LINER COMPATIBILITY REPORT

ENVIROCARE OF UTAH
11e.(2) BYPRODUCT MATERIAL DISPOSAL SITE
SOUTH CLIVE, UTAH

Prepared for

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LINER COMPATIBILITY REPORT

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EXECUTIVE SUMMARY

Physical and chemical analyses were performed on four individual soil samples originating from the proposed Envirocare Landfill Disposal Site. The four soil samples included 3 from composited brown clay samples taken from the upper 10 to 12 foot thick layer of soil identified as the material proposed for clay liner construction. The fourth sample was composited from a stockpile of material identified as white clay taken from the same upper 10 to 12 foot thick layer of material at the surface of the site. The stockpiled white clay material has been mixed with an additive. Testing of the white clay was selected to determine the additive mixture compatibility with the leachate.

The brown and white clay materials were compacted at a standard proctor at +2% optimal moisture content, for the four separate compaction permeability molds. Design specifications for the clay liner had previously been determined by correlating laboratory hydraulic conductivity testing on standard and modified proctors over a range of moistures. The moisture content of +2% optimal moisture for the standard proctor, demonstrated a hydraulic conductivity of approximately $5x10^{-8}$ cm/sec. Design performance specifications require a field hydraulic conductivity between $1.0x10^{-7}$ and $5x10^{-7}$ cm/sec. for the bottom liner.

These four compaction permeability mold samples were then tested to determine hydraulic conductivity values. The initial conductivity tests used groundwater taken from the site. The groundwater tests established the base line for the liner performance. The same permeameter molds were then tested for compatibility with tailings leachate by conducting hydraulic conductivity tests using a synthetic leachate solution. The leachate solution was specified by determining the upper range of concentrations of radionuclides, trace metals, ion concentrations and pH values which have been observed in leachate tests from 17 different sets of samples from 9 uranium tailings impoundments. The four hydraulic conductivity leachate solutions included 3 different pH values of 2,4 and 7.

The hydraulic conductivity of the liner material using the groundwater was performed for a period of 2 weeks to establish a baseline for liner hydraulic conductivity. The compatibility testing using the leachate was performed for a period of 3 months. During this 3 month period a total of 3 pore volumes were contacted with the clay liner material. Based on reported technical demonstration studies for the design performance of the disposal cell, on the same proposed liner material, the three pore volumes equate to a contact period of approximately 80 years.

The resulting hydraulic conductivity testing for both the groundwater and leachate shows no significant change due to the contact of leachate with the liner. The conclusion is that the leachate will not reduce the hydraulic conductivity performance of the proposed clay liner below the design specification of between $1.0x10^{-7}$ and $5x10^{-7}$ cm/sec.

SECTION 1

PROJECT DESCRIPTION

1.1 GENERAL OVERVIEW

The purpose of this project was to demonstrate the compatibility of a proposed clay liner with leachate typical of uranium mill tailings expected for disposal. The demonstration of compatibility is required by:

Code of Federal Regulations (CFR) 10 Part 40, Appendix A, Criterion 5E.

> *"Where clay liners are proposed or relatively thin, in-situ clay soils are to be relied upon for seepage control, tests must be conducted with representative tailings solutions and clay materials to confirm that no significant deterioration of permeability or stability properties will occur with continuous exposure of clay to tailings solutions."*

The clay liner is proposed as a bottom liner to earthen disposal cells containing 11e.(2) byproduct material. The site is located near Clive, Utah. The Clive site is proposed for disposal of low activity uranium and thorium 11e.(2) byproduct material.

1.2 COMPATIBILITY TESTING FEATURES

The compatibility of the liner material with the leachate generated from the waste was demonstrated by performing falling head hydraulic conductivity testing on the proposed clay material using a high concentration synthetic leachate based on 11e.(2) byproduct material to be disposed of at the Envirocare landfill. The results from these leachate conductivity tests were compared to those performed in the development of the clay liner design specifications. Compatibility was demonstrated by achieving results from the leachate conductivity tests which did not significantly vary from the proposed conductivity specifications.

Design specifications have been developed for the proposed clay liner from previously tested clay material from the Clive site. These previous tests included laboratory testing of the hydraulic conductivity of the clay material. The hydraulic conductivity of the bottom liner is an important parameter for impeding leachate infiltration from entering the groundwater below the site. The lower the hydraulic conductivity, the better the performance of restricting leachate movement. Leachate may be generated by the 11e.(2) material contained in the disposal cell, if it comes into contact with water infiltrating into the cell due to precipitation. A clay cover system will significantly restrict precipitation from entering the cell. The bottom liner is designed to further impede the movement of infiltration to the groundwater.

The engineered disposal cell including the cover and bottom liner were designed utilizing the U.S. Department of Energy's Unsaturated Soil Water and Heat Flow Model (UNSAT-H) and the

Environmental Protection Agency's Low-Level Radioactive Waste Environmental Transport and Risk Assessment Code (PATHRAE) model. The results of this site specific detailed contaminant transport modeling provided the long term infiltration values for the disposal cell. These infiltration values resulted in a stabilized moisture flux of not more than 2.47 cm per year through the bottom liner. This value was used to determine the approximate exposure period for the liner in these tests. Section 2.2.2 "Compatibility Hydraulic Conductivity Testing" discusses these volumes and exposure periods.

The objective of the compatibility tests was to demonstrate that the leachate from the 11e.(2) material will not significantly effect the hydraulic conductivity properties. Previous conductivity testing was performed using distilled water and shallow site groundwater, which is the standard method for the test. The compatibility test utilized a permeant which is representative of the highest concentration leachate ever expected from waste disposed at the site. The permeant contained specified concentrations of radioisotopes, metals and minerals; a range of pH levels; and other minor water quality parameters representative of the leachate. The section on leachate generation (Section 3.1) describes the details involving leachate concentrations.

1.3 PROJECT DURATION

The project began in August of 1993 and was completed on March 7, 1994. The major portion of this work was the time necessary to demonstrate adequate exposure to the clay material with the leachate. This was initiated on October 28, 1993 and was completed on February 2, 1994 for a total of 3 months. Hydraulic conductivity testing of the liner utilizing groundwater was performed in August 1993 prior to the leachate exposure. Laboratory analysis of the leachate effluent from the tests was performed in February 1994.

1.4 PROJECT RESPONSIBILITIES

Bingham Engineering Material Laboratory located in Salt Lake City, Utah performed the compatibility testing, sample preparation for compatibility tests and related soil moisture density tests. Bingham Environmental supervised all the testing activities, reviewed the results, and prepare this summary report. Barringer Laboratories, located in Golden, Colorado prepared the leachate to the requested specifications and performed the analytical testing on the permeant effluent. Envirocare collected and delivered the clay liner material from the disposal site to the Bingham Engineering Material Laboratory.

SECTION 2

MATERIAL LABORATORY PROGRAM

2.1 CLAY LINER MATERIAL

2.1.1 Unit 4 Clay Material - Envirocare Disposal Landfill Site

The clay material proposed for the bottom liner is available at the Clive site. The clay material is from the upper 10 to 12 foot thick layer of soil material identified as Unit 4 Clay. Numerous clay samples have previously been collected and tested from the Unit 4 layer, for a wide range of soil and chemical compositions. The material collected for the leachate compatibility study was from the same material in the same general locations. Two different colored clay materials make up the Unit 4 layer. The upper and majority of the layer is identified as a brown silty clay. A lower layer of material within the Unit 4 layer is identified as a white silty clay. Both clay layers have very similar material properties. Tests for this compatibility study were performed on both samples. The brown samples were composited from 3 different locations within the Unit 4 clay layer. The material was collected by a backhoe from depths ranging between 3 and 6 feet below the ground surface. The white clay material was collected from a stockpile of material on site. The material was placed in sealed 5 gallon buckets and transported to the Bingham Material Laboratory by Envirocare personnel for use in the compatibility testing. The amount collected was approximately 75 kilograms (165 pounds) or 3 moderately packed 5 gallon buckets.

2.1.2 Soil Classification

The laboratory index testing identified the proposed clay liner materials to be a reddish brown and whitish low plastic inorganic clay. Grain size distribution tests have determined that both materials contain more than 97 percent passing the #200 sieve. This compares with 98 percent passing the #200 sieve in previously performed hydraulic conductivity testing utilizing water. Material laboratory test results are provided in Attachment 1.

2.1.3 Moisture Density Specifications

Standard (ASTM D-698) proctors were performed on the Unit 4 clay material. For the brown clay, the maximum dry density of the clay is 96.7 pounds per cubic foot (pcf) at an optimum moisture of 24.4%. For the white clay, the maximum dry density of the clay is 104.1 pcf at an optimum moisture of 20.9%.

Standard (ASTM D-698) and Modified (ASTM D1557) proctors have been previously performed on the Unit 4 clay material for design hydraulic conductivity modeling. For the standard proctor, the maximum dry density of the brown clay is 98.6 pounds per cubic foot (pcf) at an optimum moisture of 25%. The modified proctor was performed on the clay samples to determine the effects of higher densities on hydraulic conductivity. For the Modified proctor, the maximum dry density of the clay is 103 pcf at an optimum moisture of 22.2 %.

The compatibility testing was performed on clay material which is proposed for the cover and bottom

liner. The moisture density relationships will be a standard proctor at +2 % of optimum moisture. The liner density moisture relationships for the 3 brown clay compatibility tests resulted in dry densities and moistures of: 97.3 pcf, +1.6% OMC; 96.1 pcf, +1.7% OMC; and 96.1 pcf, +1.8% OMC. The liner density moisture relationship for the white clay compatibility tests resulted in a dry density of 101.7 pcf and +2.5% OMC.

2.1.4 Mineralogy

Mineralogy testing was performed at the University of Utah Research Institute Earth Science Laboratory on a representative sample of the Unit 4 clay material from the disposal site. The weight percent analysis results are provided in Attachment 1 "Summary of X-Ray Diffraction Analysis". The mineralogy results indicate over 50% of the material is aragonite which is a calcium carbonate.

The compatibility testing included various leachate solutions which ranged in pH from 2 to 7. The analytical laboratory testing of the leachate effluent after the conductivity testing resulted in a pH value of approximately 7.5. The high calcium carbonate composition of the liner material is apparently buffering the low pH values of the leachate.

2.1.5 White Clay Additive

The white clay used included the addition of a deflocculent. The deflocculent used in processing the clay is tripolyphosphate (STP). STP provides 57.7 percent phosphorus pentoxide (P_2O_5) which is an effective clay deflocculent. The application rate of the sodium tripolyphospate at the Clive site is 3.5 pounds per 50 cubic feet.

The STP was added to the white clay for the testing to demonstrate leachate compatibility with the STP additive.

2.2 HYDRAULIC CONDUCTIVITY TESTING

2.2.1 Design Hydraulic Conductivity Specifications

Hydraulic conductivity is a function of porosity of the soil and the moisture content. The porosity is a function of the soils particle size and density. Uniform soils will exhibit a certain range of conductivity values based on their type and porosity. In general, clay soils will exhibit lower conductivities typically in the range of $1x10^{-5}$ to $1x10^{-8}$ cm/sec. To determine expected conductivity values for a soil of known parameters, it is important to perform a series of tests. Once the soil has been well defined by its particle size, porosity, density and water content, then the measured conductivity for the established set of soil values can be assumed to be relatively constant. Duplicating a exact set of soil values however is difficult and only a range of soil values is used to predict the resulting acceptable conductivity.

Testing of the hydraulic conductivities of the Unit 4 clay were previously run using both a distilled water permeant for the majority of the tests and groundwater samples from the site. The groundwater samples were included to correlate the effect of a higher specific gravity of permeant on the clay liner due to its high chloride content and potential solubility. The distilled water permeant results showed a solids loss due to solubility of approximately 2%. The results of the groundwater reduced the solids loss to approximately 0.2 %. Both tests resulted in approximately the same hydraulic conductivity.

The results of the previous hydraulic conductivity testing indicated a hydraulic conductivity of approximately $5x10^{-8}$ cm/sec. for both the standard and modified proctor tests. The modified proctor achieved this result over a broad range of moisture from optimum to +5 %, where the standard proctor achieved similar hydraulic conductivities at around +2 %.

The engineered disposal cell design was modeled by utilizing the UNSAT-H and PATHRAE computer programs. The results of this modeling were based on liner hydraulic conductivities of $1x10^{-6}$ cm/sec. The model estimated long term infiltration values and were the basis for the disposal cell design. These infiltration values resulted in an estimated stabilized moisture flux of 2.47 cm per year through the bottom liner.

In addition to the previous hydraulic conductivity testing there were hydraulic conductivity tests performed on the actual permeameter molds containing the Unit 4 clay material used for the compatibility tests. These tests were performed to demonstrate comparison between hydraulic conductivities of the groundwater permeant and the hydraulic conductivities for the leachate on the exact same samples. Prior to introducing the leachate solution as the permeant, the tests using the site groundwater were run for approximately 2 weeks. The results are compared in Section 2.2.3 "Compatibility Hydraulic Conductivity Testing Results" and on Figures 2-5.

The testing apparatus used in the hydraulic conductivity tests was a closed sealed compaction permeameter mold. The compaction of material was performed in the molds and top covers were then locked in places. The hydraulic conductivity measuring cylinders and tubing was then attached for the performance of the conductivity tests. The testing apparatus is shown in Figure 5.

2.2.2 Compatibility Hydraulic Conductivity Testing

The compatibility testing was performed on 4 different samples. The combinations varied by 2 different parameters; pH, and the addition of a flocculent to the white clay. The tests were performed as indicated in the following table.

TABLE 1
Hydraulic Conductivity Test Identification

Test ID #	pH	Clay sample
pH 2	2	brown
pH 4 brown	4	brown
pH 7	7	brown
pH 4 white	4	white

The initial conductivity testing using the site groundwater on the liner material was performed for 2 weeks. The compatibility testing using the leachate was performed for 3 months. Within the 3 month time period for leachate compatibility the liner material was contacted by approximately 3 pore volumes of leachate. The 3 pore volumes of leachate equates to approximately 3 liters of leachate solution. The

exposure of 3 liters of solution is equivalent to approximately 80 years of exposure for a infiltration rate of 2.47 cm/yr. The 80 years is based on a 2.47 cm/yr infiltration rate for a 6 inch diameter permeameter mold, resulting in a 37 cm^3 volume of leachate per year. The time to move over 3 liters of leachate through the material at a rate of 0.037 liter per year would be approximately 80 years.

2.2.3 Compatibility Hydraulic Conductivity Testing Results

The results of the compatibility testing indicate a stabilization at or just below $1x10^{-7}$ cm/sec for all of the 4 tests. Of the four different samples the pH 7 solution and the white clay sample stabilized slightly higher than the groundwater tests. These two samples exhibited lower groundwater conductivities of around $5x10^{-8}$ cm/sec. This compares to the stabilization of the groundwater conductivities of between $5x10^{-8}$ and $1x10^{-7}$ cm/sec. The pH 2 and pH 4 brown clay samples both exhibited similar results for the groundwater and leachate of around $1x10^{-7}$ cm/sec. The final conductivity of the pH sample was actually slightly lower than the groundwater tests.

These results compare closely to the previous conductivity testing on a range of liner specifications using distilled water. The results from these previous tests for similar dry densities and moistures was $5x10^{-8}$ cm/sec.

SECTION 3

ANALYTICAL LABORATORY PROGRAM

3.1 SYNTHETIC LEACHATE GENERATION

Leachate was produced by a EPA certified laboratory in accordance with conditions determined by Bingham to be representative of the upper range of leachate concentrations.

3.1.1 Leachate Constituents

Leachate was fabricated by Barringer Laboratories, an EPA certified laboratory, similar to leachate characteristics formed by percolation through the proposed 11e.(2) tailings. Characteristics of the leachate include:

- pH
- Radionuclide concentrations
- Trace metals
- Cation/Anion concentrations

3.1.2 Leachate Concentrations

The pH range is dependent on the particular site and processes used in the extraction and handling of the mine tailings. Research of literature indicates a large range of pH values for various mines tailing leachate. Because of the large variation in pH values, the synthetic leachate was prepared at several pH values over the pH range of possible disposal material. The pH values ranged from 2 to 7.

Radionuclide concentrations in the leachate depend on the concentration in the waste and the distribution coefficient (K_d) of the radionuclide. K_d's determine how much of the contaminant is disassociated from the waste and brought into suspension in the percolating water. The leachate concentrations are summarized below for all the contaminants expected in the waste.

TABLE 2
Radionuclide Concentrations

Contaminant	Leachate Concentration
Radium 226	2000 pCi/l
Thorium 230	2000 pCi/l
Thorium 232	6000 pCi/l
Uranium (natural)	15 mg/l

Trace metal concentrations were determined from the Toxicity Characteristic Leaching Procedure

(TCLP) results from various mine tailings. TCLP tests give the maximum concentrations of contaminates that are anticipated to leach from a particular soil. The maximum concentrations in the range of values given for each metal is specified as the concentration that the laboratory produced in the leachate. Refer to Table 3 below.

TABLE 3
Concentrations of Metals

Trace Metal	Concentration (mg/l)
Arsenic	50
Barium	8,000
Cadmium	5
Chromium	5
Copper	100
Lead	30
Mercury	0.2
Selenium	1
Silver	40
Zinc	50

Cation/anion concentrations are representative of mine tailing leachate from locations that have conditions similar to the waste expected for disposal in the South Clive site.

TABLE 4
Anion/Cation Concentrations (mg/l)

ANION	Concentration
Fluorine	25
Chloride	200
Sulfate	3000
CATION	
Calcium	600
Magnesium	150
Potassium	30
Sodium	1000

3.2 ANALYTICAL TESTING

3.2.1 Number of Samples

A total of four (4) hydraulic conductivity samples were prepared and tested. This included 3 different pH values on clay compacted at 95% of standard and 1 test performed on clay amended with a flocculate additive. See Table 5 below.

Table 5
Hydraulic Conductivity Test Specifications

Test ID #	pH	Radion uclides	Trace Metals	Cation/Anion	Clay sample
pH 2	2	A	B	C	brown
pH 4 brown	4	A	B	C	brown
pH 7	7	A	B	C	brown
pH 4 white	4	A	B	C	brown

A - Concentrations as shown in Table 2.
B - Concentrations as shown in Table 3.
C - Concentrations as shown in Table 4.

3.2.2 Sample Volumes

Compacted clay samples used in performing the hydraulic conductivity tests are 6.0 inches in diameter and 4 inches high. Leachate manufactured by the laboratory consisted of one gallon for each test, for a total of 4 gallons. The synthetic leachate solution was characterized by initial laboratory analysis. The total number pore volumes conducted through each sample was approximately 3. A final characterization was performed on the permeant after the completion of the test.

3.2.3 Sample Methods

Hydraulic conductivity tests were performed using the constant head ASTM D-2434 method. The clay samples were compacted to design densities in rigid wall permeameter molds and leachate was percolate through the clay. Hydraulic conductivity testing was continuous for approximately 13 weeks. The final reported hydraulic conductivity value was averaged over the values which had reached a steady state flux.

3.2.4 Analytical Testing Results

The leachate effluent from the conductivity testing was collected and analyzed. The same constituents which were originally specified in the synthetic leachate solution were analyzed. The results showed at dramatic decrease in the radionuclide concentrations. The original leachate solutions of 2000-6000 pCi/l for radium and thorium were less than 3 pCi/l in the effluent. The concentrations of uranium were

reduced from 15 mg/l to less than 0.02 mg/l. The metals concentrations in the leachate solutions were reduced from their original levels of 1-8000 mg/l to less than 1 mg/l and several not being detected at all. The ion concentrations in the effluent all showed concentrations typically of the groundwater at the site. This is attributed to the high levels of ion concentrations in the groundwater which were previously run on the clay molds. The most significant result of the analytical tests is the effluent pH results. The pH of the effluent for all four samples resulted in a near neutral pH. The range varied between 7.40-7.69. This is attributed to the high calcium carbonate concentrations in the clay material. The laboratory test results are provided in Attachment 2

SECTION 4

QUALITY ASSURANCE OBJECTIVES

The objective of the QA plan is to assure that results from liner compatibility tests are accurate and representative of site conditions. Quality assurance is two pronged in that quality controls must be in place for both; (1) materials - clay and leachate and, (2) testing procedures. Values that are used in design must be representative of actual hydraulic conductivity that will be seen in the field under leaching conditions.

4.1 METHODS AND THEIR DETECTION LIMITS, PRECISION, AND ACCURACY

The leachate was manufactured to Bingham's specifications for radionuclide concentrations, trace metals, pH, and cation/anion concentrations. Detection limits required for analysis of pH, radionuclides, metals, and cation/anions are:

TABLE 6

PARAMETERS	REQUIRED EPA METHOD No.	REQUIRED DETECTION LIMITS (mg/l)	MAXIMUM HOLDING TIMES
pH	150.1	0.1	
RADIONUCLIDES			
Radium 226	903.1	0.6 pCi/l ± 30%	6 Months
Thorium 230	3008	15 pCi/l ± 30%	6 Months
Thorium 232	3008	15 pCi/l ± 30%	6 Months
Uranium (total)	ASTM 2907-83B	0.7 pCi/l ± 30%	6 Months
METALS		(mg/l)	
Arsenic	7060	0.005	6 Months
Barium	6010	0.002	6 Months
Cadmium	6010	0.004	6 Months
Chromium	6010	0.005	6 Months
Copper	6010	0.005	6 Months
Lead	7421	0.005	6 Months
Mercury	7470	0.0002	28 Days
Selenium	7740	0.005	6 Months
Silver	6010	0.005	6 Months
Zinc	6010	0.002	6 Months
CATIONS/ANIONS		(mg/l)	
Chloride	325.2	1.0	28 Days
Fluorine			
Sulfate	375.2	0.5	28 Days
Calcium	6010	0.01	6 Months
Magnesium	6010	0.01	6 Months
Potassium	6010	0.01	6 Months
Sodium	6010	0.01	6 Months

SECTION 5

REFERENCES

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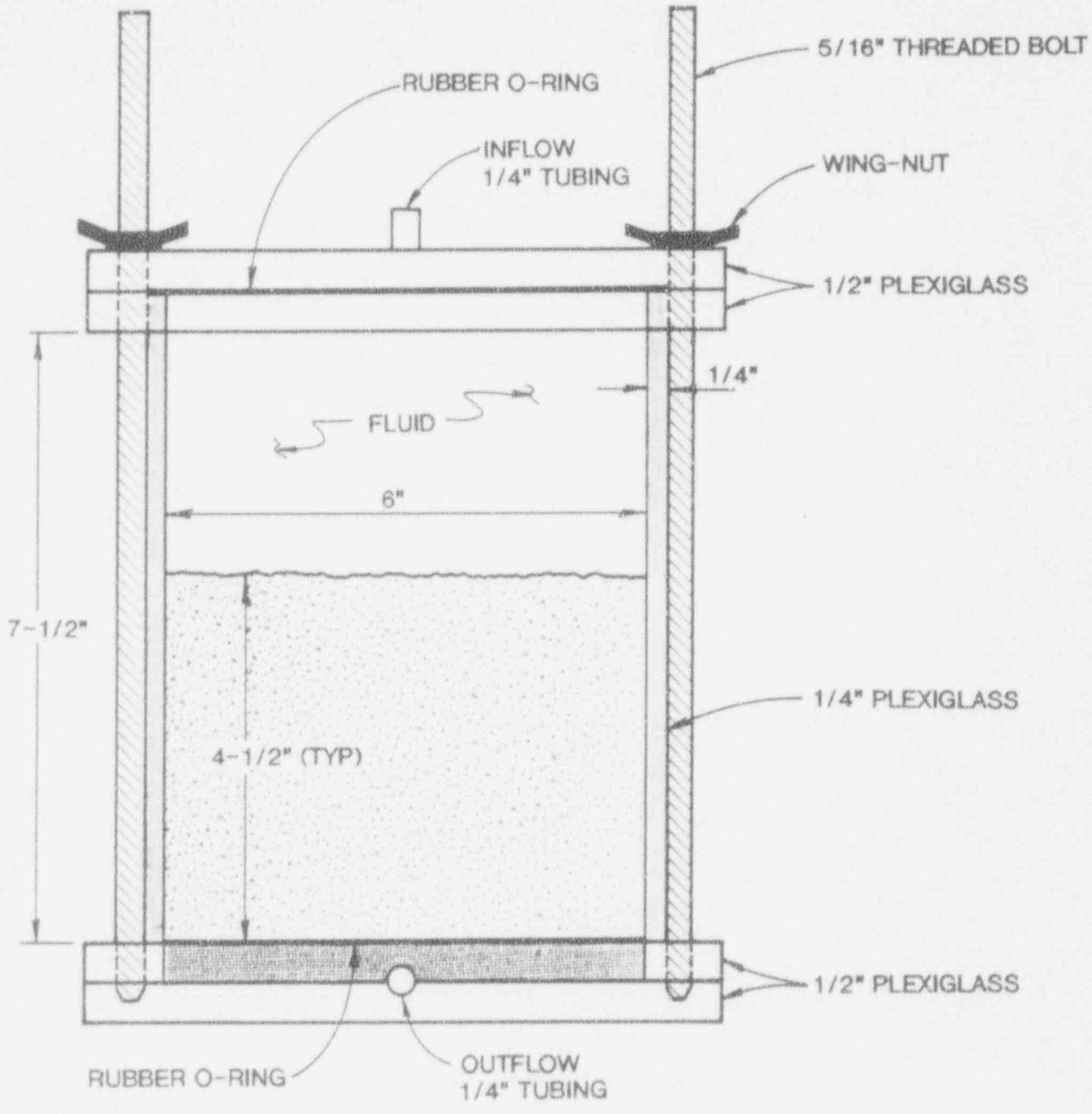
United States Department of Energy, *UMTRA Project Remedial Action Planning and Disposal Cell Design to Comply With the Proposed EPA Standards (40 CRF Part 192)*, January 1989

U. S. Nuclear Regulatory Commission, *Uranium Recovery Field Office Memorandum, Sampling of Uranium Mill Tailings Impoundments for Hazardous Constituents*, February 9, 1987.



LEGEND

- CLAY SOIL
- PLEXIGLASS MOLD
- POROUS STONE

0 1 2 4

SCALE IN INCHES

ENVIROCARE OF UTAH

LINER COMPATIBILITY STUDY

HYDRAULIC CONDUCTIVITY APPARATUS

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

FIGURE 1

Date MARCH 1994 | Proj # 1534-( )05 | Sht of

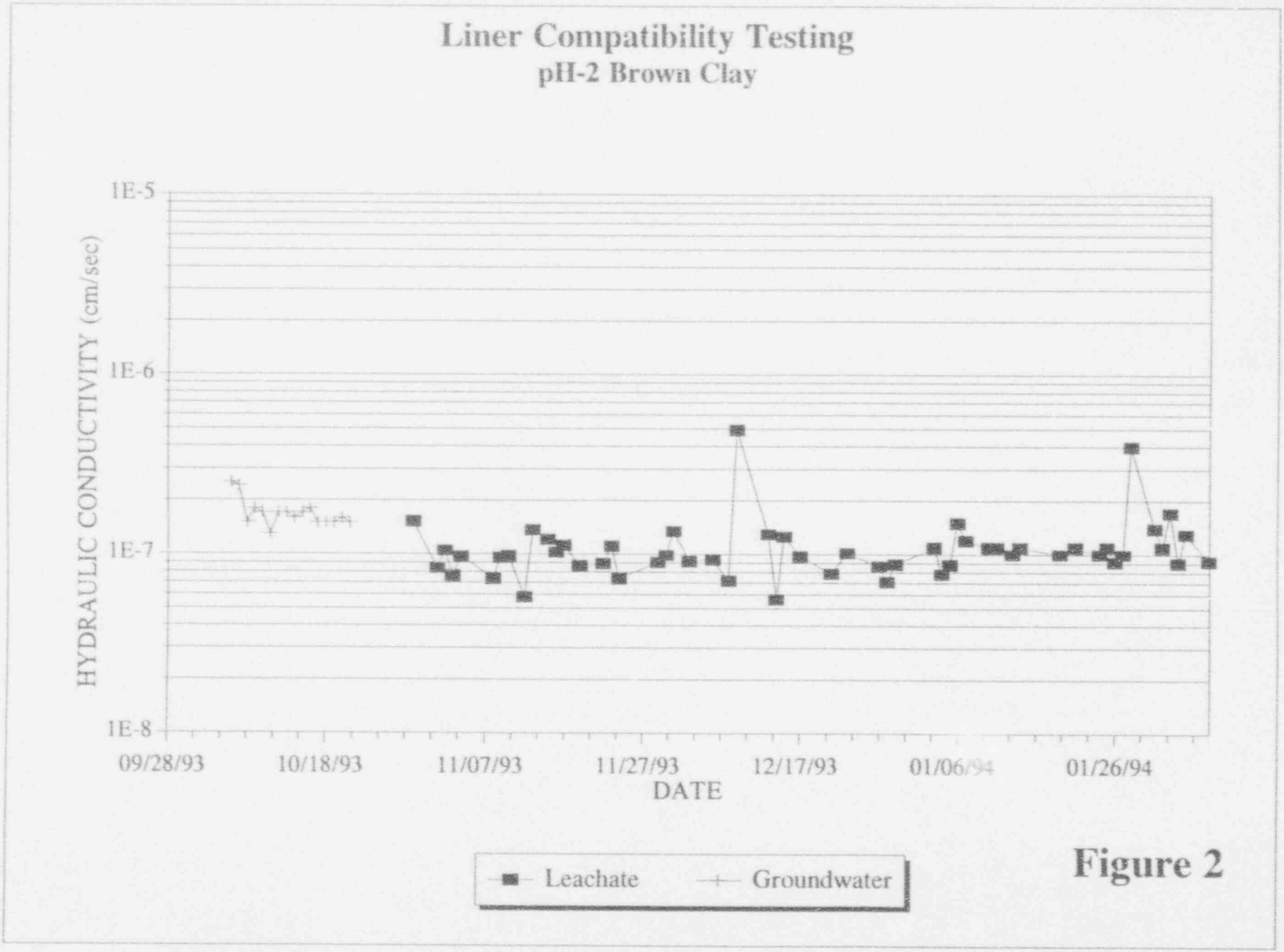

Liner Compatibility Testing
pH-2 Brown Clay
HYDRAULIC CONDUCTIVITY (cm/sec)
1E-5
1E-6
1E-7
1E-8
09/28/93
10/18/93
11/07/93
11/27/93
12/17/93
01/06/94
01/26/94
DATE
Leachate
Groundwater

Figure 2

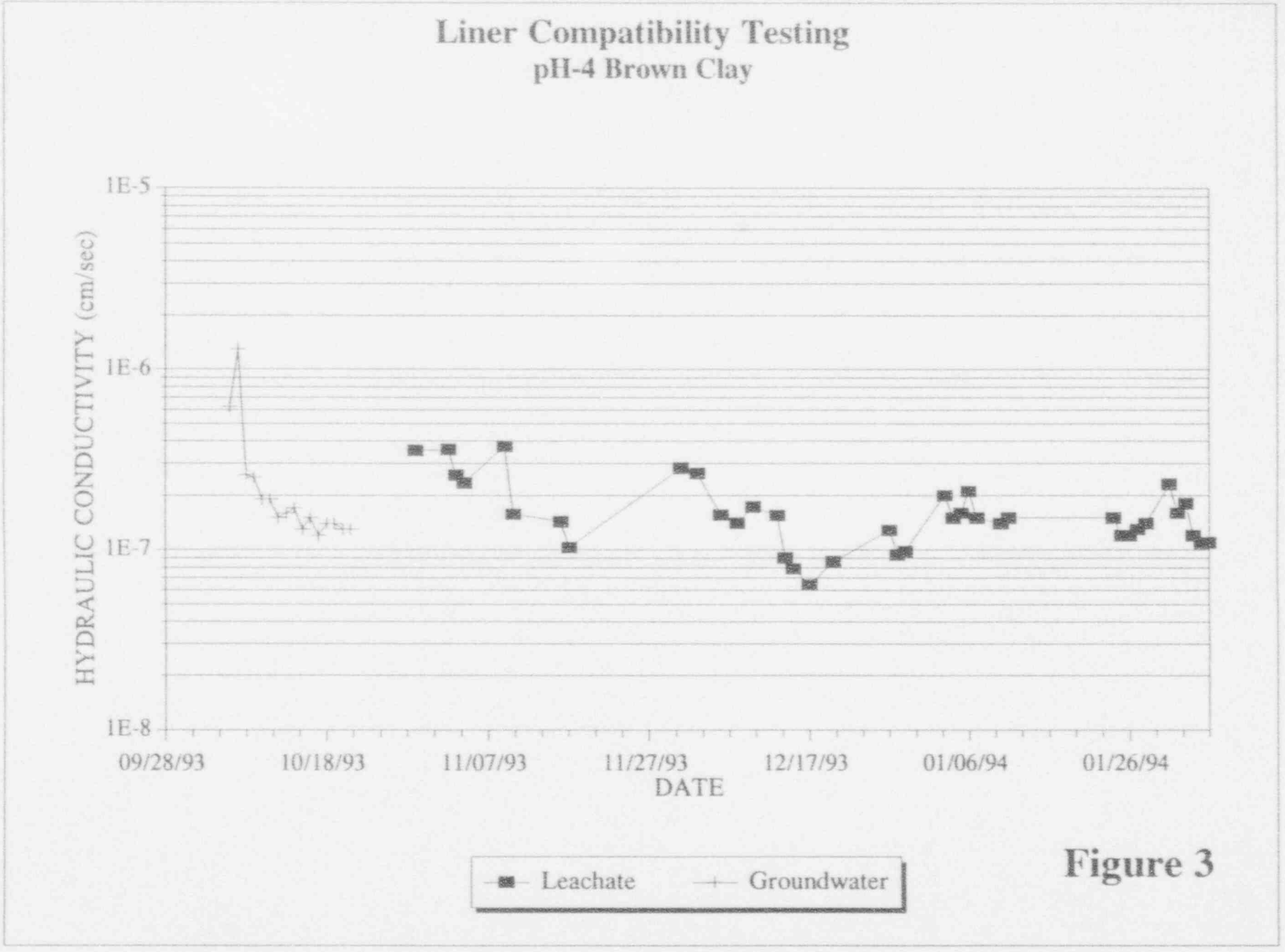

Liner Compatibility Testing
pH-4 Brown Clay
HYDRAULIC CONDUCTIVITY (cm/sec)
1E-5
1E-6
1E-7
1E-8
09/28/93
10/18/93
11/07/93
11/27/93
12/17/93
01/06/94
01/26/94
DATE
Leachate
Groundwater

Figure 3

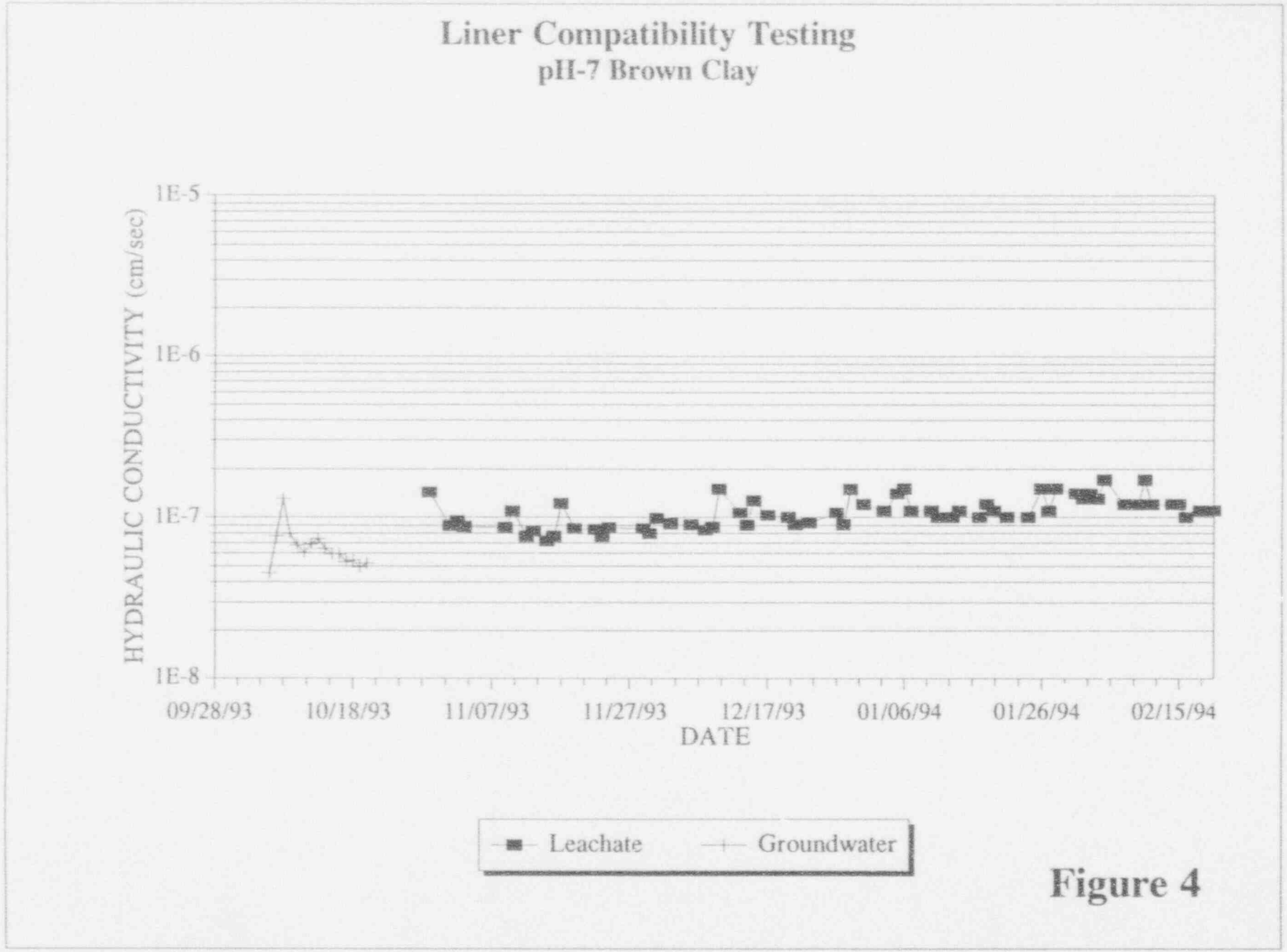

Liner Compatibility Testing
pH-7 Brown Clay
HYDRAULIC CONDUCTIVITY (cm/sec)
1E-5
1E-6
1E-7
1E-8
09/28/93
10/18/93
11/07/93
11/27/93
12/17/93
01/06/94
01/26/94
02/15/94
DATE
Leachate
Groundwater

Figure 4

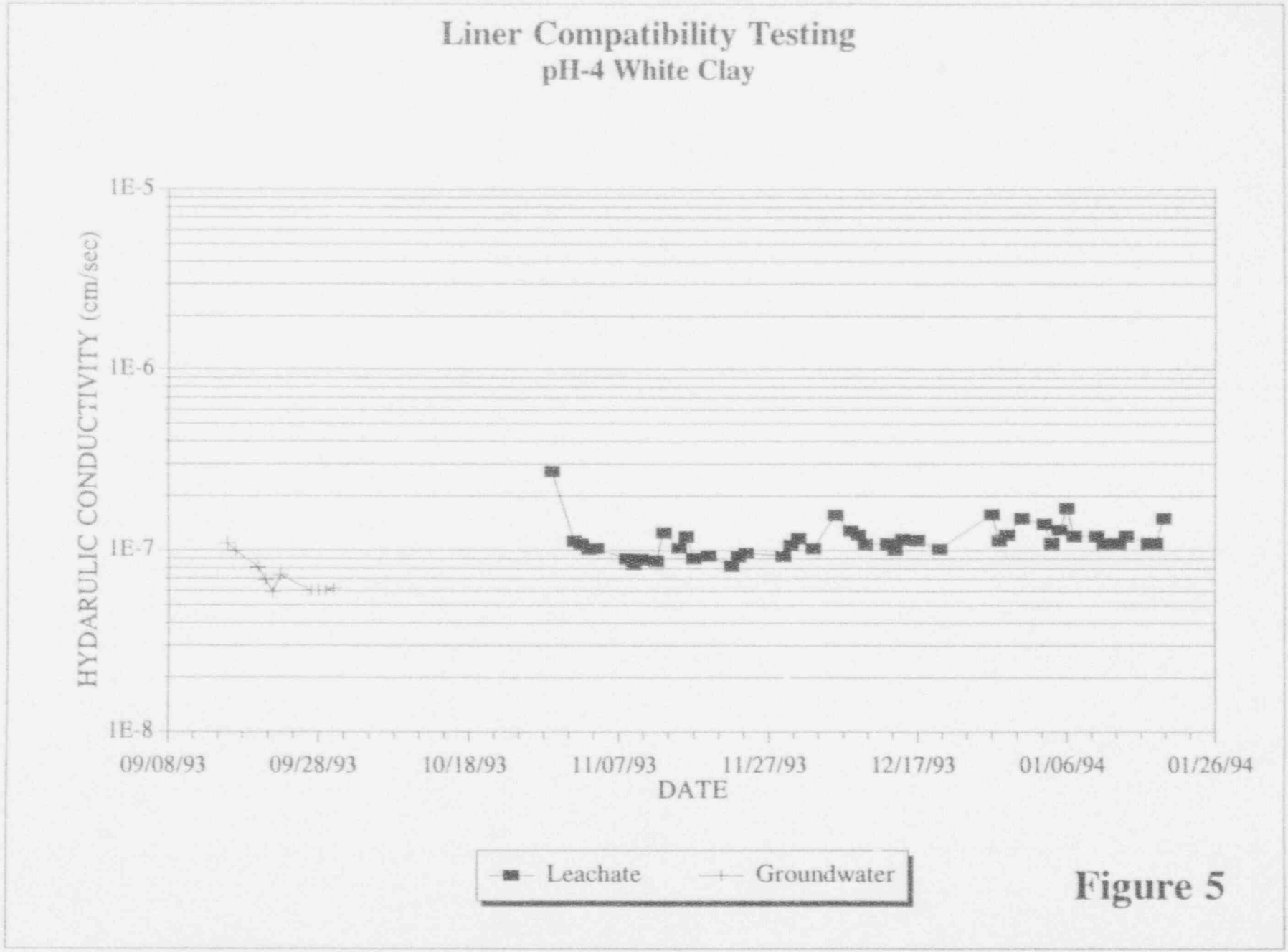

Liner Compatibility Testing
pH-4 White Clay
HYDARULIC CONDUCTIVITY (cm/sec)
1E-5
1E-6
1E-7
1E-8
09/08/93
09/28/93
10/18/93
11/07/93
11/27/93
12/17/93
01/06/94
01/26/94
DATE
Leachate
Groundwater

Figure 5

ATTACHMENT 1

PHYSICAL LABORATORY TESTING

BINGHAM ENGINEERING MATERIALS LABORATORY

COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-00 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.8% OMC

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	527.1	527.1	
WET SOIL + PAN	1110.2	1110.2	
DRY SOIL + PAN	989.3	989.3	
MOISTURE CONTENT	26.2%	26.2%	ERR

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	96.1
TARGET SOIL MOISTURE (%)	26.2%
NO. OF LAYERS	3
MOIST SOIL WT. PER LAYER (GMS)	1410.2
LAYER THICKNESS (IN)	1.57

* USE ENTIRE SAMPLE

ACTUAL DRY DENSITY @ COMPACTION (	96.1
ACTUAL MOISTURE @ COMPACTION	26.2%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGET	0

MOLD DIAMETER (IN): 6

BEG SAMPLE LENGTH (IN): 4.7 FINAL LENGTH (IN): 4.6

STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 26.2 Small Mold: 4" Dia x 4.584" H

STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 50.75 Large Mold: 6" Dia x 7" H

SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 2.1% Permeameter Large Tube 25.0"

PERMEAMETER NO: #6 on F Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOIR LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10 /	6 /	93	905	192				
10 /	6 /	93	2200	182		2.5E-07	0.3	
10 /	7 /	93	830	174		2.3E-07	0.2	
10 /	7 /	93	1548	169		2.4E-07	0.3	
10 /	8 /	93	937	158		2.0E-07	0.2	
10 /	8 /	93	1825	154		1.5E-07	0.2	
10 /	9 /	93	730	147		1.8E-07	0.2	
10 /	9 /	93	1515	143		1.8E-07	0.2	
10 /	10 /	93	915	134		1.7E-07	0.2	
10 /	11 /	93	830	123		1.7E-07	0.2	
10 /	11 /	93	1633	120		1.3E-07	0.1	
10 /	12 /	93	755	113		1.7E-07	0.2	
10 /	13 /	93	818	102		1.7E-07	0.2	
10 /	14 /	93	841	92		1.6E-07	0.2	
10 /	15 /	93	825	82		1.7E-07	0.2	
10 /	16 /	93	1500	69		1.8E-07	0.2	
10 /	17 /	93	1500	61		1.5E-07	0.2	
10 /	18 /	93	818	55		1.5E-07	0.2	
10 /	19 /	93	1100	46		1.5E-07	0.2	
10 /	20 /	93	848	39		1.6E-07	0.2	
10 /	21 /	93	903	31		1.5E-07	0.2	
/	/							

10 ML

BINGHAM ENGINEERING MATERIALS LABORATORY
COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-005 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.8% OMC PH of 2

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	527.1	527.1	
WET SOIL + PAN	1110.2	1110.2	
DRY SOIL + PAN	989.3	989.3	
MOISTURE CONTENT	26.2%	26.2%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	96.1
TARGET SOIL MOISTURE (%)	26.2%
NO. OF LAYERS	3
MOIST SOIL WT. PER LAYER (GMS)	1410.2
LAYER THICKNESS (IN)	1.57
ACTUAL DRY DENSITY @ COMPACT	96.1
ACTUAL MOISTURE @ COMPACTIO	26.2%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARG	L

MOLD DIAMETER (IN): 6

BEG SAMPLE LENGTH (IN): 4.7 FINAL LENGTH (IN): 4.7

STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 26.2 Small Mold: 4" Dia x 4.584" H

STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 50.75 Large Mold: 6" Dia x 7" H

SAMPLE COMPRESSION DURING PERMEABILITY TESTING. 0.0% Permeameter Large Tube 25.0"

PERMEAMETER NO: #6 on F Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOI LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10 /	28 /	93	951	159	5			
10 /	29 /	93	840	122	6	1.5E-07	0.2	
11 /	1 /	93	1227	41	4	8.4E-08	0.1	
11 /	2 /	93	818	17	5	1.0E-07	0.1	
___ /	___ /	___						
11 /	2 /	93	822	277	5			
11 /	3 /	93	1237	256	3	7.6E-08	0.1	
11 /	4 /	93	1040	232	5	9.7E-08	0.1	
11 /	8 /	93	849	157	3	7.3E-08	0.1	
11 /	9 /	93	645	135	5	9.6E-08	0.1	
11 /	10 /	93	1240	103	4	9.9E-08	0.1	
11 /	12 /	93	1118	76	3	5.8E-08	0.1	
11 /	13 /	93	1138	44	6	1.4E-07	0.1	
___ /	___ /	___						
11 /	13 /	93	1141	277	7			
11 /	15 /	93	1039	208	5	1.2E-07	0.1	
11 /	16 /	93	1615	169	4	1.0E-07	0.1	
11 /	17 /	93	1112	143	6	1.1E-07	0.1	
11 /	19 /	93	1658	80	6	8.6E-08	0.1	
11 /	22 /	93	948	0	6	8.9E-08	0.1	
___ /	___ /	___						
11 /	22 /	93	950	276	5			
11 /	23 /	93	1257	244	4	1.1E-07	0.1	
11 /	24 /	93	937	226	4	7.3E-08	0.1	
11 /	29 /	93	1433	104	4	9.1E-08	0.1	
11 /	30 /	93	809	86	4	9.9E-08	0.1	
12 /	1 /	93	1526	44	4	1.4E-07	0.1	
12 /	3 /	93	1449	1	5	9.1E-08	0.1	
___ /	___ /	___						
12 /	3 /	93	1455	276	5			
12 /	6 /	93	823	211	5	9.4E-08	0.1	
12 /	8 /	93	810	171	4	7.2E-08	0.1	

12	9	93	1015	46	3	4.9E-07	0.5	
12	10	93	1422	113	4			
12	13	93	1600	25	6	1.3E-07	0.1	
12	14	93	1630	9	4	5.6E-08	0.1	
12	14	93	1637	147	5			
12	15	93	820	128	4	1.3E-07	0.1	
12	17	93	850	76	4	9.8E-08	0.1	Pushed 80 ML not Shown
12	20	93	940	259	5			
12	21	93	815	241	4	7.8E-08	0.1	
12	23	93	1300	180	4	1.0E-07	0.1	
12	27	93	900	90	5	8.6E-08	0.1	
12	28	93	840	70	5	7.1E-08	0.1	
12	29	93	825	47	4	8.8E-08	0.1	
12	31	93	855	275	5			
1	3	94	810	188	5	1.1E-07	0.1	
1	4	94	1025	163	3	7.8E-08	0.1	
1	5	94	1030	139	5	8.8E-08	0.1	
1	5	94	1100	279	5			
1	6	94	1700	232	5	1.5E-07	0.2	
1	7	94	945	208	4	1.2E-07	0.1	
1	10	94	1430	116	4	1.1E-07	0.1	
1	11	94	1015	94	5	1.1E-07	0.1	
1	13	94	900	44	4	1.0E-07	0.1	
1	14	94	1200	14	4	1.1E-07	0.1	
1	18	94	1322	279	5			
1	19	94	1620	248	6	1.0E-07	0.1	
1	21	94	1645	178	4	1.1E-07	0.1	
1	24	94	840	103	4	1.0E-07	0.1	
1	25	94	940	73	6	1.1E-07	0.1	
1	26	94	1045	46	5	9.1E-08	0.1	
1	27	94	829	21	5	1.0E-07	0.1	
1	27	94	1524	278	5			
1	28	94	822	201	6	4.0E-07	0.4	
1	31	94	821	67	4	1.4E-07	0.1	
2	1	94	1212	31	4	1.1E-07	0.1	
2	1	94	1220	196	6			
2	2	94	1449	146	6	1.7E-07	0.2	
2	3	94	1449	117	5	9.0E-08	0.1	
2	4	94	924	86	6	1.3E-07	0.1	
2	7	94	811	6	5	9.2E-08	0.1	

BINGHAM ENGINEERING MATERIALS LABORATORY

COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-00 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.7% OMC

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	527.9	527.9	
WET SOIL + PAN	1034.2	1034.2	
DRY SOIL + PAN	929.3	929.3	
MOISTURE CONTENT	26.1%	26.1%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	96.1
TARGET SOIL MOISTURE (%)	26.1%
NO. OF LAYERS	5
MOIST SOIL WT. PER LAYER (GMS)	841.8
LAYER THICKNESS (IN)	0.94
ACTUAL DRY DENSITY @ COMPACTION (	96.1
ACTUAL MOISTURE @ COMPACTION	26.1%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGET	0

MOLD DIAMETER (IN): 6

BEG SAMPLE LENGTH (IN): 4.68 FINAL LENGTH (IN): 4.63

STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 30

STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 50.75

SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 1.1%

PERMEAMETER NO: #5 on B

Small Mold: 4" Dia x 4.584" H

Large Mold: 6" Dia x 7" H

Permeameter Large Tube 25.0"

Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOIR LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10	6	93	943	455				
10	6	93	2200	415		6.2E-07	0.6	
10	7	93	827	391		4.6E-07	0.5	
10	7	93	1545	346		1.3E-06	1.3	
10	8	93	936	321		3.1E-07	0.3	
10	8	93	1825	311		2.6E-07	0.3	
10	9	93	730	295		2.9E-07	0.3	
10	9	93	1515	287		2.5E-07	0.3	
10	10	93	915	273		1.9E-07	0.2	
10	11	93	830	255		1.9E-07	0.2	
10	11	93	1633	249		1.9E-07	0.2	
10	12	93	755	240		1.5E-07	0.2	
10	13	93	817	225		1.6E-07	0.2	
10	14	93	840	210		1.7E-07	0.2	
10	15	93	825	199		1.3E-07	0.1	
10	16	93	1500	183		1.5E-07	0.2	
10	17	93	1500	173		1.2E-07	0.1	
10	18	93	817	165		1.4E-07	0.1	
10	19	93	1100	153		1.4E-07	0.1	
10	20	93	848	144		1.3E-07	0.1	
10	21	93	903	134		1.3E-07	0.1	

BINGHAM ENGINEERING MATERIALS LABORATORY
COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-002 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.7% OMC PH of 4

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	527.9	527.9	
WET SOIL + PAN	1034.2	1034.2	
DRY SOIL + PAN	929.3	929.3	
MOISTURE CONTENT	26.1%	26.1%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	96.1
TARGET SOIL MOISTURE (%)	26.1%
NO. OF LAYERS	5
MOIST SOIL WT. PER LAYER (GMS)	841.8
LAYER THICKNESS (IN)	0.94
ACTUAL DRY DENSITY @ COMPACTI	96.1
ACTUAL MOISTURE @ COMPACTION	26.1%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGE	0

MOLD DIAMETER (IN): 6
BEG SAMPLE LENGTH (IN): 4.68 FINAL LENGTH (IN): 4.68
STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 30
STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 50.75
SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 0.0%
PERMEAMETER NO: #5 on E

Small Mold: 4" Dia x 4.584"
Large Mold: 6" Dia x 7"
Permeameter Large Tube 25.0"
Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOI LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10 /	28 /	93	950	163	6			
10 /	29 /	93	840	77	5	3.5E-07	0.4	
/	/							
11 /	1 /	93	1227	273	5			
11 /	2 /	93	817	194	5	3.6E-07	0.4	
11 /	3 /	93	1237	99	5	2.6E-07	0.3	
11 /	4 /	93	1040	35	5	2.4E-07	0.2	
/	/							Leak on mold
11 /	8 /	93	848	276	5			
11 /	9 /	93	645	190	5	3.7E-07	0.4	
11 /	10 /	93	1239	131	5	1.6E-07	0.2	
/	/							Leak on Mold
11 /	15 /	93	1039	229	4			
11 /	16 /	93	1615	188	5	1.4E-07	0.1	
11 /	17 /	93	1112	165	4	1.0E-07	0.1	
/	/							Leak on Mold
11 /	30 /	93	810	124	5			
12 /	1 /	93	1526	32	6	2.8E-07	0.3	
/	/							
12 /	1 /	93	1530	280	5			
12 /	3 /	93	1448	140	6	2.8E-07	0.3	
12 /	6 /	93	823	6	5	1.6E-07	0.2	
/	/							
12 /	6 /	93	828	242	5			
12 /	8 /	93	812	169	5	1.4E-07	0.1	
/	/							
12 /	9 /	93	1015	128	5			
12 /	10 /	93	1422	76	6	1.7E-07	0.2	
/	/							
12 /	10 /	93	1433	270	5			
12 /	13 /	93	1600	150	4	1.5E-07	0.2	
12 /	14 /	93	1630	124	4	9.1E-08	0.1	

12 /	15 /	93	820	110	4	7.9E-08	0.1
12 /	17 /	93	850	75	4	6.4E-08	0.1
12 /	20 /	93	927	8	4	8.6E-08	0.1
___ /	___ /	___	_____	_____	_____		
12 /	23 /	93	1300	222	5		
12 /	27 /	93	900	98	5	1.3E-07	0.1
12 /	28 /	93	840	71	5	9.4E-08	0.1
12 /	29 /	93	825	44	5	9.8E-08	0.1
___ /	___ /	___	_____	_____	_____		
12 /	31 /	93	855	279	5		
1 /	3 /	94	810	128	5	2.0E-07	0.2
1 /	4 /	94	1025	80	5	1.5E-07	0.2
1 /	5 /	94	1030	32	6	1.6E-07	0.2
___ /	___ /	___	_____	_____	_____		
1 /	5 /	94	1100	279	5		
1 /	6 /	94	1700	211	5	2.1E-07	0.2
1 /	7 /	94	945	178	5	1.5E-07	0.2
1 /	10 /	94	1430	42	5	1.4E-07	0.1
1 /	11 /	94	1015	8	5	1.5E-07	0.2
___ /	___ /	___	_____	_____	_____		
1 /	21 /	94	1645	266	5		
1 /	24 /	94	840	171	4	1.5E-07	0.2
1 /	25 /	94	940	136	4	1.2E-07	0.1
1 /	26 /	94	1045	102	4	1.2E-07	0.1
1 /	27 /	94	828	70	5	1.3E-07	0.1
1 /	28 /	94	821	32	5	1.4E-07	0.1
___ /	___ /	___	_____	_____	_____		
1 /	28 /	94	1055	242	6		
1 /	31 /	94	821	64	5	2.3E-07	0.2
2 /	1 /	94	1212	8	5	1.6E-07	0.2
___ /	___ /	___	_____	_____	_____		
2 /	1 /	94	1220	135	5		
2 /	2 /	94	1449	86	5	1.8E-07	0.2
2 /	3 /	94	924	57	5	1.2E-07	0.1
2 /	4 /	94	811	26	5	1.1E-07	0.1
2 /	5 /	94	800	1	0	1.1E-07	0.1

BINGHAM ENGINEERING MATERIALS LABORATORY

COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-00 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.6% OMC

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	182.5	182.5	
WET SOIL + PAN	829.7	829.7	
DRY SOIL + PAN	696.3	696.3	
MOISTURE CONTENT	26.0%	26.0%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	97.3
TARGET SOIL MOISTURE (%)	26.0%
NO. OF LAYERS	3
MOIST SOIL WT. PER LAYER (GMS)	1413.4
LAYER THICKNESS (IN)	1.55
ACTUAL DRY DENSITY @ COMPACTION (	97.3
ACTUAL MOISTURE @ COMPACTION	26.0%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGET	0

MOLD DIAMETER (IN): 6

BEG SAMPLE LENGTH (IN): 4.66 FINAL LENGTH (IN): 4.63

STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 26.5 Small Mold: 4" Dia x 4.584" H

STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 50.75 Large Mold: 6" Dia x 7" H

SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 0.6% Permeameter Large Tube 25.0"

PERMEAMETER NO: #1 on E Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOIR LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10	6	93	944	243				
10	6	93	2200	241		4.5E-08	0.0	
10	7	93	828	239		5.3E-08	0.1	
10	7	93	1547	237		7.6E-08	0.1	
10	8	93	937	232		7.9E-08	0.1	
10	8	93	1825	225	5	1.3E-07	0.1	
10	9	93	730	202	5	1.7E-07	0.2	
10	9	93	1515	194	5	7.9E-08	0.1	
10	10	93	915	178	5	6.7E-08	0.1	
10	11	93	830	158	5	6.8E-08	0.1	
10	11	93	1643	152	4	6.0E-08	0.1	
10	12	93	755	140	5	6.8E-08	0.1	
10	13	93	817	119	5	7.3E-08	0.1	
10	14	93	840	100	6	6.4E-08	0.1	
10	15	93	825	82	5	5.9E-08	0.1	
10	16	93	1500	59	5	5.9E-08	0.1	
10	17	93	1500	43	6	5.3E-08	0.1	
10	18	93	818	31	6	5.4E-08	0.1	
10	19	93	1100	14	5	4.9E-08	0.1	
10	20	93	845	0	5	5.2E-08	0.1	

BINGHAM ENGINEERING MATERIALS LABORATORY
COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-005 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: Brown Clay +1.8% OMC PH of 7

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	132.5	182.5	
WET SOIL + PAN	829.7	829.7	
DRY SOIL + PAN	696.3	696.3	
MOISTURE CONTENT	26.0%	26.0%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	97.3
TARGET SOIL MOISTURE (%)	26.0%
NO. OF LAYERS	3
MOIST SOIL WT. PER LAYER (GMS)	1413.4
LAYER THICKNESS (IN)	1.55
ACTUAL DRY DENSITY @ COMPACTI	97.3
ACTUAL MOISTURE @ COMPACTION	26.0%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGE	0

MOLD DIAMETER (IN): 6
BEG SAMPLE LENGTH (IN): 4.66 FINAL LENGTH (IN): 4.66
STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 26.5 Small Mold: 4" Dia x 4.584" H
STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 24.8 Large Mold: 6" Dia x 7" H
SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 0.0% Permeameter Large Tube 25.0"
PERMEAMETER NO: #1 on D Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOI LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10 /	28 /	93	953	460	4			
10 /	29 /	93	839	427	6	1.4E-07	0.1	
11 /	1 /	93	1227	340	5	8.8E-08	0.1	
11 /	2 /	93	815	316	5	9.5E-08	0.1	
11 /	3 /	93	1237	285	5	8.7E-08	0.1	
11 /	4 /	93	1040	261	6	8.6E-08	0.1	
___ /	___ /	___	_____	_____	_____			Repaired Leak
11 /	8 /	93	848	165	5			
11 /	9 /	93	845	140	6	1.1E-07	0.1	
11 /	10 /	93	1239	111	5	7.0E-08	0.1	
11 /	12 /	93	1118	65	5	8.2E-08	0.1	
11 /	13 /	93	1138	45	4	7.1E-08	0.1	
11 /	15 /	93	1038	5	5	7.6E-08	0.1	
___ /	___ /	___	_____	_____	_____			
11 /	15 /	93	1045	575	5			
11 /	16 /	93	1615	535	5	1.2E-07	0.1	
11 /	17 /	93	1112	513	5	8.5E-08	0.1	
11 /	19 /	93	1352	451	5	8.4E-08	0.1	
11 /	22 /	93	948	387	4	7.6E-08	0.1	
11 /	23 /	93	1253	360	4	8.5E-08	0.1	
11 /	24 /	93	937	340	4	8.5E-08	0.1	
11 /	29 /	93	1433	330	4	7.9E-08	0.1	
11 /	30 /	93	808	211	5	9.8E-08	0.1	
12 /	1 /	93	1525	178	5	9.1E-08	0.1	
12 /	3 /	93	1448	126	5	9.0E-08	0.1	
12 /	6 /	93	822	60	5	8.3E-08	0.1	
12 /	8 /	93	812	12	5	8.7E-08	0.1	
___ /	___ /	___	_____	_____	_____			
12 /	8 /	93	815	577	5			
12 /	9 /	93	1015	534	5	1.5E-07	0.2	
12 /	10 /	93	1420	495	4	1.1E-07	0.1	
12 /	13 /	93	1600	413	5	8.9E-08	0.1	

12 /	13 /	93	1600	413	5	8.9E-08	0.1
12 /	14 /	93	1630	375	4	1.3E-07	0.1
12 /	15 /	93	820	356	4	1.0E-07	0.1
12 /	17 /	93	850	299	5	1.0E-07	0.1
12 /	20 /	93	925	219	5	8.9E-08	0.1
12 /	21 /	93	815	194	4	9.2E-08	0.1
12 /	23 /	93	1300	131	5	1.1E-07	0.1
12 /	27 /	93	900	36	6	9.0E-08	0.1
___ /	___ /	___	_____	_____	_____		
12 /	28 /	93	845	580	5		
12 /	29 /	93	825	543	4	1.5E-07	0.2
12 /	31 /	93	855	473	5	1.2E-07	0.1
1 /	3 /	94	810	379	6	1.1E-07	0.1
___ /	___ /	___	_____	_____	_____		
1 /	4 /	94	1025	368	5		
1 /	5 /	94	1030	330	6	1.4E-07	0.1
___ /	___ /	___	_____	_____	_____		
1 /	5 /	94	1100	579	5		
1 /	6 /	94	1700	533	5	1.5E-07	0.2
1 /	7 /	94	945	510	4	1.1E-07	0.1
1 /	10 /	94	1430	408	5	1.1E-07	0.1
1 /	11 /	94	1015	383	5	1.0E-07	0.1
1 /	13 /	94	900	327	3	1.0E-07	0.1
1 /	14 /	94	1200	296	4	1.1E-07	0.1
1 /	17 /	94	740	225	4	1.0E-07	0.1
1 /	18 /	94	1255	190	3	1.2E-07	0.1
1 /	19 /	94	1620	159	6	1.1E-07	0.1
1 /	21 /	94	1645	102	4	1.0E-07	0.1
1 /	24 /	94	840	29	4	1.0E-07	0.1
___ /	___ /	___	_____	_____	_____		
1 /	25 /	94	940	580	6		
1 /	26 /	94	1045	536	5	1.5E-07	0.2
1 /	27 /	94	828	504	4	1.1E-07	0.1
1 /	28 /	94	822	460	5	1.5E-07	0.2
1 /	31 /	94	821	341	4	1.4E-07	0.1
2 /	1 /	94	1211	300	4	1.3E-07	0.1
2 /	2 /	94	1449	260	5	1.4E-07	0.1
2 /	3 /	94	924	233	4	1.3E-07	0.1
2 /	4 /	94	811	189	5	1.7E-07	0.2
2 /	7 /	94	802	85	5	1.2E-07	0.1
2 /	8 /	94	802	51	6	1.2E-07	0.1
2 /	9 /	94	1040	13	5	1.2E-07	0.1
___ /	___ /	___	_____	_____	_____		
2 /	9 /	94	1045	375	6		
2 /	10 /	94	934	334	5	1.7E-07	0.2
2 /	11 /	94	919	298	5	1.2E-07	0.1
2 /	14 /	94	1151	187	5	1.2E-07	0.1
2 /	15 /	94	848	156	6	1.2E-07	0.1
2 /	16 /	94	844	123	5	1.0E-07	0.1
2 /	18 /	94	1159	51	6	1.1E-07	0.1
2 /	20 /	94	812	1	0	1.1E-07	0.1

BINGHAM ENGINEERING MATERIALS LABORATORY

COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-00 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: White Clay +2.5% OMC

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO.			
PAN TARE	529.7	529.7	
WET SOIL + PAN	1287	1287	
DRY SOIL + PAN	1141.9	1141.9	
MOISTURE CONTENT	23.7%	23.7%	ERR

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	101.7
TARGET SOIL MOISTURE (%)	23.7%
NO. OF LAYERS	5
MOIST SOIL WT. PER LAYER (GMS)	862.7
LAYER THICKNESS (IN)	0.92
ACTUAL DRY DENSITY @ COMPACTION (	101.7
ACTUAL MOISTURE @ COMPACTION	23.7%
FINAL DRY DENSITY (PCF)	0.0
ACTUAL % COMPACTION OF TARGET	0

MOLD DIAMETER (IN): 6

BEG SAMPLE LENGTH (IN): 4.62 FINAL LENGTH (IN): 4.62

STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 17.25

STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 25

SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 0.0%

PERMEAMETER NO: 4

Small Mold: 4" Dia x 4.584" H

Large Mold: 6" Dia x 7" H

Permeameter Large Tube 25.0"

Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOIR LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
9	15	93	1608	280	4			
9	16	93	824	267	3	1.1E-07	0.1	
9	17	93	811	246	4	9.9E-08	0.1	
9	20	93	1300	187	4	8.1E-08	0.1	
9	21	93	755	173	5	6.9E-08	0.1	
9	22	93	840	157	4	5.9E-08	0.1	
9	23	93	1103	137	5	7.3E-08	0.1	
9	27	93	815	75	5	6.0E-08	0.1	
9	28	93	933	59	3	6.0E-08	0.1	
9	29	93	830	46	5	6.0E-08	0.1	
9	30	93	846	31	5	6.2E-08	0.1	

BINGHAM ENGINEERING MATERIALS LABORATORY
COMPACTION PERMEABILITY TESTING

SOIL SAMPLES FABRICATED TO PRE-DETERMINED DENSITY AND MOISTURE

PROJECT NO: 1534-005 PROJECT: Enviro Care of Utah

SAMPLE NO. & LOCATION: White Clay +2.5% OMC

MOISTURE CONTENT	BEFORE	DURING	AFTER*
PAN NO			
PAN TARE	529.7	529.7	528.1
WET SOIL + PAN	1287	1287.00	4842.2
DRY SOIL + PAN	1141.9	1141.9	3903.6
MOISTURE CONTENT	23.7%	23.7%	27.8%

* USE ENTIRE SAMPLE

COMPACTION DENSITY	
TARGET DRY DENSITY (PCF)	101.7
TARGET SOIL MOISTURE (%)	23.7%
NO. OF LAYERS	5
MOIST SOIL WT. PER LAYER (GMS)	862.7
LAYER THICKNESS (IN)	0.92
ACTUAL DRY DENSITY @ COMPACTI	101.7
ACTUAL MOISTURE @ COMPACTION	23.7%
FINAL DRY DENSITY (PCF)	98.4
ACTUAL % COMPACTION OF TARGET	

MOLD DIAMETER (IN): 6
BEG SAMPLE LENGTH (IN): 4.62 FINAL LENGTH (IN): 4.62
STATIC HEAD 1, 0 ON PERM. TO BOTTOM OF SAMPLE (IN): 17.25
STATIC HEAD 2 DATA, 0 TO 500 ON PERMEAMETER (IN): 24.8
SAMPLE COMPRESSION DURING PERMEABILITY TESTING: 0.0%
PERMEAMETER NO: C-4

Small Mold: 4" Dia x 4.584" H
Large Mold: 6" Dia x 7" H
Permeameter Large Tube 25.0"
Small Tube 475.0"

DATE MO	DAY	YR	TIME HRS	RESERVOI LEVEL (ML)	PRESSURE HEAD (PSI)	PERMEABILITY, K (CM/SEC)	(FT/YR)	COMMENTS
10 /	28 /	93	953	455	4			
10 /	29 /	93	839	396	6	2.7E-07	0.3	
11 /	1 /	93	1225	291	5	1.1E-07	0.1	
11 /	2 /	93	815	265	5	1.1E-07	0.1	
11 /	3 /	93	1237	231	5	1.0E-07	0.1	
11 /	4 /	93	1040	204	6	1.0E-07	0.1	
11 /	8 /	93	848	100	5	9.0E-08	0.1	
11 /	9 /	93	645	77	6	8.4E-08	0.1	
11 /	10 /	93	1238	45	5	8.9E-08	0.1	
11 /	12 /	93	1000	0	5	8.8E-08	0.1	
___ /	___ /	___	_____	_____	_____			
11 /	12 /	93	1122	568	5			
11 /	13 /	93	1137	538	4	1.3E-07	0.1	
11 /	15 /	93	1038	482	4	1.0E-07	0.1	
11 /	16 /	93	1614	442	5	1.2E-07	0.1	
11 /	17 /	93	1111	421	5	9.1E-08	0.1	
11 /	19 /	93	1648	356	5	9.4E-08	0.1	
11 /	22 /	93	947	292	4	8.2E-08	0.1	
11 /	23 /	93	1250	265	4	9.3E-08	0.1	
11 /	24 /	93	936	244	4	9.7E-08	0.1	
11 /	29 /	93	1433	124	4	9.4E-08	0.1	
11 /	30 /	93	808	105	5	1.1E-07	0.1	
12 /	1 /	93	1525	66	5	1.2E-07	0.1	
12 /	3 /	93	1449	11	5	1.0E-07	0.1	
___ /	___ /	___	_____	_____	_____			
12 /	3 /	93	1500	525	5			
12 /	6 /	93	822	425	4	1.6E-07	0.2	
12 /	8 /	93	811	356	5	1.3E-07	0.1	
12 /	9 /	93	1015	320	5	1.2E-07	0.1	
12 /	10 /	93	1418	285	4	1.1E-07	0.1	
12 /	13 /	93	1600	195	5	1.1E-07	0.1	
12 /	14 /	93	1630	168	4	1.0E-07	0.1	

12 /	15 /	93	820	149	4	1.2E-07	0.1
12 /	17 /	93	850	91	5	1.1E-07	0.1
12 /	20 /	93	919	9	5	1.0E-07	0.1
___ /	___ /	___	_____	_____	_____		
12 /	23 /	93	1300	521	5		
12 /	27 /	93	900	375	6	1.3E-07	0.2
12 /	28 /	93	840	341	5	1.1E-07	0.1
12 /	29 /	93	825	307	4	1.2E-07	0.1
12 /	31 /	93	855	230	5	1.5E-07	0.2
1 /	3 /	94	840	127	5	1.4E-07	0.1
1 /	4 /	94	825	99	4	1.1E-07	0.1
1 /	5 /	94	1030	62	6	1.3E-07	0.1
___ /	___ /	___	_____	_____	_____		
1 /	5 /	94	1100	423	4		
1 /	6 /	94	1700	377	5	1.7E-07	0.2
1 /	7 /	94	945	355	4	1.2E-07	0.1
1 /	10 /	94	1430	253	5	1.2E-07	0.1
1 /	11 /	94	1015	228	5	1.1E-07	0.1
1 /	13 /	94	900	174	3	1.1E-07	0.1
1 /	14 /	94	1200	145	4	1.2E-07	0.1
1 /	17 /	94	740	74	4	1.1E-07	0.1
1 /	18 /	94	1255	44	3	1.1E-07	0.1
1 /	19 /	94	1640	5	6	1.5E-07	0.2

BINGHAM ENGINEERING
SPECIFIC GRAVITY

PROJECT: Enivrocare of Utah DATE: 09-24-93

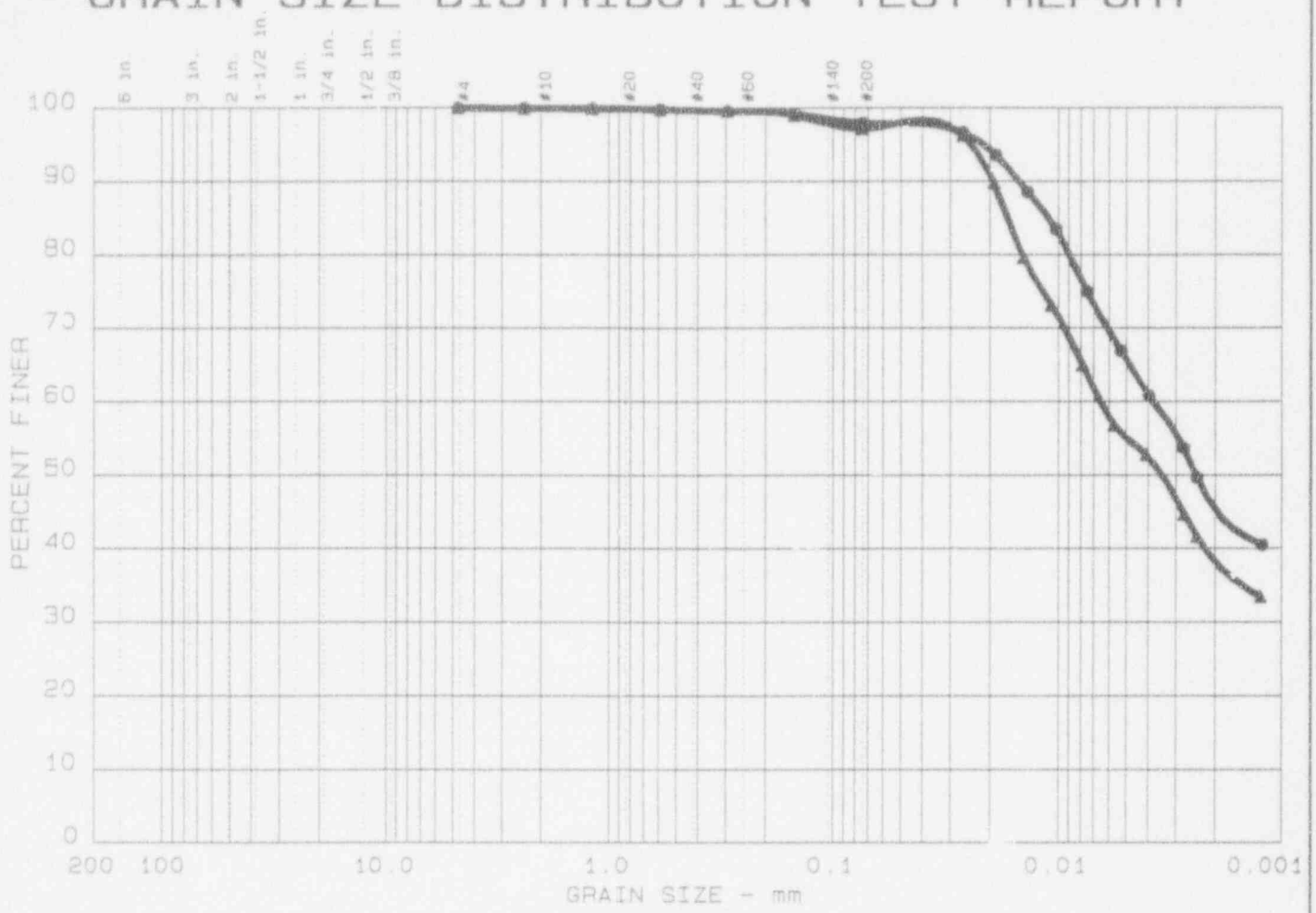
SAMPLE LOCATION: PROJ. 1534-002

SPECIFIC GRAVITY OF SOLIDS (Gs)

Sample or Speciman No.		White	Brown			
Flask No.		A	5			
Temperature of Water and Soil		20.5	18.5			
Dish Number						
Dish and Dry Soil						
Dish						
Dry Soil	Ws	99.44	86.87	0.00	0.00	0.00
Flask and Water at Temp.	Wbw	675.23	670.39			
Ws + Wbw		774.67	757.26	0.00	0.00	0.00
Flask & Water & Immersed Soil	Wbws	738.85	725.24			
Displaced Water,(Ws+Wbw-Wb		35.82	32.02	0.00	0.00	0.00
Correction Factor	K	1.00	1.00			
(WsK)+(Ws+Wbw-Wbws)	Gs	2.77	2.71	ERR	ERR	ERR
APPARENT (Gs) AND BLUK (Gm) SPECIFIC GRAVITY						
Sample or Specimen No.						
Temperature of Water and Soil						
Tare						
Saturated Suface-Dry Soil	B	0.00	0.00	0.00	0.00	0.00
(Wire Basket & Soil) in Water						
Wire Basket in Water						
Saturated Soil in Water	C	0.00	0.00	0.00	0.00	0.00
Tare and Dry Soil						
Tare						
Dry Soil	A	0.00	0.00	0.00	0.00	0.00
Correction Factor	K					
(AK) / (A-C) (Apparent)	Ga	ERR	ERR	ERR	ERR	ERR
(AK) / (B-C) (Bulk)	Gm	ERR	ERR	ERR	ERR	ERR

Tested By: Checked By:

GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	2.1	32.3	65.6
▲	0.0	0.0	2.8	42.2	55.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	39	19			0.00					
▲	36	18			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
● Light Colored Clay	CL	A-6
▲ Darker Colored Clay	CL	A-6

Project No.: 1534-005
Project: Enviro Care of Utah
● Location: White Material
▲ Location: Brown Material

Date: 08-23-93

Remarks:

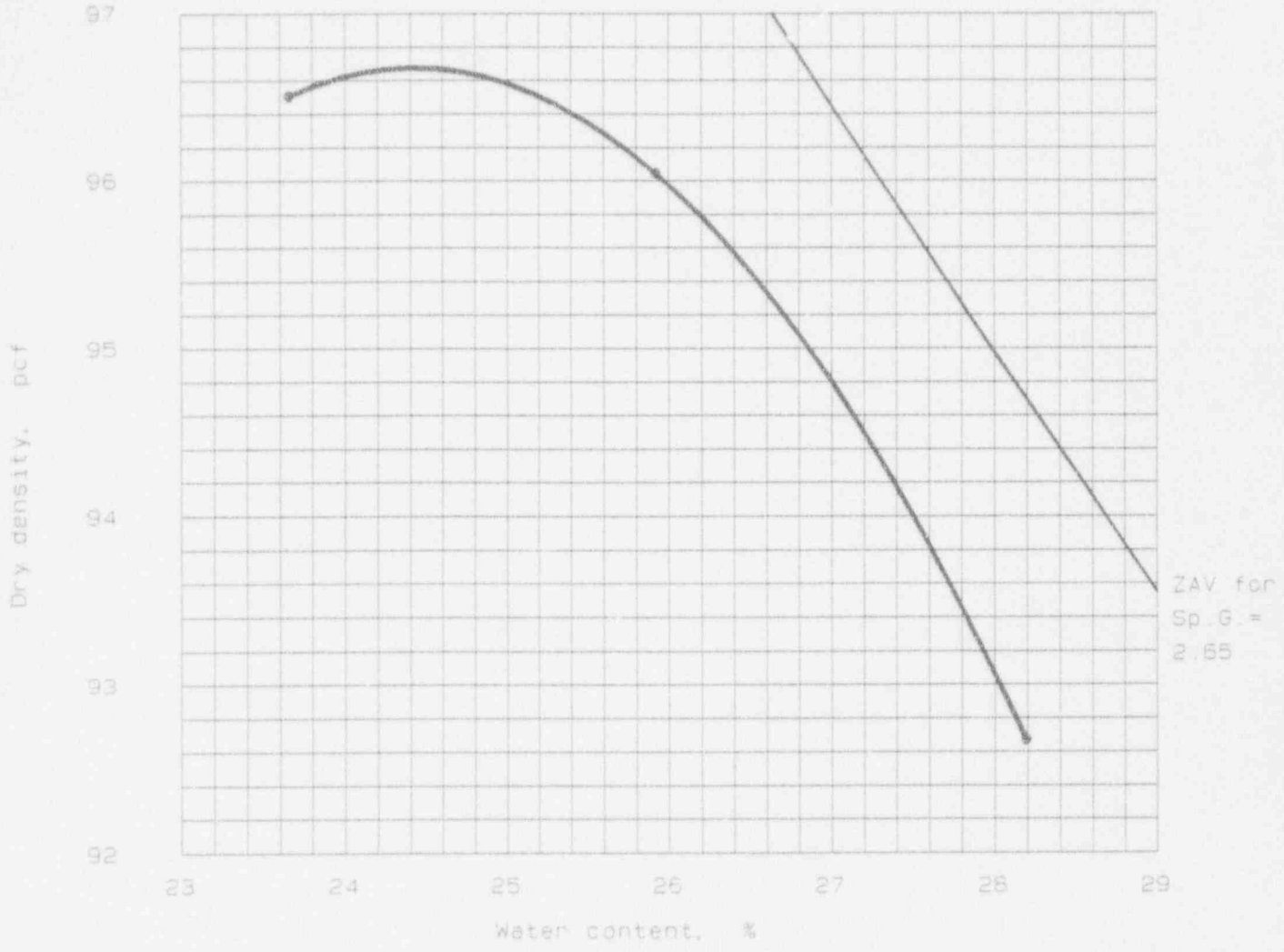
Tested By: SB

GRAIN SIZE DISTRIBUTION TEST REPORT

Bingham Engineering

Figure No. 1

PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method C

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	CL				36	18	0 %	97.9 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 24.4 % Maximum dry density = 96.7 pcf	Clay

Project No.: 1534-005
Project: Enviro Care of Utah
Location: Brown Material

Date: 09-28-93

Remarks:

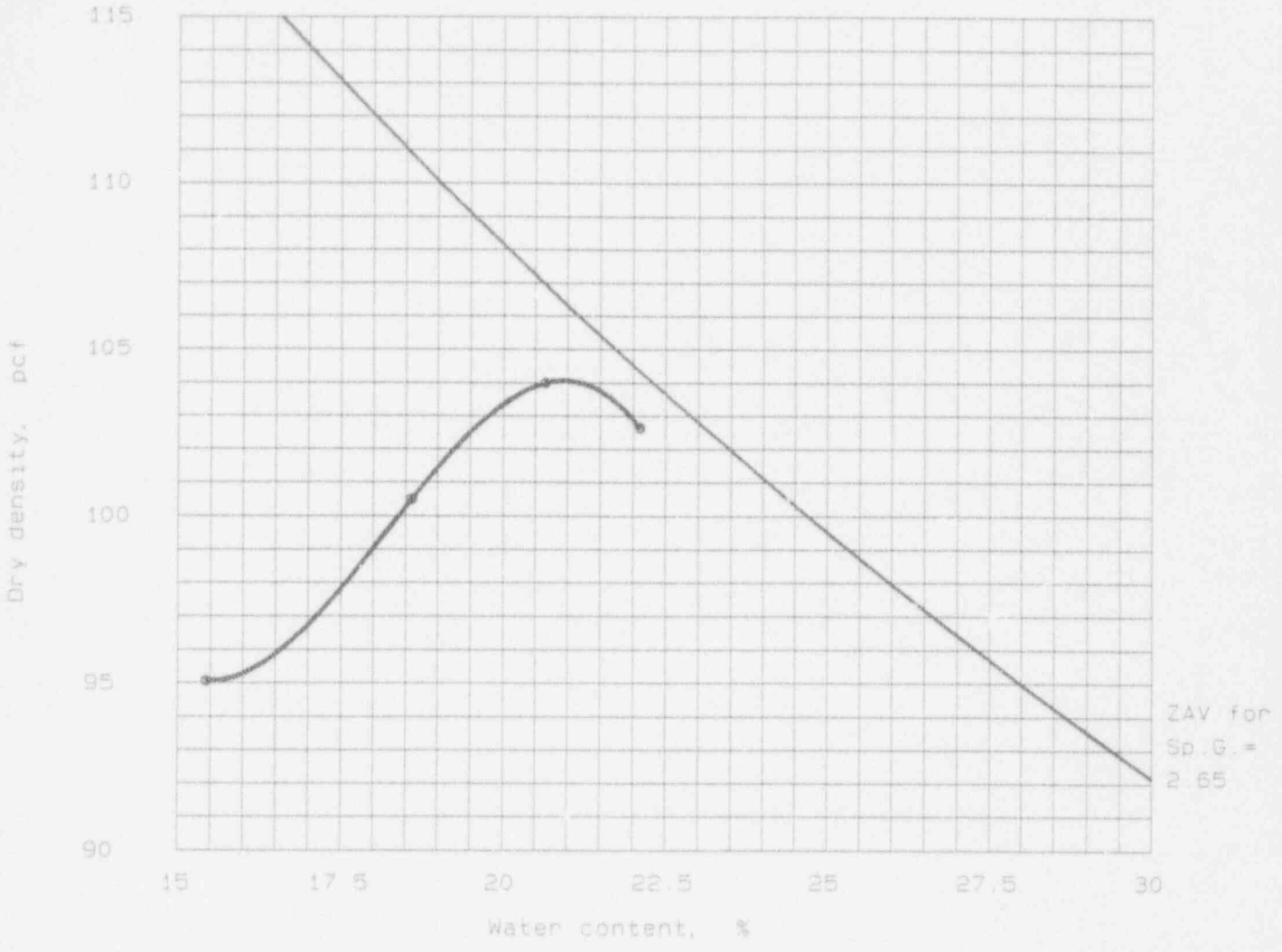
Tested By: DA

PROCTOR TEST REPORT

Bingham Engineering

Figure No. _____

PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method C

Elev/ Depth	Classification		Nat. Moist	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	CL				39	19	0 %	97.2 %

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 20.9 % Maximum dry density = 104.1 pcf	Clay

Project No.: 1534-005
Project: Enviro Care of Utah
Location: White Material

Date: 09-28-93

Remarks:

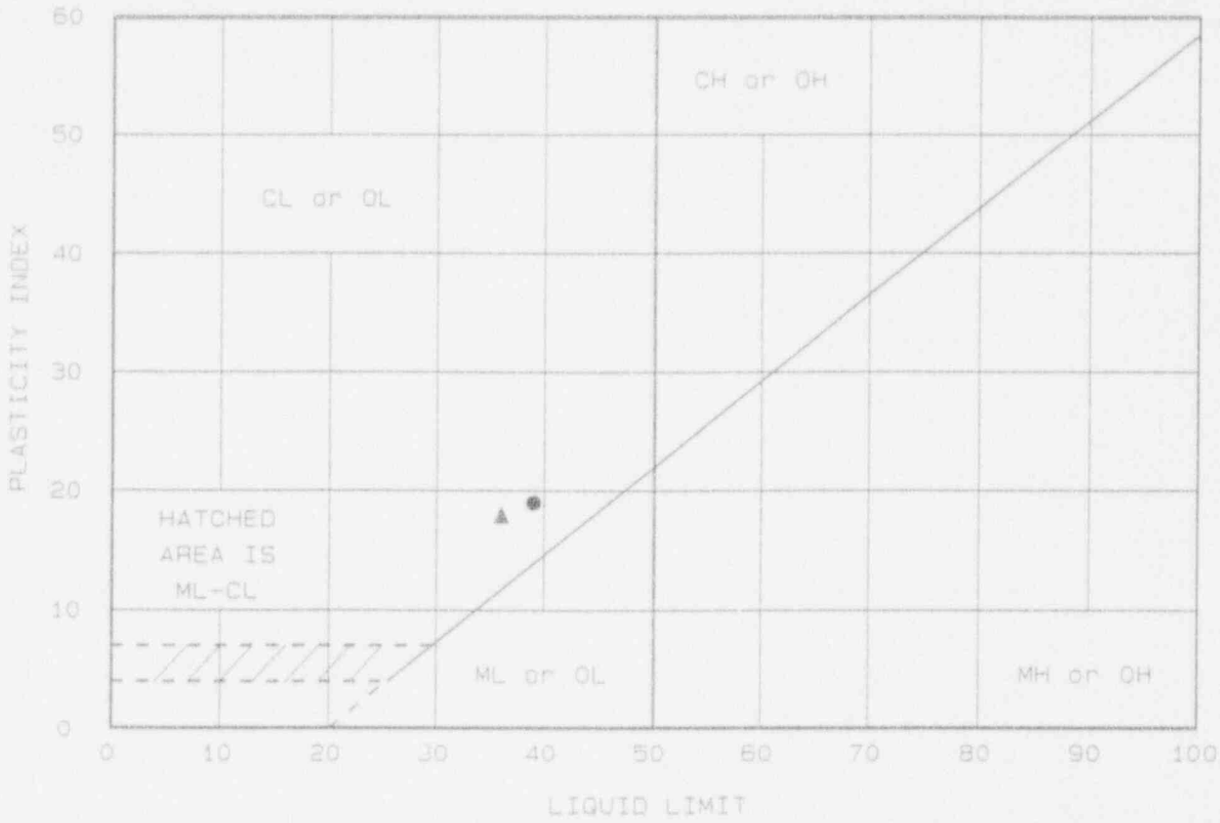
Tested By: DA

PROCTOR TEST REPORT

Bingham Engineering

Figure No. _____

LIQUID AND PLASTIC LIMITS TEST REPORT



	Location + Description	LL	PL	PI	-200	ASTM D 2487-85
●	White	39	20	19	97.9	CL, Lean clay
▲	Brown	36	18	18	97.1	CL, Lean clay

Project No.: 1534-005
Project: Liner Compatability

Client: Enviro Care of Utah
Location:

Date: 09-24-93

Remarks:

Tested By: LE

LIQUID AND PLASTIC LIMITS TEST REPORT

Bingham Engineering

Fig. No. _____

Envirocare of Utah/ Steve Peterson

Sediment and Rock Samples — Bulk XRD Sample No.	Mineralogy, Approx. Wt.% [X] (or) Relative Abundance [ ]															
	Quartz	Plagioclase	K-Feldspar	Dolomite	Calcite	Aragonite	Gypsum	Magnetite	Hematite	Clinopyroxene	Kaolin	Illite+Mica	Smectite	Amorphous/ Below Detect		
NAT sediment	12	2	3	4	8	53	Tr				2	1	15	-		
NRC rock	5	52	15		*3			8	1	15			1	*Tr	-	

*fine coating on rock?

From the XRD mineralogy and a binocular examination of the sample, the rock appears to be a pyroxene andesite, without clay alteration.

MM = Predominant M = Major m = Minor Tr = Trace ? = Tentative Identification

SUMMARY OF X-RAY DIFFRACTION ANALYSIS

UNIVERSITY OF UTAH RESEARCH INSTITUTE, EARTH SCIENCE LABORATORY

ATTACHMENT 2

CHEMICAL LABORATORY TESTING

SUMMARY OF WATER QUALITY DATA

LARW Compliance Monitor Wells

(in mg/l unless noted otherwise)

Well Identification: GW-19A

PARAMETERS	SAMPLING DATE		
	GWPL	3rd Quarter (8-4-93)	4th Quarter (11-3-93)
DISSOLVED METALS			
Arsenic	0.05	[0.021]JFD	[0.021]JS
Barium	1	0.015	0.027
Beryllium		ND	ND
Cadmium	0.01	0.015	0.046
Chromium	0.05	0.077	0.12
Copper	1	[0.025]JFD	[0.033]JFD
Lead	0.05	ND	ND
Mercury	0.002	0.0002	0.0005
Molybdenum		0.5	0.6
Nickel	0.15	[0.072]JFD	0.15
Selenium	0.01	ND	[ND]JS
Silver	0.05	ND	ND
Zinc	6.25	0.023	[0.029]JFD
ANIONS			
Bicarbonate		180	160
Carbonate		ND	ND
Chloride		23000	24000
Sulfate		5600	[4400]JFD
CATIONS			
Calcium		810	680
Magnesium		1200	910
Potassium		520	460
Sodium		16000	16000
OTHER CHEMISTRIES			
Cyanide		ND	ND
Fluoride	4.54	4.6	4.2
Nitrate		ND	ND
Nitrates (NO3-N + NO2-N)	10	ND	ND
Total Dissolved Solids	52013	50000	53000
Conductivity (umhos/cm)		66000	82000
pH	6.5-8.5	7.4	7.3
ORGANICS			
Total Organic Carbon (TOC)	13.15	ND	ND
Total Organic Halogens (TOX)	0.03	ND	ND
FIELD MEASUREMENTS			
pH		7.25	7.0
Conductivity (umhos/cm)		71800	76933
Temperature (Deg. C)		12.7	12.0

ND Not Detected

SUMMARY OF WATER QUALITY DATA

LARW Compliance Monitor Wells

(in pCi/l unless noted otherwise)

Well Identification: GW-19A

PARAMETERS	SAMPLING DATE		
	GWPL	3rd Quarter (8-4-93)	4th Quarter (11-3-93)
DISSOLVED RADIOLOGICS			
Gross Alpha	160	0+/-160	70+/-190
Gross Beta	692	260+/-170	270+/-190
Total Uranium (mg/l)	0.02	0.0008	0.0029
Beryllium-7		<24	<16
Cadmium-109		<47	<36
Carbon-14	2133.00	[3+/-12]J	[18+/-14]J
Cobalt-60		<2.8	<1.6
Iodine-129	7	0.0+/-1.4	0.0+/-2.0
Manganese-54		<2.4	<1.8
Neptunium-237	8	[0.1+/-0.3]J	0.0+/-0.7
Potassium-40	372	610+/-90	590+/-60
Radium-226	(Ra-226+Ra-228) 5	0.5+/-0.4	[0.4+/-0.4]J
Radium-228		[0.9+/-0.5]J	1.1+/-0.5
Strontium-90	8	0.0+/-0.8	1.2+/-1.6
Technetium-99	800	0.0+/-7.2	0.0+/-4.4
Thorium-230	5.33	0.0+/-0.8	[0.4+/-2.3]J
Thorium-232	5.33	0.0+/-1.5	0.0+/-2.4
Tritium		[10+/-290]J	0+/-309

FAXED ANALYTICAL REPORT

FROM: Barringer Laboratories, Inc.
JOB : 941409
DATE: 8-Mar-94
TIME: 16:41

TO :
BINGHAM ENGINEERING COMPANY
5160 Wiley Post Way
Salt Lake City, UT 84116

This is an electronically transferred fax of analytical results (preliminary or final, as designated on the report). The data contained in this report has been reviewed and approved by the laboratory managers and QA/QC personnel. The final report with all appropriate signatures and QA/QC will follow by mail. We do not assume any responsibilty for the fax transmission. It is the client's responsibility to notify us of any changes in address and/or phone number.

8-Mar-94
Page: R-1
Copy: 1 of 2
Status: Final

BINGHAM ENGINEERING COMPANY

Sample Id: pH 4W
Lab Id: 941409-1
Date Sampled: 24-Feb-94

Project: 1534-005
Matrix: Water

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Arsenic	Dissolved	206.2	0.32 mg/l	0.01	4-Mar-94
Barium	Dissolved	200.7	0.3 mg/l	0.2	3-Mar-94
Cadmium	Dissolved	200.7	U mg/l	0.1	3-Mar-94
Chromium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Copper	Dissolved	200.7	0.3 mg/l	0.2	3-Mar-94
Lead	Dissolved	239.2	U mg/l	0.05	4-Mar-94
Mercury	Dissolved	245.1	U mg/l	0.003	3-Mar-94
Selenium	Dissolved	270.2	0.03 mg/l	0.02	4-Mar-94
Silver	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Zinc	Dissolved	200.7	0.6 mg/l	0.1	3-Mar-94
Magnesium	Dissolved	200.7	426 mg/l	1	3-Mar-94
Potassium	Dissolved	200.7	263 mg/l	10	3-Mar-94
Sodium	Dissolved	200.7	11300 mg/l	1	3-Mar-94
Chloride		300.0	13300 mg/l	1	3-Mar-94
Sulfate		300.0	3830 mg/l	1	3-Mar-94
Fluorine		340.2	0.3 mg/l	0.1	3-Mar-94
pH		150.1	7.40 unit	0.01	25-Feb-94
Calcium	Dissolved	200.7	604 mg/l	1	3-Mar-94

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BINGHAM ENGINEERING COMPANY

Sample Id: pH 4B
Lab Id: 941409-2
Date Sampled: 24-Feb-94

Project: 1534-005
Matrix: Water

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Arsenic	Dissolved	206.2	0.47 mg/l	0.01	4-Mar-94
Barium	Dissolved	200.7	0.2 mg/l	0.2	3-Mar-94
Cadmium	Dissolved	200.7	U mg/l	0.1	3-Mar-94
Chromium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Copper	Dissolved	200.7	0.5 mg/l	0.2	3-Mar-94
Lead	Dissolved	239.2	U mg/l	0.05	4-Mar-94
Mercury	Dissolved	245.1	U mg/l	0.003	3-Mar-94
Selenium	Dissolved	270.2	U mg/l	0.02	4-Mar-94
Silver	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Zinc	Dissolved	200.7	3.5 mg/l	0.1	3-Mar-94
Magnesium	Dissolved	200.7	391 mg/l	1	3-Mar-94
Potassium	Dissolved	200.7	297 mg/l	10	3-Mar-94
Sodium	Dissolved	200.7	10000 mg/l	1	3-Mar-94
Chloride		300.0	10800 mg/l	1	3-Mar-94
Sulfate		300.0	1230 mg/l	1	3-Mar-94
Fluorine		340.2	0.5 mg/l	0.1	3-Mar-94
pH		150.1	7.62 unit	0.01	25-Feb-94
Calcium	Dissolved	200.7	553 mg/l	1	3-Mar-94

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BINGHAM ENGINEERING COMPANY

Sample Id: pH 7
Lab Id: 941409-3
Date Sampled: 24-Feb-94
Project: 1534-005
Matrix: Water

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Arsenic	Dissolved	206.2	0.02 mg/l	0.01	4-Mar-94
Barium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Cadmium	Dissolved	200.7	U mg/l	0.1	3-Mar-94
Chromium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Copper	Dissolved	200.7	0.9 mg/l	0.2	3-Mar-94
Lead	Dissolved	239.2	U mg/l	0.05	4-Mar-94
Mercury	Dissolved	245.1	U mg/l	0.003	3-Mar-94
Selenium	Dissolved	270.2	U mg/l	0.02	4-Mar-94
Silver	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Zinc	Dissolved	200.7	1.7 mg/l	0.1	3-Mar-94
Magnesium	Dissolved	200.7	434 mg/l	1	3-Mar-94
Potassium	Dissolved	200.7	285 mg/l	10	3-Mar-94
Sodium	Dissolved	200.7	11000 mg/l	1	3-Mar-94
Chloride		300.0	14400 mg/l	1	3-Mar-94
Sulfate		300.0	2740 mg/l	1	3-Mar-94
Fluorine		340.2	0.5 mg/l	0.1	3-Mar-94
pH		150.1	7.49 unit	0.01	25-Feb-94
Calcium	Dissolved	200.7	454 mg/l	1	3-Mar-94

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BINGHAM ENGINEERING COMPANY

Sample Id: pH 2
Lab Id: 941409-4
Date Sampled: 24-Feb-94

Project: 1534-005
Matrix: Water

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Arsenic	Dissolved	206.2	0.03 mg/l	0.01	4-Mar-94
Barium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Cadmium	Dissolved	200.7	U mg/l	0.1	3-Mar-94
Chromium	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Copper	Dissolved	200.7	0.9 mg/l	0.2	3-Mar-94
Lead	Dissolved	239.2	U mg/l	0.05	4-Mar-94
Mercury	Dissolved	245.1	U mg/l	0.003	3-Mar-94
Selenium	Dissolved	270.2	U mg/l	0.02	4-Mar-94
Silver	Dissolved	200.7	U mg/l	0.2	3-Mar-94
Zinc	Dissolved	200.7	1.5 mg/l	0.1	3-Mar-94
Magnesium	Dissolved	200.7	511 mg/l	1	3-Mar-94
Potassium	Dissolved	200.7	344 mg/l	10	3-Mar-94
Sodium	Dissolved	200.7	12500 mg/l	1	3-Mar-94
Chloride		300.0	16100 mg/l	1	3-Mar-94
Sulfate		300.0	2980 mg/l	1	3-Mar-94
Fluorine		340.2	0.5 mg/l	0.1	3-Mar-94
pH		150.1	7.57 unit	0.01	25-Feb-94
Calcium	Dissolved	200.7	526 mg/l	1	3-Mar-94

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BINGHAM ENGINEERING COMPANY

Sample Id: pH 4W
Lab Id: 941409-1
Date Sampled: 24-Feb-94
Project: 1534-005
Matrix: Water

Analyte	Fraction	Conc. ± 2σ		LLD	Date Analyzed
Ra-226	Total	0.0±1.0	pCi/l	0.3	03/01-03/04
Th-228	Total	0.0±3.2	pCi/l	0.4	03/03-03/04
Th-230	Total	0.6±3.1	pCi/l	0.4	03/03-03/04
U	Total	0.0040	mg/l	0.0003	03/01-03/03
Th-232	Total	0.0±2.5	pCi/l	0.4	03/03-03/04

Sample Id: pH 4B
Lab Id: 941409-2
Date Sampled: 24-Feb-94
Project: 1534-005
Matrix: Water

Analyte	Fraction	Conc. ± 2σ		LLD	Date Analyzed
Ra-226	Total	3.0±2.2	pCi/l	0.3	03/01-03/04
Th-228	Total	0.0±1.9	pCi/l	0.4	03/03-03/04
Th-230	Total	0.5±2.3	pCi/l	0.4	03/03-03/04
U	Total	0.0117	mg/l	0.0003	03/01-03/03
Th-232	Total	0.0±2.5	pCi/l	0.4	03/03-03/04

Sample Id: pH 7
Lab Id: 941409-3
Date Sampled: 24-Feb-94
Project: 1534-005
Matrix: Water

Analyte	Fraction	Conc. ± 2σ		LLD	Date Analyzed
Ra-226	Total	0.0±1.1	pCi/l	0.3	03/01-03/04
Th-228	Total	0.0±2.2	pCi/l	0.4	03/03-03/04
Th-230	Total	0.4±2.3	pCi/l	0.4	03/03-03/04
U	Total	0.0145	mg/l	0.0003	03/01-03/03
Th-232	Total	0.0±1.9	pCi/l	0.4	03/03-03/04

Sample Id: pH 2
Lab Id: 941409-4
Date Sampled: 24-Feb-94
Project: 1534-005
Matrix: Water

Analyte	Fraction	Conc. ± 2σ		LLD	Date Analyzed
Ra-226	Total	0.6±1.5	pCi/l	0.3	03/01-03/04
Th-228	Total	0.0±2.5	pCi/l	0.4	03/03-03/04
Th-230	Total	0.6±3.1	pCi/l	0.4	03/03-03/04
U	Total	0.0094	mg/l	0.0003	03/01-03/03
Th-232	Total	0.1±3.6	pCi/l	0.4	03/03-03/04

8-Mar-94

BINGHAM ENGINEERING COMPANY
5160 Wiley Post Way
Salt Lake City, UT 84116

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Attn: Dave Cline
Project: 1534-005 PO #:

Received: 25-Feb-94 09:40

Job: 941409E

Status: Final

Abbreviations:

Parameters:

Ra-226	: Radium-226
Th-228	: Thorium-228
Th-230	: Thorium-230
U	: Uranium
Th-232	: Thorium-232

Units:

mg/l	: milligrams per liter
pCi/l	: picoCuries per liter
pCi/g	: picoCuries per gram

Quality codes:

(4)	: Sample < 5 times LLD
U	: Undetected

cc: Vernon Andrews, ENVIROCARE OF UTAH