# Appendix C

# Barrier Material Test Reports

# Appendix C

# Barrier Material Test Reports

This appendix contains the engineered barrier material test reports for pea gravel and cobble rock used in construction of the SL-1 biotic barrier. Test reports for the consolidated soils and rip-rap were not required. Rip-rap of the proper sizes specified in construction specification 02200 was selected during the loading operation. Visual inspections are recorded in the daily follow-up inspection forms which are kept in the project files.

The configuration of the biotic barrier used in the SL-1 design is based on studies conducted by the Environmental Science and Research Foundation concerning the effects of biotic barriers against insects and small mammals. The results of these studies suggest that an effective biotic barrier is a gravel/cobble sandwich of the following dimensions from top to bottom:

- 15 cm (6 in.) of gravel—size gradation—0.6 to 1.3 cm (¼ to ½ in.)
- 25 cm (10 in.) of cobble—size gradation—5 to 15 cm (2 to 6 in.)
- 15 cm (6 in.) of gravel—size gradation—0.6 to 1.3 cm (¼ to ½ in.)

The biotic barrier material test reports are included to show that the materials used in the barrier layers meet the gradation requirements.

***Gravel Layers***—The gradation for the gravel layers as specified in construction specification 02200 shall be a mixture of clean coarse sands to fine gravel in accordance with the following gradation, as determined by ASTM D422:

| Nominal Square Opening Sieve Size | Percent Passing |
|---|---|
| 2 cm (¾ in.) | 95-100 |
| 1.3 cm (½ in.) | 30-95 |
| No. 4 | 0-25 |

All pea gravel was obtained from the Lincoln Pit located near the Naval Reactors Facility. Samples were obtained from the side of the pile at the Lincoln Pit. All samples taken passed the specification requirements.

***Cobble Layer***—One of the design assumptions as listed in the RD/RA Work Plan was the barrier will be constructed using locally available, naturally occurring materials found at the INEEL site, to the extent possible. The cobble rock available in the Idaho Falls area (within 105 km [65 mi] of the SL-1 site) did not meet the gradation requirements as originally called out in the construction specifications. After conferring with the Environmental Science & Research Foundation it was concluded that cobble in the 5 to 15 cm (2 to 6 in.) diameter size range which was available locally was acceptable. This gradation was changed by CID-SL-1/BORAX-I-015 to the following as determined by ASTM C136:

| Nominal Square Opening Sieve Size | Percent Passing |
|---|---|
| 25 cm (10 in.) | 100 |
| 20 cm (8 in.) | 100 |
| 15 cm (6 in.) | 15-95 |
| 10 cm (4 in.) | 0-70 |
| 5 cm (2 in.) | 0-70 |

The cobble was obtained from the Valley Ready Mix Company cobble pile near Idaho Falls. Samples were taken from the top of the pile. Two samples, #1 SE and #2 NE did not meet the 15-cm (6-in.) size gradation requirement, but was deemed acceptable since the average as listed below was within the requirements:

| Sieve No. | Average Percent Passing | Average Percent Retained |
|---|---|---|
| 25 cm (10 in.) | 100.0 | 0.0 |
| 20 cm (8 in.) | 100.0 | 0.0 |
| 15 cm (6 in.) | 92.5 | 7.5 |
| 10 cm (4 in.) | 71.1 | 28.9 |
| 5 cm (2 in.) | 3.6 | 96.4 |

Sample No.: Source / Gravel / #1



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P.O. Box 50691
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(208) 524-0212

GRAIN SIZE ANALYSIS-MECHANICAL

Project I. T. Corporation CFA Job No. 96623.1a

Location of Project: INEL Boring No. -- Sample No. #1

Description of Soil Gravel Class N/A Depth of Sample Stockpile 0" - 6"

Tested By R. Loftus Date of Testing 07-22-96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 2976.7

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | ΣWt. retained | % Retained | % Passing | Spec. |
|---|---|---|---|---|---|
| 3/4" | 19.00 | 0 | 0 | 100 | 95-100 |
| 1/2" | 12.50 | 660.4 | 22.2 | 78 | 30-95 |
| 3/8" | 9.50 | 1951.7 | 65.6 | 34 | -- |
| #4 | 4.750 | 2920.5 | 98.1 | 2 | 0-25 |
| #8 | 2.360 | 2952.4 | 99.2 | 0.8 | -- |
| #200 | 0.0750 | 2966.7 | 99.6 | 0.4 | -- |
| | | | | | |
| | | | | | |
| | | | | | |

% passing = 100 - Σ % retained.

X A WORK MAY PROCEED SUBJECT TO INCORPORATION OF COMMENTS

☐ B REVISE AND RESUBMIT
WORK MAY PROCEED SUBJECT TO INCORPORATION OF CHANGES INDICATED

☐ C REVISE AND RESUBMIT
WORK MAY NOT PROCEED RD

☐ D REVIEW NOT REQUIRED
WORK MAY PROCEED 082

CONTRACT NO. S-76000-
BY: Annette Poole
DATE: 9-12-96

PROFESSIONAL ENGINEER-LAND SURVEYOR REGISTERED
7/24/96
STATE OF IDAHO
JOHN J. HARPER

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Idaho Falls, Idaho 83405
(208) 524-0212


GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corporation Job No. 96623

Location of Project: SL-1 Boring No. ___ Sample No. QC/SL-1/Gravel/#1

Description of Soil Gravel Class _____ Depth of Sample _____

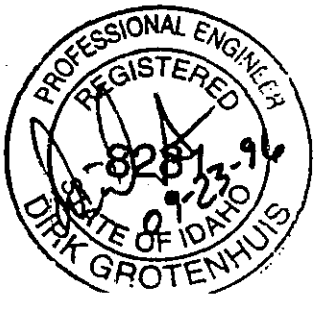
Tested By J. Gray Date of Testing 09/19/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 2826.9

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 3/4" | 19 | 0 | 0 | 100 |
| 1/2" | 12.5 | 268.5 | 9.5 | 90.5 |
| 3/8" | 9.5 | 1299.0 | 46.0 | 54.0 |
| #4 | 4.75 | 2719.9 | 96.2 | 3.8 |
| #8 | 2.36 | 2789.3 | 98.7 | 1.3 |
| #16 | 1.18 | 2796.5 | 98.9 | 1.1 |
| #30 | 0.60 | 2799.4 | 99.0 | 1.0 |
| #50 | 0.30 | 2802.7 | 99.1 | 0.9 |
| #100 | 0.15 | 2807.0 | 99.3 | 0.7 |
| #200 | 0.075 | 2810.1 | 99.4 | 0.6 |

% passing = 100 - Σ % retained



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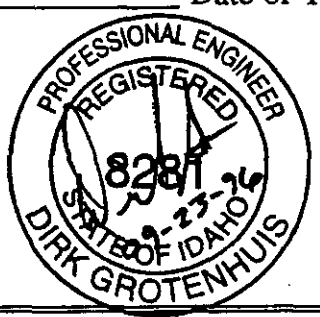
GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corporation Job No. 96623

Location of Project: SL-1 Boring No. ___ Sample No. QC/SL-1/Gravel/#2

Description of Soil Gravel Class _____ Depth of Sample _____

Tested By J. Gray Date of Testing 09/19/96

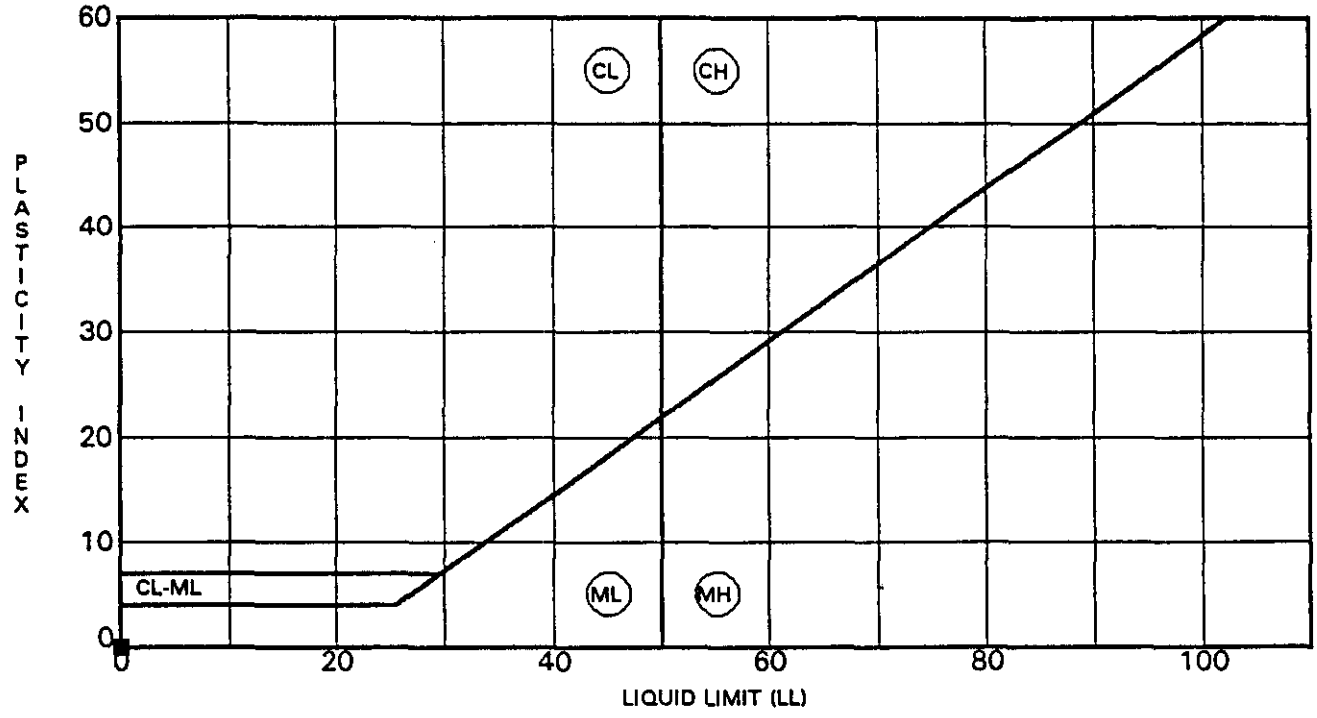



Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 2202.4

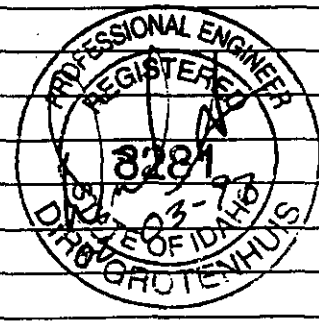
*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 3/4" | 19.0 | 0 | 0 | 100 |
| 1/2" | 12.5 | 156.3 | 7.1 | 92.9 |
| 3/8" | 9.5 | 792.5 | 36.0 | 64.0 |
| #4 | 4.75 | 2016.3 | 91.6 | 8.4 |
| #8 | 2.36 | 2154.3 | 97.8 | 2.2 |
| #16 | 1.18 | 2170.2 | 98.5 | 1.5 |
| #30 | 0.60 | 2175.4 | 98.8 | 1.2 |
| #50 | 0.30 | 2180.0 | 99.0 | 1.0 |
| #100 | 0.15 | 2186.8 | 99.3 | 0.7 |
| #200 | 0.075 | 2189.7 | 99.4 | 0.6 |

% passing = 100 - Σ % retained




| Specimen Identification | LL | PL | PI | Fines | Classification |
|---|---|---|---|---|---|
| ● GRAVEL#1 0.0 | NP | NP | NP | 0.6 | POORLY GRADED GRAVEL GP |
| ▣ GRAVEL#2 0.0 | NP | NP | NP | 0.6 | POORLY GRADED GRAVEL GP |
| | | | | | QC/SL-1/Gravel/#1 |
| | | | | | QC/SL-1/Gravel/#2 |

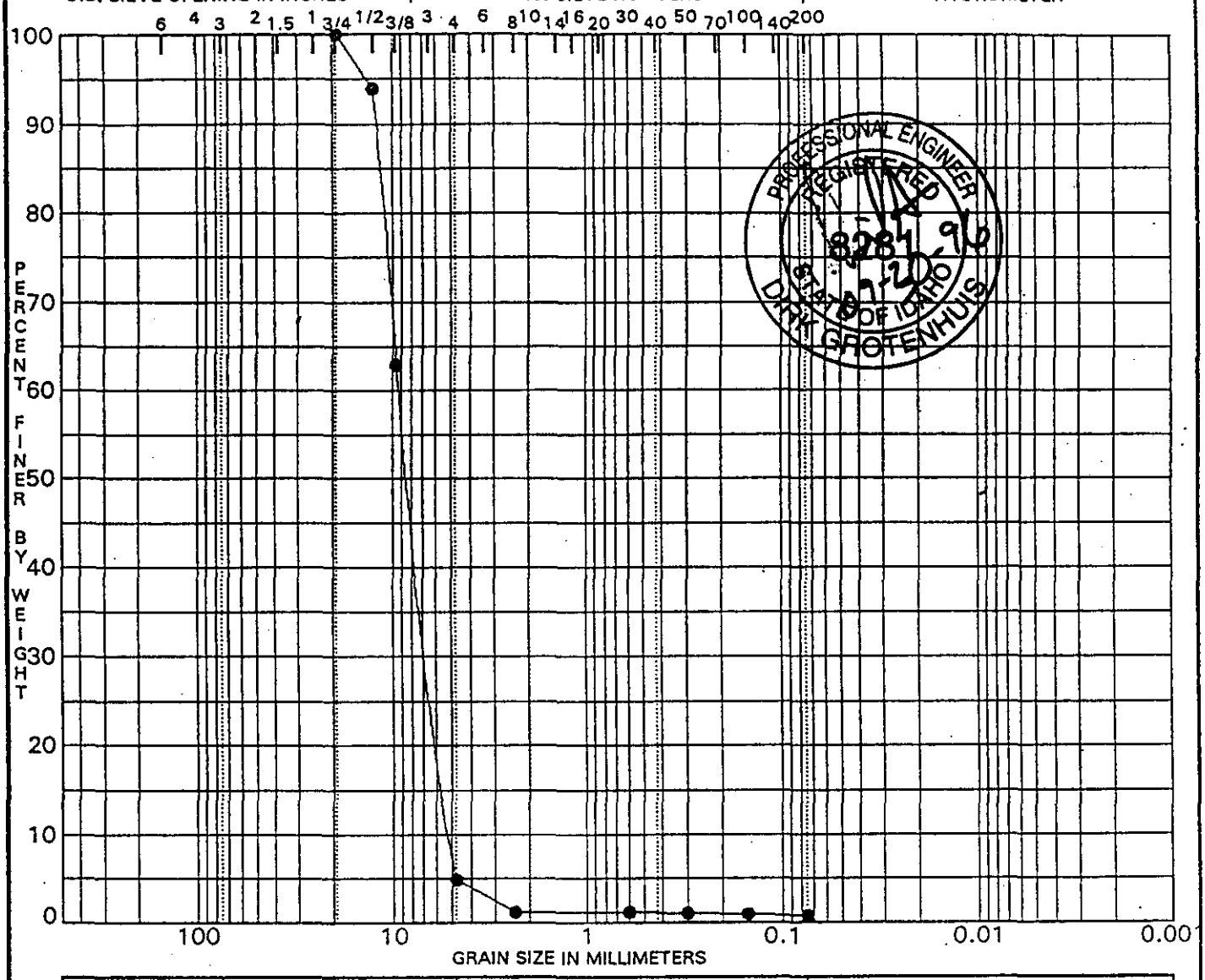



PROJECT IT CORP. - SL-1 - INEL

JOB NO. 96624
DATE 1/31/97

## ATTERBERG LIMITS' RESULTS

*Harper-Leavitt Engineering Inc.*
Idaho Falls, Idaho




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | *coarse* | *fine* | *coarse* | *medium* | *fine* | |

| Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● GRAVEL 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 0.89 | 1.8 |
| "QC/SL-1/6" Gravel/A" | | | | | | | |

| Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|
| ● GRAVEL 0.0 | 19.00 | 9.18 | 6.412 | 5.0490 | 95.1 | 4.1 | 0.8 | |

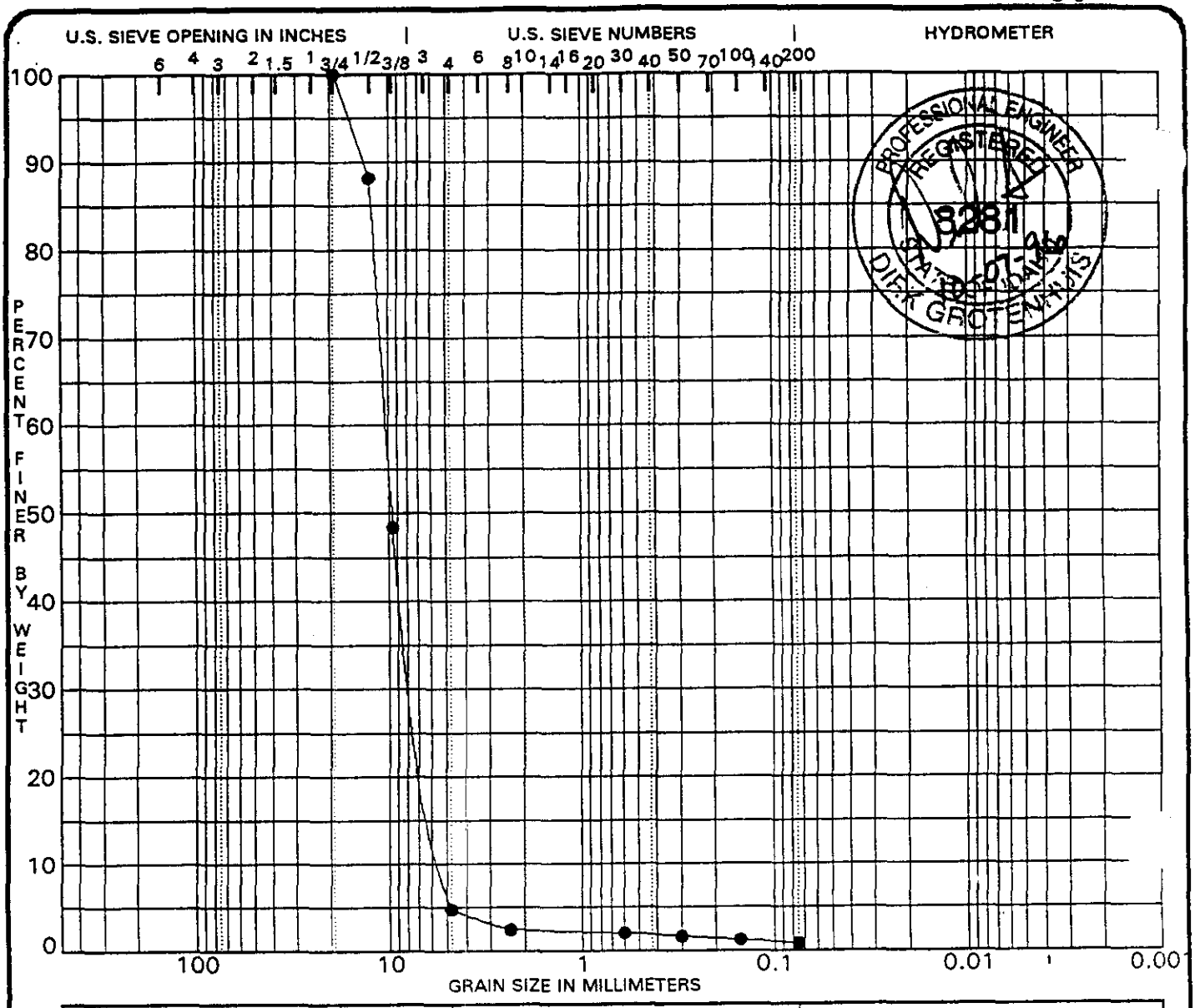
PROJECT IT CORP. - SL-1 - INEL
ASTM C136/2487

JOB NO. 96623
DATE 9/30/96

# GRADATION CURVES

Harper-Leavitt Engineering Inc.
Idaho Falls, Idaho

Figure No. 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● GRAVELB 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 0.95 | 2.0 |
| QC/SL-1/6" Gravel/B | | | | | | | |

| Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|
| ● GRAVELB 0.0 | 19.00 | 10.29 | 7.091 | 5.1590 | 95.2 | 3.9 | 0.9 | |

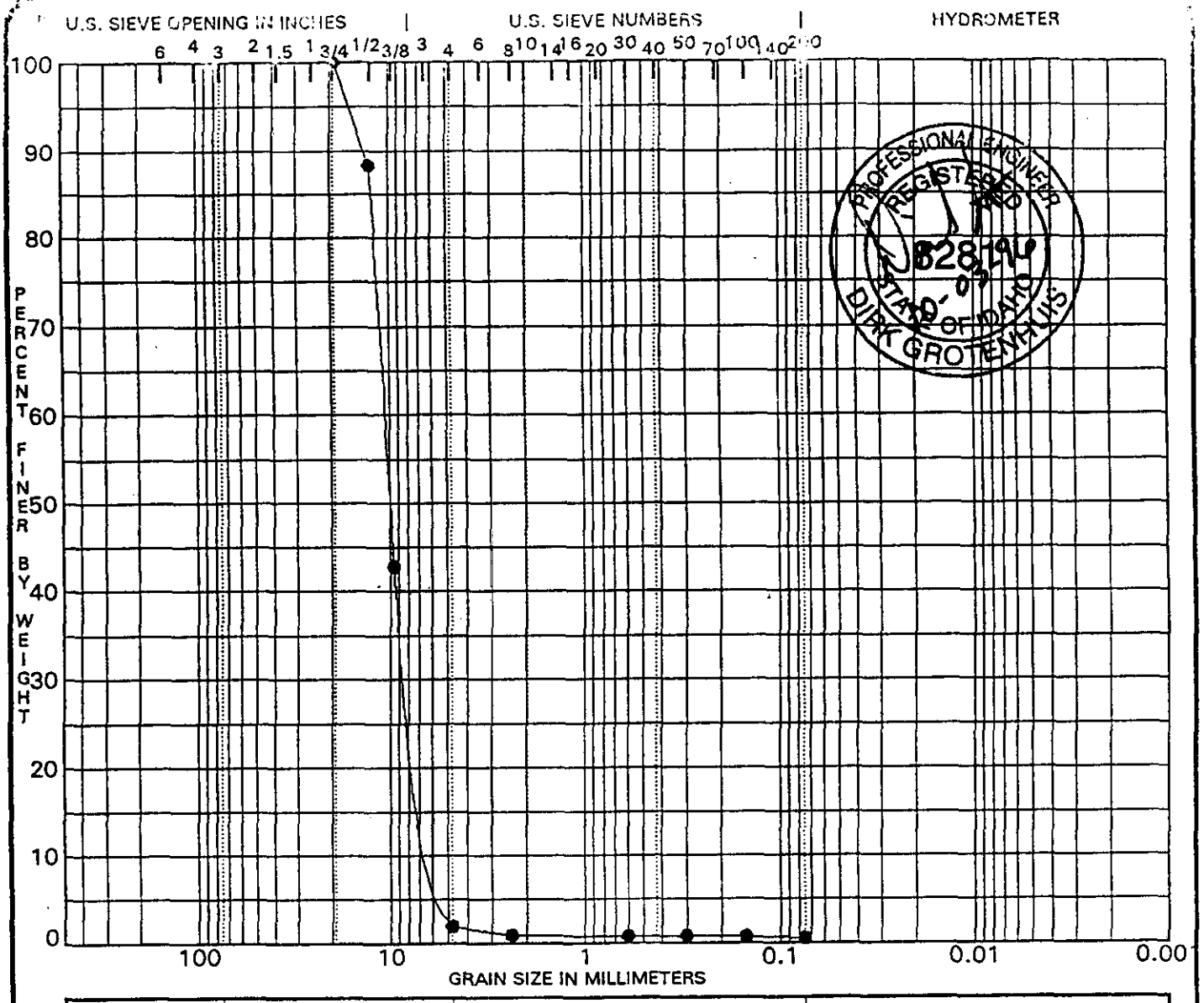
PROJECT IT CORP. - CFA LANDFILL #2 - INEL
ASTM C136/2487

JOB NO. 96623
DATE 10/4/96

# GRADATION CURVES

Harper-Leavitt Engineering Inc.
Idaho Falls, Idaho

Figure No. 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● | GRAVELC 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 1.02 | 1.9 |
| | (QC/SL-1/6"Gravel/C) | | | | | | | |

| | Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|
| ● | GRAVELC 0.0 | 19.00 | 10.54 | 7.643 | 5.4420 | 98.0 | 1.4 | 0.6 | |

PROJECT IT CORP. - SL-1 - INEL
ASTM C136/2487

JOB NO. 96623
DATE 10/1/96

## GRADATION CURVES

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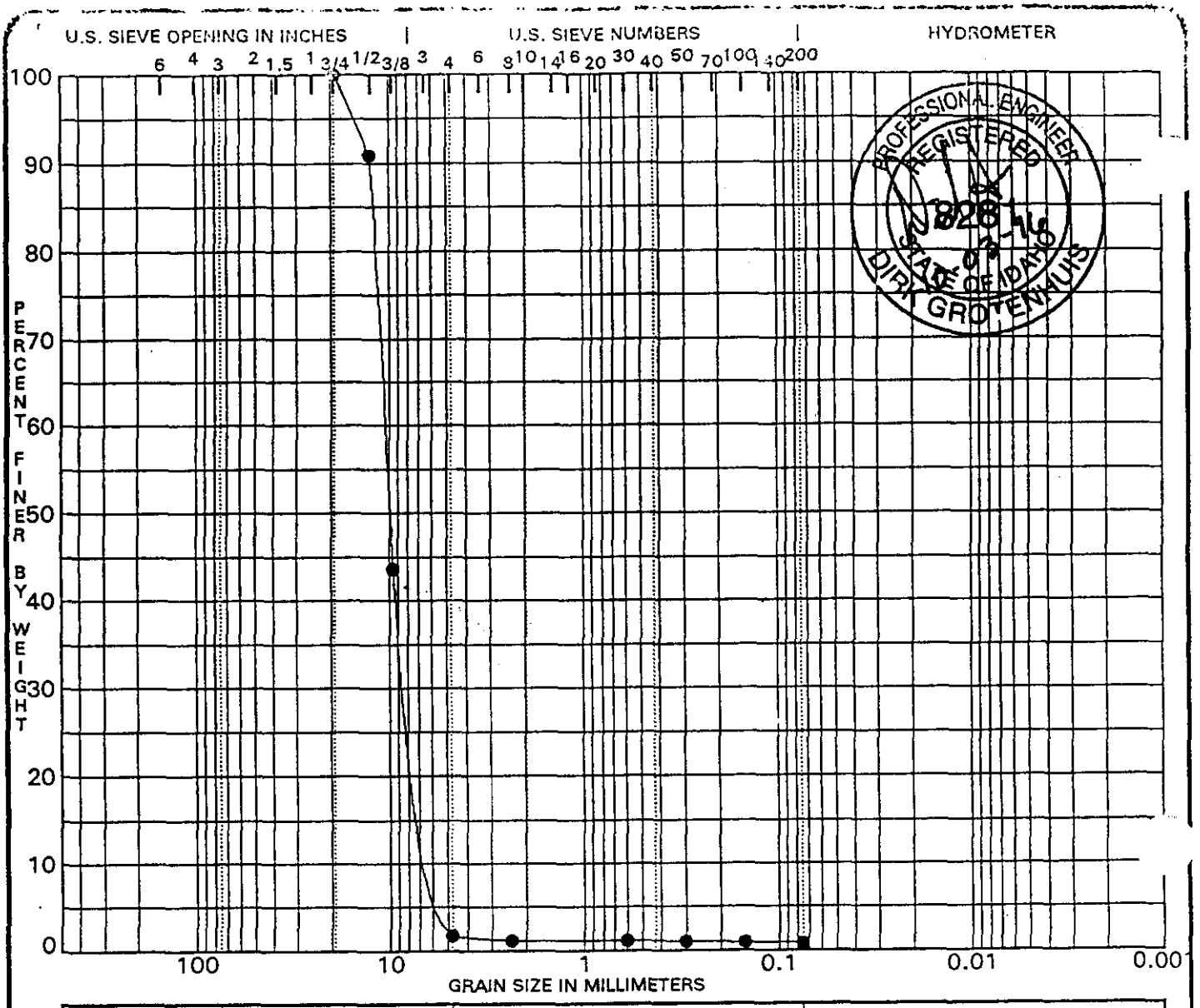
Idaho Falls, Idaho

Figure No. 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● GRAVELD 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 1.01 | 1.9 |
| (QC/SL-1/6"Gravel | /D) | | | | | | |

| Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|
| ● GRAVELD 0.0 | 19.00 | 10.45 | 7.582 | 5.4420 | 98.2 | 0.9 | 0.9 | |

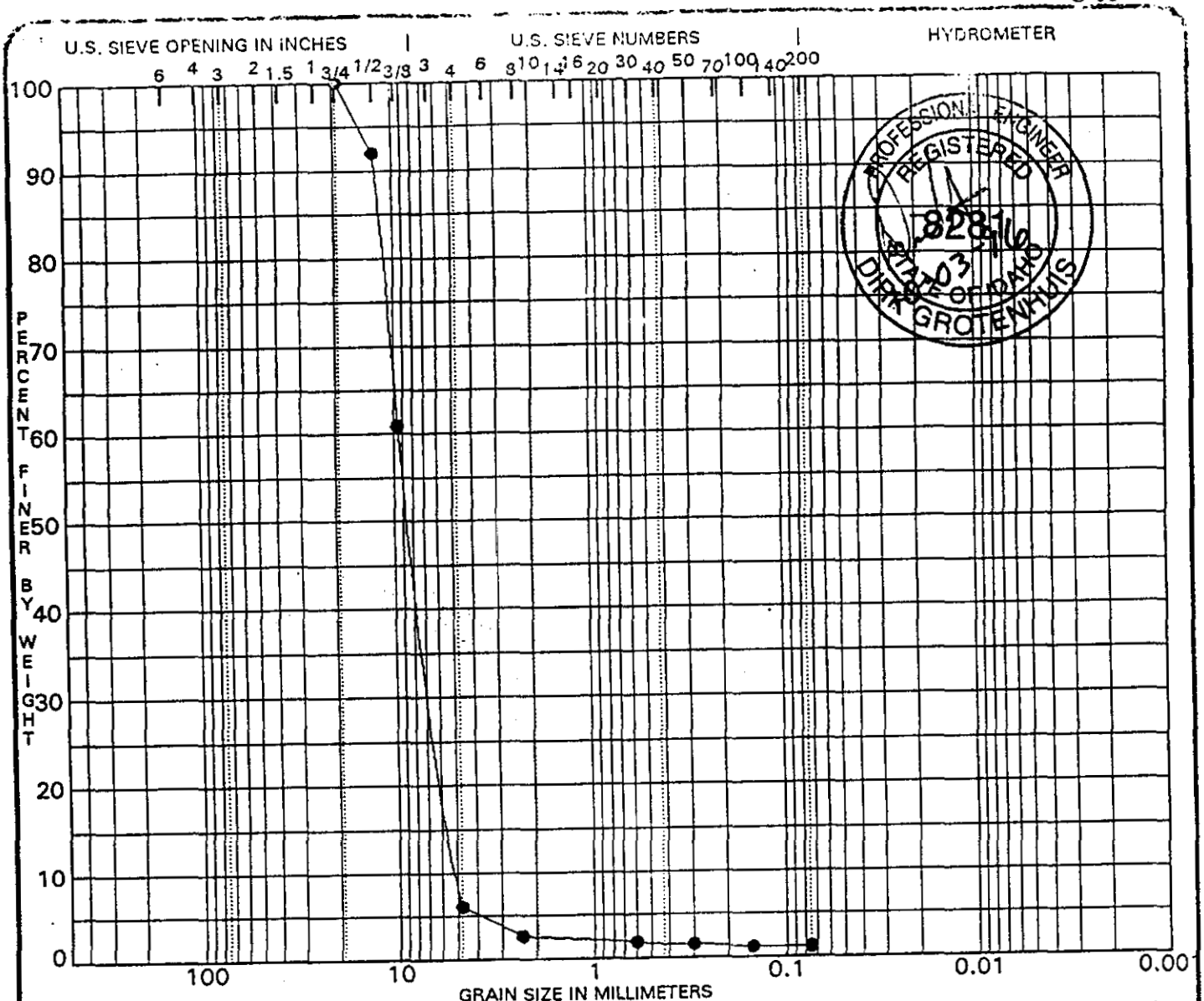
PROJECT IT CORP. - SL-1 - INEL
ASTM C136/2487

JOB NO. 96623
DATE 10/1/96

## GRADATION CURVES

Harper-Leavitt Engineering Inc.
Idaho Falls, Idaho

Figure No. 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|
| ● GRAVELE 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 0.88 | 1.9 |
| (QC/SL-1/6"gravel/E | | | | | | | |

| Specimen Identification | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|
| ● GRAVELE 0.0 | 19.00 | 9.39 | 6.427 | 4.9900 | 93.9 | 4.9 | 1.2 | |

PROJECT IT CORP. - SL-1 - INEL
JOB NO. 96623
DATE 10/1/96

ASTM C136/2487

## GRADATION CURVES

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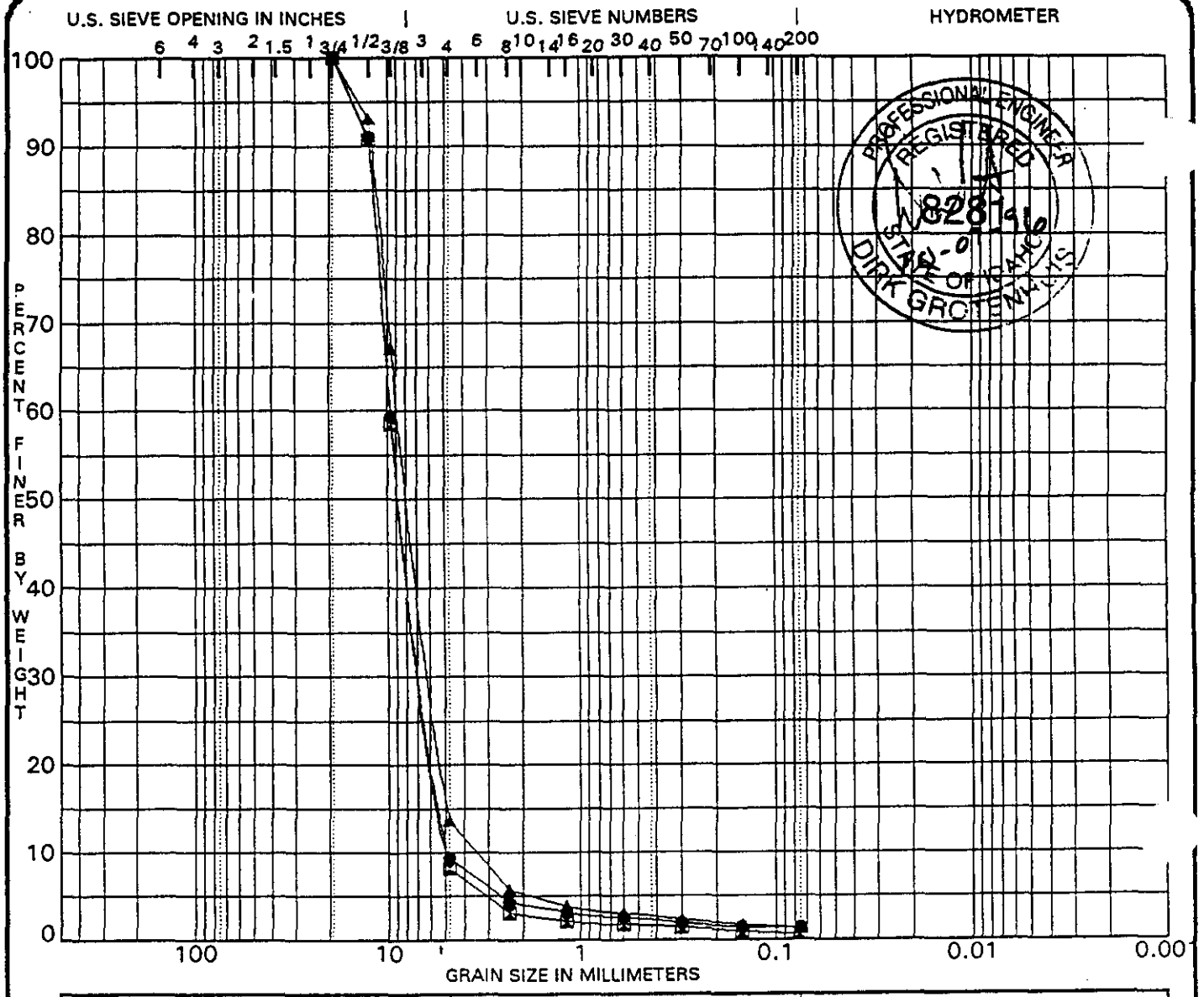
Figure No. 1




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Specimen Identification | | | Classification | MC% | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|
| ● | GRAVELF | 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 0.87 | 2.0 |
| ⊠ | GRAVELG | 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 0.88 | 2.0 |
| ▲ | GRAVELH | 0.0 | POORLY GRADED GRAVEL GP | | NP | NP | NP | 1.16 | 2.5 |

| Specimen Identification | | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | GRAVELF | 0.0 | 19.00 | 9.56 | 6.324 | 4.7900 | 90.6 | 8.0 | 1.4 | |
| ⊠ | GRAVELG | 0.0 | 19.00 | 9.62 | 6.414 | 4.8690 | 91.8 | 7.5 | 0.7 | |
| ▲ | GRAVELH | 0.0 | 19.00 | 8.67 | 5.875 | 3.4390 | 86.4 | 12.2 | 1.4 | |

PROJECT IT CORP. - SL-1 - INEL

JOB NO. 96623
DATE 10/7/96

## GRADATION CURVES

Harper-Leavitt Engineering Inc.
Idaho Falls, Idaho

Figure No. 1

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Idaho Falls, Idaho 83405
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GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corporation Job No. 96623

Location of Project: INEL Boring No. ___ Sample No. OCCOB #1

Description of Soil Cobbles Class _____ Depth of Sample N/A

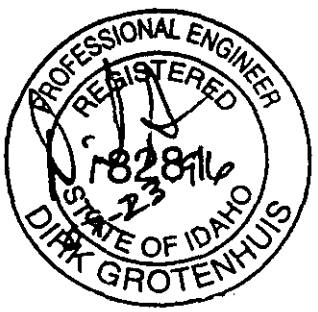
Tested By R. Loftus Date of Testing 09/19/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1794.1 lbs

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 95.5 | 5.3 | 94.7 |
| 4" | 100 | 562.0 | 31.3 | 68.7 |
| 2" | 50 | 1761.5 | 98.2 | 1.8 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained



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GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corporation Job No. 96623

Location of Project: INEL Boring No. ___ Sample No. QC/COB #2

Description of Soil Cobbles Class _____ Depth of Sample N/A

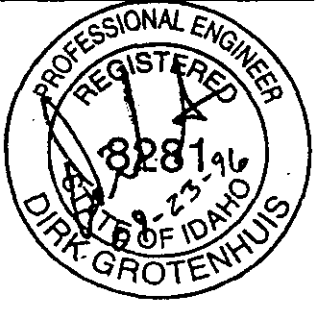
Tested By R. Loftus Date of Testing 09/19/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1026.2 lbs

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 76.0# | 7.4 | 92.6 |
| 4" | 100 | 345.3# | 33.7 | 66.3 |
| 2" | 50 | 1007.1# | 98.1 | 1.9 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained



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GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corp. Job No. 96623

Location of Project: INEL Boring No. N/A Sample No. QC/COB#3

Description of Soil Cobble Class N/A Depth of Sample N/A

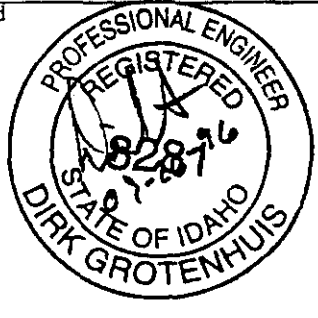
Tested By J. Gray Date of Testing 9/23/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1239.5 lbs

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 10" | 250 | 0 | 0 | 100 |
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 179.2 | 14.5 | 85.5 |
| 4" | 100 | 375.8 | 30.3 | 69.7 |
| 2" | 50 | 1178.1 | 95.1 | 4.9 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained



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Idaho Falls, Idaho 83405
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GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corp. Job No. 96623

Location of Project: INEL Boring No. N/A Sample No. QC/COB#4

Description of Soil Cobble Class N/A Depth of Sample N/A

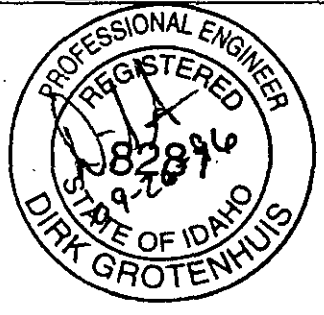
Tested By J. Gray Date of Testing 9/23/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1247.5 lbs

*Sieve analysis and grain shape*

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 10" | 250 | 0 | 0 | 100 |
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 171.5 | 13.7 | 86.3 |
| 4" | 100 | 389.4 | 31.2 | 68.8 |
| 2" | 50 | 1204.5 | 96.6 | 3.4 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained



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(208) 524-0212


*GRAIN SIZE ANALYSIS-MECHANICAL*

Project I.T. Corp. Job No. 96623

Location of Project: INEL Boring No. N/A Sample No. QC/COB#5

Description of Soil Cobble Class N/A Depth of Sample N/A

Tested By J. Gray Date of Testing 9/24/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1185.5 lbs

*Sieve analysis and grain shape* ASTM D422 C136

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 10" | 250 | 0 | 0 | 100 |
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 119.0 | 10.0 | 90.0 |
| 4" | 100 | 538.7 | 45.4 | 54.6 |
| 2" | 50 | 1129.1 | 95.2 | 4.8 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained

PROFESSIONAL ENGINEER REGISTERED STATE OF IDAHO DIRK GROTENHUIS 10281 9-26-96

# HARPER-LEAVITT ENGINEERING, INC.

PROFESSIONAL ENGINEERING, MATERIALS TESTING & LAND SURVEYING
985 N. Capital Ave.
P.O. Box 50691
Idaho Falls, Idaho 83405
(208) 524-0212


GRAIN SIZE ANALYSIS-MECHANICAL

Project I.T. Corp. Job No. 96623

Location of Project: INEL Boring No. N/A Sample No. QC/COB#6

Description of Soil Cobble Class N/A Depth of Sample N/A

Tested By J. Gray Date of Testing 9/24/96

Wt.of dry sample+cont.
Wt. of container
Wt.of dry sample 1284.7 lbs

*Sieve analysis and grain shape* ~~ASTM D422~~ C136

| Sieve No. | Diam.(mm) | Σ Wt. Retained | % Retained | % Passing |
|---|---|---|---|---|
| 10" | 250 | 0 | 0 | 100 |
| 8" | 200 | 0 | 0 | 100 |
| 6" | 150 | 115.6 | 9.0 | 91.0 |
| 4" | 100 | 430.4 | 33.5 | 66.5 |
| 2" | 50 | 1238.3 | 96.4 | 3.6 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

% passing = 100 - Σ % retained