UTAH RADIOACTIVE MATERIAL LICENSE (RML UT2300249)

UPDATED SITE-SPECIFIC PERFORMANCE ASSESSMENT

SUPPLEMENTAL RESPONSE TO ROUND 1 INTERROGATORIES

February 6, 2015

For
Utah Division of Radiation Control
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ENERGYSOLUTIONS

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1. INTRODUCTION

Energy*Solutions* operates a low-level radioactive waste (LLRW) disposal facility west of the Cedar Mountains in Clive, Utah. Clive is located along Interstate-80, approximately 3 miles south of the highway, in Tooele County. The facility is approximately 50 miles east of Wendover, Utah and approximately 75 highway miles west of Salt Lake City, Utah. The facility sits at an elevation of 4,275 feet (ft) above mean sea level (amsl).

On February 14, 2011, Energy*Solutions* requested concurrence from the Utah Division of Radiation Control (Division) that previous licensing activities be allowed for the receipt and disposal of processed ion-exchange resin waste on a large-scale at the Clive facility (Shrum, 2011a and Shrum, 2011b). The Division reviewed Energy*Solutions*' analysis supporting this request and determined that Energy*Solutions* could receive processed ion-exchange resin waste up to 40,000 cubic feet per year. However, in order to receive processed ion-exchange resin waste at volumes greater than 40,000 cubic feet per year, the Division required Energy*Solutions* to conduct new performance assessment analyses that include

> "*prediction of nuclide concentration and peak dose (at the time peak dose would occur) using updated dose conversion factors, and a suggested model time frame of 10,000 years, as well as any need to revisit/update the waste source term, receptor and exposure pathways*" (Lundberg, 2011).

While the ultimate quantity of processed ion-exchange resin waste that may eventually be disposed is unknown, Energy*Solutions* recognizes that UAC R313-25-9(1)(c) supports the Division's requirement for an updated site-specific Performance Assessment in the event that the total disposal volume of processed ion-exchange resin waste "*will result in greater than 10 percent of the total site source term over the operational life of the facility*" [UAC R313-25-9(1)(c)].

Additionally, in response to the challenges Energy*Solutions* experienced in constructing and monitoring its rock armor Cover Test Cell, the Division further directed that Energy*Solutions* design and assess the performance of an evapotranspirative cover technology (or mulch) using the more robust HYDRUS model (in place of the EPA-HELP model) (DRC, 2012).

In compliance with these requirements and in conjunction with Energy*Solutions'* application to renew Radioactive Material License UT2300249 (Energy*Solutions*, 2015; Appendix P), Energy*Solutions* submitted to the Division on October 8, 2012 an updated site-specific Performance Assessment, which includes:

- Analysis of additional subsurface fate and transport of LLRW contaminants leached from the Embankment via contact with precipitation that has infiltrated through new evapotranspirative cover designs as required in DRC (2012); and transported to a well at the point of compliance 90 feet from the outside edge of the LLRW material in the Class A West (CAW) Embankment;

- Modeling of expected groundwater well concentrations and comparison to groundwater protection levels (GWPLs) for the Permit-required Time of Compliance of 500 years following embankment closure, projected peak groundwater well concentrations for each radionuclide for a Performance Period of 10,000 years following embankment closure, and projected peak doses to the general public for a Performance Period of 10,000 years following embankment closure, as required in Lundberg (2011) and Lundberg (2014a);

- Modeling of expected exposures and resulting doses to credible hypothetical inadvertent industrial intruders within a Time of Compliance of 10,000 years following embankment closure (as required to mirror those modeled in the depleted uranium Performance Assessment per Lundberg, [2014b]);

- Evaluation of additional radionuclides that were not included in prior Class A Performance Assessments conducted in support of Energy*Solutions'* Clive-based licenses (see Table A-1 of Energy*Solutions*, 2015; Appendix P), as required by Lundberg (2011); and

- Justification for renewal of Energy*Solutions'* Radioactive Material License UT2300249, as required by Lundberg (2011).

On June 7, 2013, Energy*Solutions* received from the Division a Round 1 Request for Information regarding the updated site-specific Performance Assessment. Responses to the Round 1 Interrogatories and a revised Report were submitted to the Division December 30, 2013 (Energy*Solutions*, 2013b). Following review of Energy*Solutions'* responses to the Round 1 Interrogatories, the Division requested additional information via a Round 2 set of Interrogatories (dated July 2, 2014). Instead of employing the traditional list format historically used by the Division and Energy*Solutions*, the Round 2 interrogatories were placed contextually throughout the revised Report (previously submitted to the Division in conjunction with Energy*Solutions'* responses to the Round 1 interrogatories).

Following receipt of the Round 2 Interrogatories, Energy*Solutions* and Division staff met on July 17, 2014 and November 13, 2014 to agree upon an acceptable format for responses. As a result of these meetings, it was decided that responses to the Division's Round 2 Interrogatories would be contextually addressed within the Report and expanded Round 1 Interrogatory responses. Energy*Solutions* submitted revision 2 of the updated site-specific Performance Assessment as a comprehensive compilation of applicable legacy activities and expanded responses to Round 1 Interrogatories (Energy*Solutions*, 2015; Appendix P).

A major fraction of the Division's Round 1 and round 2 Interrogatories referenced implications a findings from a 2010 U.S. Nuclear Regulatory Commission (NRC) authorized study of changes in the post-construction hydrogeologic properties of the final covers at test facilities and operating waste containment facilities. While addressed therein, Energy*Solutions* has included herein site-specific examples of their ability to protect clay barriers from the impacts of freeze-thaw cycles.

2. NATIONAL ENGINEERED COVER STUDY

The CAW Embankment cover is designed and modeled to limit the amount of precipitation ultimately entering the disposed waste region, leaching within the waste mass, and the potential flux of contaminants to groundwater. As a result, the updated site-specific Performance Assessment demonstrates that the CAW cover is an important component in the Embankment's ability to satisfy the required performance objectives (Energy*Solutions*, 2015; Appendix P).

In recognizition of the overall importance of cover designs in the ultimate performance of disposal embankments, NRC authorized a study in 2010 of the post-construction (up to approximately 9 years) hydrogeologic properties of the final covers at test facilities and operating waste containment facilities, as presented in Figure 2-1 (Benson et al., 2011). The Study included field tests, sample collection, laboratory tests, and data analyses from sites operating in a wide range of meteorological and hydrogeologic conditions. While selecting similar arid-permeable geohydraulic/meteorologic-modeled sites similar to Clive, Benson et al. (2011) statistical analysis and in-service characteristic distributions also included humid-permeable and humid-impermeable sites (dissimilar to Clive).

In the Study, test sections from various in-service covers were exhumed to evaluate how the engineering properties of the cover materials had changed during their service life. Field tests were conducted and samples were collected and tested in the laboratory. The Study's objectives included:

- characterization of changes in the engineering properties of the cover materials directly relevant to assessing hydrologic effectiveness,
- identification of conditions that induce changes in the engineering properties of cover materials and ultimately affect percolation into waste,
- identification of soil types and design and construction approaches that result in covers that are less prone to temporal change and therefore have more predictable performance, and
- recommendation of approaches to verify the hydrologic performance of final covers.

A diverse group of field sites were selected in the Study to represent a broad range of climatological conditions, as well as types of soil and vegetation. The average annual precipitation of the Study sites ranged from 119 mm/year (Apple Valley, CA) to 1,263 mm/year (Albany, GA). Appreciable snowfall was observed at 6 sites (Helena and Polson, MT; Omaha, NE; Cedar Rapids, IA; Monticello, UT; and Underwood, ND). Similarly, the Study included a broad variety of cover designs for a wide range of waste types, including municipal solid waste, hazardous waste, low-level radioactive waste, and mixed waste.

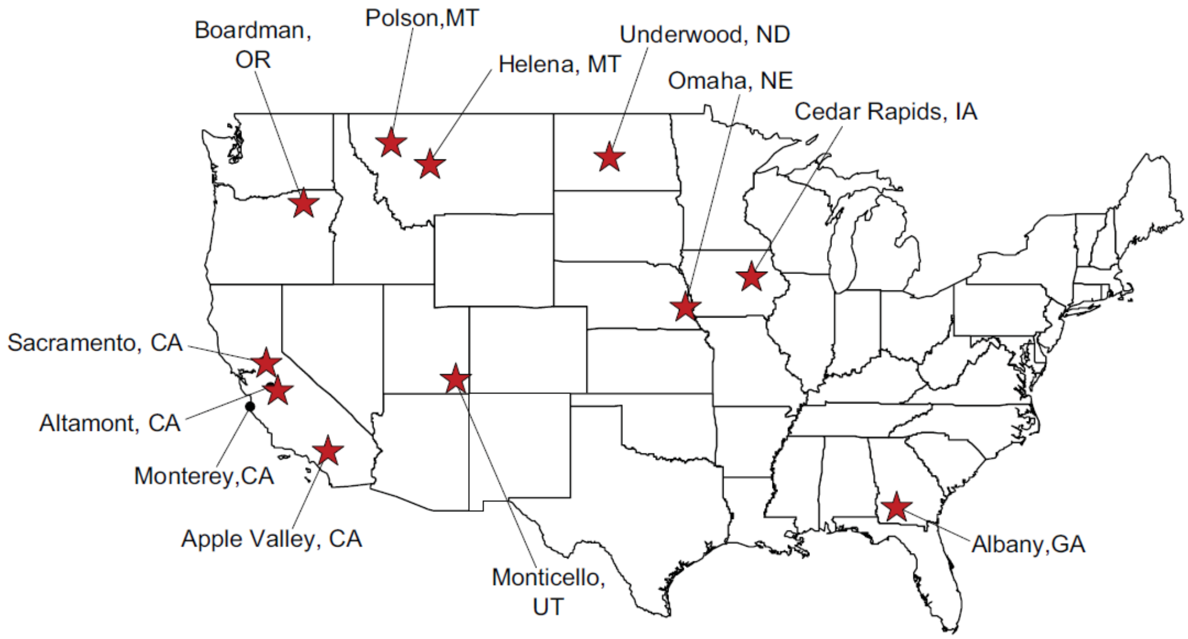

Figure 2-1. Locations of NRC's cover study sites, (Benson et al., 2011; pg. 2-2)

Of the 27 in-service covers evaluated, 15 were store-and-release covers (equivalent to CAW's evapotranspirative cover). Nine of the store-and-release covers were monolithic in design (i.e., a thick layer of finer textured soil overlain by topsoil) and six employed a simple two-layer fine over-coarse design, constructed to enhance the storage capacity of the overlying finer-textured layer. Additionally, the store-and-release covers were vegetated with a mixture of annual and perennial grass mixtures. Similarly, only 4 of the sites Benson et al (2011) studied are in arid-permeable geohydraulic/meteorologic-modeled sites similar to Clive. The wide differences in meteorologic and geohydraulic conditions of Benson et al. (2011) are representative in the wide cover performance distributions measured therein.

Prior to field testing, a minimum of 300 mm of surface soil was removed so that the tests were conducted directly on the storage layer or the barrier layer (as opposed to any present surface layer). Hydraulic conductivities were assumed to represent conditions at saturation (although, not a representative condition found in any of Clive's in-service covers). In-situ field hydraulic conductivity tests were conducted using sealed double-ring infiltrometers and borehole permeameters. As illustrated in Figures 2-2 and 2-3, these tests assumed an infinite volume of infiltration precipitation available in the storage or barrier layers.

The hydraulic conductivities of the various cover soil layers were found to be consistent with the sequence and method in which the layers were placed and exposed while in service. For example, clay barrier layers are generally placed with low hydraulic conductivities, whereas storage layers are placed to promote root development and storage capacity. As such, in-service storage layers were observed as having hydraulic conductivities with a geometric mean = $1.7\text{x}10^{-6}$ m/s. By comparison, in field hydraulic conductivities of clay barriers were observed as having a geometric mean value of $6\text{x}10^{-7}$ m/s.

When measured from the infiltration of water through the entire cover system (i.e, storage and release over clay barrier layers) overall cover in-service hydraulic conductivities were found to be within a range of $7.5\text{x}10^{-8}$ m/s and $6.0\text{x}10^{-6}$ m/s. The geometric mean of overall in-service hydraulic conductivities was $4.4\text{x}10^{-7}$ m/s, generally on order of magnitude higher than the as-built hydraulic conductivities (regardless of their initial design/as-built condition), with the largest increases observed in hydraulic conductivities for clay barriers that have been exposed to freeze-thaw cycling.

The Study defines a "freeze-thaw cycle" as a period of at least 24 hours during which the soil temperature of the layer of interest falls below 0°C, followed by a 24 hour period with temperatures greater than 0°C. As a result of the freeze-thaw cycling, structure is introduced into the soil layers that act as preferential flow paths, transforming a monolithic barrier layer with very low hydraulic conductivity into a structured and permeable soil layer. Analysis of site temperature data suggests that storage and barrier layers from all Study sites underwent a sufficient number of freeze-thaw cycles to develop the structure required to induce a maximum change in hydraulic conductivity. However, no such increases were observed in layers covered with soils of adequate depth to insulate them from below freezing atmospheric temperatures. This is of particular significance when evaluating the Study's applicability to Clive's site-specific clay barrier performance experience, in that at least one freeze-thaw cycle was observed at each of the Study sites. Most prominent changes for Study site in-service hydraulic conductivities from freeze-thaw cycles were observed within the first 1 to 3 years following construction. Negligible changes were observed from cycles occurring 5 years after initial construction.

Figure 2-2. Borehole permeability test, (Benson et al., 2011; pg. 3-3)

Figure 2-3. Infiltrometer test, (Benson et al., 2011; pg. 3-4)

The Study demonstrates that when exposed to freeze-thaw cycles, model representation of saturated hydraulic conductivities and associated van Genuchten alpha and n parameters should be increased from their initial design/as-built condition. Similarly, performance assessments should recognize that constructed covers are in a state of disequilibrium with the surrounding environment.

To account for such, a program of in-field direct monitoring should be incorporated to monitor the migration of a constructed cover from its design/as-built condition to a state of equilibrium with the surrounding environment. For example, Benson et al. (2011) generally recommends the installation of lysimeters beneath embankments for direct monitoring of the percolation (and by extension, bulk in-service hydraulic conductivity). Additionally, such migration of cover material properties should be accounted for in performance assessment, with alteration occurring until an equilibrium condition exists with the surrounding environment.

It also should be noted that the national studies documented by Benson et al. (2011) generally include covers constructed with lower percentages of clays. Because of this, Benson et al. recommends,

> "*If available, a site-specific saturated hydraulic conductivity that reflects in-service condition should be used for performance predictions [instead of the wide distribution from regional sites examined herein]*." Benson et al. (2011, pg. 6-38)

While informative to the updated site-specific Performance Assessment (Energy*Solutions*, 2015; Appendix P), several significant differences exist between Benson et al. (2011) Study sites and Energy*Solutions'* various Clive embankments (supporting Benson et al.'s recommendation for the use of site-specific hydraulic conductivities).

1) Clay barriers with several thicknesses of soil frost protection have been exposed to repeated winter conditions without any observed increase in in-service density or permeability.

2) Temperatures at the upper clay barrier surface have never been measured below 0°C at its Clive Cover Test Cell (Energy*Solutions*, 2014a).

3) While recognized as not equivalent to the evapotranspirative cover design proposed for CAW, water from infiltration through a completed cover has not been detected within lysimeters constructed beneath Energy*Solutions*' rock armored disposal embankments (Mixed Waste, LARW, 11e.(2), and Cover Test Cell).

3. CLIVE'S SITE-SPECIFIC EXAMPLES OF CLAY BARRIER PROTECTION

Because of the range of site locations studied therein, Benson et al. (2011) provides a national input parameter database, which represents a variety of expected geohydrologic conditions, climates, behaviors, and wastes. In their general guidance for site decommissioning, NRC expresses caution in the interpretation of results produced from the use of generalized national data,

> "*These data sources are available to provide estimates of parameter values in the absence of site-specific information. The large national databases can also be used to characterize parameter uncertainty. This is particularly appropriate when there are insufficient site-specific data on which to base parameter uncertainty estimates.*" [emphasis added]; (NRC, 1999; pg. ix).

NRC expresses further caution against the treatment of generic and national parameter distributions as though they are site-specific specifics,

> "*It is clear that reduction in uncertainties occur as more site specific, direct measurements are made. Frequently, however, the site-specific data are unavailable and there must be reliance on estimates from generic, regional or local data sources that act as surrogate for site specific information. There is some caution that must be exercised in applying the local, regional, or generic data bases to site-specific cases.*" [emphasis added]; (NRC, 1999; pg. 25)

Finally, NRC provides the following clarification, using an example parameter "pdf", as to its preference for selection of site-specific characteristics over the use of national data ranges,

> "*In the absence of site-specific information, the effective value of a parameter at a site could conceivably be any reasonable value. Consider Figure [3-1]. With no site-specific information to use, the distribution based on the observed national data defines the range and relative likelihood of values the parameter can reasonably be expected to assume at the site. That is, the value of 0.18 is most likely, but a value of 0.10, while unlikely, cannot be dismissed since it has been observed [nationally]. It is thus appropriate to use the national distribution to represent the probability distribution of the effective (average) parameter value at the site, again, assuming that there is no site-specific information. As discussed previously, this will tend to overestimate the uncertainty of the parameter value both because the variability of the national data is likely to be greater than the variability at the site (see Figure [3-1]) and because the variability of the national data [instead of that from site-specific observations] is being used to represent the uncertainty of the parameter.*" [emphasis added]; (NRC, 1999; pg. 27).

Therefore, in accordance with the guidance of NRC (1999) site-specific observations should be preferentially selected over Benson et al.'s national ranges reported by Benson et al. (2011). By doing so, uncertainty is reduced and the risk of overestimation of variability is minimized.

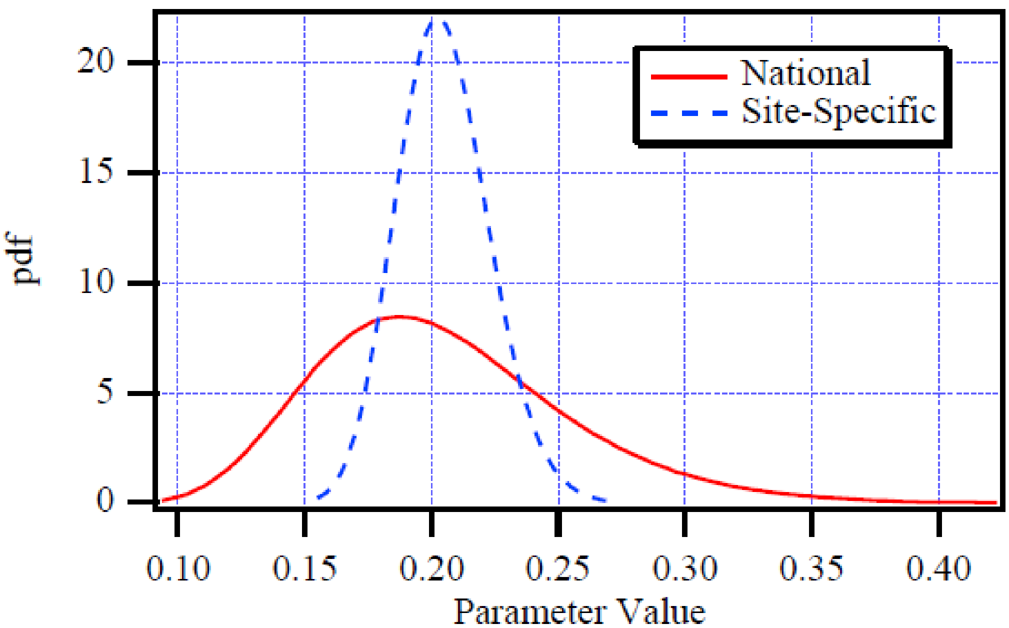

Figure 3-1. NRC's Example: Expected Relationship Between the Variability of a Parameter on a National Scale and on a Site-Specific Basis" (NRC, 1999; pg. 27)

The general cover design requirements for the licensing of near surface land low-level radioactive waste (LLRW), low activity radioactive waste (LARW), and 11e.(2) by-product disposal embankments are set forth in the UAC R313-24, UAC R313-25 and 10 CFR 40, as administered by the Division. Covers are designed to minimize, to the extent practicable, water infiltration into the waste. Location and layout of Energy*Solutions'* various Clive embankments (Mixed Waste, 11e.(2), LARW, and CAW) are shown on Figure 3-2.

The embankments are all constructed above a 2-foot thick clay barrier liner, with design/as-built permeability no greater than $1x10^{-6}$ cm/sec. Following waste placement above the 2-foot thick clay barrier liner, an engineered cover system is built. The Mixed Waste, 11e.(2), LARW, and CAW cover systems begin with clay barrier layers with design/as-built permeabilities of less than $1x10^{-8}$ m/sec for lower clay barriers and $5x10^{-10}$ m/sec for upper clay barriers. For the LARW and CAW Embankments, the lower radon barrier layers ($1x10^{-8}$ m/sec permeability) are at least 1.0 foot thick. For the 11e.(2) Embankment top slope, the lower radon barrier layer ($1x10^{-8}$ m/sec permeability) is at least 3.0 feet thick. For the 11e.(2) Embankment side slope, the lower radon barrier layer ($1x10^{-8}$ m/sec permeability) is at least 2.5 feet thick. By comparison, the LARW, CAW, and 11e.(2) Embankment upper clay barrier layers ($5x10^{-10}$ m/sec permeability) are at least 1.0 foot thick.

Embankment construction activities during the past twenty years of operation of clay barrier layers in Clive's embankments liners and covers has provided EnergySolutions with extensive experience and data demonstrating an ability to sufficiently protect these layers from freeze/thaw damage during winter/non-construction periods. This experience is reflected in the Division-approved spring start-up procedures, quality control, and quality assurance requirements of Work Element – Clay Liner Placement and Work Element – Radon Barrier Placement of the Low-Level Radioactive Waste and 11e.(2) Construction Quality Assurance / Quality Control Manual (CQA/QC Manual).

3.1 11e.(2) Embankment Clay Barrier

The capacity of the 11e.(2) Embankment is 5,048,965 cubic yards (yd^3) and occupies approximately 92 acres of Energy*Solutions'* Clive facility. Energy*Solutions'* 11e.(2) design is a near-surface landfill embankment, constructed using materials native to the site or found in close proximity to the site. Engineered features of the Embankment are designed based upon State of Utah regulations, NRC guidance, EPA guidance, and Energy*Solutions'* past experience at this location.

Since its initial licensing in 1999, 1,607,295 yd^3 of waste has been placed in the 11e.(2) Embankment from the eastern edge of its licensed footprint towards the west (Energy*Solutions*, 2014b). Waste material is placed on the liner and compacted in place to a waste column height of approximately 45 feet at the embankment shoulder (above grade). At the embankment's highest point, the waste column will be approximately 54 feet thick. When the Embankment is filled to the maximum height, a three and one-half foot thick clay barrier is placed on the side slopes and a four-foot thick layer of clay is placed on top and compacted. A twelve-inch filter zone of small diameter rock then provides a drainage layer above the clay barrier. An erosion barrier of specification-sized rock then covers the surface of the embankment.

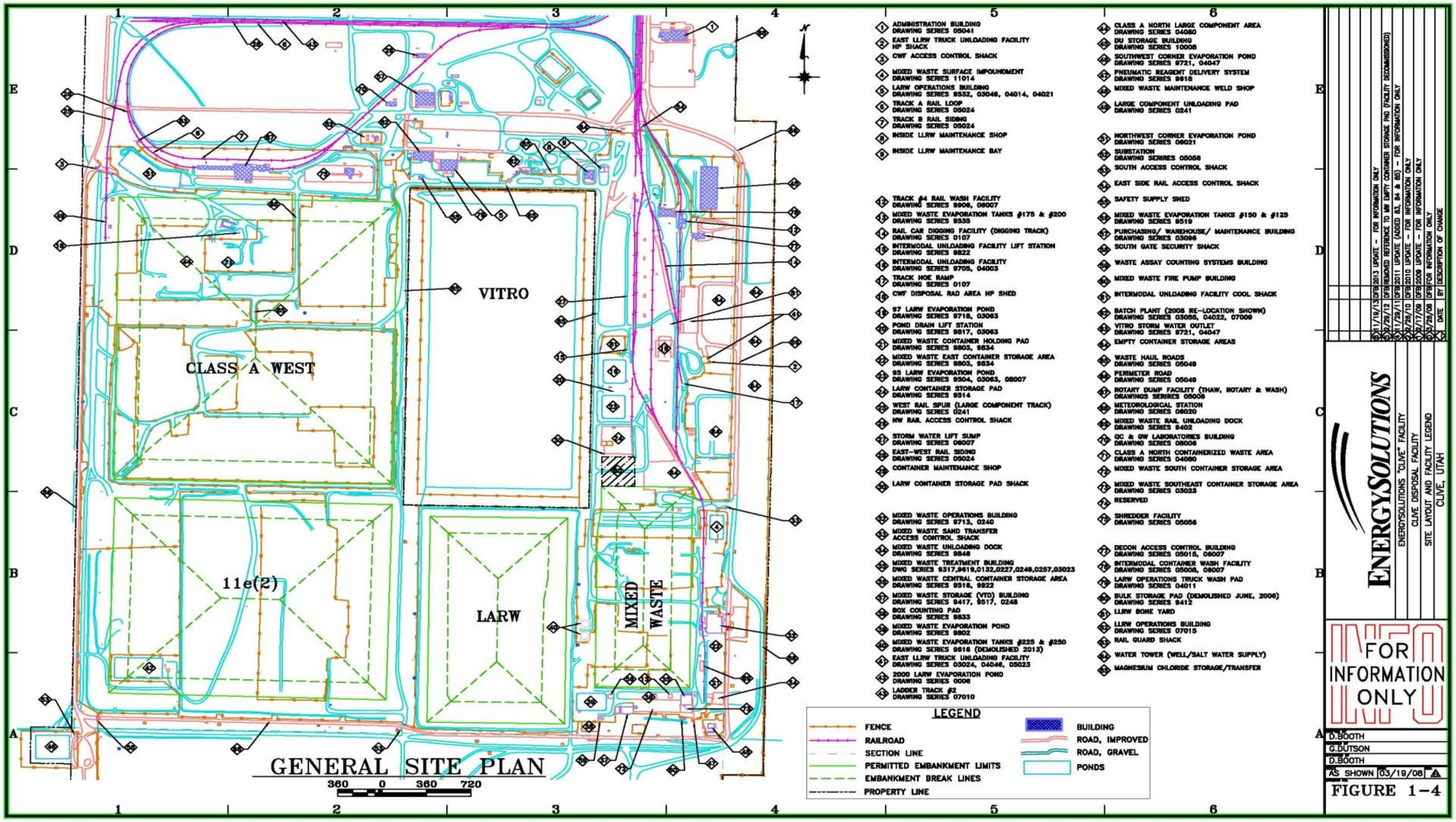

Figure 3-2. Energy*Solutions'* Clive Facility Embankment Layout and Orientation

Unlike the CAW Embankment, significant amounts of clay barrier liner were initially constructed, following the initial licensing of the 11.e(2) Embankment in the year 2000. Similarly, final cover has intermittently been constructed as 11e.(2) waste placement has reached its design height. In cases where it is recognized that waste placement will not take place above constructed clay barrier liner for a period of more than 30 days or when atmospheric temperatures drop below 0ºC, at least 9 inches of loose clay or 6 inches of compacted clay is required to be placed as frost protection. Prior to subsequent waste placement, Energy*Solutions* is required to excavate below the placed frost protection and re-test the underlying clay barrier liner for its design/as-built density and permeability. Areas compromised for placement testing are repaired by applying the same methodology applied during its initial construction.

As is illustrated in Figure 3-3, a significant portion of 11e.(2) clay barrier liner was originally constructed in 2000. In compliance with requirements of the Division-approved CQA/QC Manual, areas of the frost-protected clay barrier liner constructed in 2000 were tested prior to placement of 10,054 yd^3 of 11e.(2) byproduct waste in 2013 and 15,207 yd^3 in 2014 (see Appendix A for in-field tests). Contrary to the observations of unprotected clays by Benson et a. (2011), Energy*Solutions'* tests indicated that permeabilities of frost-protected clay barrier layers actually exhibited reductions from their design/as-built limits of $1x10^{-8}$ m/sec to $8.9x10^{-10}$ m/sec and $4.0x10^{-11}$ m/sec – with improvements in proctor densities (see Table 3-1). Of significance in determination of the unrepresentativeness of Benson et al. (2011) findings to Energy*Solutions'* clay observations at Clive, the improvements in the 11e.(2) Embankment clay barriers were seen after more than a decade of freeze/thaw cycles (where Benson et al. [2011] observed the most predominant increases in clay barrier permeabilities within the first few years following construction).

During the 11 freeze-thaw cycles in which the frost-protected 11e.(2) clay barrier liner was exposed to the atmosphere, Energy*Solutions'* Clive Meteorological Station reports average atmospheric temperatures of -2.4ºC in January and -2.7 ºC in December (MSI, 2014). MSI (2014) further reports a record minimum temperature of -31.5ºC experienced on January 14, 2013, with the period of January through December 2013 seen as the coolest year during the 11 freeze-thaw cycles since the clay barrier liner's construction. Similarly, MSI (2014) further reports the second coldest period since the clay barrier liner's construction was observed during January 2007 (with the coldest temperature of -25.5 ºC being observed on January 14, 2007). Notably, while Benson et al. (2011) report that unprotected clay barriers exhibit the greatest freeze-thaw driven changes during the first three years following construction, Energy*Solutions'* 11e.(2) frost-protected clay barrier liner exhibited improved characteristics.

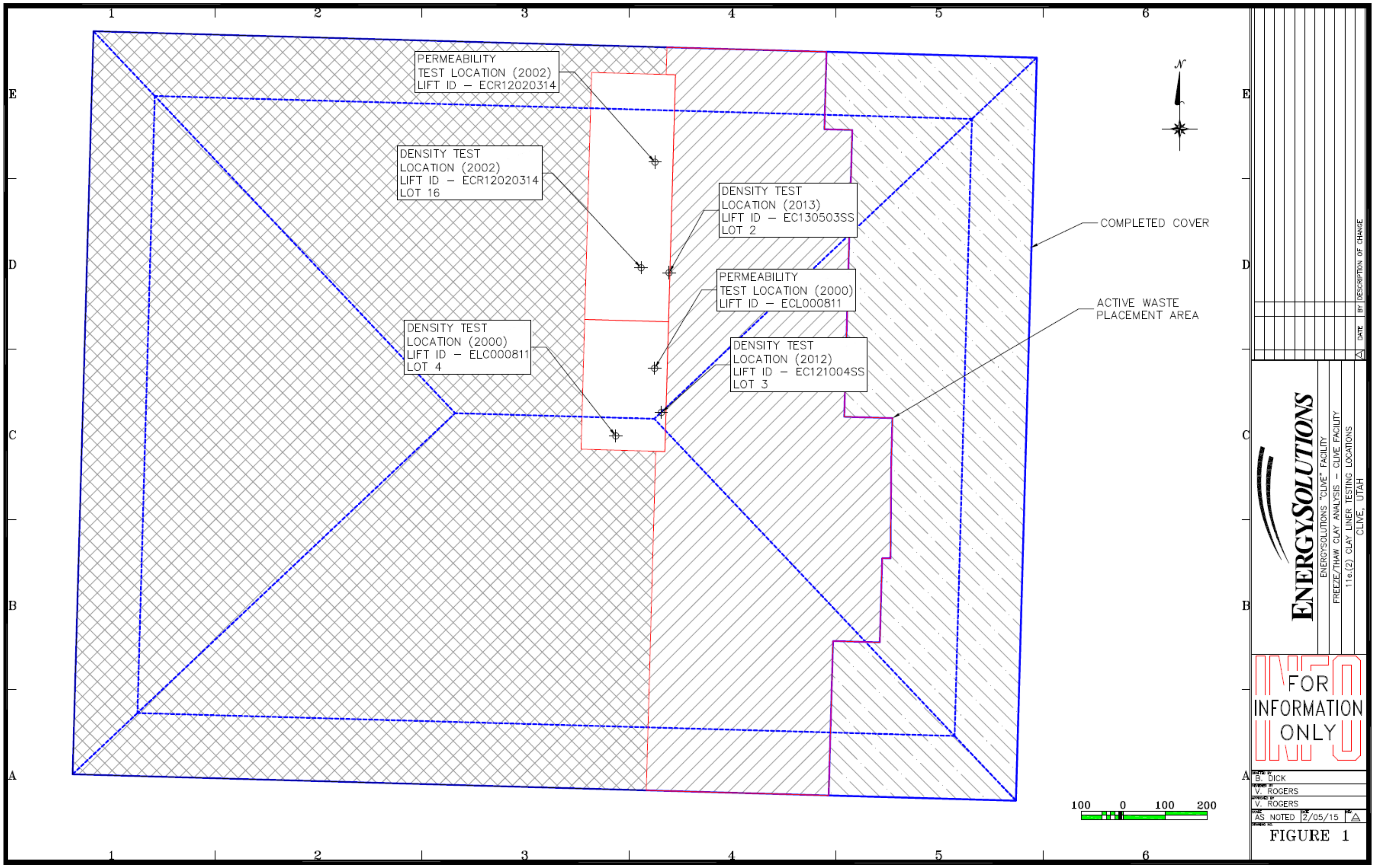

Figure 3-3. 11e.(2) Embankment Frost-Protected Clay Barrier Test Locations

Table 3-1

11e.(2) Embankment Frost-Protected Clay Barrier Spring Startup Tests

11e.(2) LIFT ID	FROST PROTECTION	DATE BUILT	DESIGN PERMEABILITY (m/sec)	DATE OF SPRING TESTING	IN-SERVICE PERMEABILITY (m/sec)	WINTER PERMEABILITY DECREASE (%)	WINTER DENSITY INCREASE (%)
ECL000811 EC121004SS	0.75 feet of uncompacted clay	August 2000	$1.1x10^{-9}$	April 2012	$8.9x10^{-10}$	1,236	102
ECR12020314 EC130503SS	1 foot of uncompacted clay	August 2000	$1.5x10^{-9}$	April 2013	$4.0x10^{-11}$	3,750	108

3.2 LARW Embankment Clay Barrier

The LARW Embankment received low-activity radioactive waste from 1988 until May, 2004, when it was filled to its design capacity. The completed LARW disposal cell is 1,115 feet by 1,670 feet, covering approximately 43 acres. Beginning in 1988, waste was placed above a 2-foot clay barrier layer of compacted clayey soils (with design/as-built permeability limited to no more than $1x10^{-8}$ m/sec). Above the two foot thick layer clay barrier layer and waste, the LARW Embankment was covered in three sections: the 1994 side slope cover, the 2004 side slope cover, and the uniform top slope cover. The 2004 slope is the same as the 1994 side slope cover, with the addition of a sacrificial soil layer (freeze protection) and a Type-B Filter (24 inches thick above the clay barrier layers). Changes in the side slope criteria were driven by the Groundwater Quality Discharge Permit No. UGW450005 (October 28, 1994) and later in July 2004. By comparison, the top slope and 2004 side slope consist of 42 inches of various materials above the clay barrier layers.

As is illustrated in Figure 3-4, several sections of LARW clay barrier liner were left frost-protected during winter months, prior to subsequent spring start-up confirmative testing and continued waste placement (see Appendix A for in-field tests). Contrary to the observations of unprotected clays by Benson et al. (2011), Energy*Solutions'* LARW Embankment tests presented in Table 3-2 demonstrate that permeabilities of frost-protected in-service clay barrier layers actually exhibited significant reductions in permeabilities from their design/as-built limits of $1x10^{-8}$ m/sec.

Notably, while Benson et al. (2011) report that unprotected clay barriers exhibit the greatest freeze-thaw driven changes during the first three years following construction, Energy*Solutions'* LARW Embankment frost-protected clay barrier liner reflects the same trend of improved characteristics as observed with the 11e.(2) Embankment.

3.3 Mixed Waste Test Pad Clay Barrier

In compliance with applicable hazardous waste management requirements found in UAC R315, Energy*Solutions'* Mixed Waste Embankment is built over a composite liner of three feet of compacted clay barrier (with permeability less than or equal to $1.0x10^{-9}$ m/sec), intermixed with several layers of high density polyethelene (HDPE) liner. However, prior to construction within the Mixed Waste Embankment footprint, Energy*Solutions* is required to demonstrate constructability application of the design, procedures, and equipment on a clay barrier test pad of approximately 60 foot by 75 foot. Construction of clays in the liner test pad must be placed and compacted in at least three lifts with loose material thicknesses not exceeding twelve inches. The clay liner test pad is required to demonstrate an ability to achieve a design/as-built permeability of no more than $1.0x10^{-9}$ m/sec.

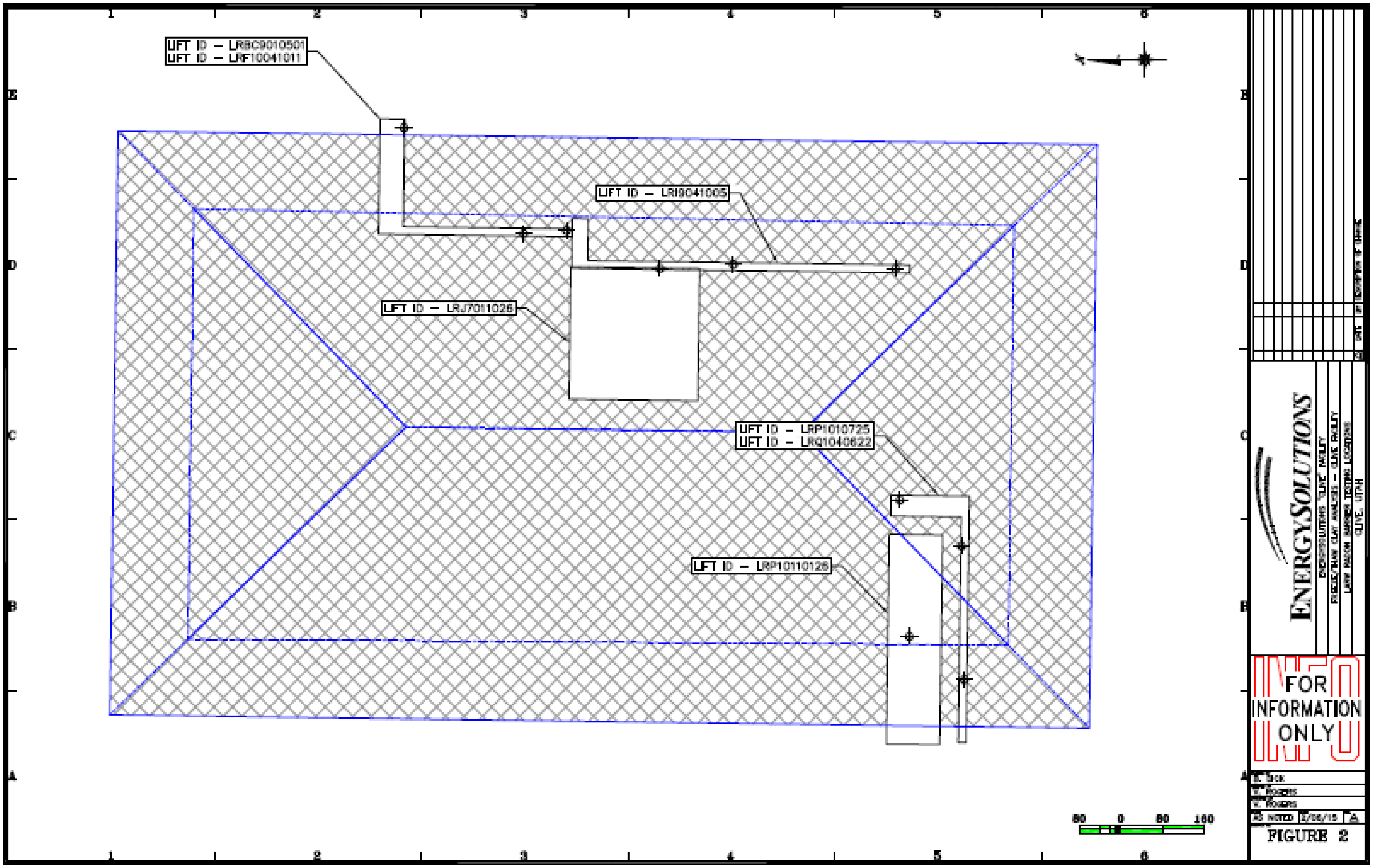

Figure 3-4. **LARW Embankment Frost-Protected Clay Barrier Test Locations**

Table 3-2

LARW Embankment Frost-Protected Clay Barrier Spring Startup Tests

LARW LIFT ID	FROST PROTECTION	DATE BUILT	DESIGN PERMEABILITY (m/sec)	DATE OF SPRING TESTING	IN-SERVICE PERMEABILITY (m/sec)	WINTER PERMEABILITY DECREASE (%)	WINTER DENSITY INCREASE (%)
LRBC9010501	1 foot of uncompacted clay	October 2004	$1x10^{-8}$	April 2005	$1.3x10^{-10}$	7,692	111
LRJ7011026	1 foot of uncompacted clay	October 2001	$1x10^{-8}$	April 2002	$1.7x10^{-9}$ - $7.7x10^{-10}$	1,000 - 10,000	98 - 105
LRP1011012	1 foot of uncompacted clay	October 2001	$1x10^{-8}$	April 2002	$7.7x10^{-10}$ - $3.1x10^{-11}$	1,299 - 32,258	113 - 118
LRF10041011	1.5 feet of uncompacted clay	October 2004	$1x10^{-8}$	April 2005	$4.4x10^{-9}$	227	102
LRP1010725	1 foot of uncompacted clay	June 2004	$1x10^{-8}$	April 2005	$1.2x10^{-9}$	833	118

Similarly, prior to construction of the Mixed Waste cover's initial two foot thick clay barrier, Energy*Solutions* is required to demonstrate its constructability via a clay cover barrier test pad also of approximately 60 foot by 75 foot. Construction of clays in the cover barrer test pad must be placed and compacted in at least two lifts with loose material thicknesses not exceeding twelve inches. The clay cover barrier test pad is required to demonstrate an ability to achieve a design/as-built permeability of no more than $5.0x10^{-10}$ m/sec.

Out of concern over the impact of freeze-thaw cycles on clay barrier layers left exposed to freezing atmospheric temperatures (without placement of protection), the Division of Solid and Hazardous Waste required Energy*Solutions* to construct a clay barrier layer test pad with a design/as-built permeability not exceeding $1.0x10^{-9}$ m/sec in 2007. This test pad was then left exposed to atmospheric temperatures (beneath a single layer of HDPE) between October 2007 and April 2008. Sspring start-up analysis observed improvements in density of 110% and permeability of 2,000% (i.e., $5.0x10^{-11}$ m/sec), respectively.

Notably, while Benson et al. (2011) report that unprotected clay barriers exhibit the greatest freeze-thaw driven changes during the first three years following construction, Energy*Solutions'* Mixed Waste clay barrier test pad left exposed without soil frost protection exhibited no freeze/thaw degradation in density or permeability.

3.4 Cover Test Cell Clay Barrier

In order to demonstrate a rock armor design's ability to comply with the legacy Class A Embankment's ability to satisfy the required performance objectives, Energy*Solutions* constructed a Cover Test Cell in 2004 mirroring the Class A Embankment design. Since its construction and in satisfaction of Condition 28 of Radioactive Material License #UT 2300249, each year Energy*Solutions* has submitted an annual Cover Test Cell Report that presents, analyzes and interprets temperature and water balance data collected over the prior year. Most recently, Energy*Solutions* provided the Division with a Report of Cover Test Cell clay barrier temperature measurements and cover system water balance information for the time period from January 1, 2005 through December 31, 2013 (Energy*Solutions*, 2014a).

While clearly not of similar layer composition above the clay barriers as the CAW's evapotranspirative cover, review of the temperature data obtained at the surface of the upper clay barrier layer (Test Cell constructed with a two-foot thick clay barrier as the initial layer) demonstrates that the clay radon barrier is adequately protected from freezing temperatures (even though long ranges of atmospheric sub-freezing temperatures were observed in January 2013). In fact, analysis of the temperatures at the midpoint of the upper clay barrier indicates that this location has never experienced freezing conditions, since its initial construction (even with a historical atmospheric low temperatures measured during January 2013 and January 2007). Similarly, THERM monitoring locations provide supplemental measurements of potential freeze/thaw depths from the midpoint of the sacrificial soil layer down to the interface between the $1x10^{-8}$ m/sec and $5x10^{-10}$ m/sec clay barriers. Analysis of THERM data further suggests that the interface between the two clay barriers is adequately protected from freeze/thaw impacts.

4. SUMMARY AND CONCLUSIONS

Benson et al. (2011) examined field tests, sample collection, laboratory tests, and data analyses from a nationwide selection of sites operating in various meteorological and hydrogeologic conditions. While including four similar arid-permeable geohydraulic/meteorologic-modeled sites similar to Clive, Benson et al. (2011) statistical analysis and in-service characteristic distributions also statistically represent humid-permeable and humid-impermeable sites (dramatically dissimilar to Clive). Furthermore, of the 27 in-service covers evaluated by Benson et al. (2011), 15 are equivalent in design and function to Energy*Solutions'* proposed CAW's evapotranspirative cover.

NRC expresses caution in the interpretation of results produced from the use of generalized national data such as those of Benson et al. (2011),

> "*These data sources are available to provide estimates of parameter values in the absence of site-specific information. The large national databases can also be used to characterize parameter uncertainty. This is particularly appropriate when there are insufficient site-specific data on which to base parameter uncertainty estimates*." [emphasis added]; (NRC, 1999; pg. ix).

NRC expresses further caution against the treatment of generic and national parameter distributions as though they are site-specific specifics,

> "*It is clear that reduction in uncertainties occur as more site specific, direct measurements are made. Frequently, however, the site-specific data are unavailable and there must be reliance on estimates from generic, regional or local data sources that act as surrogate for site specific information. There is some caution that must be exercised in applying the local, regional, or generic data bases to site-specific cases*." [emphasis added]; (NRC, 1999; pg. 25)

Substantiating and in accordance with NRC's guidance, it is significant to note that site-specific data obtained from Energy*Solutions'* use of compacted clays for embankment liners and cover barrier layers do not mirror the impact of freeze/thaw on hydraulic conductivity predicted in Benson et al. (2011). Therefore, Clive's site-specific observations should be preferentially-weighed over Benson et al.'s national ranges in the Division's approval of the demonstration of comliant-performance of the CAW's evapotranspirative cover in the updated site-specific Performance Asessment (Energy*Solutions*, 2015). By doing so, uncertainty is reduced and the risk of overestimation of variability is minimized. As such, Energy*Solutions'* Class A West evapotranspirative cover and Embankment will not exhibit degradation in long-term performance due to freeze/thaw impacts in the low permeability clay barrier layers.

5. REFERENCES

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APPENDIX A

In-Field Density and Permeability Tests

ENERGYSOLUTIONS

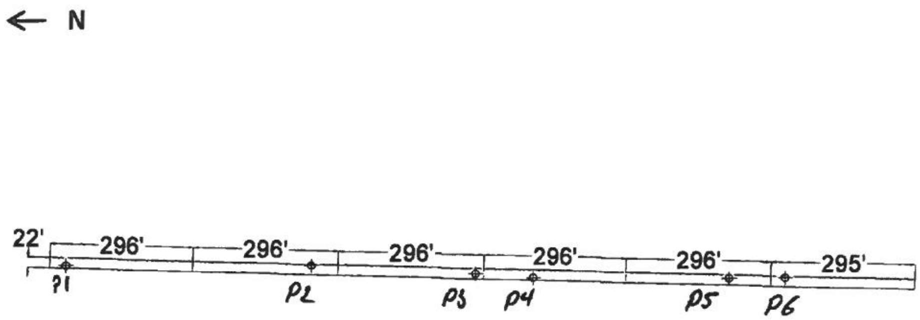
ES-98252
Rev. 0

EMBANKMENT CONSTRUCTION LIFT APPROVAL FORM

PROJECT: ______ CAN ______ MW __X__ 11e.(2) ______ CLASS A OTHER ______

WORK ELEMENT: ___ FOUNDATION __X__ CLAY LINER ____ RADON BARRIER OTHER ______

NW CORNER: N 12050.72 E 11717.21 DATE: 10/4/2012



P_1	N 11980.61 E 11720.27				
EW:	22	X	0.212	=	5
NS:	296	X	0.235	=	70
P_2	N 11512.36 E 11722.26				
EW:	22	X	0.896	=	20
NS:	296	X	0.818	=	242
P_3	N 11178.74 E 11703.99				
EW:	22	X	0.508	=	11
NS:	296	X	0.946	=	280
P_4	N 11058.96 E 11694.66				
EW:	22	X	0.205	=	5
NS:	296	X	0.353	=	104
P_5	N 10655.86 E 11692.46				
EW:	22	X	0.651	=	14
NS:	296	X	0.713	=	211

Page 2 attached: [Y] N

IDENTIFY LOTS ABOVE

LIFT ID: EC121004SS UNC. THICKNESS: 9.0" Constructed Per Test Pad #: N/A

Lift Bonding Inspections (change in grade of at least 1" - two per linear foot): By: N/A Date: N/A Time: N/A

Grade Pole Inspections (at least a 70 foot grid & all control points): By: N/A Date: N/A Time: N/A

Dry Clod Size Inspection (Less than or equal to 1"): By: N/A Date: N/A Time: N/A

Equipment Used for Compaction & # of Passes: N/A

# of Deflocculant Bags: N/A Size of Mixing Area: N/A On-Cell / Off-Cell # Passes with Tiller: N/A

KEYING IN NOTES: N E S W N/A DENSITY TESTS ID # (S): 1 - 6

PERMEABILITY TESTS LOT # (S): 3 SANDCONE TEST LOT # (S): N/A

COMMENTS: **This lift approval is for spring start-up of 38999 ft² along the Eastern side of 11e.(2) embankment lift areas S-11, R-12, L-12, H-12, and D-12. This testing satisfies the requirement that "spring start-up testing shall be conducted on" these lift areas "prior to and in the same construction season as initial waste placement for each area."**
On 10/08/12 @ 8:00 a.m., the liner temperature approximately 1" beneath the surface was found to be 41° F.
High compaction was observed on test 1 Lot 1.

LIFT APPROVED BY: Jeremy Hodges DATE: 10/8/2012 TIME: 9:21

[signature] 10-23-12 [signature] 11-5-12
QC OFFICER APPROVAL DATE QA APPROVAL DATE

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Clive, Utah

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ENERGYSOLUTIONS

RANDOM NUMBER CONTINUATION SHEET

Date: 10/04/12

Lift ID: EC121004SS **NW Corner** N 12050.72 E 11717.21

P6 N 10541.77 E 11694.29 EW: 22 X 0.884 = 19 NS: 295 X 0.099 = 29	P14 EW: X = NS: X =	P22 EW: X = NS: X =
P7 EW: X = NS: X =	P15 EW: X = NS: X =	P23 EW: X = NS: X =
P8 EW: X = NS: X =	P16 EW: X = NS: X =	P24 EW: X = NS: X =
P9 EW: X = NS: X =	P17 EW: X = NS: X =	P25 EW: X = NS: X =
P10 EW: X = NS: X =	P18 EW: X = NS: X =	P26 EW: X = NS: X =
P11 EW: X = NS: X =	P19 EW: X = NS: X =	P27 EW: X = NS: X =
P12 EW: X = NS: X =	P20 EW: X = NS: X =	P27 EW: X = NS: X =
P13 EW: X = NS: X =	P21 EW: X = NS: X =	P29 EW: X = NS: X =

COMMENTS:

ES-1905
Revision 0

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A OTHER ______

LIFT IDENTIFICATION: **EC121004SS** DATE: **10/4/2012**

TEST ID NUMBER(S): **1 LOT 1**

TEST LOCATION: **N 11980.61 E 11720.27** TEST METHOD: ____ D1556 **X** D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **19481**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **1986** Moisture **636**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **162** Density Count **1049**

Wet Density (ρ_m) **128.7** *(lbs/ft³)* Dry Density **116.4** *(lbs/ft³)*

Moisture Density **12.3** *(lbs/ft³)* Moisture Fraction **10.6** *(%)*

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID **RX7**

Mass of container & wet specimen (M_{cms})	491.9	g
Mass of container & dry specimen (M_{cds})	429.8	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	62.1	g
Mass of container (M_c)	108.7	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	321.1	g
Moisture content (w) $w = (M_w / M_s) \times 100$	19.3	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

$\rho d = (100 \times$ **128.7** $)/(100 +$ **19.3** $=$ **107.8** *lbs/ft³*

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max \times 100$

107.8 / **100.0** x 100 = **107.8** %

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ *g/cm³* ____ *lbs/ft³*

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2)/\rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

Soil Description: **Reddish brown clay**

Proctor ID: **SS020221-1**

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) **100.0** (lbs/ft³)

Optimum Moisture (w_{opt}) **23.5** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

TEST RESULTS:

X Pass Date: **10/5/12**

____ Failed Moisture

____ Failed Compaction Time: **821**

By: **Jeremy Hodges** (print) / Jeremy Hodges (signature)

[signature] 10-23-12
QC OFFICER APPROVAL DATE

[signature] 11-5-12
QA APPROVAL DATE

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FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW _X_ 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: **EC121004SS** DATE: **10/4/2012**

TEST ID NUMBER(S): **2 LOT 2**

TEST LOCATION: **N 11512.36 E 11722.26** TEST METHOD: ____ D1556 _X_ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **19481**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **1986** Moisture **636**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **196** Density Count **1307**

Wet Density (ρ_m) **120.1** *(lbs/ft³)* Dry Density **105.0** *(lbs/ft³)*

Moisture Density **15.2** *(lbs/ft³)* Moisture Fraction **14.5** *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID **FU21**

Mass of container & wet specimen (M_{cms})	468.1	g
Mass of container & dry specimen (M_{cds})	405.3	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	62.8	g
Mass of container (M_c)	108.6	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	296.7	g
Moisture content (w) $w = (M_w / M_s) \times 100$	21.2	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

$\rho d = (100 \times$ **120.1** $)/(100 +$ **21.2** $=$ **99.1** lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max \times 100$

99.1 / **100.0** x 100 = **99.1** %

Soil Description: **Reddish brown clay**

Proctor ID: **S5020221-1**

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) **100.0** (lbs/ft³)

Optimum Moisture (w_{opt}) **23.5** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

TEST RESULTS:

_X_ Pass Date: **10/5/12**

____ Failed Moisture

____ Failed Compaction Time: **822**

By: **Jeremy Hodges** / Jeremy Hodges
(print) (signature)

[signature] 10-23-12
QC OFFICER APPROVAL DATE

[signature] 11-5-12
QA APPROVAL DATE

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FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW __X__ 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: EC121004SS DATE: 10/4/2012

TEST ID NUMBER(S): 3 LOT 3

TEST LOCATION: N 11178.74 E 11703.99 TEST METHOD: ____ D1556 __X__ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model: Troxler 3430 Gauge Serial #: 19481

Last Calibration Date: 9/17/12

Daily Standard Counts: *Off-Cell Standard*

Density: 1986 Moisture: 636

Method A (Direct Transmission)

Depth Setting: 8 *(inches)* Count Time: 1 *(minutes)*

Moisture Count: 207 Density Count: 1252

Wet Density (ρ_m): 121.7 *(lbs/ft³)* Dry Density: 105.6 *(lbs/ft³)*

Moisture Density: 16.1 *(lbs/ft³)* Moisture Fraction: 15.2 *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID: Pan-3

Mass of container & wet specimen (M_{cms})	629.2	g
Mass of container & dry specimen (M_{cds})	527.8	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	101.4	g
Mass of container (M_c)	108.2	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	419.6	g
Moisture content (w) $w = (M_w / M_s) \times 100$	24.2	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

$\rho d = (100 \times 121.7) / (100 + 24.2) = 98.0$ lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = $\rho_d / \gamma_d max \times 100$

$98.0 / 97.0 \times 100 = 101.0$ %

Soil Description: Brownish gray mixed clay

Proctor ID: E000721-3

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$): 97.0 (lbs/ft³)

Optimum Moisture (w_{opt}): 25.0 (%)

Required Moisture: N/A % to N/A %

Required Percent Compaction: 95.0 (%)

Comments:

TEST RESULTS:

__X__ Pass

____ Failed Moisture

____ Failed Compaction

Date: 10/5/12

Time: 823

By: Jeremy Hodges (print) / [signature] (signature)

[signature] QC OFFICER APPROVAL 10-23-12 DATE

[signature] QA APPROVAL 11-5-12 DATE

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FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: EC121004SS DATE: 10/4/2012

TEST ID NUMBER(S): 4 LOT 4

TEST LOCATION: N 11058.96 E 11694.66 TEST METHOD: ____ D1556 X D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model Troxler 3430 Gauge Serial # 19481

Last Calibration Date: 9/17/12

Daily Standard Counts: *Off-Cell Standard*

Density 1986 Moisture 636

Method A (Direct Transmission)

Depth Setting 8 *(inches)* Count Time 1 *(minutes)*

Moisture Count 174 Density Count 1413

Wet Density (ρ_m) 117.2 *(lbs/ft³)* Dry Density 103.9 *(lbs/ft³)*

Moisture Density 13.3 *(lbs/ft³)* Moisture Fraction 12.9 *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\ M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID Pan-4

Mass of container & wet specimen (M_{cms})	599.6	g
Mass of container & dry specimen (M_{cds})	514.1	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	85.5	g
Mass of container (M_c)	108.5	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	405.6	g
Moisture content (w) $w = (M_w / M_s) \times 100$	21.1	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x 117.2) / (100 + 21.1 = 96.8 lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

96.8 / 101.0 x 100 = 95.8 %

Soil Description: Brownish mixed clay

Proctor ID: E001024-1

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) 101.0 (lbs/ft³)

Optimum Moisture (w_{opt}) 21.5 (%)

Required Moisture: N/A % to N/A %

Required Percent Compaction: 95.0 (%)

Comments:

TEST RESULTS:

X Pass Date: 10/5/12

____ Failed Moisture

____ Failed Compaction Time: 824

By: Jeremy Hodges / [signature]
(print) (signature)

[signature] 10-23-12
QC OFFICER APPROVAL DATE

[signature] 11-5-12
QA APPROVAL DATE

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Clive, Utah

ES-1905
Revision 0

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW _X_ 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: EC121004SS DATE: 10/4/2012

TEST ID NUMBER(S): 5 LOT 5

TEST LOCATION: N 10655.86 E 11692.46 TEST METHOD: ____ D1556 _X_ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model: Troxler 3430 Gauge Serial #: 19481

Last Calibration Date: 9/17/12

Daily Standard Counts: *Off-Cell Standard*

Density: 1986 Moisture: 636

Method A (Direct Transmission)

Depth Setting: 8 *(inches)* Count Time: 1 *(minutes)*

Moisture Count: 180 Density Count: 1038

Wet Density (ρ_m): 129.1 *(lbs/ft³)* Dry Density: 115.2 *(lbs/ft³)*

Moisture Density: 13.9 *(lbs/ft³)* Moisture Fraction: 12.0 *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ *g/cm³* ____ *lbs/ft³*

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm^3

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID: Pan-5

Mass of container & wet specimen (M_{cms})	703.9	g
Mass of container & dry specimen (M_{cds})	602.3	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	101.6	g
Mass of container (M_c)	108.1	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	494.2	g
Moisture content (w) $w = (M_w / M_s) \times 100$	20.6	%

Soil Description: Lean Clay

Proctor ID: S5010925-2

Standard Proctor (ASTM D698)

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

$\rho d = (100 \times 129.1)/(100 + 20.6) = 107.1$ lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = $\rho_d / \gamma_d max \times 100$

107.1 / 103.2 x 100 = 103.8 %

Maximum Dry Density ($\gamma_d max$): 103.2 (lbs/ft³)

Optimum Moisture (w_{opt}): 20.1 (%)

Required Moisture: N/A % to N/A %

Required Percent Compaction: 95.0 (%)

Comments:

TEST RESULTS:

_X_ Pass Date: 10/5/12

____ Failed Moisture

____ Failed Compaction Time: 825

By: Jeremy Hodges *(print)* / Jeremy Hodges *(signature)*

QC OFFICER APPROVAL [signature] DATE: 10-23-12

QA APPROVAL [signature] DATE: 11-5-12

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ES-1905
Revision 0

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: EC121004SS DATE: 10/4/2012

TEST ID NUMBER(S): 6 LOT 6

TEST LOCATION: N 10541.77 E 11694.29 TEST METHOD: ____ D1556 X D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model Troxler 3430 Gauge Serial # 19481

Last Calibration Date: 9/17/12

Daily Standard Counts: *Off-Cell Standard*

Density 1986 Moisture 636

Method A (Direct Transmission)

Depth Setting 8 *(inches)* Count Time 1 *(minutes)*

Moisture Count 179 Density Count 1240

Wet Density (ρ_m) 122.2 *(lbs/ft³)* Dry Density 108.5 *(lbs/ft³)*

Moisture Density 13.8 *(lbs/ft³)* Moisture Fraction 12.7 *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D2216 @ 110° C

Container ID Pan-1

Mass of container & wet specimen (M_{cms})	724.2	g
Mass of container & dry specimen (M_{cds})	617.9	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	106.3	g
Mass of container (M_c)	108.6	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	509.3	g
Moisture content (w) $w = (M_w / M_s) \times 100$	20.9	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x 122.2) / (100 + 20.9 = 101.1 lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

101.1 / 103.2 x 100 = 98.0 %

Soil Description: Lean Clay

Proctor ID: S5010925-2

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) 103.2 (lbs/ft³)

Optimum Moisture (w_{opt}) 20.1 (%)

Required Moisture: N/A % to N/A %

Required Percent Compaction: 95.0 (%)

Comments:

TEST RESULTS:

X Pass Date: 10/5/12

____ Failed Moisture

____ Failed Compaction Time: 826

By: Jeremy Hodges (print) / Jeremy Hodges (signature)

[signature] QC OFFICER APPROVAL 10-23-12 DATE

[signature] QA APPROVAL 11-5-12 DATE

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QC - 11e.(2) Lift Approval - 10/4/2012

ENERGYSOLUTIONS

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Rev. 1

FIELD PERMEABILITY TEST

PROJECT: CAW ____ MW X 11e.(2) OTHER ____

Test Location: **N. 11178.74 E. 11703.99** Elevation/Lift **EC121004SS** Lot No. **3**

TESTING DATA: TESTED BY: **Jeremy Hodges**

Soil Saturation Start: Date: **10/5/12** Time: **10:00** Max. Dry Density **97.0** pcf

Soil Saturation Finish: Date: **10/5/12** Time: **14:00** Opt. Moisture **25.0** %

Depth of Wet Front Measurements: 1) **0.8** 2) **2.2** 3) **1.3** Density test # **3**

Average Depth of Wet Front (L) **1.4** cm Dry Density **98.0** pcf

Radius of Measuring Tube (Rt) **0.32** cm Moisture content **24.2** %

Radius of Permeameter Ring (Rr) **22.0** cm Compaction **101.0** %

Height of Water, (Ht) **186.8** cm

Soil/Water temp, in ring, after test **21** °C

$\frac{dH}{dT} = \frac{\text{Change in Head (cm)}}{\text{Time (minutes)}} = \frac{\text{N/A cm}}{8 \text{ min}}$ (dH/dT) = **1.7301** Based on linear regression

R = **0.976** (From Figure 1)

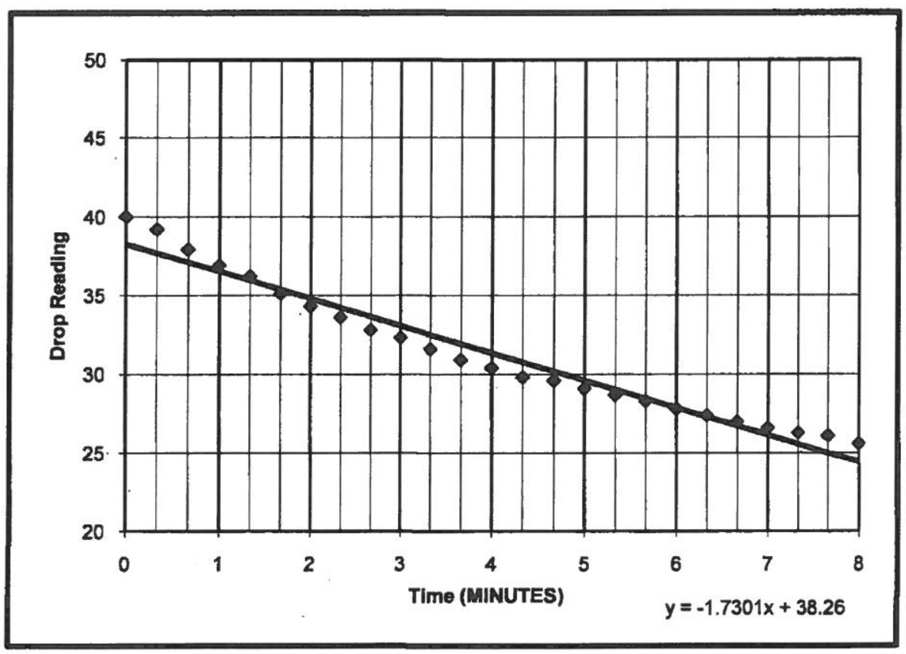
$$K_s = \left[\frac{(2)\ (dH/dT)\ (L)}{(60)\ ((Ht)+(0.5)(L))}\right]\left[\frac{(Rt)2}{(Rr)2}\right] \times (R)$$

$$K_s = \left[\frac{(2)(1.7301)(1.4)}{(60)((186.8)+(0.5)(1.4))}\right]\left[\frac{(0.32)^2}{(22.0)^2}\right] \times \underline{0.976}$$

K_s = **8.9E-08** cm/sec **Required Permeability:** x $\leq 1X10^{-6}$ ____ $\leq 5X10^{-8}$ ____ $\leq 1X10^{-7}$

Timed Water Drop Reading

min.		min.	
0:00	**40.0**	4:20	**29.8**
0:20	**39.2**	4:40	**29.6**
0:40	**37.9**	5:00	**29.1**
1:00	**36.9**	5:20	**28.7**
1:20	**36.2**	5:40	**28.3**
1:40	**35.1**	6:00	**27.8**
2:00	**34.3**	6:20	**27.4**
2:20	**33.6**	6:40	**27.0**
2:40	**32.8**	7:00	**26.6**
3:00	**32.3**	7:20	**26.3**
3:20	**31.6**	7:40	**26.1**
3:40	**30.9**	8:00	**25.6**
4:00	**30.4**		



Required Permeability:

≤ 1.0E-06

Actual Permeability:

8.9E-08

Soil/Water Temp (°C)	Corr. Factor (R)
0	1.783
1	1.723
2	1.664
3	1.611
4	1.560
5	1.511
6	1.465
7	1.421
8	1.379
9	1.339
10	1.301
11	1.265
12	1.230
13	1.197
14	1.165
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1.000
21	**0.976**
22	0.953
23	0.931
24	0.910
25	0.889
26	0.869
27	0.850
28	0.832
29	0.814
30	0.797
31	0.780
32	0.764
33	0.749
34	0.733
35	0.719
36	0.705
37	0.692
38	0.678
39	0.665
40	0.653

Figure 1

Test Results: **Pass** **Fail** **By** Jeremy Hodges **Date** 10/05/12

[signature] 10-23-12 [signature] 11-5-12

QC OFFICER APPROVAL DATE QA APPROVAL DATE

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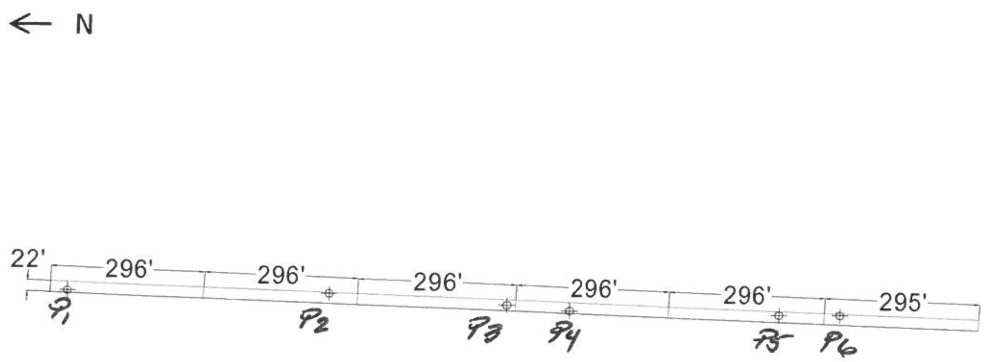
EMBANKMENT CONSTRUCTION
LIFT APPROVAL FORM

..JECT: ________ CAN ________ MW __X__ 11e.(2) ________ CLASS A OTHER ________

WORK ELEMENT: ___ FOUNDATION __X__ CLAY LINER _____ RADON BARRIER OTHER ________

NW CORNER: N 12050.72 E 11717.21 DATE: 5/3/2013



P 1	N 11980.61 E 11720.27				
EW:	22	X	0.212	=	5
NS:	296	X	0.235	=	70
P 2	N 11512.36 E 11722.26				
EW:	22	X	0.896	=	20
NS:	296	X	0.818	=	242
P 3	N 11178.74 E 11703.99				
EW:	22	X	0.508	=	11
NS:	296	X	0.946	=	280
P 4	N 11058.96 E 11694.66				
EW:	22	X	0.205	=	5
NS:	296	X	0.353	=	104
P 5	N 10655.86 E 11692.46				
EW:	22	X	0.651	=	14
NS:	296	X	0.713	=	211

Page 2 attached: Y N

IDENTIFY LOTS ABOVE

LIFT ID: EC130503SS UNC. THICKNESS: 9.0" Constructed Per Test Pad #: N/A

Lift Bonding Inspections (change in grade of at least 1" - two per linear foot): By: N/A Date: N/A Time: N/A

Grade Pole Inspections (at least a 70 foot grid & all control points): By: N/A Date: N/A Time: N/A

Dry Clod Size Inspection (Less than or equal to 1"): By: N/A Date: N/A Time: N/A

Equipment Used for Compaction & # of Passes: N/A

# of Deflocculant Bags: N/A Size of Mixing Area: N/A On-Cell / Off-Cell # Passes with Tiller: N/A

KEYING IN NOTES: N E S W N/A DENSITY TESTS ID # (S): 1 - 6

PERMEABILITY TESTS LOT # (S): 2 SANDCONE TEST LOT # (S): N/A

COMMENTS: **This lift approval is for spring start-up of 38999 ft² along the Eastern side of 11e.(2) embankment lift areas S-11, R-12, L-12, H-12, and D-12. This testing satisfies the requirement that "spring start-up testing shall be conducted on" these lift areas "prior to and in the same construction season as initial waste placement for each area."**

LIFT APPROVED BY: [signature] DATE: 5/3/2013 TIME: 15:41

[signature] QC OFFICER APPROVAL 5-07-13 DATE [signature] QA APPROVAL 1/30/15 DATE

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RANDOM NUMBER CONTINUATION SHEET

Date: 05/03/13

Lift ID: EC130503SS **NW Corner** N 12050.72 E 11717.21

P 6 N 10541.77 E 11694.29					
EW:	22	X	0.884	=	19
NS:	295	X	0.099	=	29
P 7					
EW:		X		=	
NS:		X		=	
P 8					
EW:		X		=	
NS:		X		=	
P 9					
EW:		X		=	
NS:		X		=	
P 10					
EW:		X		=	
NS:		X		=	
P 11					
EW:		X		=	
NS:		X		=	
P12					
EW:		X		=	
NS:		X		=	
P 13					
EW:		X		=	
NS:		X		=	
P 14					
EW:		X		=	
NS:		X		=	
P 15					
EW:		X		=	
NS:		X		=	
P 16					
EW:		X		=	
NS:		X		=	
P 17					
EW:		X		=	
NS:		X		=	
P 18					
EW:		X		=	
NS:		X		=	
P 19					
EW:		X		=	
NS:		X		=	
P20					
EW:		X		=	
NS:		X		=	
P 21					
EW:		X		=	
NS:		X		=	
P 22					
EW:		X		=	
NS:		X		=	
P 23					
EW:		X		=	
NS:		X		=	
P 24					
EW:		X		=	
NS:		X		=	
P 25					
EW:		X		=	
NS:		X		=	
P 26					
EW:		X		=	
NS:		X		=	
P 27					
EW:		X		=	
NS:		X		=	
P 27					
EW:		X		=	
NS:		X		=	
P 29					
EW:		X		=	
NS:		X		=	

COMMENTS:

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FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A **OTHER** ____

LIFT IDENTIFICATION: **EC130503SS** DATE: **5/3/2013**

TEST ID NUMBER(S): **1 LOT 1**

TEST LOCATION: **N 11980.61 E 11720.27** TEST METHOD: ____ D1556 X D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **31021**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **2472** Moisture **683**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **153** Density Count **1426**

Wet Density (ρ_m) **127.0** *(lbs/ft³)* Dry Density **116.4** *(lbs/ft³)*

Moisture Density **10.6** *(lbs/ft³)* Moisture Fraction **9.1** *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ *g/cm³* ____ *lbs/ft³*

Mass of Sand to Fill Cone & Plate (M_2) ____ *g*

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D4643

Container ID **TLT**

Mass of container & wet specimen (M_{cms})	364.0	g
Mass of container & dry specimen (M_{cds})	338.3	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	25.7	g
Mass of container (M_c)	230.1	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	108.2	g
Moisture content (w) $w = (M_w / M_s) \times 100$	23.8	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x **127.0**) / (100 + **23.8** = **102.6** lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

102.6 / **100.0** x 100 = **102.6** %

Soil Description: **Reddish brown clay**

Proctor ID: **S5020221-1**

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) **100.0** (lbs/ft³)

Optimum Moisture (w_{opt}) **23.5** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

X Pass Date: **5/3/13**

____ Failed Moisture

____ Failed Compaction Time: **1004**

By: **Brennon Dick** / [signature]

(print) (signature)

[signature] 5-07-13

QC OFFICER APPROVAL DATE

[signature] 5-7-13

QA APPROVAL DATE

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: EC130503SS DATE: 5/3/2013

TEST ID NUMBER(S): 2 LOT 2

TEST LOCATION: N 11512.36 E 11722.26 TEST METHOD: ____ D1556 X D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model Troxler 3430 Gauge Serial # 31021

Last Calibration Date: 9/17/12

Daily Standard Counts: *Off-Cell Standard*

Density 2472 Moisture 683

Method A (Direct Transmission)

Depth Setting 8 *(inches)* Count Time 1 *(minutes)*

Moisture Count 206 Density Count 1386

Wet Density (ρ_m) 127.9 *(lbs/ft³)* Dry Density 113.2 *(lbs/ft³)*

Moisture Density 14.7 *(lbs/ft³)* Moisture Fraction 13.0 *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D4643

Container ID WAWA

Mass of container & wet specimen (M_{cms})	343.4	g
Mass of container & dry specimen (M_{cds})	324.5	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	18.9	g
Mass of container (M_c)	232.2	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	92.3	g
Moisture content (w) $w = (M_w / M_s) \times 100$	20.5	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x 127.9) / (100 + 20.5 = 106.2 lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

106.2 / 100.0 x 100 = 106.2 %

Soil Description: Reddish brown clay

Proctor ID: S5020221-1

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) 100.0 (lbs/ft³)

Optimum Moisture (w_{opt}) 23.5 (%)

Required Moisture: N/A % to N/A %

Required Percent Compaction: 95.0 (%)

Comments:
Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

X Pass Date: 5/3/13

____ Failed Moisture

____ Failed Compaction Time: 1003

By: Brennon Dick (print) [signature] (signature)

[signature] 5-07-13 [signature] 5-7-13

QC OFFICER APPROVAL DATE QA APPROVAL DATE

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ CAN ____ MW X 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: **EC130503SS** DATE: **5/3/2013**

TEST ID NUMBER(S): **3 LOT 3**

TEST LOCATION: **N 11178.74 E 11703.99** TEST METHOD: ____ D1556 X D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **31021**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **2472** Moisture **683**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **234** Density Count **1893**

Wet Density (ρ_m) **115.8** *(lbs/ft³)* Dry Density **99.0** *(lbs/ft³)*

Moisture Density **16.9** *(lbs/ft³)* Moisture Fraction **17.0** *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ *g/cm³* ____ *lbs/ft³*

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

MOISTURE DETERMINATION

ASTM D4643

Container ID **400**

Mass of container & wet specimen (M_{cms})	382.3	g
Mass of container & dry specimen (M_{cds})	353.5	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	28.8	g
Mass of container (M_c)	228.2	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	125.3	g
Moisture content (w) $w = (M_w / M_s) \times 100$	23.0	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x **115.8**) / (100 + **23.0** = **94.2** lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

94.2 / **97.0** x 100 = **97.1** %

Soil Description: **Brownish gray mixed clay**

Proctor ID: **E000721-3**

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) **97.0** (lbs/ft³)

Optimum Moisture (w_{opt}) **25.0** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

X Pass

____ Failed Moisture

____ Failed Compaction

Date: 5/3/~~02~~ 13

Time: 1000

By: **Brennon Dick** (print) [signature] (signature)

[signature] QC OFFICER APPROVAL 5-07-13 DATE

[signature] QA APPROVAL 5-7-13 DATE

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FIELD DENSITY TEST

PROJECT: ____ **CAN** ____ **MW** **X** **11e.(2)** ____ **CLASS A** **OTHER** ________

LIFT IDENTIFICATION: **EC130503SS** DATE: **5/3/2013**

TEST ID NUMBER(S): **4 LOT 4**

TEST LOCATION: **N 11058.96 E 11694.66** TEST METHOD: ____ D1556 **X** D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **31021**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **2472** Moisture **683**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **181** Density Count **1947**

Wet Density (ρ_m) **115.0** *(lbs/ft³)* Dry Density **102.2** *(lbs/ft³)*

Moisture Density **12.8** *(lbs/ft³)* Moisture Fraction **12.5** *(%)*

MOISTURE DETERMINATION

ASTM D4643

Container ID **AZ**

Mass of container & wet specimen (M_{cms})	417.1	g
Mass of container & dry specimen (M_{cds})	386.4	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	30.7	g
Mass of container (M_c)	228.2	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	158.2	g
Moisture content (w) $w = (M_w / M_s) \times 100$	19.4	%

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x **115.0**) / (100 + **19.4** = **96.3** lbs/ft³

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

96.3 / **101.0** x 100 = **95.4** %

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft³)* ____

Bulk Density of sand (ρ_1) ____ g/cm³ ____ lbs/ft³

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm³

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft³

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm³

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft³

Soil Description: **Brownish mixed clay**

Proctor ID: **E001024-1**

Standard Proctor (ASTM D698)

Maximum Dry Density ($\gamma_d max$) **101.0** (lbs/ft³)

Optimum Moisture (w_{opt}) **21.5** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

X Pass Date: **5/3/13**

____ Failed Moisture

____ Failed Compaction Time: **1001**

By: **Brennon Dick** (print) [signature] (signature)

[signature] 5-07-13

QC OFFICER APPROVAL DATE

[signature] 5-7-13

QA APPROVAL DATE

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ **CAN** ____ **MW** __X__ **11e.(2)** ____ **CLASS A** **OTHER** ______

LIFT IDENTIFICATION: **EC130503SS** DATE: **5/3/2013**

TEST ID NUMBER(S): **5 LOT 5**

TEST LOCATION: **N 10655.86 E 11692.46** TEST METHOD: ____ D1556 __X__ D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **31021**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **2472** Moisture **683**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **188** Density Count **1618**

Wet Density (ρ_m) **122.0** *(lbs/ft^3)* Dry Density **108.7** *(lbs/ft^3)*

Moisture Density **13.3** *(lbs/ft^3)* Moisture Fraction **12.2** *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft^3)* ____

Bulk Density of sand (ρ_1) ____ *g/cm^3* ____ *lbs/ft^3*

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm^3

Dry Mass of soil $M_4 = 100\, M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft^3

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm^3

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft^3

MOISTURE DETERMINATION

ASTM D4643

Container ID **JFK**

Mass of container & wet specimen (M_{cms})	414.2	g
Mass of container & dry specimen (M_{cds})	383.0	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	31.2	g
Mass of container (M_c)	227.2	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	155.8	g
Moisture content (w) $w = (M_w / M_s) \times 100$	20.0	%

Soil Description: **Lean Clay**

Proctor ID: **S5010925-2**

Standard Proctor (ASTM D698)

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

$\rho d = ($ 100 x **122.0** $) / (100 +$ **20.0** $=$ **101.6** lbs/ft^3

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = $\rho_d \;/\; \gamma_d max \times 100$

101.6 / **103.2** x 100 = **98.5** %

Maximum Dry Density ($\gamma_d max$) **103.2** (lbs/ft^3)

Optimum Moisture (w_{opt}) **20.1** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:
Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

__X__ Pass Date: **5/3/13**

____ Failed Moisture

____ Failed Compaction Time: **1015**

By: **Brennon Dick** *(print)* [signature] *(signature)*

[signature] 5-07-13

QC OFFICER APPROVAL DATE

[signature] 5-7-13

QA APPROVAL DATE

ENERGYSOLUTIONS

FIELD DENSITY TEST

PROJECT: ____ **CAN** ____ **MW** **X** **11e.(2)** ____ **CLASS A** **OTHER** ________

LIFT IDENTIFICATION: **EC130503SS** DATE: **5/3/2013**

TEST ID NUMBER(S): **6 LOT 6**

TEST LOCATION: **N 10541.77 E 11694.29** TEST METHOD: ____ D1556 **X** D6938

ASTM D6938 (DENSITY DETERMINATION)

Make/Model **Troxler 3430** Gauge Serial # **31021**

Last Calibration Date: **9/17/12**

Daily Standard Counts: *Off-Cell Standard*

Density **2472** Moisture **683**

Method A (Direct Transmission)

Depth Setting **8** *(inches)* Count Time **1** *(minutes)*

Moisture Count **212** Density Count **1673**

Wet Density (ρ_m) **120.7** *(lbs/ft^3)* Dry Density **105.5** *(lbs/ft^3)*

Moisture Density **15.2** *(lbs/ft^3)* Moisture Fraction **14.4** *(%)*

ASTM D1556 (DENSITY DETERMINATION)

Testing Apparatus ____ Calibrated Vol. *(lbs/ft^3)* ____

Bulk Density of sand (ρ_1) ____ *g/cm^3* ____ *lbs/ft^3*

Mass of Sand to Fill Cone & Plate (M_2) ____ g

Mass of bottle & cone **before** filling cone, plate & hole		g
Mass of bottle & cone **after** filling cone, plate & hole		g
Mass of sand to fill cone, plate, & hole (M_1)		g
Mass of sand to fill hole		g
Mass of wet soil & container		g
Mass of container		g
Mass of wet soil (M_3)		g

Test Hole Volume $V = (M_1 - M_2) / \rho_1$ ____ cm^3

Dry Mass of soil $M_4 = 100\,M_3 / (w + 100)$ ____ g

Wet Denisty $\rho_m = (M_3 / V) \times 62.43$ ____ lbs/ft^3

Dry Denisty $\rho_d = M_4 / V$ ____ g/cm^3

Dry Unit Weight $\gamma_d = \rho_d \times 62.43$ ____ lbs/ft^3

MOISTURE DETERMINATION

ASTM D4643

Container ID **LALA**

Mass of container & wet specimen (M_{cms})	350.5	g
Mass of container & dry specimen (M_{cds})	328.7	g
Mass of water (M_w) $M_w = M_{cms} - M_{cds}$	21.8	g
Mass of container (M_c)	227.3	g
Mass of dry specimen (M_s) $M_s = M_{cds} - M_c$	101.4	g
Moisture content (w) $w = (M_w / M_s) \times 100$	21.5	%

Soil Description: **Lean Clay**

Proctor ID: **S5010925-2**

Standard Proctor (ASTM D698)

Dry Density $(\rho_d) = (100 \times \rho_m)/(100 + w)$

ρd = (100 x **120.7**) / (100 + **21.5** = **99.3** lbs/ft^3

Note: Wet Density from ASTM D 1556 (ρ_m) takes presidence over ASTM D 6938 (ρ_m)

Percent Compaction = ρ_d / $\gamma_d max$ x 100

99.3 / **103.2** x 100 = **96.3** %

Maximum Dry Density ($\gamma_d max$) **103.2** (lbs/ft^3)

Optimum Moisture (w_{opt}) **20.1** (%)

Required Moisture: **N/A** % to **N/A** %

Required Percent Compaction: **95.0** (%)

Comments:

Microwave oven power setting on HIGH. Initial time setting of 3 minutes and subsequent incremental drying periods of 1 minute until a change of 0.1 % or less of the initial wet mass of the soil.

TEST RESULTS:

X Pass Date: **5/3/13**

____ Failed Moisture

____ Failed Compaction Time: **1020**

By: **Brennon Dick** (print) [signature] (signature)

[signature] 5-07-13
QC OFFICER APPROVAL DATE

[signature] 5-7-13
QA APPROVAL DATE

ENERGY*SOLUTIONS*

FIELD PERMEABILITY TEST

PROJECT: CAW MW **X** 11e.(2) OTHER ______

Test Location: **N 11512.36 E 11722.26** Elevation/Lift **EC130503SS** Lot No. **2**

TESTING DATA: TESTED BY: **Brennon Dick**

Soil Saturation Start: Date: **5/3/13** Time: **0945** Max. Dry Density **100.0** pcf

Soil Saturation Finish: Date: **5/3/13** Time: **1410** Opt. Moisture **23.5** %

Depth of Wet Front Measurements: 1) **0.2** 2) **0.2** 3) **1.3** Density test # **2**

Average Depth of Wet Front (L) **0.6** cm Dry Density **106.2** pcf

Radius of Measuring Tube (Rt) **0.32** cm Moisture content **20.5** %

Radius of Permeameter Ring (Rr) **22.0** cm Compaction **106.2** %

Height of Water, (Ht) **181.6** cm

Soil/Water temp, in ring, after test **24** °C

$$\frac{dH}{dT} = \frac{\text{Change in Head (cm)}}{\text{Time (minutes)}} = \frac{\text{N/A cm}}{8 \text{ min}}$$

(dH/dT) = **0.1883**
Based on linear regression

R = **0.910** (From Figure 1)

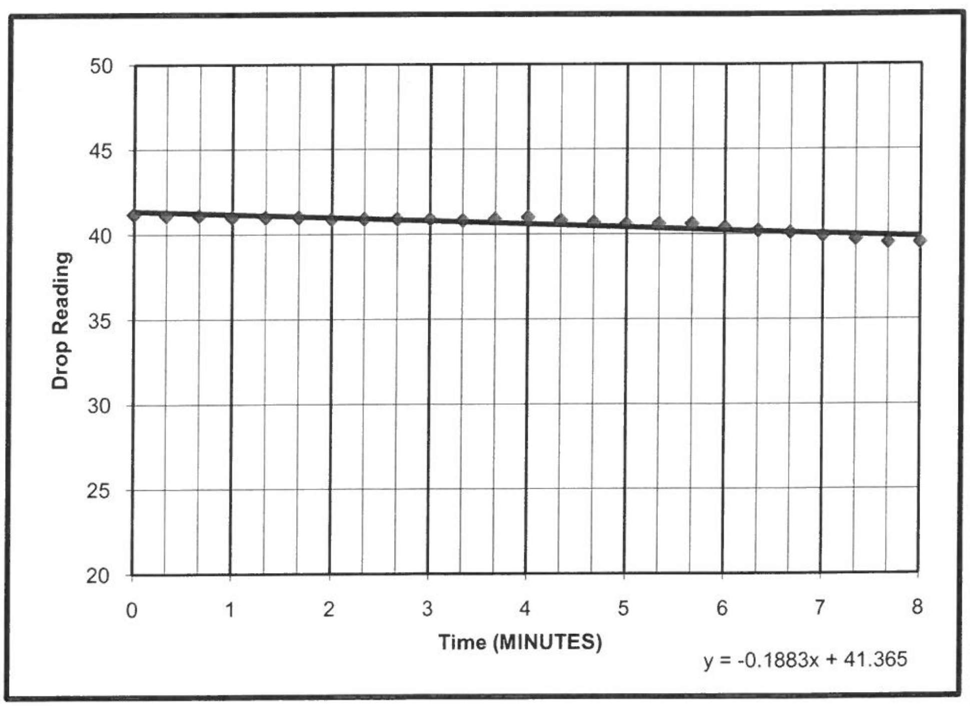
$$K_s = \left[\frac{(2)\ (dH/dT)\ (L)}{(60)\ ((Ht)+(0.5)(L))}\right]\left[\frac{(Rt)2}{(Rr)2}\right] \text{ X (R)}$$

$$K_s = \left[\frac{(2)(\ 0.1883\ )\ (\ 0.6\ )}{(60)((\ 181.6\ )+(0.5)\ (\ 0.6\ ))}\right]\left[\frac{(\ 0.32\ )^2}{(\ 22.0\ )^2}\right] \text{ X } \mathbf{0.910}$$

K_s = **4.0E-09** cm/sec **Required Permeability:** **X** $\leq 1X10^{-6}$ ____ $\leq 5X10^{-8}$ ____ $\leq 1X10^{-7}$

Timed Water Drop Reading

min.		min.	
0:00	**41.2**	4:20	**40.8**
0:20	**41.1**	4:40	**40.7**
0:40	**41.1**	5:00	**40.6**
1:00	**41.0**	5:20	**40.6**
1:20	**41.0**	5:40	**40.6**
1:40	**41.0**	6:00	**40.4**
2:00	**40.9**	6:20	**40.2**
2:20	**40.9**	6:40	**40.1**
2:40	**40.9**	7:00	**39.9**
3:00	**40.9**	7:20	**39.7**
3:20	**40.8**	7:40	**39.5**
3:40	**40.9**	8:00	**39.5**
4:00	**41.0**		



Required Permeability:

≤ 1.0E-06

Actual Permeability:

4.0E-09

Soil/Water Temp (°C)	Corr. Factor (R)
0	1.783
1	1.723
2	1.664
3	1.611
4	1.560
5	1.511
6	1.465
7	1.421
8	1.379
9	1.339
10	1.301
11	1.265
12	1.230
13	1.197
14	1.165
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1.000
21	0.976
22	0.953
23	0.931
24	**0.910**
25	0.889
26	0.869
27	0.850
28	0.832
29	0.814
30	0.797
31	0.780
32	0.764
33	0.749
34	0.733
35	0.719
36	0.705
37	0.692
38	0.678
39	0.665
40	0.653

Figure 1

Test Results: **Pass** **Fail** By [signature] Date 5.03.13

[signature] 5.07.13 [signature] 5-7-13
QC OFFICER APPROVAL DATE QA APPROVAL DATE

(EWL12)

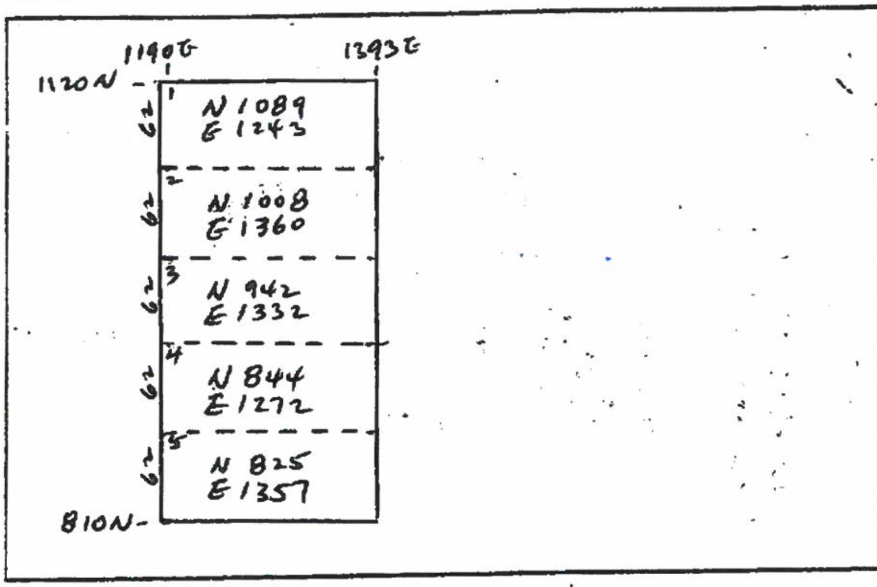
ENVIROCARE OF UTAH, INC.
LIFT APPROVAL FORM
(EC-1904)

ORIGINAL
(DATE: [illegible]/98)
REVISION: 03 RCN: 02

PROJECT: ____LARW____ MW X 11e.(2) ____ OTHER (specify) clay liner 5th Lift

NW CORNER

DATE: 8-11-00



P1			
EW:	X	=	
NS:	X	=	
P2			
EW:	X	=	
NS:	X	=	
P3			
EW:	X	=	
NS:	X	=	
P4			
EW:	X	=	
NS:	X	=	
P5			
EW:	X	=	
NS:	X	=	

IDENTIFY LOTS ABOVE

LIFT ID: ECL000811 NW CORNER: 1120 N · 1190 E INTERFACE RANDOM #: N/R

WASTE GENERATOR ID NUMBER(S): N/R

THICKNESS: UNC: Ave = 5.0" COMP: N/R ELEV: N/R

DEBRIS CALCULATIONS: N/R

KEYING IN NOTES: N (E) S W Satisfactory DENSITY TESTS ID #(S): 33, 34 35 36 37

COMMENTS: The material compacted procedures were approved in test pad 98 TP-2

LIFT APPROVED BY: Glen Chan DATE: 8-11-00 TIME: 1100

[signature] 8-15-2000 [signature] 8-15-00

QC OFFICER APPROVAL DATE QA OFFICER APPROVAL DATE

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD DENSITY TEST

(EC-1905, rev. 4)

PROJECT: ____ LARW: ______ MW: X lie.(2): ______ OTHER (specify): ______

LIFT IDENTIFICATION: ECL000811 DATE: 8-11-00

WASTE OR (TEST) ID NUMBER(S): 33 1of 1

TEST LOCATION: 1089 N 1243 E TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 25128

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2544
Moisture Counts	—	Moisture Counts	730
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	222	Density Counts	2274
Wet Density (PCF)	124.0	Dry Density (PCF)	107.6
Moisture Density (PCF)	16.5	Moisture Fraction (%)	15.3

MOISTURE DETERMINATION

Container ID: EE

Mass of wet soil & container (g)	229.6
Mass of dry soil & container (g)	209.5
Mass of water (g)	20.1
Mass of dry soil & container (g)	209.5
Mass of container (g)	129.6
Mass of dry soil (g)	79.9
Moisture content (%)	25.2

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 124.0 x 100.0 / 25.2 + 100.0 = 99.0 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 99.0 / 97.0 x 100.0 = 102.1 %

D1556 DENSITY DETERMINATION (SAND CONE)

GC 8/11/00

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # E000721-3

Proctor Dry Density (PCF) 97.0

Proctor Optimum Moisture (%) 25.0

Required Moisture (%): 25.0 to 30.0

Required Compaction (%): 95.0

TEST RESULTS:

X Pass

___ Failed Moisture

___ Failed Compaction

BY: Ryan Harris TIME: 1030

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	8-15-2000	[signature]	8-15-00

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD DENSITY TEST

(EC-1905, rev. 4)

PROJECT: ____ LARW: ______ MW: X lic.(2): ______ OTHER (specify): ______

LIFT IDENTIFICATION: ECL000811 DATE: 8-11-00

WASTE OR (TEST) ID NUMBER(S): 34 1 of 2

TEST LOCATION: 1008 N 1360 E TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 2512B

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2544
Moisture Counts	—	Moisture Counts	730
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	235	Density Counts	2305
Wet Density (PCF)	123.4	Dry Density (PCF)	105.9
Moisture Density (PCF)	17.5	Moisture Fraction (%)	16.6

MOISTURE DETERMINATION

Container ID AJD

Mass of wet soil & container (g)	233.3
Mass of dry soil & container (g)	213.0
Mass of water (g)	20.3
Mass of dry soil & container (g)	213.0
Mass of container (g)	133.3
Mass of dry soil (g)	79.7
Moisture content (%)	25.5

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 123.4 x 100.0 / 25.5 + 100.0 = 98.3 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 98.3 / 97.0 x 100.0 = 101.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

G.C. 8/11/00

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) x Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # E000721-3

Proctor Dry Density (PCF) 97.0

Proctor Optimum Moisture (%) 25.0

Required Moisture (%): 25.0 to 30.0

Required Compaction (%): 95.0

TEST RESULTS:

X Pass

___ Failed Moisture

___ Failed Compaction

BY: Ryan Harris TIME: 1030

[signature] 8-15-2000 — QC OFFICER APPROVAL, DATE

[signature] 8-15-00 — QA OFFICER APPROVAL, DATE

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD DENSITY TEST
(EC-1905, rev. 4)

PROJECT: ____ LARW: ____ MW: X lie.(2): ____ OTHER (specify): ____

LIFT IDENTIFICATION: ECL000B11 DATE: 8-11-00

WASTE OR (TEST) ID NUMBER(S): 35 1 of 3

TEST LOCATION: 942 N 1332 E TEST METHOD: ____ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 25128

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2544
Moisture Counts	—	Moisture Counts	730
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	231	Density Counts	2401
Wet Density (PCF)	121.7	Dry Density (PCF)	104.5
Moisture Density (PCF)	17.2	Moisture Fraction (%)	16.5

MOISTURE DETERMINATION

Container ID: R

Mass of wet soil & container (g)	230.1
Mass of dry soil & container (g)	209.1
Mass of water (g)	21.0
Mass of dry soil & container (g)	209.1
Mass of container (g)	130.1
Mass of dry soil (g)	79.0
Moisture content (%)	26.6

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 121.7 x 100.0 / 26.6 + 100.0 = 96.1 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 96.1 / 97.0 x 100.0 = 99.1 %

D1556 DENSITY DETERMINATION (SAND CONE)

(crossed out) G.C. 8/11/00

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA:

PROCTOR # E000721-3

Proctor Dry Density (PCF) 97.0

Proctor Optimum Moisture (%) 25.0

Required Moisture (%): 25.0 to 30.0

Required Compaction (%): 95.0

TEST RESULTS:

X Pass

____ Failed Moisture

____ Failed Compaction

BY: Ryan Harris TIME: 1030

[signature] 8-15-2000
QC OFFICER APPROVAL DATE

[signature] 8-15-00
QA OFFICER APPROVAL DATE

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD DENSITY TEST

(EC-1905, rev. 4)

PROJECT: ____ LARW: ____ MW: X 11e.(2): ____ OTHER (specify): ____

LIFT IDENTIFICATION: ECL000811 DATE: 8-11-00

WASTE OR TEST ID NUMBER(S): 36 1 of 4

TEST LOCATION: 844 N 1272 E TEST METHOD: ____ D1556 + D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 25128

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2544
Moisture Counts	—	Moisture Counts	730
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	219	Density Counts	2489
Wet Density (PCF)	120.3	Dry Density (PCF)	104.0
Moisture Density (PCF)	16.2	Moisture Fraction (%)	15.6

MOISTURE DETERMINATION

Container ID AFG

Mass of wet soil & container (g)	233.4
Mass of dry soil & container (g)	213.3
Mass of water (g)	20.1
Mass of dry soil & container (g)	213.3
Mass of container (g)	133.4
Mass of dry soil (g)	79.9
Moisture content (%)	~~25~~ 25.2 (8-11-00)

Dry Density = Wet Density (PCF) / Moisture content (%) + 100.0 x 100.0

Dry Density = 120.3 / 25.2 + 100.0 x 100.0 = 96.1 pcf

Percent Compaction = Dry Density / Proctor Density x 100.0

Percent Compaction = 96.1 / 97.0 x 100.0 = 99.1 %

D1556 DENSITY DETERMINATION (SAND CONE)

(crossed out — G.C. 8/11/00)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) x Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA: PROCTOR # E000721-3

Proctor Dry Density (PCF) 97.0

Proctor Optimum Moisture (%) 25.0

Required Moisture (%): 25.0 to 30.0

Required Compaction (%): 95.0

TEST RESULTS:

X Pass

___ Failed Moisture

___ Failed Compaction

BY: Ryan Harris TIME: 1030

Ray O Leech	8-15-2000	D Yhaley	8-15-00
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD DENSITY TEST

(EC-1905, rev. 4)

PROJECT:____ LARW:______ MW: + lie.(2):______ OTHER (specify):________

LIFT IDENTIFICATION: ECL000811 DATE: 8-11-00

WASTE OR TEST ID NUMBER(S): 37 lot 5

TEST LOCATION: 825N 1357E TEST METHOD:________ D1556 + D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 25128

On-Cell Standard:		Off-Cell Standard:	
Density Counts	____	Density Counts	2544
Moisture Counts	____	Moisture Counts	730
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	226	Density Counts	2427
Wet Density (PCF)	121.3	Dry Density (PCF)	104.5
Moisture Density (PCF)	16.8	Moisture Fraction (%)	16.1

MOISTURE DETERMINATION

Container ID: AH

Mass of wet soil & container (g)	230.6
Mass of dry soil & container (g)	210.5
Mass of water (g)	20.1
Mass of dry soil & container (g)	210.5
Mass of container (g)	130.6
Mass of dry soil (g)	79.9
Moisture content (%)	25.2

Dry Density = Wet Density (PCF) / Moisture content (%) + 100.0 x 100.0

Dry Density = 121.3 / 25.2 + 100.0 x 100.0 = 96.9 pcf

Percent Compaction = Dry Density / Proctor Density x 100.0

Percent Compaction = 96.9 / 97.0 x 100.0 = 99.9 %

D1556 DENSITY DETERMINATION (SAND CONE)

Q.C 8/11/00

Bulk Density of sand (PCF)	____
Mass of Sand to Fill Cone & Plate (g)	____
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

SOIL DATA: PROCTOR # E000721-3

Proctor Dry Density (PCF) 97.0

Proctor Optimum Moisture (%) 25.0

Required Moisture (%): 25.0 to 30.0

Required Compaction (%): 95.0

TEST RESULTS:

X Pass

____ Failed Moisture

____ Failed Compaction

BY: Ryan Harris TIME: 1030

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	8-15-2000	[signature]	8-15-00

ENVIROCARE OF UTAH, INC. ORIGINAL

FIELD PERMEABILITY TEST

(EC-1906 rev 1)

REVISION: 05/05/00

PROJECT: ______ LARW: ______ MW: X 11e.(2): ______ OTHER (specify) ______

Test Location: 1008 N 1360 E Elevation/Lift 5th Lot No. 2

TESTING DATA: TESTED BY: Ryan Harris

Soil Saturation Start: Date: 8-10-00 Time: 1500 Max. Dry Density 97.0 pcf

Soil Saturation Finish: Date: 8-11-00 Time: 0800 Opt. Moisture 25.0 %

Depth of Wet Front (L) 4.3 cm

Radius of Measuring Tube (Rt) .16 cm Density test # 34

Radius of Permeameter Ring (Rr) 13.02 cm Dry Density 98.3 pcf

Height of Water, (Ht) 140.0 cm Moisture content 25.5 %

Soil/Water temp, in ring, after test N/R °C N/R 11e(2) Compaction 101.4 %

$\frac{dH}{dT} = \frac{\text{Change in Head (cm)}}{\text{Time (minutes)}} = \frac{5.9 \text{ cm}}{8 \text{ min}} \times 0.01667 =$ .012294125 cm/sec

R = 1.000 (From Figure 1) *(R = 1.000 for 11e(2))

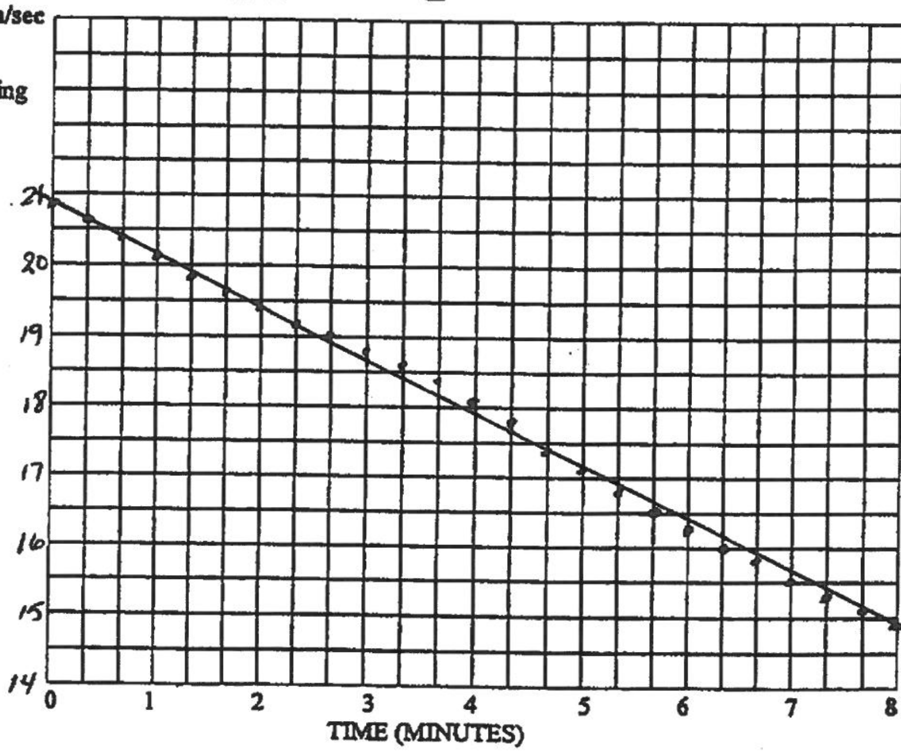
$$K_s = \left[\frac{(2)\ (dH/dT)\ (L)}{(Ht) + (0.5)\ (L)}\right]\left[\frac{(Rt)^2}{(Rr)^2}\right] \times (R)$$

$$K_s = \left[\frac{(2)(.01224125)(4.3)}{(140.0) + (0.5)(4.3)}\right]\left[\frac{(.16)^2}{(13.02)^2}\right] \times 1.000$$

K_s = 1.1x10⁻⁷ cm/sec

Timed Water Drop Reading

min.		min.	
0.00	20.8	4.20	17.8
0.20	20.6	4.40	17.4
0.40	20.4	5.00	17.1
1.00	20.1	5.20	16.8
1.20	19.8	5.40	16.5
1.40	19.6	6.00	16.3
2.00	19.4	6.20	16.0
2.20	19.2	6.40	15.8
2.40	19.0	7.00	15.6
3.00	18.8	7.20	15.3
3.20	18.6	7.40	15.1
3.40	18.4	8.00	14.9
4.00	18.1		



Soil/ Water Temp (°C)	Corr. Factor (R)
0	1.783
1	1.723
2	1.664
3	1.611
4	1.560
5	1.511
6	1.465
7	1.421
8	1.379
9	1.339
10	1.301
11	1.265
12	1.230
13	1.197
14	1.165
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1.000
21	0.976
22	0.953
23	0.931
24	0.910
25	0.889
26	0.869
27	0.850
28	0.832
29	0.814
30	0.797
31	0.780
32	0.764
33	0.749
34	0.733
35	0.719
36	0.705
37	0.692
38	0.678
39	0.665
40	0.653

Figure 1

Required Permeability 1x10⁻⁷ - 5x10⁻⁷ cm/sec Test Results (Pass) Fail By Glencha Date 8-11-00

[signature] 8-15-2000 [signature] 8-15-00

QC APPROVAL DATE QA APPROVAL DATE

EC-1905 Calculation Check

Lift ID: ECR12020314 Clay Liner R12 1711N; 1189E
Date: 3/14/02 4th Lift

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?
4th/1	100.0	23.5	382.7	326.0	56.7	133.2	192.8	29.4	118.3	91.4	91.4	5.9	S5020221-1	Yes
4th/1A (Retest)	100.0	23.5	328.2	308.2	20.0	228.2	80.0	25.0	118.1	94.5	94.5	1.5	S5020221-1	Yes
4th/1 B (Retest)	100.0	23.5	326.5	307.2	19.3	226.5	80.7	23.9	119.6	96.5	96.5	0.4	S5020221-1	Yes
4th/2	100.0	23.5	459.6	411.4	48.2	228.2	183.2	26.3	119.4	94.5	94.5	2.8	S5020221-1	Yes
4th/2A (Retest)	100.0	23.5	327.6	306.4	21.2	227.6	78.8	26.9	118.6	93.5	93.5	3.4	S5020221-1	Yes
4th/2B (Retest)	100.0	23.5	326.5	306.5	20.0	226.5	80.0	25.0	121.7	97.4	97.4	1.5	S5020221-1	Yes
4th/3	100.0	23.5	464.7	412.6	52.1	226.8	185.8	28.0	118.1	92.3	92.3	4.5	S5020221-1	Yes
4th/3A (Retest)	100.0	23.5	231.9	211.5	20.4	131.9	79.6	25.6	119.7	95.3	95.3	2.1	S5020221-1	Yes
4th/4	100.0	23.5	463.6	413.7	49.9	236.6	177.1	28.2	115.9	90.4	90.4	4.7	S5020221-1	Yes
4th/4A (Retest)	100.0	23.5	327.4	305.9	21.5	227.4	78.5	27.4	120.7	94.7	94.7	3.9	S5020221-1	Yes
4th/4B (Retest)	100.0	23.5	229.5	210.3	19.2	129.5	80.8	23.8	119.7	96.7	96.7	0.3	S5020221-1	Yes
4th/5	100.0	23.5	431.5	388.9	42.6	227.8	161.1	26.4	118.5	93.8	93.8	2.9	S5020221-1	Yes
4th/5A (Retest)	100.0	23.5	336.6	315.9	20.7	236.6	79.3	26.1	120.7	95.7	95.7	2.6	S5020221-1	Yes
4th/6	100.0	23.5	475.2	421.6	53.6	232.3	189.3	28.3	119.6	93.2	93.2	4.8	S5020221-1	Yes
4th/6A (Retest)	100.0	23.5	327.4	308.1	19.3	227.4	80.7	23.9	121.9	98.4	98.4	0.4	S5020221-1	Yes
4th/7	100.0	23.5	453.8	410.6	43.2	227.6	183.0	23.6	119.7	96.8	96.8	0.1	S5020221-1	Yes
4th/8	100.0	23.5	459.3	412.1	47.2	227.0	185.1	25.5	121.0	96.4	96.4	2.0	S5020221-1	Yes
4th/9	100.0	23.5	465.9	422.7	43.2	227.5	195.2	22.1	121.9	99.8	99.8	-1.4	S5020221-1	Yes
4th/9A (Retest)	100.0	23.5	328.1	309.0	19.1	228.0	81.0	23.6	123.1	99.6	99.6	0.1	S5020221-1	Yes
4th/10	100.0	23.5	432.8	394.3	38.5	232.5	161.8	23.8	119.6	96.6	96.6	0.3	S5020221-1	Yes
4th/11	100.0	23.5	477.4	432.3	45.1	227.8	204.5	22.1	123.0	100.7	100.7	-1.4	S5020221-1	Yes
4th/11A (Retest)	100.0	23.5	327.6	307.3	20.3	227.6	79.7	25.5	121.7	97.0	97.0	2.0	S5020221-1	Yes
4th/12	100.0	23.5	337.8	298.2	39.6	130.6	167.6	23.6	122.9	99.4	99.4	0.1	S5020221-1	Yes
4th/13	100.0	23.5	451.5	409.5	42.0	232.6	176.9	23.7	118.2	95.6	95.6	0.2	S5020221-1	Yes
4th/14	100.0	23.5	370.6	324.7	45.9	129.5	195.2	23.5	122.1	98.9	98.9	0.0	S5020221-1	Yes
4th/15	100.0	23.5	467.9	422.7	45.2	226.6	196.1	23.0	122.8	99.8	99.8	-0.5	S5020221-1	Yes
4th/15A (Retest)	100.0	23.5	332.0	312.5	19.5	232.0	80.5	24.2	120.6	97.1	97.1	0.7	S5020221-1	Yes
4th/16	100.0	23.5	445.8	402.7	43.1	231.3	171.4	25.1	122.9	98.2	98.2	1.6	S5020221-1	Yes
4th/17	100.0	23.0	443.3	407.7	35.6	227.8	179.9	19.8	120.7	100.8	100.8	-3.2	S5020221-2	Yes
4th/17A (Retest)	100.0	23.0	326.8	307.7	19.1	226.8	80.9	23.6	118.5	95.9	95.9	0.6	S5020221-2	Yes
4th/18	100.0	23.0	455.3	405.3	50.0	227.8	177.5	28.2	127.4	99.4	99.4	5.2	S5020221-2	Yes
4th/18A (Retest)	100.0	23.0	229.6	209.1	20.5	129.6	79.5	25.8	121.0	96.2	96.2	2.8	S5020221-2	Yes

Permeability Testing Lot 8

Depth of Wet Front	3.4	cm
Radius of Tube	0.16	cm
Radius of Ring	13.02	cm
Height of Water	157.1	cm
Soil/Water Temp	N/R	°C
R (from Table)	1	
Change in Head	11	cm
Time	8	min
K_s	**1.5E-07**	**cm/sec**

Sand Cone Lot # 18

Density of sand	92.4	pcf
Mass of sand to fill cone & plate	1710.7	g
Mass of sand & bottle before filling hole	6118.7	g
Mass of sand & bottle after filling hole & cone	3150.8	g
Mass of sand to fill hole & cone	2967.9	g
Mass of sand to fill hole	1257.2	g
Mass of soil & container	1745.5	g
Mass of container	12.3	g
Mass of wet soil	1733.2	g
Wet density of soil	127.4	**pcf**
Wet density per nuclear density gauge	123.1	**pcf**
Wet density correlation ≥ .95 and ≤ 1.05	0.97	

E[N]VIROCARE OF UTA[H], INC.

LIFT APPROVAL FORM ORIG[INAL] 4th lift

(EC-1904, rev. 5)

PROJECT: ______ **LARW** ______ **MW** ✓ **11e.(2)** ______ **CLASS A** **OTHER** Clay liner - R12

NW CORNER **DATE:** 3/14/02 **PAGE 1 of** 2

N/A NB 3/8/02 / See page 2 of 2	P1 ____ EW: ____ X ____ = ____ NS: ____ X ____ = ____
	P2 ____ EW: ____ X ____ = ____ NS: ____ X ____ = ____
	P3 ____ EW: ____ X ____ = ____ NS: ____ X ____ = ____
	P4 ____ EW: ____ X ____ = ____ NS: ____ X ____ = ____
	P5 ____ EW: ____ X ____ = ____ NS: ____ X ____ = ____
	Page 2 attached: (Y) N

IDENTIFY LOTS ABOVE

LIFT ID: ECR12020314 NW CORNER: N 1711 E 1189 INTERFACE RANDOM #: N/R

WASTE GENERATOR ID NUMBER(S): N/R

THICKNESS: UNC: 9.0" COM: N/R ELEV: N/R Debris Insp. By: N/R Date: N/R Time: N/R

DEBRIS CALCULATIONS: N/R

KEYING IN NOTES: (N)(E)(S)W Satisfactory DENSITY TESTS ID # (S): 47 - 64, 47A&B, 48A&B, 49A, 50A&B, 51A, 52A, 55A, 57A, 61A, 63A, 64A

COMMENTS: This lift of Clay liner was placed and Compacted in accordance with ETP 98-1. Lots 1, 2, 3, 4, 5, 6, 9, 11, 15, 17, 18 failed on 3/14/02. Lots were retested on 3/19/02 after contractor worked failing lots. Lots 1, 2 and 4 failed retest on 3/19/02. Lots were retested on 3/20/02 after contractor worked failing lots. All lots meet specifications

LIFT APPROVED BY: [signature] DATE: 3/21/02 TIME: 1651

[signature]	3/21/02	D. Young [signature]	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

RDL 3.21-02

ENVIROCARE OF UTAH, INC

RANDOM NUMBER TEST ID FORM

(Continuation Sheet)

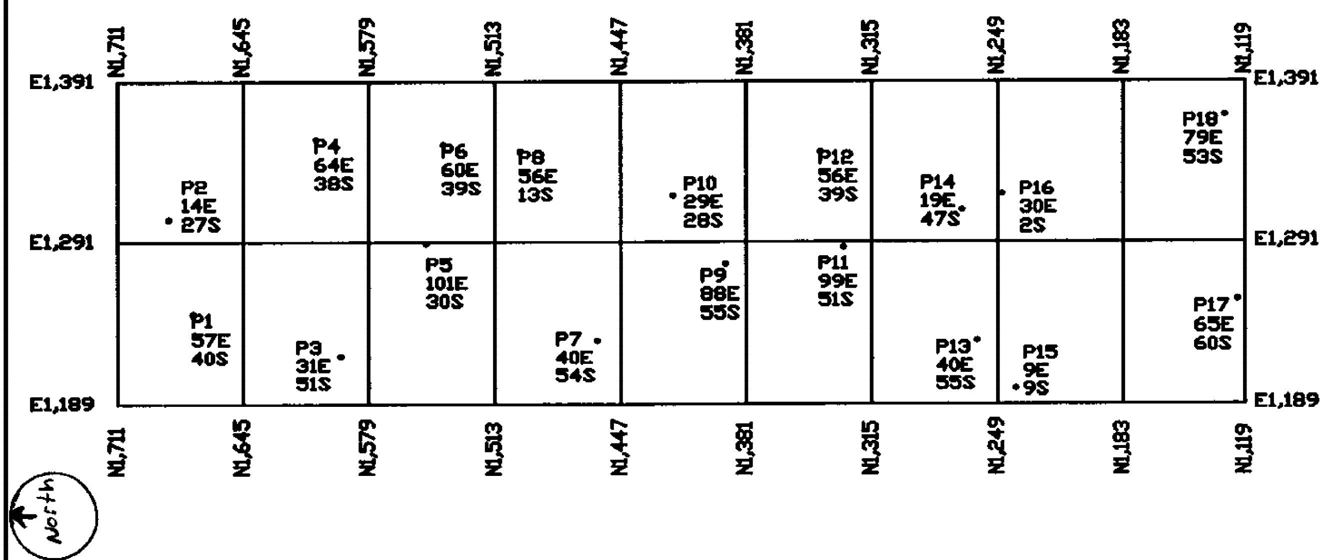
ORIGINAL

DATE: 3/4/02

PAGE: 2 of 2

LIFT ID: ECR12 020314 4th lift

LIFT NW CORNER: N1711, E1189



LOT	nw N	nw E	NS Side	EW Side	Rand N	Rand E	Test dN	Test dE	Test N	Test E
P 1	1,711	1,189	66	102	0.600	0.555	40	57	1,671	1,246
P 2	1,711	1,291	66	100	0.407	0.136	27	14	1,684	1,305
P 3	1,645	1,189	66	102	0.778	0.299	51	31	1,594	1,220
P 4	1,645	1,291	66	100	0.582	0.636	38	64	1,607	1,355
P 5	1,579	1,189	66	102	0.455	0.990	30	101	1,549	1,290
P 6	1,579	1,291	66	100	0.592	0.603	39	60	1,540	1,351
P 7	1,513	1,189	66	102	0.812	0.395	54	40	1,459	1,229
P 8	1,513	1,291	66	100	0.200	0.562	13	56	1,500	1,347
P 9	1,447	1,189	66	102	0.837	0.864	55	88	1,392	1,277
P 10	1,447	1,291	66	100	0.418	0.286	28	29	1,419	1,320
P 11	1,381	1,189	66	102	0.776	0.968	51	99	1,330	1,288
P 12	1,381	1,291	66	100	0.591	0.558	39	56	1,342	1,347
P 13	1,315	1,189	66	102	0.837	0.397	55	40	1,260	1,229
P 14	1,315	1,291	66	100	0.717	0.193	47	19	1,268	1,310
P 15	1,249	1,189	66	102	0.144	0.092	9	9	1,240	1,198
P 16	1,249	1,291	66	100	0.032	0.297	2	30	1,247	1,321
P 17	1,183	1,189	64	102	0.938	0.642	60	65	1,123	1,254
P 18	1,183	1,291	64	100	0.834	0.786	53	79	1,130	1,370

COMMENTS:

ENVIROCARE OF UTAH INC.
FIELD DENSITY TEST
(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW ✓ 11e.(2) ____ CLASS A ____ OTHER ____

LIFT IDENTIFICATION: E window ACR1202031 4 DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 47 lot 1

TEST LOCATION: N 1671 E 1246 TEST METHOD: ____ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)
GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	230	Density Counts	1638
Wet Density (PCF)	118.3	Dry Density (PCF)	98.0
Moisture Density (PCF)	20.3	Moisture Fraction (%)	20.7

MOISTURE DETERMINATION

Container ID: BI5

Mass of wet soil & container (g)	382.7
Mass of dry soil & container (g)	326.0
Mass of water (g)	56.7
Mass of dry soil & container (g)	326.0
Mass of container (g)	133.2
Mass of dry soil (g)	192.8
Moisture content (%)	29.4

Dry Density = Wet Density (PCF) / Moisture content (%) + 100.0 x 100.0

Dry Density = 118.3 / 29.4 + 100.0 x 100.0 = 91.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 91.4 / 100.0 x 100.0 = 91.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section crossed out — 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

- ____ Pass
- X Failed Moisture
- X Failed Compaction

BY: S.D. [signature] TIME: 1300

[signature] QC OFFICER APPROVAL — DATE 3/21/02

[signature] QA OFFICER APPROVAL — DATE 3-25-02

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW __✓__ 11e.(2) ___✓___ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ECR12020314 DATE: 3/19/02

WASTE OR TEST ID NUMBER(S): 47A 1 of 1

TEST LOCATION: N 11071 E 1244 TEST METHOD: ______ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	202	Density Counts	1653
Wet Density (PCF)	118.1	Dry Density (PCF)	99.5
Moisture Density (PCF)	18.6	Moisture Fraction (%)	18.7

MOISTURE DETERMINATION

Container ID	05
Mass of wet soil & container (g)	328.2
Mass of dry soil & container (g)	308.2
Mass of water (g)	20.0
Mass of dry soil & container (g)	308.2
Mass of container (g)	228.2
Mass of dry soil (g)	80.0
Moisture content (%)	25.0%

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 118.1 x 100.0 / 25.0% + 100.0 = 94.5 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 94.5 / 100.0 x 100.0 = 94.5 %

D1556 DENSITY DETERMINATION (SAND CONE)

N/A 3/19/02 MD

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) x Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

____ Failed Moisture

__x__ Failed Compaction

BY: MD TIME: 1400

[signature] 3/21/02 — QC OFFICER APPROVAL, DATE

[signature] 3-25-02 — QA OFFICER APPROVAL, DATE

RWJ 3-21-02

ENVIROCARE OF UTAH, INC.
FIELD DENSITY TEST
(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW __✓__ 11e.(2) ______ CLASS A OTHER ________

LIFT IDENTIFICATION: ECR12020314 DATE: 3/21/02

WASTE OR (TEST) ID NUMBER(S): 47B Lift 1

TEST LOCATION: N1691 E1246 TEST METHOD: ______ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2505
Moisture Counts	/	Moisture Counts	648
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	205	Density Counts	1400
Wet Density (PCF)	119.6	Dry Density (PCF)	101.6
Moisture Density (PCF)	18.0	Moisture Fraction (%)	17.7

MOISTURE DETERMINATION

Container ID	X1
Mass of wet soil & container (g)	326.5
Mass of dry soil & container (g)	307.2
Mass of water (g)	19.3
Mass of dry soil & container (g)	307.2
Mass of container (g)	226.5
Mass of dry soil (g)	80.7
Moisture content (%)	23.9

Dry Density = Wet Density (PCF) / (Moisture content (%) + 100.0) x 100.0

Dry Density = 119.6 / (23.9 + 100.0) x 100.0 = 96.5 pcf

Percent Compaction = Dry Density / Proctor Density x 100.0

Percent Compaction = 96.5 / 100.0 x 100.0 = 96.5 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF) ________

Mass of Sand to Fill Cone & Plate (g) ________

Mass of bottle & cone before filling cone, plate, & hole (g)	/
Mass of bottle & cone, after filling cone, plate, & hole (g)	NA
Mass of sand to fill cone, plate, & hole	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

NA

SOIL DATA: PROCTOR # 5502022(-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

___ Failed Moisture

___ Failed Compaction

BY: M TIME: 1150

[signature] 3/21/02
QC OFFICER APPROVAL DATE

[signature] 3-25-02
QA OFFICER APPROVAL DATE

RAL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5) ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: EACR120203 14 DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 48 lot 2

TEST LOCATION: N 1684 E 1305 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2501
Moisture Counts	—	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	226	Density Counts	1590
Wet Density (PCF)	119.4	Dry Density (PCF)	99.4
Moisture Density (PCF)	19.9	Moisture Fraction (%)	20.0

MOISTURE DETERMINATION

Container ID	E5
Mass of wet soil & container (g)	459.6
Mass of dry soil & container (g)	411.4
Mass of water (g)	48.2
Mass of dry soil & container (g)	411.4
Mass of container (g)	228.2
Mass of dry soil (g)	183.2
Moisture content (%)	26.3

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.4 x 100.0 / 26.3 + 100.0 = 94.5 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 94.5 / 100.0 x 100.0 = 94.5 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; initialed and dated 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF): 100.6

Proctor Optimum Moisture (%): 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

- ___ Pass
- ___ Failed Moisture
- X Failed Compaction

BY: J. D. [signature] TIME: 1300

[signature] 3/21/02 — QC OFFICER APPROVAL / DATE

[signature] 3-25-02 — QA OFFICER APPROVAL / DATE

RDL 3-21-02

E[illegible] IROCARE OF UTAH, INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW __✓__ 11e.(2) ____ CLASS A   OTHER ________

LIFT IDENTIFICATION: ECR12020314   DATE: 3/19/02

WASTE OR (TEST) ID NUMBER(S): 48A 0o12

TEST LOCATION: N 1684 E 1305   TEST METHOD: ____ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	221	Density Counts	1628
Wet Density (PCF)	118.6	Dry Density (PCF)	98.1
Moisture Density (PCF)	20.5	Moisture Fraction (%)	20.9

MOISTURE DETERMINATION

Container ID	A2
Mass of wet soil & container (g)	327.6
Mass of dry soil & container (g)	306.4
Mass of water (g)	21.2
Mass of dry soil & container (g)	306.4
Mass of container (g)	227.6
Mass of dry soil (g)	78.8
Moisture content (%)	26.9

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 118.6 x 100.0 / 26.9 + 100.0 = 93.5 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 93.5 / 100.0 x 100.0 = 93.5 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

N/A 3/19/02 AM

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

____ Failed Moisture

__✓__ Failed Compaction

BY: AM   TIME: 1400

[signature] 3/21/02
QC OFFICER APPROVAL   DATE

[signature] 3-25-02
QA OFFICER APPROVAL   DATE

RDL 3-21-02

ENVIROCARE OF UTAH, INC.
FIELD DENSITY TEST
(EC-1905, rev. 5) ORIGINAL

PROJECT: ______ LARW ______ MW ___x___ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: GCR12020314 DATE: 3/20/02

WASTE OR (TEST) ID NUMBER(S): 48 B lot 2

TEST LOCATION: M 1684 G1305 TEST METHOD: ______ D1556 ___x___ D2922

D2922 DENSITY DETERMINATION
(NUCLEAR DENSITY GAUGE)
GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2505
Moisture Counts	/	Moisture Counts	648
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	202	Density Counts	1520
Wet Density (PCF)	121.7	Dry Density (PCF)	103.9
Moisture Density (PCF)	17.7	Moisture Fraction (%)	17.1

MOISTURE DETERMINATION

Container ID	X1
Mass of wet soil & container (g)	326.5
Mass of dry soil & container (g)	306.5
Mass of water (g)	20.0
Mass of dry soil & container (g)	306.5
Mass of container (g)	226.5
Mass of dry soil (g)	80.0
Moisture content (%)	25.0%

Dry Density = Wet Density (PCF) / Moisture content (%) + 100.0 x 100.0

Dry Density = 121.7 / 25.0 + 100.0 x 100.0 = 97.4 pcf

Percent Compaction = Dry Density / Proctor Density x 100.0

Percent Compaction = 97.4 / 100.0 x 100.0 = 97.4 %

D1556 DENSITY DETERMINATION
(SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

(Section struck through; annotated: N/A 3/20/02 MM)

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # SS020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

x Pass

___ Failed Moisture

___ Failed Compaction

BY: MM TIME: 1150

[signature]	3/21/02	D Young	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST ORIGINAL
(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: E ACR1020314 DATE: 3-14-02

WASTE OR TEST ID NUMBER(S): 49 lot 3

TEST LOCATION: N 1594 E 1220 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	6	Count Time (minutes)	1
Moisture Counts	233	Density Counts	1644
Wet Density (PCF)	118.1	Dry Density (PCF)	97.6
Moisture Density (PCF)	20.6	Moisture Fraction (%)	21.1

MOISTURE DETERMINATION

Container ID	A11
Mass of wet soil & container (g)	464.7
Mass of dry soil & container (g)	412.6
Mass of water (g)	52.1
Mass of dry soil & container (g)	412.6
Mass of container (g)	226.8
Mass of dry soil (g)	185.8
Moisture content (%)	28.0

Dry Density = Wet Density (PCF) / Moisture content (%) + 100.0 x 100.0

Dry Density = 118.1 / 28.0 + 100.0 x 100.0 = 92.3 pcf

Percent Compaction = Dry Density / Proctor Density x 100.0

Percent Compaction = 92.3 / 100.0 x 100.0 = 92.3 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

D 3/14/02

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): ~~0~~ 23.5 (3/8/02) to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

~~____~~ Pass

____ Failed Moisture

X Failed Compaction

BY: S. Dalton TIME: 1300

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	[signature]	3-25-02

RDL 3-21-02

E1 IROCARE OF UTAH, INC.

FIELD DENSITY TEST

(EC-1905, rev. 5) ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: ECR1202034 DATE: 3/19/02

WASTE OR (TEST) ID NUMBER(S): 49A lot 3

TEST LOCATION: N1594 E1210 TEST METHOD: ______ D1556 ✓ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	184	Density Counts	1591
Wet Density (PCF)	119.7	Dry Density (PCF)	102.9
Moisture Density (PCF)	16.8	Moisture Fraction (%)	16.3

MOISTURE DETERMINATION

Container ID	E
Mass of wet soil & container (g)	231.9
Mass of dry soil & container (g)	211.5
Mass of water (g)	20.4
Mass of dry soil & container (g)	211.5
Mass of container (g)	131.9
Mass of dry soil (g)	79.6
Moisture content (%)	25.6

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.7 x 100.0 / 25.6 + 100.0 = 95.3 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 95.3 x 100.0 / 100.0 = 95.3 %

D1556 DENSITY DETERMINATION (SAND CONE)

N/A 3/19/02

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # 5502022-1 (-2 struck) 3/19/02

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

X Pass

____ Failed Moisture

____ Failed Compaction

BY: [initials] TIME: 1400

[signature] 3/21/02
QC OFFICER APPROVAL DATE

[signature] 3-25-02
QA OFFICER APPROVAL DATE

RDL 3-21-02

EN'VIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ECR 020314 (E 3/20/02) DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 50 lot 4

TEST LOCATION: N 1607 E 1355 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	200	Density Counts	1742
Wet Density (PCF)	115.9	Dry Density (PCF)	98.5
Moisture Density (PCF)	17.5	Moisture Fraction (%)	17.7

MOISTURE DETERMINATION

Container ID: A8

Mass of wet soil & container (g)	463.4
Mass of dry soil & container (g)	413.7
Mass of water (g)	49.9
Mass of dry soil & container (g)	413.7
Mass of container (g)	236.6
Mass of dry soil (g)	177.1
Moisture content (%)	28.2

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 115.9 x 100.0 / 28.2 + 100.0 = 90.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 90.4 x 100.0 / 100.0 = 90.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; annotated "D.Y. 3-25-02")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF): 100.0

Proctor Optimum Moisture (%): 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

____ Failed Moisture

X Failed Compaction

BY: J. Oeller TIME: 1300

[signature]	3/21/02	D Yaux 4	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

RDL 3-21-02

EI IROCARE OF UTAH, INC.
FIELD DENSITY TEST ORIGINAL
(EC-1905, rev. 5)

PROJECT: ____ LARW ____ MW X 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: ELR12020214 DATE: 3/19/02

WASTE OR (TEST) ID NUMBER(S): 50A lot 4

TEST LOCATION: N1007 E1355 TEST METHOD: ____ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	420
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	177	Density Counts	1553
Wet Density (PCF)	120.7	Dry Density (PCF)	104.6
Moisture Density (PCF)	16.1	Moisture Fraction (%)	15.4

MOISTURE DETERMINATION

Container ID	E
Mass of wet soil & container (g)	327.4
Mass of dry soil & container (g)	305.9
Mass of water (g)	21.5
Mass of dry soil & container (g)	305.9
Mass of container (g)	227.4
Mass of dry soil (g)	78.5
Moisture content (%)	27.4

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 120.7 x 100.0 / 27.4 + 100.0 = 94.7 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 94.7 / 100.0 x 100.0 = 94.7 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; annotated "N/A 3/19/02 MO")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

3/19 ~~X~~ Failed Moisture

X Failed Compaction

BY: MO TIME: 1400

[signature]	3/21/02	[signature]	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

RDJ 3-21-02

ENVIROCARE OF UTAH, INC. ORIGINAL
FIELD DENSITY TEST
(EC-1905, rev. 5)

PROJECT: ____ LARW ____ MW __x__ 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: ECR12020314 DATE: 3/20/02

WASTE OR ~~TEST~~ ID NUMBER(S): 50 B lot 4

TEST LOCATION: N1607 E 1355 TEST METHOD: ____ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)
GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2505
Moisture Counts	/	Moisture Counts	648
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	203	Density Counts	1594
Wet Density (PCF)	119.7	Dry Density (PCF)	101.7
Moisture Density (PCF)	17.8	Moisture Fraction (%)	17.5

MOISTURE DETERMINATION

Container ID	EE
Mass of wet soil & container (g)	229.5
Mass of dry soil & container (g)	210.3
Mass of water (g)	19.2
Mass of dry soil & container (g)	210.3
Mass of container (g)	129.5
Mass of dry soil (g)	80.8
Moisture content (%)	23.8

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.7 x 100.0 / 23.8 + 100.0 = 96.7 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 96.7 / 100.0 x 100.0 = 96.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

(not used — struck through, initialed and dated 3/20/02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA:
PROCTOR # SS020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:
__x__ Pass

____ Failed Moisture

____ Failed Compaction

BY: [signature] TIME: 1100

[signature] 3/21/02
QC OFFICER APPROVAL DATE

[signature] 3-25-02
QA OFFICER APPROVAL DATE

RWJ 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: E Ac R12020314 (E Expansion) DATE: 3.14.02

WASTE OR (TEST) ID NUMBER(S): 51 Lot 5

TEST LOCATION: N 1549 E 1290 TEST METHOD: ______ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	215	Density Counts	1631
Wet Density (PCF)	118.5	Dry Density (PCF)	99.7
Moisture Density (PCF)	18.9	Moisture Fraction (%)	19.0

MOISTURE DETERMINATION

Container ID	E2
Mass of wet soil & container (g)	431.5
Mass of dry soil & container (g)	388.9
Mass of water (g)	42.6
Mass of dry soil & container (g)	388.9
Mass of container (g)	227.8
Mass of dry soil (g)	161.1
Moisture content (%)	26.4

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 118.5 x 100.0 / 26.4 + 100.0 = 93.8 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 93.8 / 100.0 x 100.0 = 93.8%

D1556 DENSITY DETERMINATION (SAND CONE)

(section struck through diagonally, annotated 3.14.02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

___ Pass

___ Failed Moisture

_X_ Failed Compaction

BY: J. Da[illegible] TIME: 1300

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	[signature]	3-25-02

RDL 3-21-02

E. /IROCARE OF UTAL. INC.
FIELD DENSITY TEST
(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW _✗_ 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: ECR12020314 DATE: 3/19/02

WASTE OR (TEST) ID NUMBER(S): 51A 20f5

TEST LOCATION: N1549 E1290 TEST METHOD: ____ D1556 _✗_ D2922

D2922 DENSITY DETERMINATION
(NUCLEAR DENSITY GAUGE)
GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2904
Moisture Counts	/	Moisture Counts	420
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	212	Density Counts	1549
Wet Density (PCF)	120.7	Dry Density (PCF)	101.1
Moisture Density (PCF)	19.4	Moisture Fraction (%)	19.4

MOISTURE DETERMINATION

Container ID: A8

Mass of wet soil & container (g)	336.4
Mass of dry soil & container (g)	315.9
Mass of water (g)	20.7
Mass of dry soil & container (g)	315.9
Mass of container (g)	236.6
Mass of dry soil (g)	79.3
Moisture content (%)	26.1

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 120.7 x 100.0 / 26.1 + 100.0 = 95.7 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 95.7 x 100.0 / 100.0 = 95.7 %

D1556 DENSITY DETERMINATION
(SAND CONE)

N/A 3/19/02 MD

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA: PROCTOR # SS020221-1

Proctor Dry Density (PCF): 100.0

Proctor Optimum Moisture (%): 23.0

Required Moisture (%): 23.0 to 28.0

Required Compaction (%): 95.0%

TEST RESULTS:
✓ Pass
____ Failed Moisture
____ Failed Compaction

BY: MD TIME: 1400

QC OFFICER APPROVAL: [signature] DATE: 3/21/02

QA OFFICER APPROVAL: [signature] DATE: 3-25-02

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST ORIGINAL

(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: Embankment ECR1020314 DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 52 lot 6

TEST LOCATION: N 1540 E 1351 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	237	Density Counts	1586
Wet Density (PCF)	119.6	Dry Density (PCF)	98.6
Moisture Density (PCF)	21.0	Moisture Fraction (%)	21.3

MOISTURE DETERMINATION

Container ID	C5
Mass of wet soil & container (g)	475.2
Mass of dry soil & container (g)	421.6
Mass of water (g)	53.6
Mass of dry soil & container (g)	421.6
Mass of container (g)	232.3
Mass of dry soil (g)	189.3
Moisture content (%)	28.3

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.6 x 100.0 / 28.3 + 100.0 = 93.2 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 93.2 / 100.0 x 100.0 = 93.2 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section crossed out — J.P. 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA:

PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

___ Pass

___ Failed Moisture

X Failed Compaction

BY: [signature] TIME: 1300

QC OFFICER APPROVAL: [signature] DATE: 3/21/02

QA OFFICER APPROVAL: [signature] DATE: 3-25-02

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW __✓__ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ECR12020314 DATE 3/19/02

WASTE OR (TEST) ID NUMBER(S): 52A 0016

TEST LOCATION: N1540 E 1351 TEST METHOD: ______ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	195	Density Counts	1506
Wet Density (PCF)	121.9	Dry Density (PCF)	104.0
Moisture Density (PCF)	17.9	Moisture Fraction (%)	17.2

MOISTURE DETERMINATION

Container ID	A9
Mass of wet soil & container (g)	327.4
Mass of dry soil & container (g)	308.1
Mass of water (g)	19.3
Mass of dry soil & container (g)	308.1
Mass of container (g)	227.4
Mass of dry soil (g)	80.7
Moisture content (%)	23.9

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 121.9 x 100.0 / 23.9 + 100.0 = 98.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 98.4 x 100.0 / 100.0 = 98.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

N/A for nuke

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

__X__ Pass

____ Failed Moisture

____ Failed Compaction

BY: AO TIME: 1400

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	[signature]	3-25-02

RDJ 3-21-02

ENVIROCARE OF UTAH INC.
FIELD DENSITY TEST
ORIGINAL

(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW / 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ~~ACR~~ EM 3/21/02 CR12020314 DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 53 Lot 7

TEST LOCATION: N 1459 E 1229 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	1050
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	192	Density Counts	1588
Wet Density (PCF)	119.7	Dry Density (PCF)	103.0
Moisture Density (PCF)	16.7	Moisture Fraction (%)	16.2

MOISTURE DETERMINATION

Container ID	E6
Mass of wet soil & container (g)	453.8
Mass of dry soil & container (g)	410.6
Mass of water (g)	43.2
Mass of dry soil & container (g)	410.6
Mass of container (g)	227.6
Mass of dry soil (g)	183.0
Moisture content (%)	23.6

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.7 x 100.0 / 23.6 + 100.0 = 96.8 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 96.8 / 100.0 x 100.0 = 96.8 %

D1556 DENSITY DETERMINATION (SAND CONE)

(section struck through; annotated D.Y. 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

____ Failed Moisture

____ Failed Compaction

BY: S. Dutton TIME: 1300

[signature] 3/21/02
QC OFFICER APPROVAL DATE

[signature] 3-25-02
QA OFFICER APPROVAL DATE

RDJ 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW ____ 11e.(2) ____ CLASS A OTHER ____

LIFT IDENTIFICATION: EACR12020314 DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 54 Lot 8

TEST LOCATION: N 1500 E 1347 TEST METHOD: ____ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts		Density Counts	2501
Moisture Counts		Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	230	Density Counts	1531
Wet Density (PCF)	121.0	Dry Density (PCF)	100.7
Moisture Density (PCF)	20.3	Moisture Fraction (%)	20.2

MOISTURE DETERMINATION

Container ID	A4
Mass of wet soil & container (g)	459.3
Mass of dry soil & container (g)	412.1
Mass of water (g)	47.2
Mass of dry soil & container (g)	412.1
Mass of container (g)	227.0
Mass of dry soil (g)	185.1
Moisture content (%)	25.5

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 121.0 x 100.0 / 25.5 + 100.0 = 96.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 96.4 x 100.0 / 100.0 = 96.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

(D 3-14-02)

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

____ Failed Moisture

____ Failed Compaction

BY: S. Dalton TIME: 1300

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	[signature]	3-25-02

RefD 3-21-02

ENVIROCARE OF UTAH INC.
FIELD DENSITY TEST ORIGINAL
(EC-1905, rev. 5)

PROJECT: ______ LARW ____ MW __/__ 11e.(2) ______ CLASS A   OTHER ______

LIFT IDENTIFICATION: ACR1202031Y (E M 3/20/02)   DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 55 lot 9

TEST LOCATION: N 1392 E 1277   TEST METHOD: ______ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	210	Density Counts	1504
Wet Density (PCF)	121.9	Dry Density (PCF)	103.4
Moisture Density (PCF)	18.4	Moisture Fraction (%)	17.8

MOISTURE DETERMINATION

Container ID	A7
Mass of wet soil & container (g)	465.9
Mass of dry soil & container (g)	422.7
Mass of water (g)	43.2
Mass of dry soil & container (g)	422.7
Mass of container (g)	227.5
Mass of dry soil (g)	195.2
Moisture content (%)	22.1

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 121.9 x 100.0 / 22.1 + 100.0 = 99.8 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 99.8 / 100.0 x 100.0 = 99.8 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; annotated "J.D. 3-14-02")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

__X__ Failed Moisture

____ Failed Compaction

BY: J. Dalton   TIME: 1300

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	D Young	3-25-02

RDJ 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW __X__ 11a.(2) ____ CLASS A ____ OTHER ____

LIFT IDENTIFICATION: ECR1202031 4 DATE 3-19-02

WASTE OR (TEST) ID NUMBER(S): 55A 6+9

TEST LOCATION: N1392 E1277 TEST METHOD: ____ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 17481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	626
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	193	Density Counts	1463
Wet Density (PCF)	123.1	Dry Density (PCF)	105.4
Moisture Density (PCF)	17.7	Moisture Fraction (%)	16.8

MOISTURE DETERMINATION

Container ID	E4
Mass of wet soil & container (g)	328.1
Mass of dry soil & container (g)	309.0
Mass of water (g)	19.1
Mass of dry soil & container (g)	309.0
Mass of container (g)	228.0
Mass of dry soil (g)	81.0
Moisture content (%)	~~23.5~~ 23.6 [initialed] 3/21/02

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 123.1 x 100.0 / ~~23.5~~ 23.6 [initialed] 3/21/02 + 100.0 = ~~99.7~~ 99.6 [initialed] 3/21/02 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = ~~99.7~~ 99.6 [initialed] 3/21/02 x 100.0 / ~~99.7~~ [initialed] 3/21/02 = ~~99.7~~ ~~99.6~~ 99.6 [initialed] 3/21/02

100.0

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

(Section struck through; annotated "D 3-19-02")

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.6

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

__✓__ Pass

____ Failed Moisture

____ Failed Compaction

BY: [signature] TIME: 1400

[signature]	3/21/02	[signature]	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

[signature] 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST ORIGINAL
(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: E m3/rotor ACR12020314 DATE: 3-14-02

WASTE OR TEST ID NUMBER(S): 56 Lot 10

TEST LOCATION: N 1419 E 1320 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. ~~18704~~ 17481 3-14-02

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	4	Count Time (minutes)	1
Moisture Counts	225	Density Counts	1586
Wet Density (PCF)	~~99.~~ 119.6 (3-14-02)	Dry Density (PCF)	99.8
Moisture Density (PCF)	19.8	Moisture Fraction (%)	19.9

MOISTURE DETERMINATION

Container ID	B12
Mass of wet soil & container (g)	432.8
Mass of dry soil & container (g)	394.3
Mass of water (g)	38.5
Mass of dry soil & container (g)	394.3
Mass of container (g)	232.5
Mass of dry soil (g)	161.8
Moisture content (%)	23.8

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 119.6 x 100.0 / 23.8 + 100.0 = 96.6 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 96.6 / 100.0 x 100.0 = 96.6 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through, marked "D.D. 3-14-02")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

X Pass

___ Failed Moisture

___ Failed Compaction

BY: S. Allen TIME: 1300

QC OFFICER APPROVAL [signature] DATE 3/21/02

QA OFFICER APPROVAL [signature] DATE 3-25-02

[initials] 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: LARW ___ MW / 11e.(2) ___ CLASS A ___ OTHER ___

LIFT IDENTIFICATION: EACR120203 14 (mo 3/20/02) DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 57 Lot 11

TEST LOCATION: N 1330 E 1288 TEST METHOD: ___ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts		Density Counts	2501
Moisture Counts		Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	205	Density Counts	1402
Wet Density (PCF)	123.0	Dry Density (PCF)	105.1
Moisture Density (PCF)	17.9	Moisture Fraction (%)	17.1

MOISTURE DETERMINATION

Container ID: E8

Mass of wet soil & container (g)	477.4
Mass of dry soil & container (g)	432.3
Mass of water (g)	45.1
Mass of dry soil & container (g)	432.3
Mass of container (g)	227.8
Mass of dry soil (g)	204.5
Moisture content (%)	22.1

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 123.0 x 100.0 / 22.1 + 100.0 = 100.7 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 100.7 x 100.0 / 100.0 = 100.7 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; initialed J.D. 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ___

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF): 100.0

Proctor Optimum Moisture (%): 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

___ Pass

X Failed Moisture

___ Failed Compaction

BY: J.D. [signature] TIME: 1300

[signature] 3/21/02

QC OFFICER APPROVAL DATE

[signature] 3-25-02

QA OFFICER APPROVAL DATE

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST
(EC-1905, rev. 5) ORIGINAL

PROJECT: ______ LARW ______ MW __X__ 11a.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ECR12020314 DATE 3/19/02

WASTE OR TEST ID NUMBER(S): 57A Soil

TEST LOCATION: N 1330 E 1288 TEST METHOD: ______ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	187	Density Counts	1515
Wet Density (PCF)	121.7	Dry Density (PCF)	104.6
Moisture Density (PCF)	17.1	Moisture Fraction (%)	16.4

MOISTURE DETERMINATION

Container ID	AC/RC
Mass of wet soil & container (g)	327.6
Mass of dry soil & container (g)	307.3
Mass of water (g)	20.3
Mass of dry soil & container (g)	307.3
Mass of container (g)	227.6
Mass of dry soil (g)	79.7
Moisture content (%)	25.5

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 121.7 x 100.0 / 25.5 + 100.0 = 97.0 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 97.0 / 100.0 x 100.0 = 97.0 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

N/A 3/19/02 [initials]

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95%

TEST RESULTS:

__X__ Pass

_____ Failed Moisture

_____ Failed Compaction

BY: MD TIME: 1400

[signature] QC OFFICER APPROVAL 3/21/02 DATE

[signature] QA OFFICER APPROVAL 3-25-02 DATE

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW / 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: E Mainliner ACR12020314 DATE: 3-14-02

WASTE OR TEST ID NUMBER(S): 58 Lot 12

TEST LOCATION: N 1342 E 1347 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	199	Density Counts	1466
Wet Density (PCF)	122.9	Dry Density (PCF)	105.4
Moisture Density (PCF)	17.4	Moisture Fraction (%)	16.5

MOISTURE DETERMINATION

Container ID	HA
Mass of wet soil & container (g)	337.8
Mass of dry soil & container (g)	298.2
Mass of water (g)	39.6
Mass of dry soil & container (g)	298.2
Mass of container (g)	130.6
Mass of dry soil (g)	167.6
Moisture content (%)	23.6

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 122.9 x 100.0 / 23.6 + 100.0 = 99.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 99.4 / 100.0 x 100.0 = 99.4 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section crossed out; annotated "D 3-14-02")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

___ Failed Moisture

___ Failed Compaction

BY: S. Oaks TIME: 1300

[signature] 3/21/02 — QC OFFICER APPROVAL, DATE

[signature] 3-25-02 — QA OFFICER APPROVAL, DATE

RQL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST ORIGINAL

(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ACR1202031 4 (E MB 3/20/02) DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 59 lot 13

TEST LOCATION: N 1260 E 1229 TEST METHOD: ______ D1556 ✓ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	0	Count Time (minutes)	1
Moisture Counts	200	Density Counts	1648
Wet Density (PCF)	118.2	Dry Density (PCF)	100.7
Moisture Density (PCF)	17.5	Moisture Fraction (%)	17.4

D1556 DENSITY DETERMINATION (SAND CONE)

(section crossed out — J.D. 3/14/02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

MOISTURE DETERMINATION

Container ID	A5
Mass of wet soil & container (g)	451.5
Mass of dry soil & container (g)	409.5
Mass of water (g)	42.0
Mass of dry soil & container (g)	409.5
Mass of container (g)	232.6
Mass of dry soil (g)	176.9
Moisture content (%)	23.7

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 118.2 x 100.0 / 23.7 + 100.0 = 95.6 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 95.6 x 100.0 / 100.0 = 95.6 %

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

____ Failed Moisture

____ Failed Compaction

BY: [signature] TIME: 1300

[signature] 3/21/02 [signature] 3-25-02

QC OFFICER APPROVAL DATE QA OFFICER APPROVAL DATE

RDJ 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: E ~~A~~CR12020314 (E 3/21/02) DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 60 Lot 14

TEST LOCATION: N 1268 E 1310 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	—	Density Counts	2501
Moisture Counts	—	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	198	Density Counts	1498
Wet Density (PCF)	122.1	Dry Density (PCF)	104.8
Moisture Density (PCF)	17.3	Moisture Fraction (%)	16.5

MOISTURE DETERMINATION

Container ID	EE
Mass of wet soil & container (g)	370.6
Mass of dry soil & container (g)	324.7
Mass of water (g)	45.9
Mass of dry soil & container (g)	324.7
Mass of container (g)	129.5
Mass of dry soil (g)	195.2
Moisture content (%)	23.5

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 122.1 x 100.0 / 23.5 + 100.0 = 98.9 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 98.9 / 100.0 x 100.0 = 98.9 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through — D 3-14-02)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

____ Failed Moisture

____ Failed Compaction

BY: S. Dillon TIME: 1300

QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE
[signature]	3/21/02	D Young	3-25-02

RDL 3-21-02

ENVIROCARE OF UTAH, INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW ✓ 11e.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ACR12020314 (E ... 4/20/02) DATE: 3-14-02

WASTE OR (TEST) ID NUMBER(S): 61 Lot 15

TEST LOCATION: N 1240 E 1198 TEST METHOD: ______ D1556 X D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	1050
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	210	Density Counts	1409
Wet Density (PCF)	122.8	Dry Density (PCF)	104.4
Moisture Density (PCF)	18.4	Moisture Fraction (%)	17.6

MOISTURE DETERMINATION

Container ID: X1

Mass of wet soil & container (g)	467.9
Mass of dry soil & container (g)	422.7
Mass of water (g)	45.2
Mass of dry soil & container (g)	422.7
Mass of container (g)	226.6
Mass of dry soil (g)	196.1
Moisture content (%)	23.0

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 122.8 x 100.0 / 23.0 + 100.0 = 99.8 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 99.8 x 100.0 / 100.0 = 99.8%

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through — marked "D 3/14/02")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ______

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF): ~~100.0~~ 100.0 (initialed 3/18/02)

Proctor Optimum Moisture (%): 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

X Failed Moisture

____ Failed Compaction

BY: S. Dalken TIME: 1300

[signature]	3/21/02	[signature]	3-25-02
QC OFFICER APPROVAL	DATE	QA OFFICER APPROVAL	DATE

RDL 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW __✓__ 11a.(2) ____ CLASS A ____ OTHER ____

LIFT IDENTIFICATION: ECR12020314 DATE 3/19/02

WASTE OR (TEST) ID NUMBER(S): 61A lot 15

TEST LOCATION: N1240 E1198 TEST METHOD: ____ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	212	Density Counts	1551
Wet Density (PCF)	120.4	Dry Density (PCF)	101.0
Moisture Density (PCF)	19.4	Moisture Fraction (%)	19.4

MOISTURE DETERMINATION

Container ID: B13

Mass of wet soil & container (g)	332.0
Mass of dry soil & container (g)	312.5
Mass of water (g)	19.5
Mass of dry soil & container (g)	312.5
Mass of container (g)	232.0
Mass of dry soil (g)	80.5
Moisture content (%)	24.2

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 120.4 x 100.0 / 24.2 + 100.0 = 97.1 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 97.1 / 100.0 x 100.0 = ~~99.0~~ 97.1 % 3.21.02

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

N/A 3/19/02 M

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ____

SOIL DATA: PROCTOR # 55020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

✓ Pass

____ Failed Moisture

____ Failed Compaction

BY: MM TIME: 1400

[signature] 3/21/02 [signature] 3-25-02

QC OFFICER APPROVAL DATE QA OFFICER APPROVAL DATE

RDf 3-21-02

ENVIROCARE OF UTAH INC.
FIELD DENSITY TEST
(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW __✓__ 11e.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: ACR12020314 (E 3/20/02) DATE: 3.14.02

WASTE OR TEST ID NUMBER(S): 62 lot 16

TEST LOCATION: N 1247 E 1321 TEST METHOD: ______ D1556 __X__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	218	Density Counts	1463
Wet Density (PCF)	122.9	Dry Density (PCF)	103.8
Moisture Density (PCF)	19.2	Moisture Fraction (%)	18.5

MOISTURE DETERMINATION

Container ID: B15

Mass of wet soil & container (g)	445.8
Mass of dry soil & container (g)	402.7
Mass of water (g)	43.1
Mass of dry soil & container (g)	402.7
Mass of container (g)	231.3
Mass of dry soil (g)	171.4
Moisture content (%)	25.1

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 122.9 x 100.0 / 25.1 + 100.0 = 98.2 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 98.2 / 100.0 x 100.0 = 98.2 %

D1556 DENSITY DETERMINATION (SAND CONE)

(Section struck through; marked "S.D. 3-14")

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

SOIL DATA: PROCTOR # S5020221-1

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.5

Required Moisture (%): 23.5 to 28.5

Required Compaction (%): 95.0%

TEST RESULTS:

__✓__ Pass

____ Failed Moisture

____ Failed Compaction

BY: S. Dalton TIME: 1300

[signature] 3/21/02
QC OFFICER APPROVAL DATE

[signature] 3-25-02
QA OFFICER APPROVAL DATE

RDJ 3-21-02

E·VIROCARE OF UTAH, INC.
FIELD DENSITY TEST
(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW _X_ 11a.(2) ____ CLASS A OTHER ________

LIFT IDENTIFICATION: ECR12020214 DATE 2/14/02

WASTE OR (TEST) ID NUMBER(S): 03 lot 17

TEST LOCATION: N 1123 E 1254 TEST METHOD: ____ D1556 _X_ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Call Standard:		Off-Call Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	224	Density Counts	1545
Wet Density (PCF)	120.7	Dry Density (PCF)	101.0
Moisture Density (PCF)	19.7	Moisture Fraction (%)	19.4

MOISTURE DETERMINATION

Container ID 07

Mass of wet soil & container (g)	443.3
Mass of dry soil & container (g)	407.7
Mass of water (g)	35.6
Mass of dry soil & container (g)	407.4
Mass of container (g)	227.8
Mass of dry soil (g)	179.6
Moisture content (%)	19.8

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 120.7 x 100.0 / 19.8 + 100.0 = 100.8 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 100.8 x 100.0 / 100.0 = 100.8 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

N/A 3/11/02

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

SOIL DATA: PROCTOR # SS020221-2

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.0

Required Moisture (%): 23.0 to 28.0

Required Compaction (%): 95.0%

TEST RESULTS:

____ Pass

_X_ Failed Moisture

____ Failed Compaction

BY: [signature] TIME: 1300

[signature] 3/21/02
QC OFFICER APPROVAL DATE
RDL 3-21-02

[signature] 3-25-02
QA OFFICER APPROVAL DATE

ENVIROCARE OF UTAH, INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ____ LARW ____ MW __x__ 11e.(2) ____ CLASS A   OTHER ________

LIFT IDENTIFICATION: CCR12020314   DATE 3/19/02

WASTE OR (TEST) ID NUMBER(S): 63A Lot 17

TEST LOCATION: N1123 E1254   TEST METHOD: ____ D1556 __x__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts	/	Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	209	Density Counts	1633
Wet Density (PCF)	118.5	Dry Density (PCF)	99.2
Moisture Density (PCF)	19.3	Moisture Fraction (%)	19.4

MOISTURE DETERMINATION

Container ID	X1
Mass of wet soil & container (g)	326.8
Mass of dry soil & container (g)	307.7
Mass of water (g)	19.1
Mass of dry soil & container (g)	307.7
Mass of container (g)	226.8
Mass of dry soil (g)	80.9
Moisture content (%)	23.6

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 118.5 x 100.0 / 23.6 + 100.0 = 95.9 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 95.9 / 100.0 x 100.0 = 95.9 %

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	/
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	/
Mass of bottle & cone, after filling cone, plate, & hole (g)	N/A
Mass of sand to fill cone, plate, & hole (g)	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

Wet Density (PCF) = Bulk density of sand (PCF) X Mass of wet soil (g) / Mass of sand filling hole

Wet Density (PCF) = ________

SOIL DATA: PROCTOR # SS020221-2

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.0

Required Moisture (%): 23.0 to 28.0

Required Compaction (%): 96.0%

TEST RESULTS:

__x__ Pass

____ Failed Moisture

____ Failed Compaction

BY: [signature]   TIME: 1400

[signature] 3/21/02
QC OFFICER APPROVAL   DATE

[signature] 3-25-02
QA OFFICER APPROVAL   DATE

RDL 3-21-02

E 'IROCARE OF UTAH, INC.

FIELD DENSITY TEST

(EC-1905, rev. 5)

ORIGINAL

PROJECT: ______ LARW ______ MW __✓__ 11e.(2) ______ CLASS A OTHER ______

LIFT IDENTIFICATION: GCR12020314 DATE 3/14/02

WASTE OR TEST ID NUMBER(S): 64 lot 18

TEST LOCATION: N 1130 E 1370 TEST METHOD: ✓ D1556 ✓ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Call Standard:		Off-Call Standard:	
Density Counts	/	Density Counts	2501
Moisture Counts	/	Moisture Counts	650
Depth Setting (inches)	2	Count Time (minutes)	1
Moisture Counts	207	Density Counts	1458
Wet Density (PCF)	123.1	Dry Density (PCF)	105.0
Moisture Density (PCF)	18.1	Moisture Fraction (%)	17.3

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	92.1
Mass of Sand to Fill Cone & Plate (g)	1710.7
Mass of bottle & cone before filling cone, plate, & hole (g)	6118.7
Mass of bottle & cone, after filling cone, plate, & hole (g)	3150.8
Mass of sand to fill cone, plate, & hole (g)	2967.9
Mass of sand to fill cone & plate (g)	1710.7
Mass of sand to fill hole (g)	1257.2
Mass of wet soil & container (g)	1745.5
Mass of container (g)	12.3
Mass of wet soil (g)	1733.2

Wet Density (PCF) = (Bulk density of sand (PCF) X Mass of wet soil (g)) / Mass of sand filling hole

Wet Density (PCF) = 127.4

MOISTURE DETERMINATION

Container ID	D5
Mass of wet soil & container (g)	455.3
Mass of dry soil & container (g)	405.3
Mass of water (g)	50.0
Mass of dry soil & container (g)	405.3
Mass of container (g)	227.8
Mass of dry soil (g)	177.5
Moisture content (%)	28.2

SOIL DATA: PROCTOR #SS020221-2

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.0

Required Moisture (%): 23.0 to 28.0

Required Compaction (%): 95.0%

Dry Density = Wet Density (PCF) x 100.0 / Moisture content (%) + 100.0

Dry Density = 127.4 x 100.0 / 28.2 + 100.0 = 99.4 pcf

Percent Compaction = Dry Density x 100.0 / Proctor Density

Percent Compaction = 99.4 x 100.0 / 100.0 = 99.4 %

TEST RESULTS:

___ Pass

_X_ Failed Moisture

___ Failed Compaction

BY: S. Dalton TIME: 1300

[signature] 3/21/02 [signature] 3-25-02

QC OFFICER APPROVAL DATE QA OFFICER APPROVAL DATE

RDJ 3-21-02

ENVIROCARE OF UTAH INC.

FIELD DENSITY TEST ORIGINAL
(EC-1905, rev. 5)

PROJECT: ______ LARW ______ MW __K__ 11a.(2) ______ CLASS A ______ OTHER ______

LIFT IDENTIFICATION: ECR12020314 DATE 3/19/02

WASTE OR TEST ID NUMBER(S): 64A 1 of 18

TEST LOCATION: N1130 @ V370 TEST METHOD: ______ D1556 __✓__ D2922

D2922 DENSITY DETERMINATION (NUCLEAR DENSITY GAUGE)

GUAGE ID NO. 19481

On-Cell Standard:		Off-Cell Standard:	
Density Counts		Density Counts	2504
Moisture Counts	/	Moisture Counts	620
Depth Setting (inches)	8	Count Time (minutes)	1
Moisture Counts	210	Density Counts	1535
Wet Density (PCF)	121.0	Dry Density (PCF)	101.7
Moisture Density (PCF)	19.4	Moisture Fraction (%)	19.1

D1556 DENSITY DETERMINATION (SAND CONE)

Bulk Density of sand (PCF)	
Mass of Sand to Fill Cone & Plate (g)	
Mass of bottle & cone before filling cone, plate, & hole (g)	
Mass of bottle & cone, after filling cone, plate, & hole (g)	
Mass of sand to fill cone, plate, & hole	
Mass of sand to fill cone & plate (g)	
Mass of sand to fill hole (g)	
Mass of wet soil & container (g)	
Mass of container (g)	
Mass of wet soil (g)	

NA 3/19/02

Wet Density (PCF) = (Bulk density of sand (PCF) X Mass of wet soil (g)) / Mass of sand filling hole

Wet Density (PCF) = ______

MOISTURE DETERMINATION

Container ID BBC

Mass of wet soil & container (g)	227.6
Mass of dry soil & container (g)	209.1
Mass of water (g)	20.5
Mass of dry soil & container (g)	209.1
Mass of container (g)	129.6
Mass of dry soil (g)	79.5
Moisture content (%)	25.8

SOIL DATA: PROCTOR # 55020221-2

Proctor Dry Density (PCF) 100.0

Proctor Optimum Moisture (%) 23.0

Required Moisture (%): 23.0 to 28.0

Required Compaction (%): 95.0%

Dry Density = (Wet Density (PCF) x 100.0) / (Moisture content (%) + 100.0)

Dry Density = (121.0 x 100.0) / (25.8 + 100.0) = 96.2 pcf

Percent Compaction = (Dry Density x 100.0) / Proctor Density

Percent Compaction = (96.2 x 100.0) / 100.0 = 96.2 %

TEST RESULTS:

__X__ Pass

_____ Failed Moisture

_____ Failed Compaction

BY: MO TIME: 1400

[signature] 3/21/02 — QC OFFICER APPROVAL, DATE

[signature] 4 3-25-02 — QA OFFICER APPROVAL, DATE

RDJ 3-21-02

ENVIROCARE OF UTAH, INC.

FIELD PERMEABILITY TEST
(EC-1906 rev 2)

ORIGINAL

REVISION: 08/16/00

PROJECT: ______ LARW ______ MW ___✓___ 11e.(2) ______ CLASS A ______ OTHER ______

Test Location: N1500 E1347 Elevation/Lift CLR2020814 Lot No. 8

TESTING DATA: TESTED BY: Brennon Dick

Soil Saturation Start:	Date: 3-20-02	Time: 1045	Max. Dry Density	100 pcf
Soil Saturation Finish:	Date: 3-20-02	Time: 1445	Opt. Moisture	23.5 %
Depth of Wet Front (L)	3.4 cm			
Radius of Measuring Tube (Rt)	0.14 cm		Density test #	54
Radius of Permeameter Ring (Rr)	13.02 cm		Dry Density	96.4 pcf
Height of Water, (Ht)	157.1 cm		Moisture content	25.5 %
Soil/Water temp, in ring, after test	N/R °C	N/R 11e(2)	Compaction	96.4 %

dH = Change in Head (cm) = 11.0 cm

dT Time (minutes) 8 min

R = 1.000 (From Figure 1) *(R = 1.000 for 11e(2))

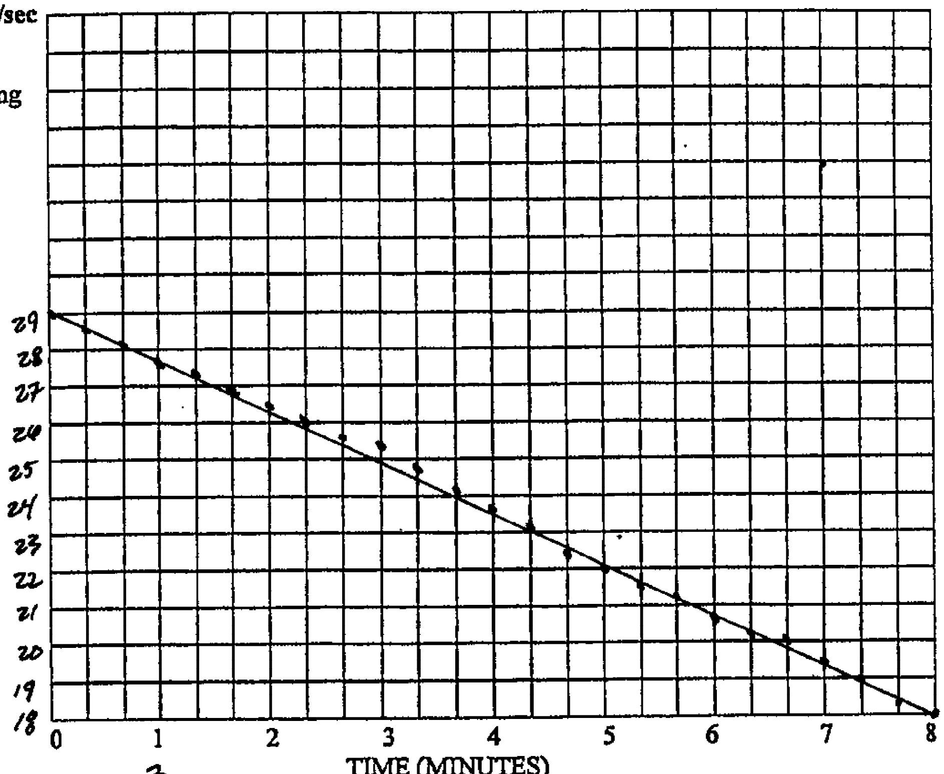
$$K_s = \left[\frac{(2)\ (dH/dT)\ (L)}{(60)\ ((Ht)+(0.5)(L))}\right]\left[\frac{(Rt)^2}{(Rr)^2}\right] \times (R)$$

$$K_s = \left[\frac{(2)(11.0/8)(3.4)}{(60)((157.1)+(0.5)(3.4))}\right]\left[\frac{(0.14)^2}{(13.02)^2}\right] \times 1.000$$

K_s = 1.5×10^{-7} cm/sec

Timed Water Drop Reading

min.		min.	
0:00	29.0	4:20	23.1
0:20	28.6	4:40	22.4
0:40	28.1	5:00	22.0
1:00	27.6	5:20	21.5
1:20	27.3	5:40	21.2
1:40	26.9	6:00	20.7
2:00	26.4	6:20	20.2
2:20	26.0	6:40	20.0
2:40	25.4	7:00	19.4
3:00	25.3	7:20	18.9
3:20	24.8	7:40	18.3
3:40	24.1	8:00	18.0
4:00	23.7		



Soil/ Water Temp (°C)	Corr. Factor (R)
0	1.783
1	1.723
2	1.664
3	1.611
4	1.560
5	1.511
6	1.465
7	1.421
8	1.379
9	1.339
10	1.301
11	1.265
12	1.230
13	1.197
14	1.165
15	1.135
16	1.106
17	1.077
18	1.051
19	1.025
20	1.000
21	0.976
22	0.953
23	0.931
24	0.910
25	0.889
26	0.869
27	0.850
28	0.832
29	0.814
30	0.797
31	0.780
32	0.764
33	0.749
34	0.733
35	0.719
36	0.705
37	0.692
38	0.678
39	0.665
40	0.653

Figure 1

$< 5 \times 10^{-7}$

Required Permeability $\geq 1 \times 10^{-7}$ Test Results (Pass) Fail By Brennon Dick Date 3/20/02

QC APPROVAL [signature] DATE 3/21/02 QA APPROVAL [signature] DATE 3-25-02

RDL 3-21-02

EC-1905 Calculation Check

Lift ID: LRBC9010501 Spring Start-Up 530S; 925E
Date: 10/7/04 Spring Start Up

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?	Liner/RB OK?
1st/1	97.0	25.5	325.7	294.6	31.1	166.1	128.5	24.2	133.7	107.6	111.0	-1.3	A010214-4	TRUE	Yes

Permeability Testing **Lot 1**

Depth of Wet Front	0.2	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	173.3	cm
Soil/Water Temp	22	°C
R (from Table)	0.953	
Change in Head	N/A	cm
Time	8	min
Linear Regression	1.6355	
K_s	**1.3E-08**	**cm/sec**

EC-1905 Calculation Check

Lift ID: LRF10041011 In active Lift Start Up 530S; 925E
Date: 10/11/04

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?	Liner/RB OK?
1st/1	98.0	24.5	336.2	301.4	34.8	171.2	130.2	26.7	125.9	99.4	101.4	2.2	A010425-1	TRUE	Yes
1st/2	98.0	24.5	339.1	304.3	34.8	166.6	137.7	25.3	125.8	100.4	102.4	0.8	A010425-1	TRUE	Yes

Permeability Testing **Lot 2**

Depth of Wet Front	3.1	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	175.5	cm
Soil/Water Temp	22	°C
R (from Table)	0.953	
Change in Head	N/A	cm
Time	8	min
Linear Regression	3.7272	
K_s	**4.4E-07**	**cm/sec**

EC-1905 Calculation Check

Lift ID: LRI9041005 I9 Radon Barrier 870S; 865E
Date: 10/5/04 Inactive Lift Start Up for I9, L9

Lift / Lot	Proctor	Proctor	Mass of	Dry Mass	Water	Cont	Mass of	Moist	Wet	Dry	%	Moist. Diff.	Proctor	Liner/RB	Liner/RB
Number	Dry Dens	Opti.Moist	Soil+Cont	soil+cont	Mass	Mass	dry soil	Cont	Dens	Dens	Comp	Act. - Opti.	ID Number	OK?	OK?
1st/1	97.9	24.2	412.6	372.7	39.9	217.4	155.3	25.7	121.3	96.5	98.6	1.5	S5011015-1	TRUE	Yes
1st/2	97.9	24.2	390.0	358.8	31.2	218.0	140.8	22.2	126.1	103.2	105.4	-2.0	S5011015-1	TRUE	Yes
1st/2A	97.9	24.2	322.8	292.6	30.2	170.7	121.9	24.8	128.7	103.1	105.3	0.6	S5011015-1	TRUE	Yes

EC-1905 Calculation Check

Lift ID: LRJ7011026 (Inactive Lift Start-up) J7 Radon Barrier 868S; 615E
Date: 4/4/02 12th Lift

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?
12th/1	102.2	21.5	330.5	311.8	18.7	230.5	81.3	23.0	122.0	99.2	97.1	1.5	S5011011-3	Yes
12th/1 (West)	102.2	21.5	317.1	300.3	16.8	217.1	83.2	20.2	129.1	107.4	105.1	-1.3	S5011011-3	Yes
12th/1 (East)	102.2	21.5	330.6	314.0	16.6	230.6	83.4	19.9	120.3	100.3	98.2	-1.6	S5011011-3	Yes

Permeability Testing **Lot 1**

Depth of Wet Front	1.7	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	162.0	cm
Soil/Water Temp	22	°C
R (from Table)	0.953	
Change in Head	19.8	cm
Time	8	min
K_s	**1.7E-07**	**cm/sec**

Permeability Testing **Lot 1**

Depth of Wet Front	1.3	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	165.3	cm
Soil/Water Temp	22	°C
R (from Table)	0.953	
Change in Head	5.1	cm
Time	8	min
K_s	**3.4E-08**	**cm/sec**

Permeability Testing **Lot 1**

Depth of Wet Front	1.7	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	157.7	cm
Soil/Water Temp	20	°C
R (from Table)	1	
Change in Head	2	cm
Time	8	min
K_s	**1.9E-08**	**cm/sec**

Permeability Test Check **Lift ID:** **LRJ7011026 (Inactive Lift Start-up) J7 Radon Barrier 868S; 615E**

Test 1

Depth of Wet Front	4.4	cm
Radius of Tube	0.16	cm
Radius of Ring	21.9	cm
Height of Water	131.9	cm
Soil/Water Temp	23	°C
R (from Table)	0.931	
Change in Head	11.3	cm
Time	8	min
K_s	**7.7E-08**	**cm/sec**

EC-1905 Calculation Check

Lift ID: LRP1010725 Spring Start-Up P1 Radon Barrier 1620S; 30W
Date: 6/17/04 SS 10^{-6}

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?	Liner/RB OK?
1st/1	100.0	22.5	323.3	310.4	12.9	217.5	92.9	13.9	134.2	117.8	117.8	-8.6	A010717-2	TRUE	Yes

Permeability Testing **Lot 1**

Depth of Wet Front	2.0	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	164.5	cm
Soil/Water Temp	20	°C
R (from Table)	1	
Change in Head	N/A	cm
Time	8	min
Liner Regression	1.3902	
K_s	**1.2E-07**	**cm/sec**

EC-1905 Calculation Check

Lift ID: LRP1011012 Radon Barrier P1 (In-Active Lift Start-Up) 1483S; 35W
Date: 4/29/02 14th Lift (Processed Clay)

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?
14th/1	96.0	25.5	230.6	214.9	15.7	130.6	84.3	18.6	134.3	113.2	118.0	-6.9	S5011008	Yes
14th/2	96.0	25.5	317.3	301.8	15.5	217.3	84.5	18.3	127.8	108.0	112.5	-7.2	S5011008	Yes

Permeability Testing **Lot 1**

Depth of Wet Front	0.5	cm
Radius of Tube	0.32	cm
Radius of Ring	22	cm
Height of Water	161.5	cm
Soil/Water Temp	25	°C
R (from Table)	0.889	
Change in Head	1.3	cm
Time	8	min
K_s	**3.1E-09**	**cm/sec**

Sand Cone **Lot # 2**

Density of sand	95.3	pcf
Mass of sand to fill cone & plate	1787.1	g
Mass of sand & bottle before filling hole	6538.2	g
Mass of sand & bottle after filling hole & cone	3109.9	g
Mass of sand to fill hole & cone	3428.3	g
Mass of sand to fill hole	1641.2	g
Mass of soil & container	2212.3	g
Mass of container	12.1	g
Mass of wet soil	2200.2	g
Wet density of soil	127.8	**pcf**
Wet density per nuclear density gauge	132.2	**pcf**
Wet density correlation ≥ .95 and ≤ 1.05	1.03	

Permeability Test Check **Lift ID:** **LRP1011012 Radon Barrier P1 (In-Active Lift Start-Up) 1483S; 35W**

Test 1

Depth of Wet Front	4.4	cm
Radius of Tube	0.16	cm
Radius of Ring	21.9	cm
Height of Water	131.9	cm
Soil/Water Temp	23	°C
R (from Table)	0.931	
Change in Head	11.3	cm
Time	8	min
K_s	**7.7E-08**	**cm/sec**

EC-1905 Calculation Check

Lift ID: LRQ1040622 Q1 In-Active Start-up 1620S; 30W
Date: 6/22/04 7th Lift 10^{-6}

Lift / Lot Number	Proctor Dry Dens	Proctor Opti.Moist	Mass of Soil+Cont	Dry Mass soil+cont	Water Mass	Cont Mass	Mass of dry soil	Moist Cont	Wet Dens	Dry Dens	% Comp	Moist. Diff. Act. - Opti.	Proctor ID Number	Liner/RB OK?	Liner/RB OK?
7th/1	100.0	22.5	506.6	438.1	68.5	116.8	321.3	21.3	128.5	105.9	105.9	-1.2	A010717-2	TRUE	Yes
7th/1A	100.0	22.5	269.9	250.4	19.5	166.2	84.2	23.2	122.1	99.1	99.1	0.7	A010717-2	TRUE	Yes
7th/2	100.0	22.5	276.1	258.4	17.7	172.6	85.8	20.6	125.8	104.3	104.3	-1.9	A010717-2	TRUE	Yes
7th/2A	100.0	22.5	294.0	270.3	23.7	166.5	103.8	22.8	126.5	103.0	103.0	0.3	A010717-2	TRUE	Yes