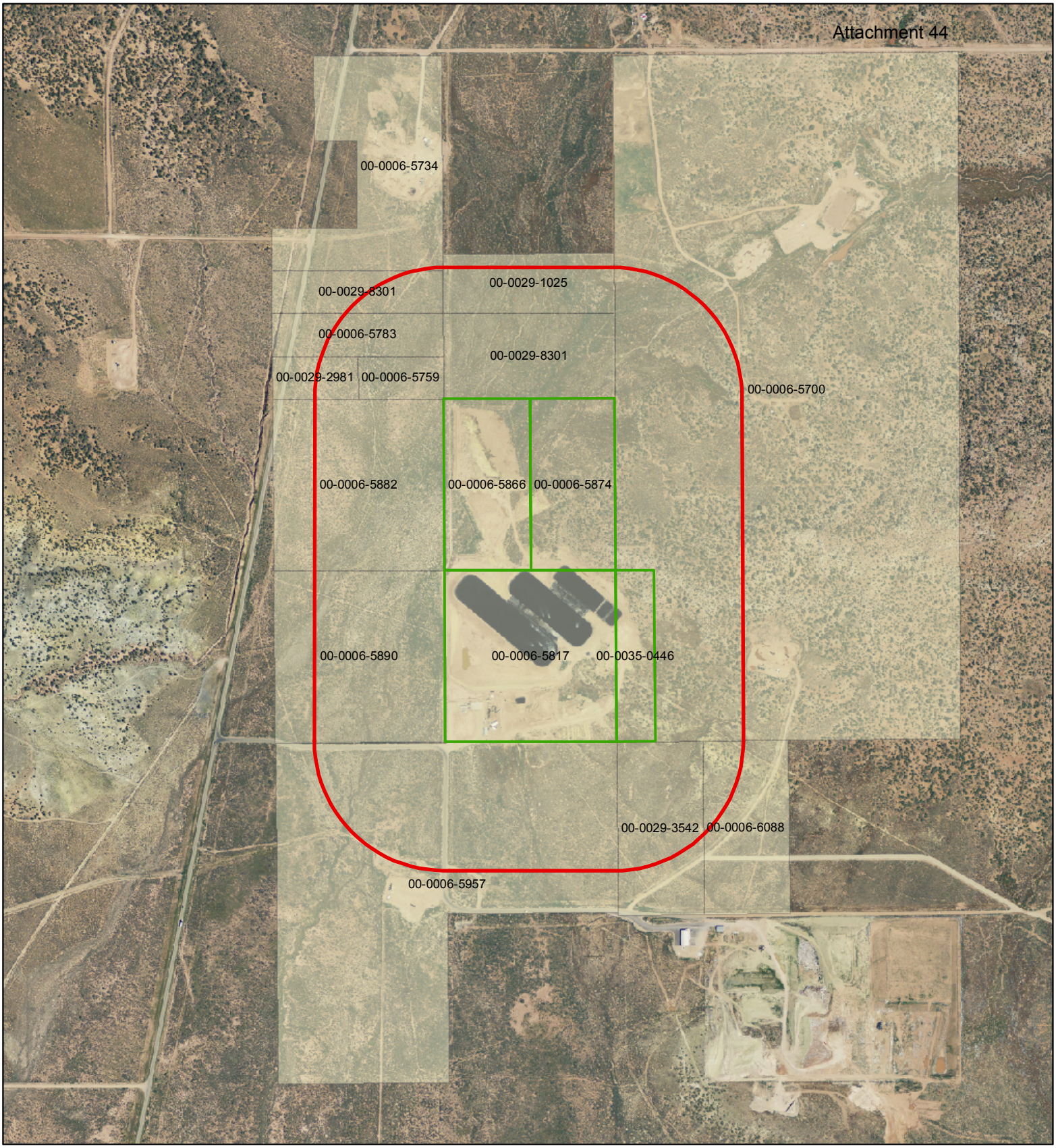
The landfill will occupy the current location of one of the existing water disposal evaporation ponds. No new construction of roadways or disposal pits will be necessary to operate this landfill. The solid waste landfill will be utilized for the permanent disposal of oil and gas production and exploration solid wastes meeting the definition of RCRA-Exempt, Exploration and Production (E&P) Waste (no household waste accepted). This change of use is being done in an ongoing "Good Neighbor" effort to reduce the impact of the evaporation ponds. The ponds were a source of an odor nuisance to the area. IWM has also decommissioned the other large evaporation pond at the facility in this same effort.

After IWM submits their application to operate an E&P landfill to the UDSHW, a draft permit will be prepared by the division and a 30 day comment period will follow which you may participate in. The division will also send you a letter with information on how to make a request to be placed on a list to receive public information in relation to this proposed landfill facility.

Respectfully

Mike Vorkink, P.G. GeoStrata

J.T. Martin, D.F.G. IWM



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GeoStrata

Copyright GeoStrata, 2014

Legend

- IWM Parcel
- 1000 ft Buffer
- Parcels within 1000 ft of IWM Facility

Intergrated Water Management
Landfill Permit Application
Project Number: 751-013

Property Owners within 1000 ft

Plate 1

GeoStrata Engineering & Geosciences
14425 South Center Point Way Bluffdale, Utah 84065 ~ T: (801) 501-0583 ~ F: (801) 501-0584

April 25, 2014

Utah Department of Environmental Quality
c/o Mr. Scott T. Anderson, Director
Division of Solid and Hazardous Waste
195 North 1950 West
Salt Lake City, Utah 84114-4880

Subject: Integrated Water Management Exploration and Production Waste Landfill

Mr. Anderson,

In your review letter dated April 8, 2014, you state the following: " 7.0 The permit application did not contain engineered and stamped quality control and quality assurance documents from the construction of the impoundment and liner systems." We have made efforts to obtain and provide these documents, however, as we have verbally communicated to you we were not present at the site during construction and the parties that were involved have little to no data to support the work performed.

This letter is written to provide information about work that our company performed assessing the integrity of the embankment. GeoStrata performed a geotechnical investigation of the pond embankments, the field work was completed on July 25, 2013. The work consisted of boring into the embankment using hollow stem augers. Total depths of the borings ranged from 16 to 48.5 feet below existing site grade. The borings were completed using a hollow stem auger system and sampling was completed using split spoon and modified California samplers. Results of our investigation and details of the testing and engineering analysis performed were presented in a final report that was attached to the permit application.

Based on our investigation, it is our opinion that the embankments are suitable for the proposed use of a landfill cell. We consider the embankments to be stable and meet the current engineering standards, the embankments have been used to contain produced water. We consider the Loads associated with a landfill use to be less than its current usage.

Please contact us if you have any questions about the geotechnical work completed at the site.

Sincerely
GeoStrata

REGISTERED PROFESSIONAL ENGINEER
04/25/14
HIRAM ALBA
175774
STATE OF UTAH

Hiram Alba, PE
Principal Engineer

Copyright © 2014 GeoStrata

INTEGRATED
WATER MANAGEMENT & LAND FARM

April 24, 2014

Scott T. Anderson, Director
Division of Solid and Hazardous Waste
195 North 950 West
Salt Lake City, UT 84114

Dear Director Anderson,

Integrated Water Management (IWM) has and is working diligently and utilizing every available resource to address and answer the comments that were generated from the Division's review of IWM's application for an Exploration and Production (E&P) Landfill permit. We have submitted documentation, explanations and made changes to the documents verbiage/descriptions as requested. We have been able to obtain the QC documents on compaction results that had previously been allusive or otherwise not available by complications put in our way from the General Contractor who installed the ponds. We are drilling an additional two monitoring wells as requested by your staff to provide sufficient groundwater data coverage.

Each comment has been addressed with the exception of being able to obtain a full QA/QC report of the installation of the HDPE liners. We have been able to locate most of the original HDPE liner notations from the air seam and welds tests, which show they were satisfactory and passed (see enclosed photos). The company that installed the liner and preformed the QC testing unfortunately did not retain the records and documentation. It had been our understanding that DOGM, which oversaw the construction and completion of the ponds, would have maintained the records of the QC test results. All has agreed; DOGM (which accepted and granted license to operate the ponds) and other onsite staff which were present during the installation of the liners, that all QC/QA, were performed and passed. Further; the Division has been given a stamped letter from the Civil Engineer who designed the cells and was involved at every step, certifying the pond containments and liners were build as designed and passed a QC/QA inspection.

In my opinion the Division of S&HW should be confidant the pond(s) did and do meet or exceed the standards set forth in the regulations. The Division should easily be able to defend its acceptance of the available data on the pond(s) as being complete, compliant and very suitable as E&P landfills cells. It is important to recognize the ponds have preformed flawlessly as designed and

have never and currently do not show any sign of leaking. From what I have been able to learn, the IWM E&P Landfill will be the only Landfill facility to have doubled HDPE lined cells and with a robust leak detection system. I believe the pond(s) will prove to "raise the bar" and be an example of "Best Practices" for E&P Landfills.

IWM has been diligent and forthcoming in our application. We have responded to each comment and request. Additionally, we recently put on staff a person who is recognized as an experienced professional of E&P Landfills to manage and operate our Solid Waste Facility. IWM has the reputation of operating a professional and compliant E&P waste stream operations with a dedicated and trusted team who understand the responsibility and long-term liability not only to the company, but also to the Producer and community, but also to the environment.

I again respectfully request, IWM be granted prior to the final permit, immediate authorization to construct as designed and prepare the cell with drainage material over the liner and permit us to temporarily accept "clean" watered based drilling muds to place a protective layer over the drainage material.

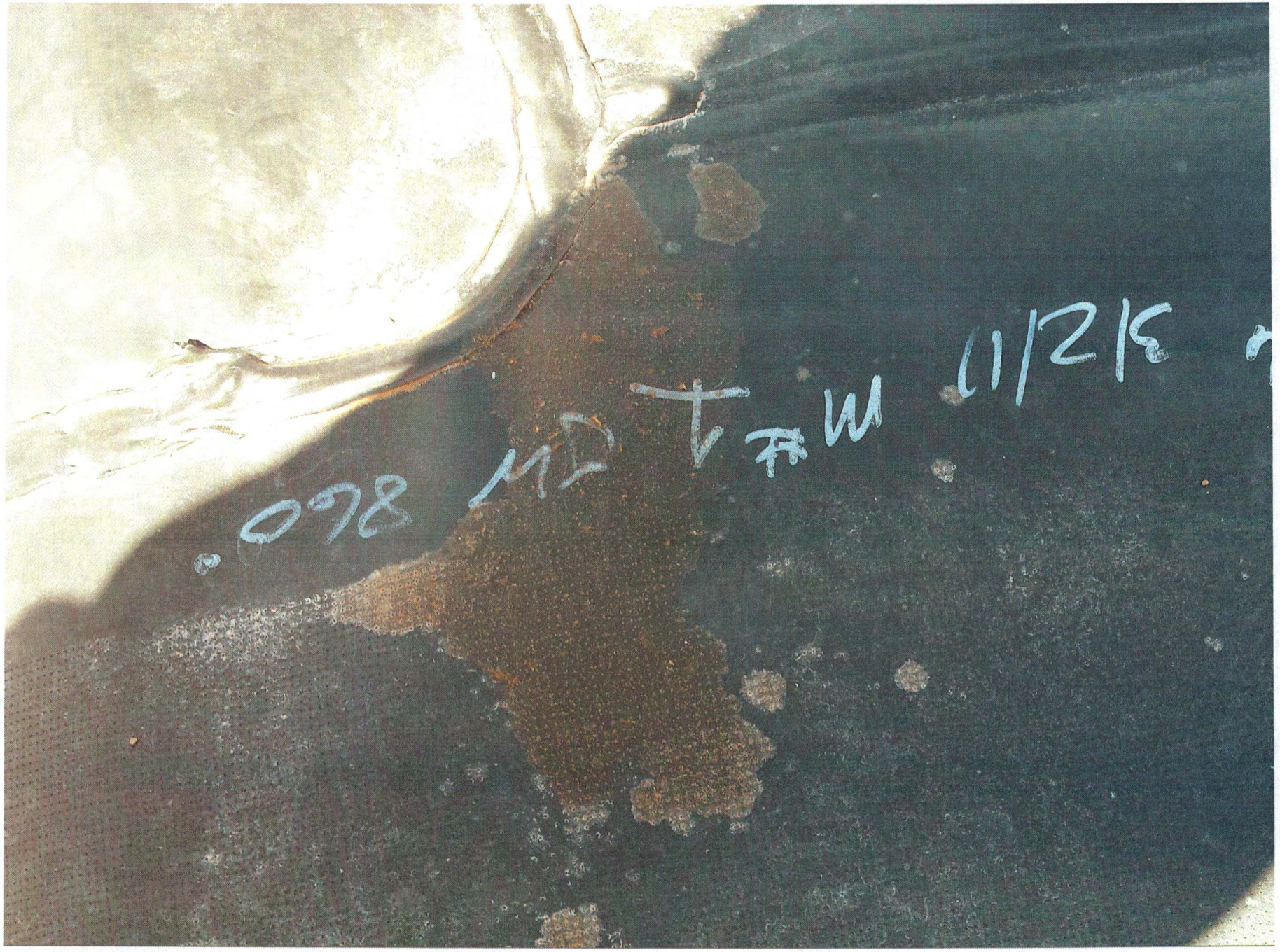
IWM's Solid Waste E&P Landfill will provide a much needed facility to properly dispose of drilling muds and other E&P waste streams. The pressures are great and the need is imminent for a facility in our region of the basin. Our location will help insure proper and secure storage of these waste stream materials and greatly help avoid damaging and illegal dumping.

Sincerely yours,

JT Martin, Managing Director

c: Michael Vorkink, GeoStrata
Doug Taylor, DS&HW
Allan Moore, DS&HW
Nate Robinson, Director IWM

U:20
SP:2 T821
JA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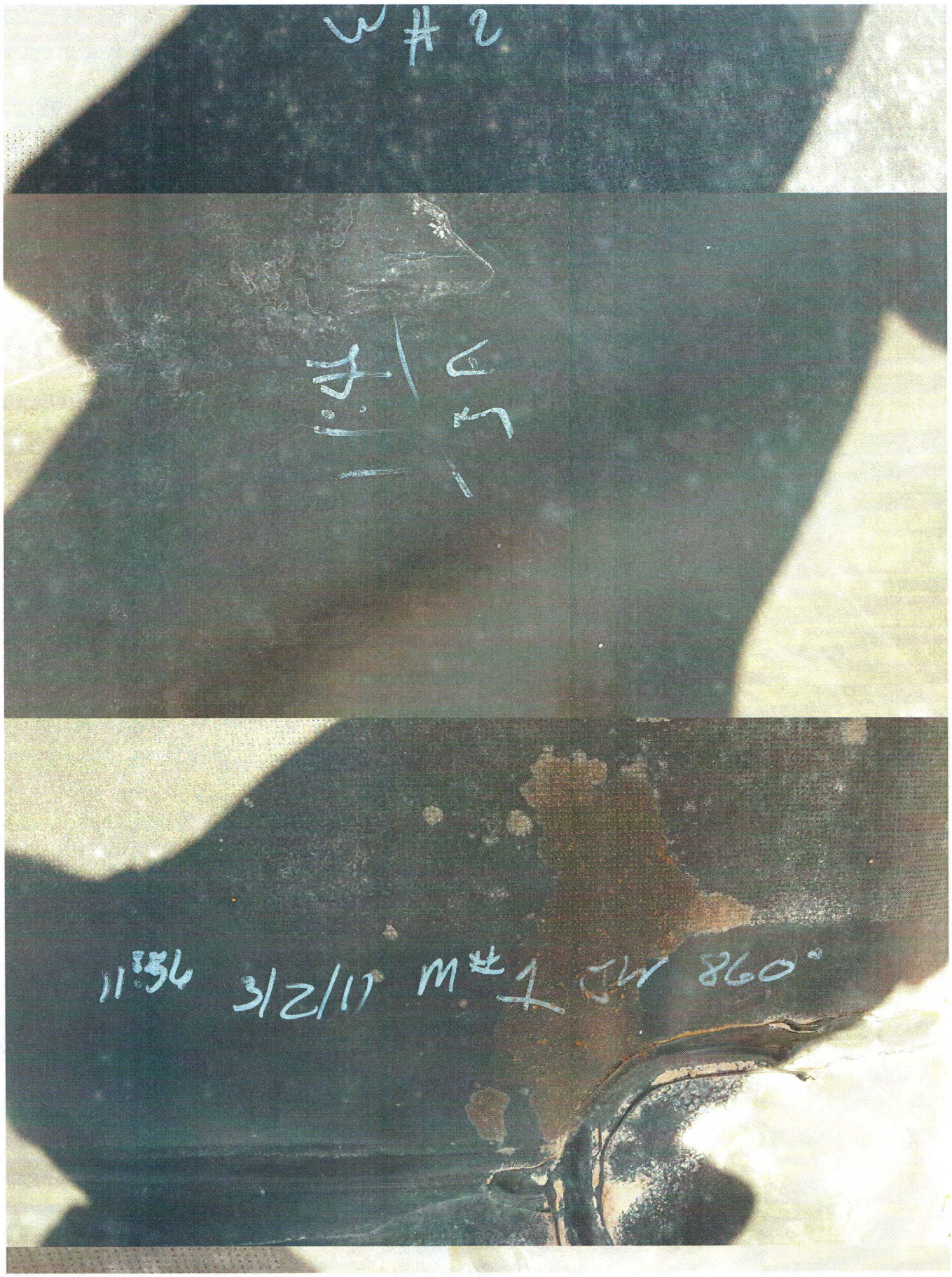
W#2
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1 ПЛК
5 ф6
1850
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10.00
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Site #5
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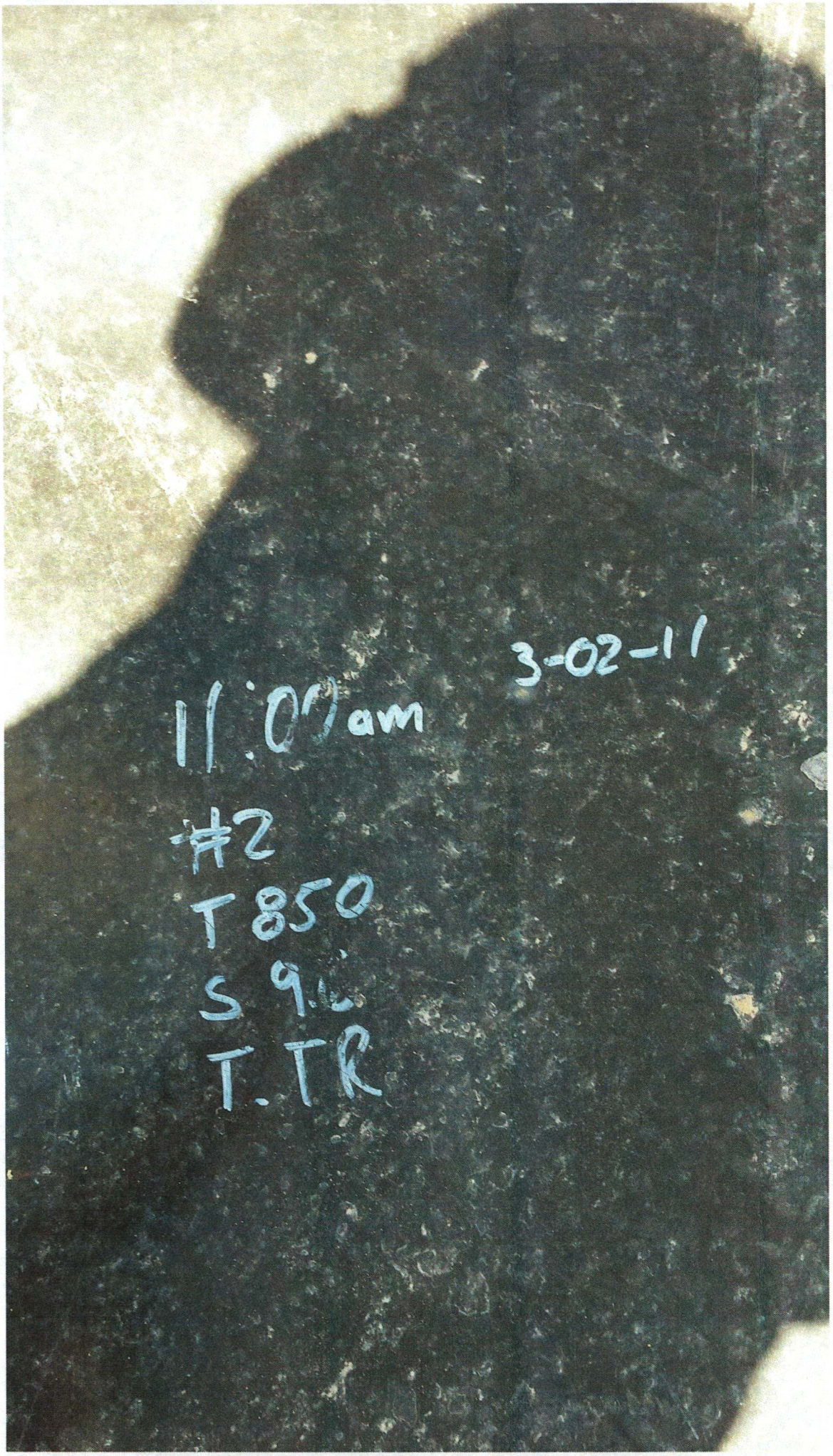
Foundation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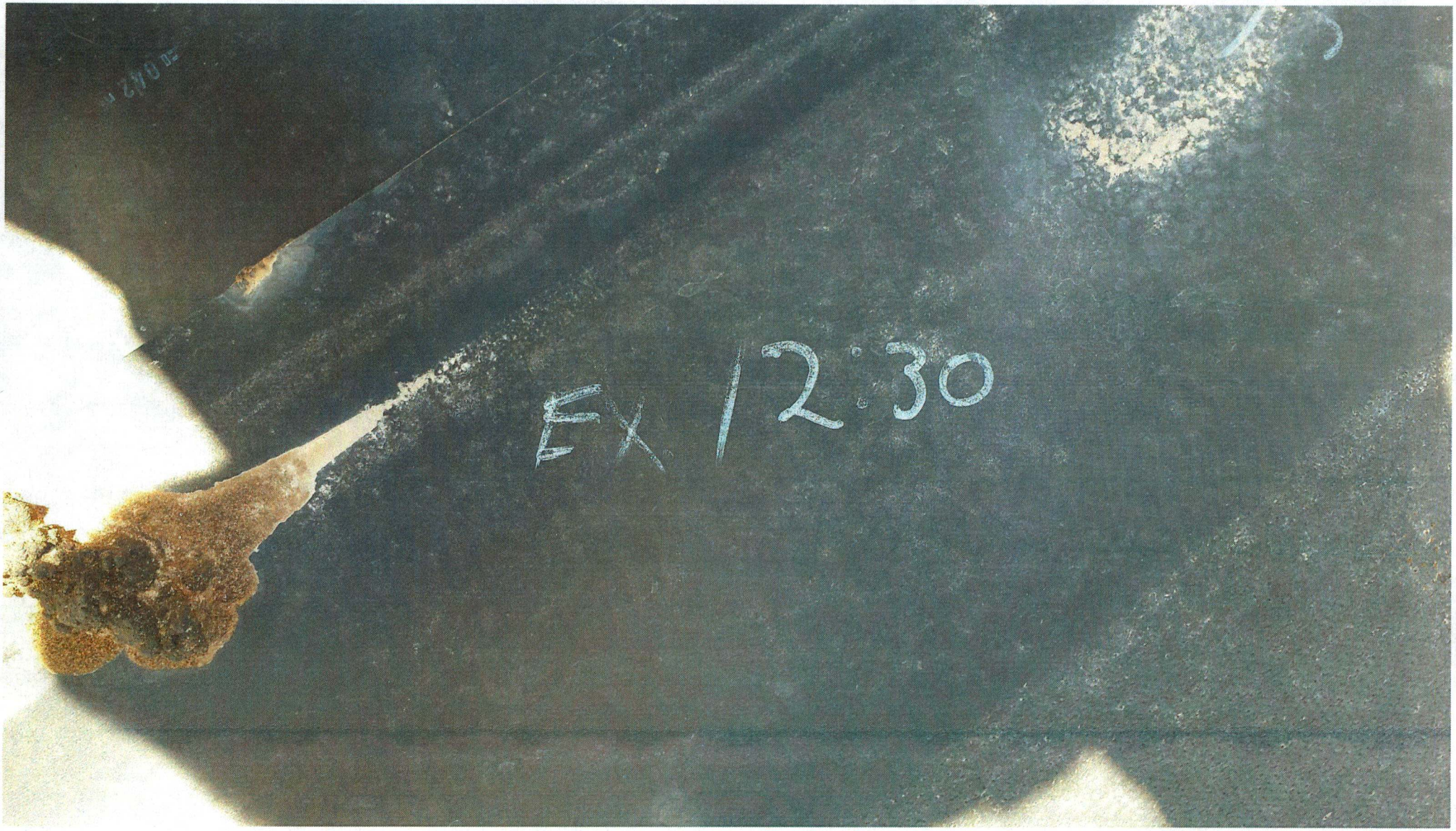
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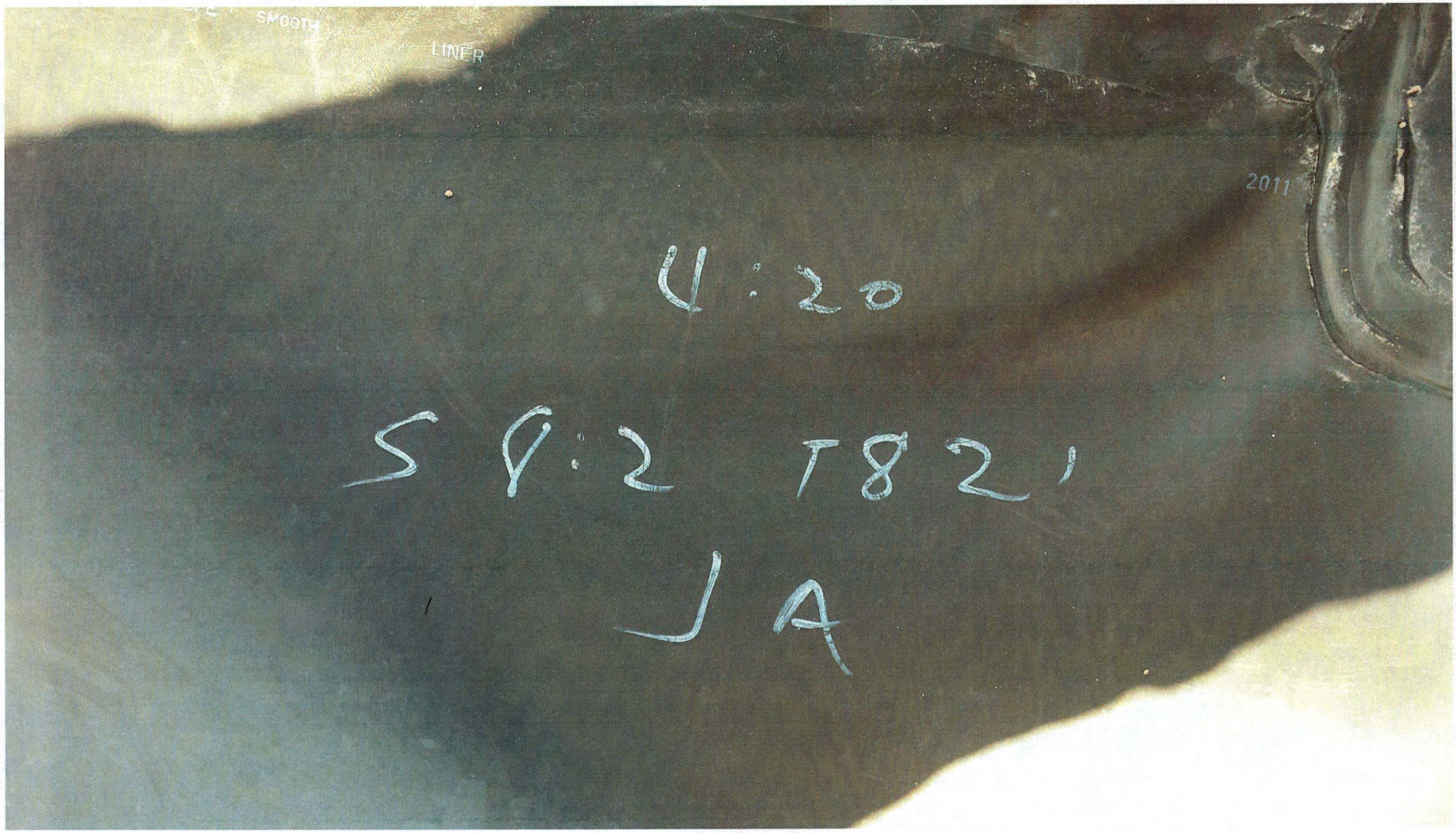
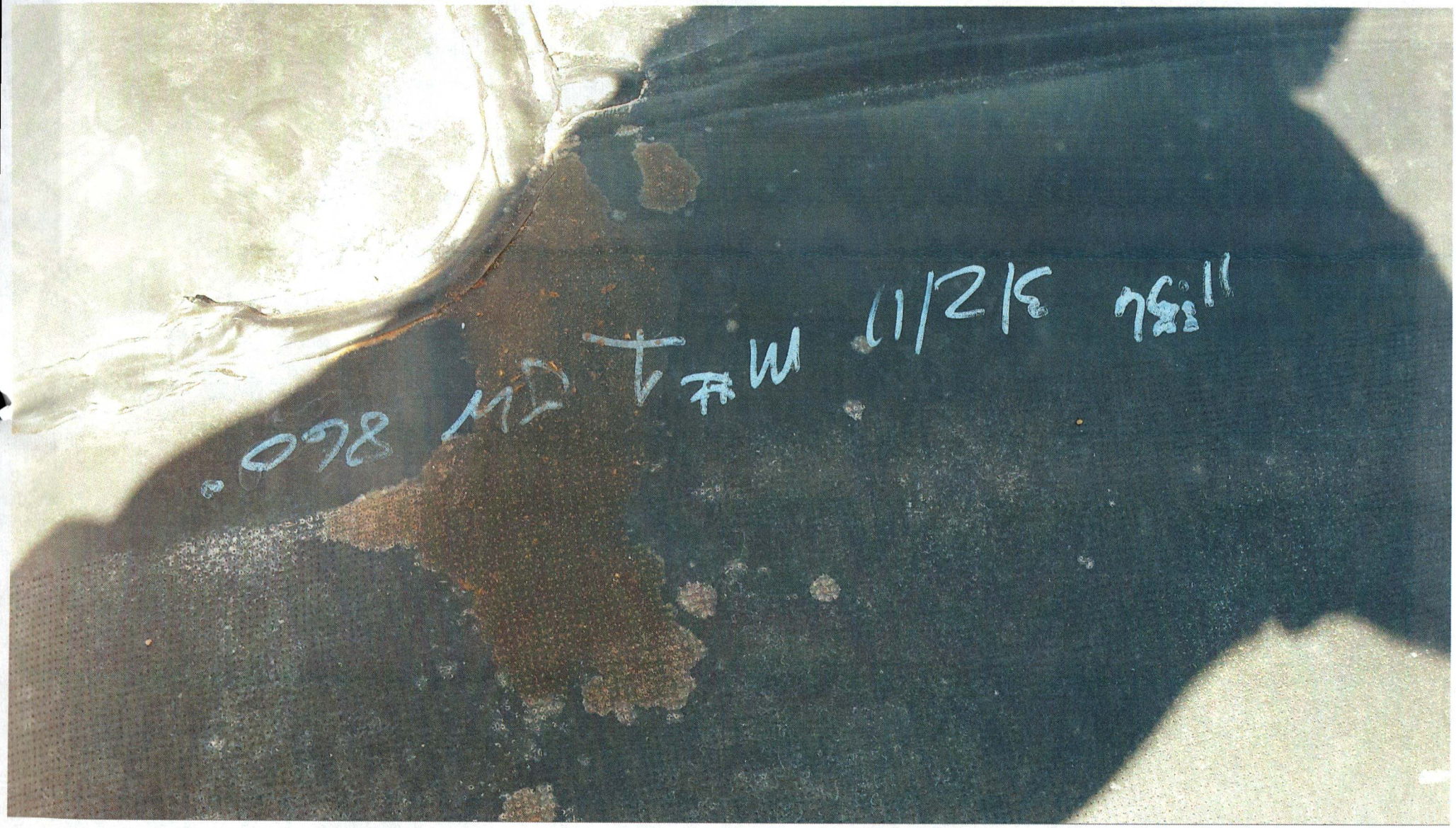
W 11:50
12:15 3.03
नं 2
T 850
S 10.5
T T.R


SMOOTH
LINER
2011
4:20
S 9:2 T82'
JA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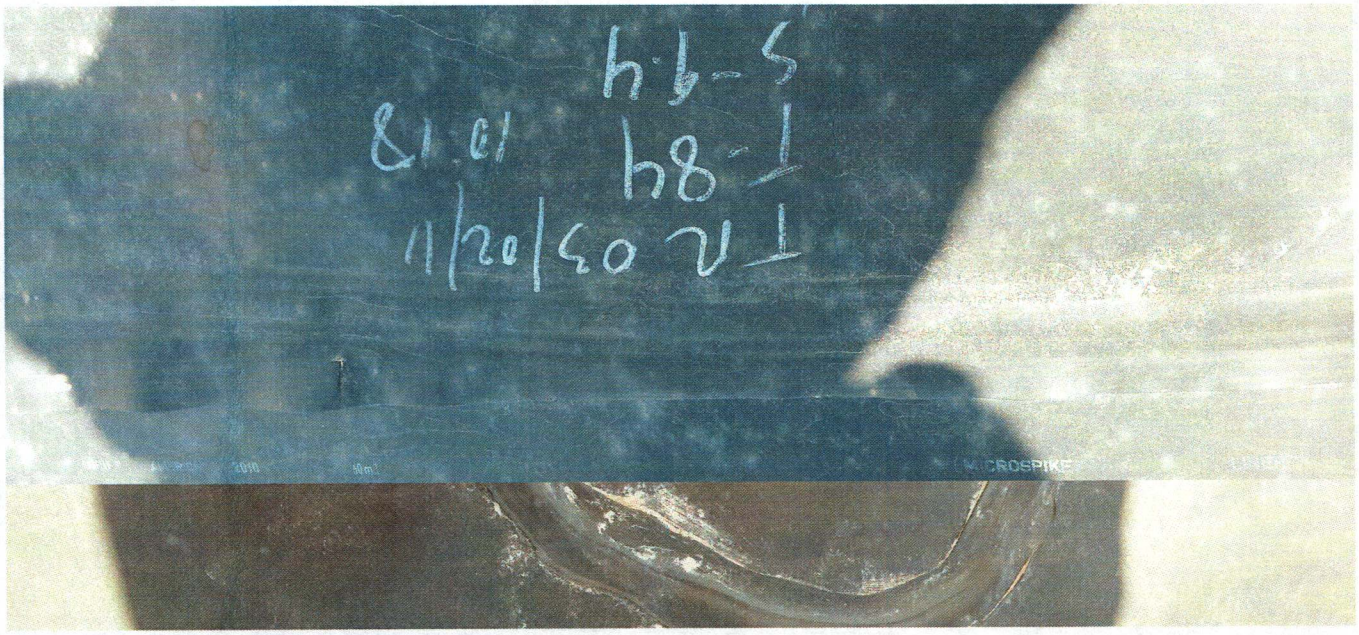
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MICROSPIKE

APPENDIX J

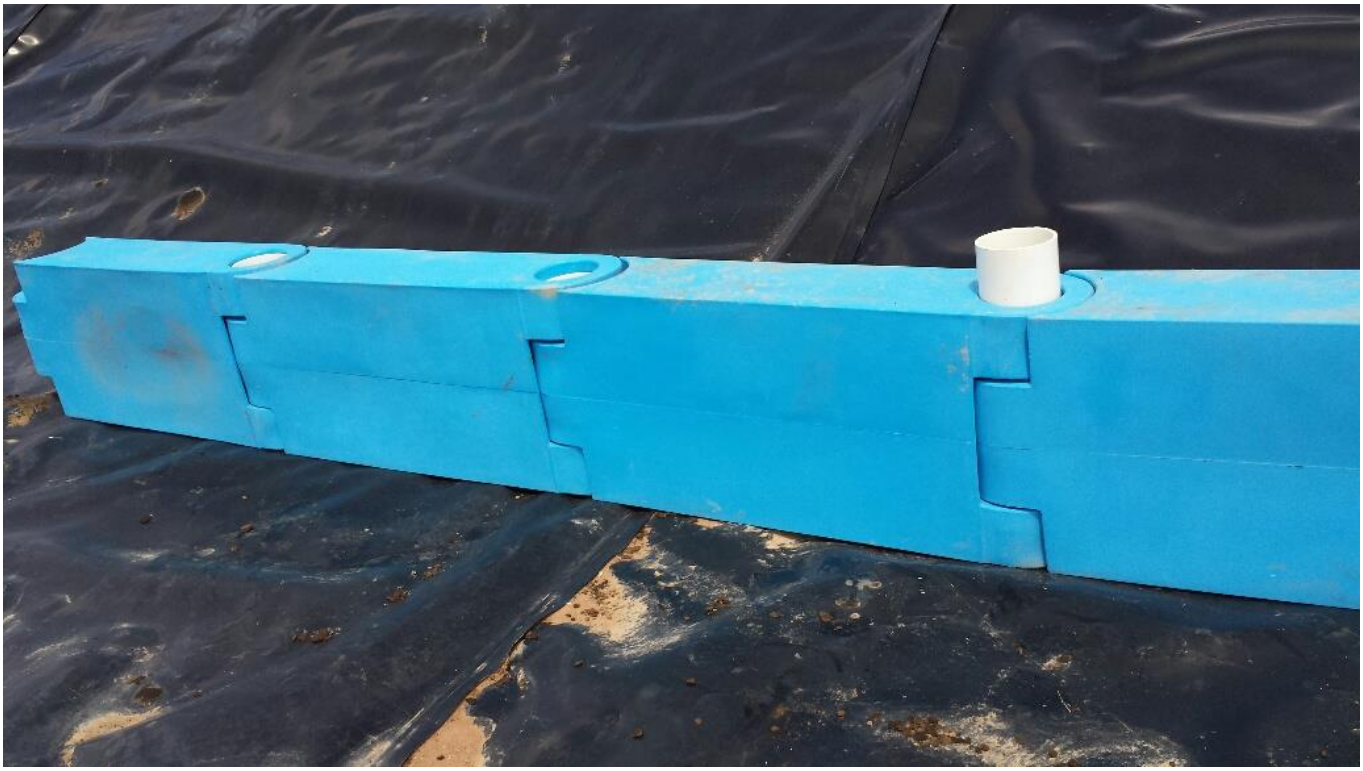

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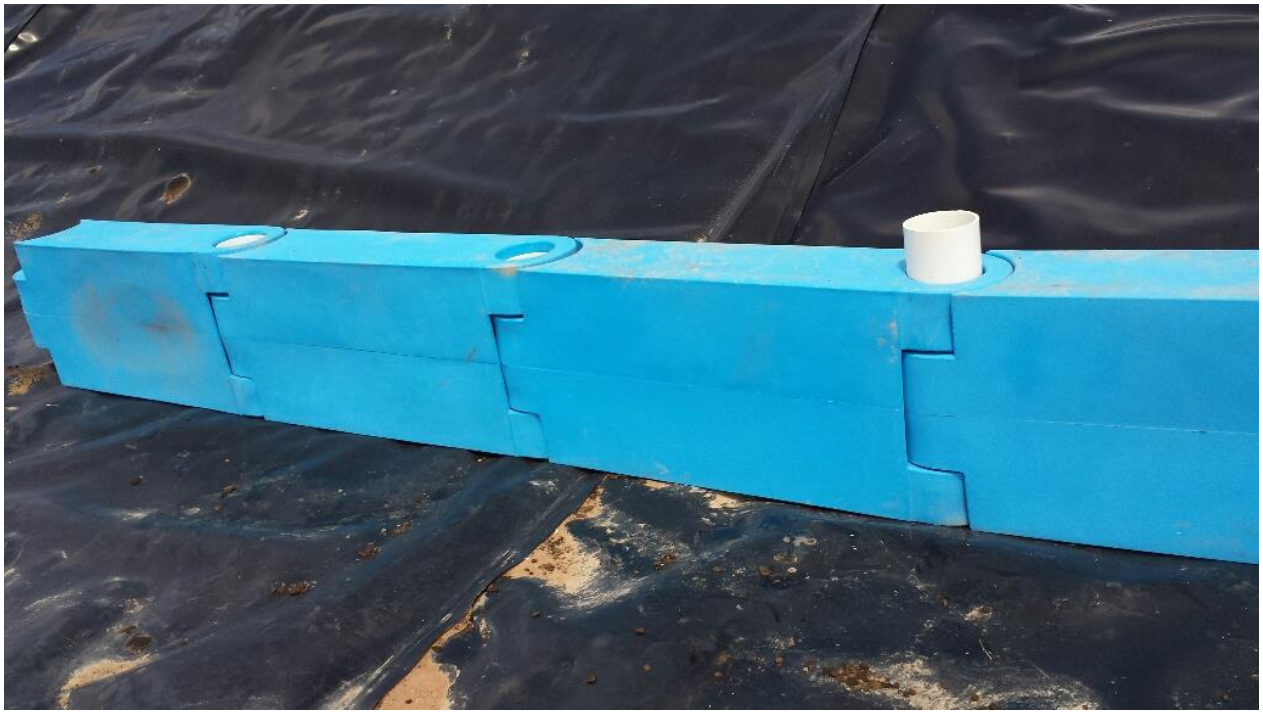
Plate J-1



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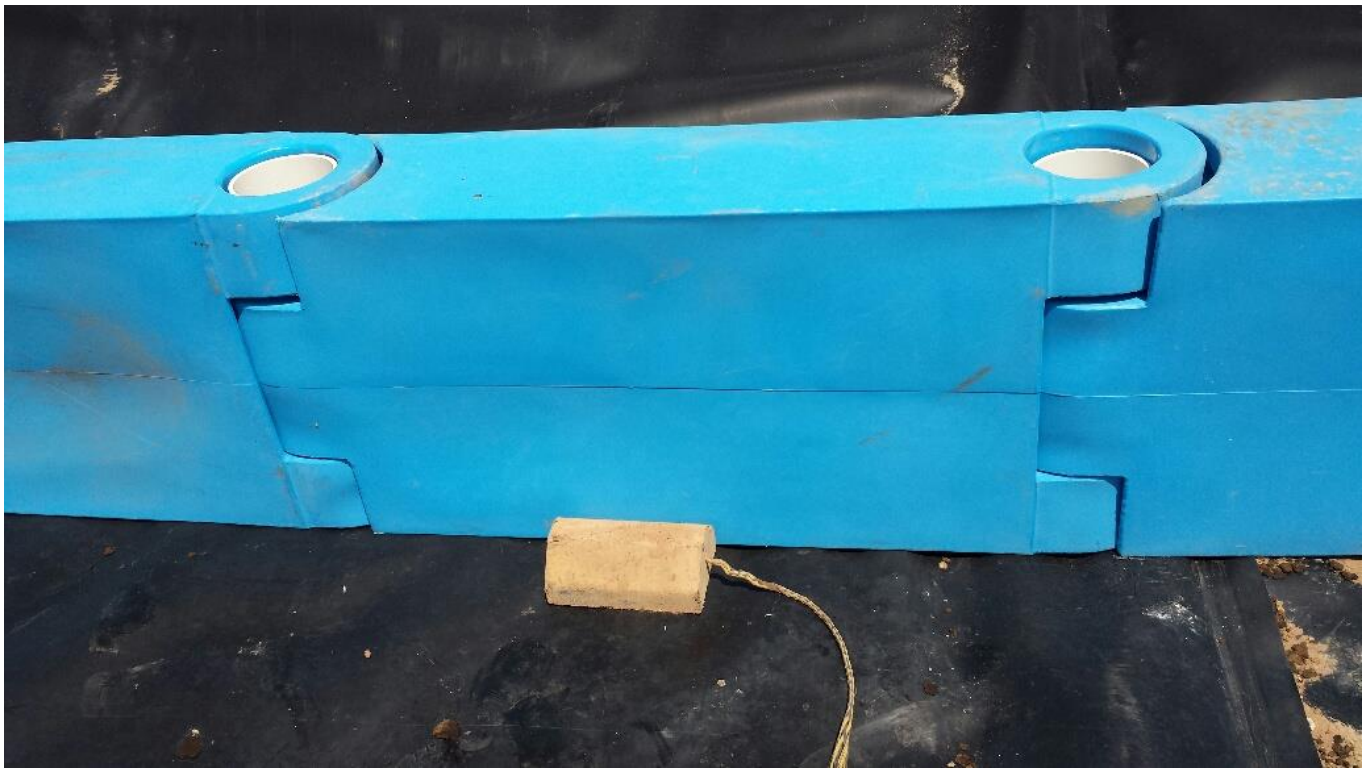

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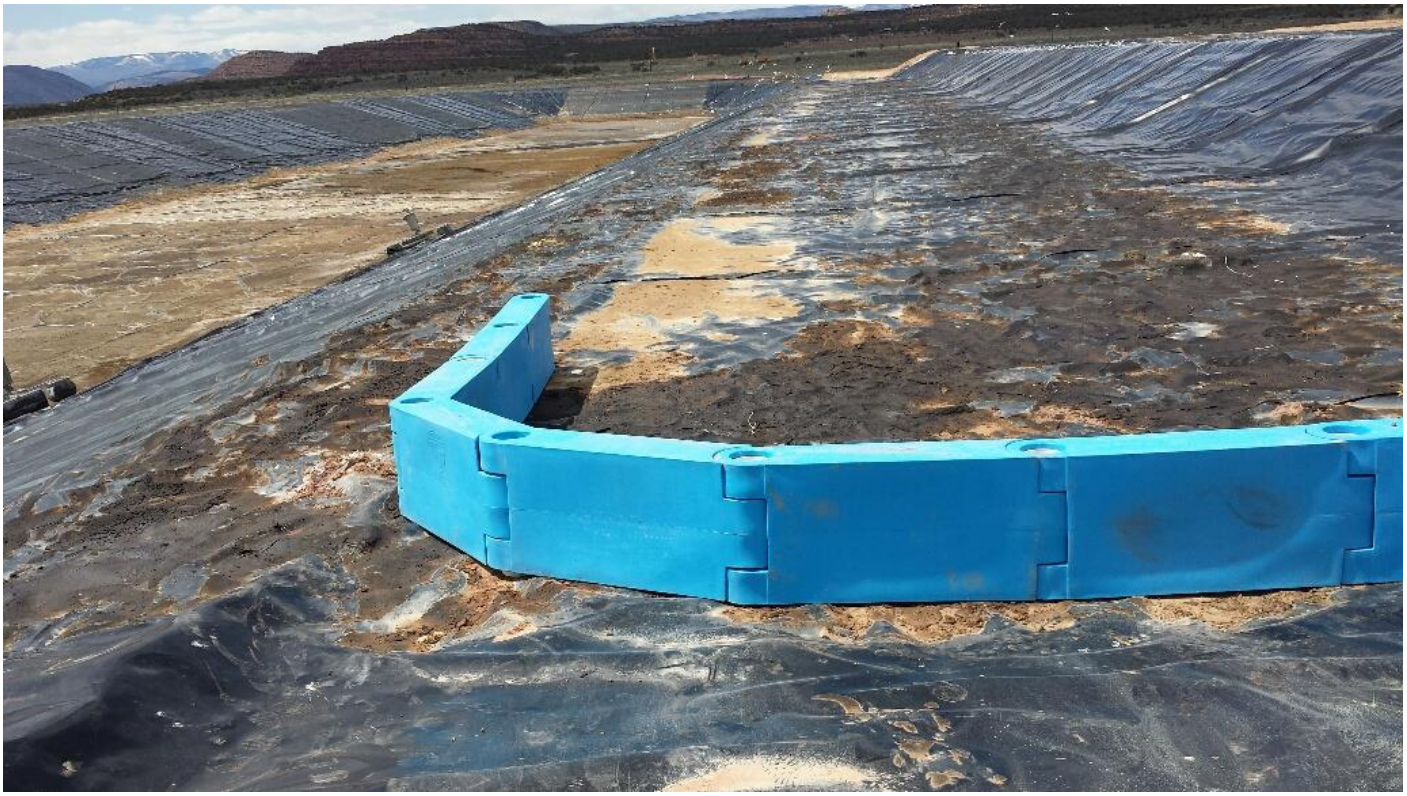
Plate J-5



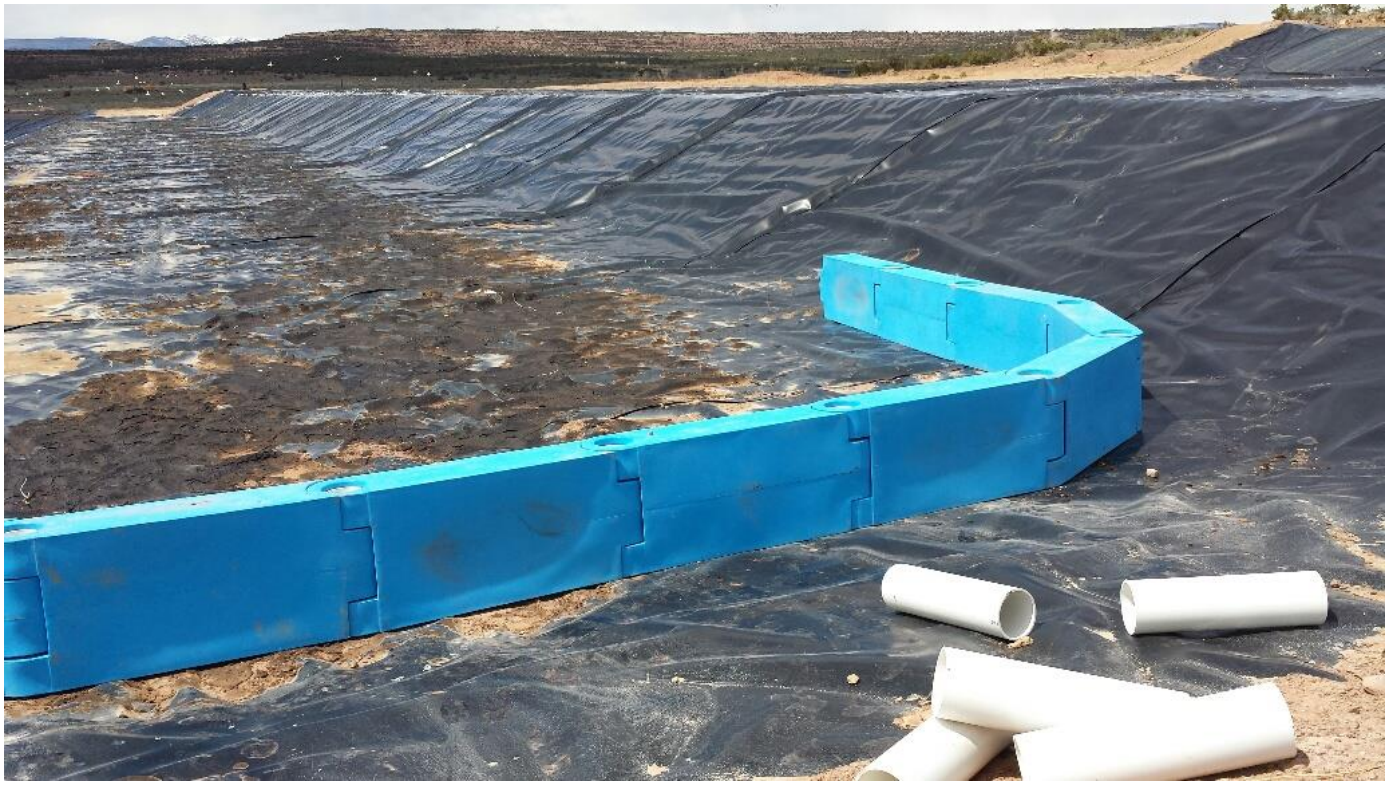


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Plate J-6

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Plate J-7