Consolidation Test Results, Triaxial Permeability Values, and Particle Size Distributions

98th Street Ground Water Monitoring Well

Albuquerque, New Mexico

Open File Report #436

Report Prepared at the
New Mexico Bureau of Mines and Mineral Resources

by

William Haneberg
Barry Allred
Priscilla Swearingen
Amy Gibson

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Monitoring Well Location

The monitoring well is located off 98th Street, north of Interstate 40, about 6.5 km west of downtown Albuquerque. This well was installed by the City of Albuquerque, in collaboration with the United States Geological Survey and the New Mexico Bureau of Mines and Mineral Resources. The first borehole at this location was drilled solely for the purpose of obtaining continuous sample core to a depth of 457m (1500 feet). A second larger diameter borehole was drilled 6m offset from the first. Only select intervals were cored in this borehole, which was used for placement of monitoring well piezometers. Mud rotary drilling procedures were used for both holes, and the second, like the first, had a depth of 457m.

Unit Abbreviations

Length:

mm - millimeters
cm - centimeters
m - meters
km - kilometers

Weight:

g - weight in grams
kg_f - weight in kilograms

Time:

s - seconds

Pressure:

kPa - kilopascals

- Section B -
Consolidation Test Results

Consolidation Testing of Undisturbed Samples

Consolidation testing of undisturbed samples from the 98th Street monitoring well location was accomplished using a SOILTEST C-252 fixed-ring consolidometer and a Soil Test C-280 consolidation loading device. Samples were selected by visually examining the core, and removing sections that appeared to be representative fine grained material. The samples were moist, and all were quickly wrapped in plastic film to reduce dehydration. Because the core diameter was slightly less than the standard consolidation test sample diameter of 6.3 cm (2.5 inches), the consolidation apparatus was modified to accept diameters of 5.1 cm (2.0 inch). A trimming ring was used to reduce sample diameter to the 5.1 cm value required. All samples were saturated with distilled water prior to laboratory testing. Applied consolidation pressures for the first five tests were 48, 145, 339, 726, and 1500 kPa. For the final four tests, the they were 27, 75, 172, 365, 753, 1140, and 1914 kPa. Due to the limited range of the consolidation apparatus available, applied loads were substantially less than the in situ vertical stress for each sample. Consolidation parameters determined through testing may therefore differ from actual in situ values. Tests were conducted using standard procedures as described by Das (1983) and Wray (1986).

Consolidation testing is used to determine several important soil/sediment parameters. The coefficient of consolidation, **Cv**, is one of these. The coefficient of consolidation governs the rate of consolidation under a change in applied pressure. Wray (1986) describes two graphical procedures for determining **Cv**. The equation for the log-of-time method is expressed:

$$C_V = \frac{0.197 H_D^2}{t_{50}} \quad ,$$

while the expression for the square-root-of-time method is given as:

$$C_V = \frac{0.848 H_D^2}{t_{90}} \quad .$$

$\mathbf{H_D}$ is one-half the initial specimen thickness prior to change in applied pressure. The values of $\mathbf{t_{50}}$ and $\mathbf{t_{90}}$ reflect the time for 50 % and 90 % of total specimen thickness reduction to occur. **Cv** values were obtained for each of the applied consolidation pressures.

The parameter controlling the total amount of consolidation resulting from an applied load is expressed:

$$C_{CN}, C_{RCN} = \frac{-\Delta e}{\log_{10}\left(\frac{p_2}{p_1}\right)} \quad ,$$

where $\mathbf{C_{CN}}$ is the compression index, $\mathbf{C_{RCN}}$ is the recompression index, and Δe is the change in void ratio The values, $\mathbf{p_1}$ **and** $\mathbf{p_2}$, are the initial and final consolidation pressures for a given change in load. Due to the limited consolidation pressures that could be achieved using the apparatus available, it was not possible to ascertain whether calculated index values represent compression or recompression.

Saturated hydraulic conductivity was another important parameter determined through consolidation testing. The flow rate of water through soil or aquifer material depends on the magnitude of the hydraulic conductivity value. The saturated hydraulic conductivity for each load increment was calculated using (Terzaghi, 1943; Das, 1983):

$$K = \frac{C_1 \alpha_1 \gamma_w}{1+e} \quad ,$$

where γ_w is the specific weight of water, **e** is the initial load increment void ratio, and α_v is the negative local value of the change in void ratio divided by the change in applied pressure, $-\frac{\Delta e}{\Delta p}$. The samples that were tested came from a vertical borehole in flat lying sediments. Therefore, the value given by the above equation represents the vertical component of the hydraulic conductivity tensor.

References:

Das, B. M. 1983. Advanced Soil Mechanics. Hemisphere Publishing Corporation. Washington, DC. 511 pages.

Terzaghi, K. 1943. Theoretical Soil Mechanics. John Wiley and Sons. New York, NY. 510 pages.

Wray, W. K. 1986. Measuring Engineering Properties of Soil. Prentice-Hall, Inc. Englewood Cliffs, NJ. 276 pages.

Tabulated Results of Consolidation Testing of Undisturbed Samples from the 98th Street Monitoring Well Location

Drive 20 *Depth = 38.3m* *Lithology - 'Silt'*
Specific Gravity of Grains = 2.75 *Dry Bulk Density = 1.34 g/cm^3*
Unconfined Compressive Strength = 306 kPa *Shear Strength = 49 kPa*
Initial Void Ratio = 1.052 *Average (Re?)Compression Index = 0.151*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
27	0.985	1.25×10^{-3}	2.15×10^{-9}
75	0.954	3.34×10^{-4}	4.91×10^{-11}
172	0.912	1.78×10^{-4}	3.37×10^{-11}
365	0.863	1.38×10^{-4}	2.69×10^{-11}
753	0.801	9.26×10^{-5}	1.18×10^{-11}
1140	0.761	4.29×10^{-5}	3.57×10^{-12}
1914	0.706	3.92×10^{-5}	2.59×10^{-12}

Drive 24A *Depth = 45.8m* *Lithology - 'Silty Sand'*
Specific Gravity of Grains = 2.68 *Dry Bulk Density = 1.59 g/cm^3*
Unconfined Compressive Strength = >431 kPa *Shear Strength = 27 kPa*
Initial Void Ratio = 0.686 *Average (Re?)Compression Index = 0.109*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
27	0.605	3.07×10^{-3}	1.39×10^{-8}
75	0.569	2.69×10^{-3}	2.21×10^{-9}
172	0.53	1.32×10^{-3}	4.91×10^{-10}
365	0.489	1.25×10^{-3}	2.40×10^{-10}
753	0.454	1.04×10^{-3}	1.24×10^{-10}
1140	0.428	7.77×10^{-4}	6.75×10^{-12}

Drive 37A *Depth = 72.4m* *Lithology - 'Silty Clay'*
Specific Gravity of Grains = 2.71 *Dry Bulk Density = 1.86 g/cm³*
Unconfined Compressive Strength = 396 kPa *Shear Strength = 69 kPa*
Initial Void Ratio = 0.457 *Average (Re?)Compression Index = 0.109*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
27	0.422	1.11×10^{-3}	1.20×10^{-9}
75	0.406	5.11×10^{-4}	2.40×10^{-10}
172	0.381	1.95×10^{-4}	6.60×10^{-11}
365	0.344	1.77×10^{-4}	4.00×10^{-11}
753	0.287	9.10×10^{-5}	1.50×10^{-11}
1140	0.259	5.11×10^{-5}	4.50×10^{-12}
1914	0.221	4.46×10^{-5}	2.60×10^{-12}

Drive 38A *Depth = 74.2m* *Lithology - 'Sand'*
Specific Gravity of Grains = 2.66 *Dry Bulk Density = 1.72 g/cm³*
Unconfined Compressive Strength = 26 kPa *Shear Strength = --*
Initial Void Ratio = 0.547 *Average (Re?)Compression Index = 0.033*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
27	0.511	7.80×10^{-2}	9.80×10^{-8}
75	0.496	6.04×10^{-2}	1.85×10^{-8}
172	0.486	5.95×10^{-2}	6.70×10^{-9}
365	0.477	5.85×10^{-2}	2.90×10^{-9}
753	0.466	5.76×10^{-2}	1.70×10^{-9}
1140	0.46	1.39×10^{-2}	2.49×10^{-10}
1914	0.45	8.83×10^{-3}	1.20×10^{-10}

Drive 40A *Depth = 76.5m* *Lithology - 'Very Fine Silt'*
Specific Gravity of Grains = 2.75 *Dry Bulk Density = 1.33 g/cm^3*
Unconfined Compressive Strength = >431 kPa *Shear Strength = 81 kPa*
Initial Void Ratio = 1.068 *Average (Re?)Compression Index = 0.167*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
48	0.976	3.41×10^{-4}	4.49×10^{-10}
145	0.921	1.48×10^{-4}	8.18×10^{-11}
339	0.859	9.18×10^{-5}	2.89×10^{-11}
726	0.794	6.19×10^{-5}	1.15×10^{-11}
1500	0.727	3.47×10^{-5}	5.51×10^{-12}

Drive 4 *Depth = 78.1m* *Lithology - 'Silt'*
Specific Gravity of Grains = 2.71 *Dry Bulk Density = 1.29 g/cm^3*
Unconfined Compressive Strength = >431 kPa *Shear Strength = 56 kPa*
Initial Void Ratio = 1.101 *Average (Re?)Compression Index = 0.194*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
48	1.009	3.85×10^{-3}	6.45×10^{-9}
145	0.955	1.18×10^{-3}	6.40×10^{-10}
339	0.887	7.53×10^{-4}	2.25×10^{-10}
726	0.804	3.01×10^{-4}	4.78×10^{-11}
1500	0.719	9.19×10^{-5}	7.43×10^{-12}

Drive 5 *Depth = 97.3m* *Lithology - 'Fine Sand'*
Specific Gravity of Grains = 2.65 *Dry Bulk Density = 1.75 g/cm^3*
Unconfined Compressive Strength = >431 kPa *Shear Strength = 156 kPa*
Initial Void Ratio = 0.514 *Average (Re?)Compression Index = 0.105*

Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
48	0.504	6.37×10^{-3}	1.23×10^{-8}
145	0.435	3.41×10^{-3}	1.89×10^{-9}
339	0.411	2.32×10^{-3}	5.24×10^{-10}
726	0.381	1.38×10^{-3}	1.18×10^{-10}
1500	0.347	7.85×10^{-4}	3.99×10^{-11}

Drive 90C *Depth = 154.5m* *Lithology - 'Silt/Clay'*
Specific Gravity of Grains = 2.70 *Dry Bulk Density = 1.48 g/cm^3*
Unconfined Compressive Strength = >431 kPa *Shear Strength = 156 kPa*
Initial Void Ratio = 0.824 *Average (Re?)Compression Index = 0.122*

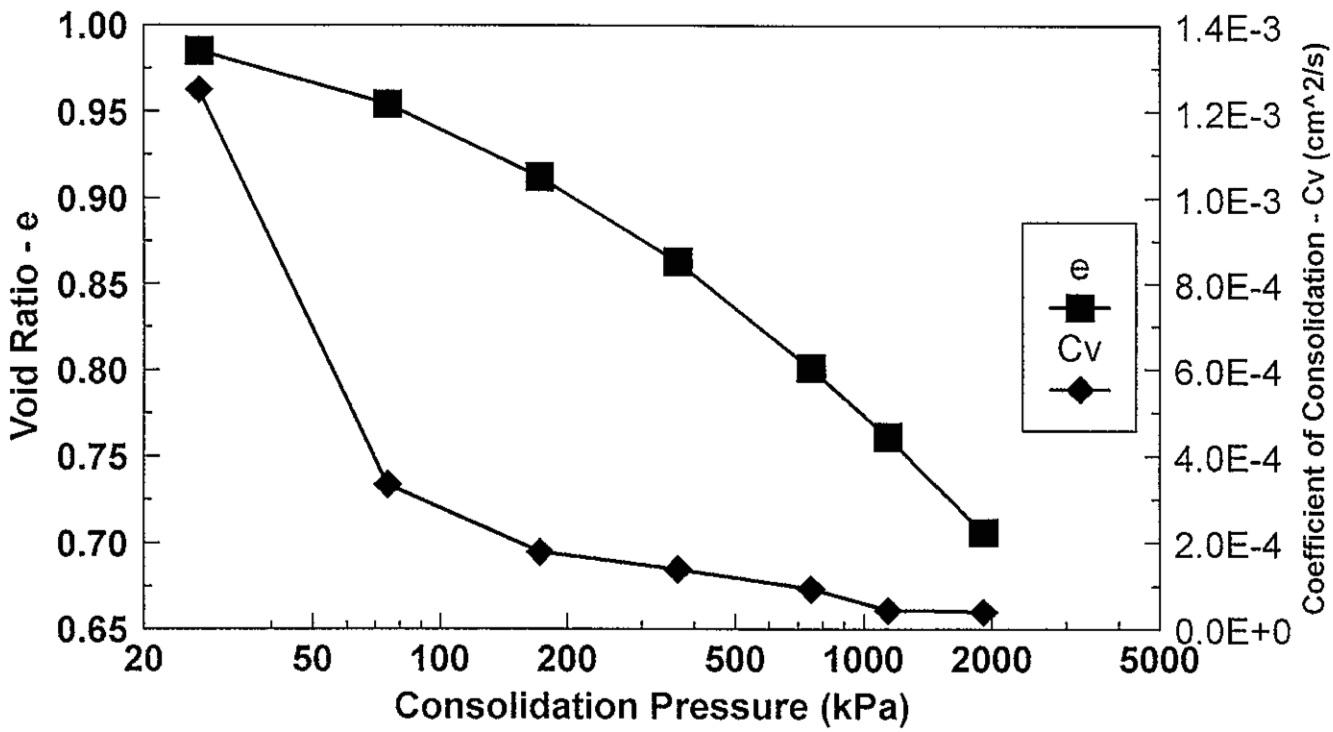
Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
48	0.766	8.10×10^{-4}	8.38×10^{-10}
145	0.728	4.88×10^{-4}	1.67×10^{-10}
339	0.684	1.36×10^{-4}	2.55×10^{-11}
726	0.636	1.15×10^{-4}	1.36×10^{-11}
1500	0.583	6.74×10^{-5}	7.31×10^{-12}

Drive 93B *Depth = 159.2m* *Lithology - 'Fine Sand'*
Specific Gravity of Grains = 2.66 *Dry Bulk Density = 1.81 g/cm^3*
Unconfined Compressive Strength = -- *Shear Strength = --*
Initial Void Ratio = 0.470 *Average (Re?)Compression Index = 0.122*

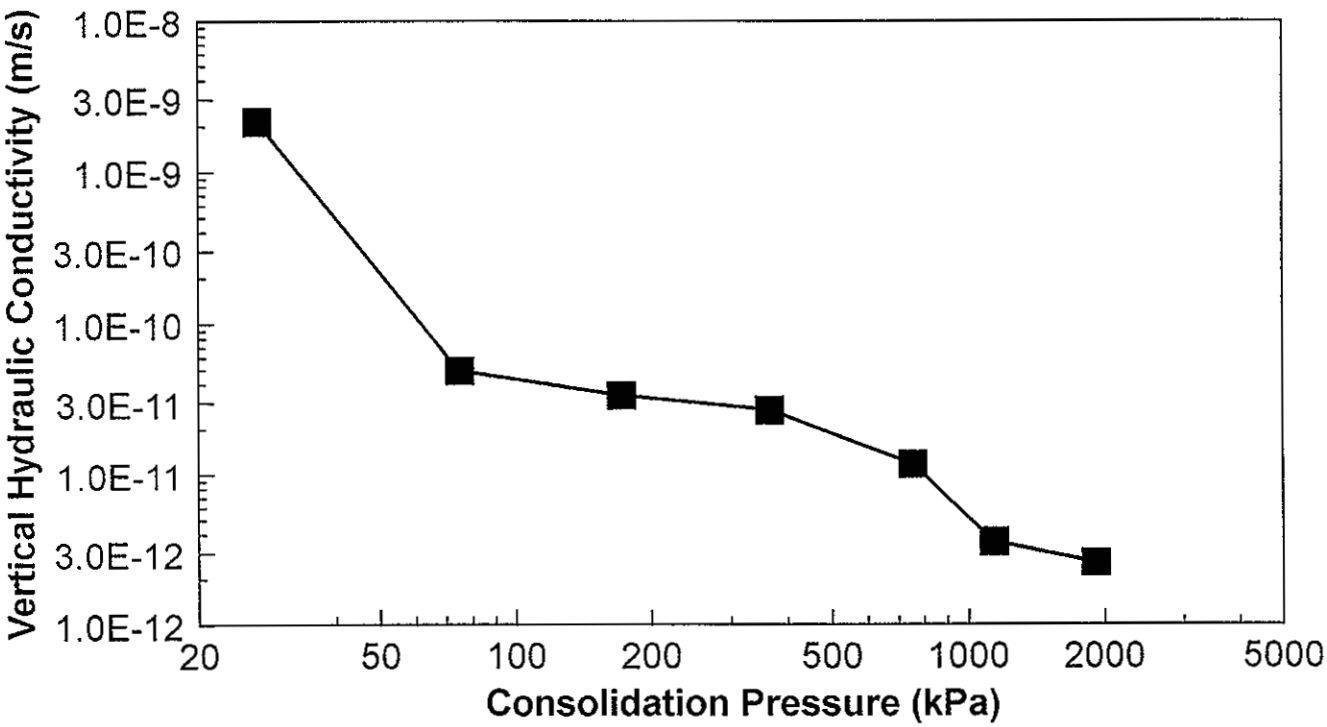
Consolidation Pressure (kPa)	Void Ratio	Coefficient of Consolidation (cm^2/s)	Vertical Hydraulic Conductivity (m/s)
48	0.433	5.98×10^{-2}	5.11×10^{-8}
145	0.411	5.75×10^{-2}	1.45×10^{-8}
339	0.395	5.62×10^{-2}	5.67×10^{-9}
726	0.377	4.66×10^{-2}	2.56×10^{-9}
1500	0.357	2.41×10^{-2}	6.97×10^{-10}

Note: **Unconfined compressive strength was measured using a SOILTEST pocket penetrometer. A SOILTEST torvane shear device was used to obtain shear strength values. Drive 4 (78.1m) and Drive 5 (97.3m) samples were obtained from a borehole offset approximately 6m from the coring location. Only select intervals were cored in this borehole, which was used for placement of monitoring well piezometers.**

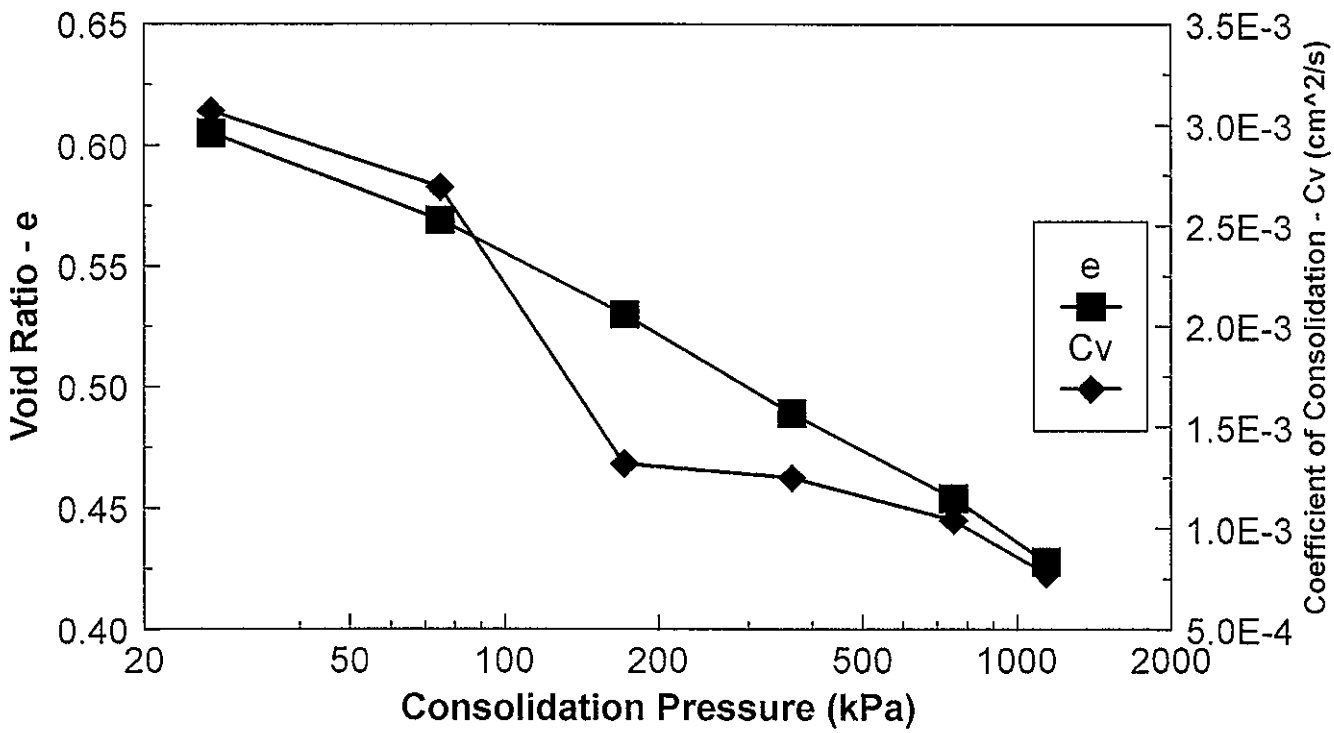
Drive 20 Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



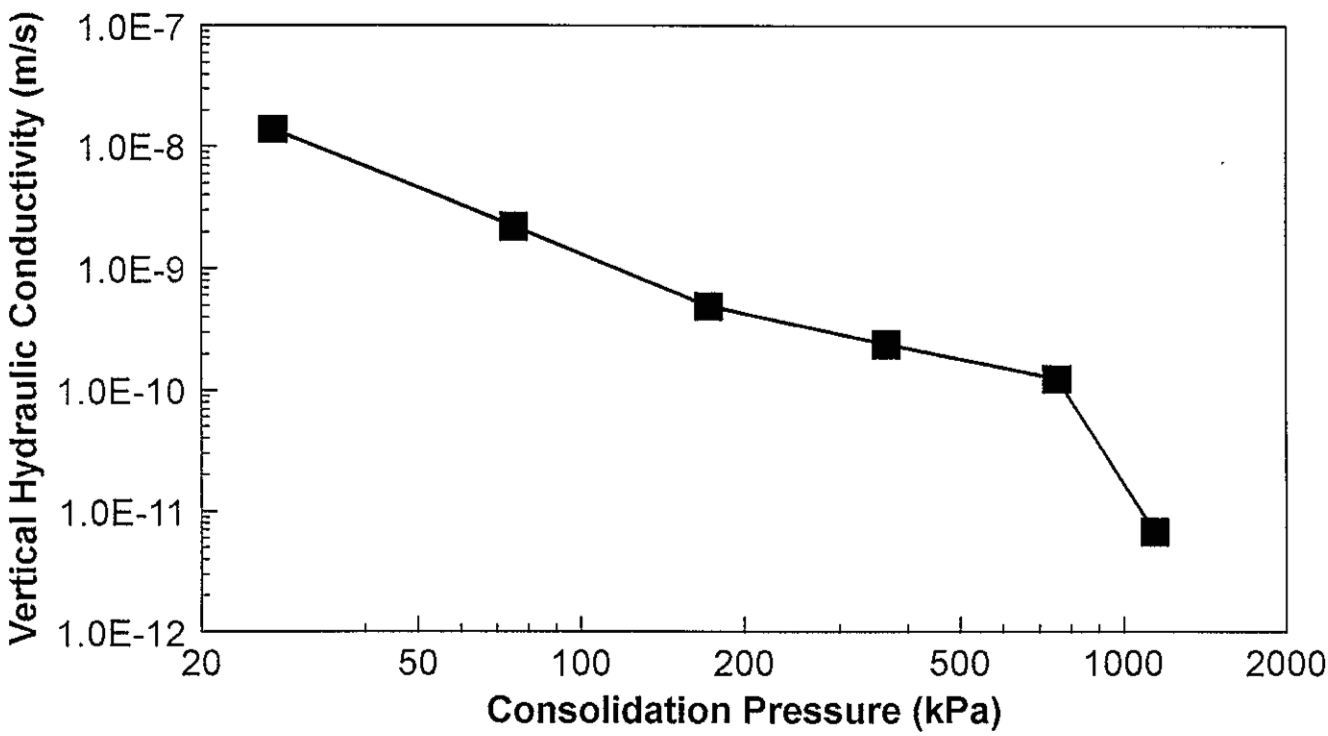
Drive 20 Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



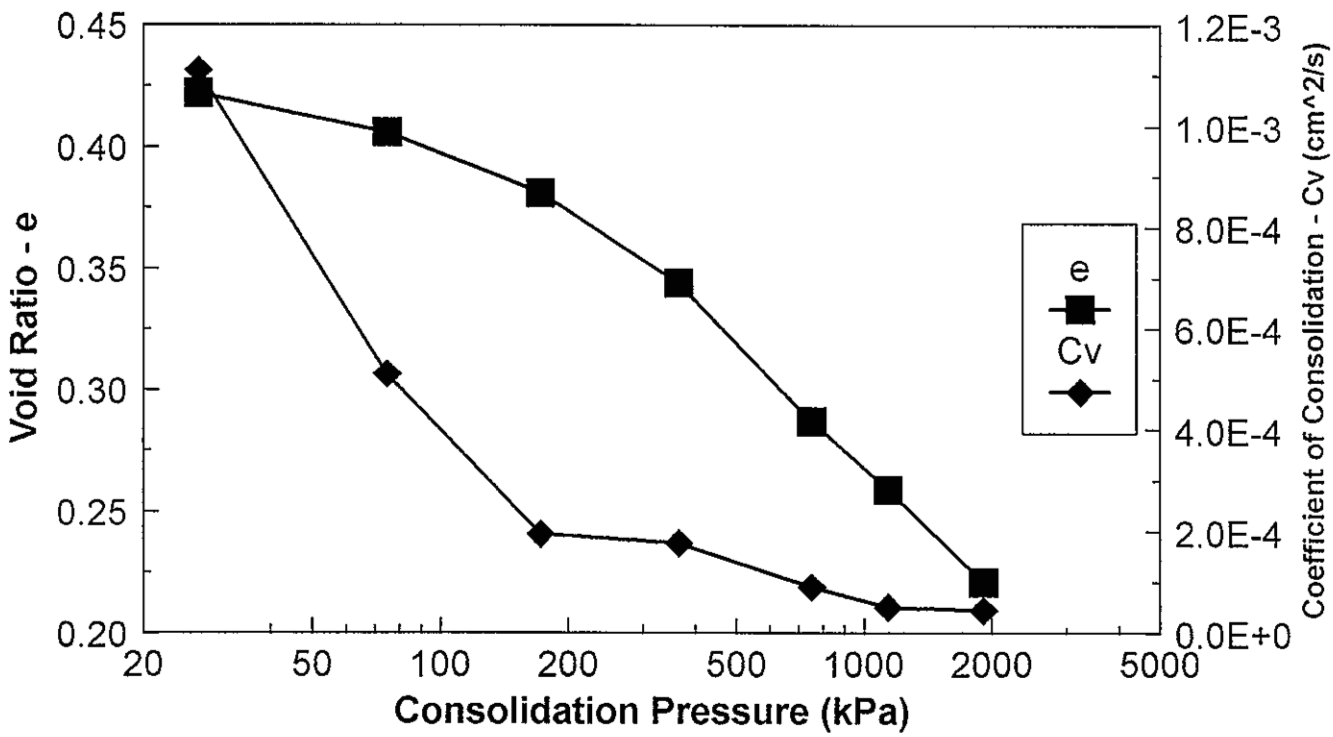
Drive 24A Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



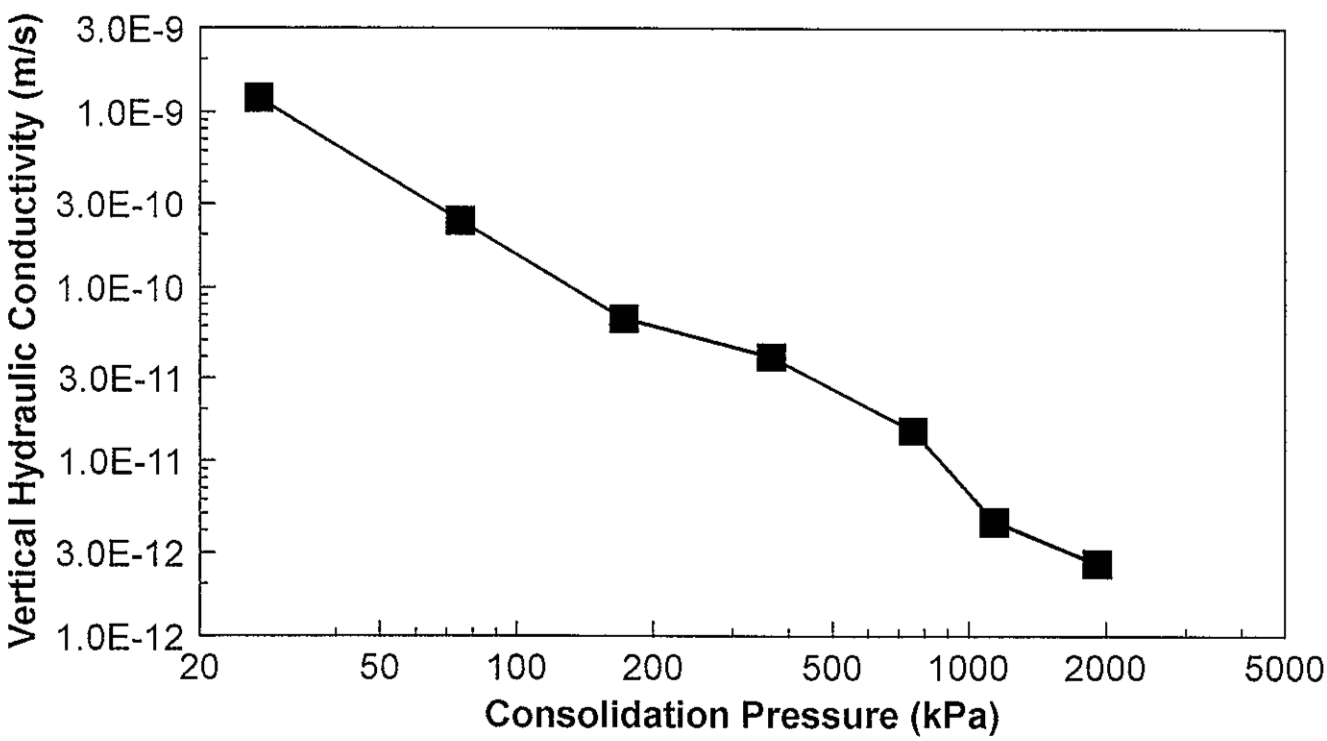
Drive 24A Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



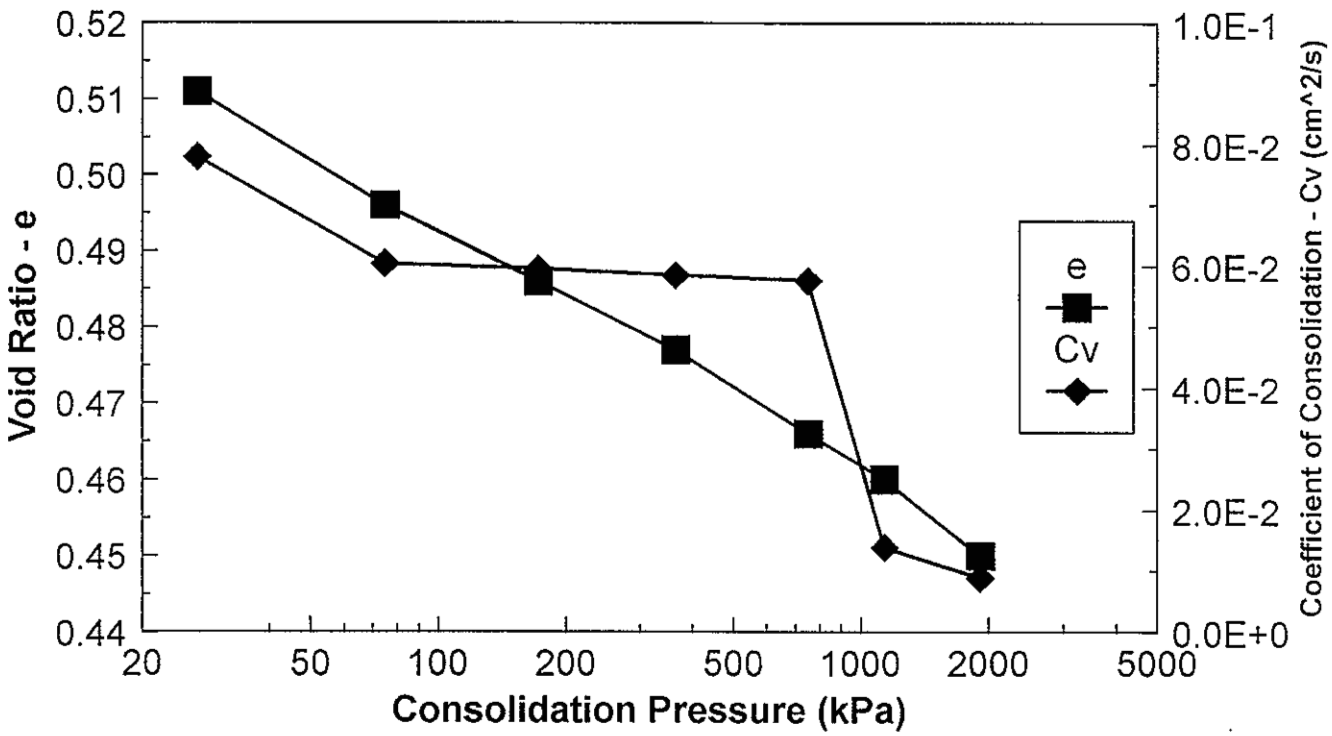
Drive 37A Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



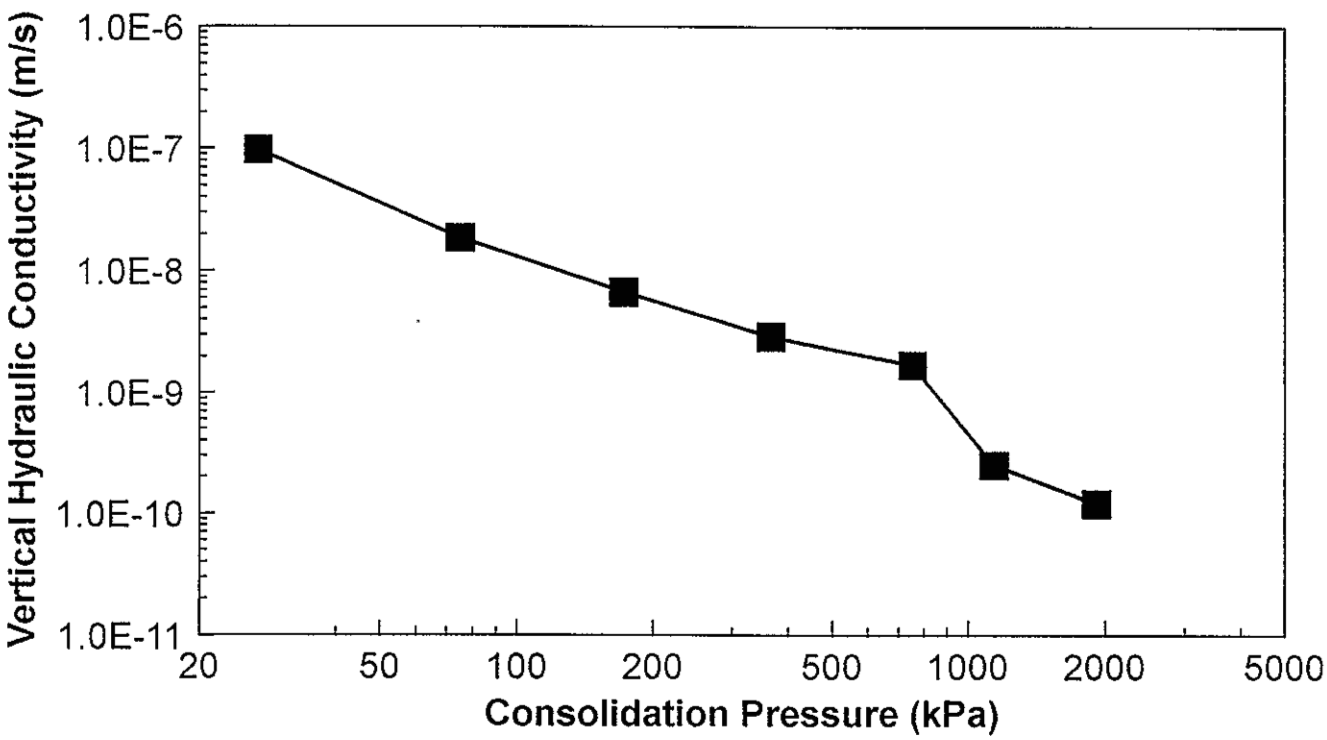
Drive 37A Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



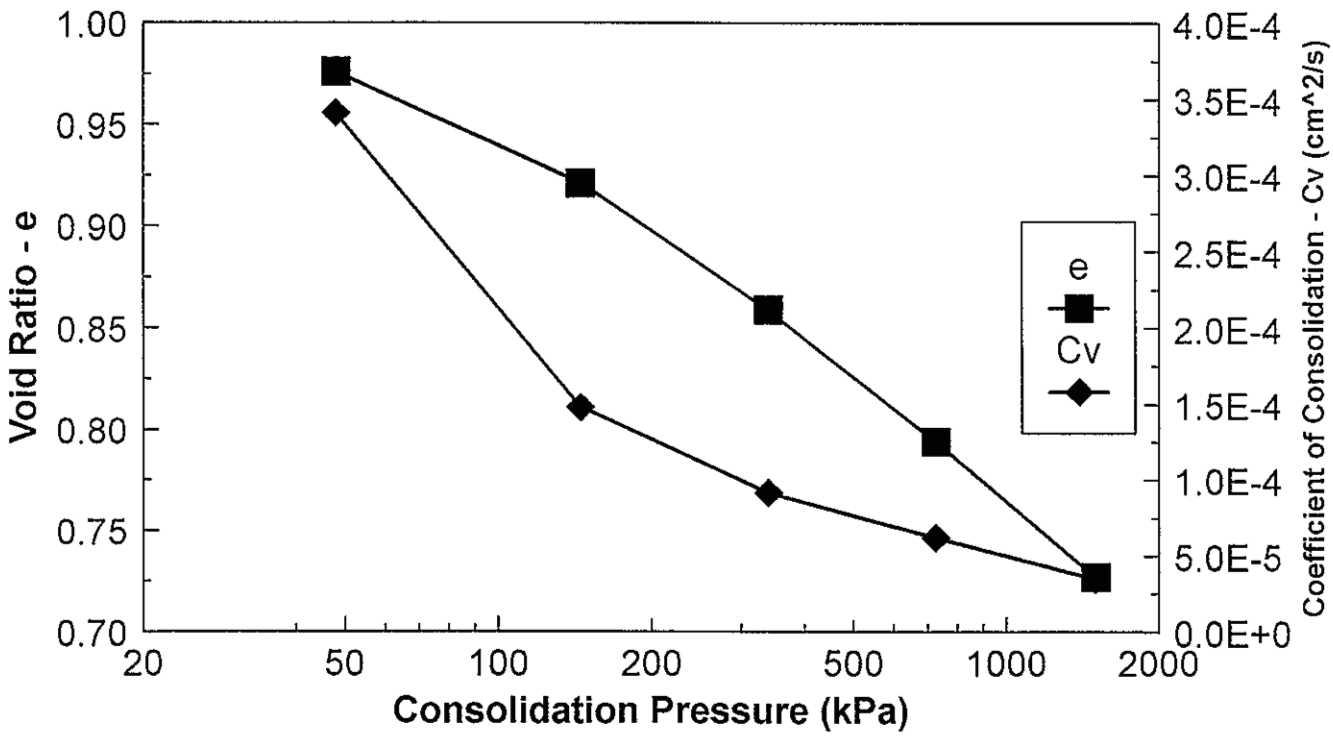
Drive 38A Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



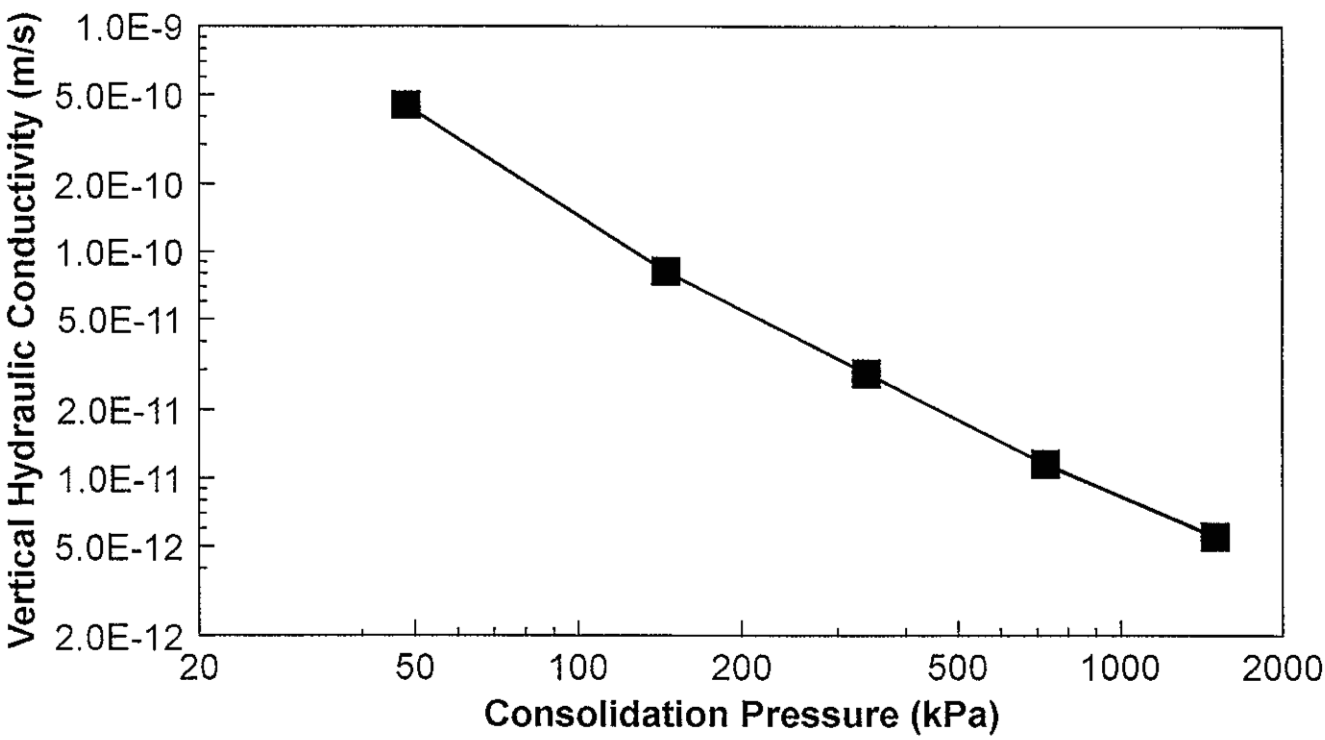
Drive 38A Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



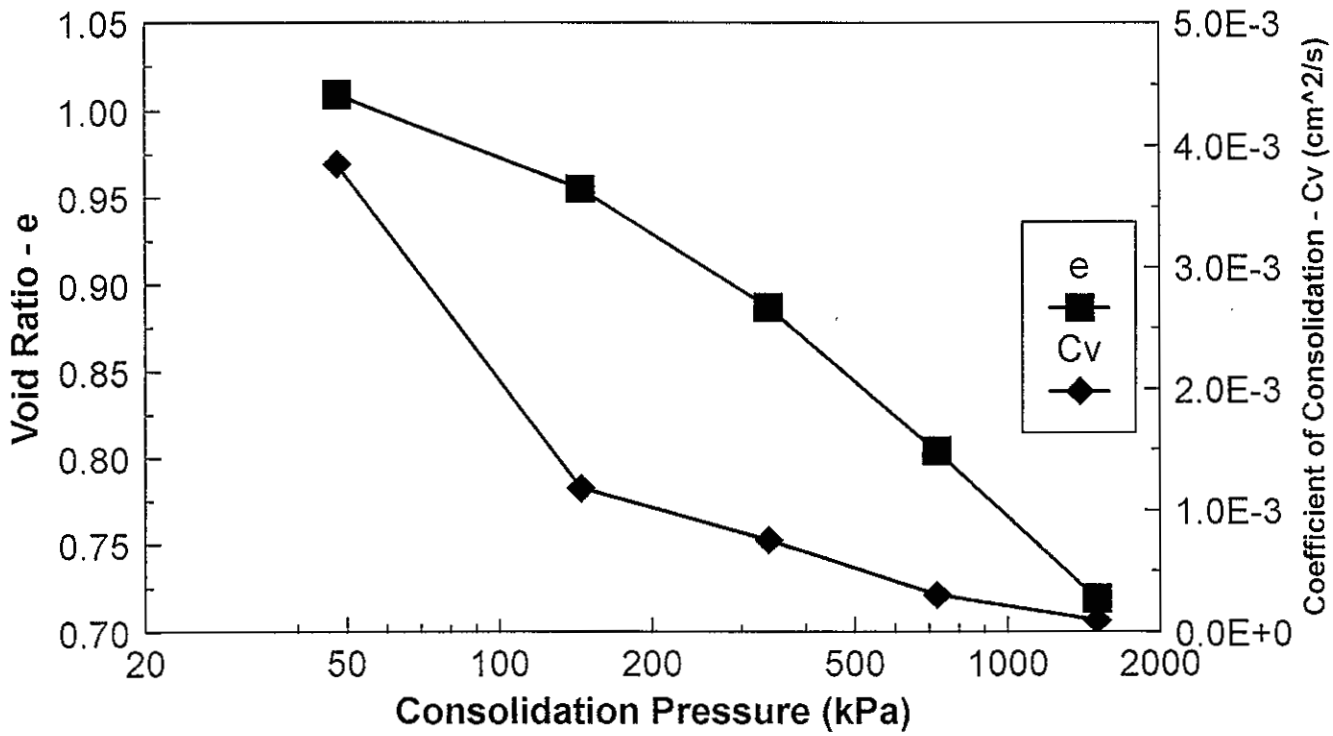
Drive 40A Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



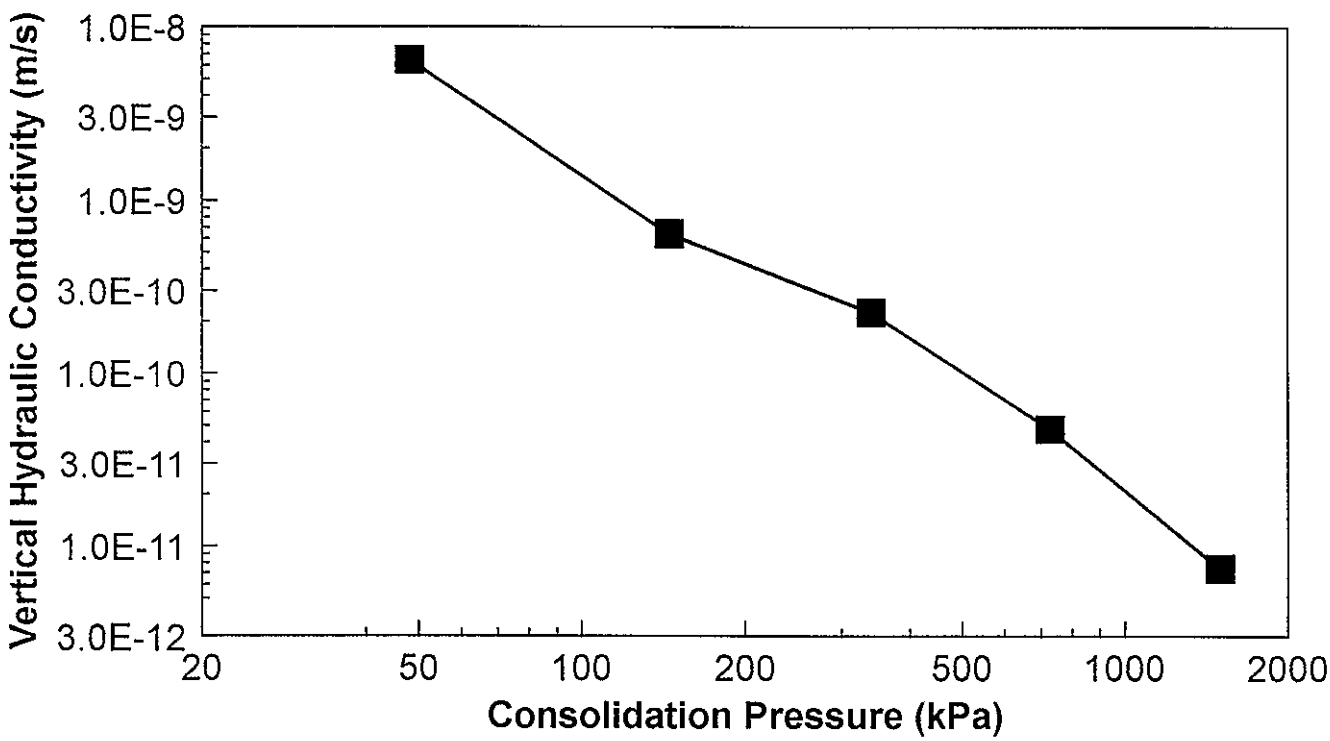
Drive 40A Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



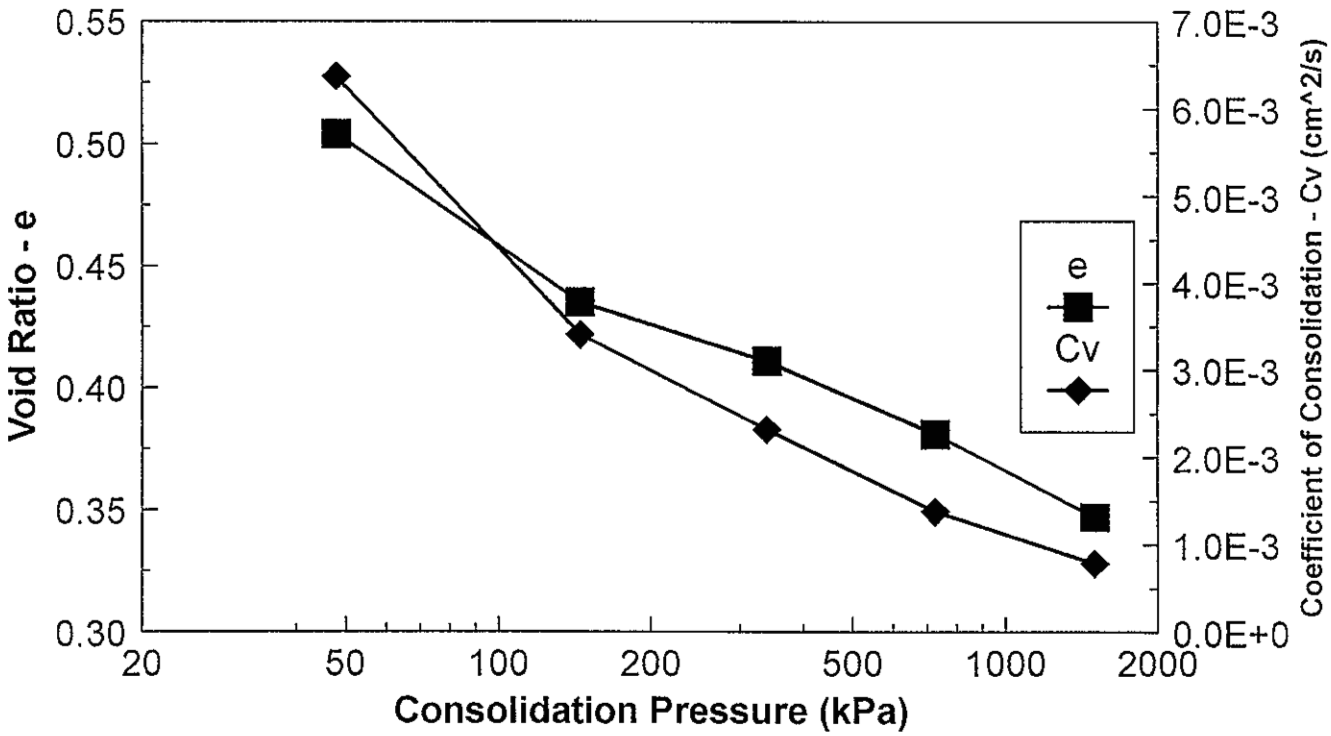
Drive 4 Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



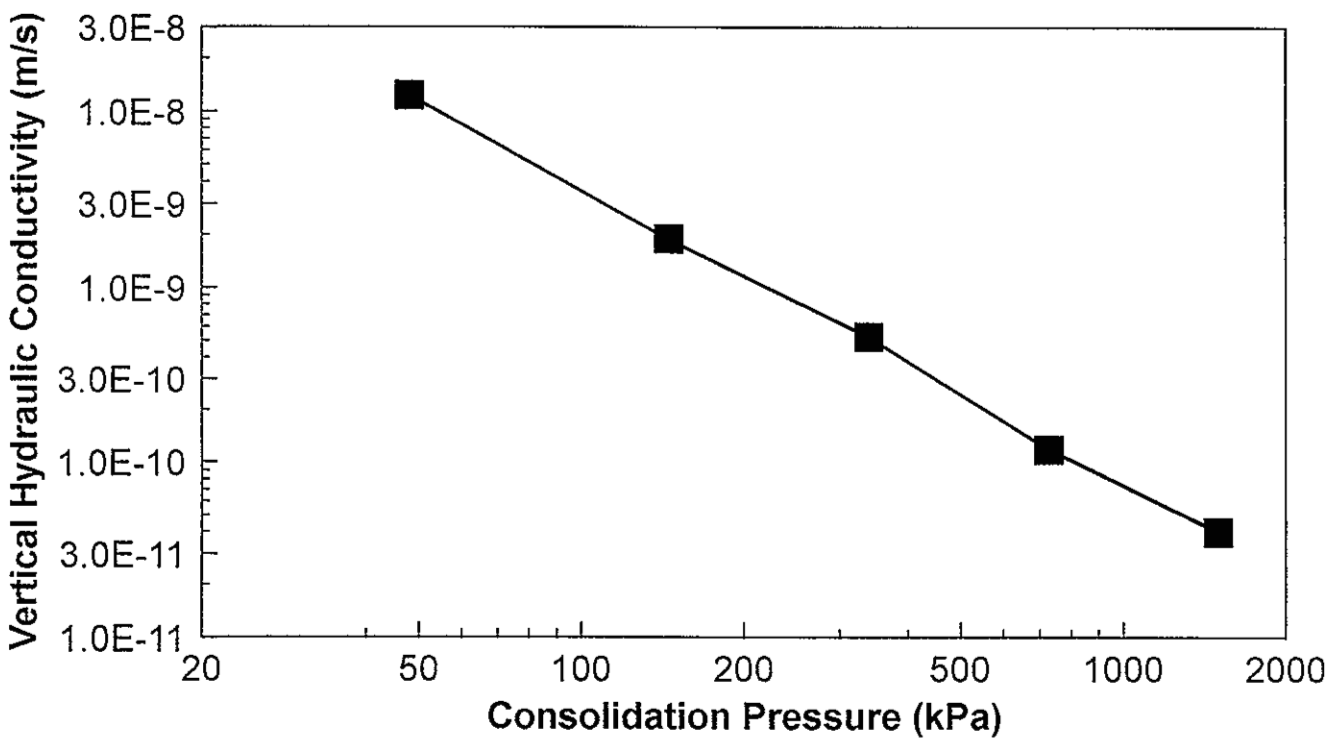
Drive 4 Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



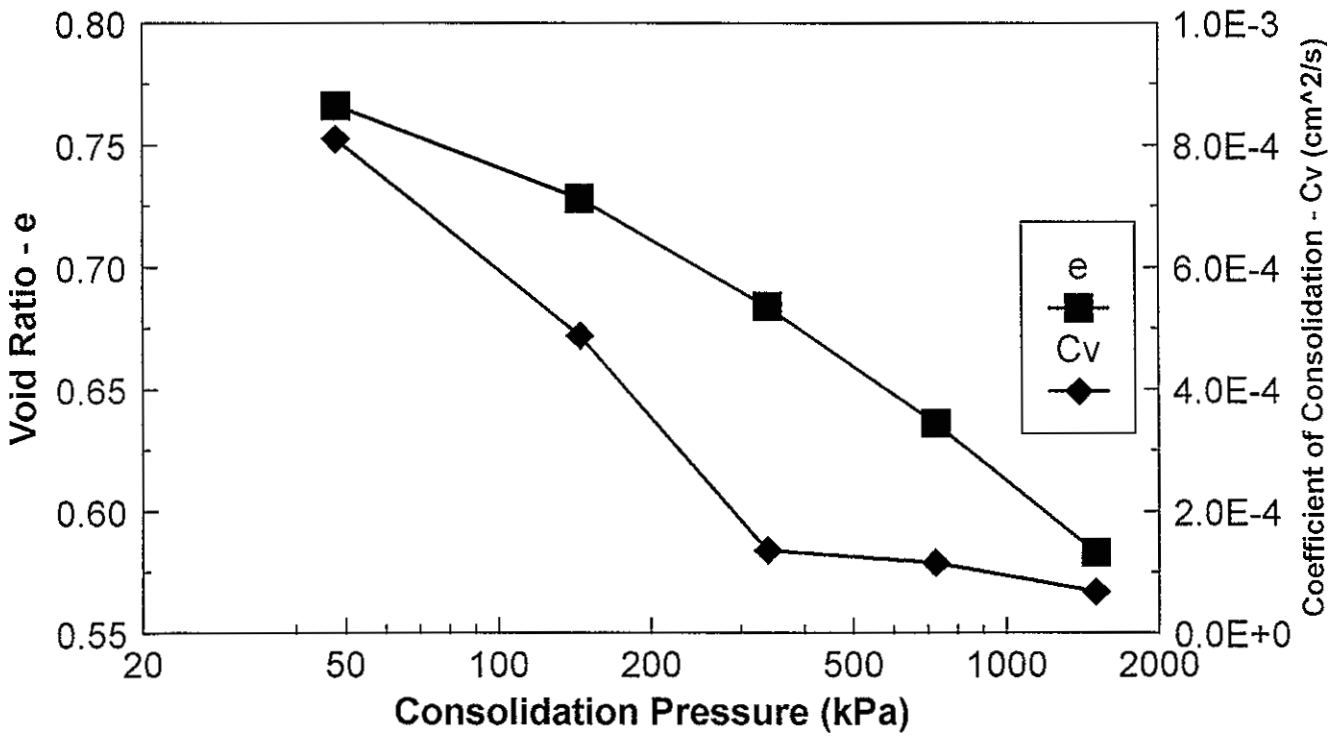
Drive 5 Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



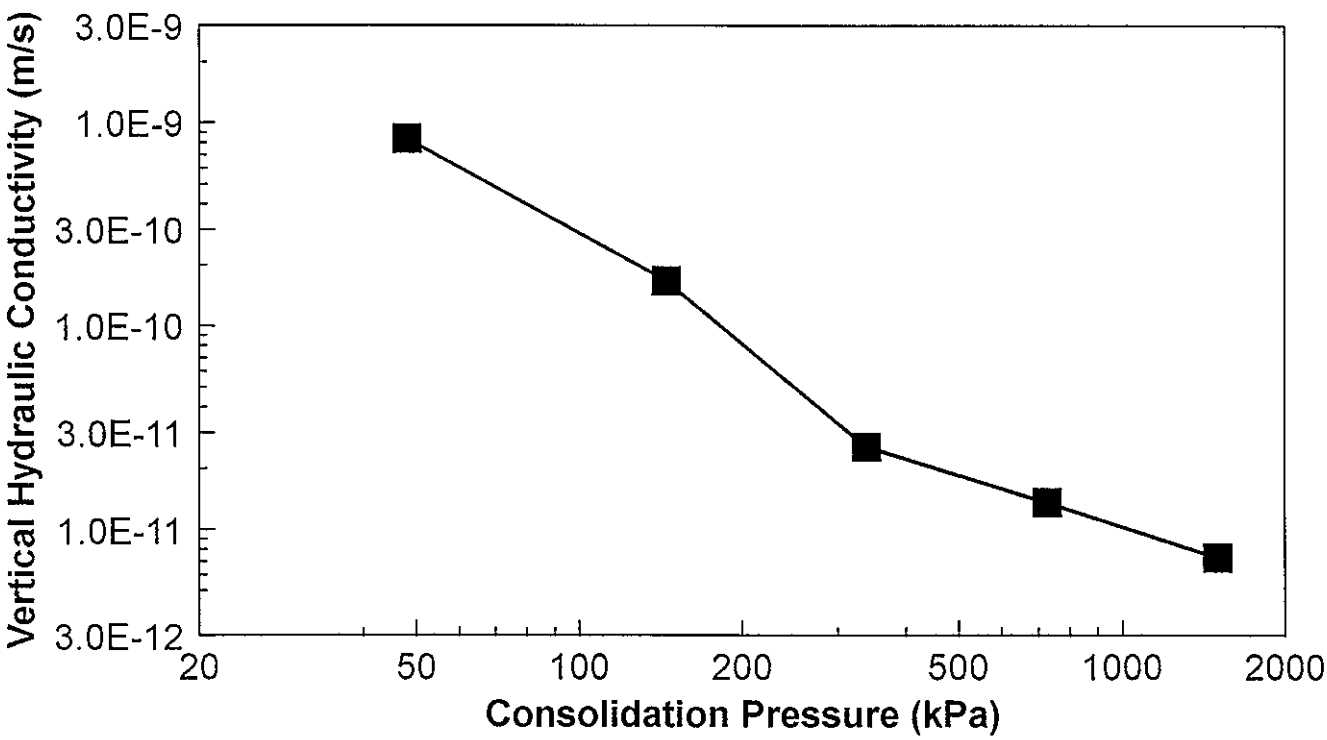
Drive 5 Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



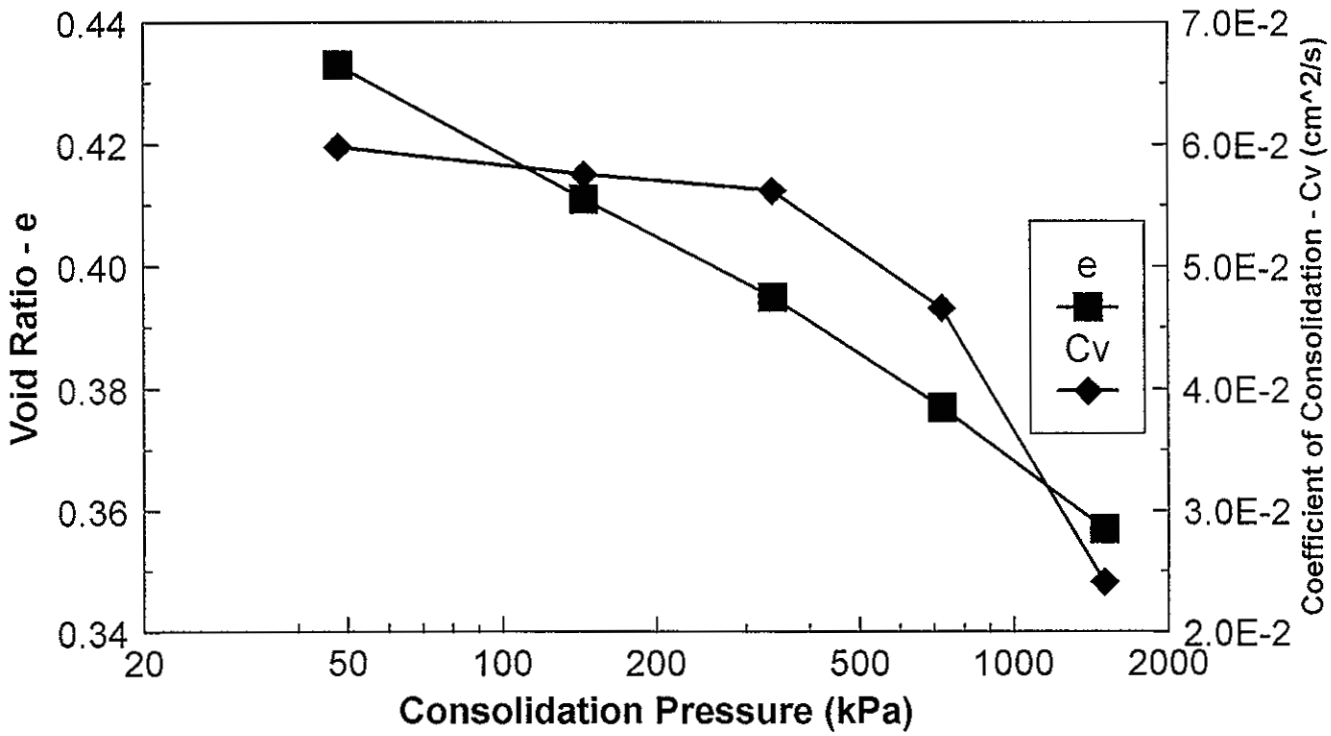
Drive 90C Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



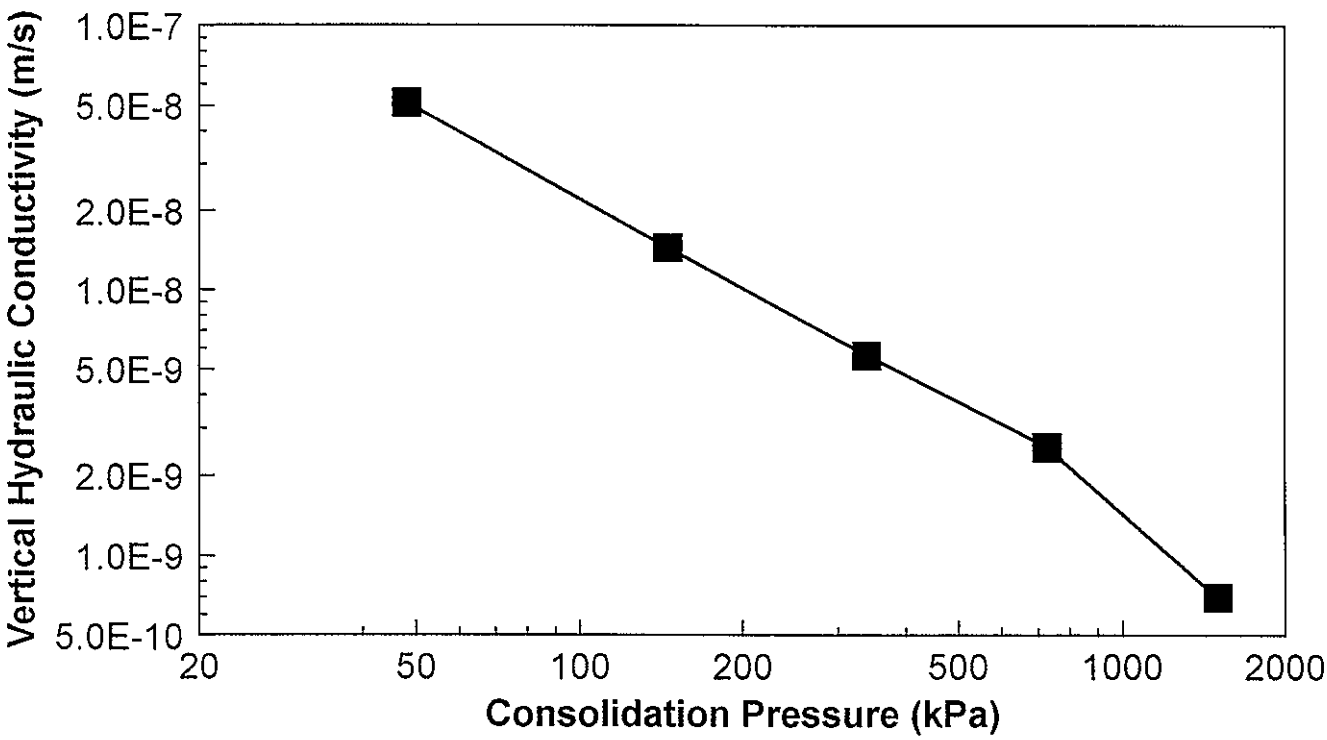
Drive 90C Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



Drive 93B Consolidation Test Results: Void Ratio and Coefficient of Consolidation vs Applied Pressure



Drive 93B Consolidation Test Results: Vertical Hydraulic Conductivitty vs Applied Pressure



- Section C -
Triaxial Permeability Test Results

Triaxial Hydraulic Conductivity Procedures for Recompacted Samples

The hydraulic conductivity of recompacted samples from the 98th street core was measured in a triaxial cell using the constant head method (Das, 1983). Samples that appeared to be visually representative of the sandy portions of the core were chosen for triaxial permeability testing, although we discovered that many of these samples had appreciable fine grained components. (See particle size distribution data provided in this section.) Samples that contained very coarse sand granules were not selected in order to make sure that the typical grain size was much smaller than the diameter of the triaxial samples. Our original intention was to use trimmed undisturbed samples; however, the sandy materials were brittle and intact samples could not be removed from the core. Each sample was manually disaggregated and homogenized, then recompacted in a cylindrical mold to a length of 7.4 to 8.6 cm and a diameter of 3.6 cm. Hydraulic conductivity was measured for flow parallel to the long axis of the sample (i.e., perpendicular to the direction of compaction).

The hydraulic conductivity was measured under confining pressures of approximately 69, 207, 345, 483, and 621 kPa. The head difference for all tests was 1.07 m, which produced an average pore water pressure of approximately 10 kPa. The permeant was tap water. Trials with smaller head differences produced infinitesimally small flow rates and would have resulted in unacceptably long test durations. Because the triaxial cell serves as a flexible walled permeameter and the sample is encased in only a thin latex membrane, attempts to saturate the sample in an empty cell and head difference in excess of 1 m resulted in sample liquefaction. Therefore, we could not measure hydraulic conductivity values for zero confining pressure using the triaxial cell. Each confining pressure was maintained for only a short time, generally less than an hour, so the results obtained represent values for the unconsolidated state.

References:

Das, B. M. 1983. Advanced Soil Mechanics. Hemisphere Publishing Corporation. Washington, DC. 511 pages.

Tabulated Results of Unconsolidated-Drained Triaxial Hydraulic Conductivity Testing of Recompacted Samples from the 98th Street Core

Note: Axial load represents the force exerted by the specimen on the loading ram as the cell pressure is increased. It is negative for compression and positive for tension.

Drive 14B Depth = 29.9m Packed Density = 1803 kg/m³ Sample Length = 7.40 cm

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	7.15×10^{-7}	0.5
207	2.47×10^{-7}	-0.5
345	2.05×10^{-7}	-2.3
483	1.88×10^{-7}	-4.1
621	1.73×10^{-7}	-5.9

Drive 17B Depth = 35.7m Packed Density = 2023 kg/m³ Sample Length = 7.90 cm

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	6.51×10^{-6}	0.5
207	4.65×10^{-6}	-0.5
345	3.80×10^{-6}	-2.3
483	3.27×10^{-6}	-4.1
621	2.88×10^{-6}	-5.9

Drive 21B Depth = 41.5m Packed Density = 2184 kg/m³ Sample Length = 8.34 cm

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	2.31×10^{-6}	0.5
207	1.73×10^{-6}	-0.9
345	1.42×10^{-6}	-2.3
483	1.21×10^{-6}	-4.1
621	1.04×10^{-6}	-5.9

Drive 23A *Depth = 44.8m* *Packed Density = 1773 kg/m³* *Sample Length = 8.56 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	4.67×10^{-6}	0.5
207	3.35×10^{-6}	-0.9
345	2.73×10^{-6}	-2.7
483	2.32×10^{-6}	-4.5
621	2.02×10^{-6}	-6.4

Drive 25A *Depth = 48.8m* *Packed Density = 1996 kg/m³* *Sample Length = 7.91 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	3.10×10^{-6}	0
207	1.40×10^{-6}	-0.5
345	1.01×10^{-6}	-2.7
483	8.11×10^{-7}	-4.1
621	7.04×10^{-7}	-5

Drive 25B *Depth = 49.4m* *Packed Density = 2020 kg/m³* *Sample Length = 8.10 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	1.47×10^{-6}	0.9
207	1.22×10^{-6}	-0.9
345	1.03×10^{-6}	-3.2
483	8.80×10^{-7}	-4.1

Drive 27B *Depth = 52.7m* *Packed Density = 1828 kg/m³* *Sample Length = 8.28 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	2.05×10^{-6}	1.4
207	1.69×10^{-6}	-1.4
345	1.57×10^{-6}	-2.3
483	1.49×10^{-6}	-4.1
621	1.45×10^{-6}	-5.9

Drive 33A *Depth = 62.2m* *Packed Density = 1944 kg/m^3* *Sample Length = 8.30 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	8.06×10^{-7}	0.9
207	5.09×10^{-7}	-0.5
345	3.56×10^{-7}	-2.7
483	2.78×10^{-7}	-4.1
621	2.37×10^{-7}	-5.9

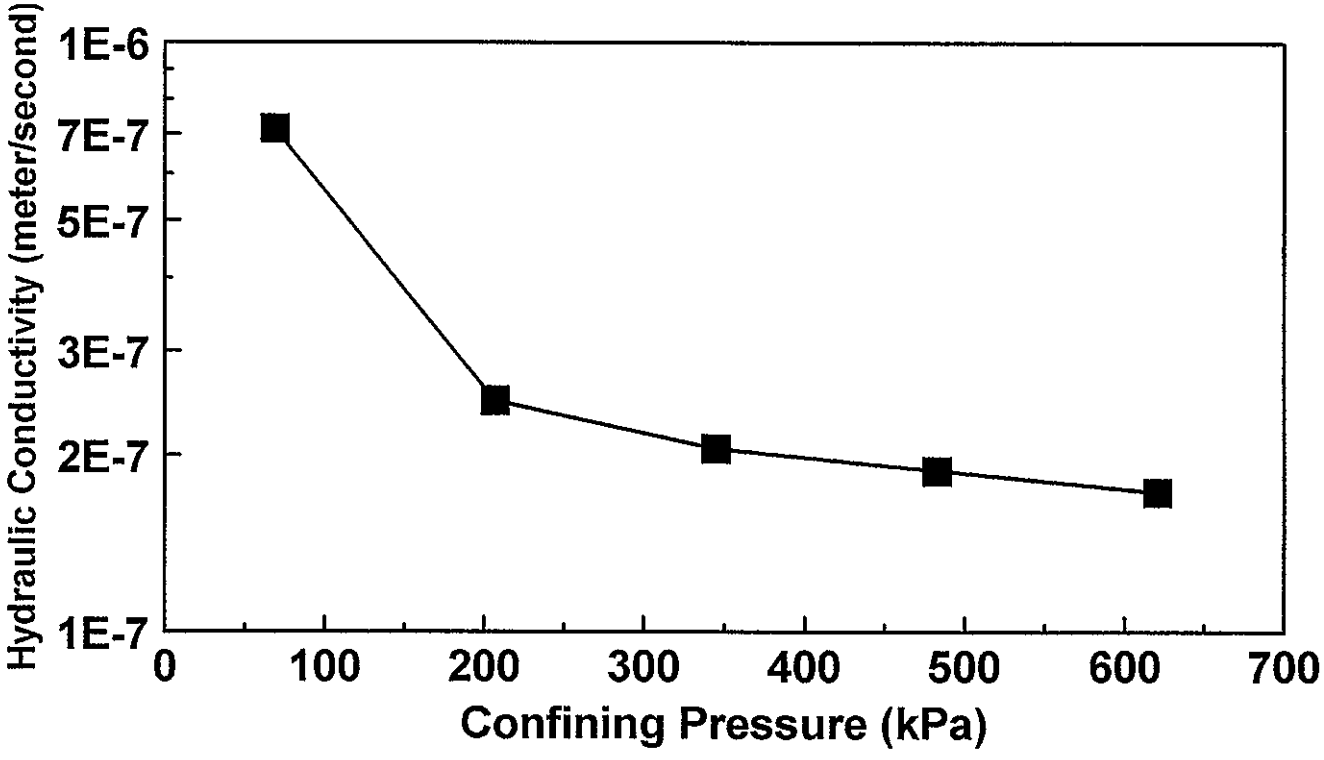
Drive 38A *Depth = 74.4m* *Packed Density = 1726 kg/m^3* *Sample Length = 8.51 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	2.55×10^{-6}	0.9
207	2.76×10^{-7}	-1.4
345	1.95×10^{-7}	-3.2
483	1.30×10^{-7}	-5
621	9.80×10^{-8}	-5

Drive 55B *Depth = 102.1m* *Packed Density = 1822 kg/m^3* *Sample Length = 7.40 cm*

Confining Pressure (kPa)	Hydraulic Conductivity (m/s)	Axial Load (kg_f)
69	1.86×10^{-6}	1.4
207	1.49×10^{-6}	-0.5
345	1.34×10^{-6}	-2.3
483	1.23×10^{-6}	-4.1
621	1.15×10^{-6}	-5.9

Triaxial Hydraulic Conductivity
Drive 14B at Depth = 29.9m
Initial Density = 1803 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 14B: 29.6m-30.1m

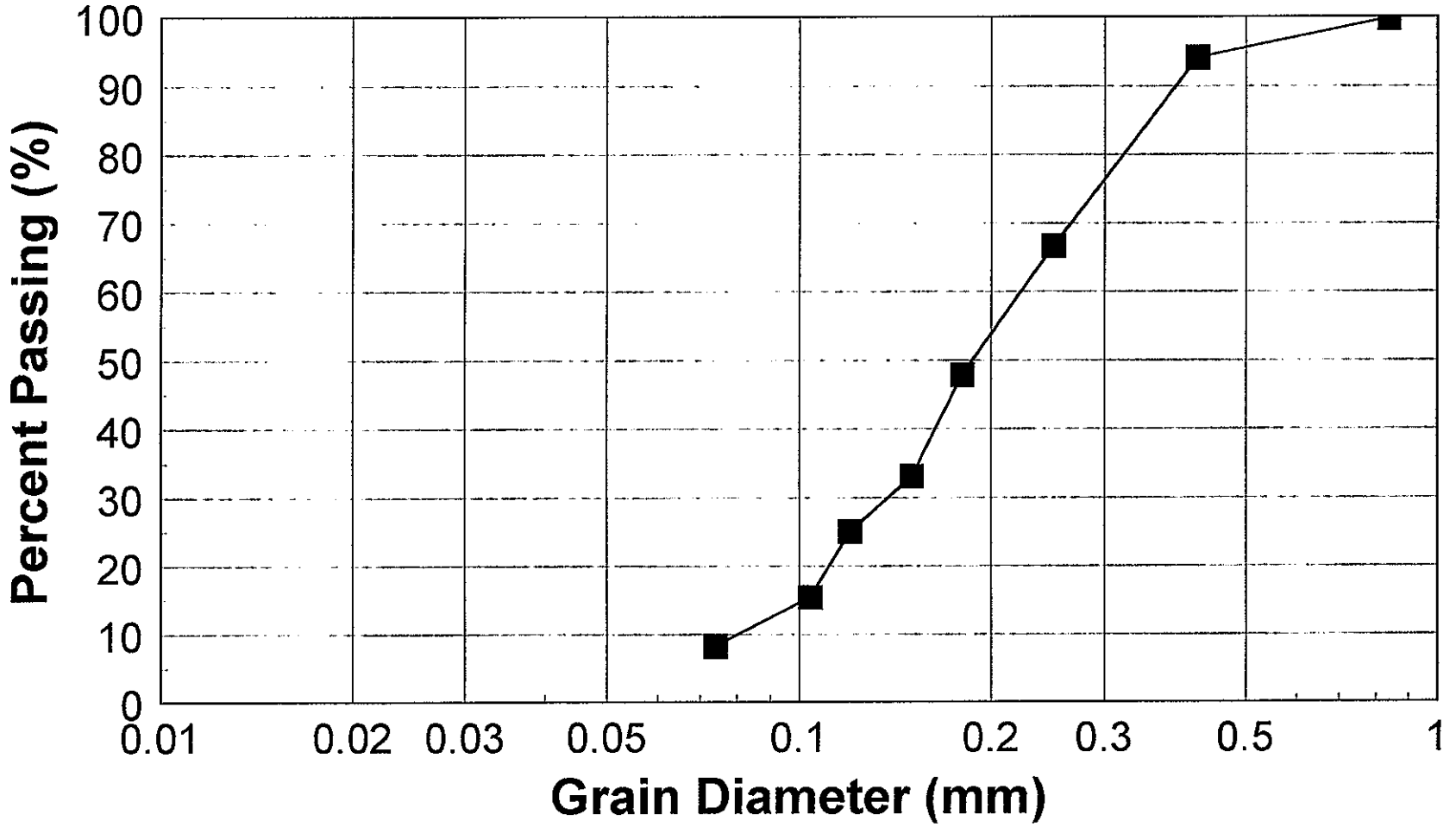
Sample Weight = 140.29 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.25	0.25	0.18	99.82
40	0.42	7.92	8.17	5.82	94.18
60	0.25	38.61	46.78	33.35	66.65
80	0.18	26.28	73.06	52.08	47.92
100	0.15	20.81	93.87	66.91	33.09
120	0.12	11.22	105.09	74.91	25.09
140	0.1	13.53	118.62	84.55	15.45
200	0.07	10.12	128.74	91.77	8.23
PAN	-	11.11	139.85	99.69	-

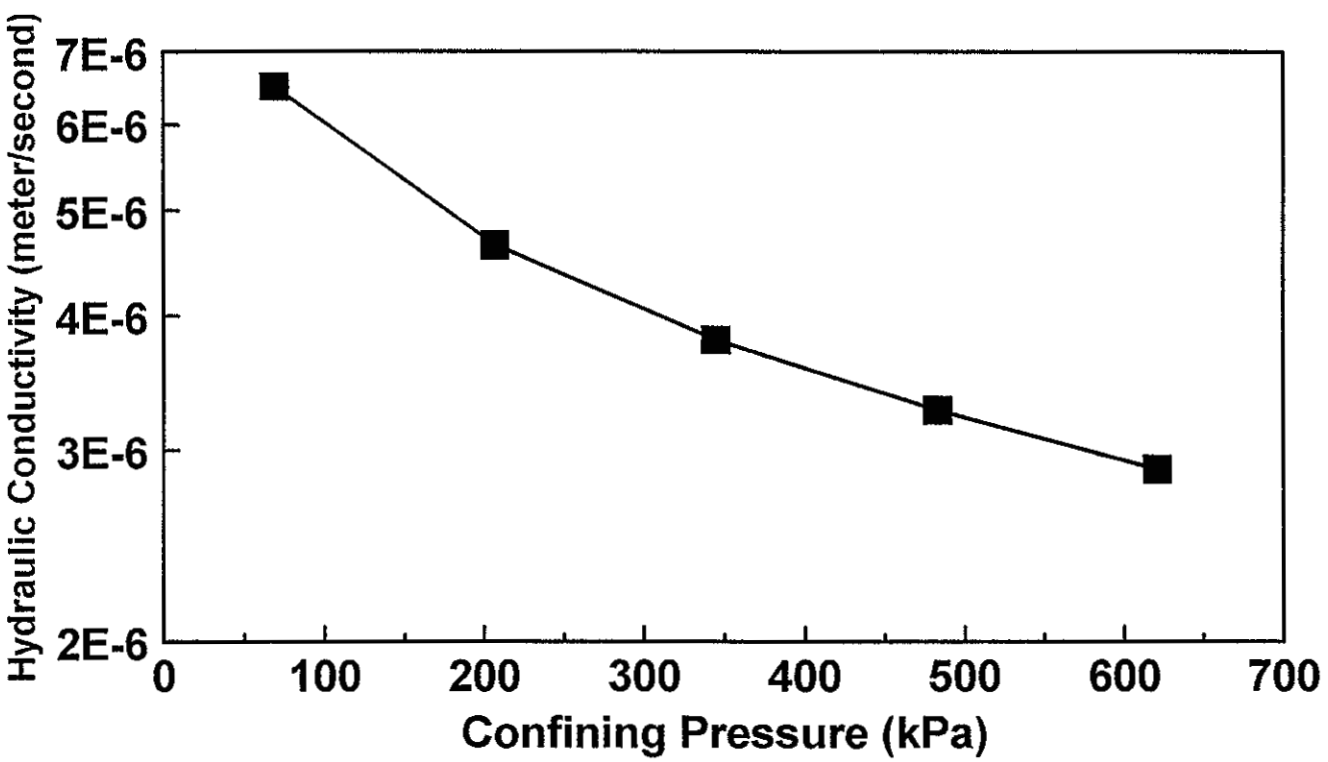
[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 14B: 29.6m-30.1m



Triaxial Hydraulic Conductivity
Drive 17B at Depth = 35.7m
Initial Density = 2023 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 17B: 35.4m-36.0m

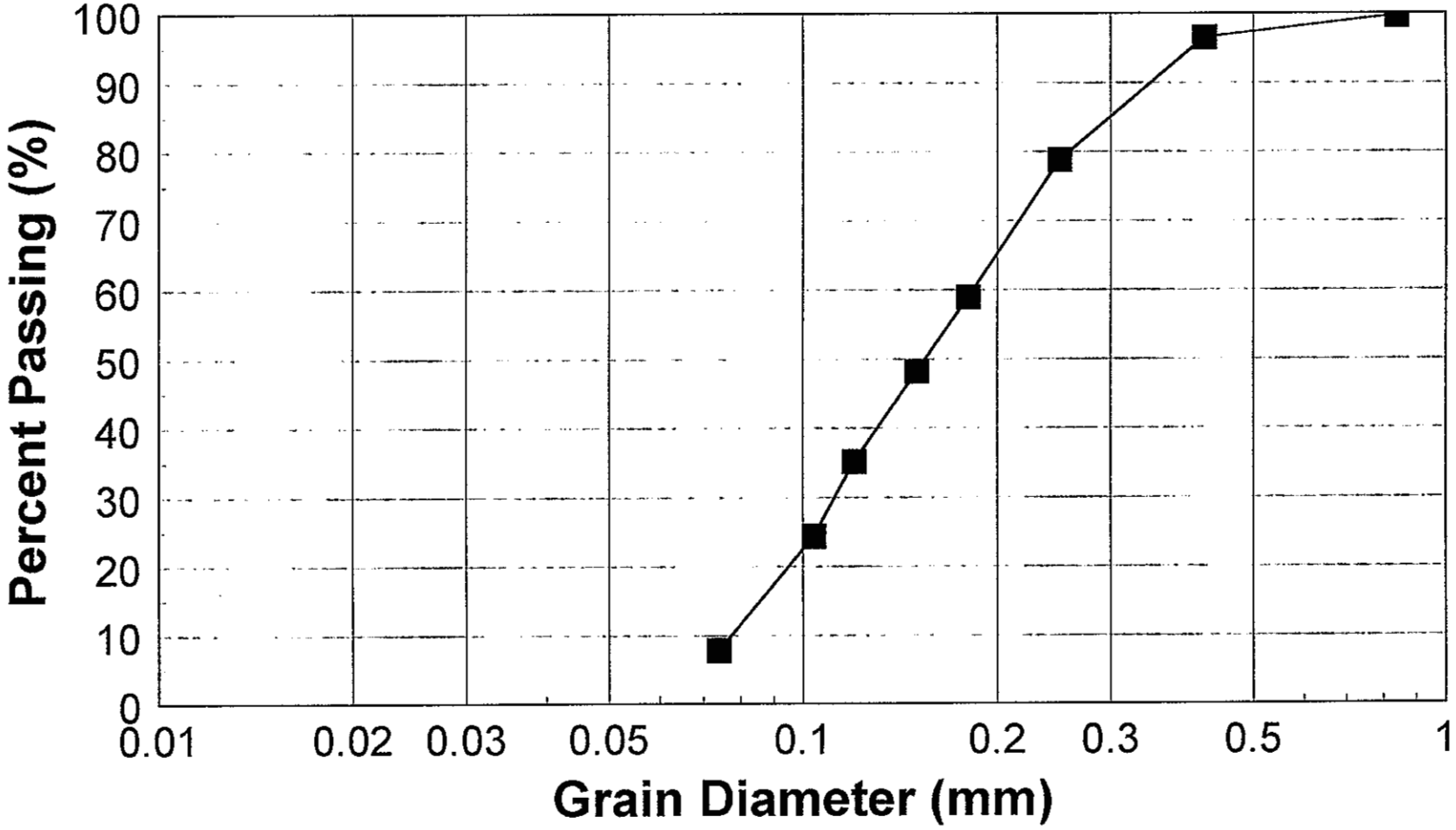
Sample Weight = 139.76 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.35	0.35	0.25	99.75
40	0.42	4.43	4.78	3.42	96.58
60	0.25	24.82	29.6	21.18	78.82
80	0.18	27.73	57.33	41.02	58.98
100	0.15	15.05	72.38	51.79	48.21
120	0.12	18.17	90.55	64.79	35.21
140	0.1	15.13	105.68	75.62	24.38
200	0.07	23.15	128.83	92.18	7.82
PAN	-	10.7	139.53	99.84	-

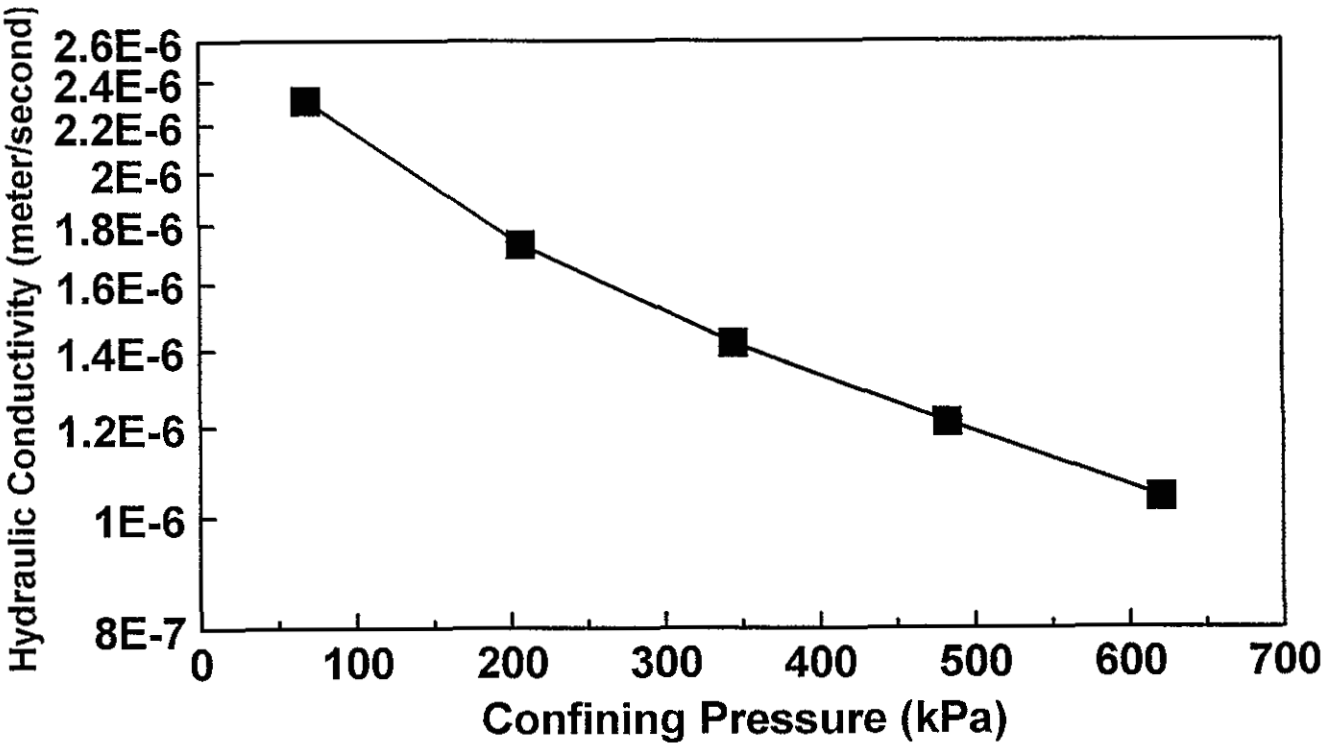
[1] mm = millimeters

[2] g = grams

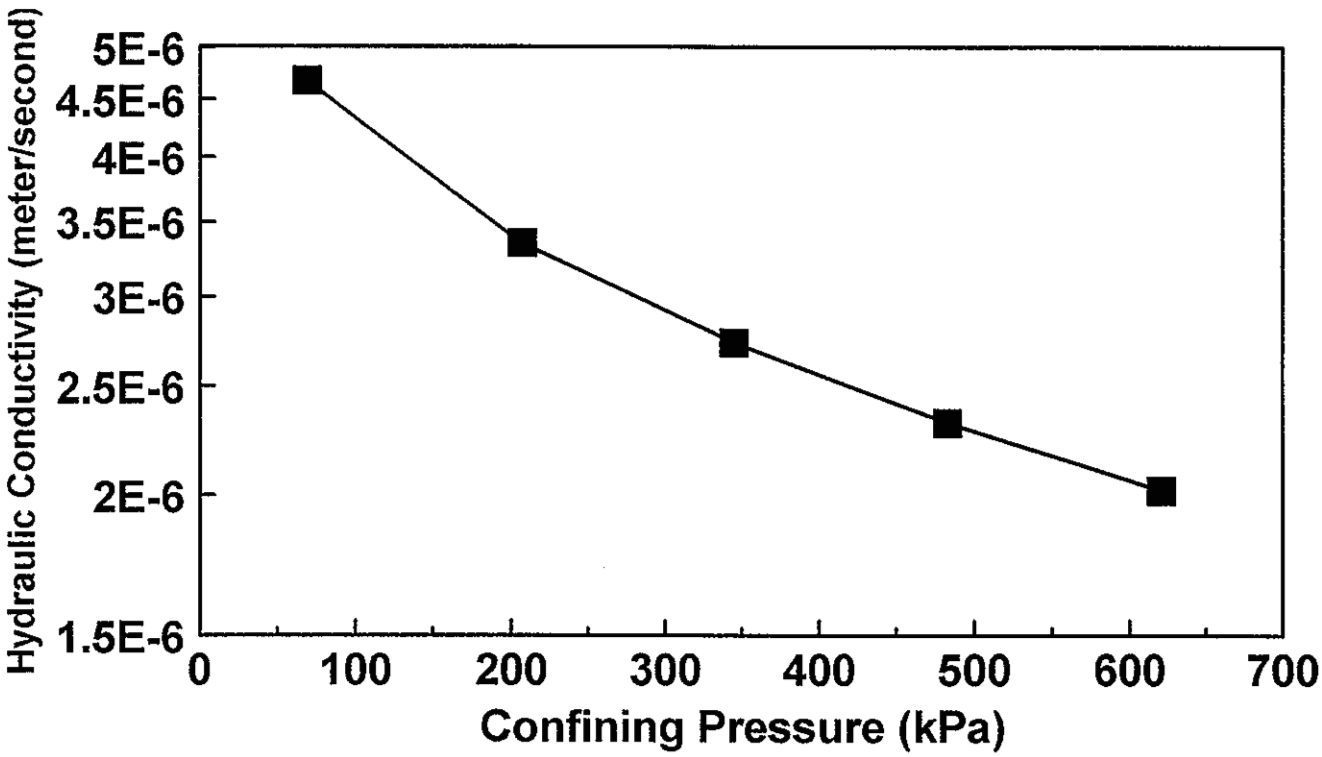
Particle Size Distribution of
Triaxial Permeability Test Sample
98th St. Core - Drive 17B: 35.4m-36.0m



Triaxial Hydraulic Conductivity
Drive 21B at Depth = 41.5m
Initial Density = 2184 kg/m^3



Triaxial Hydraulic Conductivity
Drive 23A at Depth = 44.8
Initial Density = 1773 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 23A: 44.5m-45.1m

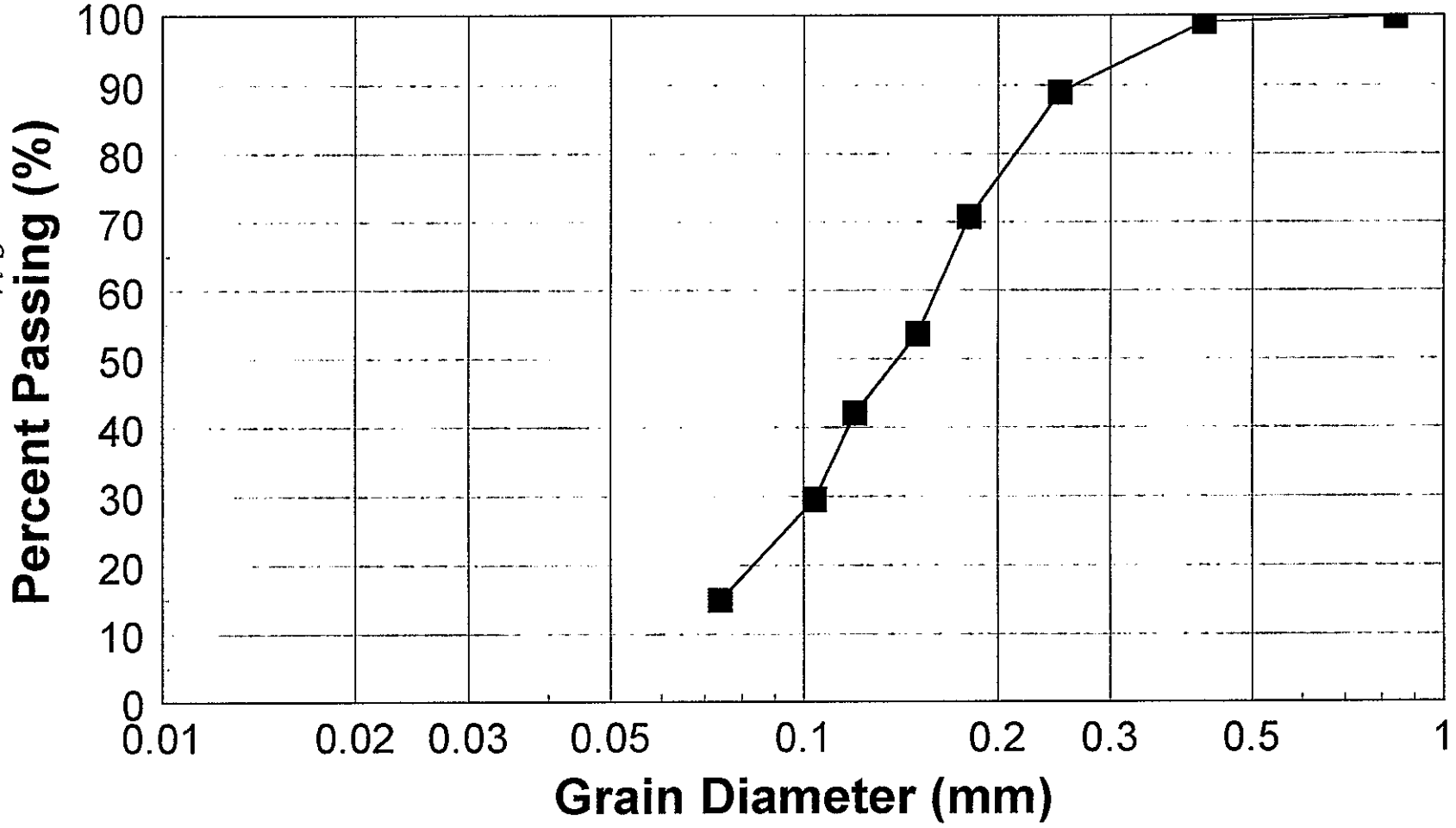
Sample Weight = 141.71 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.21	0.21	0.15	99.85
40	0.42	1.11	1.32	0.93	99.07
60	0.25	14.36	15.68	11.06	88.94
80	0.18	25.79	41.47	29.26	70.74
100	0.15	24.22	65.69	46.36	53.64
120	0.12	16.42	82.11	57.94	42.06
140	0.1	17.76	99.87	70.47	29.53
200	0.07	20.68	120.55	85.07	14.93
PAN	-	20.65	141.2	99.64	-

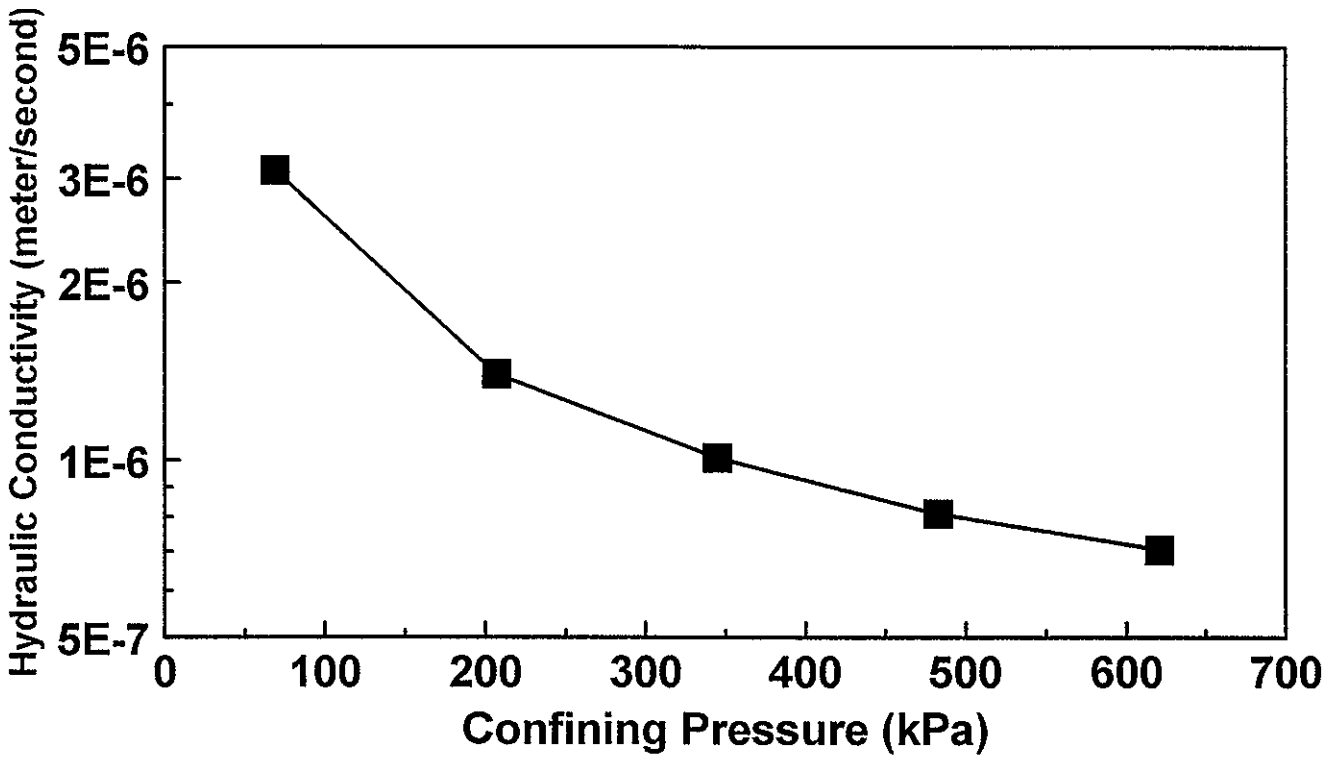
[1] mm = millimeters

[2] g = grams

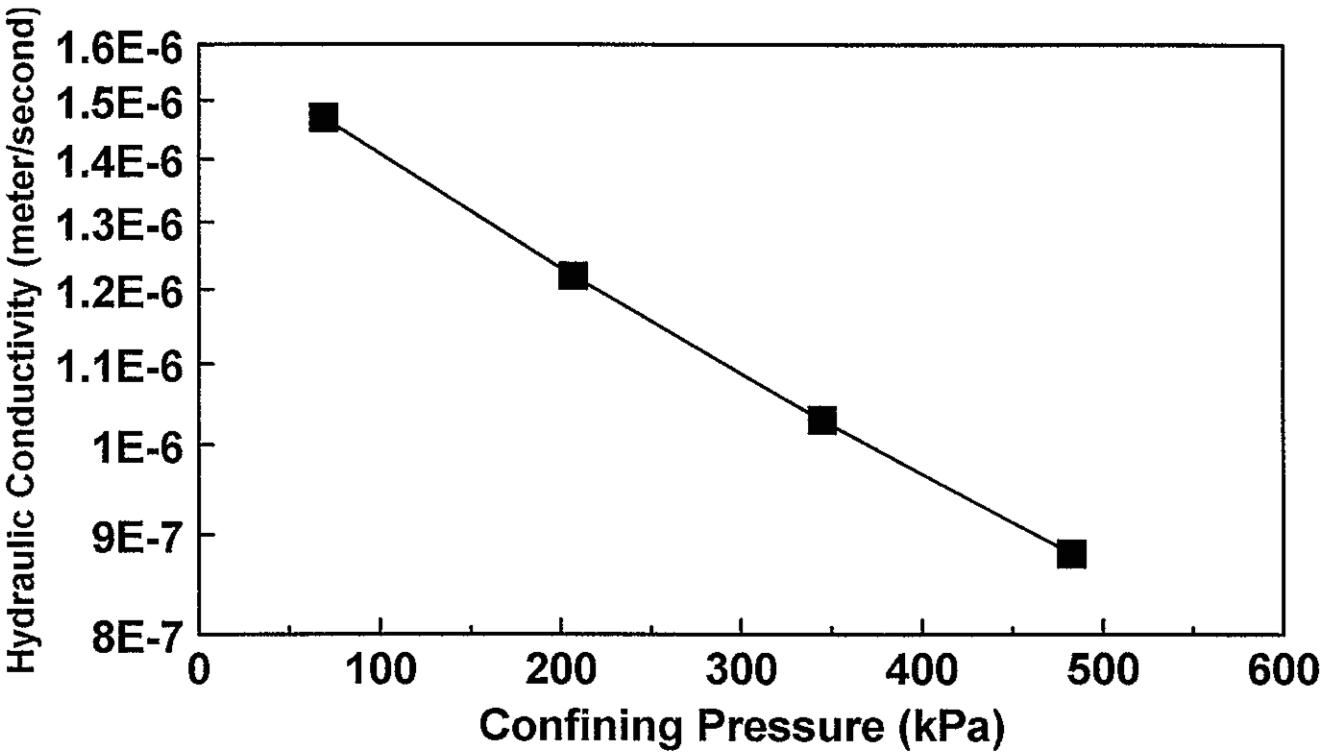
Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 23A: 44.5m-45.1m



Triaxial Hydraulic Conductivity
Drive 25A at Depth = 48.8m
Initial Density = 1996 kg/m^3



Triaxial Hydraulic Conductivity
Drive 25B at Depth = 49.4m
Initial Density = 2020 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 25B: **49.0m-49.7m**

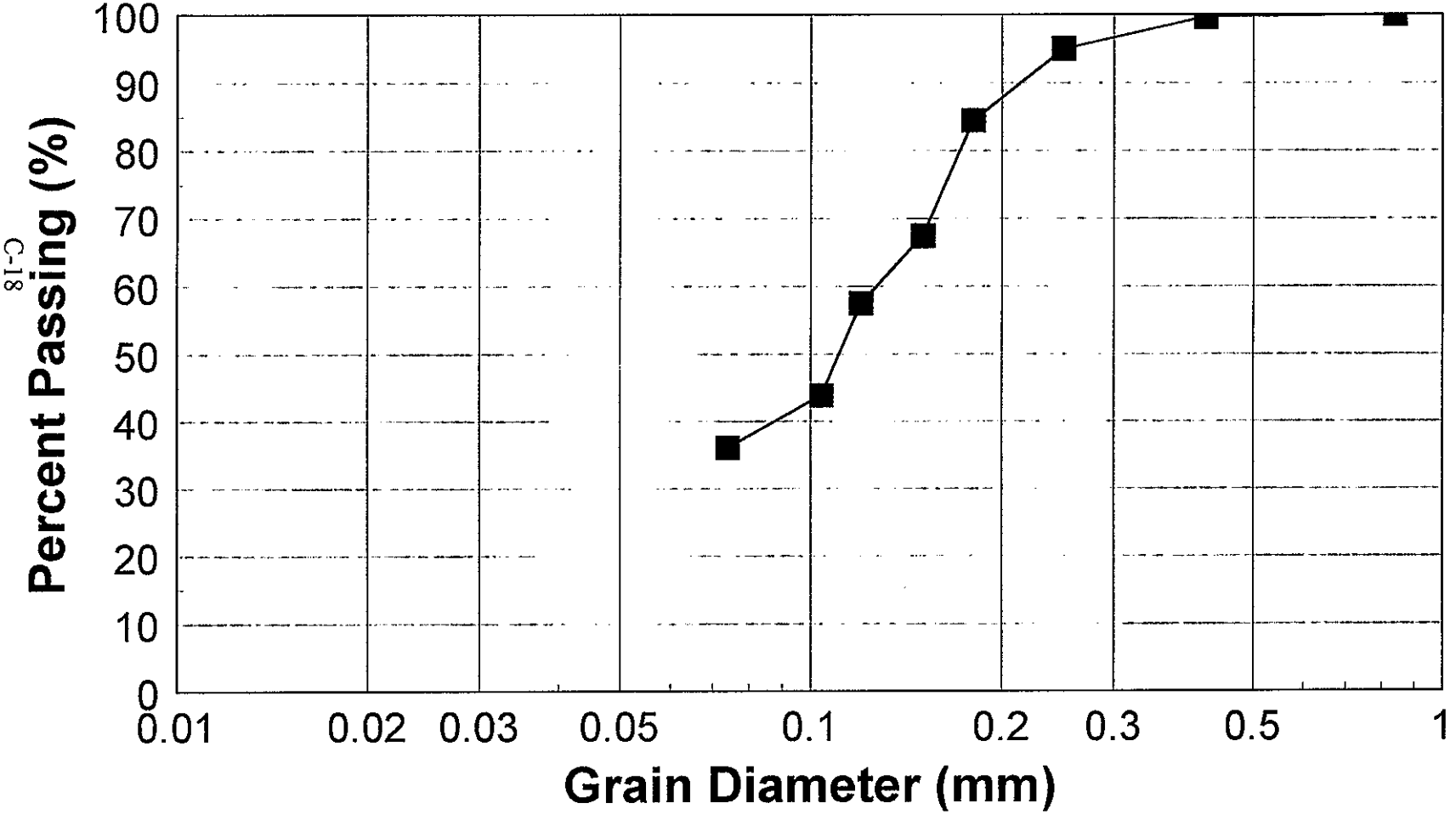
Sample Weight = 146.21 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0	0	0	100
40	0.42	0.48	0.48	0.33	99.67
60	0.25	6.83	7.31	5	95
80	0.18	15.35	22.66	15.5	84.5
100	0.15	24.93	47.59	32.55	67.45
120	0.12	14.49	62.08	42.46	57.54
140	0.1	19.97	82.05	56.12	43.88
200	0.07	11.38	93.43	63.9	36.1
PAN	-	51.7	145.13	99.26	-

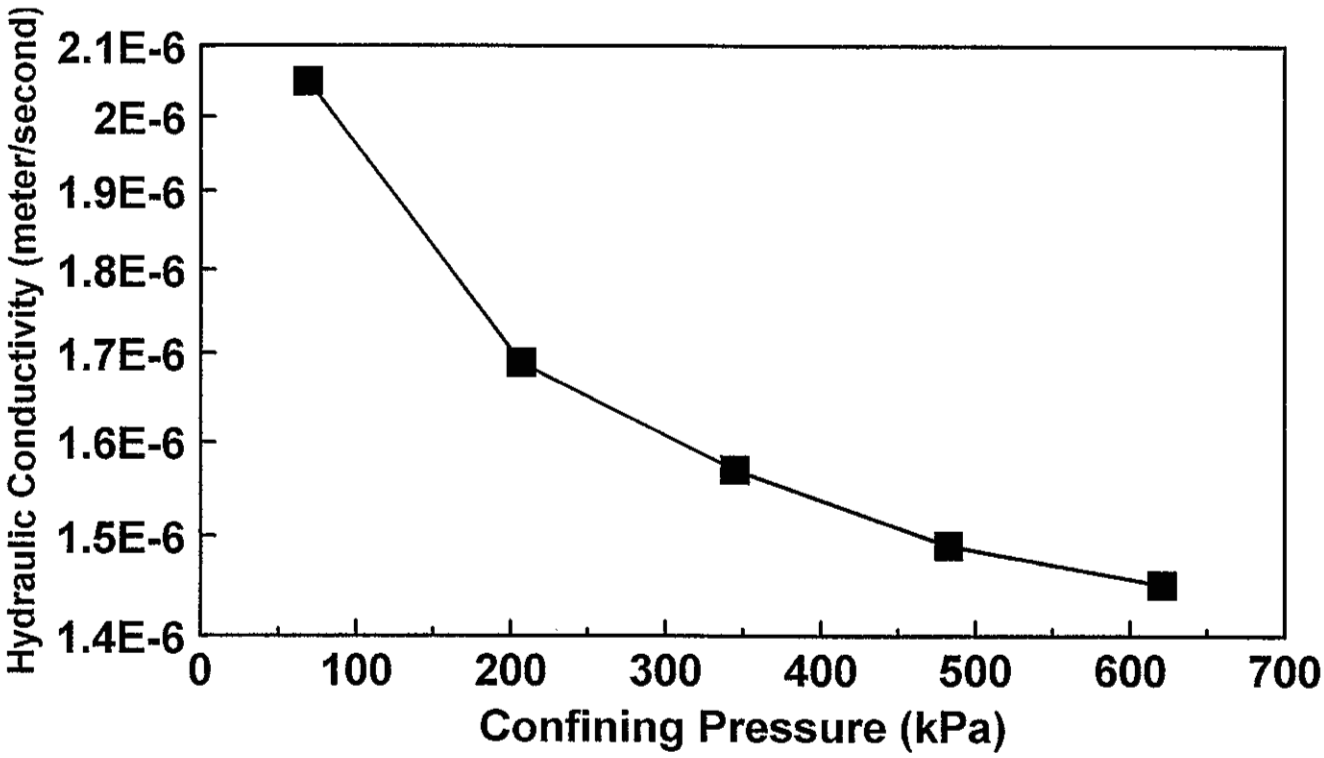
[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 25B: 49.0m-49.7m



Triaxial Hydraulic Conductivity
Drive 27B at Depth = 52.7m
Initial Density = 1828 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 27B: 52.6m-53.2m

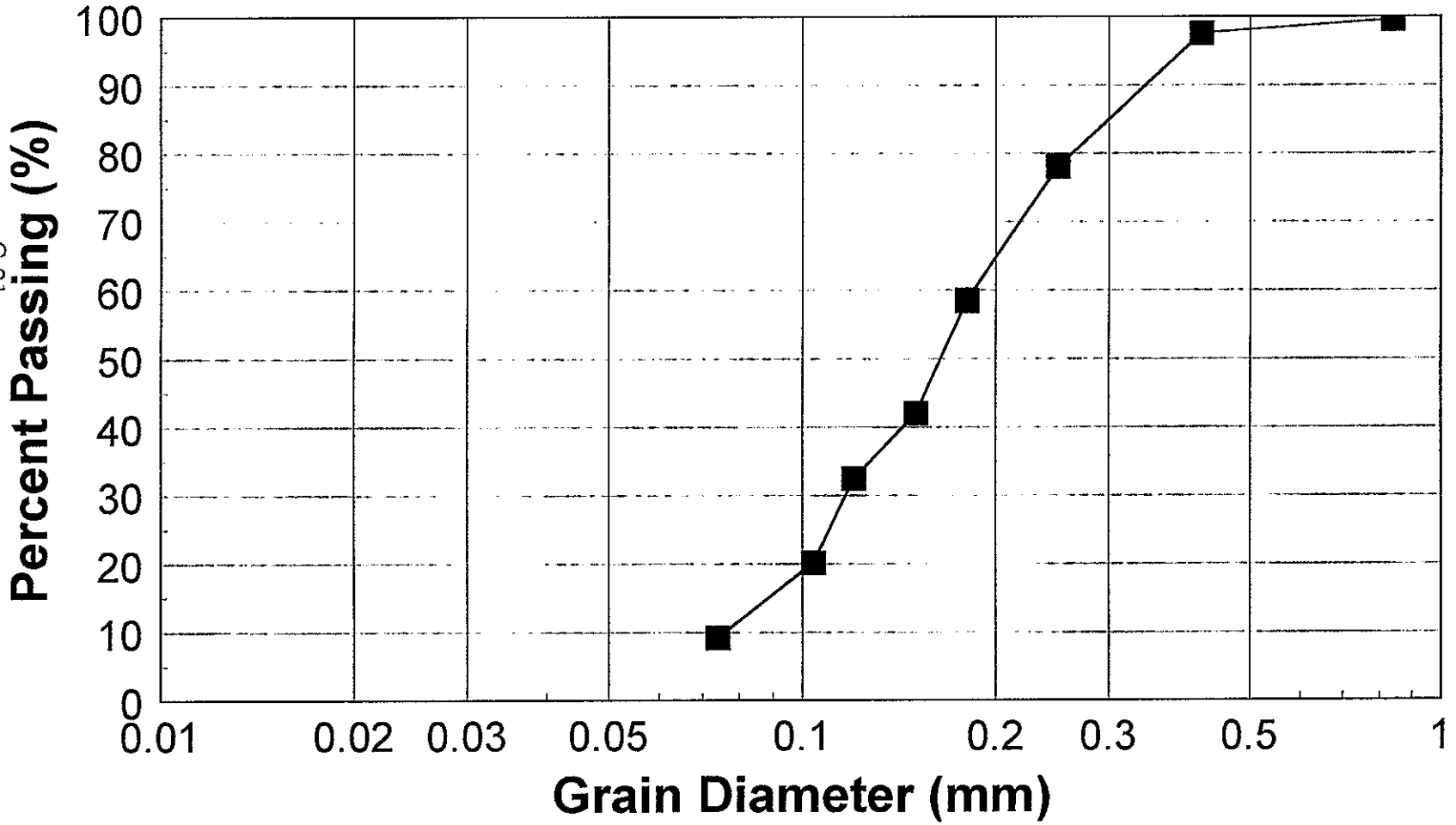
Sample Weight = 153.17 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.52	0.52	0.34	99.66
40	0.42	3.11	3.63	2.37	97.63
60	0.25	29.94	33.57	21.92	78.08
80	0.18	29.92	63.49	41.45	58.55
100	0.15	25.34	88.83	57.99	42.01
120	0.12	14.61	103.44	67.53	32.47
140	0.1	18.82	122.26	79.82	20.18
200	0.07	16.89	139.15	90.85	9.15
PAN	-	13.34	152.49	99.56	-

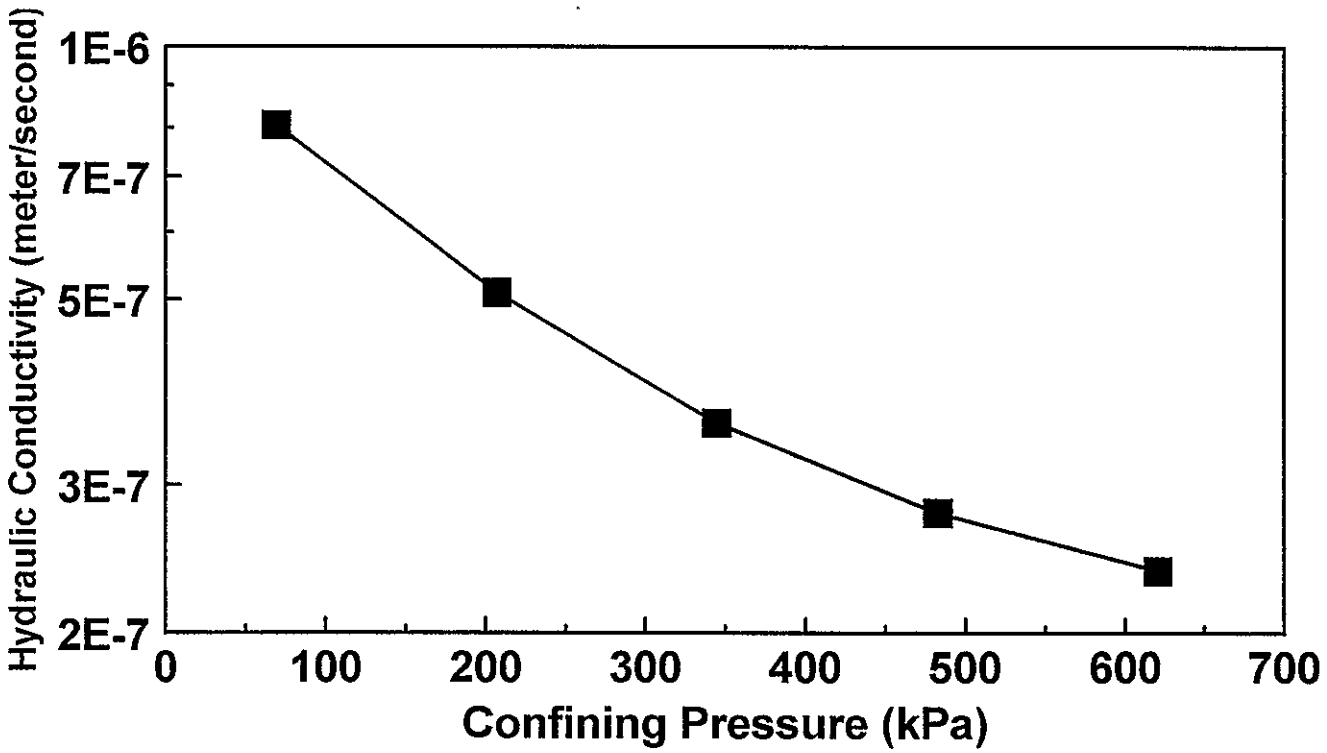
[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 27B: 52.6m-53.2m



Triaxial Hydraulic Conductivity
Drive 33A at Depth = 62.2m
Initial Density = 1944 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 33A: 61.9m-62.5m

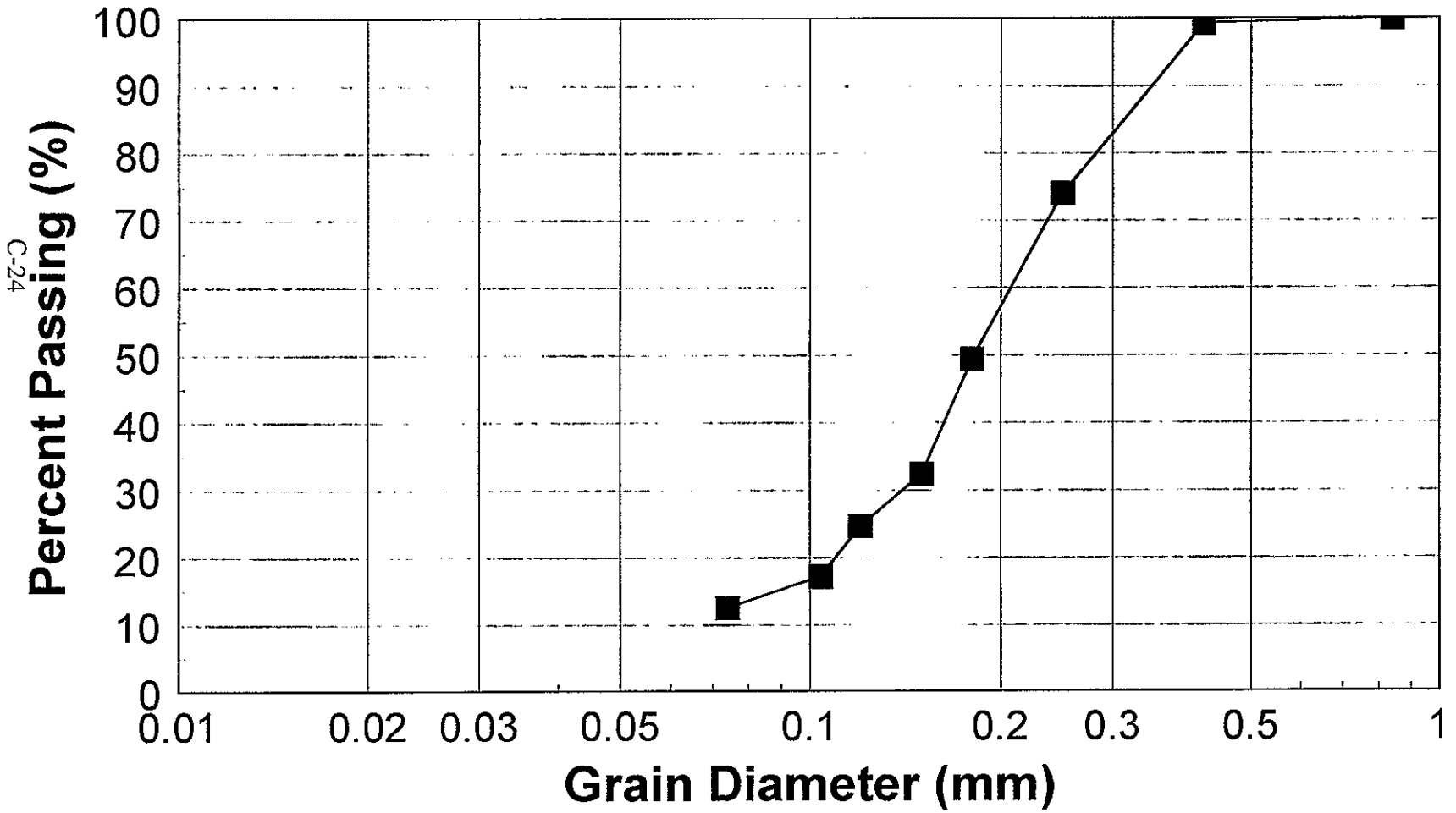
Sample Weight = 152.25 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0	0	0	100
40	0.42	1.08	1.08	0.71	99.29
60	0.25	38.36	39.44	25.9	74.1
80	0.18	37.59	77.03	50.59	49.41
100	0.15	25.96	102.99	67.65	32.35
120	0.12	11.58	114.57	75.25	24.75
140	0.1	11.43	126	82.76	17.24
200	0.07	7.16	133.16	87.46	12.54
PAN	-	18.54	151.7	99.64	-

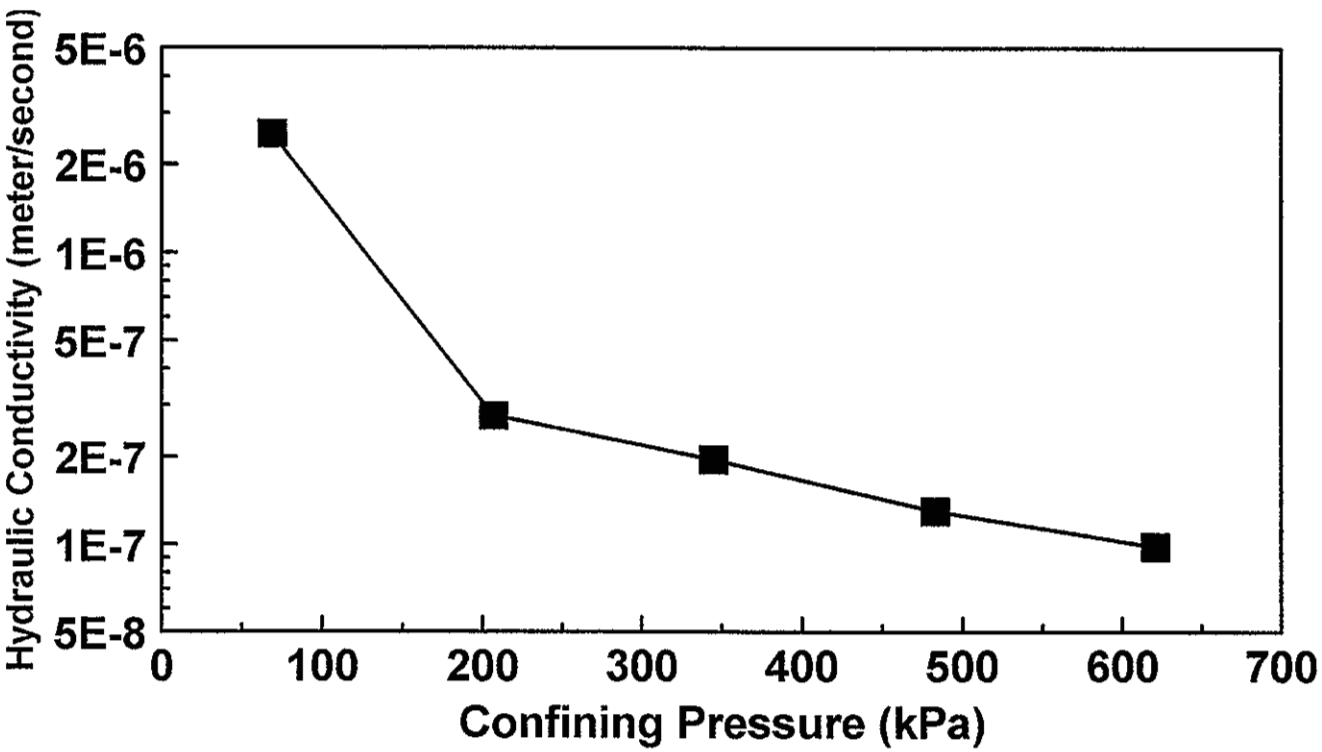
[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 33A: 61.8m-62.5m



Triaxial Hydraulic Conductivity
Drive 38A at Depth = 74.4m
Initial Density = 1726 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 38A: 74.1m-74.7m

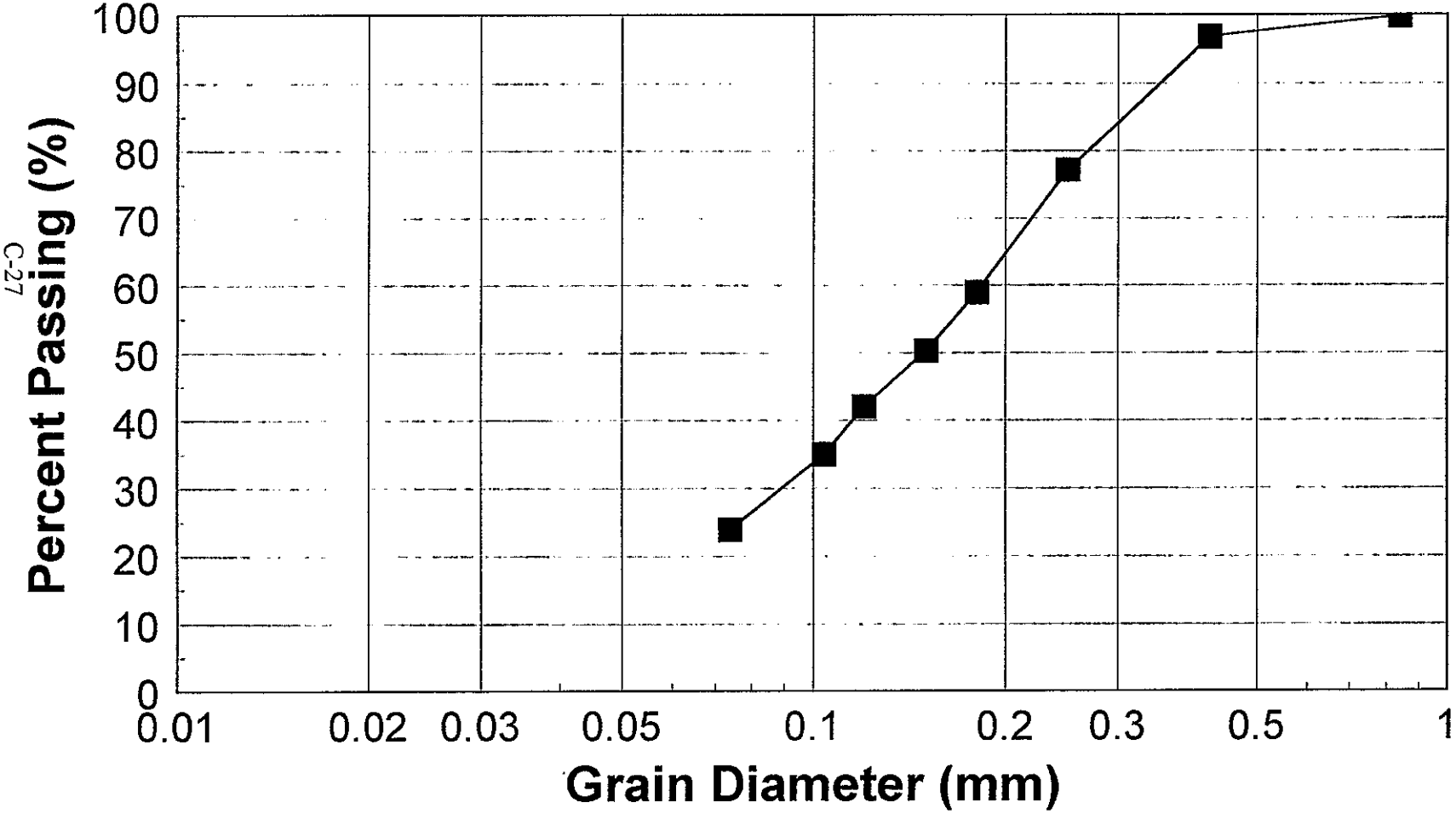
Sample Weight = 137.98 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.12	0.12	0.09	99.91
40	0.42	4.21	4.33	3.14	96.86
60	0.25	27.12	31.45	22.79	77.21
80	0.18	25.19	56.64	41.05	58.95
100	0.15	11.96	68.6	49.72	50.28
120	0.12	11.39	79.99	57.97	42.03
140	0.1	9.73	89.72	65.02	34.98
200	0.07	15.2	104.92	76.04	23.96
PAN	-	33.23	138.15	100.12	-

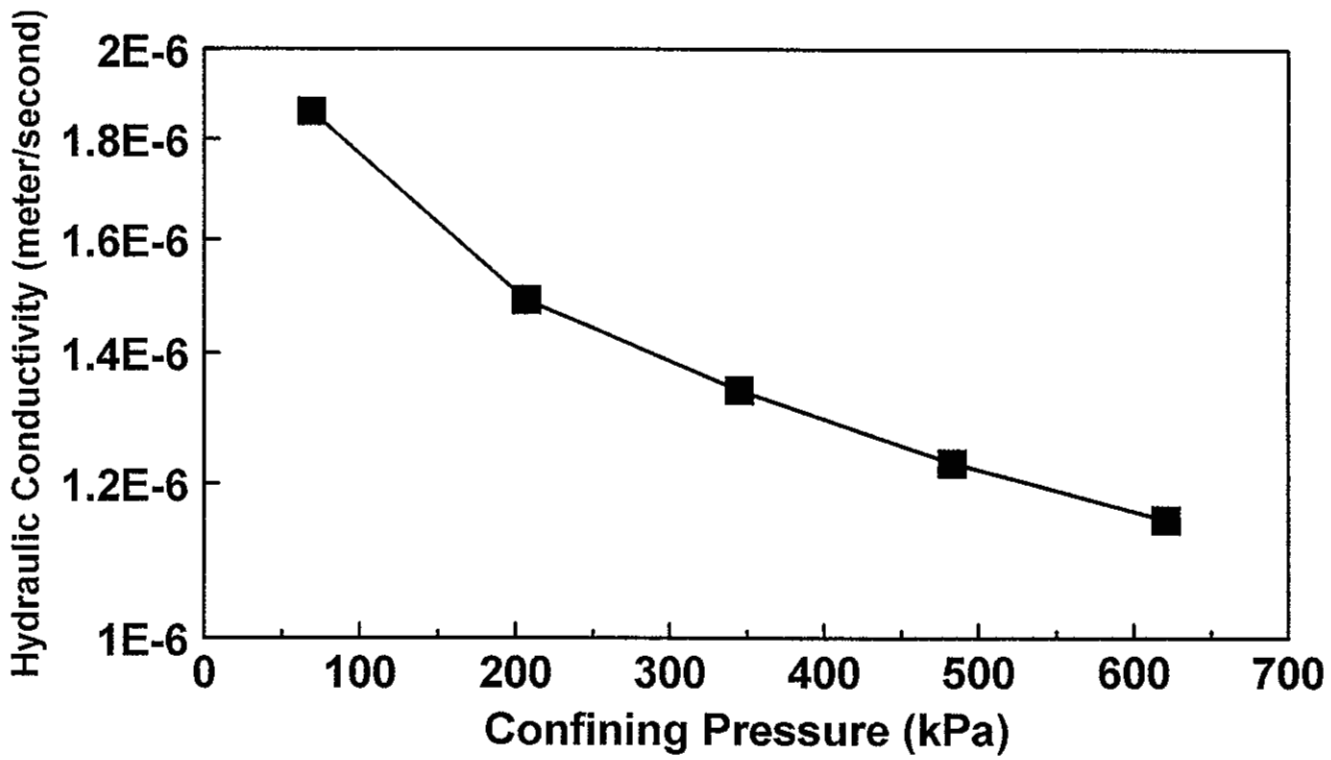
[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 38A: 74.1m-74.7m



Triaxial Hydraulic Conductivity
Drive 55B at Depth = 102.1m
Initial Density = 1822 kg/m^3



Mechanical Sieve Analysis
of Triaxial Permeability Test Sample

Drive 55B: 101.8m-102.4m

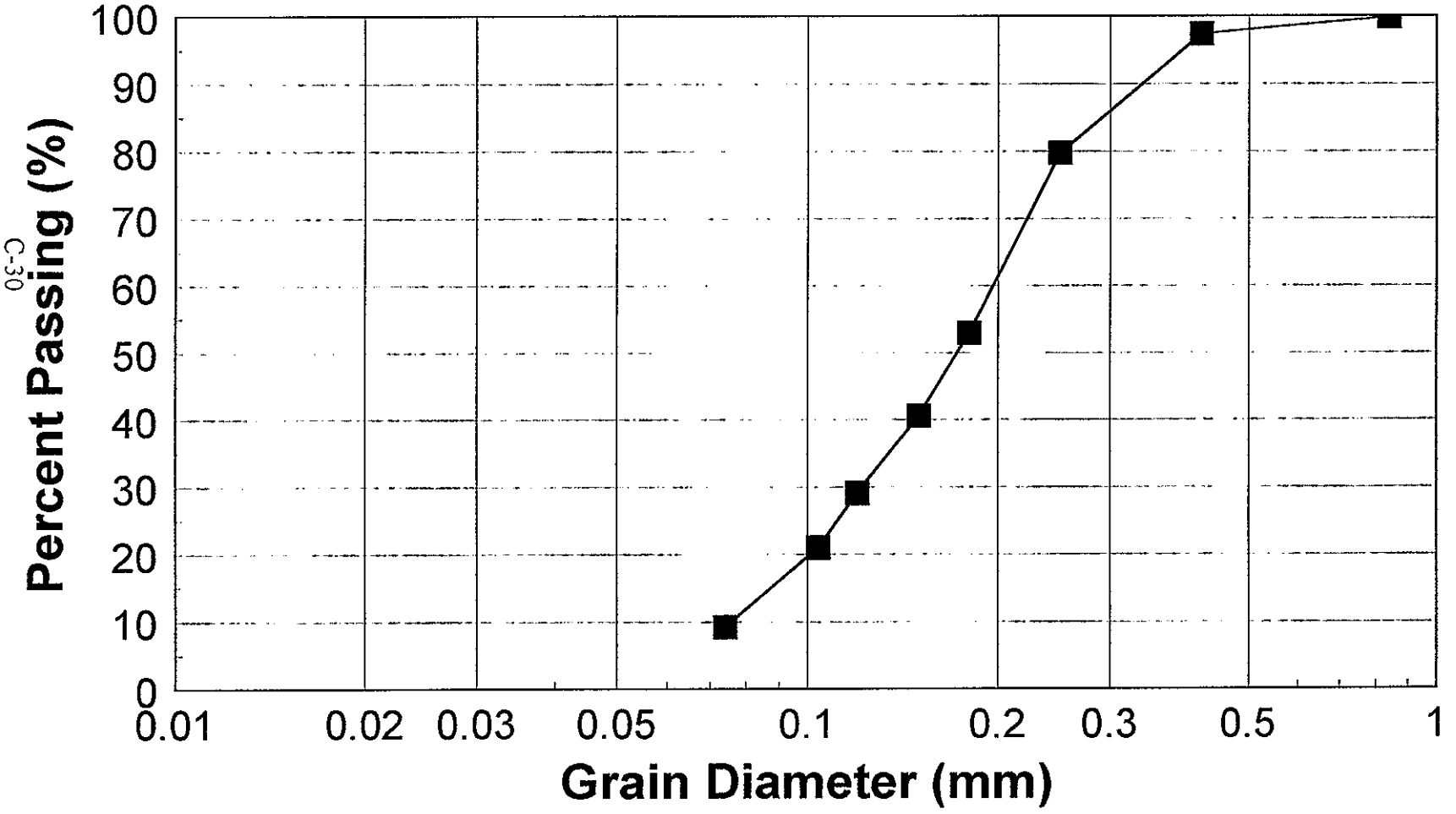
Sample Weight = 142.14 grams

Sieve Number	Grain Diameter (mm[1])	Retained Soil Weight (g[2])	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
20	0.84	0.18	0.18	0.13	99.87
40	0.42	3.58	3.76	2.65	97.35
60	0.25	25.01	28.77	20.24	79.76
80	0.18	38.09	66.86	47.04	52.96
100	0.15	17.62	84.48	59.43	40.57
120	0.12	16.24	100.72	70.86	29.14
140	0.1	11.57	112.29	79	21
200	0.07	16.75	129.04	90.78	9.22
PAN	-	12.51	141.55	99.58	-

[1] mm = millimeters

[2] g = grams

Particle Size Distribution of Triaxial Permeability Test Sample 98th St. Core - Drive 55B: 101.8m-102.4m



- Section D -
Composite Sample
Particle Size Distribution Data

Particle Size Distribution Analysis

Mechanical Sieve Analysis:

Prior to sieving, samples were broken-up with a mortar and pestle. A standard set of sieves were used, including numbers 4, 10, 20, 40, 60, 140, and 200. The sample portion retained in each sieve was weighed to determine the distribution of gravel and sand size particles. Fines were collected in a pan placed at the bottom of the stacked sieves. After dry sieving, the fines (silt/clay) were set aside for later use in hydrometer analysis.

Hydrometer Analysis:

Hydrometer analysis was used to measure the silt and clay distribution of the sample that passed through the number 200 sieve. The fines collected in the pan during mechanical sieving were soaked overnight in 125 mL of sodium hexametaphosphate solution in order to disperse the grains. Afterwards, the suspension was placed in a blender for 10 minutes for further dispersion. Next, the suspension was diluted to 1000 mL with distilled water, placed in a hydrometer cylinder, and the test conducted using a 152H hydrometer. A hydrometer correction of -3 was used to account for the impact of sodium hexametaphosphate on solution density. The following two equations were used for hydrometer analysis of grain size, **d**, in millimeters and percent finer than, $\mathbf{P_f}$:

$$d = \sqrt{\frac{30NL}{980(G_S - G_W)t}} \quad \text{, and}$$

$$P_f = \frac{100aR}{W_S} \quad ,$$

where **N** is the coefficient of viscosity in poises for water at test temperature, **L** is hydrometer effective depth in centimeters, $\mathbf{G_S}$ is the specific gravity of the soil solids (assumed to be 2.65), $\mathbf{G_W}$ is the specific gravity of water at test temperature, **t** is time in minutes, **a** is ratio of $\mathbf{G_S}$ to 2.65, **R** is the corrected hydrometer reading, and $\mathbf{W_S}$ is the dry weight in grams of the sample used in the hydrometer analysis. Wray (1986) provides a thorough description of particle size distribution analysis.

Gradation Analysis:

Sample gradation was determined after calculating the coefficient of curvature, $\mathbf{C_C}$, and the coefficient of uniformity, $\mathbf{C_U}$. Equations for both coefficients are as follows:

$$C_C = \frac{(D_{30})^2}{(D_{10})(D_{60})} \quad \text{, and}$$

$$C_U = \frac{D_{60}}{D_{10}} \quad ,$$

where $\mathbf{D_{10}}$ is the grain diameter at 10 % passing, $\mathbf{D_{30}}$ is the grain diameter at 30 % passing, and $\mathbf{D_{60}}$ is the grain diameter at 60 % passing. A sandy sample is considered well-graded if:

$$1 \leq C_C \leq 3 \quad , \text{and}$$

$$C_U \geq 6 \quad .$$

If either of these conditions do not hold, then the sample is said to be uniformly-graded.

References:

Wray, W. K. 1986. Measuring Engineering Properties of Soil. Prentice-Hall, Inc. Englewood Cliffs, NJ. 276 pages.

Note: **These samples (Units 1-21) appear to be composite rotary drill cuttings obtained from the borehole offset approximately 6 meters from the coring location. If this is the case, residual drilling mud may skew the overall results. Coring was done for stratigraphic information, while the rotary drill borehole was used for placement of monitoring well piezometers.**

Percentage of Gravel, Sand, and Fines

Sample	Percent Gravel (greater than 2 mm[1]) %	Percent Sand (2 mm to 0.074 mm) %	Percent Silt and Clay (less than 0.074 mm) %
Unit 1 (452m-457m)	0.9	84.5	14.6
Unit 2 (426m-452m)	0.7	93.4	5.9
Unit 3 (409m-426m)	0.9	89.4	9.7
Unit 4 (393m-409m)	1.2	94.5	4.3
Unit 5 (380m-393m)	8.8	85.3	5.9
Unit 6 (328m-380m)	0.5	95.3	4.2
Unit 7 (310m-328m)	6.5	87.4	6.1
Unit 8 (240m-310m)	3.7	91.0	5.3
Unit 9 (229m-240m)	14.3	76.6	9.1
Unit 10 (216m-229m)	23.7	63.7	12.6
Unit 11 (190m-216m)	13.6	78.4	8.0
Unit 12 (163m-190m)	9.8	76.0	14.2
Unit 13 (141m-163m)	2.7	80.0	17.3
Unit 14 (134m-141m)	7.7	80.7	11.6
Unit 15 (102m-134m)	1.6	89.2	9.2
Unit 16 (72m-102m)	1.5	89.2	9.3
Unit 17 (56m-72m)	2.8	89.6	7.6
Unit 18 (30m-56m)	7.7	83.5	8.8
Unit 19 (24m-30m)	1.9	92.8	5.3
Unit 20 (18m-24m)	-	-	-
Unit 21 (6m-18m)	12.8	81.3	5.9

[1] mm = millimeters

Coefficients of Curvature, Coefficients of Uniformity, and Grading

Sample	Coefficient of Curvature (C_C)	Coefficient of Uniformity (C_U)	Grading
Unit 1 (452m-457m)	1.32	4.00	Uniform
Unit 2 (426m-452m)	1.20	2.40	Uniform
Unit 3 (409m-426m)	0.86	3.00	Uniform
Unit 4 (393m-409m)	1.47	3.40	Uniform
Unit 5 (380m-393m)	1.23	3.17	Uniform
Unit 6 (328m-380m)	1.19	2.33	Uniform
Unit 7 (310m-328m)	0.95	2.70	Uniform
Unit 8 (240m-310m)	1.16	2.69	Uniform
Unit 9 (229m-240m)	0.74	6.67	Uniform
Unit 10 (216m-229m)	0.29	8.24	Uniform
Unit 11 (190m-216m)	0.85	4.70	Uniform
Unit 12 (163m-190m)	1.52	9.25	Well
Unit 13 (141m-163m)	1.33	5.33	Uniform
Unit 14 (134m-141m)	1.47	7.55	Well
Unit 15 (102m-134m)	0.88	3.00	Uniform
Unit 16 (72m-102m)	1.04	2.74	Uniform
Unit 17 (56m-72m)	1.13	2.84	Uniform
Unit 18 (30m-56m)	1.00	2.78	Uniform
Unit 19 (24m-30m)	1.07	2.70	Uniform
Unit 20 (18m-24m)	-	-	-
Unit 21 (6m-18m)	1.10	3.92	Uniform

Mechanical Sieve Analysis

Unit #1: 452m-457m (1483'-1500')

Date: 5/29/97

Sample Weight = 150 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g^2)	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	500.8	1.3	1.3	0.87	99.13
20	0.84	304.1	307.3	3.2	4.5	3	97
40	0.42	391.8	400.5	8.7	13.2	8.8	91.2
60	0.25	403.3	424.4	21.1	34.3	22.87	77.13
100	0.15	465	511.9	46.9	81.2	54.13	45.87
140	0.1	242.3	266.4	24.1	105.3	70.2	29.8
200	0.07	358.9	381.7	22.8	128.1	85.4	14.6
PAN	-	370.2	392	21.8	149.9	99.93	-

[1] mm = millimeters

[2] g = grams

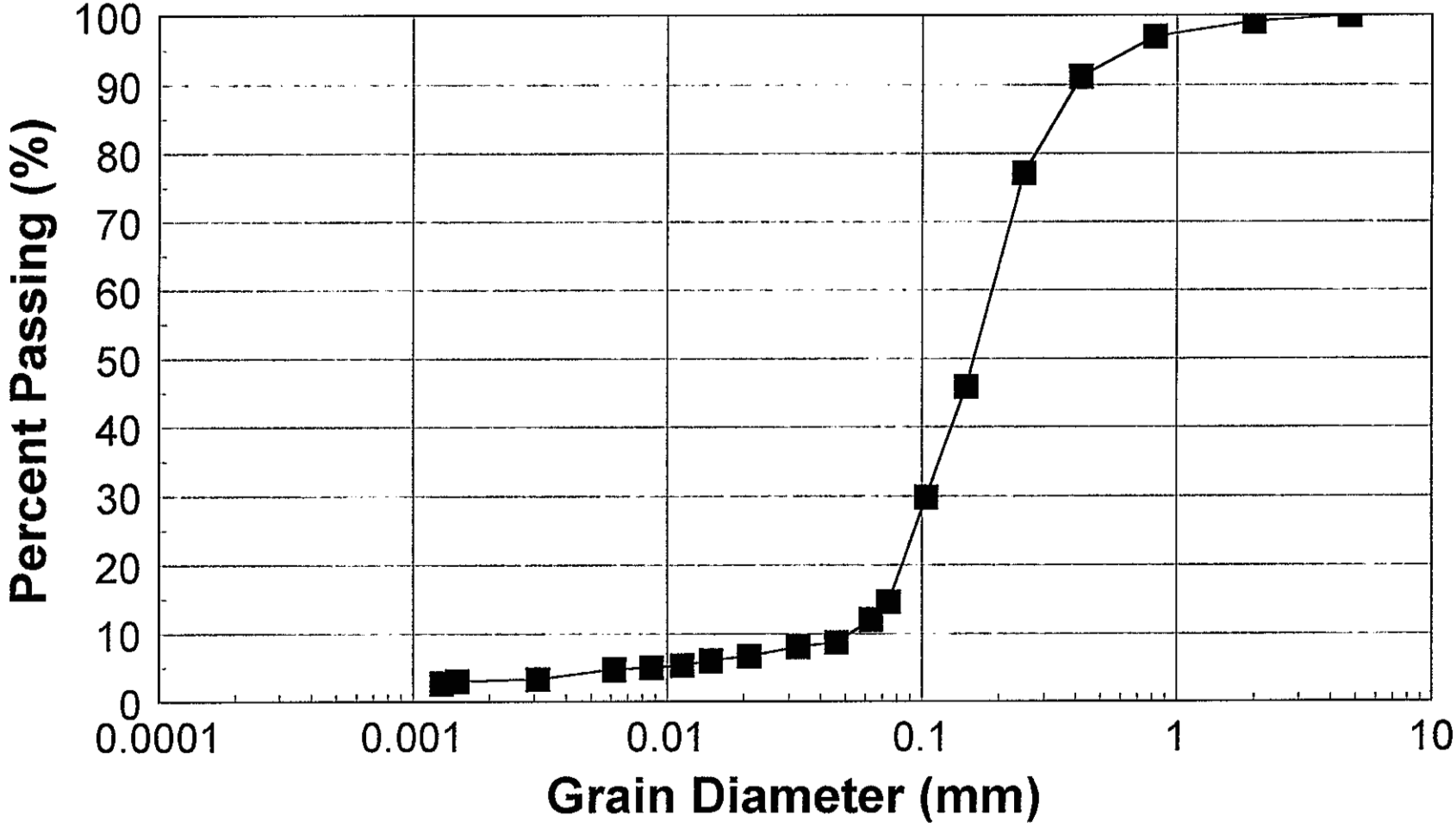
Hydrometer Analysis

Unit #1: 452m-457m (1483'-1500')

Date: 6/2/97
Sample Weight for Hydrometer Analysis = 21.8 grams
Overall Sample Weight = 150 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	25	22	28	0.99623	0.00836	12.2	0.0869	100	-
0.5	21	18	28	0.99623	0.00836	12.9	0.0632	82.6	12
1	16	13	28	0.99623	0.00836	13.7	0.046	59.6	8.7
2	15	12	28	0.99623	0.00836	13.8	0.0327	55	8
5	13	10	28	0.99623	0.00836	14.2	0.021	45.9	6.7
10	12	9	28	0.99623	0.00836	14.3	0.0149	41.3	6
17	11	8	28	0.99623	0.00836	14.5	0.0115	36.7	5.3
30	10.5	7.5	28	0.99623	0.00836	14.6	0.0087	34.4	5
60	10	7	28	0.99623	0.00836	14.7	0.0062	32.1	4.7
240	8	5	28	0.99623	0.00836	15	0.0031	22.9	3.3
990	7.5	4.5	28	0.99623	0.00836	15.1	0.0015	20.6	3
1500	7	4	28	0.99623	0.00836	15.2	0.0013	18.3	2.7

Particle Size Distribution
98th St. Monitoring Well - Unit 1: 452m-457m



Mechanical Sieve Analysis

Unit #2: 426m-452m (1399'-1483')

Date: 6/6/97

Sample Weight = 150 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	500.5	1	1	0.67	99.33
20	0.84	304.1	305.5	1.4	2.4	1.6	98.4
40	0.42	391.8	400.4	8.6	11	7.33	92.67
60	0.25	403.3	440.5	37.2	48.2	32.13	67.87
100	0.15	465	527.5	62.5	110.7	73.8	26.2
140	0.1	242.3	263.4	21.1	131.8	87.87	12.13
200	0.07	358.9	368.2	9.3	141.1	94.07	5.93
PAN	-	370.2	379.3	9.1	150.2	100.13	-

[1] mm = millimeters

[2] g = grams

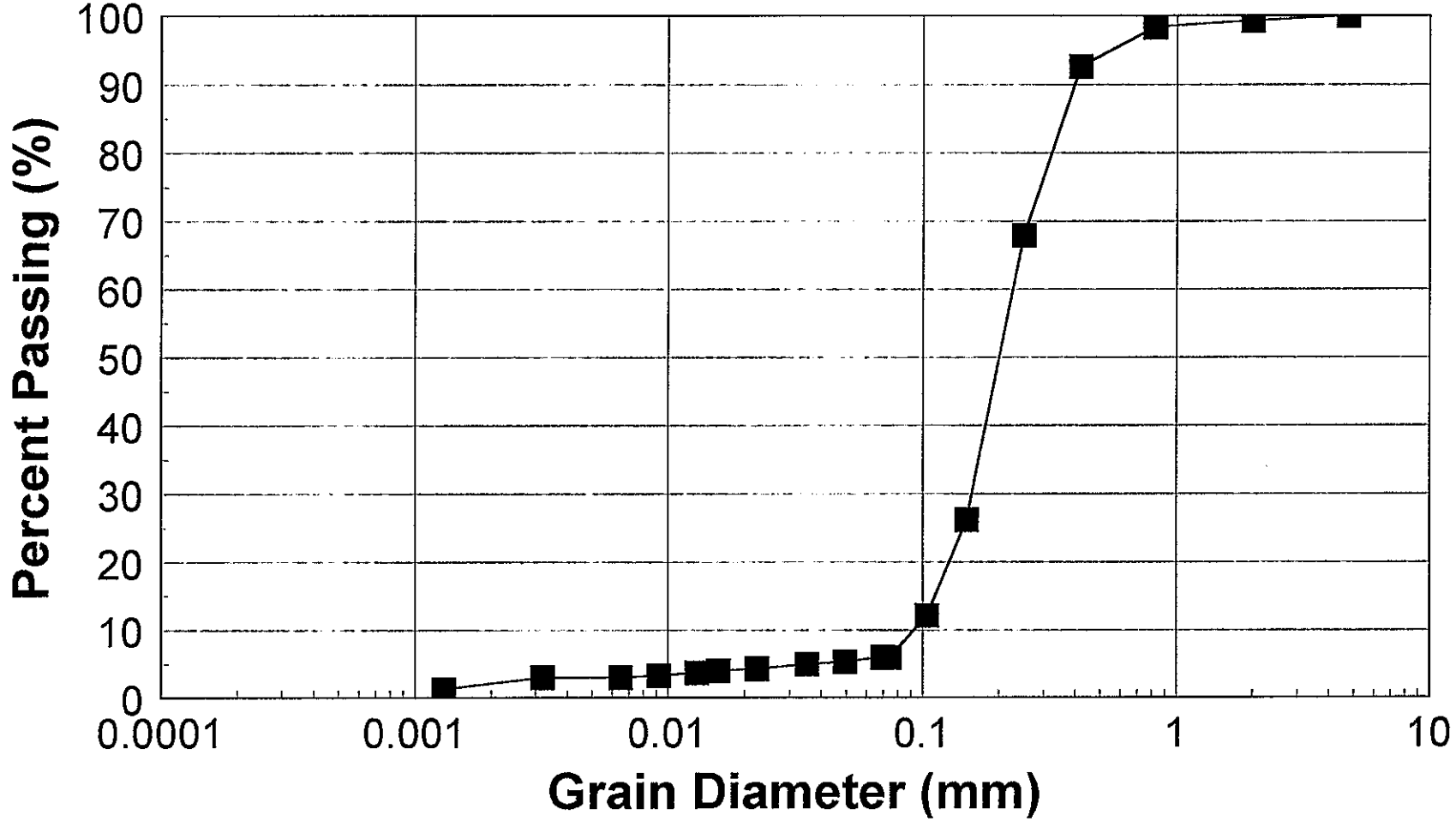
Hydrometer Analysis

Unit #2: 426m-452m (1399'-1483')

Date: 6/9/97
Sample Weight for Hydrometer Analysis = 9.1 grams
Overall Sample Weight = 150 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	12.5	9.5	24	0.9973	0.00916	14.25	0.0983	100	-
0.5	12	9	24	0.9973	0.00916	14.3	0.0697	98.9	6
1	11	8	24	0.9973	0.00916	14.5	0.0496	87.9	5.3
2	10.5	7.5	24	0.9973	0.00916	14.6	0.0352	82.4	5
5	9.5	6.5	24	0.9973	0.00916	14.75	0.0224	71.4	4.3
10	9	6	24	0.9973	0.00916	14.8	0.0158	65.9	4
15	8.5	5.5	24	0.9973	0.00916	14.9	0.013	60.4	3.7
30	8	5	24	0.9973	0.00916	15	0.0092	54.9	3.3
60	7.5	4.5	24	0.9973	0.00916	15.1	0.0065	49.5	3
245	7.5	4.5	25	0.99704	0.00895	15.1	0.0032	49.5	3
1560	5	2	25	0.99704	0.00895	15.5	0.0013	21.9	1.3

Particle Size Distribution
98th St. Monitoring Well - Unit 2: 426m-452m



Mechanical Sieve Analysis

Unit #3: 409m-426m (1341'-1399')

Date: 6/6/97

Sample Weight = 150 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	535.1	0	0	0	100
10	2	524.5	525.9	1.4	1.4	0.93	99.07
20	0.84	404.3	411.9	7.6	9	6	94
40	0.42	280.6	297.1	16.5	25.5	17	83
60	0.25	392.3	425.7	33.4	58.9	39.27	60.73
100	0.15	243.7	280.6	36.9	95.8	63.87	36.13
140	0.1	297.9	320.6	22.7	118.5	79	21
200	0.07	238	254.9	16.9	135.4	90.27	9.73
PAN	-	349.9	364.3	14.4	149.8	99.87	-

[1] mm = millimeters

[2] g = grams

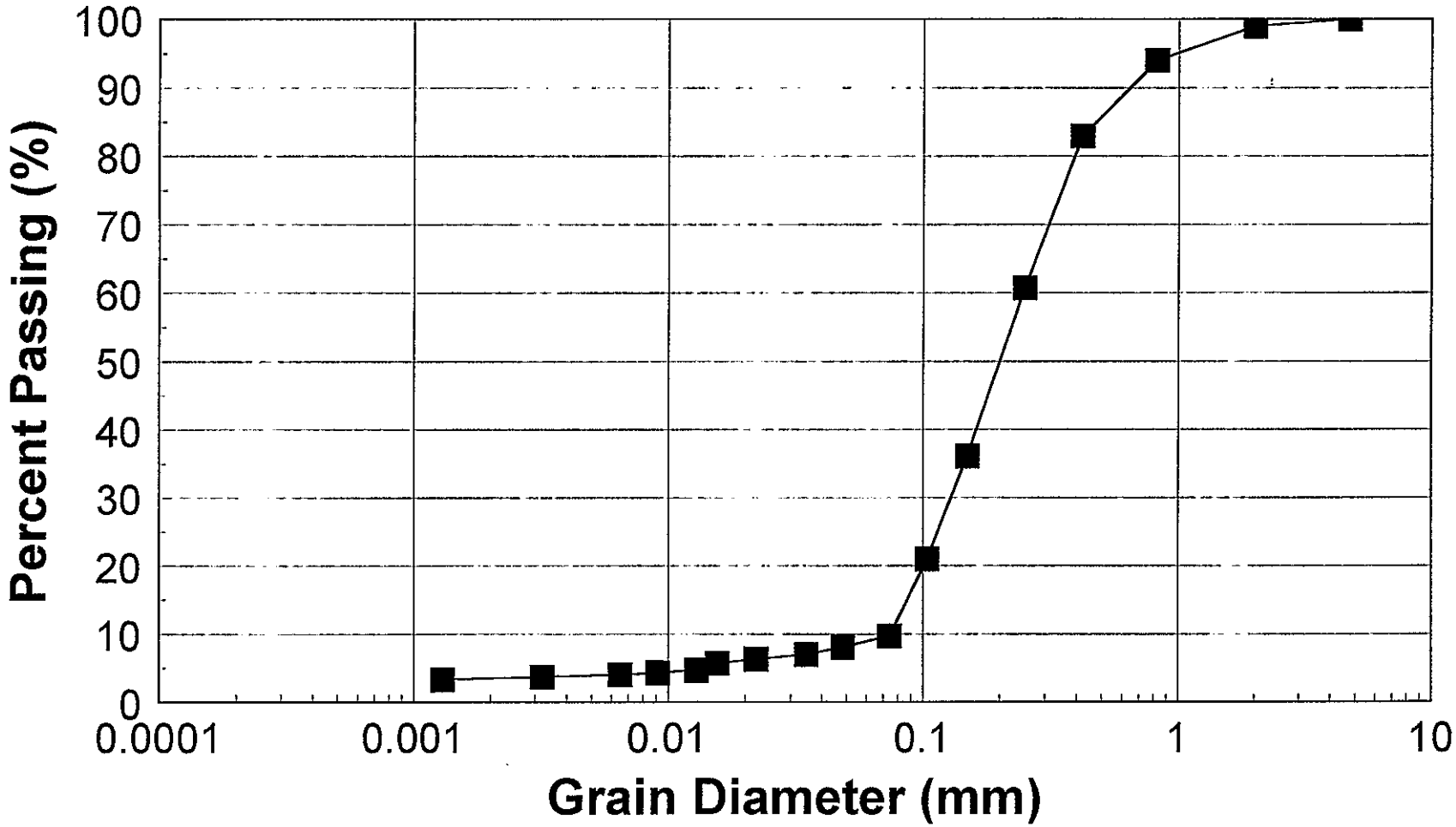
Hydrometer Analysis

Unit #3: 409m-426m (1341'-1399')

Date: 6/9/97
Sample Weight for Hydrometer Analysis = 14.4 grams
Overall Sample Weight = 150 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	18	15	24	0.9973	0.00916	13.3	0.095	100	-
0.5	17.5	14.5	24	0.9973	0.00916	13.4	0.0674	100	-
1	15	12	24	0.9973	0.00916	13.8	0.0484	83.3	8
2	13.5	10.5	24	0.9973	0.00916	14.1	0.0346	72.9	7
5	12.5	9.5	24	0.9973	0.00916	14.25	0.022	66	6.3
10	11.5	8.5	24	0.9973	0.00916	14.4	0.0156	59	5.7
15	10	7	24	0.9973	0.00916	14.7	0.0129	48.6	4.7
30	9.5	6.5	24	0.9973	0.00916	14.75	0.0091	45.1	4.3
60	9	6	24	0.9973	0.00916	14.8	0.0065	41.7	4
245	8.5	5.5	25	0.99704	0.00895	14.9	0.0032	38.2	3.7
1560	8	5	25	0.99704	0.00895	15	0.0013	34.7	3.3

Particle Size Distribution
98th St. Monitoring Well - Unit 3: 409m-426m



Mechanical Sieve Analysis

Unit #4: 393m-409m (1291'-1341')

Date: 6/12/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	501.9	2.4	2.4	1.2	98.8
20	0.84	304.1	311.6	7.5	9.9	4.95	95.05
40	0.42	391.8	426.2	34.4	44.3	22.15	77.85
60	0.25	403.3	475	71.7	116	58	42
100	0.15	465	520.2	55.2	171.2	85.6	14.4
140	0.1	242.3	256.6	14.3	185.5	92.75	7.25
200	0.07	358.9	364.9	6	191.5	95.75	4.25
PAN	-	370.2	378.7	8.5	200	100	-

[1] mm = millimeters

[2] g = grams

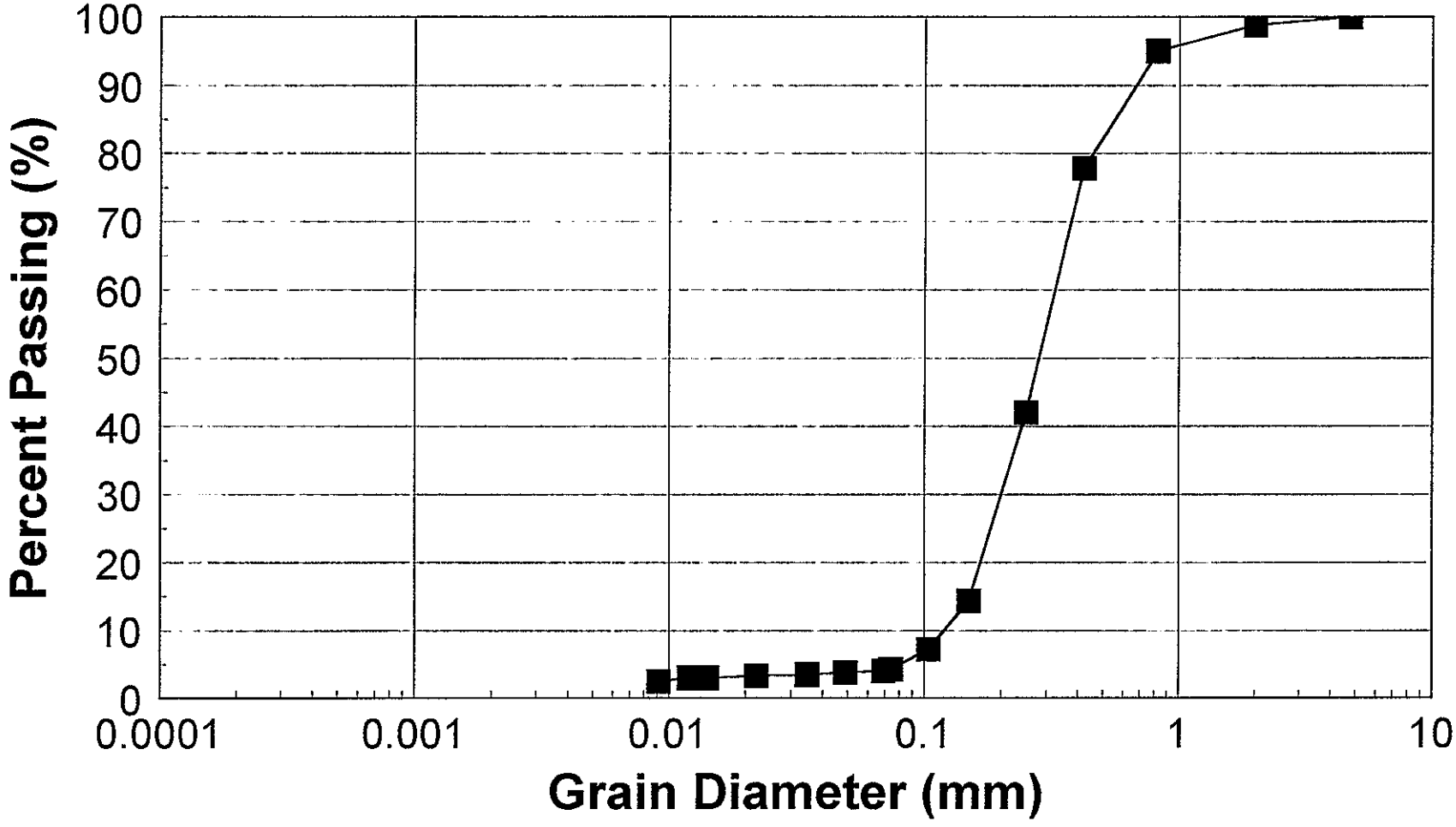
Hydrometer Analysis

Unit #4: 393m-409m (1291'-1341')

Date: 6/13/97
Sample Weight for Hydrometer Analysis = 8.5 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	11.5	8.5	25	0.99704	0.00895	14.4	0.0977	100	-
0.5	11	8	25	0.99704	0.00895	14.5	0.0693	94.1	4
1	10.5	7.5	25	0.99704	0.00895	14.6	0.0492	88.2	3.8
2	10	7	25	0.99704	0.00895	14.7	0.0349	82.4	3.5
5	9.5	6.5	25	0.99704	0.00895	14.75	0.0221	76.5	3.3
10	9	6	25	0.99704	0.00895	14.8	0.0142	70.6	3
17	9	6	25	0.99704	0.00895	14.8	0.012	70.7	3
30	8	5	25	0.99704	0.00895	15	0.0091	58.8	2.5

Particle Size Distribution
98th St. Monitoring Well - Unit 4: 393m-409m



Mechanical Sieve Analysis

Unit #5: **380m-393m (1246'-1291')**

Date: 6/12/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	548.4	13.3	13.3	6.65	93.35
10	2	524.5	528.8	4.3	17.6	8.8	91.2
20	0.84	404.3	413	8.7	26.3	13.15	86.85
40	0.42	280.6	302.5	21.9	48.2	24.1	75.9
60	0.25	392.3	451.3	59	107.2	53.6	46.4
100	0.15	243.7	295.2	51.5	158.7	79.35	20.65
140	0.1	297.9	317	19.1	177.8	88.9	11.1
200	0.07	238	248.5	10.5	188.3	94.15	5.85
PAN	-	349.9	360.7	10.8	199.1	99.55	-

[1] mm = millimeters

[2] g = grams

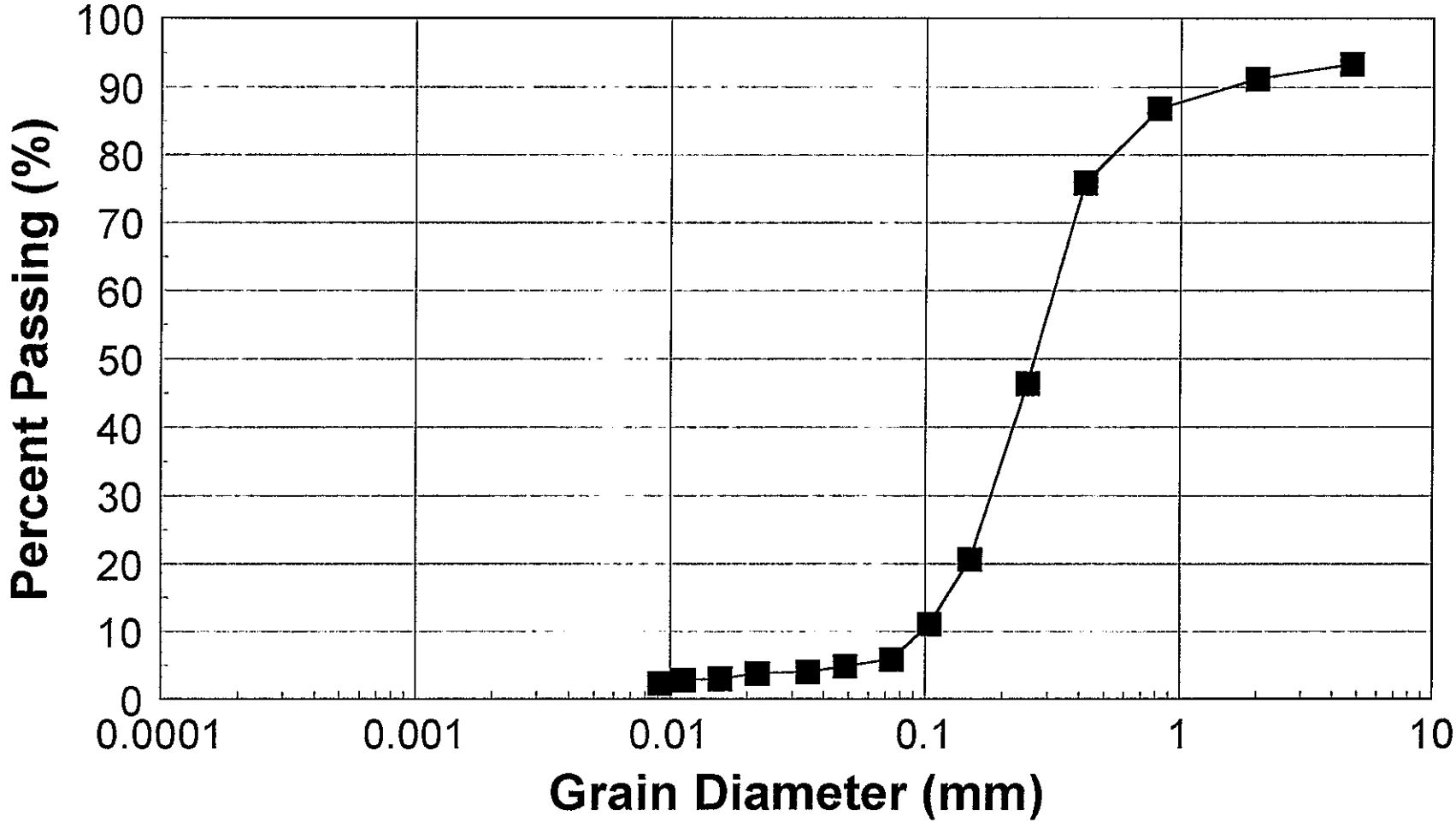
Hydrometer Analysis

Unit #5: 380m-393m (1246'-1291')

Date: 6/13/97
Sample Weight for Hydrometer Analysis = 10.8 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	14.5	11.5	25	0.99704	0.00895	13.9	0.096	100	-
0.5	14	11	25	0.99704	0.00895	14	0.0681	100	-
1	12.5	9.5	25	0.99704	0.00895	14.25	0.0486	88	4.8
2	11	8	25	0.99704	0.00895	14.5	0.0347	74.1	4
5	10.5	8.5	25	0.99704	0.00895	14.6	0.022	69.4	3.8
10	9	6	25	0.99704	0.00895	14.8	0.0157	55.6	3
17	8.5	5.5	25	0.99704	0.00895	14.9	0.0113	50.9	2.8
30	7.5	4.5	25	0.99704	0.00895	15.1	0.0091	41.7	2.3

Particle Size Distribution
98th St. Monitoring Well - Unit 5: 380m-393m



Mechanical Sieve Analysis

Unit #6: 328m-380m (1076'-1246')

Date: 6/16/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	500.4	0.9	0.9	0.45	99.55
20	0.84	304.1	311.3	7.2	8.1	4.05	95.95
40	0.42	391.8	415.3	23.5	31.6	15.8	84.2
60	0.25	403.3	467.2	63.9	95.5	47.75	52.25
100	0.15	465	534.9	69.9	165.4	82.7	17.3
140	0.1	242.3	261.2	18.9	184.3	92.15	7.85
200	0.07	358.9	366.2	7.3	191.6	95.8	4.2
PAN	-	370.2	378.8	8.6	200.2	100.1	-

[1] mm = millimeters

[2] g = grams

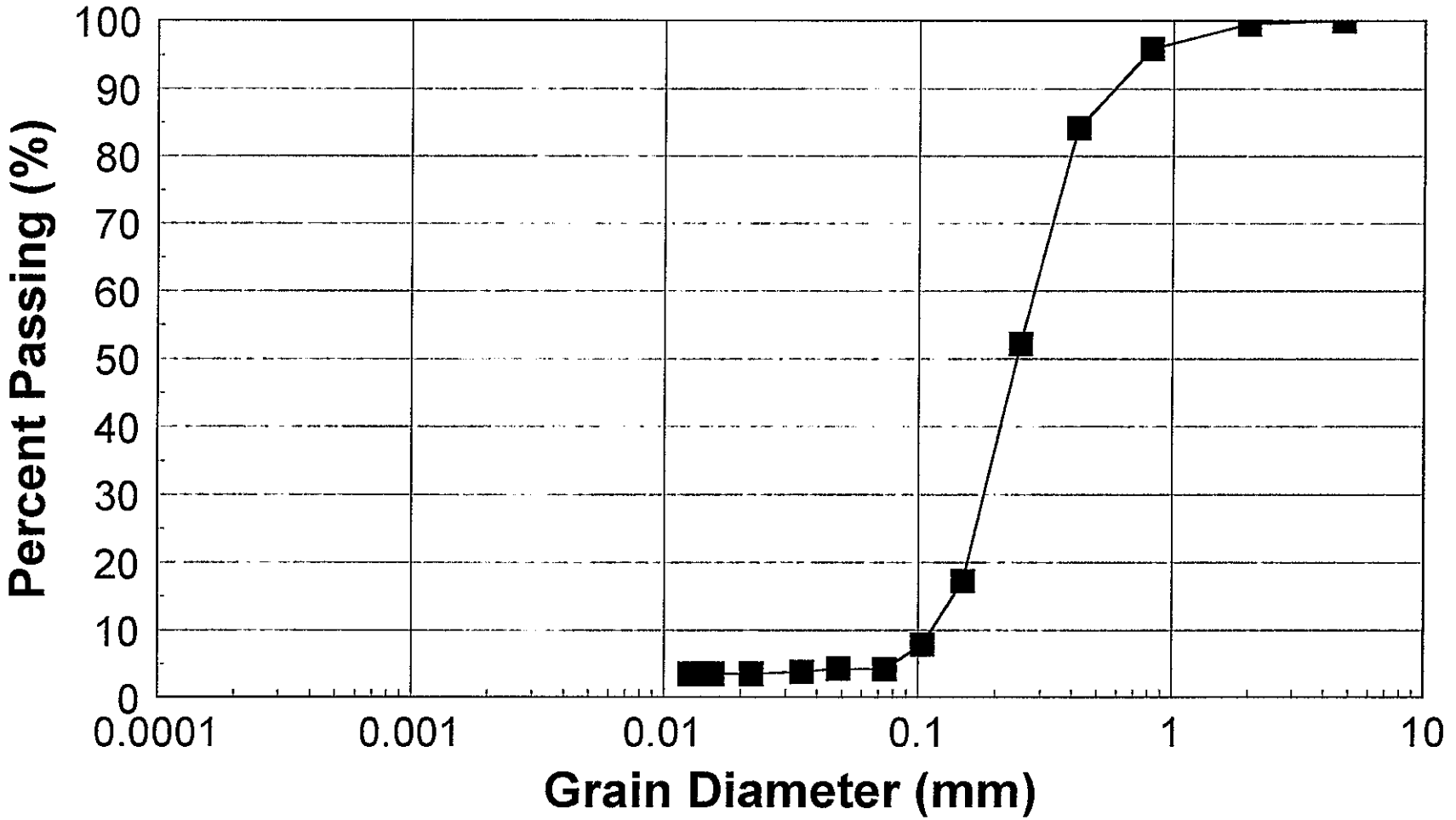
Hydrometer Analysis

Unit #6: 328m-380m (1076'-1246')

Date: 6/17/97
Sample Weight for Hydrometer Analysis = 8.6 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	13	10	25	0.99704	0.00895	14.2	0.097	100	-
0.5	12	9	25	0.99704	0.00895	14.3	0.0689	100	-
1	11.5	8.5	25	0.99704	0.00895	14.2	0.0485	98.8	4.3
2	10.5	7.5	25	0.99704	0.00895	14.6	0.0348	87.2	3.8
5	10	7	25	0.99704	0.00895	14.7	0.0221	81.4	3.5
10	10	7	25	0.99704	0.00895	14.7	0.0156	81.4	3.5
15	10	7	25	0.99704	0.00895	14.7	0.0127	81.1	3.5

Particle Size Distribution
98th St. Monitoring Well - Unit 6: 328m-380m



Mechanical Sieve Analysis

Unit #7: 310m-328m (1017'-1076')

Date: 6/16/97

Sample Weight = 193.8 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	539	3.9	3.9	2.01	97.99
10	2	524.5	533.1	8.6	12.5	6.45	93.55
20	0.84	404.3	419.4	15.1	27.6	14.24	85.76
40	0.42	280.6	297.7	17.1	44.7	23.07	76.93
60	0.25	392.3	425.3	33	77.7	40.09	59.91
100	0.15	243.7	302.7	59	136.7	70.54	29.46
140	0.1	297.9	325.1	27.2	163.9	84.57	15.43
200	0.07	238	256	18	181.9	93.86	6.14
PAN	-	349.9	361.8	11.9	193.8	100	-

[1] mm = millimeters

[2] g = grams

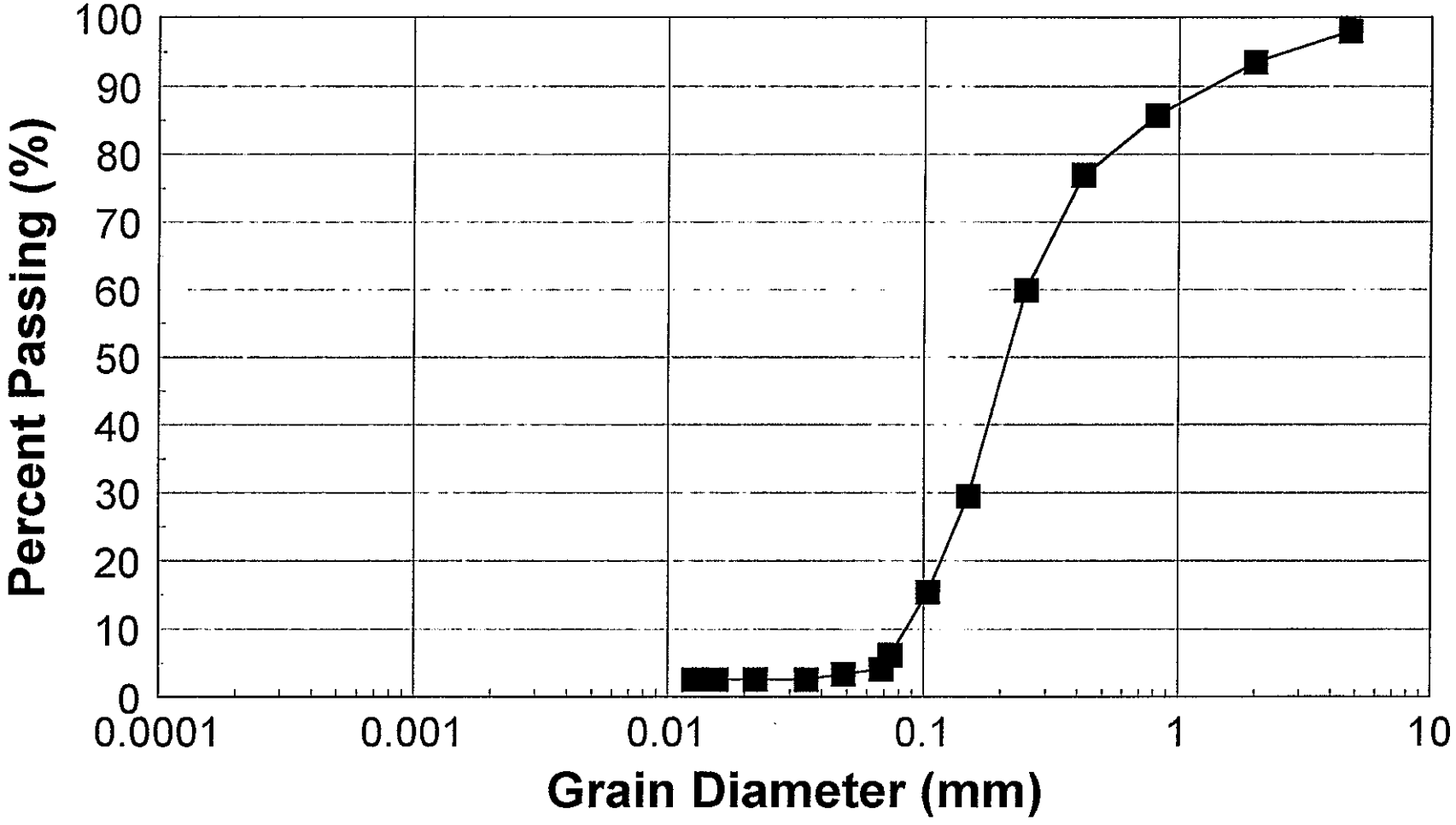
Hydrometer Analysis

Unit #7: 310m-328m (1017'-1076')

Date: 6/17/97
Sample Weight for Hydrometer Analysis = 11.9 grams
Overall Sample Weight = 193.8 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	15	12	25	0.99704	0.00895	13.8	0.0957	100	-
0.5	14	11	25	0.99704	0.00895	14	0.0681	92.4	4.1
1	12	9	25	0.99704	0.00895	14.3	0.0487	75.6	3.4
2	10	7	25	0.99704	0.00895	14.7	0.0349	58.8	2.6
5	10	7	25	0.99704	0.00895	14.7	0.0221	58.8	2.6
10	10	7	25	0.99704	0.00895	14.7	0.0156	58.8	2.6
15	10	7	25	0.99704	0.00895	14.7	0.0127	58.8	2.6

Particle Size Distribution
98th St. Monitoring Well - Unit 7: 310m-328m



Mechanical Sieve Analysis

Unit #8: 240m-310m (786'-1017')

Date: 6/18/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	541.2	5	5	2.5	97.5
10	2	499.5	501.9	2.4	7.4	3.7	96.3
20	0.84	304.1	314.3	10.2	17.6	8.8	91.2
40	0.42	391.8	420.9	29.1	46.7	23.35	76.65
60	0.25	403.3	468.7	65.4	112.1	56.05	43.95
100	0.15	465	521.6	56.6	168.7	84.35	15.65
140	0.1	242.3	256.8	14.5	183.2	91.6	8.4
200	0.07	358.9	365.2	6.3	189.5	94.75	5.25
PAN	-	370.2	380.7	10.5	200	100	-

[1] mm = millimeters

[2] g = grams

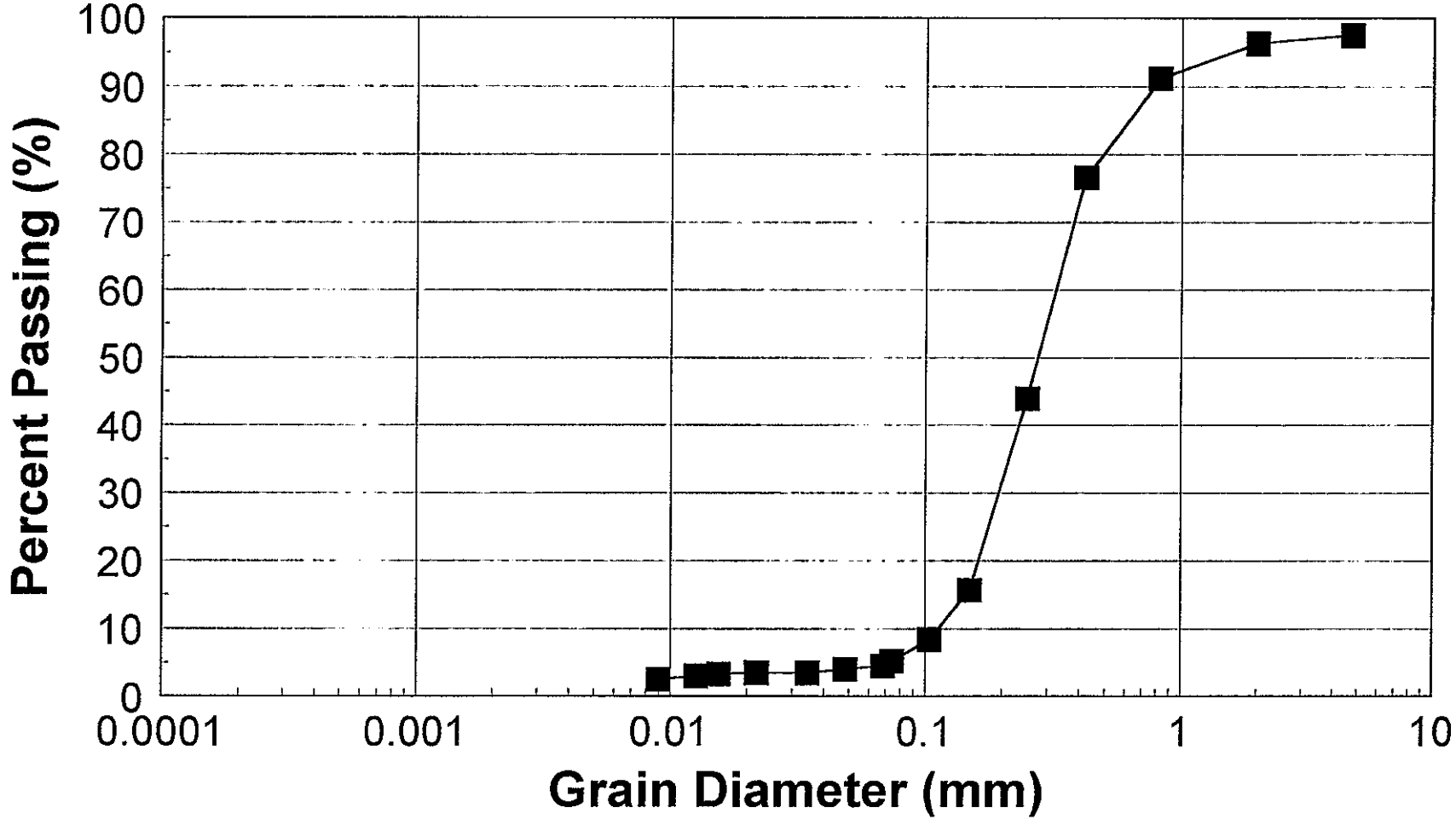
Hydrometer Analysis

Unit #8: 240m-310m (786'-1017')

Date: 6/19/97
Sample Weight for Hydrometer Analysis = 10.5 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (^{o}Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	13	10	26	0.99678	0.00875	14.2	0.0959	100	-
0.5	12	9	26	0.99678	0.00875	14.3	0.0681	85.7	4.5
1	11	8	26	0.99678	0.00875	14.5	0.0485	76.2	4
2	10	7	26	0.99678	0.00875	14.7	0.0345	66.7	3.5
5	10	7	26	0.99678	0.00875	14.7	0.0218	66.7	3.5
10	9.5	6.5	26	0.99678	0.00875	14.75	0.0155	61.9	3.3
15	9	6	26	0.99678	0.00875	14.8	0.0126	57.1	3
30	8	5	26	0.99678	0.00875	15	0.009	47.6	2.5

Particle Size Distribution
98th St. Monitoring Well - Unit 8: 240m-310m



Mechanical Sieve Analysis

Unit #9: 229m-240m (751'-786')

Date: 6/18/97

Sample Weight = 175 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g^2)	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	537.7	2.6	2.6	1.49	98.51
10	2	524.5	546.9	22.4	25	14.29	85.71
20	0.84	404.3	439.1	34.8	59.8	34.17	65.83
40	0.42	280.6	305	24.4	84.2	48.11	51.89
60	0.25	392.3	414.8	22.5	106.7	60.97	39.03
100	0.15	243.7	271	27.3	134	76.57	23.43
140	0.1	297.9	313.3	15.4	149.4	85.37	14.63
200	0.07	238	247.7	9.7	159.1	90.91	9.09
PAN	-	349.9	365.8	15.9	175	100	-

[1] mm = millimeters

[2] g = grams

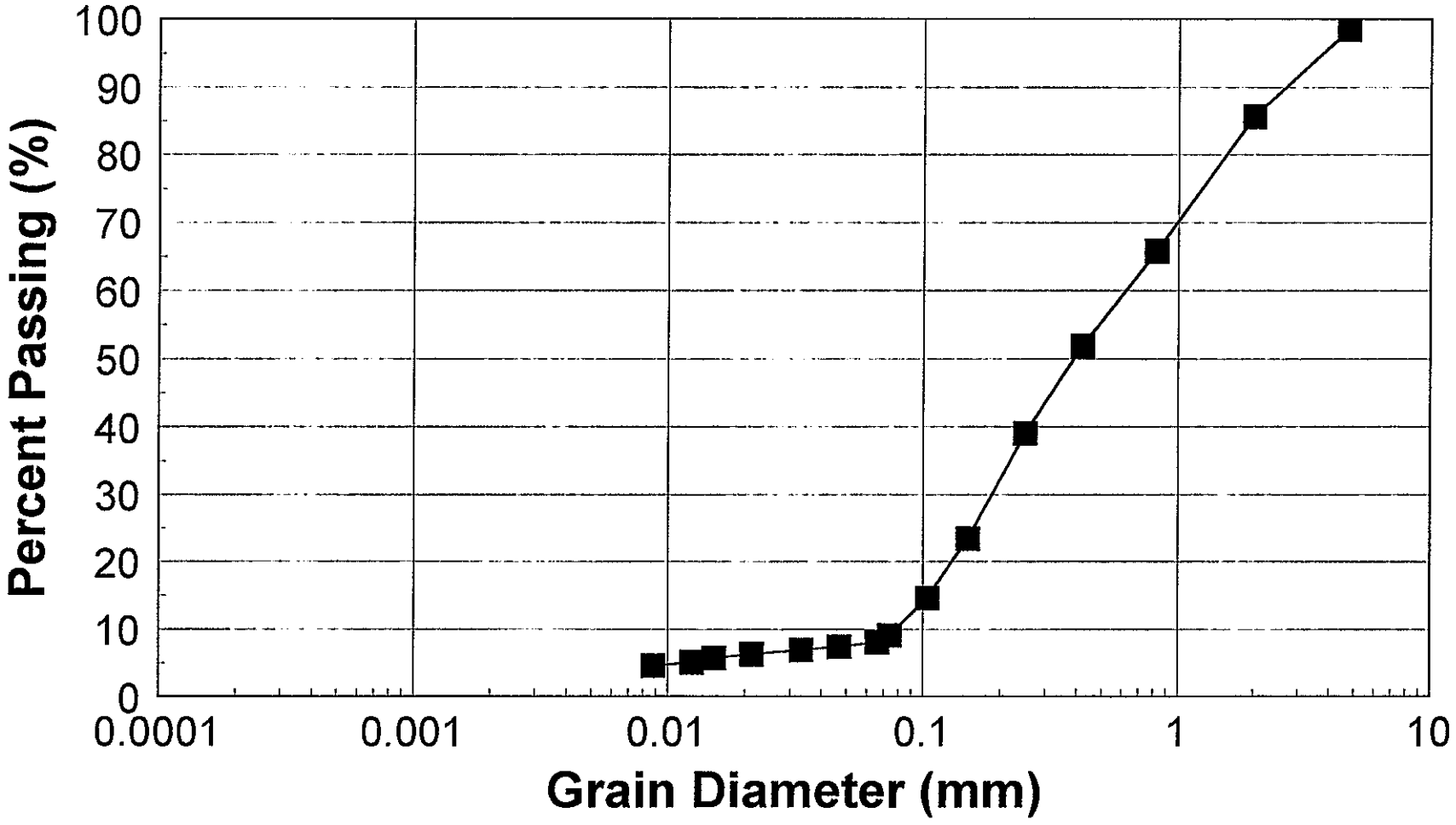
Hydrometer Analysis

Unit #9: 229m-240m (751'-786')

Date: 6/19/97
Sample Weight for Hydrometer Analysis = 15.9 grams
Overall Sample Weight = 175 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	19	16	26	0.99678	0.00875	13.2	0.0925	100	-
0.5	17	14	26	0.99678	0.00875	13.5	0.0661	88.1	8
1	16	13	26	0.99678	0.00875	13.7	0.0471	81.8	7.4
2	15	12	26	0.99678	0.00875	13.8	0.0334	75.5	6.9
5	14	11	26	0.99678	0.00875	14	0.0213	69.1	6.3
10	13	10	26	0.99678	0.00875	14.2	0.0152	62.9	5.7
15	12	9	26	0.99678	0.00875	14.3	0.0124	56.6	5.1
30	11	8	26	0.99678	0.00875	14.5	0.0088	50.3	4.6

Particle Size Distribution
98th St. Monitoring Well - Unit 9: 229m-240m



Mechanical Sieve Analysis

Unit #10: 216m-229m (710'-751')

Date: 6/25/97

Sample Weight = 186 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	544.6	8.4	8.4	4.52	95.48
10	2	499.5	535.1	35.6	44	23.66	76.34
20	0.84	304.1	327.9	23.8	67.8	36.45	63.55
40	0.42	391.8	403.5	11.7	79.5	42.74	57.26
60	0.25	403.3	412.8	9.5	89	47.85	52.15
100	0.15	465	481.1	16.1	105.1	56.51	43.49
140	0.1	242.3	269.9	27.6	132.7	71.34	28.66
200	0.07	358.9	388.8	29.9	162.6	87.42	12.58
PAN	-	370.2	392.1	21.9	184.5	99.19	-

[1] mm = millimeters

[2] g = grams

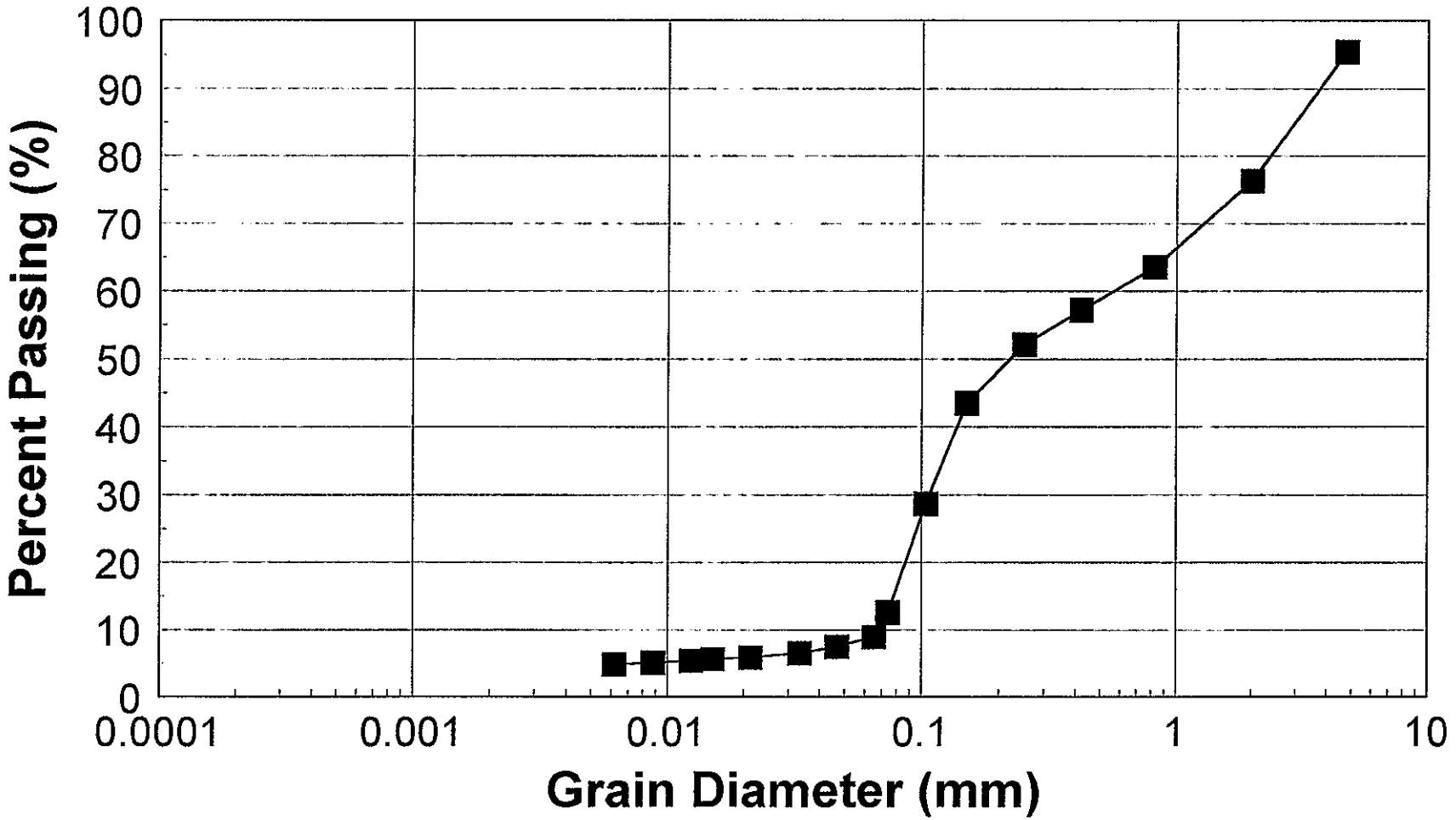
Hydrometer Analysis

Unit #10: 216m-229m (710'-751')

Date: 6/27/97
Sample Weight for Hydrometer Analysis = 22.2 grams
Overall Sample Weight = 186 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	22	19	26	0.99678	0.00875	12.7	0.0907	100	-
0.5	19.5	16.5	26	0.99678	0.00875	13.1	0.0652	75.3	8.9
1	17	14	26	0.99678	0.00875	13.5	0.0468	63.9	7.5
2	15	12	26	0.99678	0.00875	13.8	0.0334	54.8	6.5
5	14	11	26	0.99678	0.00875	14	0.0213	50.2	5.9
10	13.5	10.5	26	0.99678	0.00875	14.1	0.0151	47.9	5.6
15	13	10	26	0.99678	0.00875	14.2	0.0124	45.7	5.4
30	12.5	9.5	26	0.99678	0.00875	14.25	0.0088	43.4	5.1
60	12	9	26	0.99678	0.00875	14.3	0.0062	41.1	4.8

Particle Size Distribution
98th St. Monitoring Well - Unit 10: 216m-229m



Mechanical Sieve Analysis

Unit #11: 190m-216m (624'-710')

Date: 6/25/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	539.2	4.1	4.1	2.05	97.95
10	2	524.5	547.6	23.1	27.2	13.6	86.4
20	0.84	404.3	437	32.7	59.9	29.95	70.05
40	0.42	280.6	305.4	24.8	84.7	42.35	57.65
60	0.25	392.3	426.8	34.5	119.2	59.6	40.4
100	0.15	243.7	277.1	33.4	152.6	76.3	23.7
140	0.1	297.9	314.7	16.8	169.4	84.7	15.3
200	0.07	238	252.6	14.6	184	92	8
PAN	-	349.9	365.4	15.5	199.5	99.75	-

[1] mm = millimeters

[2] g = grams

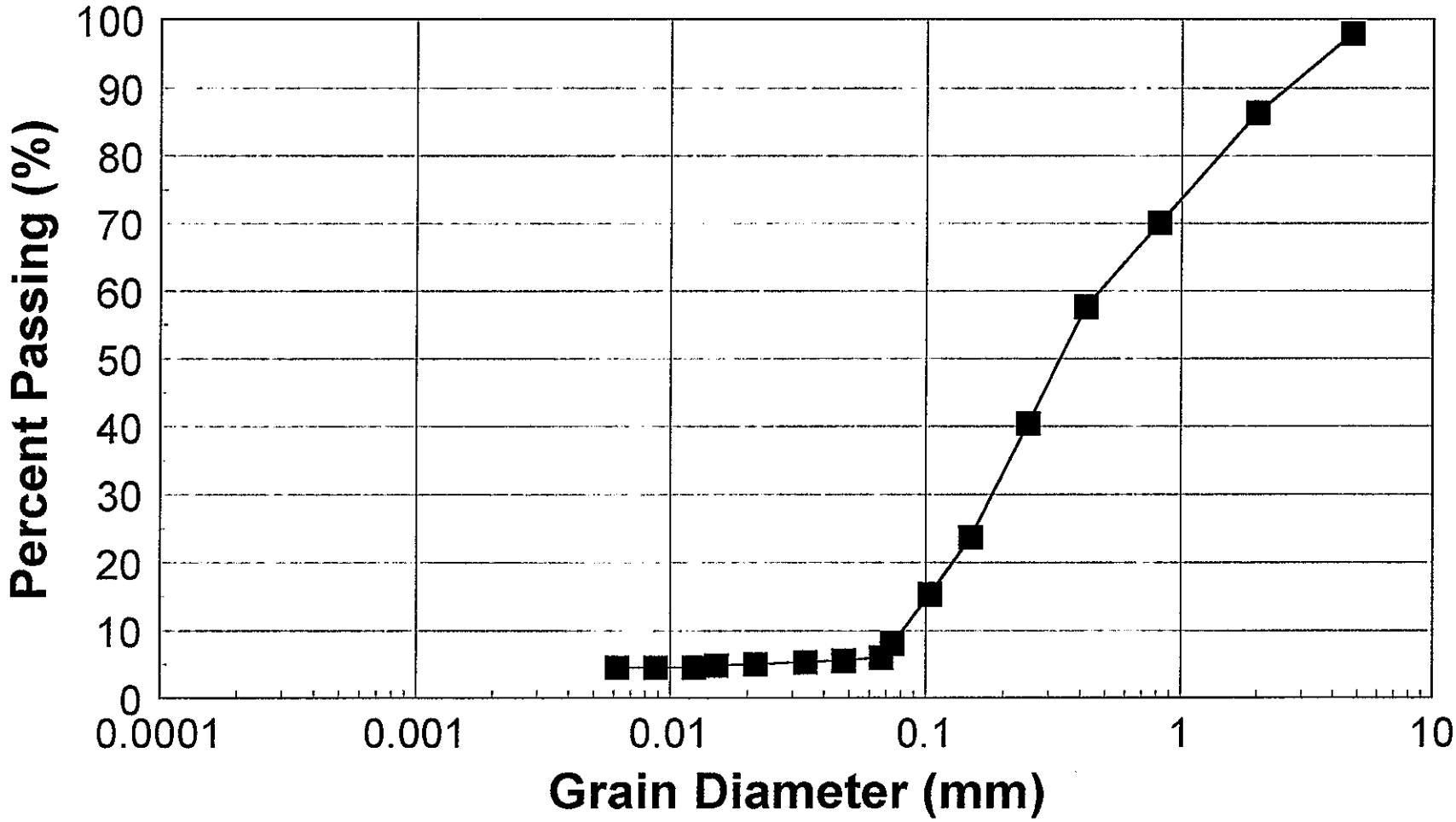
Hydrometer Analysis

Unit #11: 190m-216m (624'-710')

Date: 6/27/97
Sample Weight for Hydrometer Analysis = 15.5 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	17	14	26	0.99678	0.00875	13.5	0.0935	100	-
0.5	15	12	26	0.99678	0.00875	13.8	0.0669	77.4	6
1	14	11	26	0.99678	0.00875	14	0.0476	71	5.5
2	13.5	10.5	26	0.99678	0.00875	14.1	0.0338	67.7	5.3
5	13	10	26	0.99678	0.00875	14.2	0.0215	64.5	5
10	12.5	9.5	26	0.99678	0.00875	14.25	0.0152	61.3	4.8
15	12	9	26	0.99678	0.00875	14.3	0.0124	58.1	4.5
30	12	9	26	0.99678	0.00875	14.3	0.0088	58.1	4.5
60	12	9	26	0.99678	0.00875	14.3	0.0062	58.1	4.5

Particle Size Distribution
98th St. Monitoring Well - Unit 11: 190m-216m



Mechanical Sieve Analysis

Unit #12: 163m-190m (535'-624')

Date: 6/27/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	538.7	2.5	2.5	1.25	98.75
10	2	499.5	516.6	17.1	19.6	9.8	90.2
20	0.84	304.1	336.1	32	51.6	25.8	74.2
40	0.42	391.8	414.3	22.5	74.1	37.05	62.95
60	0.25	403.3	426.5	23.2	97.3	48.65	51.35
100	0.15	465	503.7	38.7	136	68	32
140	0.1	242.3	264.4	22.1	158.1	79.05	20.95
200	0.07	358.9	372.4	13.5	171.6	85.8	14.2
PAN	-	370.2	397.7	27.5	199.1	99.55	-

[1] mm = millimeters

[2] g = grams

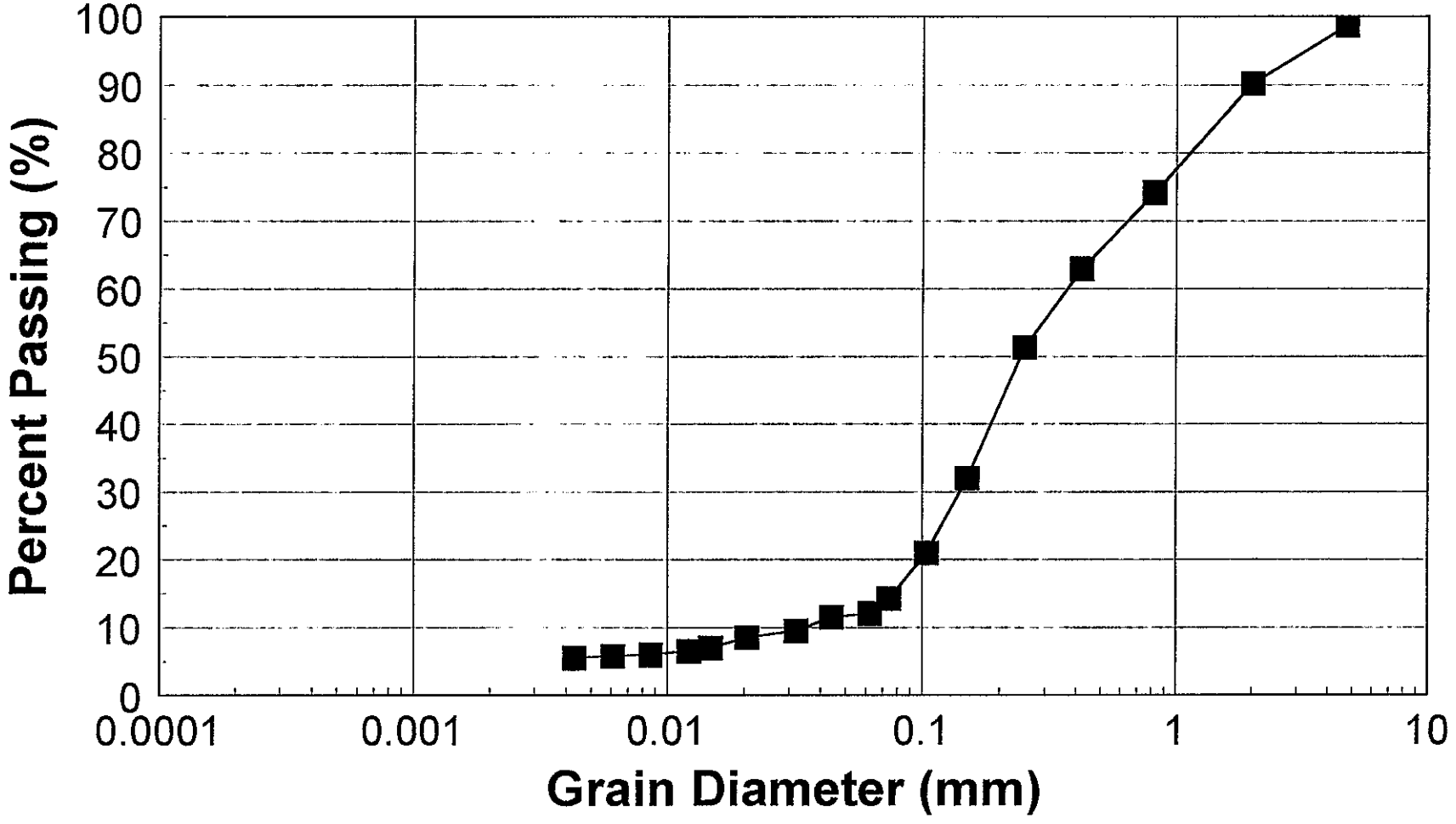
Hydrometer Analysis

Unit #12: 163m-190m (535'-624')

Date: 6/30/97
Sample Weight for Hydrometer Analysis = 27.5 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	29	26	26	0.99678	0.00875	11.5	0.0863	100	-
0.5	27	24	26	0.99678	0.00875	11.9	0.0621	87.3	12
1	26	23	26	0.99678	0.00875	12	0.0441	83.6	11.5
2	22	19	26	0.99678	0.00875	12.7	0.0321	69.1	9.5
5	20	17	26	0.99678	0.00875	13	0.0205	61.8	8.5
10	17	14	26	0.99678	0.00875	13.5	0.0148	50.9	7
15	16	13	26	0.99678	0.00875	13.7	0.0122	47.3	6.5
30	15	12	26	0.99678	0.00875	13.8	0.0086	43.6	6
60	14.5	11.5	26	0.99678	0.00875	13.9	0.0061	41.8	5.8
120	14	11	26	0.99678	0.00875	14	0.0043	40	5.5

Particle Size Distribution
98th St. Monitoring Well - Unit 12: 163m-190m



Mechanical Sieve Analysis

Unit #13: 141m-163m (464'-535')

Date: 6/27/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	535.6	0.5	0.5	0.25	99.75
10	2	524.5	529.4	4.9	5.4	2.7	97.3
20	0.84	404.3	417.9	13.6	19	9.5	90.5
40	0.42	280.6	296.3	15.7	34.7	17.35	82.65
60	0.25	392.3	426.9	34.6	69.3	34.65	65.35
100	0.15	243.7	289.7	46	115.3	57.65	42.35
140	0.1	297.9	324.5	26.6	141.9	70.95	29.05
200	0.07	238	261.6	23.6	165.5	82.75	17.25
PAN	-	349.9	384.5	34.6	200.1	100.05	-

[1] mm = millimeters

[2] g = grams

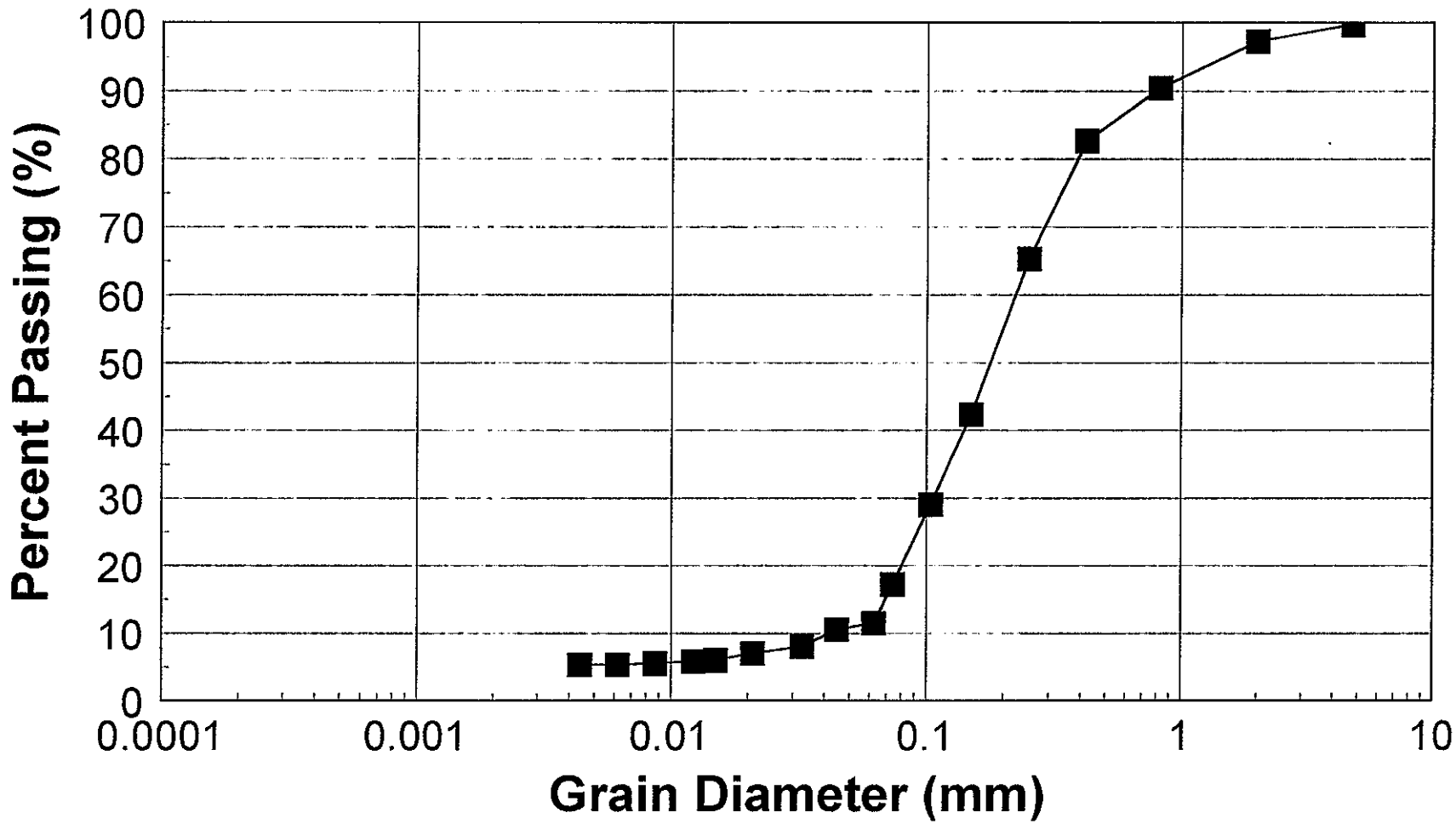
Hydrometer Analysis

Unit #13: 141m-163m (464'-535')

Date: 6/30/97
Sample Weight for Hydrometer Analysis = 34.6 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	31	28	26	0.99678	0.00875	11.2	0.0852	100	-
0.5	26	23	26	0.99678	0.00875	12	0.0624	66.5	11.5
1	24	21	26	0.99678	0.00875	12.4	0.0448	60.7	10.5
2	19	16	26	0.99678	0.00875	13.2	0.0327	46.2	8
5	17	14	26	0.99678	0.00875	13.5	0.0209	40.5	7
10	15	12	26	0.99678	0.00875	13.8	0.015	34.7	6
15	14.5	11.5	26	0.99678	0.00875	13.9	0.0123	33.2	5.8
30	14	11	26	0.99678	0.00875	14	0.0087	31.8	5.5
60	13.5	10.5	26	0.99678	0.00875	14.1	0.0062	30.3	5.3
120	13.5	10.5	26	0.99678	0.00875	14.1	0.044	30.3	5.3

Particle Size Distribution
98th St. Monitoring Well - Unit 13: 141m-163m



Mechanical Sieve Analysis

Unit #14: 134m-141m (441'-464')

Date: 6/30/97

Sample Weight = 100 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	507.2	7.7	7.7	7.7	92.3
20	0.84	304.1	317.9	13.8	21.5	21.5	78.5
40	0.42	391.8	402.3	10.5	32	32	68
60	0.25	403.3	419.8	16.5	48.5	48.5	51.5
100	0.15	465	484.8	19.8	68.3	68.3	31.7
140	0.1	242.3	254.6	12.3	80.6	80.6	19.4
200	0.07	358.9	366.7	7.8	88.4	88.4	11.6
PAN	-	370.2	381.4	11.2	99.6	99.6	-

[1] mm = millimeters

[2] g = grams

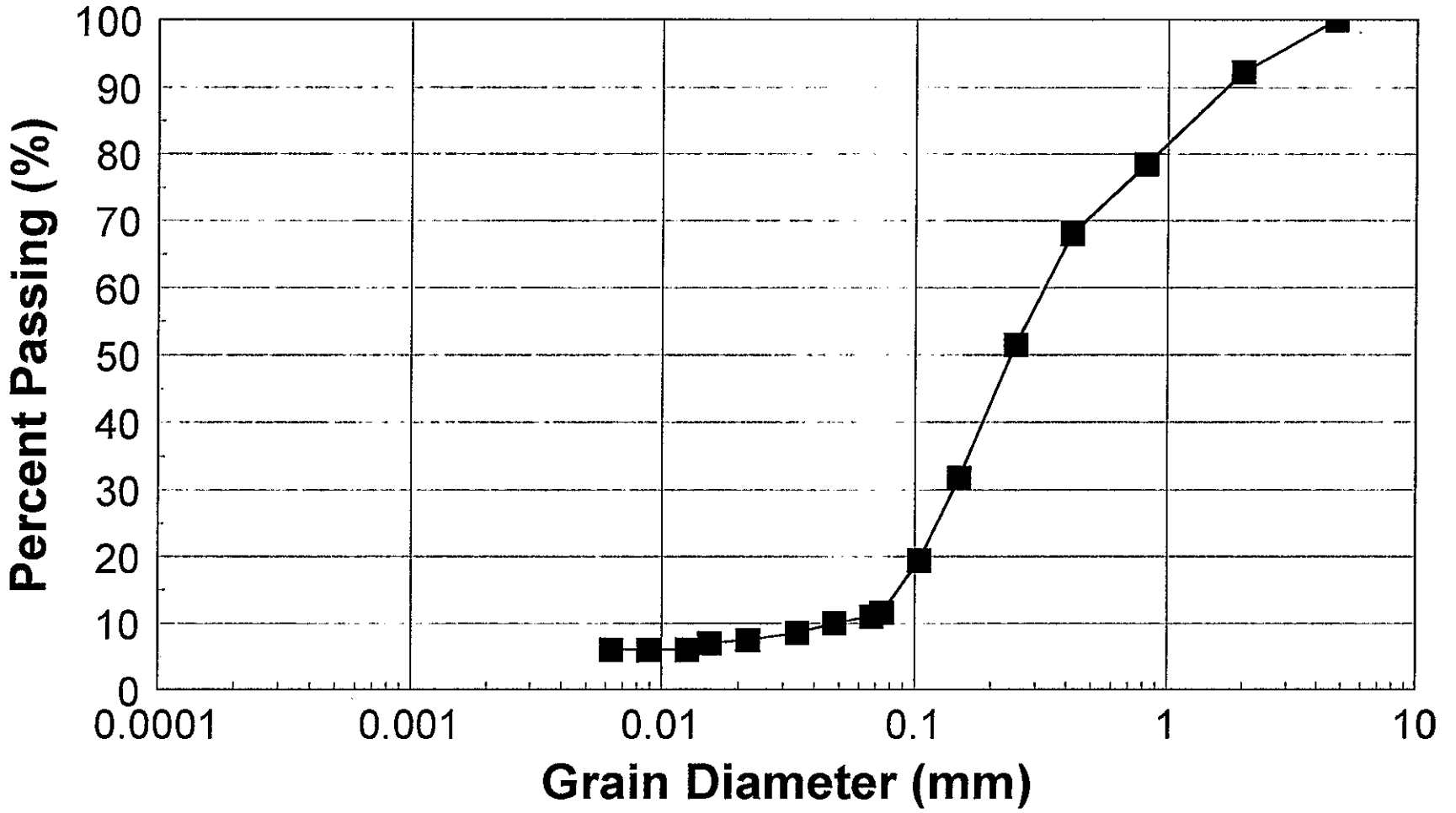
Hydrometer Analysis

Unit #14: 134m-141m (441'-464')

Date: 7/3/97
Sample Weight for Hydrometer Analysis = 11.2 grams
Overall Sample Weight = 100 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	15	12	26	0.99678	0.00875	13.8	0.0946	100	-
0.5	14	11	26	0.99678	0.00875	14	0.0674	98.2	11
1	13	10	26	0.99678	0.00875	14.2	0.048	89.3	10
2	11.5	8.5	26	0.99678	0.00875	14.4	0.0342	75.9	8.5
5	10.5	7.5	26	0.99678	0.00875	14.6	0.0218	66	7.5
10	10	7	26	0.99678	0.00875	14.7	0.0154	62.5	7
15	9	6	26	0.99678	0.00875	14.8	0.0126	53.6	6
30	9	6	26	0.99678	0.00875	14.8	0.0089	53.6	6
60	9	6	26	0.99678	0.00875	14.8	0.0063	53.6	6

Particle Size Distribution
98th St. Monitoring Well - Unit 14: 134m-141m



Mechanical Sieve Analysis

Unit #15: **102m-134m (336'-441')**

Date: 6/30/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	535.5	0.4	0.4	0.2	99.8
10	2	524.5	527.2	2.7	3.1	1.55	98.45
20	0.84	404.3	411.8	7.5	10.6	5.3	94.7
40	0.42	280.6	294.7	14.1	24.7	12.35	87.65
60	0.25	392.3	437.5	45.2	69.9	34.95	65.05
100	0.15	243.7	305	61.3	131.2	65.6	34.4
140	0.1	297.9	327.5	29.6	160.8	80.4	19.6
200	0.07	238	258.8	20.8	181.6	90.8	9.2
PAN	-	349.9	368.7	18.8	200.4	100.2	-

[1] mm = millimeters

[2] g = grams

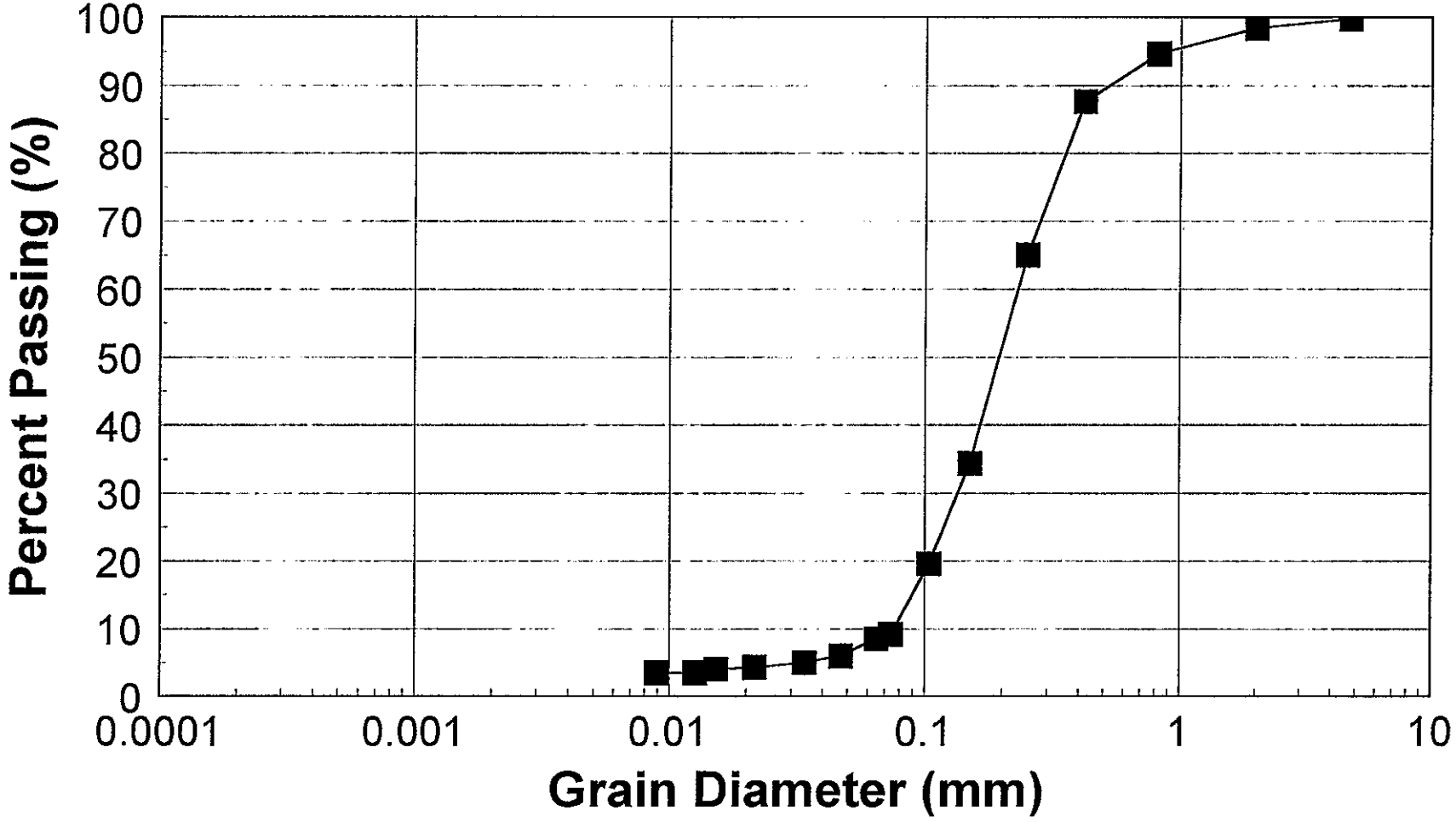
Hydrometer Analysis

Unit #15: 102m-134m (336'-441')

Date: 7/3/97
Sample Weight for Hydrometer Analysis = 18.8 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	22	19	26	0.99678	0.00875	12.7	0.0907	100	-
0.5	20	17	26	0.99678	0.00875	13	0.0649	90.4	8.5
1	15	12	26	0.99678	0.00875	13.8	0.0473	63.8	6
2	13	10	26	0.99678	0.00875	14.2	0.0339	53.2	5
5	11.5	8.5	26	0.99678	0.00875	14.4	0.0216	45.2	4.3
10	11	8	26	0.99678	0.00875	14.5	0.0153	42.6	4
15	10	7	26	0.99678	0.00875	14.7	0.0126	37.2	3.5
30	10	7	26	0.99678	0.00875	14.7	0.0089	37.2	3.5

Particle Size Distribution
98th St. Monitoring Well - Unit 15: 102m-134m



Mechanical Sieve Analysis

Unit #16: 72m-102m (237'-336')

Date: 7/1/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	536.2	0	0	0	100
10	2	499.5	502.5	3	3	1.5	98.5
20	0.84	304.1	320.4	16.3	19.3	9.65	90.35
40	0.42	391.8	412.7	20.9	40.2	20.1	79.9
60	0.25	403.3	441.7	38.4	78.6	39.3	60.7
100	0.15	465	529.7	64.7	143.3	71.65	28.35
140	0.1	242.3	267	24.7	168	84	16
200	0.07	358.9	372.4	13.5	181.5	90.75	9.25
PAN	-	370.2	388	17.8	199.3	99.65	-

[1] mm = millimeters

[2] g = grams

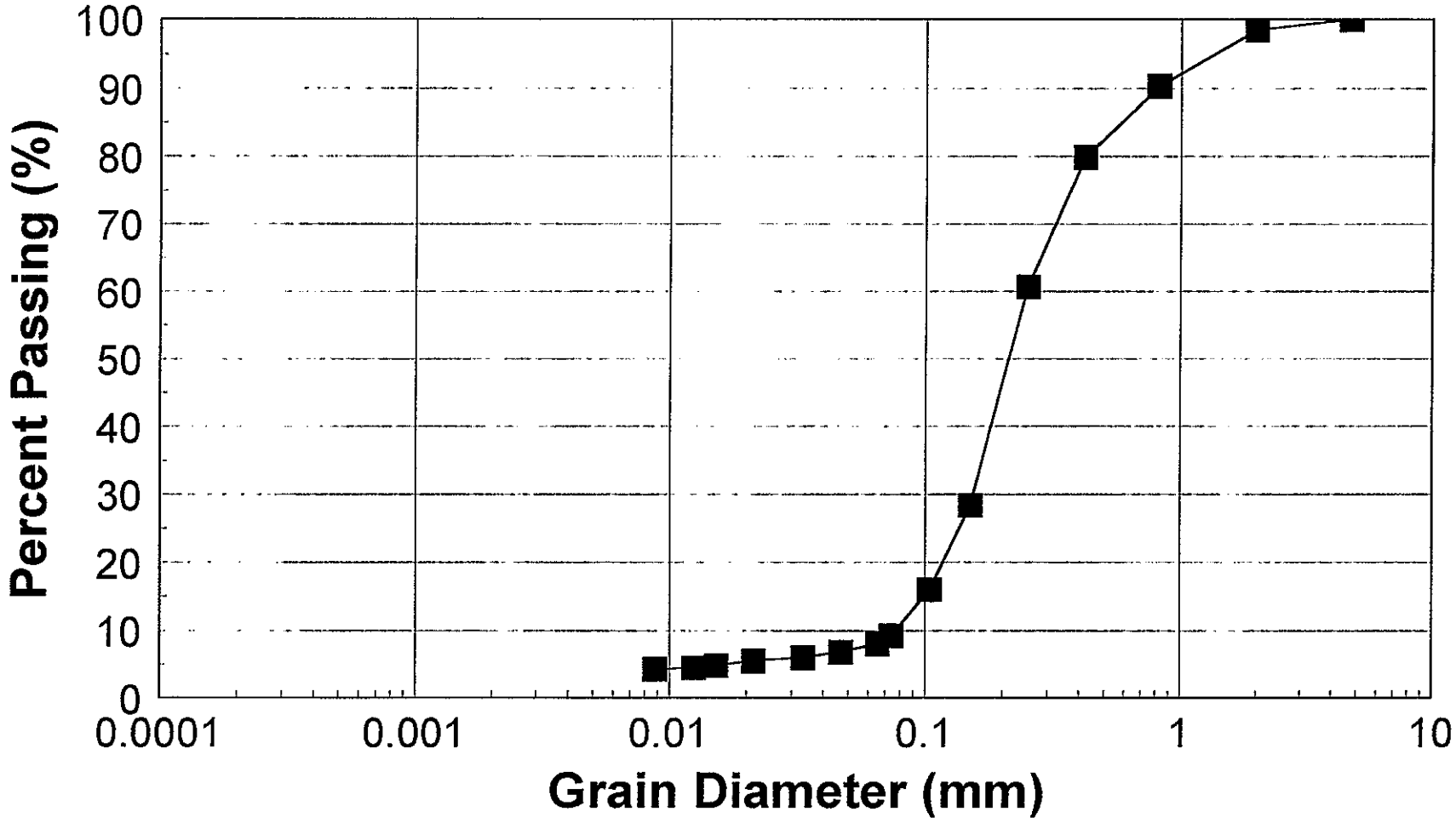
Hydrometer Analysis

Unit #16: 72m-102m (237'-336')

Date: 7/10/97
Sample Weight for Hydrometer Analysis = 17.8 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (^{o}Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	20	17	26	0.99678	0.00875	13	0.0918	100	-
0.5	19	16	26	0.99678	0.00875	13.2	0.0654	89.9	8
1	16.5	13.5	26	0.99678	0.00875	13.6	0.0469	75.8	6.8
2	15	12	26	0.99678	0.00875	13.8	0.0334	67.4	6
5	14	11	26	0.99678	0.00875	14	0.0213	61.8	5.5
10	12.5	9.5	26	0.99678	0.00875	14.25	0.0152	53.4	4.8
15	12	9	26	0.99678	0.00875	14.3	0.0124	50.6	4.5
30	11.5	8.5	26	0.99678	0.00875	14.4	0.0088	47.8	4.3

Particle Size Distribution
98th St. Monitoring Well - Unit 16: 72m-102m



Mechanical Sieve Analysis

Unit #17: 56m-72m (183'-237')

Date: 7/7/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	535.5	0.4	0.4	0.2	99.8
10	2	524.5	529.7	5.2	5.6	2.8	97.2
20	0.84	404.3	415.3	11	16.6	8.3	91.7
40	0.42	280.6	298.2	17.6	34.2	17.1	82.9
60	0.25	392.3	440.6	48.3	82.5	41.25	58.75
100	0.15	243.7	302.3	58.6	141.1	70.55	29.45
140	0.1	297.9	325.1	27.2	168.3	84.15	15.85
200	0.07	238	254.5	16.5	184.8	92.4	7.6
PAN	-	349.9	365.4	15.5	200.3	100.15	-

[1] mm = millimeters

[2] g = grams

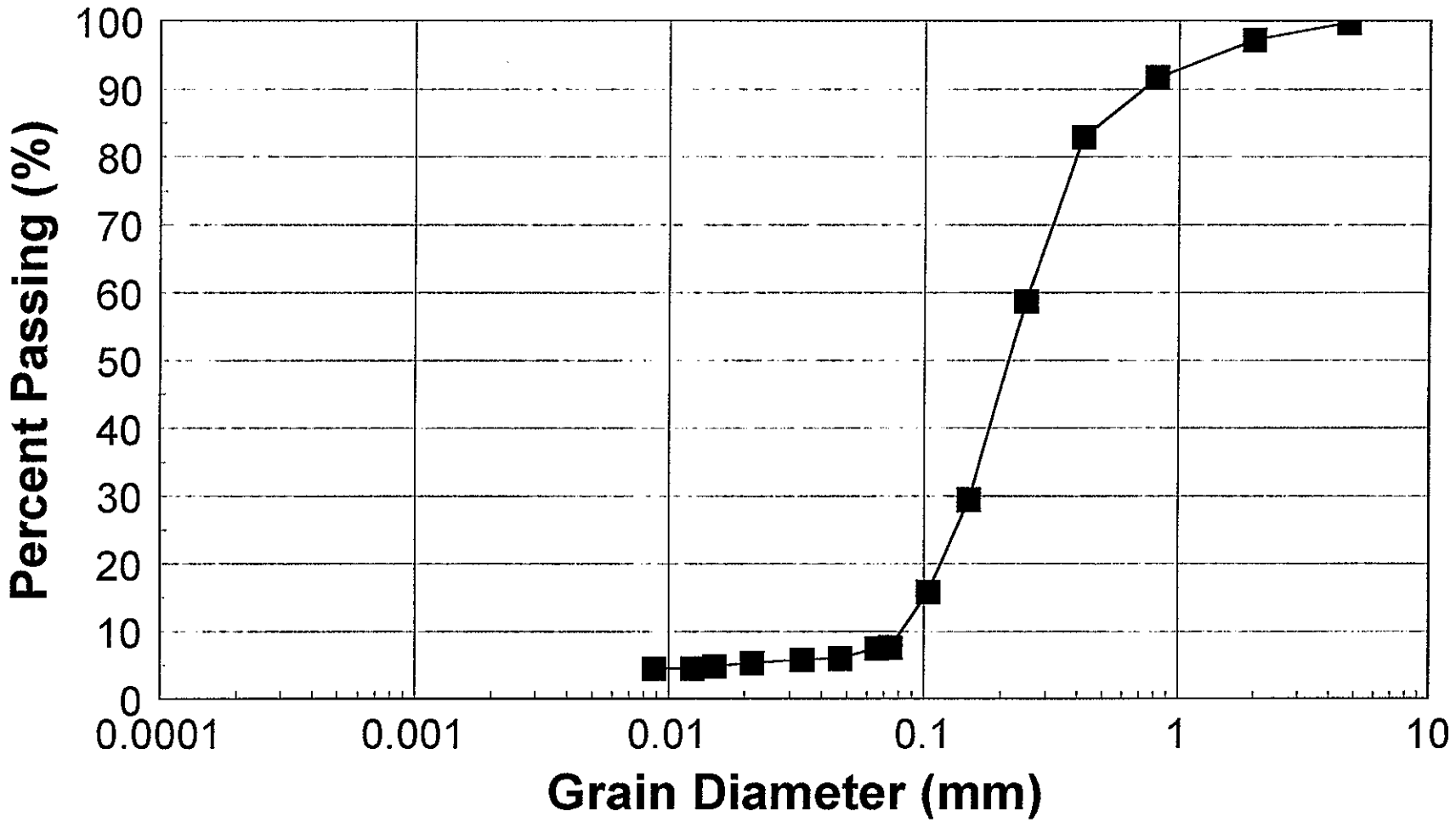
Hydrometer Analysis

Unit #17: 56m-72m (183'- 237')

Date: 7/10/97
Sample Weight for Hydrometer Analysis = 15.5 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (^{o}Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	19	16	26	0.99678	0.00875	13.2	0.0925	100	-
0.5	18	15	26	0.99678	0.00875	13.3	0.0656	96.8	7.5
1	15	12	26	0.99678	0.00875	13.8	0.0473	77.4	6
2	14.5	11.5	26	0.99678	0.00875	13.9	0.0336	74.2	5.8
5	13.5	10.5	26	0.99678	0.00875	14.1	0.0214	67.7	5.3
10	12.5	9.5	26	0.99678	0.00875	14.25	0.0152	61.3	4.8
15	12	9	26	0.99678	0.00875	14.3	0.0124	58.1	4.5
30	12	9	26	0.99678	0.00875	14.3	0.0088	58.1	4.5

Particle Size Distribution
98th St. Monitoring Well - Unit 17: 56m-72m



Mechanical Sieve Analysis

Unit #18: 30m-56m (97'-183')

Date: 7/10/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	540.5	4.3	4.3	2.15	97.85
10	2	499.5	510.6	11.1	15.4	7.7	92.3
20	0.84	304.1	322.4	18.3	33.7	16.85	83.15
40	0.42	391.8	405.1	13.3	47	23.5	76.5
60	0.25	403.3	432.3	29	76	38	62
100	0.15	465	524.3	59.3	135.3	67.65	32.35
140	0.1	242.3	271.5	29.2	164.5	82.25	17.75
200	0.07	358.9	376.8	17.9	182.4	91.2	8.8
PAN	-	370.2	387.3	17.1	199.5	99.75	-

[1] mm = millimeters

[2] g = grams

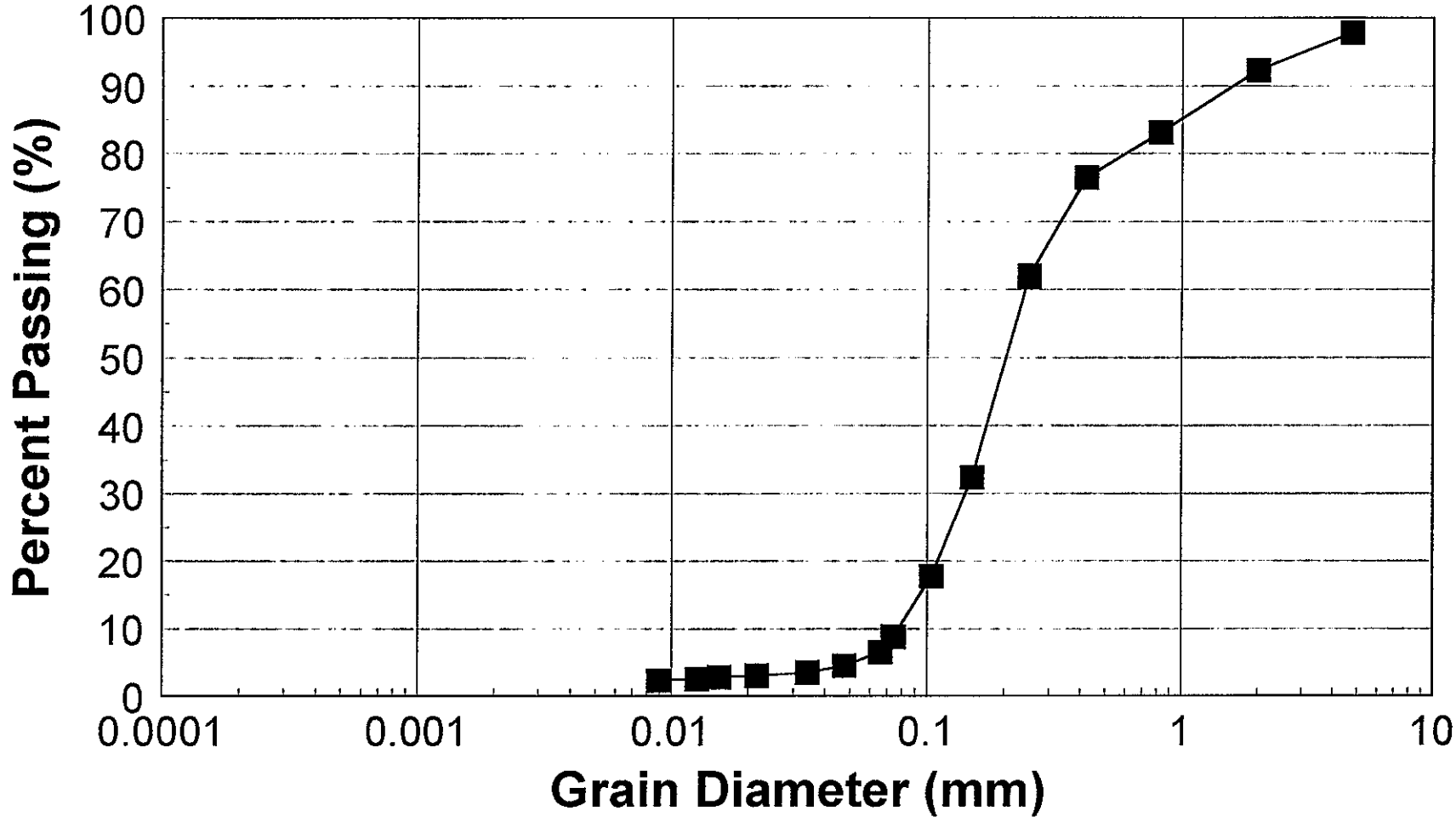
Hydrometer Analysis

Unit #18: 30m-56m (97'-183')

Date: 7/14/97
Sample Weight for Hydrometer Analysis = 17.1 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (^{O}Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	20	17	27	0.99651	0.00855	13	0.0907	100	-
0.5	16	13	27	0.99651	0.00855	13.7	0.0659	76	6.5
1	12	9	27	0.99651	0.00855	14.3	0.0476	52.6	4.5
2	10	7	27	0.99651	0.00855	14.7	0.0341	40.9	3.5
5	9	6	27	0.99651	0.00855	14.8	0.0216	35.1	3
10	8.5	5.5	27	0.99651	0.00855	14.9	0.0154	32.2	2.8
15	8	5	27	0.99651	0.00855	15	0.0126	29.2	2.5
30	7.5	4.5	27	0.99651	0.00855	15.1	0.0089	26.3	2.3

Particle Size Distribution
98th St. Monitoring Well - Unit 18: 30m-56m



Mechanical Sieve Analysis

Unit #19: 24m-30m (80'-97')

Date: 7/10/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g[2])	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	535.1	536.4	1.3	1.3	0.65	99.35
10	2	524.5	527	2.5	3.8	1.9	98.1
20	0.84	404.3	410.5	6.2	10	5	95
40	0.42	280.6	300.2	19.6	29.6	14.8	85.2
60	0.25	392.3	445.3	53	82.6	41.3	58.7
100	0.15	243.7	307.4	63.7	146.3	73.15	26.85
140	0.1	297.9	323.5	25.6	171.9	85.95	14.05
200	0.07	238	255.5	17.5	189.4	94.7	5.3
PAN	-	349.9	360.6	10.7	200.1	100.05	-

[1] mm = millimeters

[2] g = grams

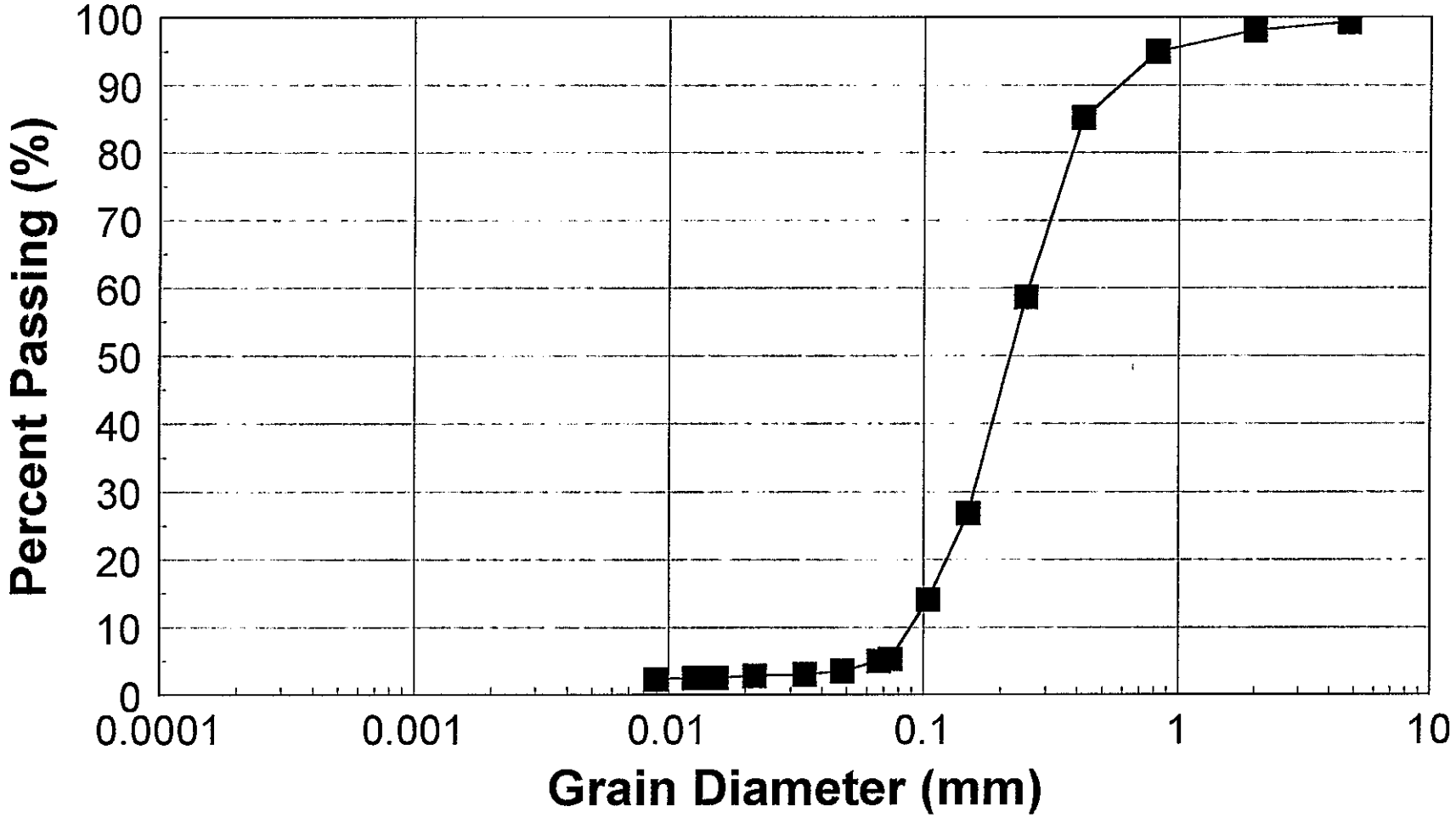
Hydrometer Analysis

Unit #19: 24m-30m (80'-97')

Date: 7/14/97
Sample Weight for Hydrometer Analysis = 10.7 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (°Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	14	11	27	0.99651	0.00855	14	0.0942	100	-
0.5	13	10	27	0.99651	0.00855	14.2	0.067	93.5	5
1	10	7	27	0.99651	0.00855	14.7	0.0482	65.4	3.5
2	9	6	27	0.99651	0.00855	14.8	0.0342	56	3
5	8.5	5.5	27	0.99651	0.00855	14.9	0.0217	51.4	2.8
10	8	5	27	0.99651	0.00855	15	0.0154	46.7	2.5
15	8	5	27	0.99651	0.00855	15	0.0126	46.7	2.5
30	7.5	4.5	27	0.99651	0.00855	15.1	0.0089	42.1	2.3

Particle Size Distribution
98th St. Monitoring Well - Unit 19: 24m-30m



Mechanical Sieve Analysis

Unit #21: 6m-18m (19'-60')

Date: 7/14/97

Sample Weight = 200 grams

Sieve Number	Grain Diameter (mm[1])	Sieve Weight (g^2)	Sieve + Retained Soil Weight (g)	Retained Soil Weight (g)	Cumulative Retained Soil Weight (g)	Cumulative Percent Retained (%)	Percent Passing (%)
4	4.75	536.2	546.8	10.6	10.6	5.3	94.7
10	2	499.5	514.5	15	25.6	12.8	87.2
20	0.84	304.1	331.7	27.6	53.2	26.6	73.4
40	0.42	391.8	429.5	37.7	90.9	45.45	54.55
60	0.25	403.3	447.6	44.3	135.2	67.6	32.4
100	0.15	465	497.5	32.5	167.7	83.85	16.15
140	0.1	242.3	255.4	13.1	180.8	90.4	9.6
200	0.07	358.9	366.3	7.4	188.2	94.1	5.9
PAN	-	370.2	381.5	11.3	199.5	99.75	-

[1] mm = millimeters

[2] g = grams

Hydrometer Analysis

Unit #21: 6m-18m (19'-60')

Date: 7/14/97
Sample Weight for Hydrometer Analysis = 11.3 grams
Overall Sample Weight = 200 grams
Hydrometer Type = 152H

Elapsed Time (minutes)	Actual Hydrometer Reading	Corrected Hydrometer Reading (-3)	Water Temperature (^{o}Celsius)	Specific Gravity of Water at Test Temperature	Viscosity of Water at Test Temperature (poises)	L (centimeters)	Grain Diameter (millimeters)	Percent Smaller (Hydrometer Sample (%)	Percent Smaller (Overall Sample) (%)
0.25	14	11	27	0.99651	0.00855	14	0.0942	100	-
0.5	13	10	27	0.99651	0.00855	14.2	0.067	88.5	5
1	10.5	7.5	27	0.99651	0.00855	14.6	0.048	66.4	3.8
2	9	6	27	0.99651	0.00855	14.8	0.0342	53.1	3
5	8	5	27	0.99651	0.00855	15	0.0218	44.2	2.5
10	8	5	27	0.99651	0.00855	15	0.0154	44.2	2.5
15	7.5	4.5	27	0.99651	0.00855	15.1	0.0126	39.8	2.3
30	7	4	27	0.99651	0.00855	15.2	0.009	35.4	2

Particle Size Distribution
98th St. Monitoring Well - Unit 21: 6m-18m