Petersburg Navigation Improvements

Appendix A: Geotechnical

Petersburg, Alaska

US Army Corps of Engineers
Alaska District

US Army Corps of Engineers

Geotechnical Data Report

Petersburg Navigation Improvements South Harbor Dredging

Petersburg, Alaska, Alaska District, Pacific Ocean Division

November 2018

PN: 447803
Status: Revised

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 6898
JBER, AK 99506-0898

CEPOA-EN-G-GM 29 August 2018

MEMORANDUM FOR

Civil Works Project Management (CEPOA-PM-C-PL), Amber Metallo

SUBJECT: Geotechnical Data Report for Petersburg Navigation Improvements, Petersburg, Alaska.

1. Enclosed is the Geotechnical Data Report for the Petersburg Navigation Improvement project, Petersburg, Alaska. Included with the report are the Project Location and Vicinity Map, a Test Boring Location Map, geotechnical exploration logs, and a discussion of the findings of the geotechnical investigation for the project.

2. Questions should be addressed to Inocencio Roman at 907-753-2685 or John Rajek at 907-753-5695.

ROMAN.INOCENCIO.JIMENEZ.1086685066
Digitally signed by ROMAN.INOCENCIO.JIMENEZ.1086685066
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=ROMAN.INOCENCIO.JIMENEZ.1086685066
Date: 2018.08.29 14:56:47 -08'00'

Inocencio J. Roman
Civil Engineer
CEPOA-EC-G-GM

SIGNED
John Rajek, P.E.
Chief, Geotechnical and Materials Section
CEPOA-EC-G-GM

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Douglas A. Bliss, P.E., P.G.
Chief, Geotechnical and Engineering Services
CEPOA-EC-G

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1.0 INTRODUCTION

This report documents the results of the geotechnical investigation performed for the planned dredging at the Petersburg South Harbor located in Petersburg Alaska. The scope of the investigation was to identify surface and subsurface conditions and address geotechnical concerns of the site. This report presents a summary of the findings based on site observations and results of the field exploration and laboratory testing program.

2.0 PROJECT LOCATION AND DESCRIPTION

Petersburg South Harbor is located on Mitkof Island west of the City of Petersburg and adjacent to the Wrangell Narrows Channel. Petersburg Harbor is divided into three parts respectively, the North Harbor, Middle Harbor, and South Harbor. This report documents geotechnical site conditions within the Petersburg South Harbor for proposed new work and maintenance dredging within the harbor basin and navigation channels to depths ranging from -9.0 to -20.0 feet mean lower low water (MLLW) respectively. A Project Location and Vicinity Map and Petersburg Harbor map is enclosed as Figure A-1 and A-2.

3.0 EXISTING GEOTECHNICAL INFORMATION

Peratrovich, Nottingham & Drage, Inc. (PND) performed a geotechnical site investigation which included drilling test borings within the Petersburg South Harbor in 1997 for the City of Petersburg. This field exploration effort was documented in the Geotechnical Report Petersburg South Harbor Improvements, Petersburg, Alaska, dated September 1997. The approximate locations of test borings drilled by PND in 1997 are shown on the Test Boring Location Map provided in Appendix A. For reference, exploration logs from the 1997 PND Geotechnical Report are included in Appendix D.

4.0 REGIONAL GEOLOGY

The Coastal Village of Petersburg is located on Mitkof Island in southeastern Alaska which is bound by Frederick Sound to the north, Sumner Strait to the south, Scow Bay to the east and Wrangell Narrows and Petersburg Harbor to the west. Mitkof Island is one of thousands of forest-covered islands located in offshore, southeastern Alaska that make up the Alexander Archipelago.

According to the United States Geological Survey (USGS), Geologic Map of Southeastern Alaska, 1992, the surface geology of the Village of Petersburg is comprised of sedimentary rocks from the Cretaceous and Jurassic Geologic Eras (KJs). Beneath this surface sedimentary layer, the geology is comprised of volcanic rocks (KJv) from the same eras. These volcanic rocks outcrop in the Midwestern and Southern portions of Mitkof Island. Also predominant of the island are the igneous intrusive rocks granodiorite and tonalite from the Cretaceous Era (Kgt) that are found on either near vertical mountain slopes above the tree line or along the coast.

Past (and present) glaciations also occurred in this region, carving present day landscapes and depositing glacial sediment. Tidewater glaciers dumped glacial sediment from floating icebergs

and sea ice. The glacial sediments were deposited in the sea then carried to the shore area of Mitkof Island by ocean tide. Most of the shore area is presently underlain by these glacial-marine deposits.

5.0 FIELD EXPLORATION

The geotechnical subsurface investigation for this project was conducted from 7 through 10 April 2018. A total of 18 locations where sampled to ten feet below the ground surface or to refusal using a Gravity Environmental Vibracore equipped with either a five foot or ten foot long by 3-1/4 inch inside diameter split barrel sampler or by manually pushing a 2.0 inch inside diameter PVC sampling tube to refusal. Sampling locations were assigned permanent numbers and are designated AP-20 through AP-37. Sampling operations were performed aboard the landing craft RB (Reid Brothers), owned and operated by Glen Reid under contract with the City of Petersburg. The landing craft was utilized as a conveyance and a work platform, it was equipped with a crane to lift the vibracore from the deck to selected locations within the harbor. A photograph of the Gravity Environmental Vibracore equipment is shown as Figure 1 and Figure 2, providing a view of the Vibracore being lowered into the water to collect a sample.

Figure 1: Environmental Gravity Vibracore

Figure 2: Preparing to lower the Environmental Gravity Vibracore sampling equipment below water for sampling.

An engineer from U.S. Army Corps of Engineers, Alaska District (USACE-AD) supervised the sampling effort and logged the sediment samples. Field identification and classification of the soils were conducted in accordance with ASTM D 2488, Description and Identification of Soils (Visual-Manual Procedure). Exploration logs which documented the sampling effort are presented in Appendix B.

Chemists from USACE-AD also collected soil from the samples for further environmental contamination testing. All environmental contamination test results were reported below the Dredged Material Management Project screening criteria. Those results are presented separately in the report titled "Chemical Data Report, Petersburg South Harbor Sediment Sampling (18-041), Petersburg South Boat Harbor, Alaska", dated June 2018.

Horizontal coordinates of sampling locations were determined by a handheld Magellan global positioning system (GPS) and should be considered approximate. Sample location coordinates reported on the exploration logs are based on NAD83 (CORS), Alaska State Plane Zone 1, in feet. The elevations at each sampling location were determined by importing the horizontal coordinates

of the sample locations into the Petersburg South Harbor Project Condition Survey CAD drawing dated 19 January 2018 by eTrac, Inc. Sampling surface elevations were selected from the digital surface within the bathymetry survey drawing. Vertical control from the hydrographic survey is referenced to mean lower low water (MLLW) datum, in feet. Test boring locations can be found as Sheet A-3 and a summary table of sample coordinates and elevations are presented in Appendix B.

6.0 LABORATORY TESTING PROGRAM

A laboratory testing program was established to classify and determine physical properties of the soils encountered. The testing program consisted of sieve analyses and classification testing for the soil's Liquid Limit, Plastic Limit, and Plasticity Index. These tests were performed in accordance with the latest edition of the following methods shown in Table 1. Laboratory soil test results, and grain-size distribution curves are provided in Appendix C.

Table 1: Soils Laboratory Test Methods

Test Designation	Test Description
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

7.0 SITE CONDITIONS

The Petersburg Harbor was first dredged in 1937 under the Rivers and Harbors Act dated 30 August 1935. New work and maintenance dredging and harbor expansions have been performed since then with the most recent dredging effort conducted in 2013 at the Petersburg North Harbor.

7.1. Surface Conditions

The harbor basin and navigation channel surfaces within the proposed dredge areas are comprised of coarse and fine-grained soils. Recent marine sediment deposits have been transported from tidal currents, waves, and from the nearby Hammer Slough which drains into the South Harbor basin. During low tides the seafloor surface could vaguely be seen while standing on the harbor floats or sampling barge. Marine organisms consisting of star fish, sea anemones, clams, sea shells, and other organisms were present throughout the dredge areas. In addition to the organic marine life, debris consisting of metal and plastic pipes, ropes, metal cables, logs, miscellaneous metal, and other debris could be seen within the dredge area. Hydrographic survey results also indicate the presence of dredging obstructions and debris within the dredging limits. Several large wooden or

steel pipe piles were identified during the hydrographic survey lying on the surface within the harbor basin.

A sunken vessel measuring approximately ten feet by four feet by three feet near AP-32 was also reported. During this site investigation braided steel cable commonly used in the marine industry was caught in the anchor of the landing craft RB. A portion of the steel cable that had to be cut to release the anchor is shown in Figure 3.

Figure 3. Part of the cable that was caught in the anchor of the landing craft RB.

7.2. Subsurface Conditions

The subsurface conditions in the South Harbor dredge area generally consist of recent marine deposits overlying glacial marine deposits. Soils within the dredge limits were generally classified as sandy silty clay, sandy silt, silty sand, poorly graded sand with silt, and poorly graded sand with gravel (CL-ML, ML, SM, SP-SM, SP). Field and laboratory testing indicated the soils plasticity ranged from non-plastic to medium plasticity. Laboratory test results reported the soil's Liquid Limit (LL) ranged from 19 to 30 percent, Plastic Limit (PL) ranged from 13 to 17 percent and the Plasticity Index (PI) ranged from three to seven percent. Figure 4 shows a typical sample of sandy silty clay (CL-ML) encountered during the site investigation.

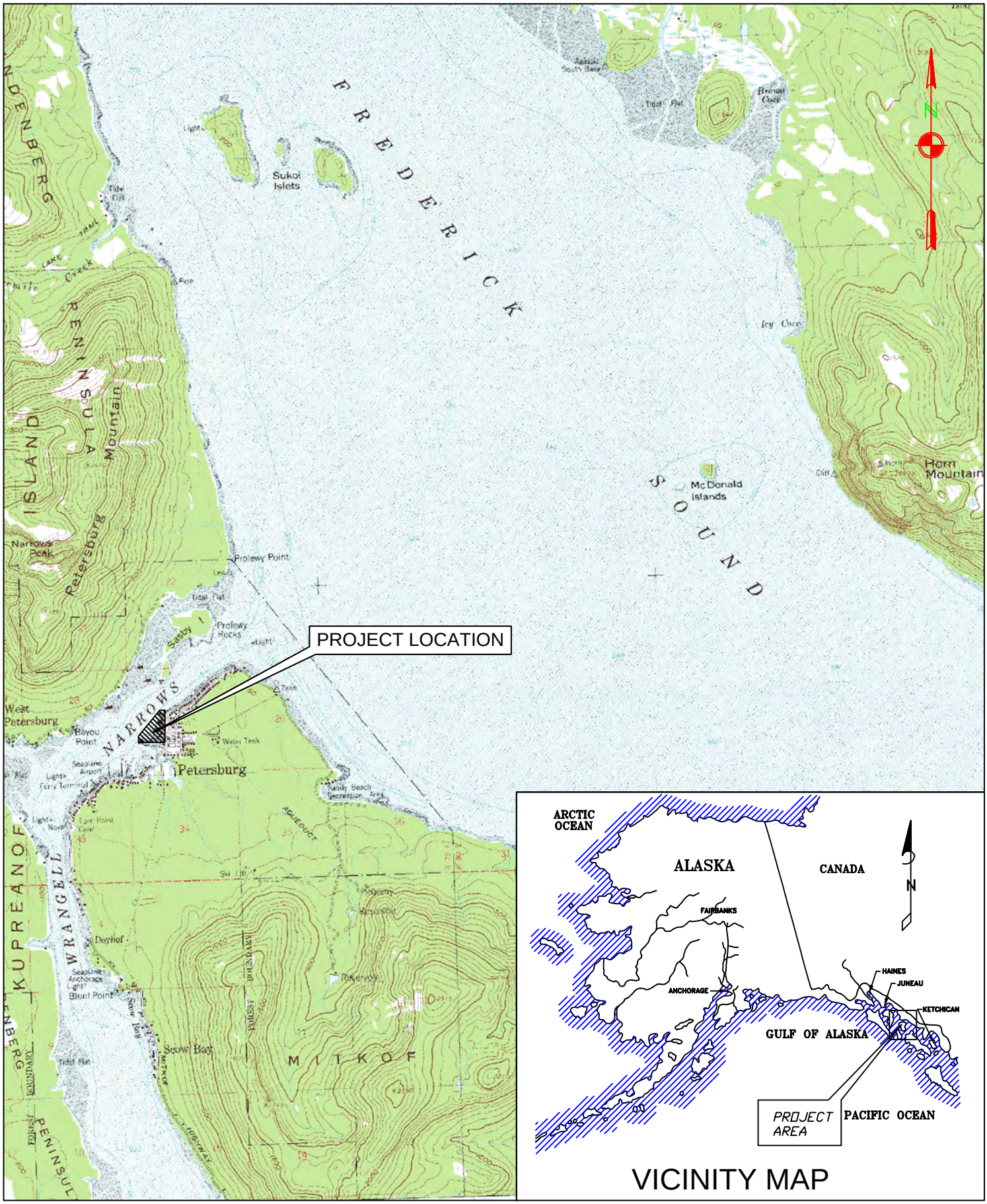
Figure 4: Sandy silty clay (CL-ML) encountered in AP-24.

Environmental Gravity Vibracore sampler refusal was encountered in most locations sampled. Sampler refusal was attributed to the dense to very dense glacial marine deposits underlying the softer marine sediments and the presence of cobbles and boulders. During previous dredging efforts in the Petersburg North Harbor, larger boulders were removed from the harbor basin. Figure 5 shows an example boulder that was dredged from the Petersburg North Harbor. Similar sized boulders will be encountered while dredging the South Harbor. The average dimension of boulders within the South Harbor dredge area is anticipated to be 15 feet or less.

Figure 5: Example 8.5 foot boulder that was dredged from the Petersburg North Harbor basin during the Fall of 2013.

APPENDIX A
Maps and Drawings

Project Location and Vicinity Map ..... Sheet A-1
Float Names and Harbor Names ..... Sheet A-2
Test Boring Location Map ..... Sheet A-3



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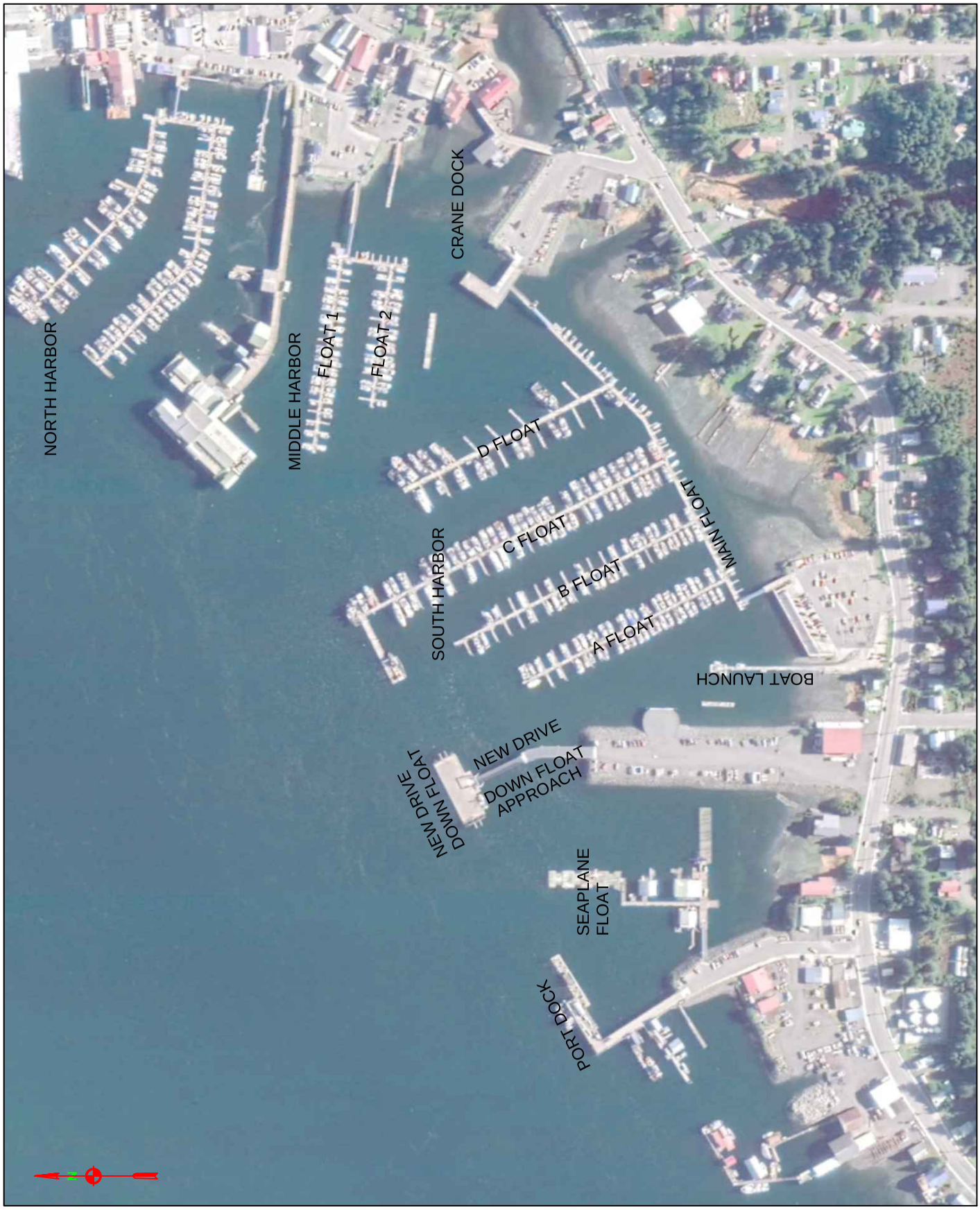
PROJECT LOCATION AND VICINITY MAP
PETERSBURG NAVIGATION IMPROVEMENTS
PETERSBURG, ALASKA

SCALE: NTS
DATE: JUN 2018
DRAWN/RVW: IJR/JJR
FIGURE A–1



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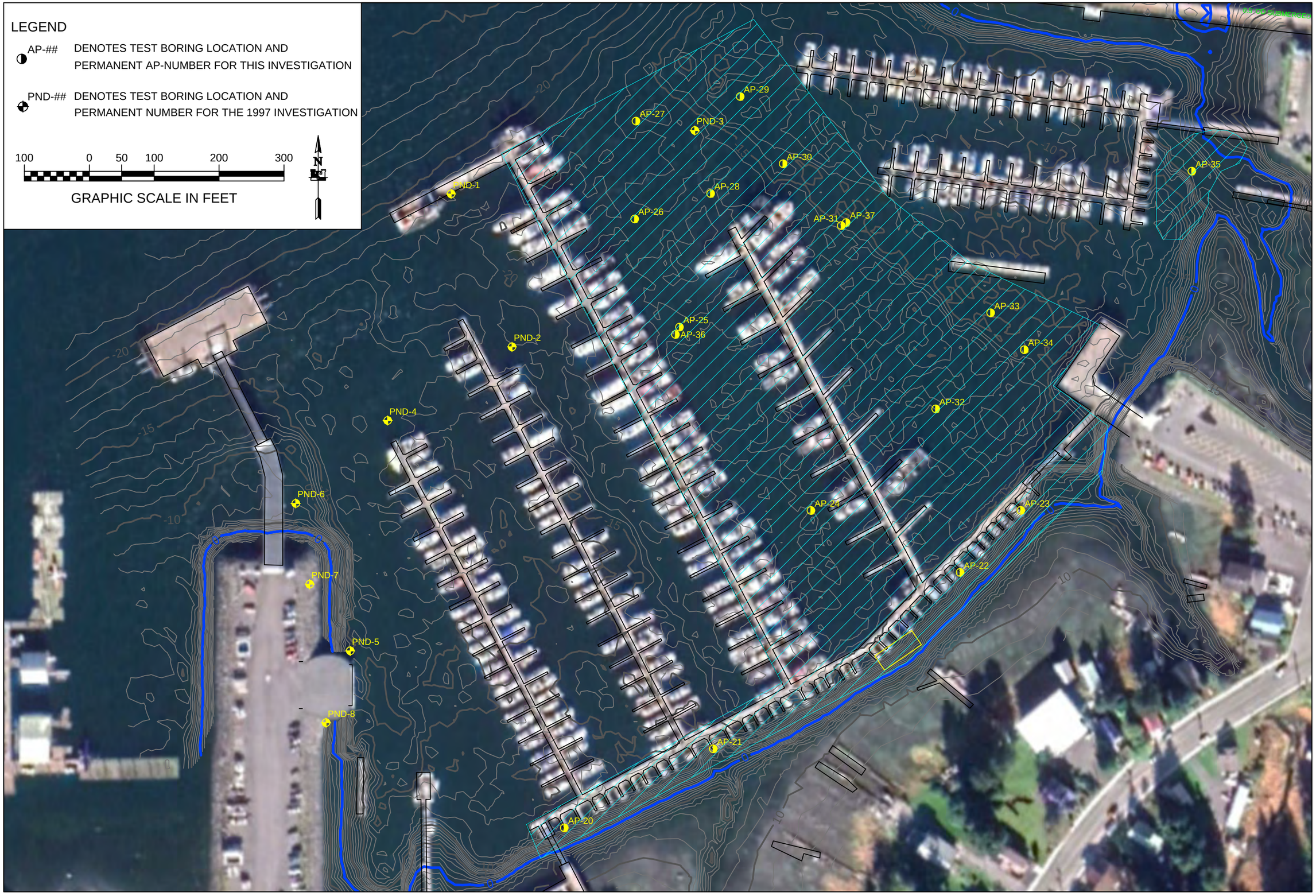
FLOAT NAMES AND HARBOR NAMES
PETERSBURG NAVIGATION IMPROVEMENTS
SOUTH HARBOR DREDGING
PETERSBURG, ALASKA

SCALE: NTS
DATE: JULY 2018
DRAWN/RVW: IJR/JJR
FIGURE A-2



US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

SCALE: GRAPHICAL
DRAWN: IJR
REVIEWED: JJR
DATE: AUGUST 2018

TEST BORING LOCATION MAP
PETERSBURG NAVIGATION IMPROVEMENTS
PETERSBURG, ALASKA

ALASKA DISTRICT
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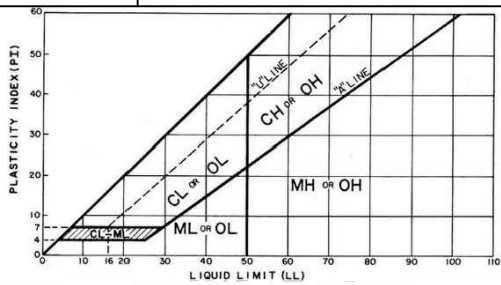
REFERENCE NUMBER
A-3
SHEET A-3

APPENDIX B
Exploration Logs

Approximate Location Coordinates ..... 1 Sheet
Exploration Logs Legend ..... 1 Sheet
Exploration Logs ..... 18 Sheets

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART (modified from ASTM D2487)

MAJOR DIVISIONS				SYMBOLS	DESCRIPTIONS	
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS > 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS <5% FINES	$C_u \geq 4$ AND $1 \leq C_c \leq 3$	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	If soil contains ≥15% sand, add "with sand"
			$C_u < 4$ AND/OR [$C_c < 1$ OR $C_c > 3$]	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	GM	Silty gravels, gravel-sand-silt mixtures	
			FINES CLASSIFY AS CL OR CH	GC	Clayey gravels, gravel-sand-clay mixtures	
	SAND AND SANDY SOILS > 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS <5% FINES	$C_u \geq 6$ AND $1 \leq C_c \leq 3$	SW	Well-graded sands, gravelly sands, little or no fines	If soil contains ≥15% gravel, add "with gravel"
			$C_u < 6$ AND/OR [$C_c < 1$ OR $C_c > 3$]	SP	Poorly graded sands, gravelly sands, little or no fines	
		SANDS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	Silty sands, sand-silt mixtures	
			FINES CLASSIFY AS CL OR CH	SC	Clayey sands, sand-clay mixtures	
FINE GRAINED SOILS 50% OR MORE PASSES THE NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT <50	PLASTICITY CHART		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	If soil contains coarse-grained soil from 15% to 29%, add "with sand" or "with gravel" for whichever type is prominent, or for ≥30%, add "sandy" or "gravelly"
				ML	Inorganic silts, very fine sands, rock flour, silty/clayey fine sands or clayey silts of slight plasticity	
				OL	Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS LIQUID LIMIT ≥50			CH	Inorganic clays of high plasticity, fat clays	
				MH	Inorganic silts, macaceous or dimaceous fine sandy or silty soils, elastic silt	
				OH	Organic clays of high plasticity, fat clays	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	Peat humus, swamp soils with high organic content	



COMPONENT DEFINITIONS BY GRADATION

COMPONENT	SIZE RANGE
BOULDERS	> 12 IN. (300 MM)
COBBLES	12 IN. (300 MM) to 3 IN. (75 MM)
GRAVEL	3 IN. (75 MM) to #4 SIEVE (4.76 MM)
COARSE GRAVEL	3 IN. (75 MM) to 3/4 IN. (18.75 MM)
FINES GRAVEL	3/4 IN. to #4 SIEVE (4.76 MM)
SAND	#4 (4.76 MM) to #200 (0.074 MM)
COARSE SAND	#4 (4.76 MM) to #10 (2.0 MM)
MEDIUM SAND	#10 (2.0 MM) to #40 (0.42 MM)
FINE SAND	#40 (0.42 MM) to #200 (0.074 MM)
SILT & CLAY (FINES)	< #200 (0.074 MM)

FROST DESIGN SOIL CLASSIFICATION (UFC 3-250-01FA, TABLE 18-2)

GROUP	TYPICAL SOILS
F1	Gravelly Soils
F2	Gravelly Soils, Sands
F3	Gravelly Soils, Sands, Except Very Fine Silt Sands
F4	All Silts, Very Fine Silty Sands, Clays, PI >12, Varved Clays and Other Fine-Grained Banded Sediments
NFS	Non-Frost-Susceptible
PFS	Possibly Frost Susceptible
S1	Gravelly Soils
S2	Sandy Soils

DESCRIPTION OF FROZEN SOILS (ASTM D4083)

GROUP	DESCRIPTION
ICE NOT VISIBLE	
Nf	Poorly Bonded or Friable
Nbn	Well Bonded, No Excess Ice
Nbe	Well Bonded, Excess Ice
VISIBLE ICE, < 1 IN. THICK	
Vx	Crystals
Vc	Ice Coatings or Particles
Vr	Ice Formations
Vs	Stratified or Distinctly Oriented Ice Formations
VISIBLE ICE, > 1 IN. THICK	
Ice	Ice without Soil Inclusions
Ice + Soil	Ice with Soil Inclusions

NOTES TO UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

NOTES:

1: Coefficient of uniformity : $C_u = D_{60}/D_{10}$
2: Coefficient of curvature: $C_c = [(D_{30})^2] / (D_{10} \times D_{60})$
3: $D_{(x\%)}$ is soil particle diameter where x% is % finer.
4: Gravels or sands with 5% to 12% fines require dual symbols (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC) and add "with clay" or "with silt" to group name. If fines classify as CL-ML for GM or SM, use dual symbol GC-GM or SC-SM.

TEST BORING NOTES

TEST BORING NOTES:

1: The number of blows required to drive each six-inch increment is recorded on the exploration logs. The reported blow count is an indication of the relative density or consistency of the soil. It should be noted that blow counts obtained in frozen soils do not represent the penetration of those same soils in a thawed state.
2: Soil classifications and descriptions reported on the exploration logs are in accordance with ASTM D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and ASTM D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
3: The soil classifications and descriptions contained on the exploration logs are the project engineer's interpretation of the field logs and results of the laboratory testing program. The stratification lines shown on the exploration logs represent approximate boundaries between soil types. The actual transitions are often gradual or not discernable by drill action.

CRITERIA FOR DESCRIBING MOISTURE CONDITION (ASTM D2488)

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below water table

OTHER MATERIAL SYMBOLS

ASPHALT PAVEMENT	
BASALT	
BEDROCK	
PORTLAND CEMENT CONCRETE	
COBBLES/BOULDERS	

SAMPLER ABBREVIATIONS/SYMBOLS

AUGER	Auger Cuttings
CORE	Rock Core
GRAB	Grab Sample
LPT	Large Penetration Test
NR	No Recovery
SH	Tube Sample
SPT	Standard Penetration Test (ASTM D 1586)
UNDIST	Undisturbed Sample
VANE	Vane Shear

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LEGEND TO EXPLORATION LOGS
PETERSBURG NAVIGATION IMPROVEMENTS
PETERSBURG, ALASKA

SCALE: NTS
DATE: JUN 2018
DRAWN/RVW: GF/CJC
LOG LEGEND

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Geotechnical and Materials Section

EXPLORATION LOG

Project:	Petersburg Navigation Improvements, Petersburg, Alaska
Page	1 of 1
Date:	10 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,817,643 ft. ±; Easting: 2,826,373 ft. ±
Top of Hole Elevation:	-11.5 ft. ±
Hole Number, Field:	TB-01
Permanent:	AP-20
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Tube sampler; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	3.0 ft.
Total Depth:	3.0 ft.
Hammer Weight:	
Split Spoon I.D.:	
Size and Type of Bit:	NA
Type of Equipment:	2 in. inside diameter clear plastic pipe
Type of Samples:	Tube

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks south end of floats parallel to the shore
		1		F4*				SM	Silty SAND	-/ 0.0		Black, wet, 2% gravel, 58% fine to coarse sand, 40% nonplastic fines, organic odor, refusal at three feet
1												
2												
3												Bottom of Hole 3.0 ft. Elevation -14.5 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Surficial sample was taken by manually pushing a 2 in. inside diameter clear plastic pipe
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-20

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Geotechnical and Materials Section

EXPLORATION LOG

Project: **Petersburg Navigation Improvements, Petersburg, Alaska**

Date: **10 Apr 2018**

Drilling Agency: ☐ Alaska District ☒ Other **ERDC**

Datum: Vertical **MLLW** Horizontal **ASP1 NAD83**

Location: Northing: **1,817,766 ft. ±** Easting: **2,826,602 ft. ±**

Top of Hole Elevation: **-7.5 ft. ±**

Hole Number, Field: **TB-02** Permanent: **AP-21**

Operator: **Tommy Kirklin**

Inspector: **Inocencio Roman**

Type of Hole: ☒ other **Tube sampler** ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **Sampled Below Water**

Depth Drilled: **1.0 ft.**

Total Depth: **1.0 ft.**

Hammer Weight:

Split Spoon I.D.:

Size and Type of Bit: **NA**

Type of Equipment: **2 in. inside diameter PVC pipe**

Type of Samples: **Tube**

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks south end of floats parallel to the shore
		1		NFS*				SP	Poorly graded SAND			Gray, wet, 6% gravel, 90% fine to coarse sand, 4% nonplastic fines, seashells, organic odor, refusal at one foot
1												Bottom of Hole 1.0 ft. Elevation -8.5 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Surficial sample was taken by manually pushing a 2 in. inside diameter PVC pipe
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

EXPLORATION LOG 2018 SOUTH HARBOR - REV.GPJ BUCKLAND.GPJ 8/29/18

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Geotechnical and Materials Section

EXPLORATION LOG

Project: **Petersburg Navigation Improvements, Petersburg, Alaska**

Date: **10 Apr 2018**

Drilling Agency: ☐ Alaska District ☒ Other **ERDC**

Datum: Vertical **MLLW** Horizontal **ASP1 NAD83**

Location: Northing: **1,818,038 ft. ±** Easting: **2,826,982 ft. ±**

Top of Hole Elevation: **-11.6 ft. ±**

Hole Number, Field: **TB-03** Permanent: **AP-22**

Operator: **Tommy Kirklin**

Inspector: **Inocencio Roman**

Type of Hole: ☒ other **Tube sampler** ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **Sampled Below Water**

Depth Drilled: **1.0 ft.**

Total Depth: **1.0 ft.**

Hammer Weight:

Split Spoon I.D.:

Size and Type of Bit: **NA**

Type of Equipment: **2 in. inside diameter PVC pipe**

Type of Samples: **Tube**

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks **south end of floats parallel to the shore**
		1		**F4***				**SM**	**Silty SAND**			**Gray to black, wet, 5% angular to subrounded gravel, 58% fine to coarse sand, 37% nonplastic to low plasticity plasticity fines, max size = 0.25 in., seashells, organic odor, refusal at one foot**
1												**Bottom of Hole 1.0 ft.** **Elevation -12.6 ft. ±** **Sampled Below Water** **PID = (Cold/Hot) Photo Ionization Detector** **Surficial sample was taken by manually pushing a 2 in. inside diameter PVC pipe**
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

EXPLORATION LOG 2018 SOUTH HARBOR - REV.GPJ BUCKLAND.GPJ 8/29/18

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Geotechnical and Materials Section

EXPLORATION LOG

Project:	Petersburg Navigation Improvements, Petersburg, Alaska
Page	1 of 1
Date:	10 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,134 ft. ±; Easting: 2,827,076 ft. ±
Top of Hole Elevation:	-8.8 ft. ±
Hole Number, Field:	TB-04
Permanent:	AP-23
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Tube sampler; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	2.0 ft.
Total Depth:	2.0 ft.
Hammer Weight:	
Split Spoon I.D.:	
Size and Type of Bit:	NA
Type of Equipment:	2 in. inside diameter PVC pipe
Type of Samples:	Tube

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks south end of floats parallel to the shore
1		1		F4*				SM	Silty SAND			Gray to black, wet, 82% fine to coarse sand, 18% nonplastic fines, organic odor, shells, Liquid Limit =30, Plasticity Index = Nonplastic, refusal at two feet
2												Bottom of Hole 2.0 ft. Elevation -10.8 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Surficial sample was taken by manually pushing a 2 in. inside diameter PVC pipe
3												
4												
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6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-23

ALASKA DISTRICT
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Geotechnical and Materials Section

EXPLORATION LOG

Project:	Petersburg Navigation Improvements, Petersburg, Alaska
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Date:	8 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,127 ft. ±; Easting: 2,826,753 ft. ±
Top of Hole Elevation:	-16.5 ft. ±
Hole Number, Field:	TB-05
Permanent:	AP-24
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	3.0 ft.
Total Depth:	3.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		F4*				CL-ML	Sandy Silty CLAY with Gravel			Gray, wet, 21% subangular to subrounded gravel, 28% fine to coarse sand, 51% low to medium plasticity fines, max size = 1.5 in.
1				F4*				CL-ML	Sandy Silty Clay			Gray, wet, 8% subangular to subrounded gravel, 25% fine to coarse sand, 67% low to medium plasticity fines, max size = 2.5 in., Liquid Limit =24, Plastic Limit = 17, Plasticity Index = 7, refusal at 3 feet
2		2										
3												Bottom of Hole 3.0 ft. Elevation -19.5 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-24

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Geotechnical and Materials Section

EXPLORATION LOG

Project: **Petersburg Navigation Improvements, Petersburg, Alaska**

Date: **8 Apr 2018**

Drilling Agency: ☐ Alaska District ☒ Other **ERDC**

Datum: Vertical **MLLW** Horizontal **ASP1 NAD83**

Location: Northing: **1,818,416 ft. ±** Easting: **2,826,550 ft. ±**

Top of Hole Elevation: **-16.3 ft. ±**

Hole Number, Field: **TB-06** Permanent: **AP-25**

Operator: **Tommy Kirklin**

Inspector: **Inocencio Roman**

Type of Hole: ☒ other **Gravity Environmental Vibracore** ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **Sampled Below Water**

Depth Drilled: **1.0 ft.**

Total Depth: **1.0 ft.**

Hammer Weight:

Split Spoon I.D.: **3.25 in.**

Size and Type of Bit: **NA**

Type of Equipment: **Gravity Environmental Vibracore**

Type of Samples: **Core**

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		F4*				CL-ML	Sandy Silty Clay			Gray, wet, 9% subangular to subrounded gravel, 41% fine to coarse sand, 50% low plasticity plasticity fines, max size = 1 in., refusal at one foot
1												Bottom of Hole 1.0 ft. Elevation -17.3 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
2												
3												
4												
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6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: **Petersburg Navigation Improvements,**

Hole Number: **AP-25**

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EXPLORATION LOG

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Date:	8 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,583 ft. ±; Easting: 2,826,481 ft. ±
Top of Hole Elevation:	-16.5 ft. ±
Hole Number, Field:	TB-07
Permanent:	AP-26
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	1.0 ft.
Total Depth:	1.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		S2*				SP-SM	Poorly graded SAND with Silt and Gravel			Gray, wet, 21% subangular to subrounded gravel, 68% fine to coarse sand, 11% nonplastic fines, max size = 1 in., seashells, piece of wood, refusal at one foot
1												Bottom of Hole 1.0 ft. Elevation -17.5 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-26

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Project:	Petersburg Navigation Improvements, Petersburg, Alaska
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Date:	8 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,734 ft. ±; Easting: 2,826,483 ft. ±
Top of Hole Elevation:	-15.7 ft. ±
Hole Number, Field:	TB-08
Permanent:	AP-27
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	3.5 ft.
Total Depth:	3.5 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
1		1		NFS*				SP	Poorly graded SAND			Gray, wet, 13% subangular to subrounded gravel, 83% fine to coarse sand, 4% nonplastic fines, seashells
2		2		S2*				SP-SM	Poorly graded SAND with Silt and Gravel			Gray, wet, 19% subangular to subrounded gravel, 75% fine to coarse sand, 6% nonplastic fines, max size = 1.25 in., seashells, refusal at three feet
3												
4												Bottom of Hole 3.5 ft. Elevation -19.2 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-27

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Project:	Petersburg Navigation Improvements, Petersburg, Alaska
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Date:	8 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,622 ft. ±; Easting: 2,826,598 ft. ±
Top of Hole Elevation:	-16.7 ft. ±
Hole Number, Field:	TB-09
Permanent:	AP-28
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	0.5 ft.
Total Depth:	0.5 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		F2*				SM	Silty SAND with Gravel			Gray, wet, 24% subangular to subrounded gravel, 56% fine to coarse sand, 20% nonplastic fines, max size = 2.5 in., seashells, refusal
1												Bottom of Hole 0.5 ft. Elevation -17.2 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-28

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Date:	9 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,771 ft. ±; Easting: 2,826,643 ft. ±
Top of Hole Elevation:	-12.4 ft. ±
Hole Number, Field:	TB-10
Permanent:	AP-29
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	1.0 ft.
Total Depth:	1.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks Near two large boulders identified in the survey
		1		S2*				SP-SM	Poorly graded SAND with Silt			Gray, wet, 8% subangular to subrounded gravel, 86% fine to coarse sand, 6% nonplastic fines, max size = 1 in., seashells, refusal at one foot
1												Bottom of Hole 1.0 ft. Elevation -13.4 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-29

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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,668 ft. ±; Easting: 2,826,709 ft. ±
Top of Hole Elevation:	-13.5 ft. ±
Hole Number, Field:	TB-11
Permanent:	AP-30
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	1.0 ft.
Total Depth:	1.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks Near two large boulders identified in the survey
		1		F4*				SM	Silty SAND with Gravel			Gray, wet, 19% subangular to subrounded gravel, 37% fine to coarse sand, 44% nonplastic fines, max size = 2.5 in., seashells, refusal at one foot
1												Bottom of Hole 1.0 ft. Elevation -14.5 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
2												
3												
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-30

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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,573 ft. ±; Easting: 2,826,799 ft. ±
Top of Hole Elevation:	-16.1 ft. ±
Hole Number, Field:	TB-12
Permanent:	AP-31
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	2.5 ft.
Total Depth:	2.5 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
1 2		1		F4*				SM	Silty SAND with Gravel			Gray, wet, 14% subangular to subrounded gravel, 37% fine to coarse sand, 49% low to medium plasticity fines, max size = 1.5 in., seashells, refusal at 2.5 feet
3 4 5 6 7 8 9												Bottom of Hole 2.5 ft. Elevation -18.6 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-31

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Project:	Petersburg Navigation Improvements, Petersburg, Alaska
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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,290 ft. ±; Easting: 2,826,945 ft. ±
Top of Hole Elevation:	-18.1 ft. ±
Hole Number, Field:	TB-13
Permanent:	AP-32
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	7.0 ft.
Total Depth:	7.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
0–2		1		F4*				ML	Sandy SILT			Gray, wet, 11% subangular to subrounded gravel, 35% fine to coarse sand, 54% low to medium plasticity fines, max size = 0.5 in., organics, seashells, refusal at seven feet
2–7		2		F4*				CL	Sandy lean CLAY with Gravel			Gray, wet, 15% subangular to subrounded gravel, 27% fine to coarse sand, 58% low plasticity fines, max size = 2 in., Liquid Limit = 19, Plastic Limit = 16, Plasticity Index=3, refusal at seven feet
7												Bottom of Hole 7.0 ft. Elevation -25.1 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-32

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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,438 ft. ±; Easting: 2,827,029 ft. ±
Top of Hole Elevation:	-14.8 ft. ±
Hole Number, Field:	TB-14
Permanent:	AP-33
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	6.0 ft.
Total Depth:	6.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
0–4		1		F4*				SM	Silty SAND with Gravel			Gray, wet, 16% subangular to subrounded gravel, 38% fine to coarse sand, 46% low to medium plasticity fines, max size = 2 in.
4–6		2		F4*				ML	Sandy SILT			Gray, wet, 4% gravel, 31% fine to coarse sand, 65% low to medium plasticity fines, max size = 0.5 in., refusal at six feet
6												Bottom of Hole 6.0 ft. Elevation -20.8 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-33

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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,381 ft. ±; Easting: 2,827,081 ft. ±
Top of Hole Elevation:	-16.2 ft. ±
Hole Number, Field:	TB-15
Permanent:	AP-34
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	10.0 ft.
Total Depth:	10.0 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		F4*				SM	Silty SAND with Gravel			Gray, wet, 24% subangular to subrounded gravel, 30% fine to coarse sand, 46% low to medium plasticity fines, max size = 2 in.
1				F4*				CL-ML	Sandy Silty Clay			Gray, wet, 6% subangular to subrounded gravel, 29% fine to coarse sand, 65% low to medium plasticity fines, Liquid Limit = 20, Plastic Limit = 15, Plasticity Index = 5
2												
3												
4												
5												
		2										
6												
7												
8												
9												
10												Bottom of Hole 10.0 ft. Elevation -26.2 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
11												
12												
13												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-34

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Date:	7 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,656 ft. ±; Easting: 2,827,340 ft. ±
Top of Hole Elevation:	-3.5 ft. ±
Hole Number, Field:	TB-16
Permanent:	AP-35
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	1.7 ft.
Total Depth:	1.7 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
1		1		F2*				SM	Silty SAND with Gravel			Gray, wet, 29% subangular to subrounded gravel, 41% fine to coarse sand, 30% low to medium plasticity fines, max size = 1.5 in., seashells, refusal at 1.67 feet
2												Bottom of Hole 1.7 ft. Elevation -5.2 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
3												
4												
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7												
8												
9												

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-35

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Date:	9 Apr 2018
Drilling Agency:	☐ Alaska District ☒ Other ERDC
Datum:	Vertical MLLW; Horizontal ASP1 NAD83
Location:	Northing: 1,818,405 ft. ±; Easting: 2,826,543 ft. ±
Top of Hole Elevation:	-16.9 ft. ±
Hole Number, Field:	TB-06A
Permanent:	AP-36
Operator:	Tommy Kirklin
Inspector:	Inocencio Roman
Type of Hole:	☒ other Gravity Environmental Vibracore; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater:	Sampled Below Water
Depth Drilled:	2.5 ft.
Total Depth:	2.5 ft.
Hammer Weight:	
Split Spoon I.D.:	3.25 in.
Size and Type of Bit:	NA
Type of Equipment:	Gravity Environmental Vibracore
Type of Samples:	Core

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
1 2		1		F4*				CL-ML	Sandy Silty Clay			Gray, wet, 11% subangular to subrounded gravel, 28% fine to coarse sand, 61% low to medium plasticity fines, seashells, seaweed, Liquid Limit = 20, Plastic Limit = 13, Plasticity Index = 7, refusal at 2.5 feet
3 4 5 6 7 8 9												Bottom of Hole 2.5 ft. Elevation -19.4 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore

* Indicates Estimated Frost Classification

Project: Petersburg Navigation Improvements,

Hole Number: AP-36

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Geotechnical and Materials Section

EXPLORATION LOG

Project: **Petersburg Navigation Improvements, Petersburg, Alaska**

Date: **9 Apr 2018**

Drilling Agency: ☐ Alaska District ☒ Other **ERDC**

Datum: Vertical **MLLW** Horizontal **ASP1 NAD83**

Location: Northing: **1,818,577 ft. ±** Easting: **2,826,807 ft. ±**

Top of Hole Elevation: **-15.3 ft. ±**

Hole Number, Field: **TB-12A** Permanent: **AP-37**

Operator: **Tommy Kirklin**

Inspector: **Inocencio Roman**

Type of Hole: ☒ other **Gravity Environmental Vibracore** ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: **Sampled Below Water**

Depth Drilled: **2.5 ft.**

Total Depth: **2.5 ft.**

Hammer Weight:

Split Spoon I.D.: **3.25 in.**

Size and Type of Bit: **NA**

Type of Equipment: **Gravity Environmental Vibracore**

Type of Samples: **Core**

Depth (ft.)	Lithology	Sample Recovery	ASTM D 4083 Frozen	Frost Class. ufc3-250-01fa	Blow Count	N-Value	Sample Type	Symbol	Classification ASTM: D 2487 or D 2488	PID (ppm)	% Water	Description and Remarks
		1		F4*				ML	Sandy SILT			Gray, wet, 13% subangular to subrounded gravel, 31% fine to coarse sand, 56% low to medium plasticity fines, max size = 1.5 in., seashells
1		2		F4*				ML	Sandy SILT			Gray, wet, 12% subangular to subrounded gravel, 31% fine to coarse sand, 57% low to medium plasticity fines, max size = 1.5 in., Liquid Limit = 19, Plastic Limit = 16, Plasticity Index = 3, refusal at 2.5 feet
2												
3												Bottom of Hole 2.5 ft. Elevation -17.8 ft. ± Sampled Below Water PID = (Cold/Hot) Photo Ionization Detector Samples were taken with a 3-1/4 in. inside diameter split barrel sampler driven by the Vibracore
4												
5												
6												
7												
8												
9												

* Indicates Estimated Frost Classification

EXPLORATION LOG 2018 SOUTH HARBOR - REV.GPJ BUCKLAND.GPJ 8/29/18

APPENDIX C
Laboratory Test Results

Summary of Laboratory Test Results ..... 1 Sheet
Individual Laboratory Resuts.....24 Sheets

Summary of Laboratory Test Results

Petersburg South Harbor Navigation Improvements

Petersburg, Alaska

NGE-TFT Project #:4977-18

Exploration ID	Sample Number	Depth Interval (ft) Top	Depth Interval (ft) Bottom	Atterberg Limit ASTM D4318	Particle Size Analysis ASTM C136/D422/D6913 (% By Mass) Gravel	Sand	Silt/Clay	Passing 0.02mm ASTM D7928 (% By Mass)	Frost Class.	Unified Soil Classification ASTM D2487
TB-01	S-1	0.0	3.0		2.0	58.0	40.0			(SM) Silty sand
TB-02	S-1	0.0	1.0		6.6	89.8	3.6			(SP) Poorly-graded sand
TB-03	S-1	0.0	1.0		4.6	58.5	36.9			(SM) Silty sand
TB-04	S-1	0.0	2.0	LL=30	0.2	82.0	17.8			(SM) Silty sand
TB-05	S-1	0.0	1.0		21.3	27.9	50.8			(ML) Sandy silt w/ gravel
TB-05	S-2	1.0	3.0	LL=24 / PL=17 / PI=7	8.2	25.0	66.8			(CL-ML) Sandy silty clay
TB-06	S-1	0.0	1.0		8.7	41.0	50.3			(ML) Sandy silt
TB-06A	S-1	0.0	2.5	LL=20 / PL=13 / PI=7	10.9	28.3	60.8			(CL-ML) Sandy silty clay
TB-07	S-1	0.0	1.0		20.8	68.4	10.8			(SP-SM) Poorly-graded sand w/ silt and gravel
TB-08	S-1	0.0	1.8		13.4	82.8	3.8			(SP) Poorly-graded sand
TB-08	S-2	1.8	3.5		19.1	75.0	5.9			(SP-SM) Poorly-graded sand w/ silt and gravel
TB-09	S-1	0.0	0.6		24.1	56.4	19.5			(SM) Silty sand w/ gravel
TB-10	S-1	0.0	1.0		7.8	86.6	5.6			(SP-SM) Poorly-graded sand w/ silt
TB-11	S-1	0.0	1.0		18.6	36.9	44.5			(SM) Silty sand w/ gravel
TB-12	S-1	0.0	2.5		13.6	36.7	49.7			(SM) Silty sand
TB-12A	S-1	0.0	1.0		12.6	31.1	56.3			(ML) Sandy silt
TB-12A	S-2	1.0	2.5	LL=19 / PL=16 / PI=3	12.4	30.7	56.9			(ML) Sandy silt
TB-13	S-1	0.0	2.0		11.2	34.8	54.0			(ML) Sandy silt
TB-13	S-2	2.0	7.0	LL=19 / PL=16 / PI=3	15.3	26.4	58.3			(ML) Sandy silt w/ gravel
TB-14	S-1	0.0	1.0		16.2	37.5	46.3			(SM) Silty sand w/ gravel
TB-14	S-2	1.0	6.0		3.6	31.2	65.2			(ML) Sandy silt
TB-15	S-1	0.0	1.0		23.7	30.2	46.1			(SM) Silty sand w/ gravel
TB-15	S-2	1.0	10.0	LL=20 / PL=15 / PI=5	6.1	28.9	65.0			(CL-ML) Sandy silty clay
TB-16	S-1	0.0	1.6		28.9	41.2	29.9			(SM) Silty sand w/ gravel

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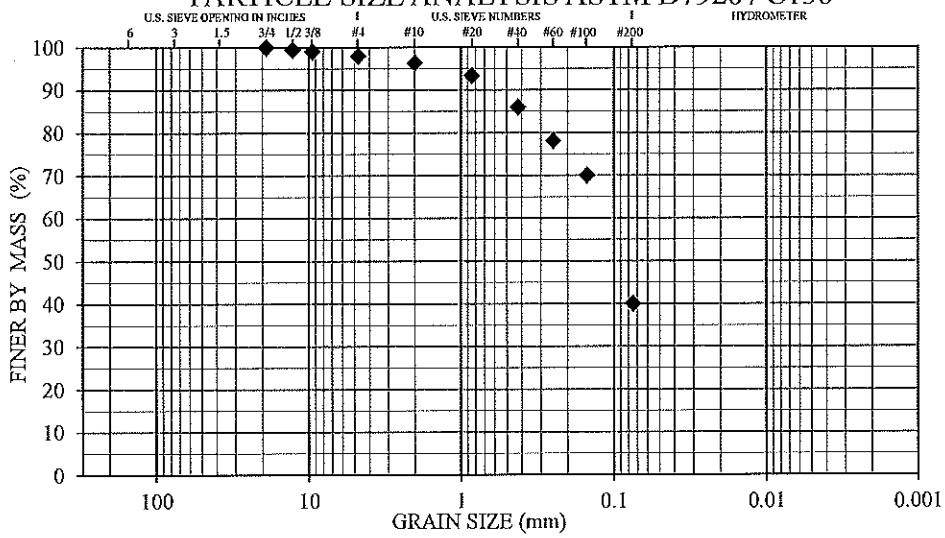
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-01
NUMBER/ DEPTH:	S-1 / 0' - 3'
DESCRIPTION:	Silty sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	2.0	USCS	SM
% SAND	58.0	USACOE FC	N/A
% SILT/CLAY	40.0	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

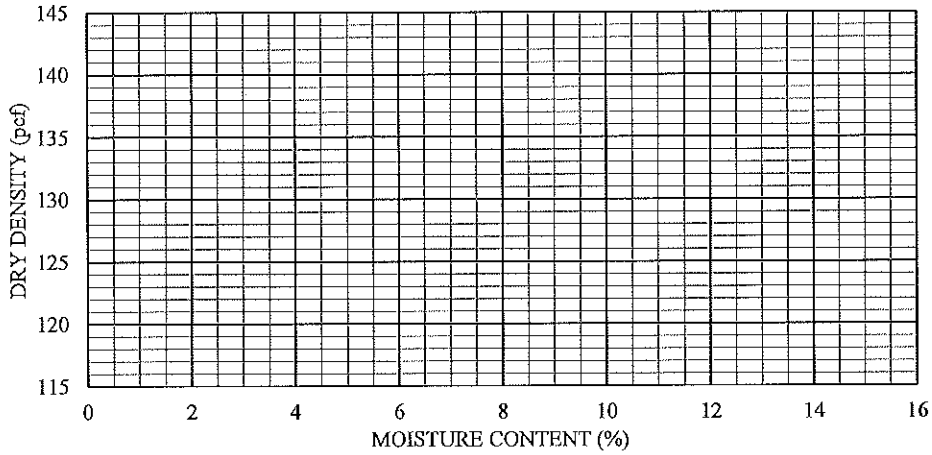
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	99	
9.50	3/8"	99	
4.75	#4	98	
2.00	#10	96	
0.85	#20	93	
0.43	#40	86	
0.25	#60	78	
0.15	#100	70	
0.075	#200	40.0	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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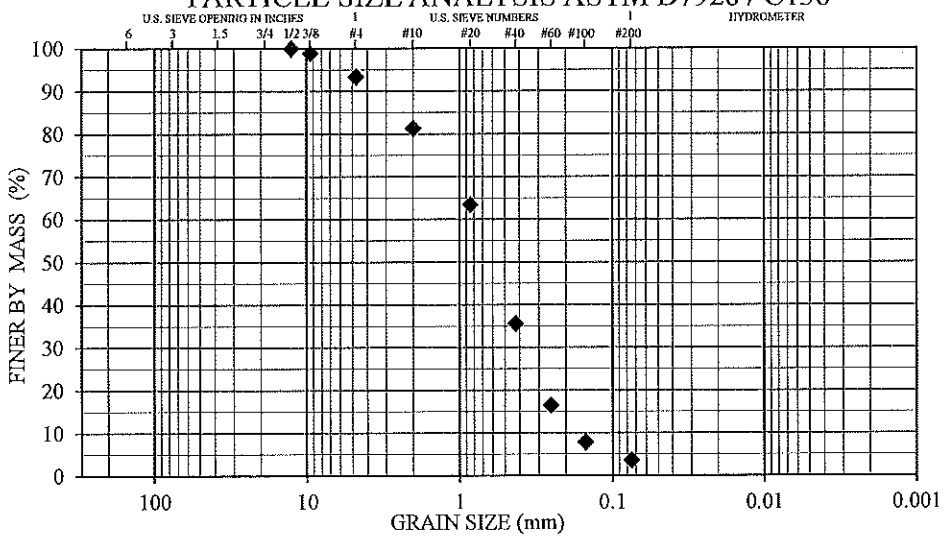
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-02
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Poorly-graded sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	6.6	USCS	SP
% SAND	89.8	USACOE FC	N/A
% SILT/CLAY	3.6	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	4.6
COEFFICIENT OF GRADATION (C_c)	1.0
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

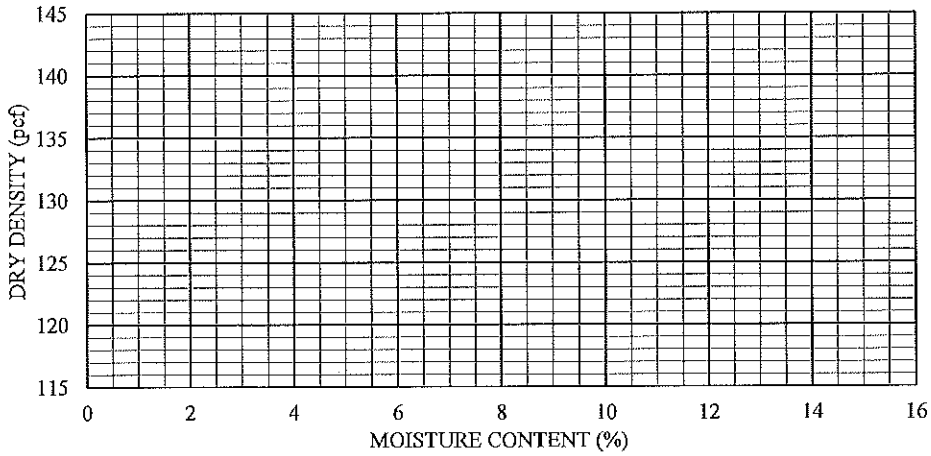
SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"	100	
9.50	3/8"	99	
4.75	#4	93	
2.00	#10	81	
0.85	#20	63	
0.43	#40	36	
0.25	#60	16	
0.15	#100	8	
0.075	#200	3.6	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



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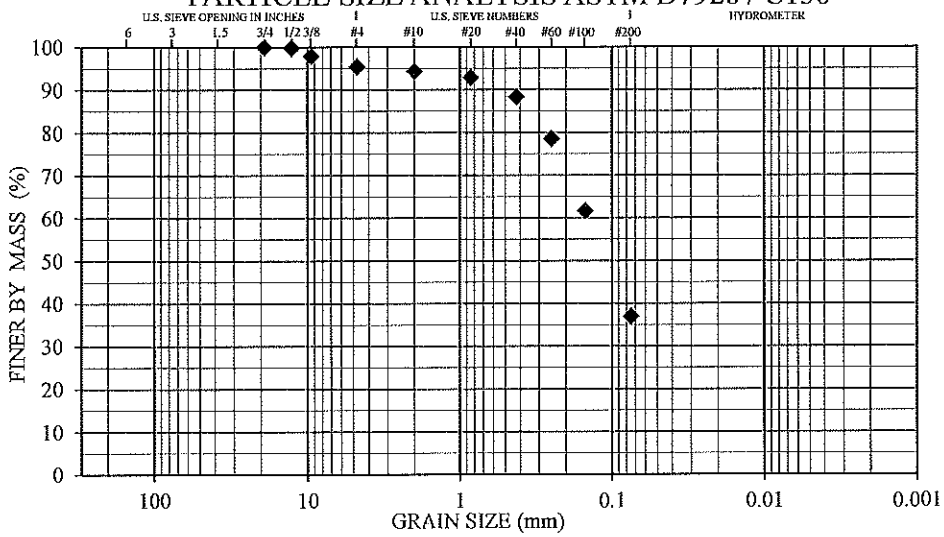
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-03
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Silty sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	4.6	USCS	SM
% SAND	58.5	USACOE FC	N/A
% SILT/CLAY	36.9	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

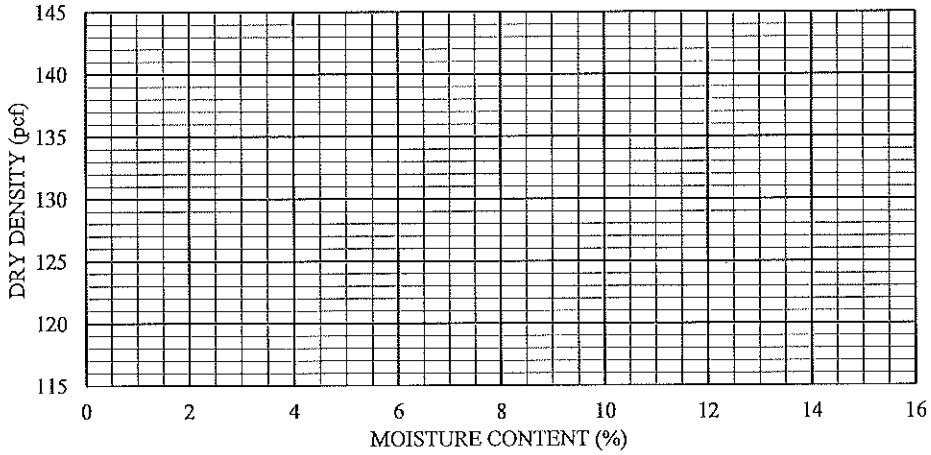
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	100	
9.50	3/8"	98	
4.75	#4	95	
2.00	#10	94	
0.85	#20	93	
0.43	#40	88	
0.25	#60	79	
0.15	#100	62	
0.075	#200	36.9	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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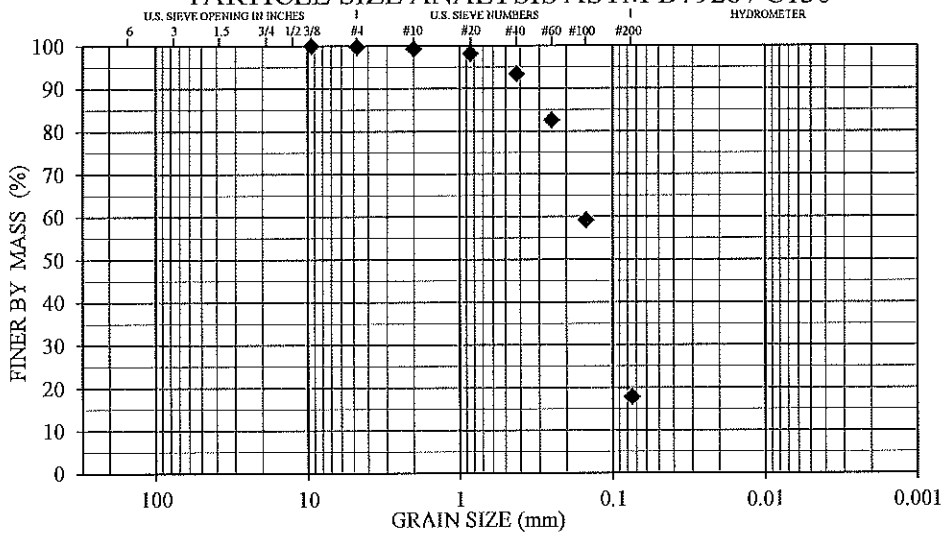
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-04
NUMBER/ DEPTH:	S-1 / 0' - 2'
DESCRIPTION:	Silty sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	0.2	USCS	SM
% SAND	82.0	USACOE FC	N/A
% SILT/CLAY	17.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

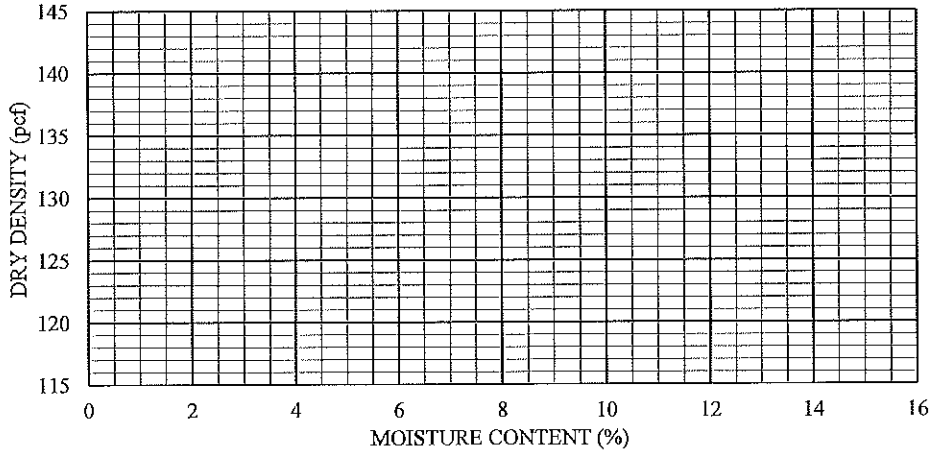
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"	100	
4.75	#4	100	
2.00	#10	99	
0.85	#20	98	
0.43	#40	93	
0.25	#60	83	
0.15	#100	59	
0.075	#200	17.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	LL = 30

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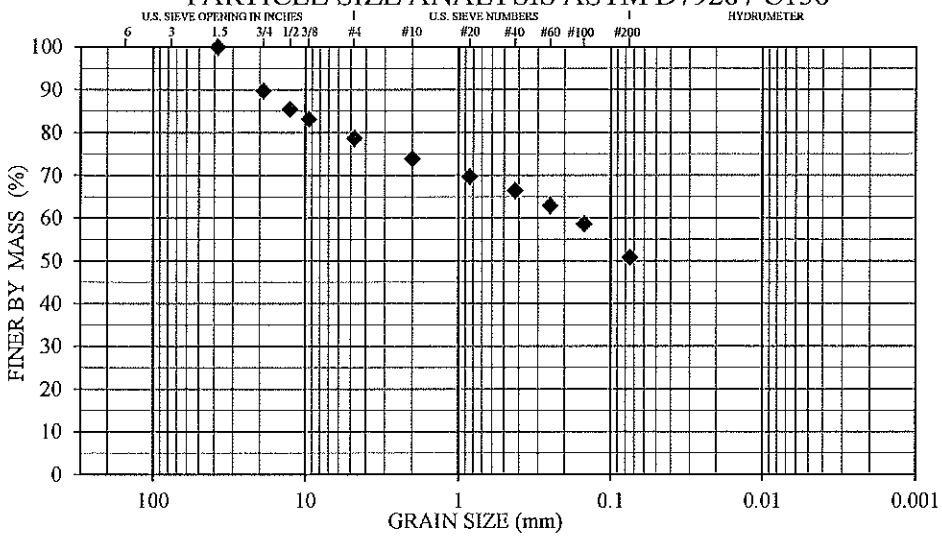
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-05
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Sandy silt w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	21.3	USCS	ML
% SAND	27.9	USACOE FC	N/A
% SILT/CLAY	50.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

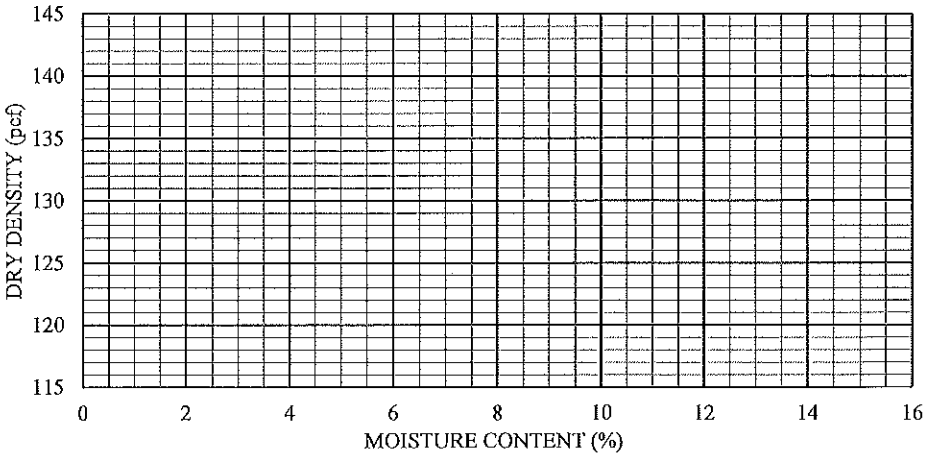
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	90	
12.70	1/2"	85	
9.50	3/8"	83	
4.75	#4	79	
2.00	#10	74	
0.85	#20	70	
0.43	#40	66	
0.25	#60	63	
0.15	#100	59	
0.075	#200	50.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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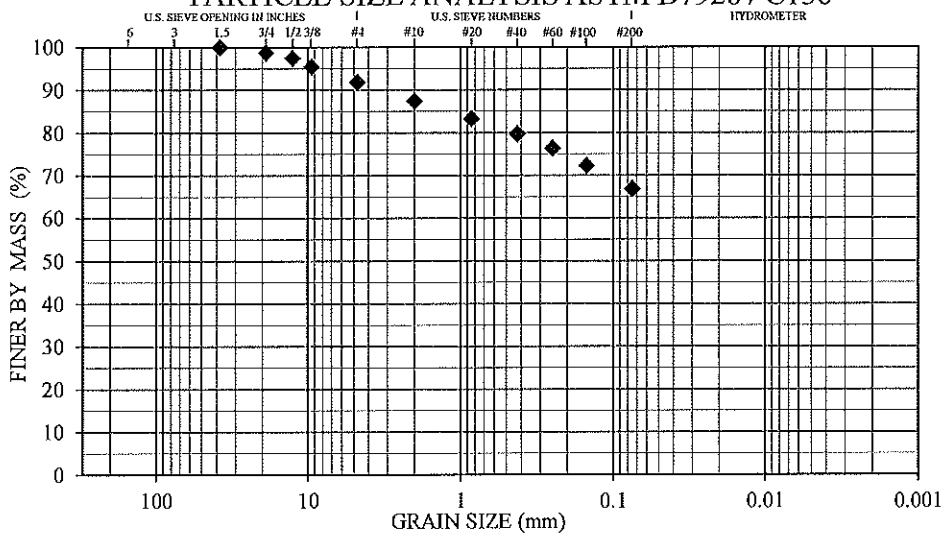
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-05
NUMBER/ DEPTH:	S-2 / 1' - 3'
DESCRIPTION:	Sandy silty clay
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	8.2	USCS	CL-ML
% SAND	25.0	USACOE FC	N/A
% SILT/CLAY	66.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

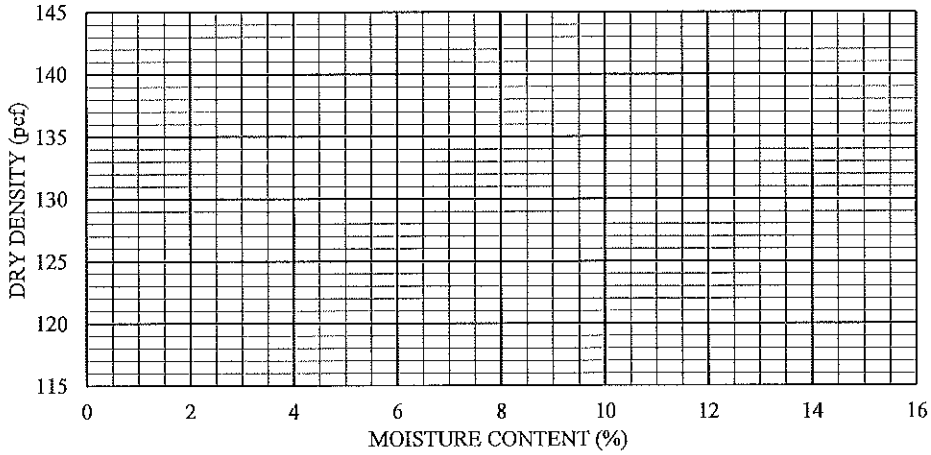
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	99	
12.70	1/2"	97	
9.50	3/8"	95	
4.75	#4	92	
2.00	#10	87	
0.85	#20	83	
0.43	#40	80	
0.25	#60	76	
0.15	#100	72	
0.075	#200	66.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	**LL = 24** **PI = 7**

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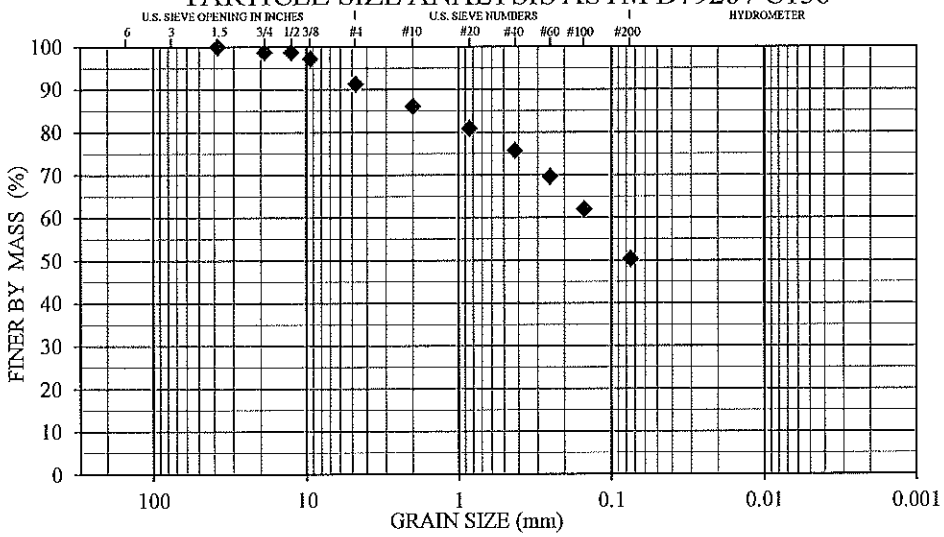
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-06
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	8.7	USCS	ML
% SAND	41.0	USACOE FC	N/A
% SILT/CLAY	50.3	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

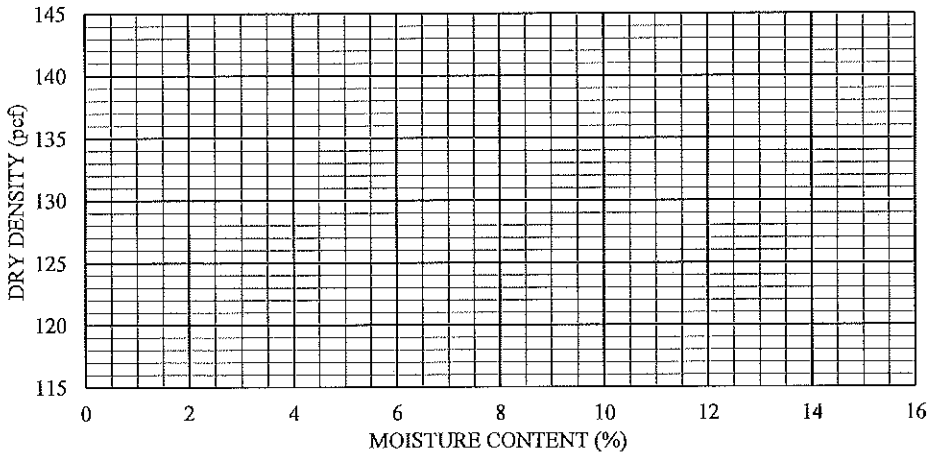
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	99	
12.70	1/2"	99	
9.50	3/8"	97	
4.75	#4	91	
2.00	#10	86	
0.85	#20	81	
0.43	#40	76	
0.25	#60	70	
0.15	#100	62	
0.075	#200	50.4	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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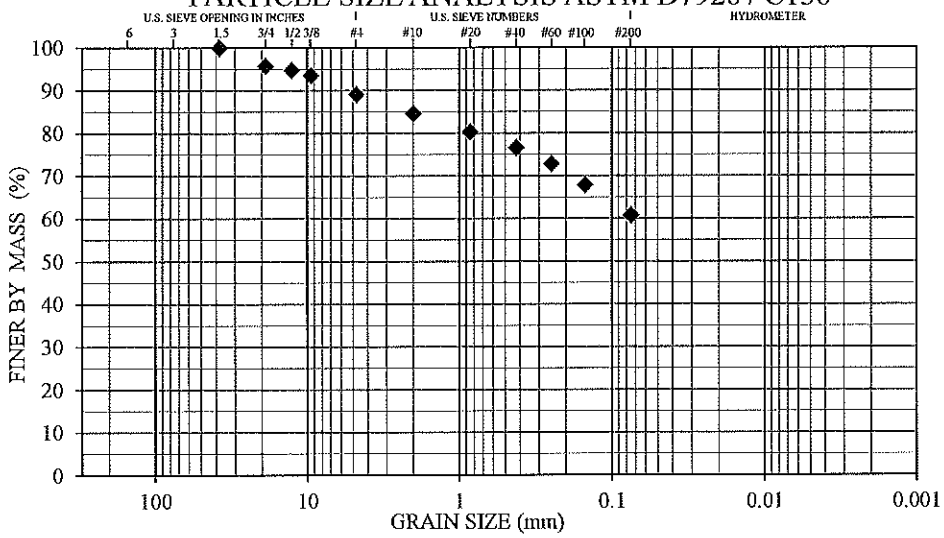
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-06A
NUMBER/ DEPTH:	S-1 / 0' - 2.5'
DESCRIPTION:	Sandy silty clay
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	10.9	USCS	CL-ML
% SAND	28.3	USACOE FC	N/A
% SILT/CLAY	60.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

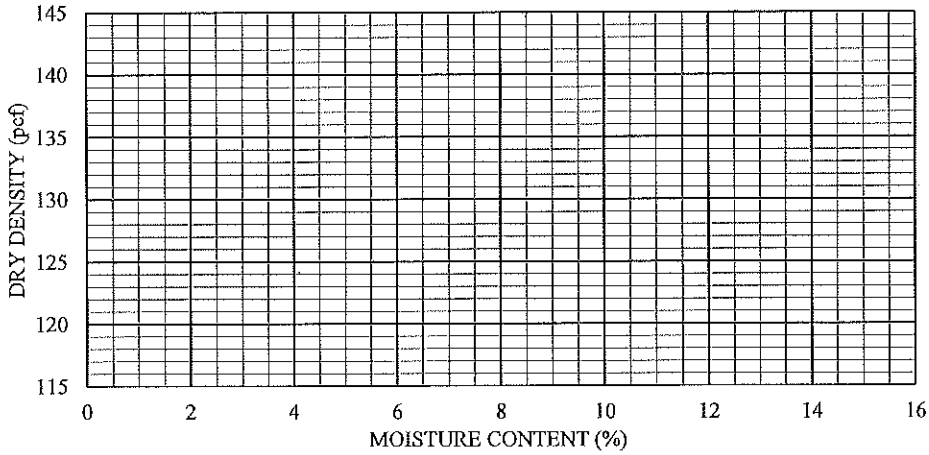
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	96	
12.70	1/2"	95	
9.50	3/8"	94	
4.75	#4	89	
2.00	#10	85	
0.85	#20	80	
0.43	#40	77	
0.25	#60	73	
0.15	#100	68	
0.075	#200	60.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	LL =20 PI = 7

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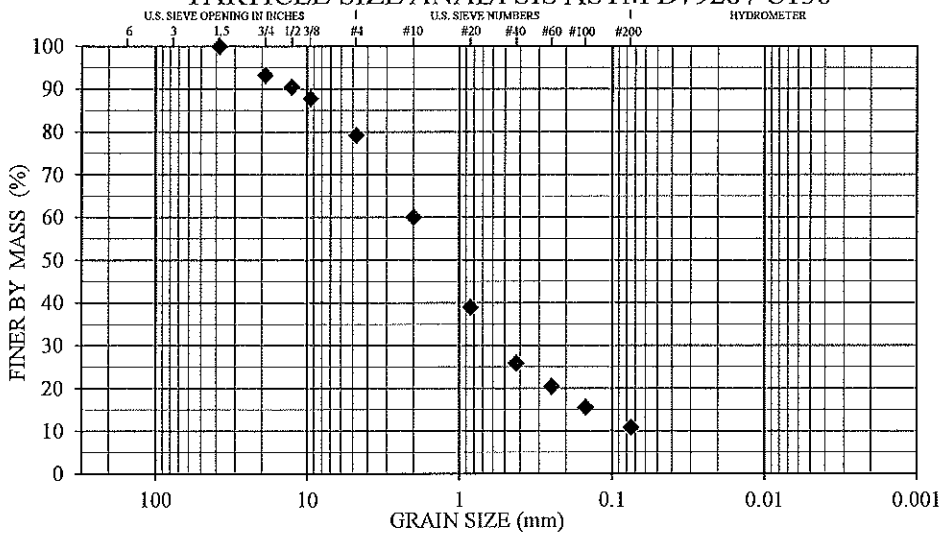
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-07
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Poorly-graded sand w/ silt and gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	20.8	USCS	SP-SM
% SAND	68.4	USACOE FC	N/A
% SILT/CLAY	10.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

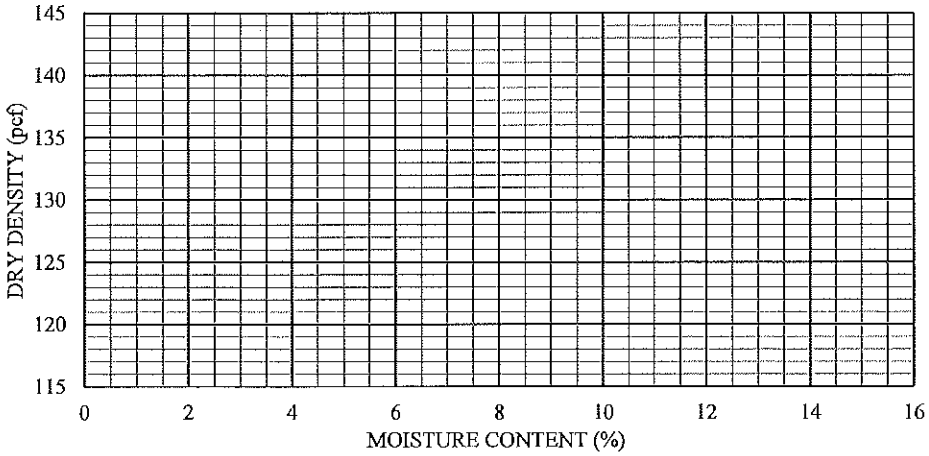
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	93	
12.70	1/2"	91	
9.50	3/8"	88	
4.75	#4	79	
2.00	#10	60	
0.85	#20	39	
0.43	#40	26	
0.25	#60	20	
0.15	#100	16	
0.075	#200	10.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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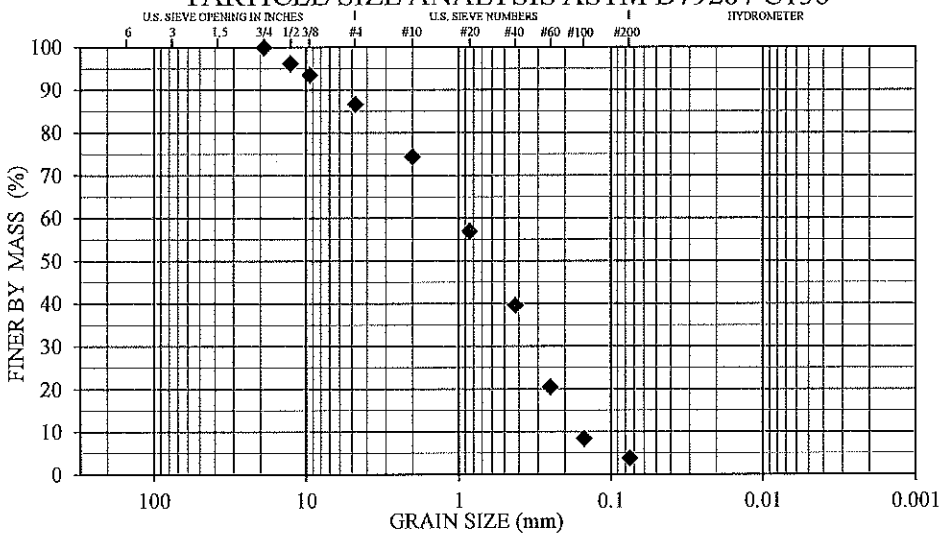
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-08
NUMBER/ DEPTH:	S-1 / 0' - 1.8'
DESCRIPTION:	Poorly-graded sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	13.4	USCS	SP
% SAND	82.8	USACOE FC	N/A
% SILT/CLAY	3.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	6.4
COEFFICIENT OF GRADATION (C_c)	0.7
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

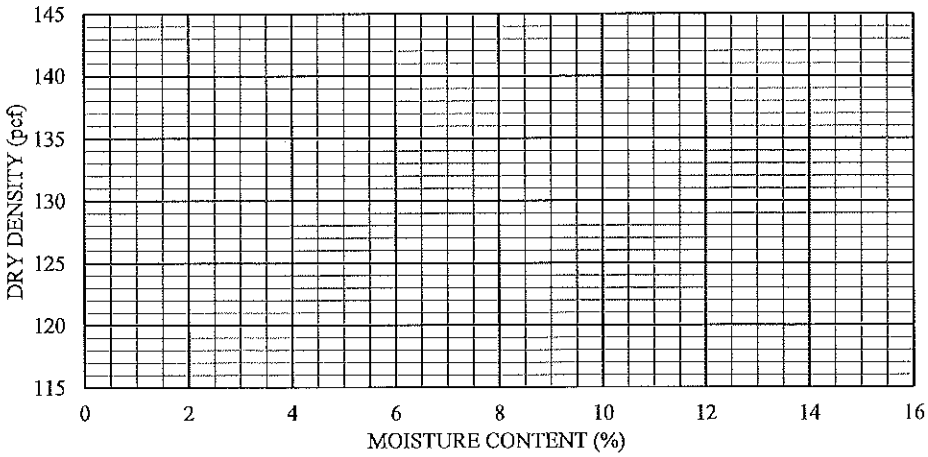
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	96	
9.50	3/8"	93	
4.75	#4	87	
2.00	#10	74	
0.85	#20	57	
0.43	#40	40	
0.25	#60	20	
0.15	#100	8	
0.075	#200	3.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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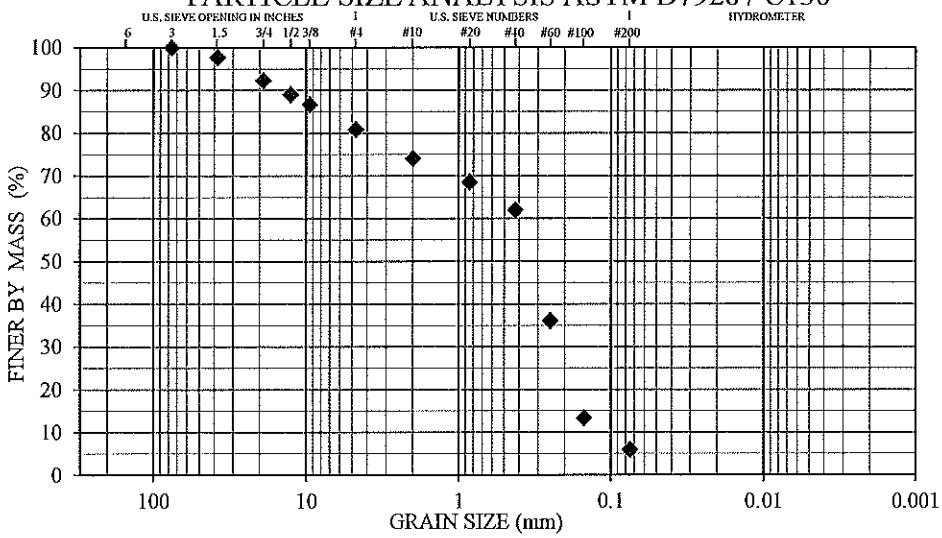
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-08
NUMBER/ DEPTH:	S-2 / 1.8' - 3.5'
DESCRIPTION:	Poorly-graded sand w/ silt and gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	19.1	USCS	SP-SM
% SAND	75.0	USACOE FC	N/A
% SILT/CLAY	5.9	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	3.5
COEFFICIENT OF GRADATION (C_c)	1.0
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

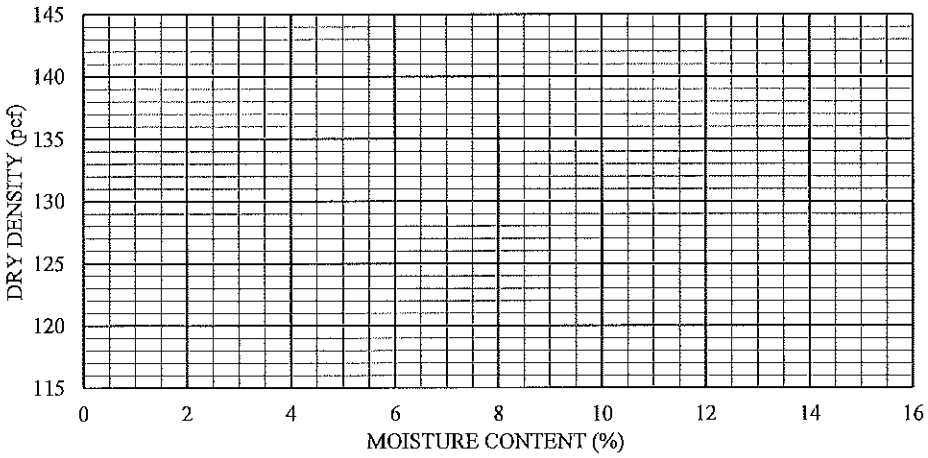
SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"	100	
38.10	1.5"	98	
19.00	3/4"	92	
12.70	1/2"	89	
9.50	3/8"	87	
4.75	#4	81	
2.00	#10	74	
0.85	#20	69	
0.43	#40	62	
0.25	#60	36	
0.15	#100	13	
0.075	#200	5.9	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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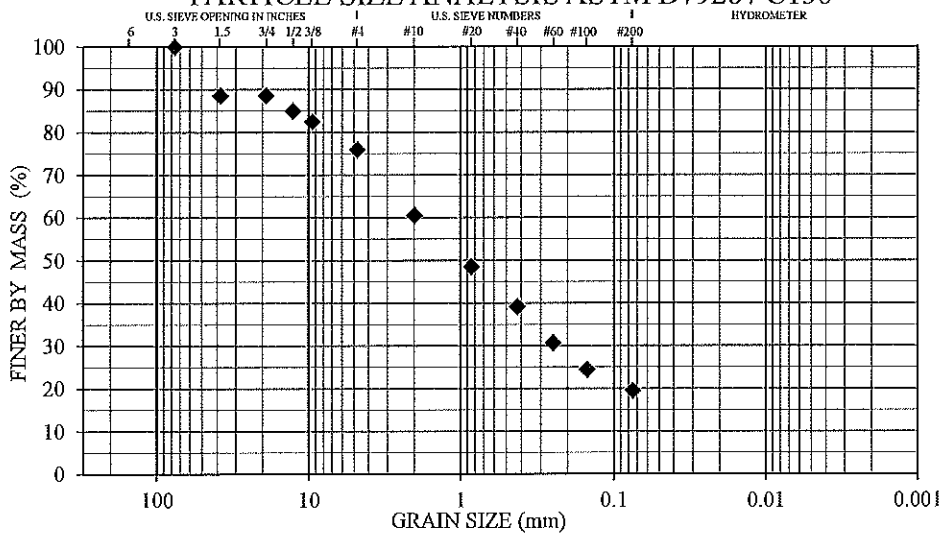
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-09
NUMBER/ DEPTH:	S-1 / 0' - 0.6'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	24.1	USCS	SM
% SAND	56.4	USACOE FC	N/A
% SILT/CLAY	19.5	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

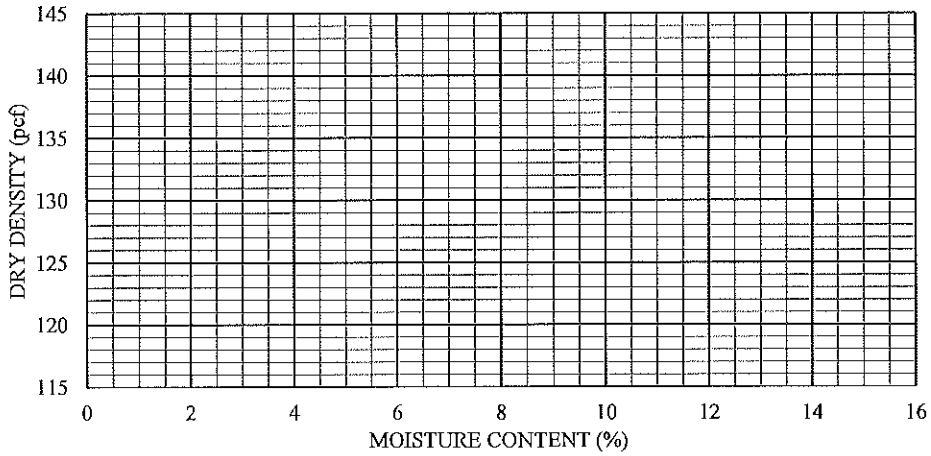
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"	100	
38.10	1.5"	89	
19.00	3/4"	89	
12.70	1/2"	85	
9.50	3/8"	82	
4.75	#4	76	
2.00	#10	61	
0.85	#20	49	
0.43	#40	39	
0.25	#60	31	
0.15	#100	24	
0.075	#200	19.5	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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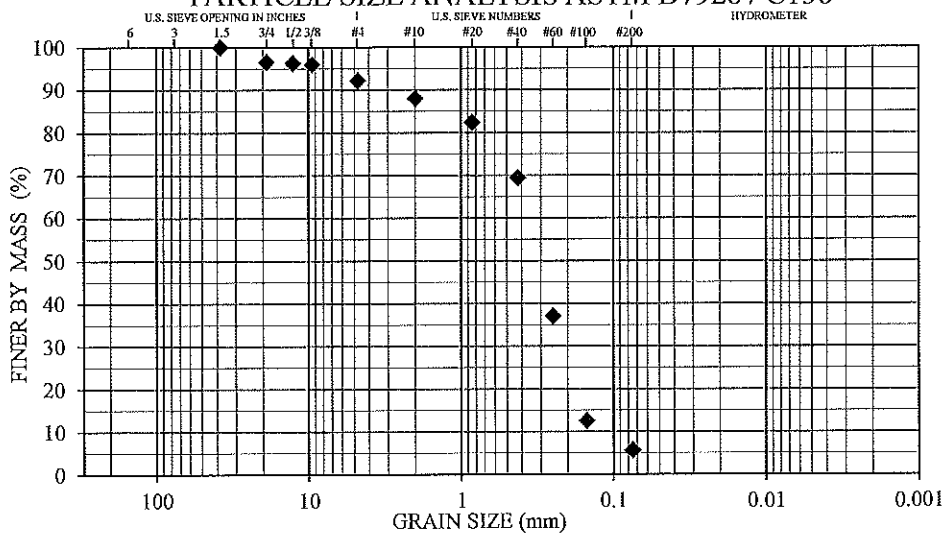
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-10
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Poorly-graded sand w/ silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	7.8	USCS	SP-SM
% SAND	86.6	USACOE FC	N/A
% SILT/CLAY	5.6	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		3.1	
COEFFICIENT OF GRADATION (C_c)		1.1	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

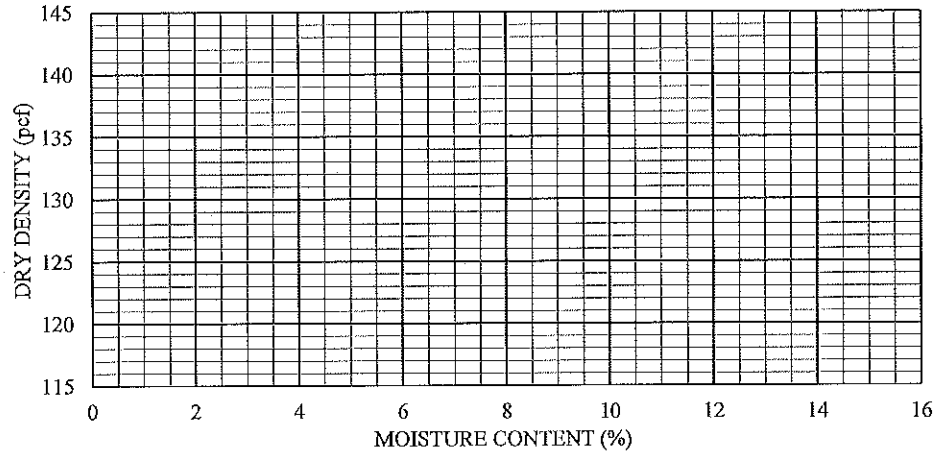
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	97	
12.70	1/2"	96	
9.50	3/8"	96	
4.75	#4	92	
2.00	#10	88	
0.85	#20	82	
0.43	#40	69	
0.25	#60	37	
0.15	#100	13	
0.075	#200	5.6	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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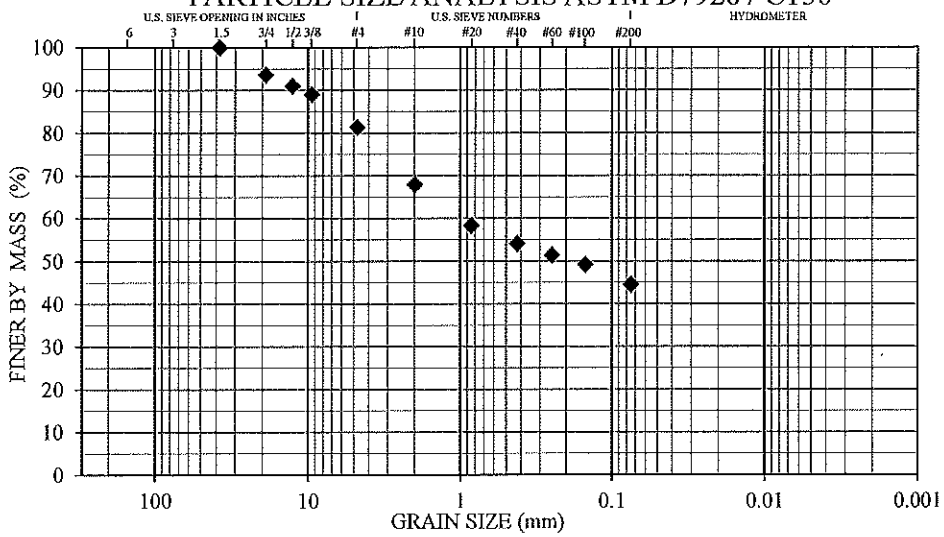
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-11
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	18.6	USCS	SM
% SAND	36.9	USACOE FC	N/A
% SILT/CLAY	44.5	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

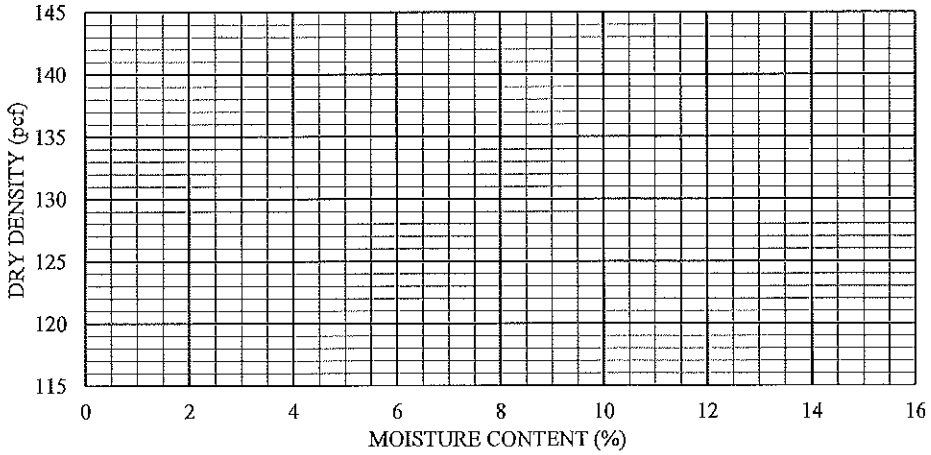
SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	94	
12.70	1/2"	91	
9.50	3/8"	89	
4.75	#4	81	
2.00	#10	68	
0.85	#20	58	
0.43	#40	54	
0.25	#60	51	
0.15	#100	49	
0.075	#200	44.5	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



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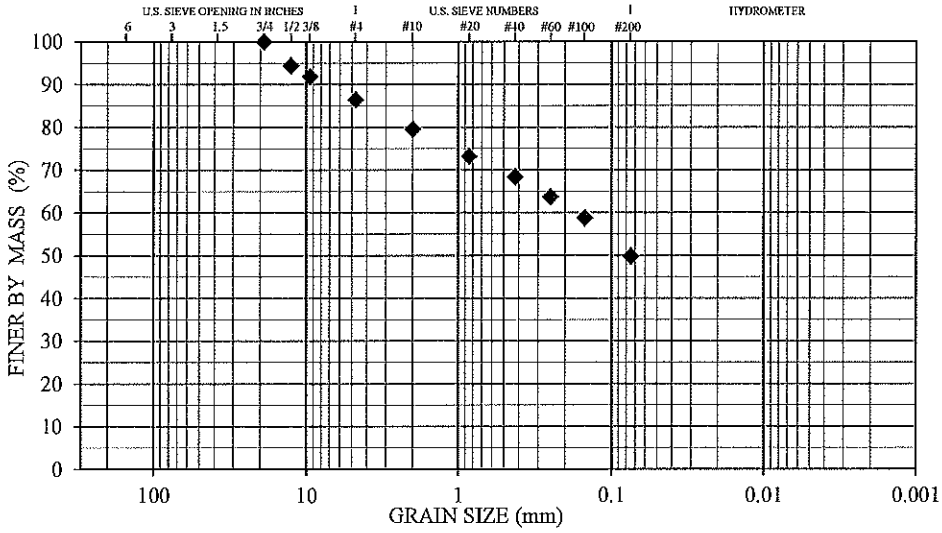
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-12
NUMBER/ DEPTH:	S-1 / 0' - 2.5'
DESCRIPTION:	Silty sand
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	13.6	USCS	SM
% SAND	36.7	USACOE FC	N/A
% SILT/CLAY	49.7	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

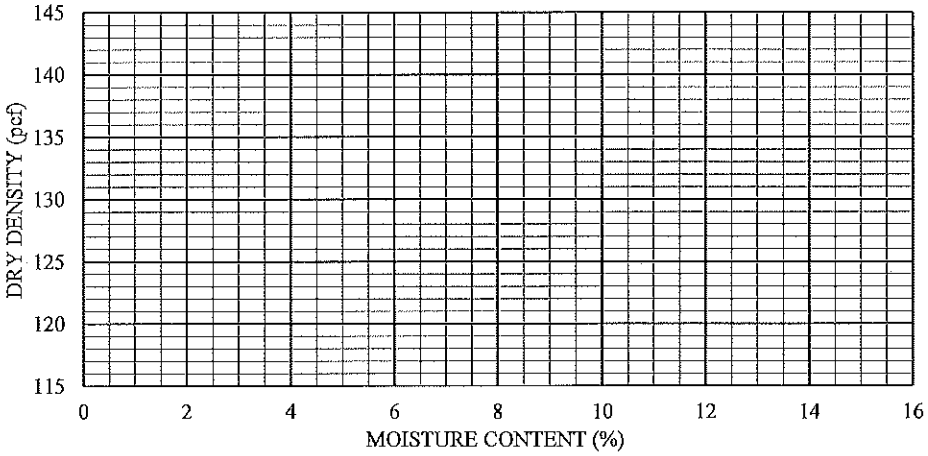
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	94	
9.50	3/8"	92	
4.75	#4	86	
2.00	#10	80	
0.85	#20	73	
0.43	#40	68	
0.25	#60	64	
0.15	#100	59	
0.075	#200	49.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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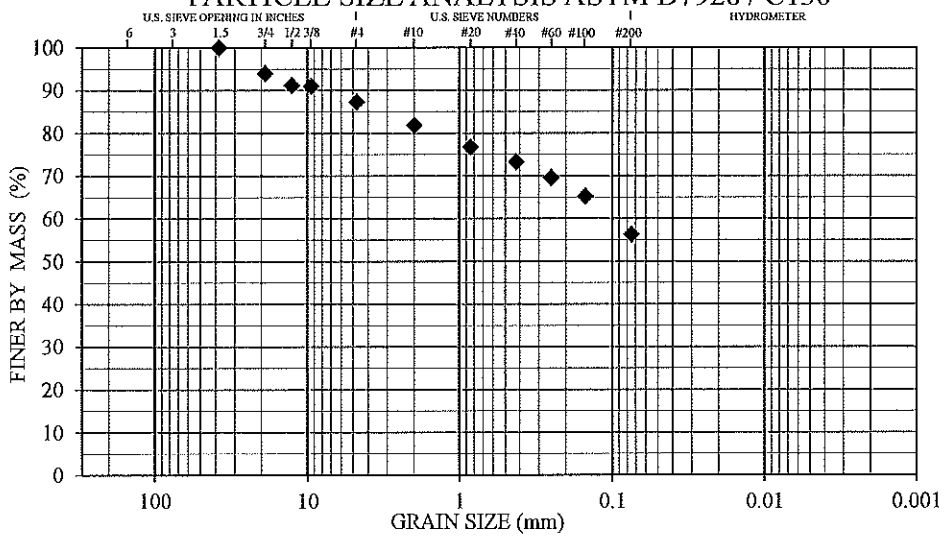
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-12A
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	12.6	USCS	ML
% SAND	31.1	USACOE FC	N/A
% SILT/CLAY	56.3	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	UNKNOWN
COEFFICIENT OF GRADATION (C_c)	UNKNOWN
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

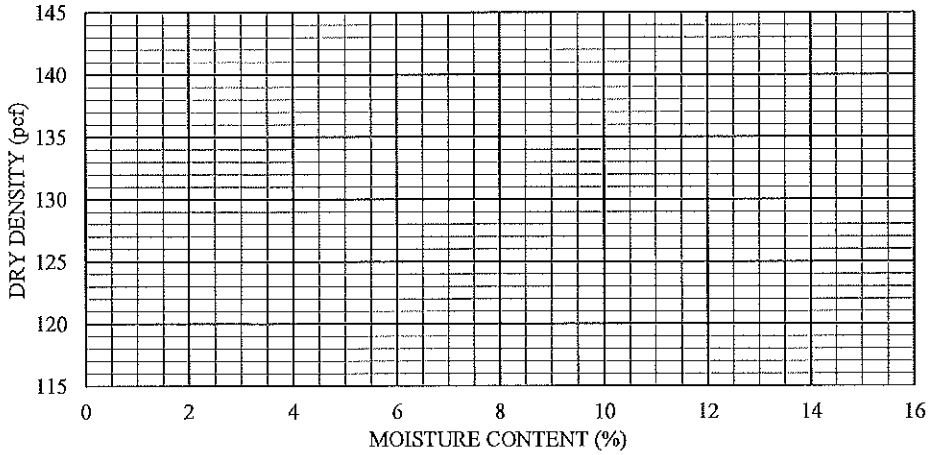
SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	94	
12.70	1/2"	91	
9.50	3/8"	91	
4.75	#4	87	
2.00	#10	82	
0.85	#20	77	
0.43	#40	73	
0.25	#60	70	
0.15	#100	65	
0.075	#200	56.3	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



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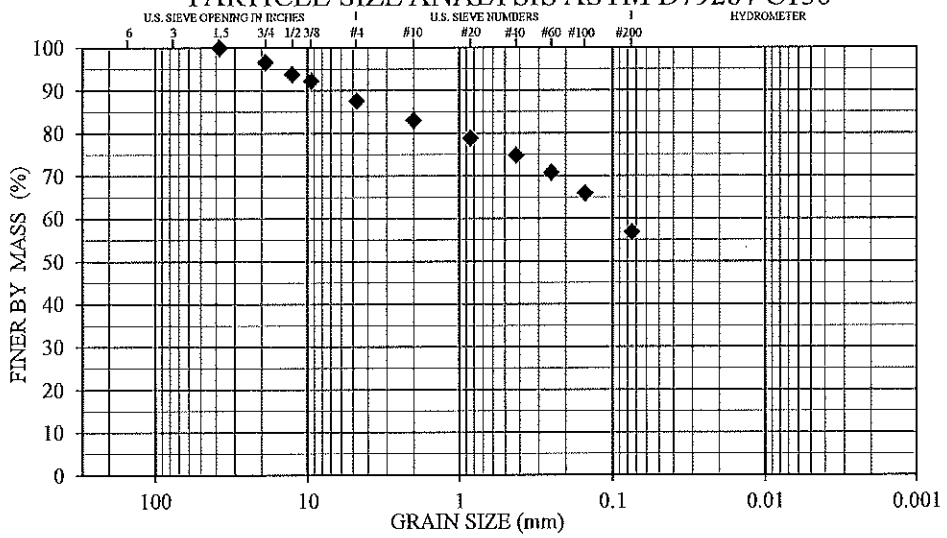
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-12A
NUMBER/ DEPTH:	S-2 / 1' - 2.5'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	12.4	USCS	ML
% SAND	30.7	USACOE FC	N/A
% SILT/CLAY	56.9	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

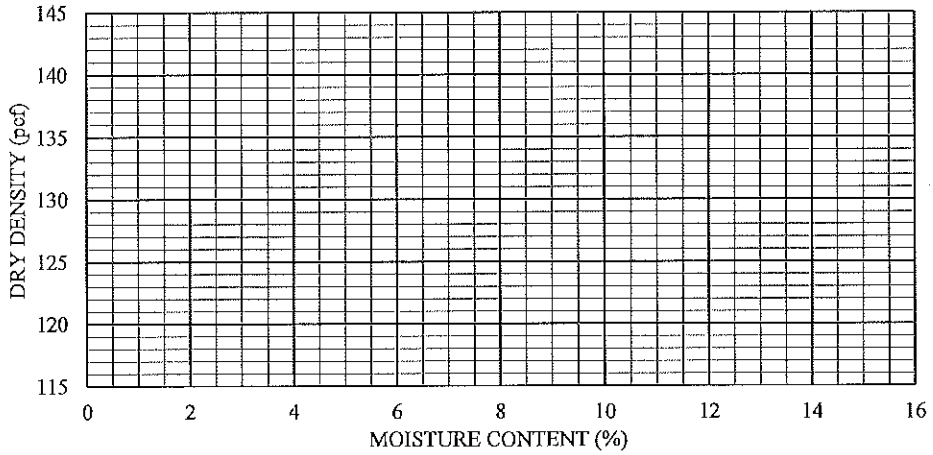
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	97	
12.70	1/2"	94	
9.50	3/8"	92	
4.75	#4	88	
2.00	#10	83	
0.85	#20	79	
0.43	#40	75	
0.25	#60	71	
0.15	#100	66	
0.075	#200	56.8	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	**LL = 19** **PI = 3**

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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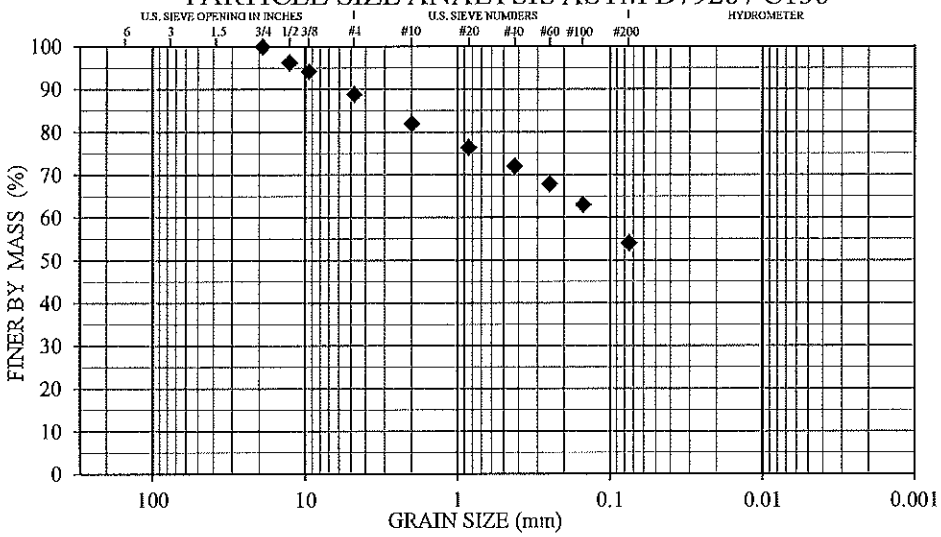
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-13
NUMBER/ DEPTH:	S-1 / 0' - 2'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	11.2	USCS	ML
% SAND	34.8	USACOE FC	N/A
% SILT/CLAY	54.0	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	UNKNOWN
COEFFICIENT OF GRADATION (C_c)	UNKNOWN
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

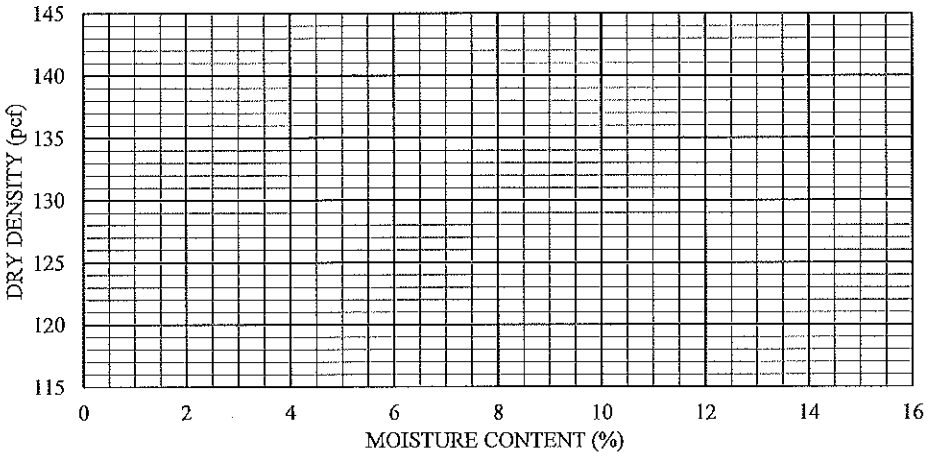
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	96	
9.50	3/8"	94	
4.75	#4	89	
2.00	#10	82	
0.85	#20	76	
0.43	#40	72	
0.25	#60	68	
0.15	#100	63	
0.075	#200	54.0	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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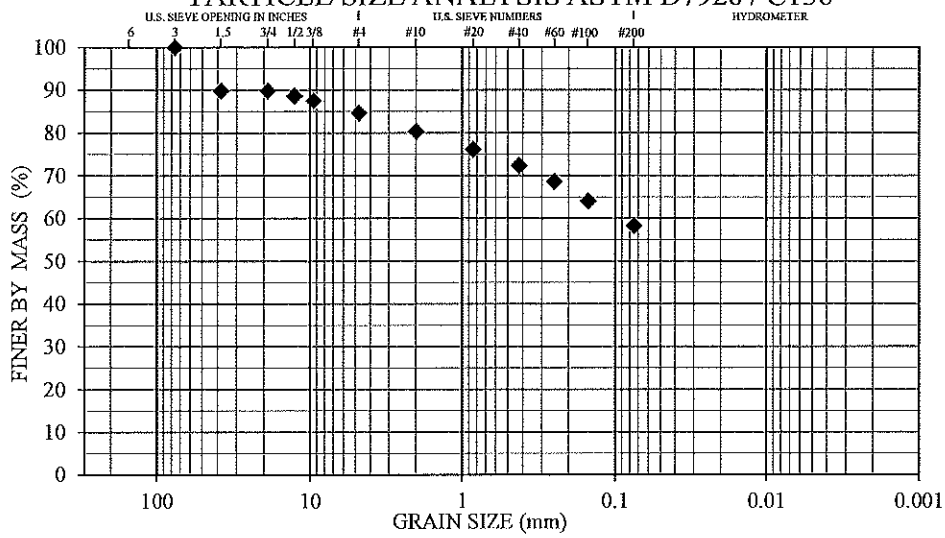
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-13
NUMBER/ DEPTH:	S-2 / 2' - 7'
DESCRIPTION:	Sandy silt w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	15.3	USCS	ML
% SAND	26.4	USACOE FC	N/A
% SILT/CLAY	58.3	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

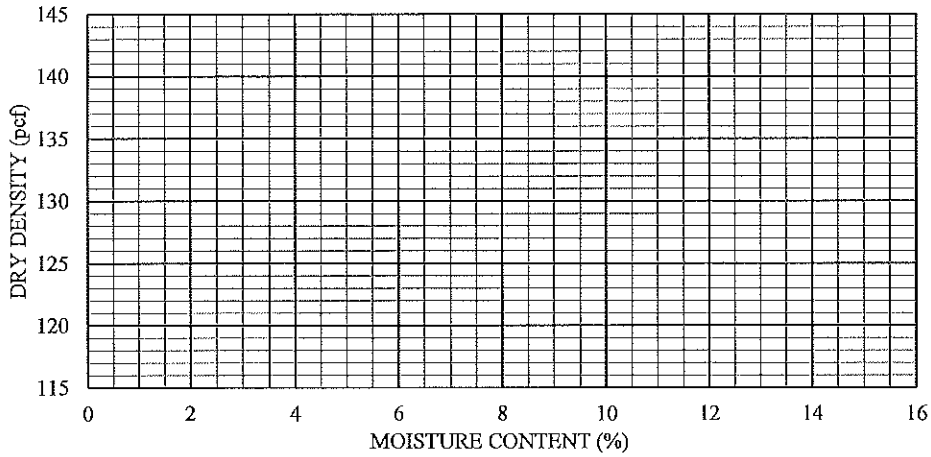
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"	100	
38.10	1.5"	90	
19.00	3/4"	90	
12.70	1/2"	89	
9.50	3/8"	87	
4.75	#4	85	
2.00	#10	80	
0.85	#20	76	
0.43	#40	72	
0.25	#60	69	
0.15	#100	64	
0.075	#200	58.2	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	LL = 19 PI = 3

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

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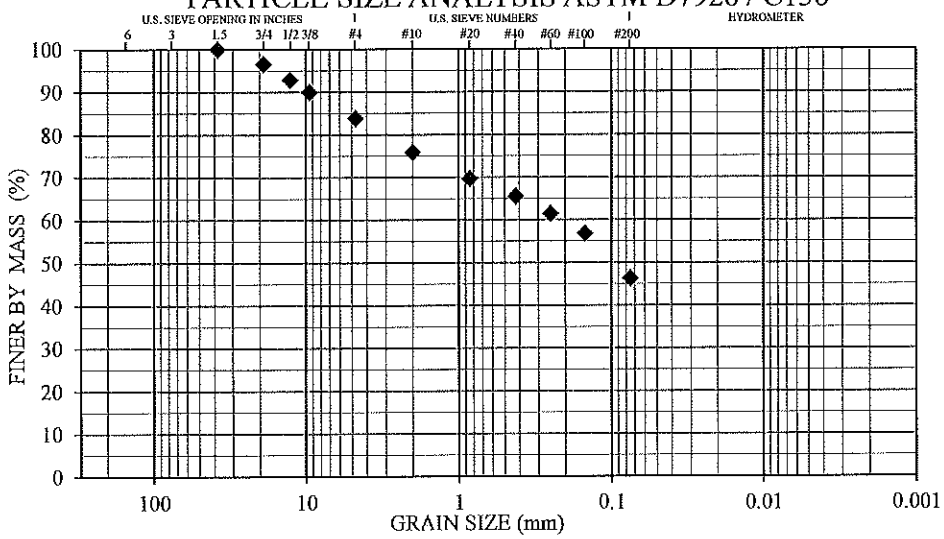
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-14
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	16.2	USCS	SM
% SAND	37.5	USACOE FC	N/A
% SILT/CLAY	46.3	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

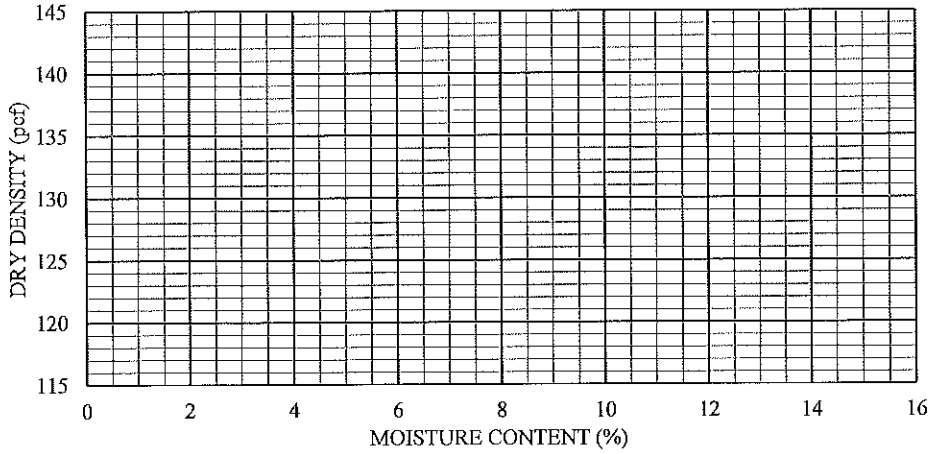
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	97	
12.70	1/2"	93	
9.50	3/8"	90	
4.75	#4	84	
2.00	#10	76	
0.85	#20	70	
0.43	#40	66	
0.25	#60	61	
0.15	#100	57	
0.075	#200	46.3	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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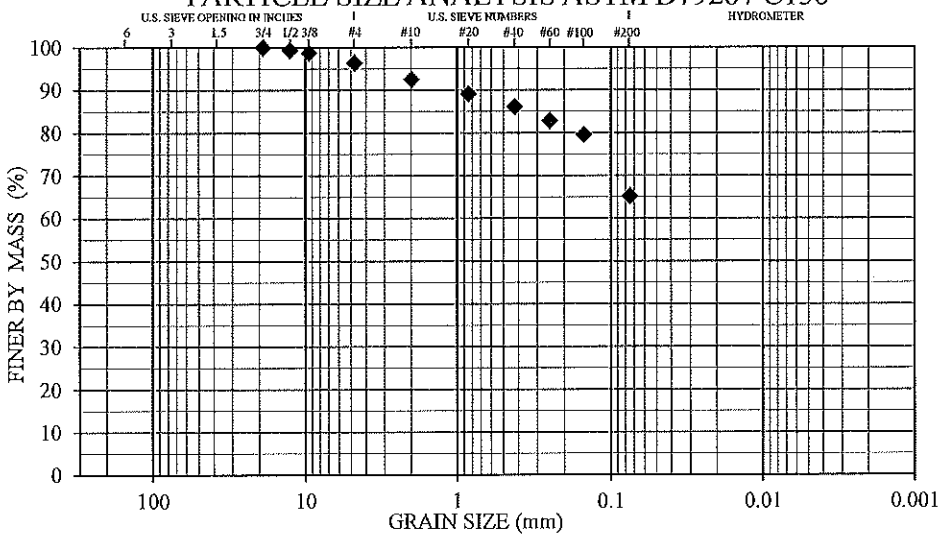
PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-14
NUMBER/ DEPTH:	S-2 / 1' - 6'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	3.6	USCS	ML
% SAND	31.2	USACOE FC	N/A
% SILT/CLAY	65.2	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	UNKNOWN
COEFFICIENT OF GRADATION (C_c)	UNKNOWN
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

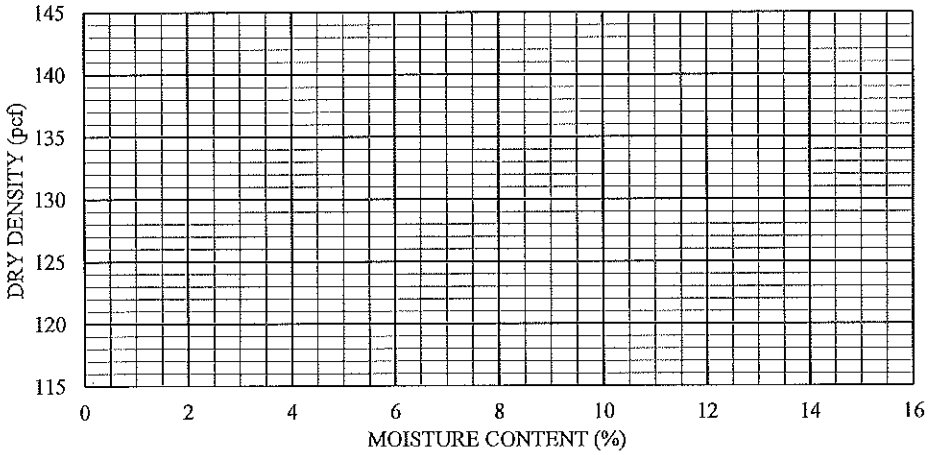
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	99	
9.50	3/8"	99	
4.75	#4	96	
2.00	#10	93	
0.85	#20	89	
0.43	#40	86	
0.25	#60	83	
0.15	#100	80	
0.075	#200	65.1	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

The testing services reported herein have been performed to recognized industry standards, unless otherwise noted. No other warranty is made. Should engineering interpretation or opinion be required, NGE-TFT will provide upon written request.

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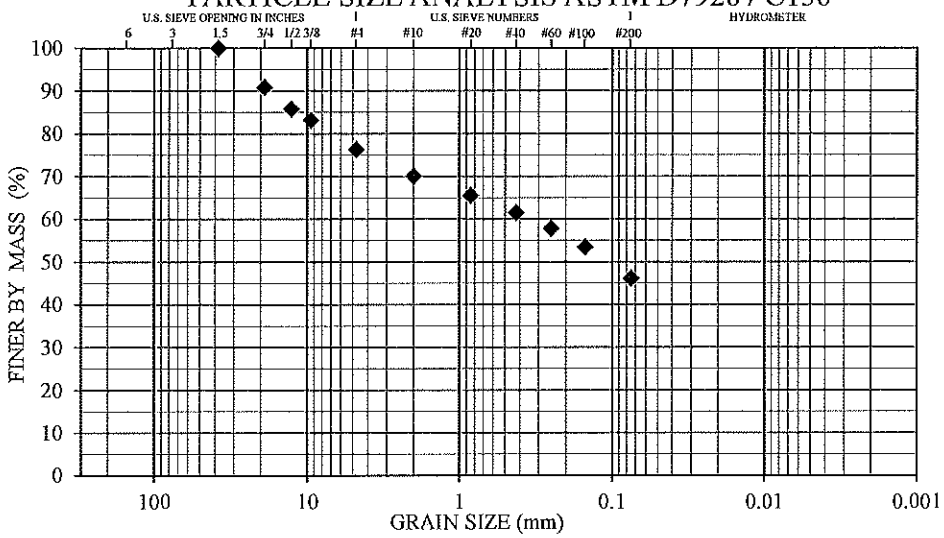
NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

Laboratory Testing | Geotechnical Engineering | Instrumentation | Construction Monitoring Services | Thermal Analysis

PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-15
NUMBER/ DEPTH:	S-1 / 0' - 1'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	23.7	USCS	SM
% SAND	30.2	USACOE FC	N/A
% SILT/CLAY	46.1	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

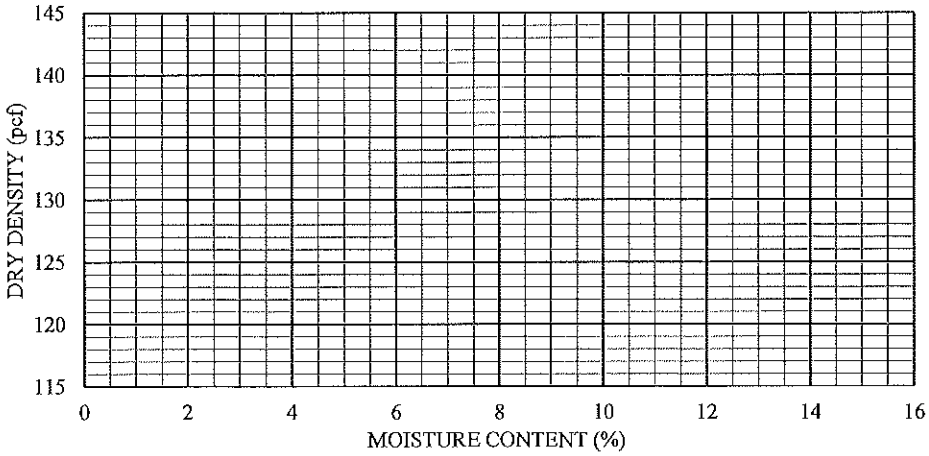
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	91	
12.70	1/2"	86	
9.50	3/8"	83	
4.75	#4	76	
2.00	#10	70	
0.85	#20	66	
0.43	#40	62	
0.25	#60	58	
0.15	#100	53	
0.075	#200	46.1	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

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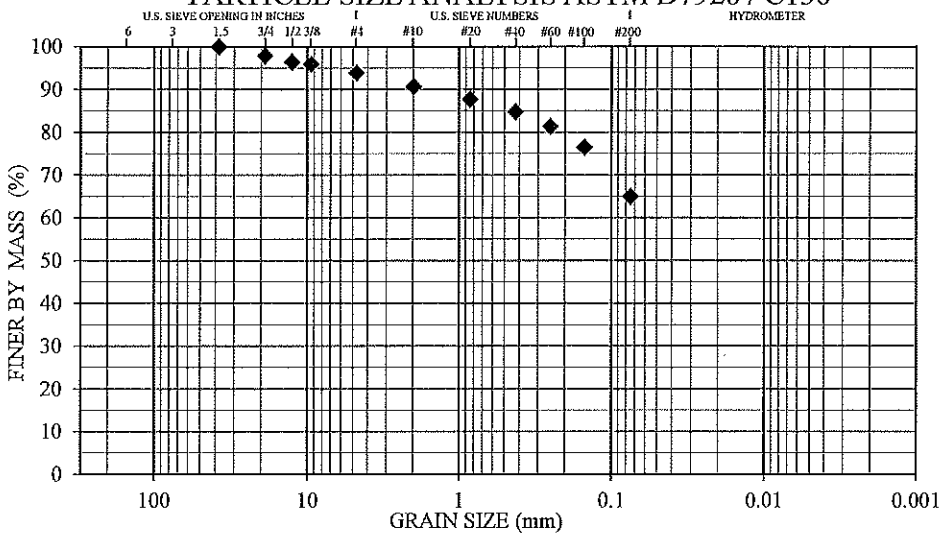
NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

Laboratory Testing · Geotechnical Engineering · Instrumentation · Construction Monitoring Services · Thermal Analysis

PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-15
NUMBER/ DEPTH:	S-2 / 1' - 10'
DESCRIPTION:	Sandy silty clay
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	6.1	USCS	CL-ML
% SAND	28.9	USACOE FC	N/A
% SILT/CLAY	65.0	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

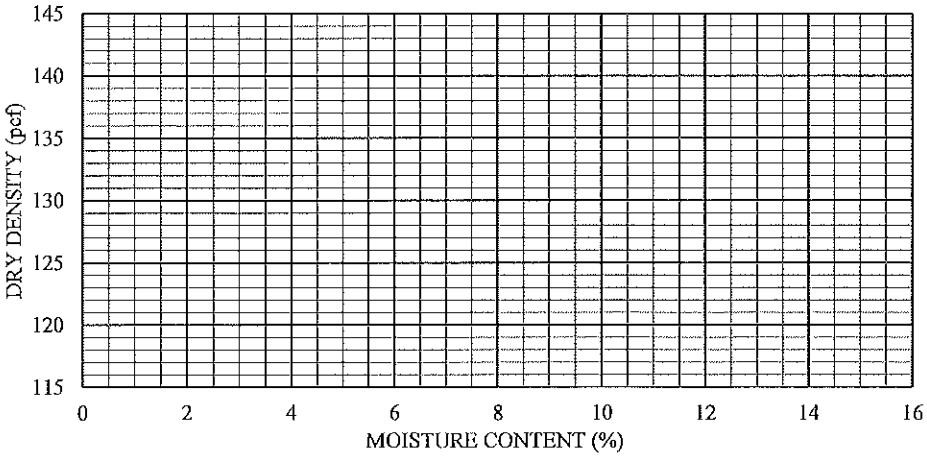
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	98	
12.70	1/2"	96	
9.50	3/8"	96	
4.75	#4	94	
2.00	#10	91	
0.85	#20	88	
0.43	#40	85	
0.25	#60	81	
0.15	#100	77	
0.075	#200	65.0	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	LL = 20 PI = 5

The testing services reported herein have been performed to recognized industry standards, unless otherwise noted. No other warranty is made. Should engineering interpretation or opinion be required, NGE-TFT will provide upon written request.

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NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

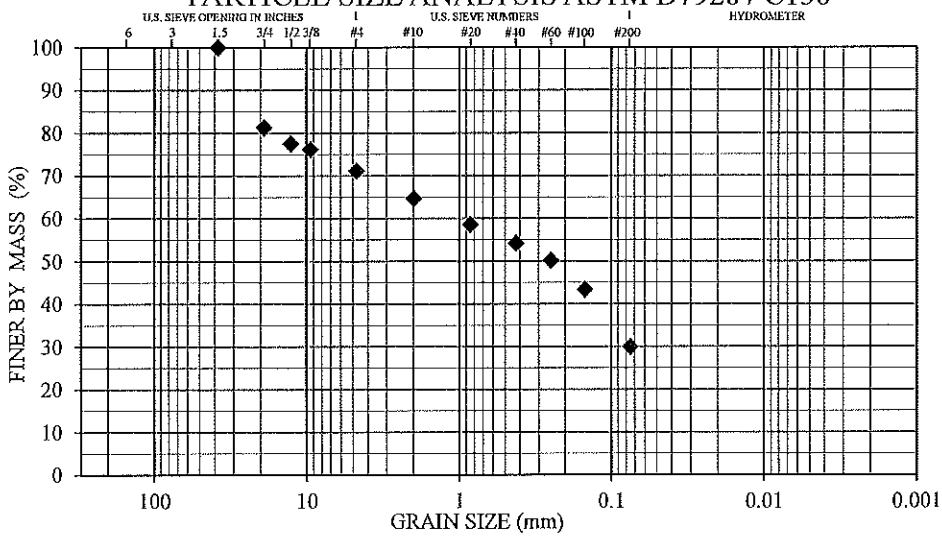
Laboratory Testing | Geotechnical Engineering | Instrumentation | Construction Monitoring Services | Thermal Analysis

PROJECT CLIENT:	U.S. Army Corps of Engineers
PROJECT NAME:	Petersburg S. Harbor Navigation Improvements
PROJECT NO.:	4977-18
SAMPLE LOC.:	TB-16
NUMBER/ DEPTH:	S-1 / 0' - 1.6'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	4/13/2018
TESTED BY:	JA
REVIEWED BY:	RJPC

% GRAVEL	28.9	USCS	SM
% SAND	41.2	USACOE FC	N/A
% SILT/CLAY	29.9	% PASS. 0.02 mm	N/A
% MOIST. CONTENT		% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	UNKNOWN
COEFFICIENT OF GRADATION (C_c)	UNKNOWN
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

PARTICLE SIZE ANALYSIS ASTM D7928 / C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

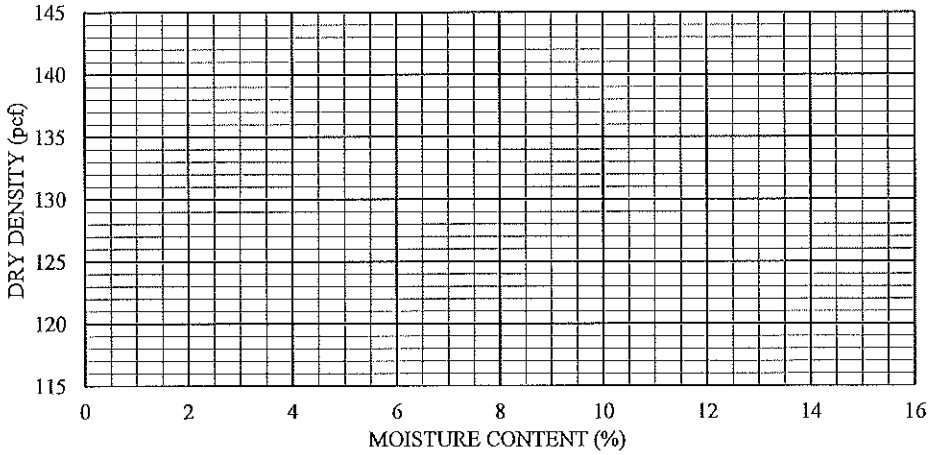
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
152.40	6"		
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	81	
12.70	1/2"	78	
9.50	3/8"	76	
4.75	#4	71	
2.00	#10	65	
0.85	#20	59	
0.43	#40	54	
0.25	#60	50	
0.15	#100	43	
0.075	#200	29.9	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	
DEGRADATION (ATM T-313)	
ATTERBERG LIMITS ASTM 4318	

The testing services reported herein have been performed to recognized industry standards, unless otherwise noted. No other warranty is made. Should engineering interpretation or opinion be required, NGE-TFT will provide upon written request.

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APPENDIX D
Old Exploration Logs and Laboratory Test Results

Test Hole Logs ..... 11 Sheets
Laboratory Test Results ..... 38 Sheets

SOILS

CLASSIFICATION, CONSISTENCY AND SYMBOLS

CLASSIFICATION: Identification and classification of the soil is accomplished in general accordance with the ASTM version of the Unified Soil Classification System (USCS) as presented in ASTM Standard D 2487-93. The standard is a qualitative method of classifying soil into the following major divisions (1) coarse grained (2) fine-grained, and (3) highly organic soils. Classification is performed on the soils passing the 75 mm (3 inch) sieve and if possible the amount of oversize material (> 75 mm particles) is noted on the soil logs. This is not always possible for drilled test holes because the oversize particles are typically too large to be captured in the sampling equipment. Oversize materials greater than 300 mm (12 inches) are termed boulders, while materials between 75 mm and 300 mm are termed cobbles. Coarse grained soils are those having 50% or more of the non-oversize soil retained on the No. 200 sieve; if a greater percentage of the coarse grains is retained on the No. 4 sieve the coarse grained soil is classified as gravel, otherwise it is classified as sand. Fine grained soils are those having more than 50% of the non-oversize material passing the No. 200 sieve; these may be classified as silt or clay depending their Atterberg liquid and plastic limits or observations of field consistency. Refer to ASTM D 2487-93 for a complete discussion of the classification method.

SOIL CONSISTENCY - CRITERIA: Soil consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure,, i.e. fissure systems, shinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soils may vary significantly and unexplainably with ice content, thermal regime and soil type.

Relative Density of Sands According to results of Standard Penetration Test

	N*(blows/ft)	Relative Density
Loose	0 - 10	0 - 40%
Medium Dense	10 - 30	40 - 70%
Dense	30 - 60	70 - 90%
Very Dense	>60	90 - 100%

Consistency of Clay in Terms of Unconfined Compressive Strength (tsf)

Very Soft	0 - 0.25
Soft	0.25 - 0.5
Stiff	0.5 - 1.0
Firm	1.0 - 2.0
Very Firm	2.0 - 4.0
Hard	> 4.0

* Standard Penetration, "N": Blows per foot of a 140-pound hammer falling 30 inches on a 1.4" ID split-spoon sampler except where noted.

DRILLING SYMBOLS

WO:	Wash Out	WD:	While Drilling
WL:	Water Level	BCR:	Before Casing Removal
WCI:	Wet Cave In	ACR:	After Casing Removal
DCI:	Dry Cave In	AB:	After Boring
WS:	While Sampling	TD:	Total Depth

Note: Water levels indicated on the boring logs are the levels measured in the boring at the time(s) indicated. In pervious unfrozen soils, the indicated elevations are considered to represent actual ground water conditions. In impervious and frozen soils, accurate determinations of ground water elevations cannot be obtained within a limited period of observation and other evidence of ground water elevations and conditions are required.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-1

SAMPLER TYPE SYMBOLS

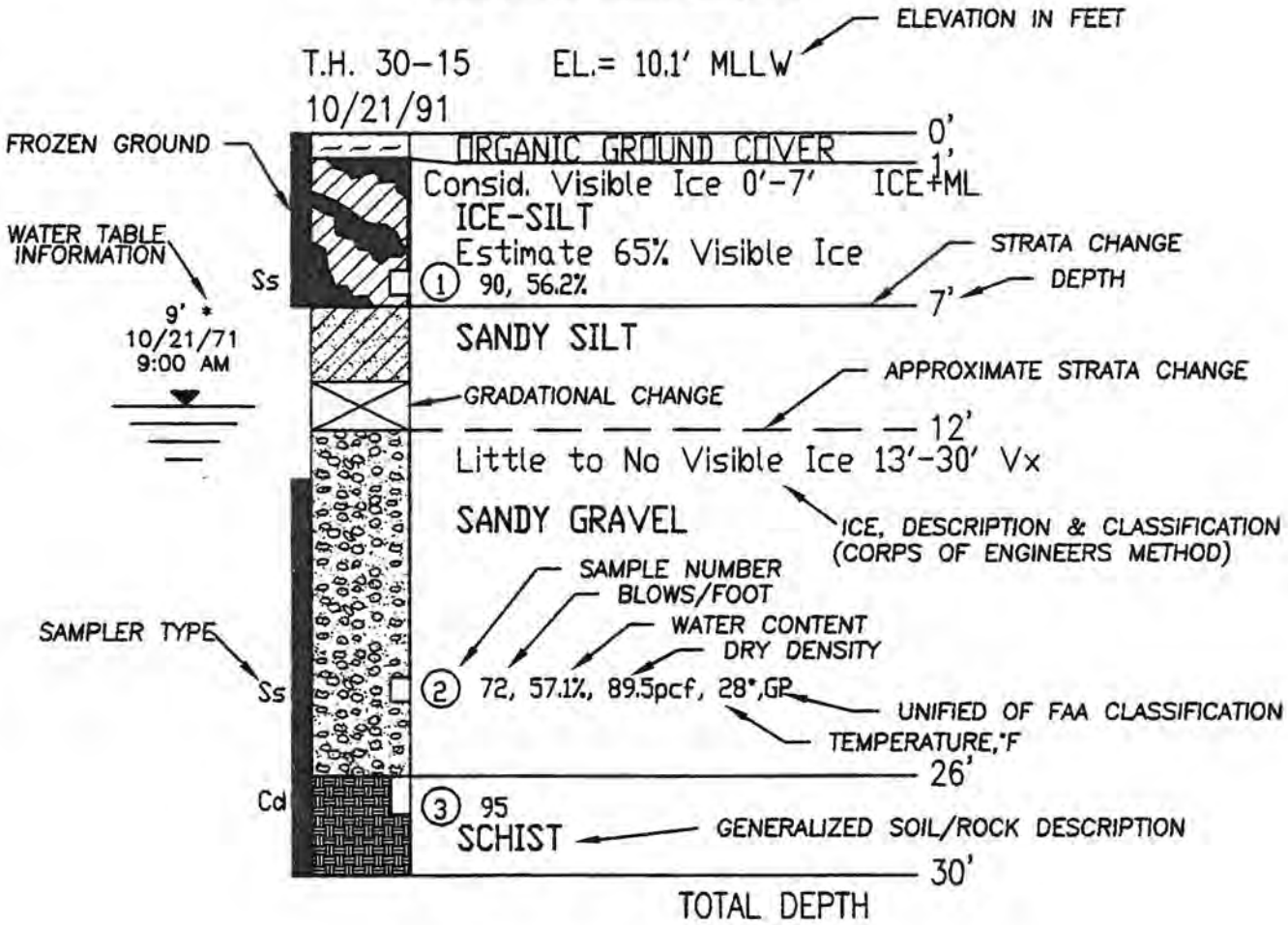
St . . . 1.4" SPLIT SPOON W/ 47# HAMMER
Ss . . . 1.4" SPLIT SPOON W/ 140# HAMMER
Sl . . . 2.5" SPLIT SPOON W/ 140# HAMMER
Sm . . . 2.5" SPLIT SPOON W/ 300# HAMMER
Sh . . . 2.5" SPLIT SPOON W/ 340# HAMMER
Sp . . . 2.5" SPLIT SPOON, PUSHED
Hs . . . 1.4" SPLIT SPOON DRIVEN W/ AIR HAMMER
Hl . . . 2.5" SPLIT SPOON DRIVEN W/ AIR HAMMER
Sx . . . 2" SPLIT SPOON DRIVEN W/ 140# HAMMER

Ts . . . SHELBY TUBE
Tm . . . MODIFIED (2.5'O.D.) SHELBY TUBE
Pb . . . PITCHER BARREL
Cs . . . CORE BARREL W/ SINGLE TUBE
Cd . . . CORE BARREL W/ DOUBLE TUBE
Bs . . . BULK SAMPLE
A . . . AUGER SAMPLE
G . . . GRAB SAMPLE

NOTES: 1. SAMPLER TYPES ARE EITHER NOTED ABOVE THE BORING LOG OR ADJACENT TO IT AT THE RESPECTIVE DEPTH.

2. SPLIT SPOON SAMPLER SIZES PRESENTED ABOVE REFER TO THE INSIDE DIAMETER OF THE SAMPLER.

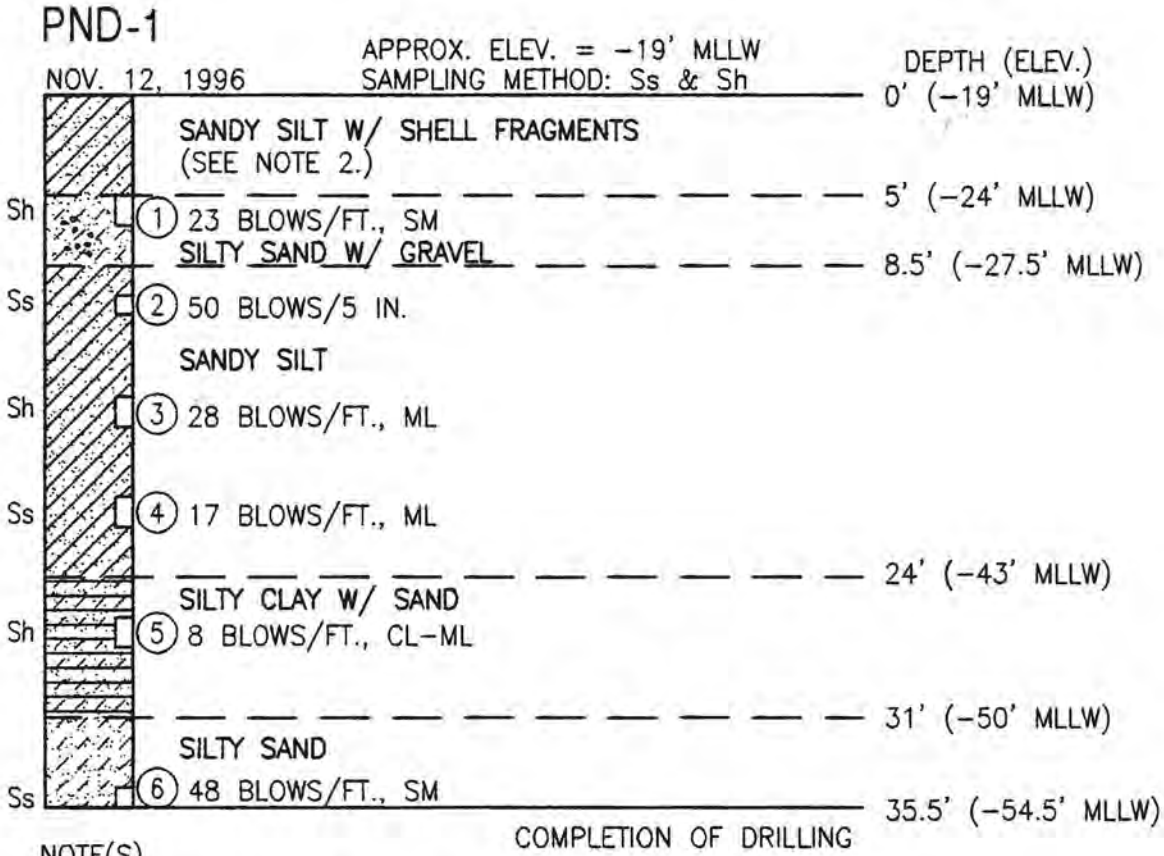
TYPICAL BORING LOG



* W.D. – WHILE DRILLING, A.B. – AFTER DRILLING

SOUTH HARBOR EXPANSION GEOTECHNICAL INVESTIGATION PN&D PROJECT NO. 96256
TEST HOLE LOGS
FIGURE B-2

Peratrovich, Nottingham & Drage, Inc.
August, 1997



NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 5' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

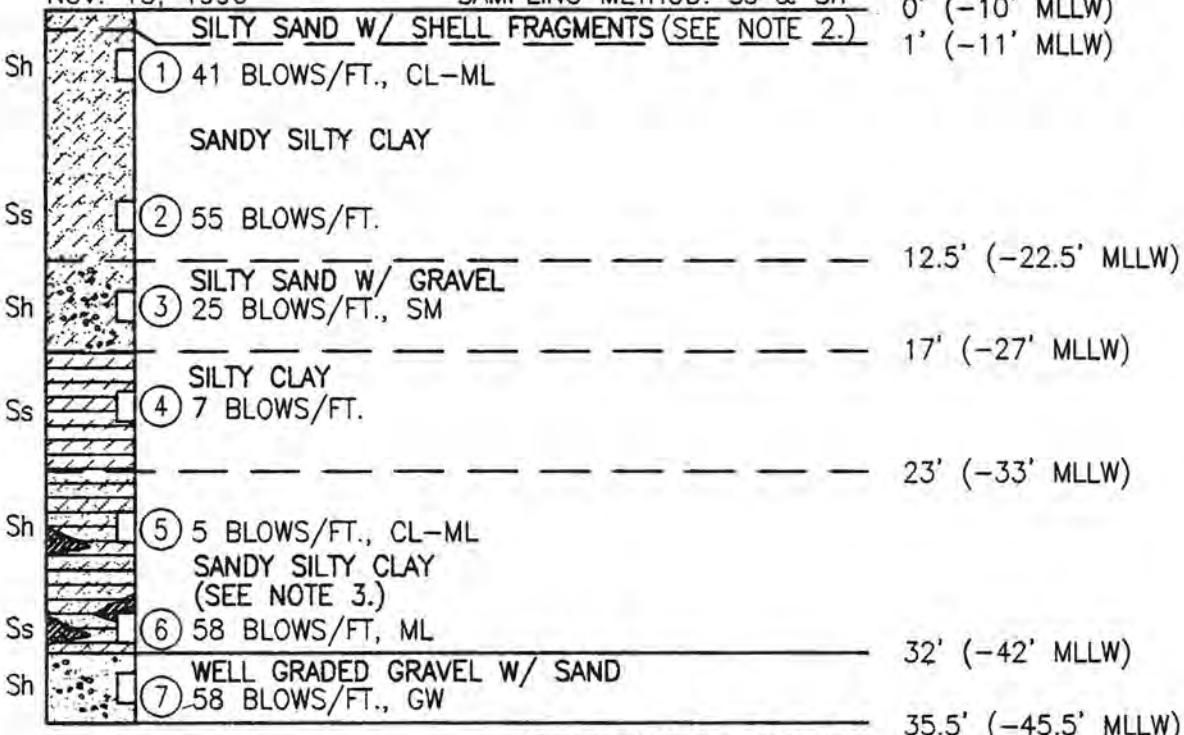
FIGURE B-3

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-2

NOV. 13, 1996

APPROX. ELEV. = −10' MLLW
SAMPLING METHOD: Ss & Sh



NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 1' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.
3. OCCASIONAL LENSES OF GRAVELLY SANDY SILT WERE ENCOUNTERED BETWEEN SOIL DEPTHS 26' TO 32'.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

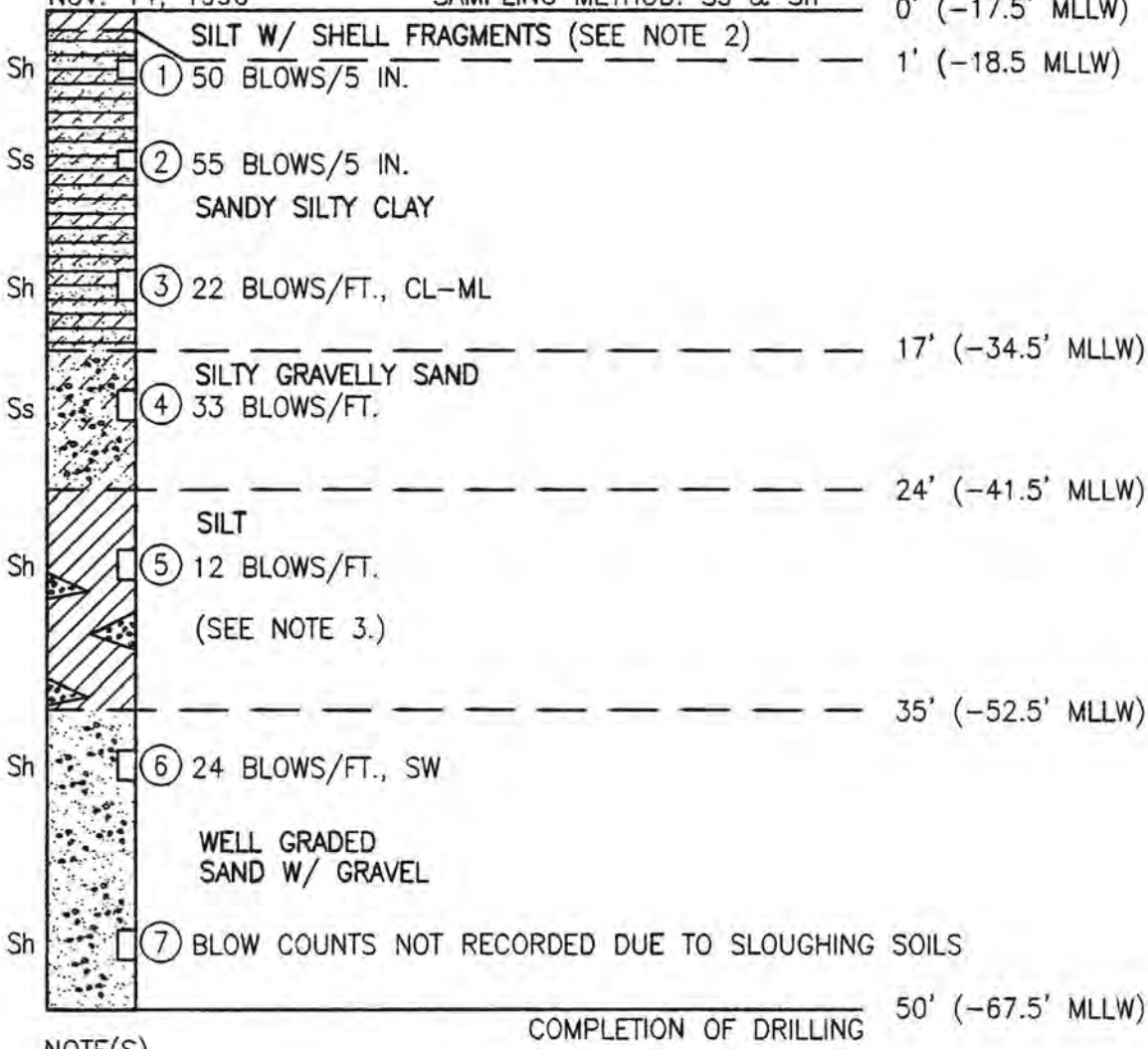
FIGURE B−4

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-3

NOV. 14, 1996

APPROX. ELEV. = −17.5' MLLW
SAMPLING METHOD: Ss & Sh



NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 1' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.
3. OCCASIONAL LENSES OF GRAVEL WERE INDICATED BY DRILLING BETWEEN SOIL DEPTHS OF 29' TO 35'.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B−5

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-4

NOV. 15, 1996

APPROX. ELEV. = −10' MLLW
SAMPLING METHOD: Ss & Sh

DEPTH (ELEV.)

0' (−10' MLLW)

SILT W/ SHELL FRAGMENTS (SEE NOTE 2.)

1' (−11' MLLW)

Sh (1) 38 BLOWS/FT., ML

SILT W/ SAND

Ss (2) 45 BLOWS/FT.

13' (−23' MLLW)

SILTY SAND W/ GRAVEL

Sh (3) 26 BLOWS/FT., SM

18' (−28' MLLW)

Ss (4) 16 BLOWS/FT.

Sh (5) 11 BLOWS/FT.

SILTY CLAY

Ss (6) 25 BLOWS/FT., LENS OF SAND W/ SOME GRAVEL & TRACE SILT

Sh (7) 5 BLOWS/FT.

40' (−50' MLLW)

WELL GRADED GRAVEL W/ SAND

Sh (8) 22 BLOWS/FT.

Sh (9) BLOW COUNT NOT RECORDED DUE TO COLLAPSING SOILS, GW

47.5' (−57.5' MLLW)

COMPLETION OF DRILLING

NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 1' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-6

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-5

NOV. 15, 1996

APPROX. ELEV. = 0' MLLW
SAMPLING METHOD: Ss & Sh

		DEPTH (ELEV.)
		0' (0' MLLW)
Sh	(1A) SILTY GRAVELLY SAND W/ SHELL FRAGMENTS (SEE NOTE 2.)	0.5' (−0.5' MLLW)
	(1B) 11 BLOWS/FT., CL−ML SILTY CLAY W/ SAND	5.5' (−5.5' MLLW)
Sh	(2) 12 BLOWS/FT. SILTY CLAYEY SAND W/ GRAVEL	
Sh	(3) 12 BLOWS/FT., SC−SM	19' (−19' MLLW)
Ss	SILT (4) 21 BLOWS/FT.	24' (−24' MLLW)
Sh	GRAVELLY SAND (5) 4 BLOWS/FT.	30.5' (−30.5' MLLW)
Sh	(6) 21 BLOWS/FT., SM SILTY SAND	
Sh	(7) 12 BLOWS/FT.	42.5' (−42.5' MLLW)
	COMPLETION OF DRILLING	

NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 1' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-7

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-6

NOV. 16, 1996

APPROX. ELEV. = −9' MLLW
SAMPLING METHOD: Ss, Sh & Ts

		DEPTH (ELEV.)
	SAND W/ SHELL FRAGMENTS (SEE NOTE 2.)	0' (−9' MLLW)
Sh	(1) 30 BLOWS/FT., ML	0.5' (9.5' MLLW)
	SILT W/ SAND	
	GRADING TO SILT	
Ss	(2) 37 BLOWS/FT.	
	SILTY CLAY	13' (−22' MLLW)
Sh	(3) 10 BLOWS/FT.	
	SILTY SAND	19' (−28' MLLW)
Ss	(4) 49 BLOWS/FT., SM	
		24.5' (−33.5' MLLW)
Sh	(5) 2 BLOWS/FT.	
	SILTY CLAY	
	32' LENS OF SAND W/ SOME SILT W/ TRACE GRAVEL	
Ss	(6) 10 BLOWS/ FT., CC−ML	32' (−41' MLLW)
	6 BLOWS/6 IN. (SEE NOTE 3)	
	13 BLOWS/FT.	
	17 BLOWS/FT.	
	23 BLOWS/FT SANDY SILTY CLAY	
	28 BLOWS/FT.	
	20 BLOWS/FT.	
	25 BLOWS/FT.	
Ts	(7) SM	43' (−52' MLLW)
	SILTY SAND	
	SAND W/ GRAVEL	50' (−59' MLLW)
Sh	(8) 60 BLOWS/FT.	
	SILTY SAND W/ GRAVEL	55' (−64' MLLW)
Sh	(9) 21 BLOWS/FT.	
	COMPLETION OF DRILLING	58' (−67' MLLW)

NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 5' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.
3. SAMPLE 6 WAS DRIVEN FROM 32' TO 40' TO PROVIDE ADDITIONAL BLOW COUNT INFORMATION.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-8

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-7

NOV. 17, 1996

APPROX. ELEV. = −4' MLLW
SAMPLING METHOD: Ss & Sh

DEPTH (ELEV.)

0' (−4' MLLW)

SAND W/ SHELL FRAGMENTS (SEE NOTE 2)

1' (−5' MLLW)

SILTY CLAY

Sh (1) 16 BLOWS/FT.

8' (−12' MLLW)

Ss (2) 26 BLOWS/FT.

Sh (3) 8 BLOWS/FT.

SAND
GRADING TO
SILTY SAND W/ GRAVEL

Sh (4) 8 BLOWS/FT., SM

Sh 28.5' (−32.5' MLLW)

(5) 12 BLOWS/FT.

SANDY SILT W/ GRAVEL

Sh (6) 7 BLOWS/FT., ML

37' (−41' MLLW)

SAND

Sh (7) 7 BLOWS/FT.
10 BLOWS/FT. (SEE NOTE 3)
16 BLOWS/FT.

42' (−46' MLLW)

COMPLETION OF DRILLING

NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 1' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.
3. SAMPLE 7 WAS DRIVEN FROM 38' TO 41.5' TO PROVIDE ADDITIONAL BLOW COUNT INFORMATION.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-9

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-8

NOV. 17, 1996

APPROX. ELEV. = +5' MLLW
SAMPLING METHOD: Ss & Sh

		DEPTH (ELEV.)
		0' (+5' MLLW)
Sh	SAND W/ SHELL FRAGMENTS (SEE NOTE 2.)	0.5' (+4.5' MLLW)
	(1) 13 BLOWS/FT., CL-ML	
	SILTY CLAY W/ SAND GRADING TO SILTY CLAY W/ GRAVEL	
Ss	(2) 15 BLOWS/FT., NO RETRIEVAL	
	(SEE NOTE 3.)	
Sh	(3) 8 BLOWS/FT.	
		18.5' (-13.5' MLLW)
	SILTY SAND W/ GRAVEL	
Ss	(4) 9 BLOWS/FT.	
		23.5' (-18.5' MLLW)
	SANDY SILTY CLAY	
Sh	(5) 12 BLOWS/FT., CL-ML	
		29' (-24' MLLW)
	SAND W/ GRAVEL	
Sh	(6) 27 BLOWS/FT.	
	COMPLETION OF DRILLING	31.5' (-26.5' MLLW)

NOTE(S)

1. TEST HOLE DRILLED WITH ROTARY WASH AND CASING EQUIPMENT.
2. IDENTIFICATION OF SOILS FROM 0' TO 0.5' WAS BASED ON OBSERVATION OF ROTARY WASH CUTTINGS.
3. OCCASIONAL LENSES OF GRAVEL WERE INDICATED BY DRILLING BETWEEN SOIL DEPTHS OF 6' TO 13'.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-10

Peratrovich, Nottingham & Drage, Inc.
August, 1997

PND-9

NOV. 18, 1996

APPROX. ELEV. = +23' MLLW
SAMPLING METHOD: Ss & Sh

		DEPTH (ELEV.)
	ASPHALT PAVEMENT	0' (+23' MLLW)
		0.3' (+22.7' MLLW)
Sh	(1) 59 BLOWS/FT.	
	SILTY GRAVEL GRADING TO SILTY SANDY GRAVEL (FILL)	
Sh	(2) 7 BLOWS/FT.	
		14.5' (+8.5' MLLW)
Sh	(3) 7 BLOWS/FT.	
Ss	(4) 13 BLOWS/FT., CL-ML	
	SILTY CLAY W/ SAND	
Sh	(5) 6 BLOWS/FT.	
Ss	(6) 9 BLOWS/FT	
		32' (-9' MLLW)
Sh	(7) 20 BLOWS/FT., SM	
	SILTY SAND W/ GRAVEL	
Sh	(8) 73 BLOWS/9 IN.	
	COMPLETION OF DRILLING	40.2' (-17.2' MLLW)

NOTE(S)

1. TEST HOLE DRILLED WITH HOLLOW STEM AUGER EQUIPMENT.

SOUTH HARBOR EXPANSION
GEOTECHNICAL INVESTIGATION
PN&D PROJECT NO. 96256

TEST HOLE LOGS

FIGURE B-11

Peratrovich, Nottingham & Drage, Inc.
August, 1997

ALASKA
TESTLAB
A Division of DOWL, Incorporated

AASHTO ACCREDITED
CONSTRUCTION
MATERIALS TESTING
LABORATORY

W.O. A27160
March 10, 1997

Peratrovich Nottingham & Drage
1506 2 36th Ave., Suite 101
Anchorage, Alaska 99503

Attention: Jim Heumann

Subject: Consolidated Drained Triaxial Testing and a Consolidation Test

Dear: Mr. Heumann:

We received a sample of soil from you contained in a Shelby tube on February 26, 1997. We were instructed to perform a consolidation test and three consolidated drained triaxial tests on the material. The test was performed in accordance with ASTM D2435 "One-dimensional Consolidation Properties of Soils" and ASTM 4767 "Consolidated-Undrained Triaxial Compression Test on Cohesive Soils" except the test was allowed to drain and no pour water pressures were taken.

The dry density of the samples used to perform the triaxial tests vary due to the variation in the amount of gravel and sand from sample to sample. The dry density of the sample that was tested at 64 psi is 115.0 pcf. This sample had a large 1 inch gravel with several 3/4 inch gravels. The sample performed at 16 psi has a dry density of 108.7 pcf. This sample had a seam of 2 inches of very coarse sand with #4 gravel. The sample with a dry density of 97.9 pcf had less gravel than the other two samples.

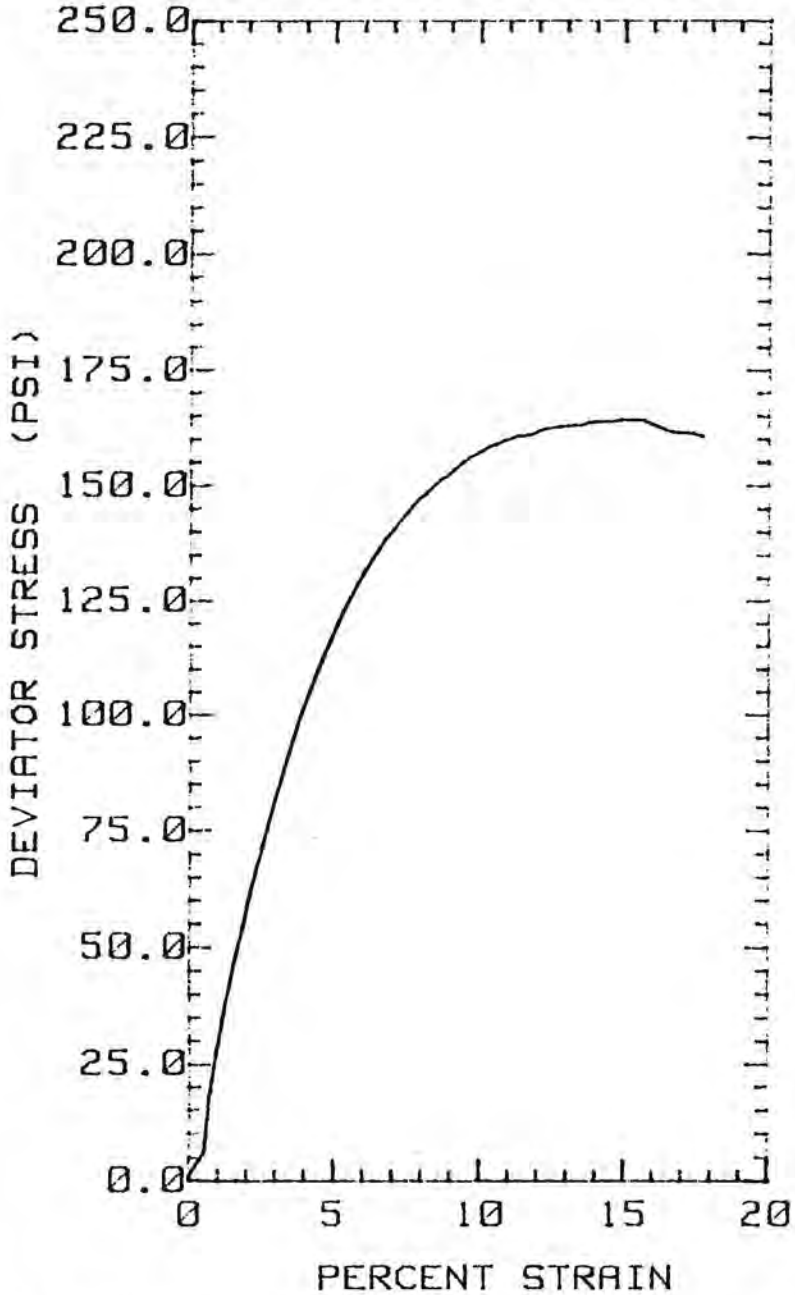
Attached are the time rate of consolidation curves, the compression curve for e verses log p, the compression curve of percent compression verses log p, the Mohr diagram and the triaxial compression curves. All the sieve analyses, Atterbergs, moistures and unit weight results are attached. The sieve analysis that corresponds with the triaxial test is lab number 311.

If you have any questions regarding these results , please call me.

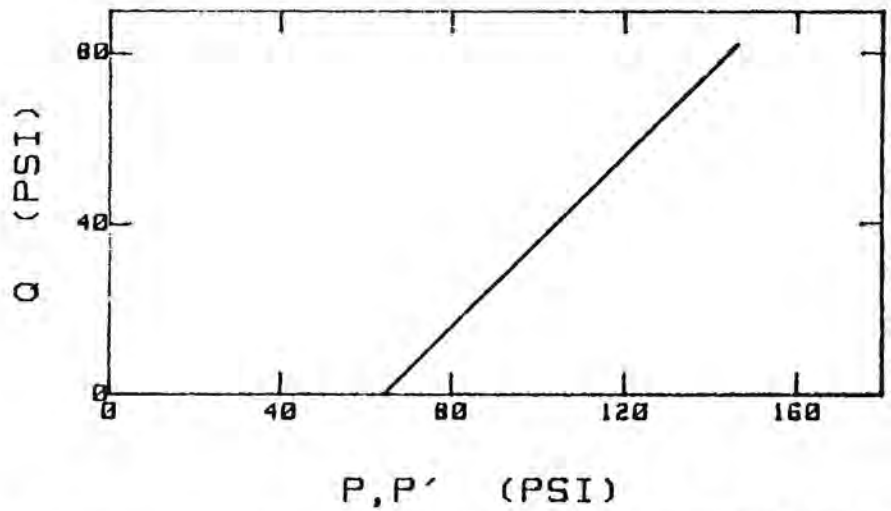
Sincerely,
ALASKA TESTLAB

David L. Andersen, P.E.
Laboratory Supervisor

4040 B STREET • ANCHORAGE • ALASKA • 99503-5999 • 907/562-2000 • FAX 907/563-3953



PROJECT : PETERSBURG HARBOR 96256-02
CLIENT : PN&D
WO # A27160
BORING # 6 DEPTH : 43.5'-46.0'
SAMPLE # 7
INITIAL DRY DENSITY: 115.0 pcf
EFFECTIVE CONFINING PRESSURE: 64.0 psi
FINAL MOISTURE CONTENT: 10.3 percent
LABORATORY # T97004
DATE: 7 Mar 1996 08:36:38



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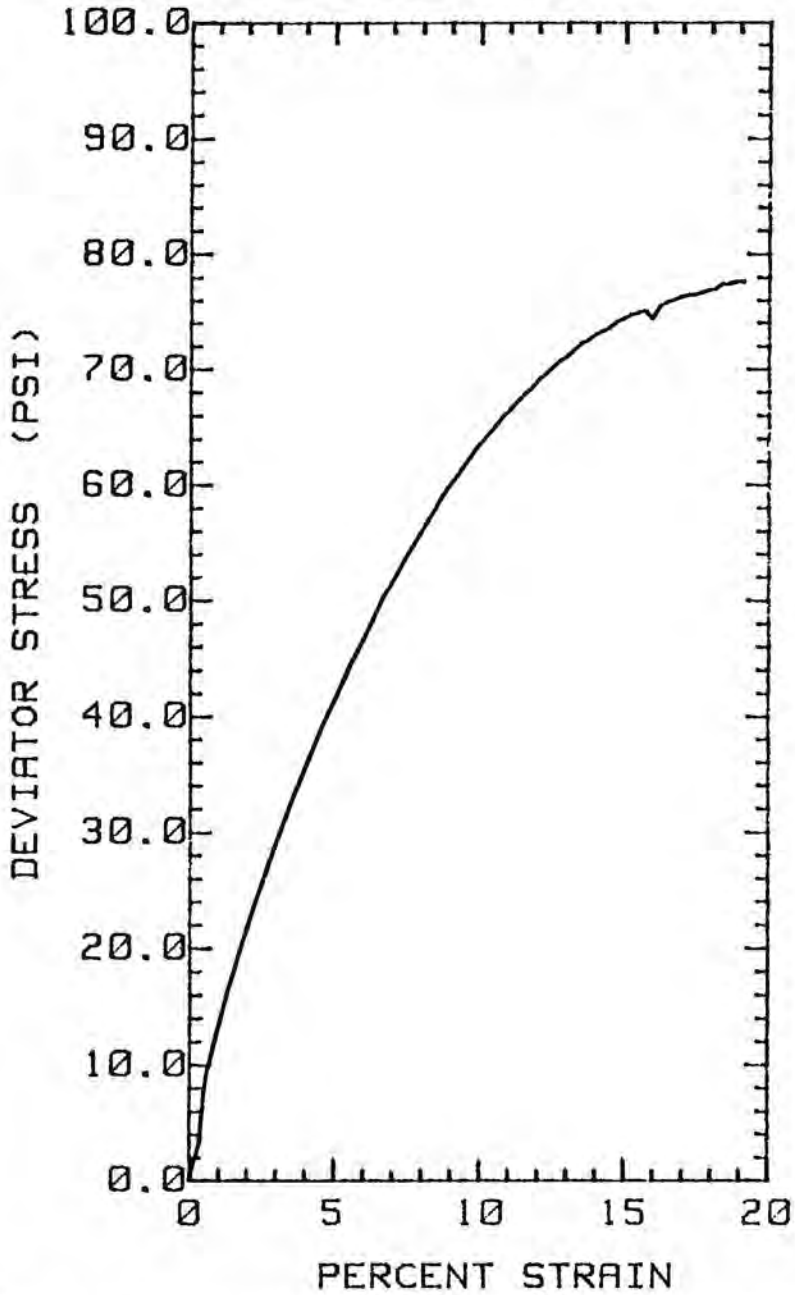
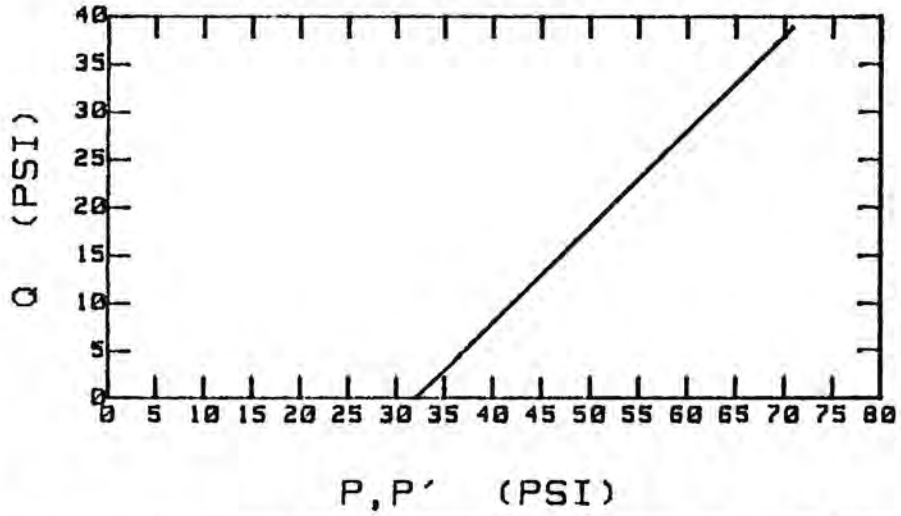
Consolidated Drained Triaxial Compression

WO # A27160
FIGURE



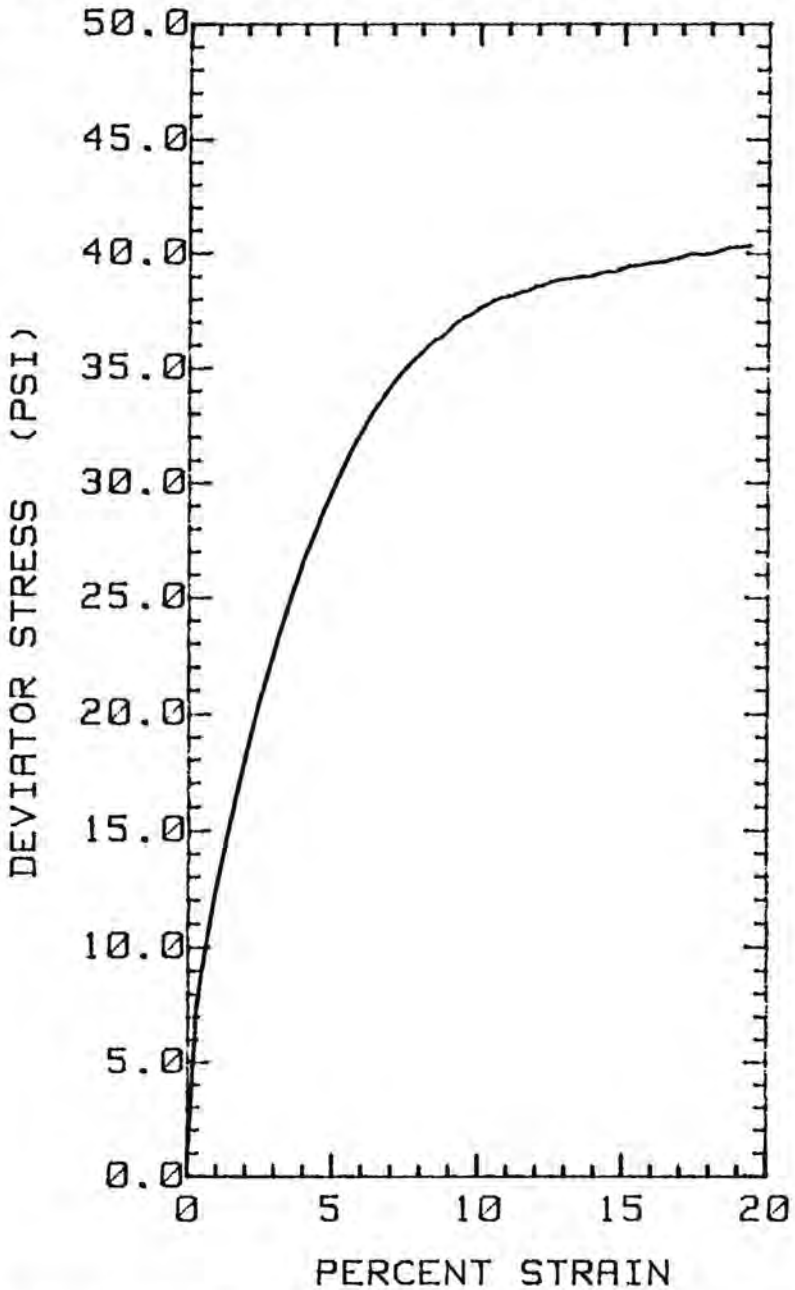
PROJECT : PETERSBURG HARBOR 96256-02
CLIENT : PN&D
WO # A27160
BORING # 6 DEPTH : 43.5'-46.0'
SAMPLE # 7
INITIAL DRY DENSITY: 97.9 pcf
EFFECTIVE CONFINING PRESSURE: 32.0 psi
FINAL MOISTURE CONTENT: 15.0 percent
LABORATORY # T97003
DATE: 6 Mar 1996 17:47:21



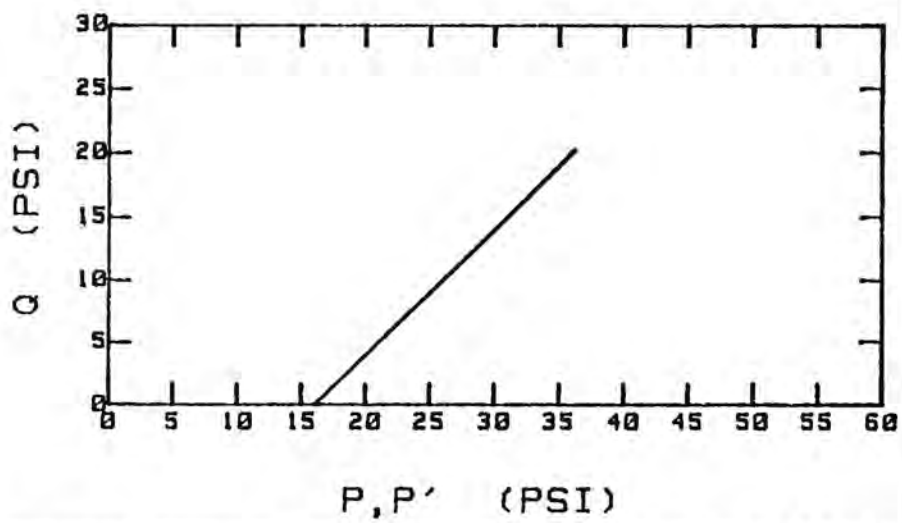
ALASKA TESTLAB

Consolidated Drained Triaxial Compression

WO # A27160
FIGURE



PROJECT : PETERSBURG HARBOR 96256.02
CLIENT : PN&D
WO # A27160
BORING # 6 DEPTH : 43.5'-46.0'
SAMPLE # 7
INITIAL DRY DENSITY: 108.7 pcf
EFFECTIVE CONFINING PRESSURE: 16.0 psi
FINAL MOISTURE CONTENT: 13.9 percent
LABORATORY # T97002
DATE: 6 Mar 1996 08:19:24



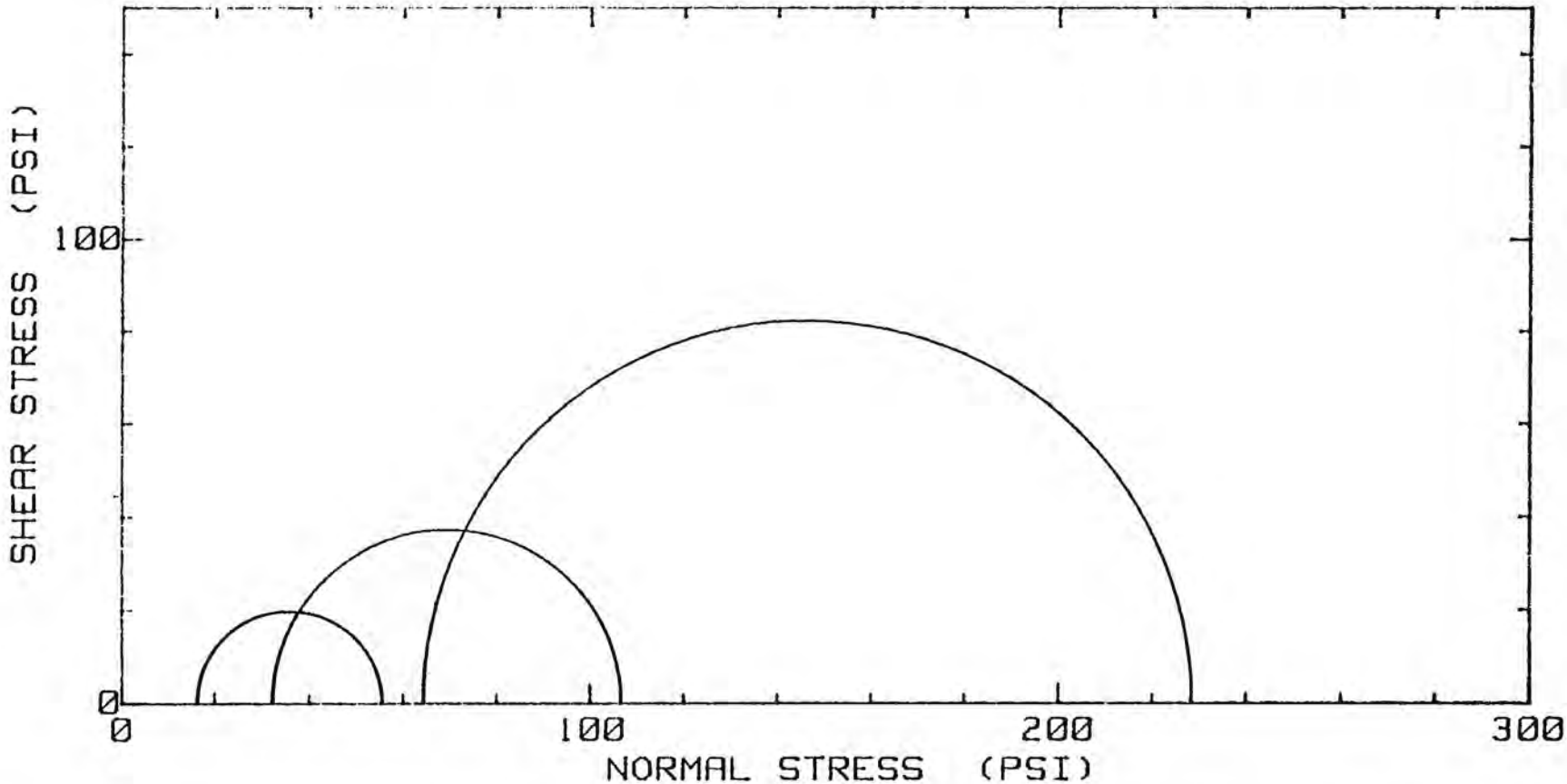
ALASKA TESTLAB

Consolidated Drained Triaxial Compression

WO # A27160
FIGURE

PROJECT : PETERSBURG HARBOR 96256-02 LAB # T97004; σ_3 = 64.0 psi; γ_d = 115.0 pcf
CLIENT : PN&D
W.O. # A27160 LAB # T97003; σ_3 = 32.0 psi; γ_d = 97.9 pcf
BORING # 6 LAB # T97002; σ_3 = 16.0 psi; γ_d = 108.7 pcf
SAMPLE # 7
DEPTH: 43.5'-46.0'

DATE : 7 Mar 1996 08:36:38

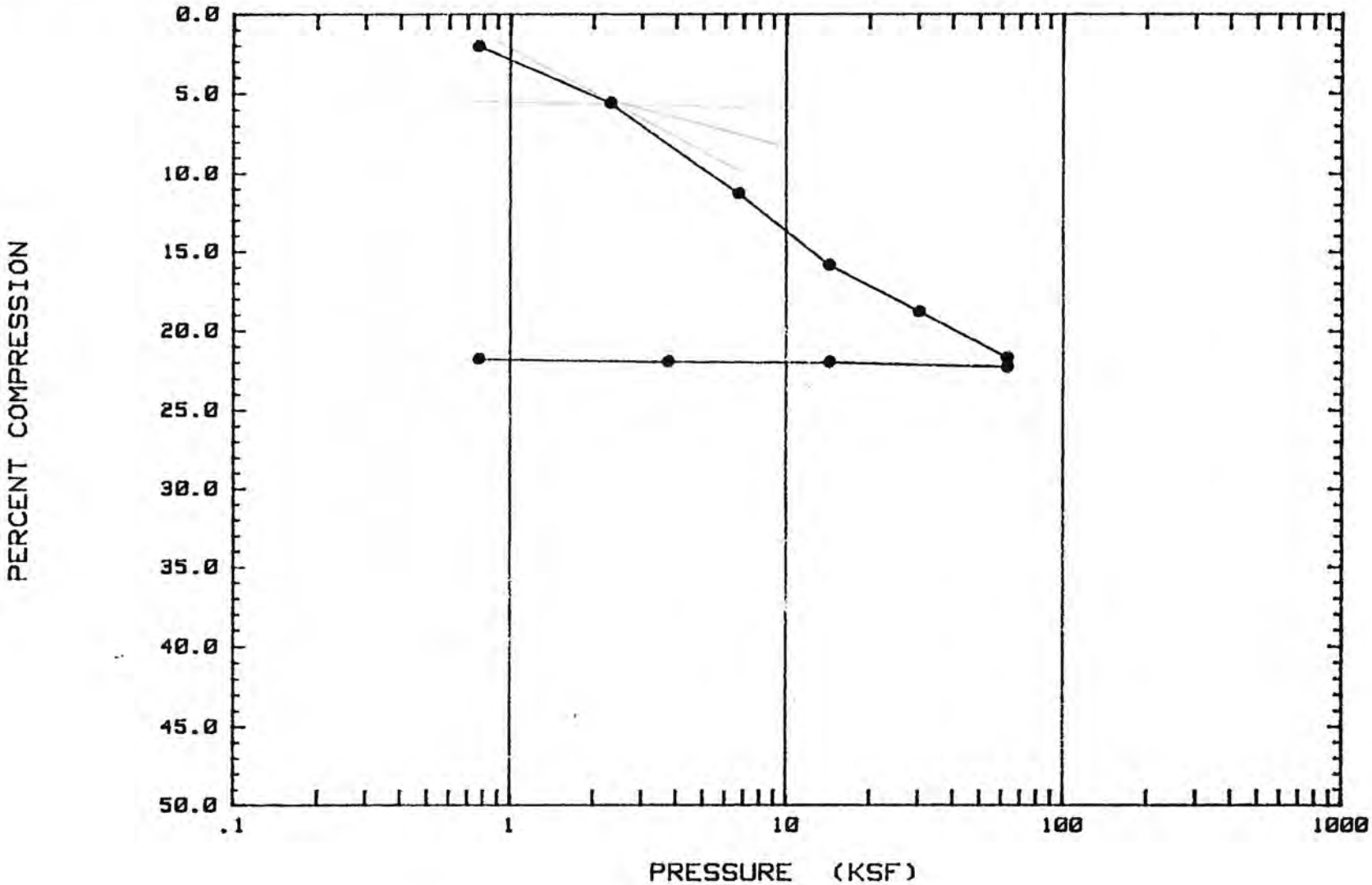


ALASKA TESTLAB

Mohr Diagram - CD Tests

WO # A27160
FIGURE

PROJECT : PETERSBURG HARBOR 96256.02 CLIENT : PN&D
BORING # 6
SAMPLE # 7 DEPTH: 33.5-36 LABORATORY # C97004



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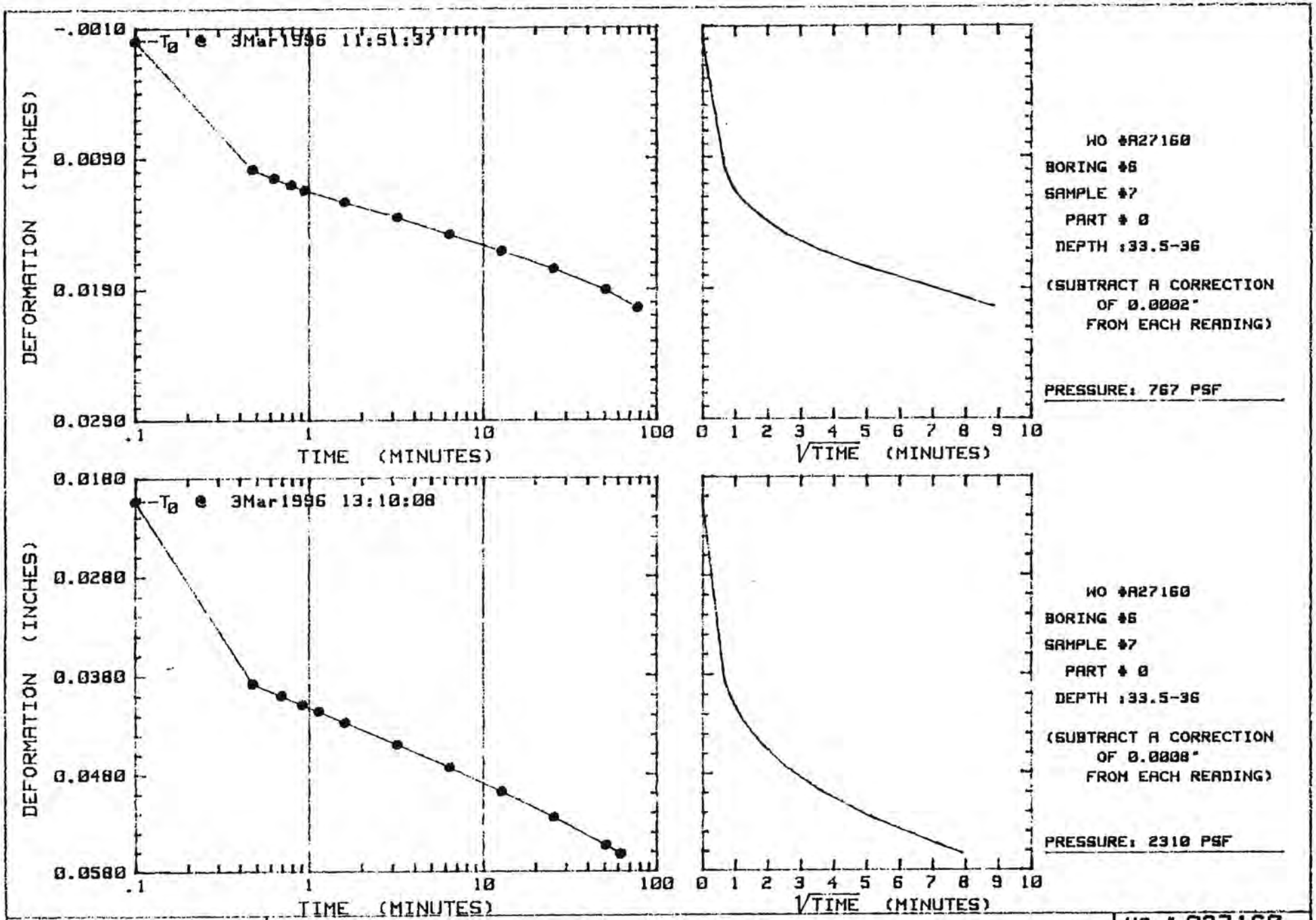
Compression Curve (%Comp. vs. Log P)

WO # A27160
FIGURE



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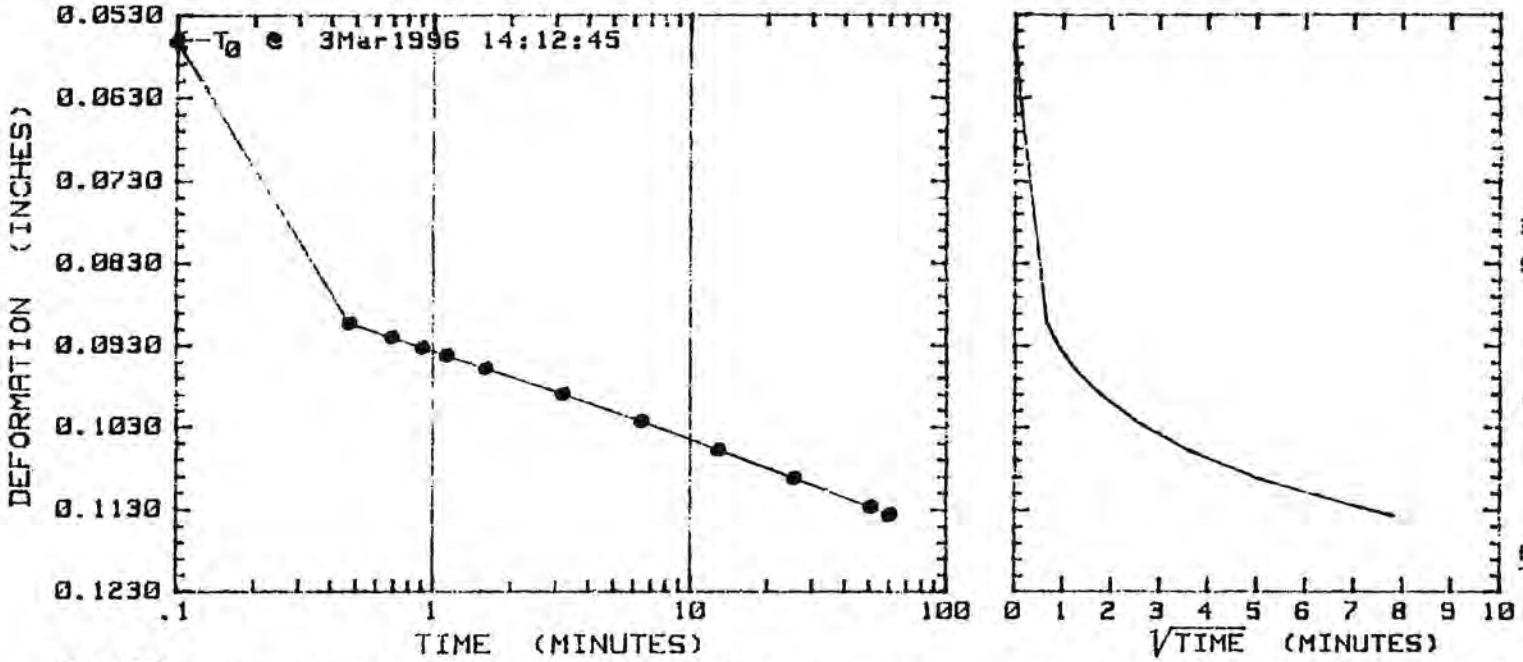
Time Rate of Consolidation

WO # A27160

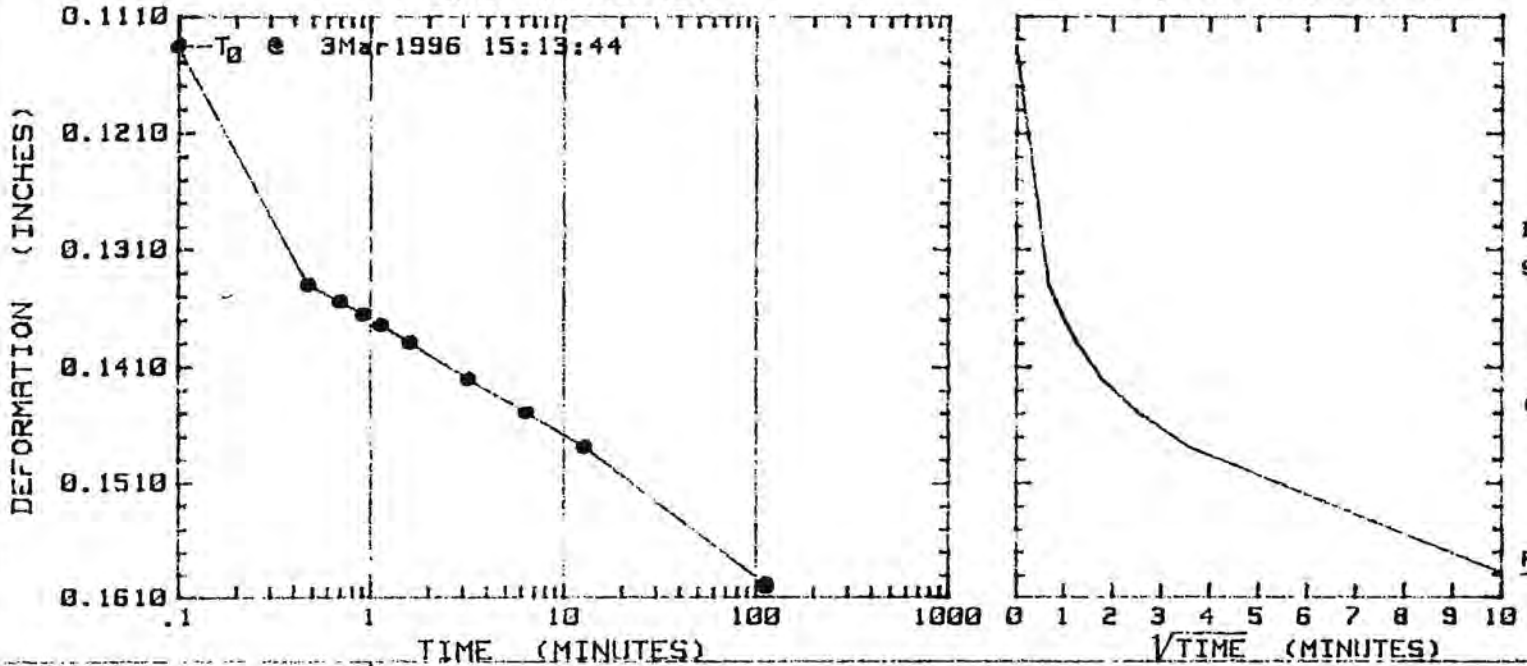
FIGURE



WO #A27160
BORING #6
SAMPLE #7
PART # 0
DEPTH :33.5-36

(SUBTRACT A CORRECTION OF 0.0015" FROM EACH READING)

PRESSURE: 6710 PSF



WO #A27160
BORING #6
SAMPLE #7
PART # 0
DEPTH :33.5-36

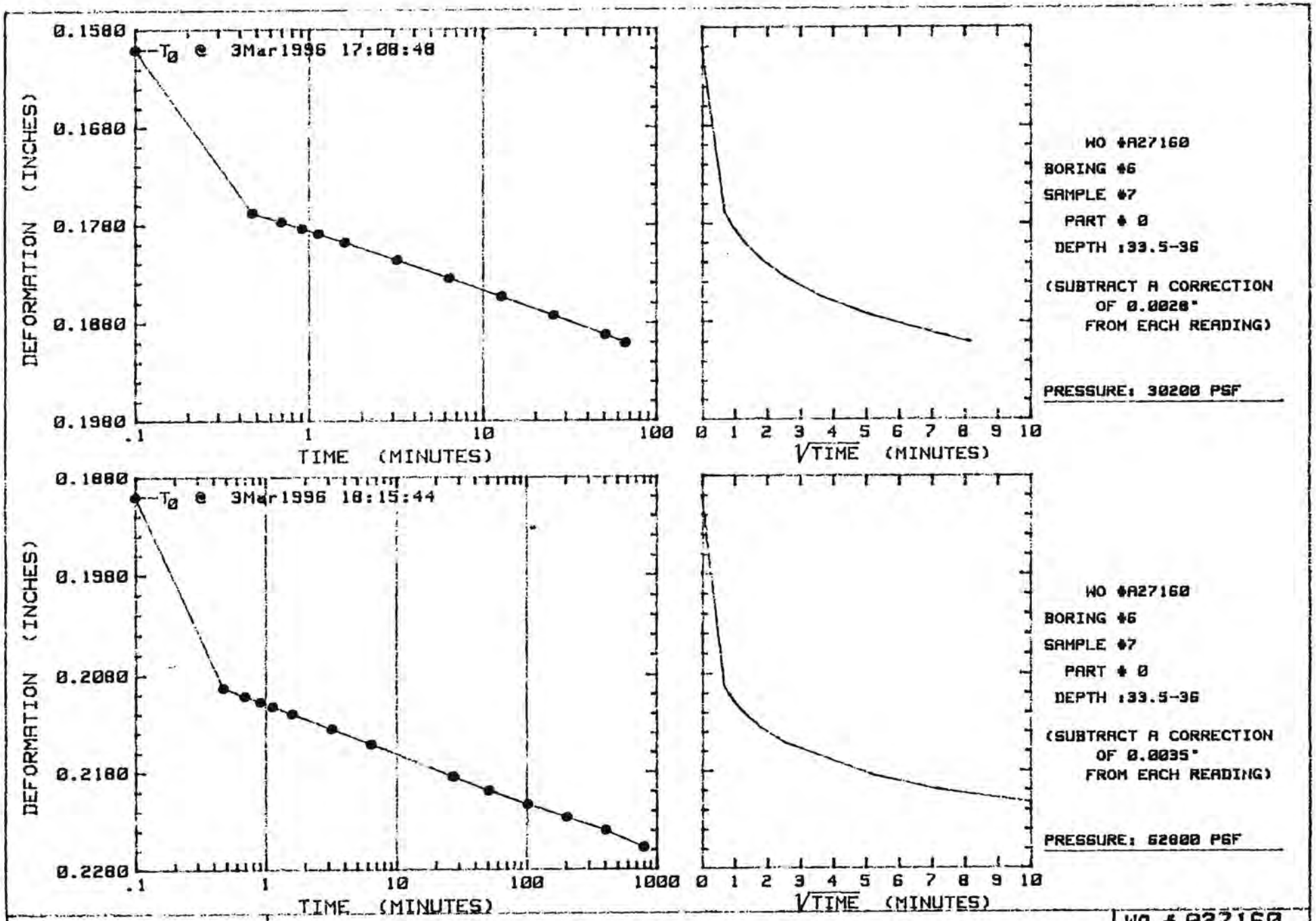
(SUBTRACT A CORRECTION OF 0.0021" FROM EACH READING)

PRESSURE: 14300 PSF

ALASKA TESTLAB

Time Rate of Consolidation

WO # A27160
FIGURE

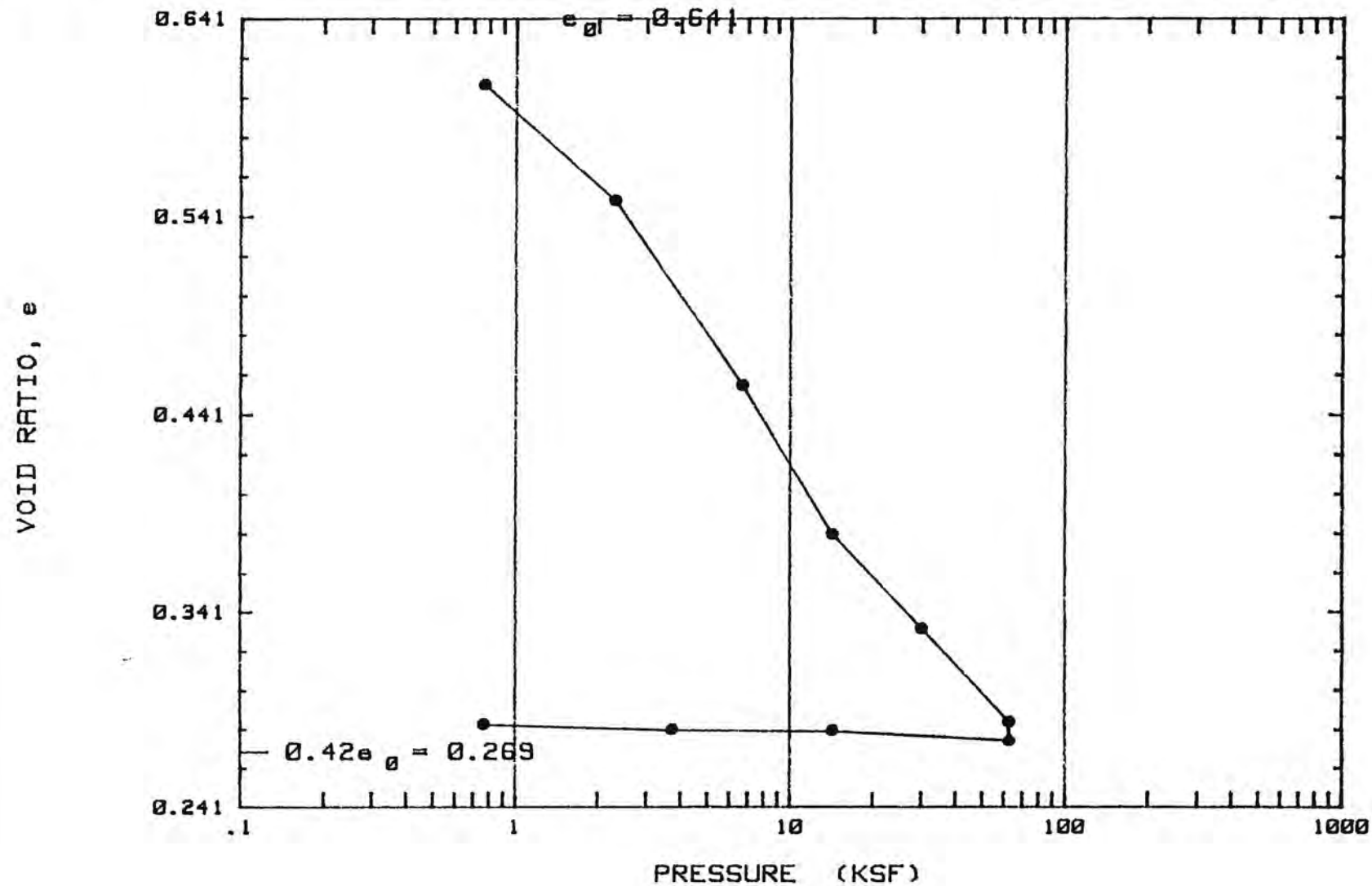


ALASKA TESTLAB

Time Rate of Consolidation

WO # A27160
FIGURE

PROJECT : PETERSBURG HARBOR 96256.02 CLIENT : PN&D
BORING # 6
SAMPLE # 7 DEPTH: 33.5-36 LABORATORY # C97004



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Compression Curve (e vs. Log P)

WO # A27160
FIGURE

ALASKA TESTLAB
A Division of DOWL, Incorporated
4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

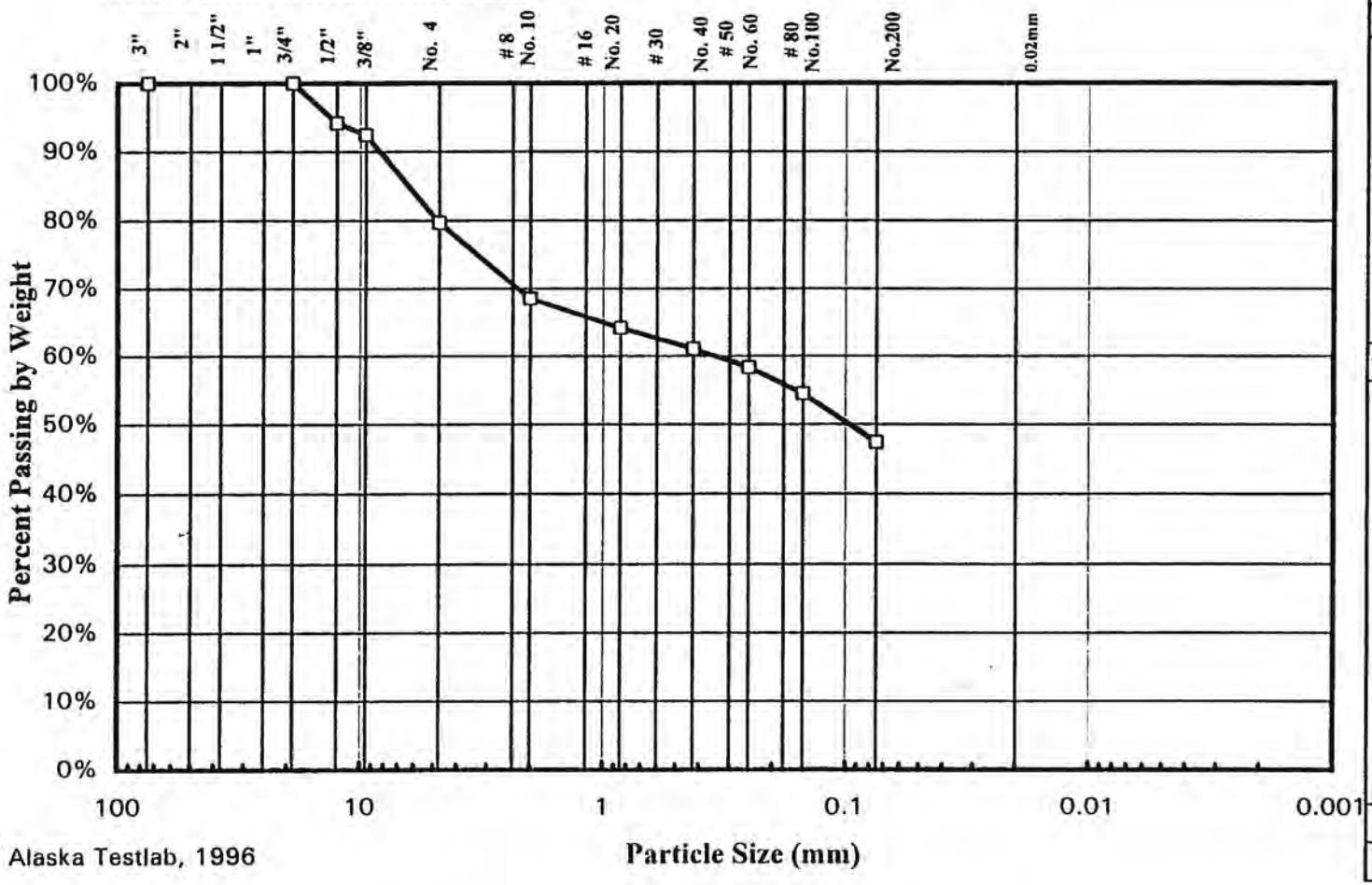
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-1, SA-1 @ 6.0'-6.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 290
Received: February 26, 1997

Engineering Classification: Silty SAND with Gravel, SM ✓
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	94%	
3/8"	92%	
No. 4	80%	
Total Wt. of Coarse Fraction = 526.6g		
No. 8		
No. 10	69%	
No. 16		
No. 20	64%	
No. 30		
No. 40	61%	
No. 50		
No. 60	58%	
No. 80		
No.100	54%	
No.200	47%	
Total Wt. of Fine Fraction = 419.5g		
0.02 mm		

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David L. Andersen, P.E. Laboratory Supervisor

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4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

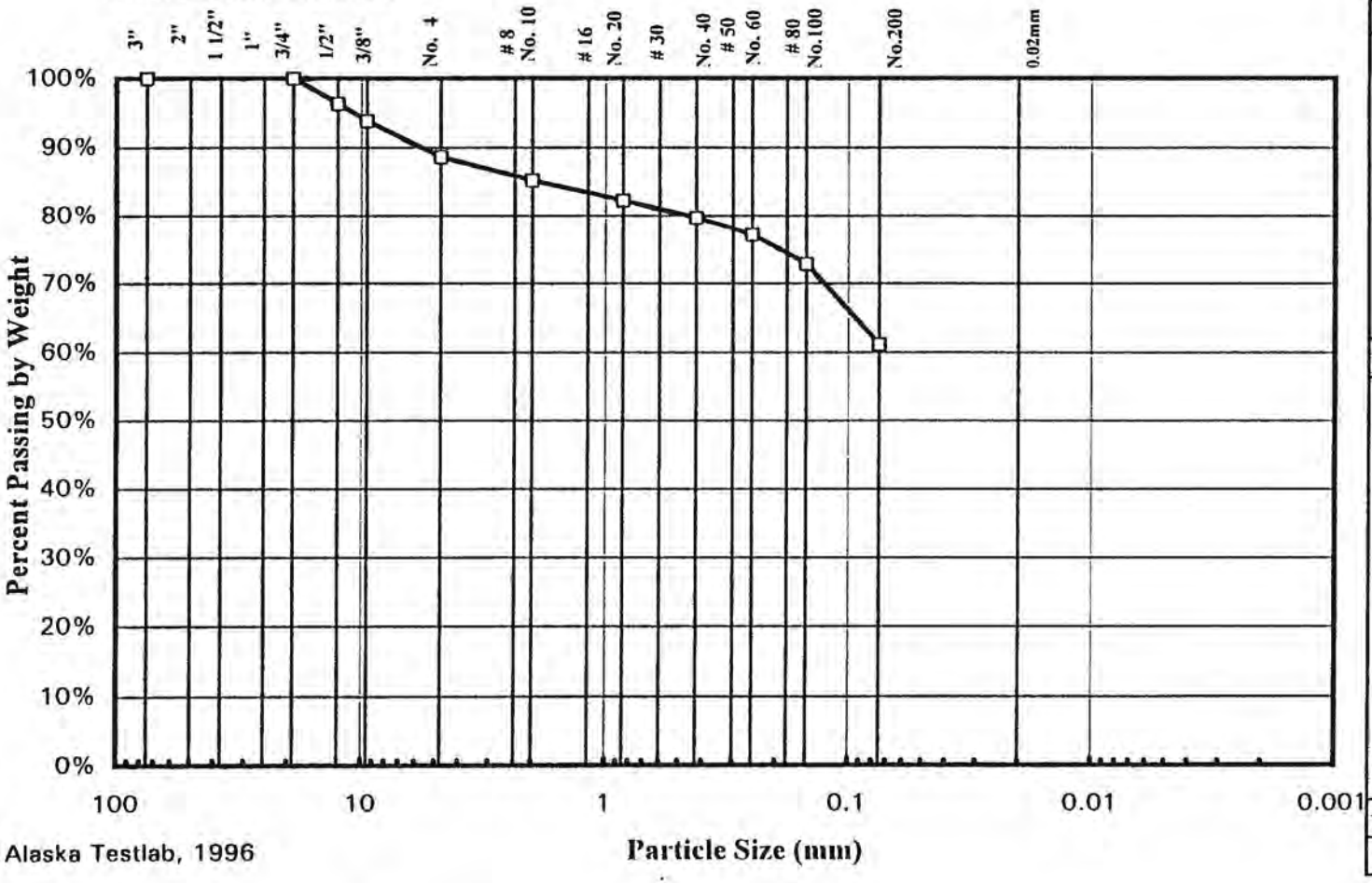
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-1, SA-3 @ 15.5'-16.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 291
Received: February 26, 1997

Engineering Classification: Sandy SILT, ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	96%	
3/8"	94%	
No. 4	89%	
Total Wt. of Coarse Fraction = 1091g		
No. 8		
No. 10	85%	
No. 16		
No. 20	82%	
No. 30		
No. 40	80%	
No. 50		
No. 60	77%	
No. 80		
No.100	73%	
No.200	61%	
Total Wt. of Fine Fraction = 328.7g		
0.02 mm		

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David L. Andersen, P.E. Laboratory Supervisor

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4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

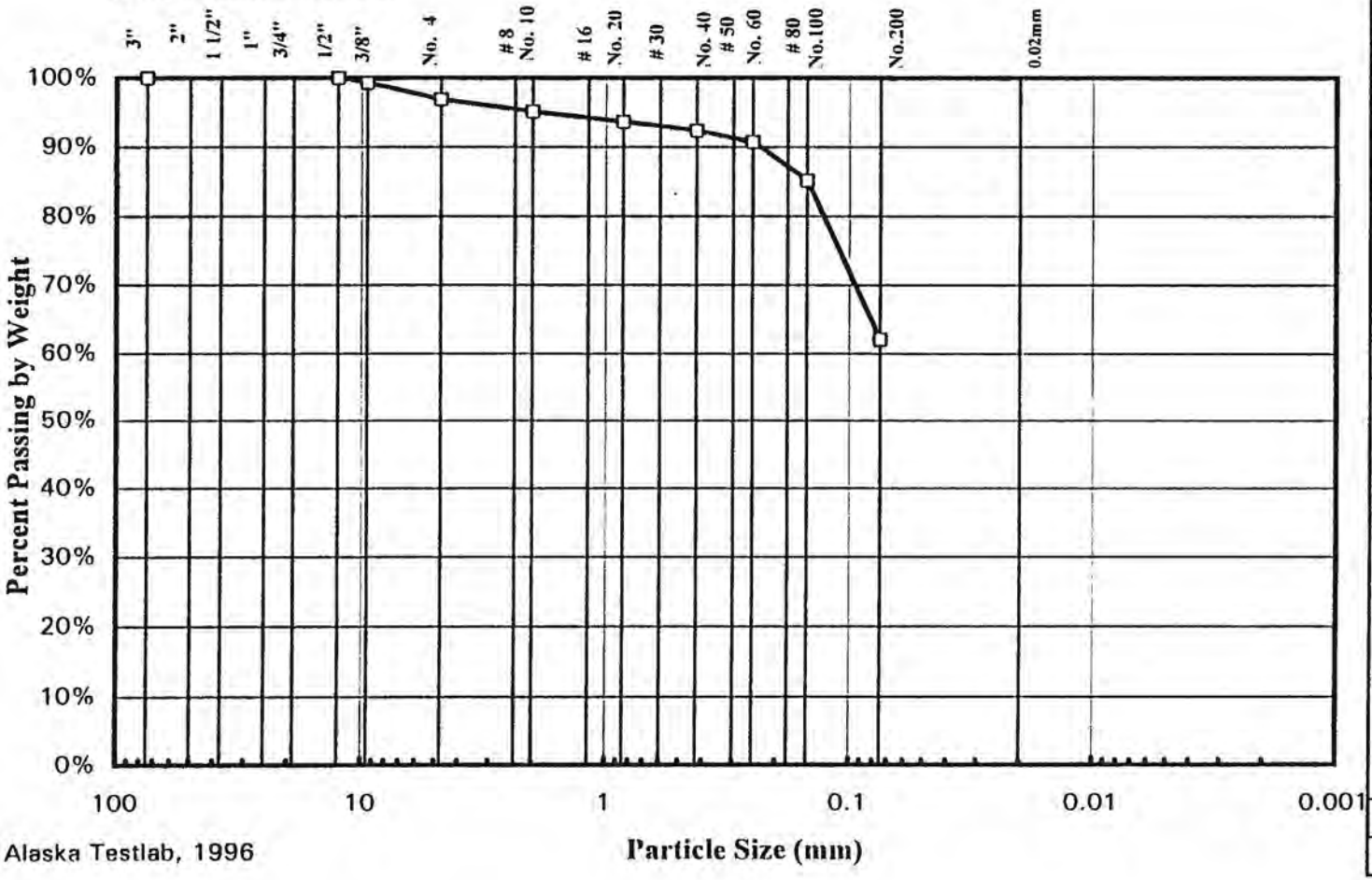
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-1, SA-4 @ 20.5'-21.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 292
Received: February 26, 1997

Engineering Classification: Sandy SILT, ML✓
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"	100%	
3/8"	99%	
No. 4	97%	
Total Wt. of Coarse Fraction = 310.4g		
No. 8		
No. 10	95%	
No. 16		
No. 20	94%	
No. 30		
No. 40	92%	
No. 50		
No. 60	91%	
No. 80		
No.100	85%	
No.200	62%	
Total Wt. of Fine Fraction = 300.8g		
0.02 mm		

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David L. Andersen, P.E. Laboratory Supervisor

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(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

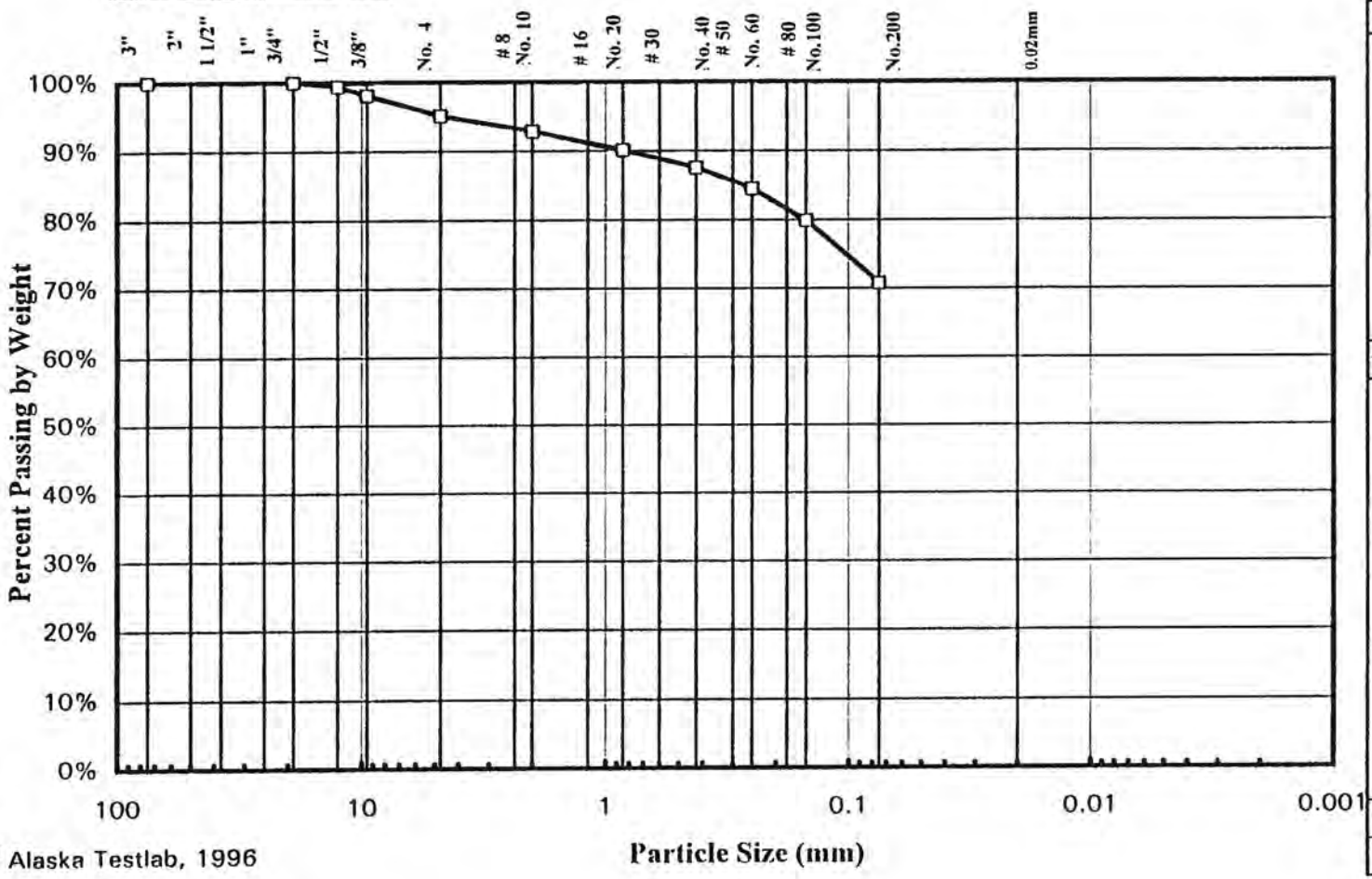
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-1, SA-5 @ ~~36.5'-37.5'~~ 26.5'-27.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 293
Received: February 26, 1997

Engineering Classification: Silty CLAY w/ Sand, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	98%	
No. 4	95%	
Total Wt. of Coarse Fraction = 1144.8g		
No. 8		
No. 10	93%	
No. 16		
No. 20	90%	
No. 30		
No. 40	88%	
No. 50		
No. 60	84%	
No. 80		
No.100	80%	
No.200	71%	
Total Wt. of Fine Fraction = 331.8g		
0.02 mm		

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David L. Andersen, P.E. Laboratory Supervisor

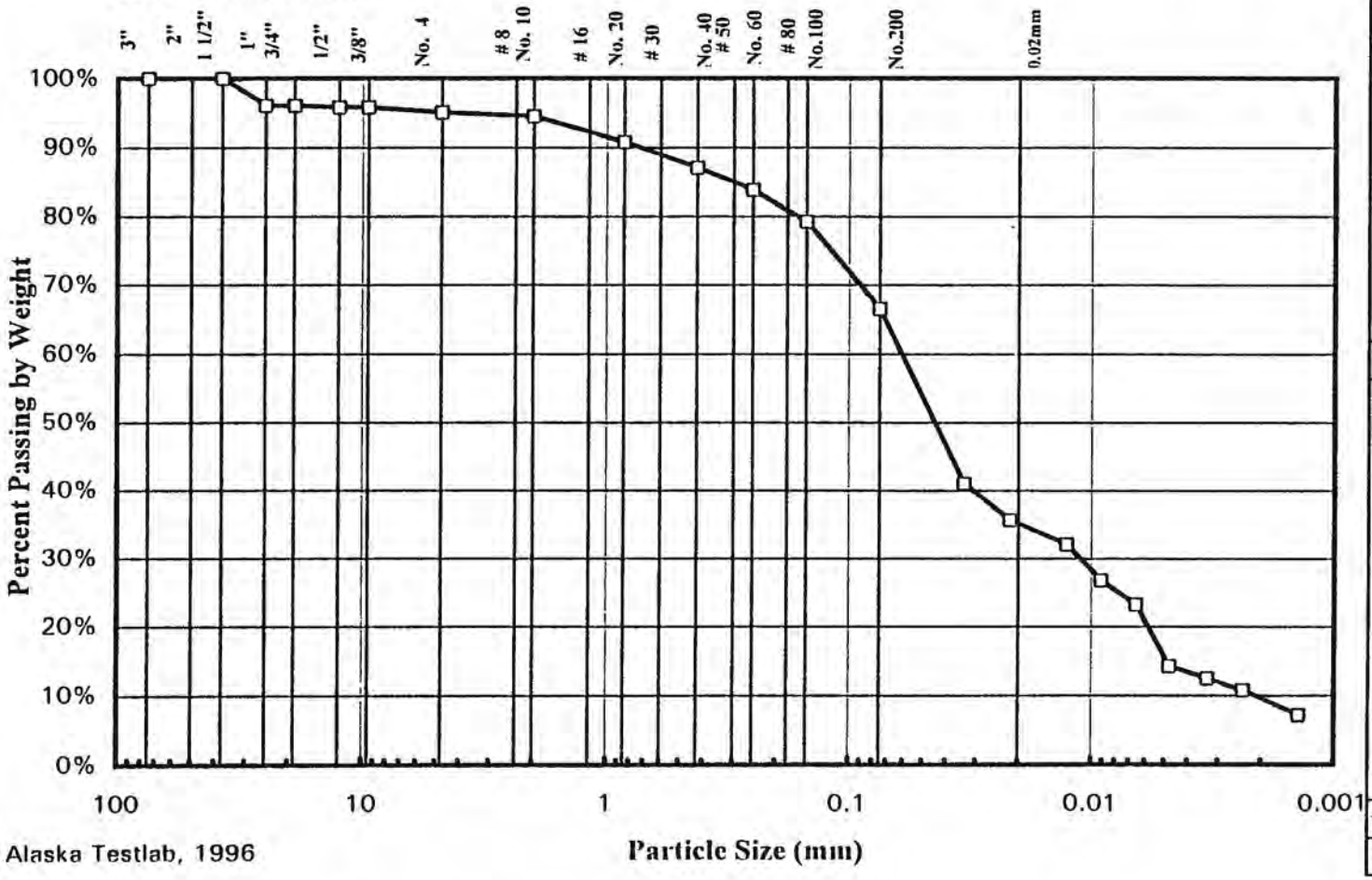
ALASKA TESTLAB
A Division of DOWL, Incorporated
4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage
Project: Petersburg Harbor GEO No. 96256.02
Location: TH-2, SA-1 @ 2.5'-3.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 295
Received: February 26, 1997

Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	96%	
1/2"	96%	
3/8"	96%	
No. 4	95%	
Total Wt. of Coarse Fraction = 1768.5g		
No. 8		
No. 10	95%	
No. 16		
No. 20	91%	
No. 30		
No. 40	87%	
No. 50		
No. 60	84%	
No. 80		
No.100	79%	
No.200	67%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	35.1%	

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Howard K. Weston, P.E. Technical Director
David L. Andersen, P.E. Laboratory Supervisor

ALASKA TESTLAB
A Division of DOWL, Incorporated
4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

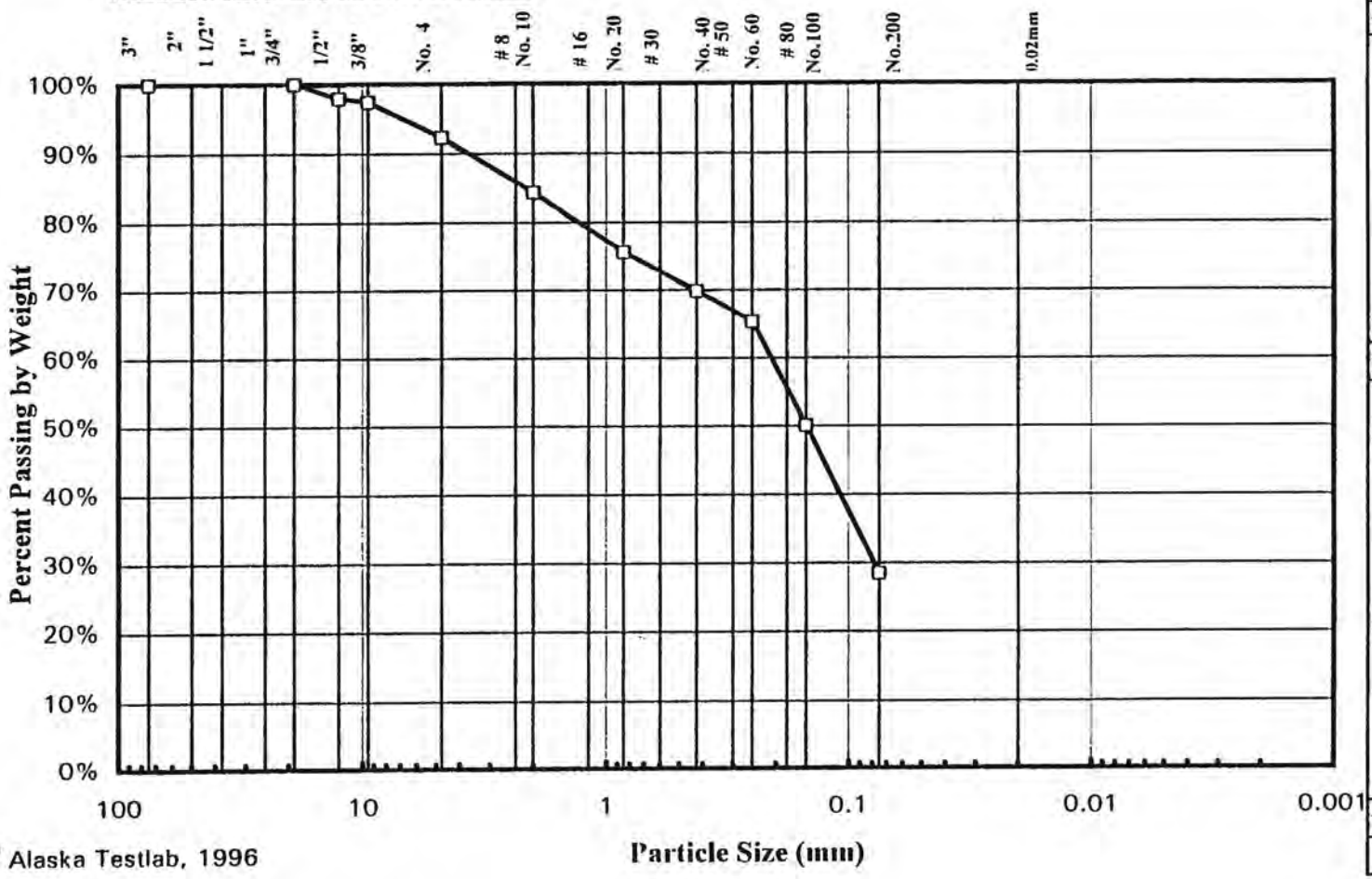
Project: Petersburg Harbor GEO No. 96256.02

Location: TII-1, SA-6 @ 34.5'-35.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 294
Received: February 26, 1997

Engineering Classification: Silty SAND , SM✓
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	98%	
3/8"	97%	
No. 4	92%	
Total Wt. of Coarse Fraction = 668.8g		
No. 8		
No. 10	84%	
No. 16		
No. 20	76%	
No. 30		
No. 40	70%	
No. 50		
No. 60	65%	
No. 80		
No.100	50%	
No.200	28%	
Total Wt. of Fine Fraction = 313.5g		
0.02 mm		

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ALASKA TESTLAB
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4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

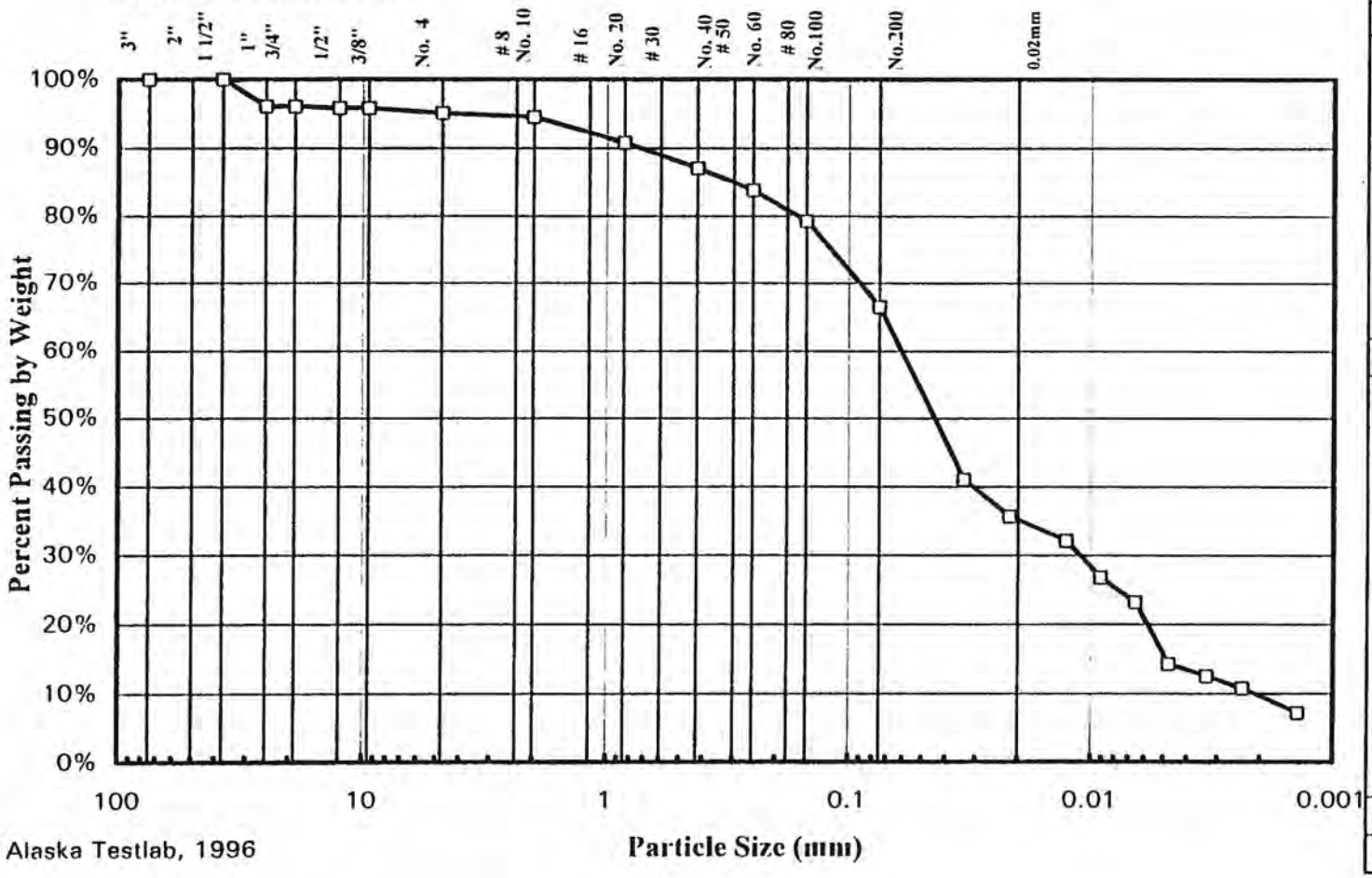
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-2, SA-1 @ 2.5'-3.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 295
Received: February 26, 1997

Engineering Classification: Sandy Clayey Silt, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	96%	
1/2"	96%	
3/8"	96%	
No. 4	95%	
Total Wt. of Coarse Fraction = 1768.5g		
No. 8		
No. 10	95%	
No. 16		
No. 20	91%	
No. 30		
No. 40	87%	
No. 50		
No. 60	84%	
No. 80		
No.100	79%	
No.200	67%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	35.1%	

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Client: Peratrovich Nottingham & Drage

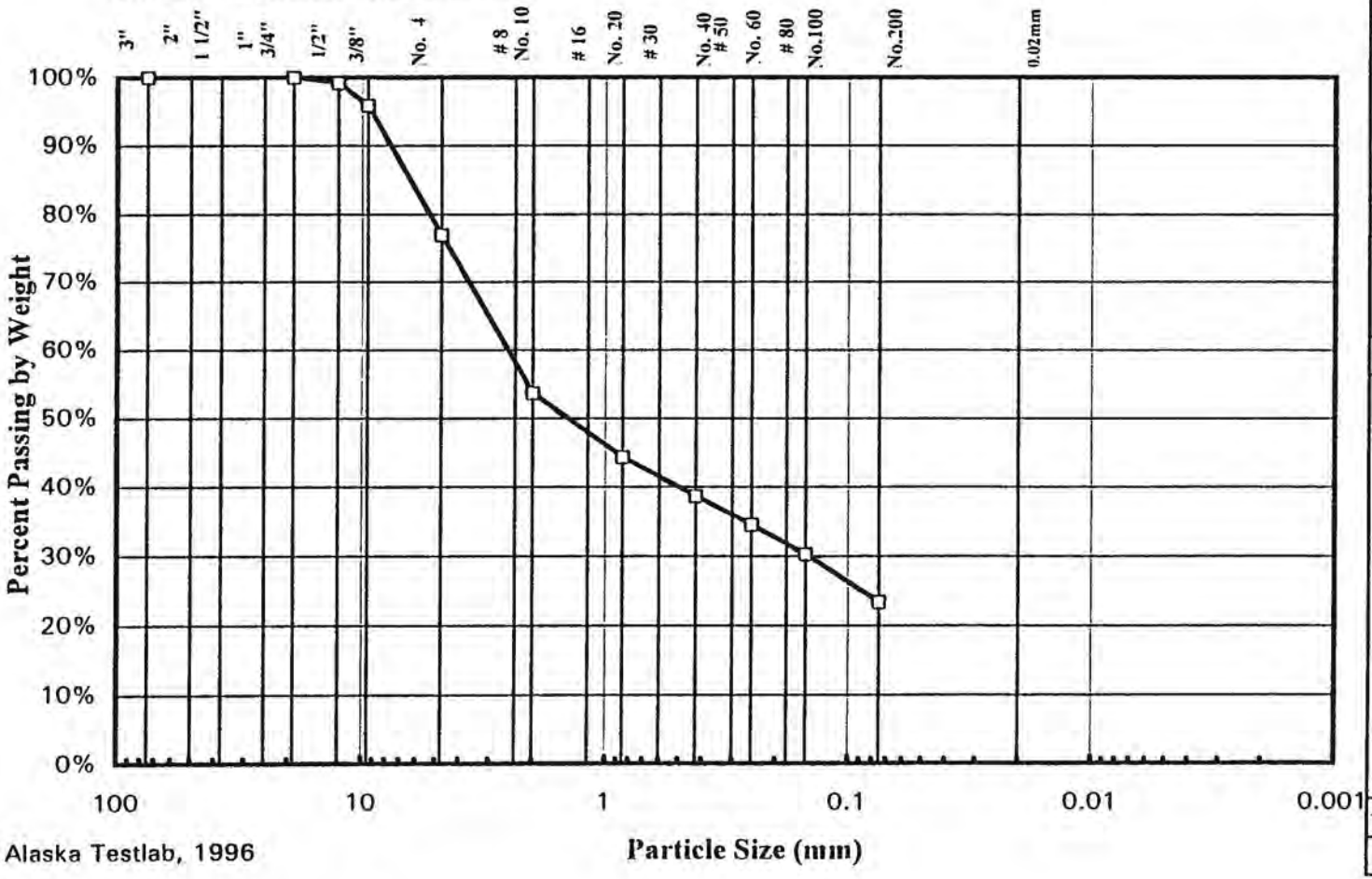
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-2, SA-3 @ 14.0'-14.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 296
Received: February 26, 1997

Engineering Classification: Silty SAND with Gravel, SM ✓
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	96%	
No. 4	77%	
Total Wt. of Coarse Fraction = 245.1g		
No. 8		
No. 10	54%	
No. 16		
No. 20	44%	
No. 30		
No. 40	39%	
No. 50		
No. 60	35%	
No. 80		
No.100	30%	
No.200	23%	
Total Wt. of Fine Fraction = 188.5g		
0.02 mm		

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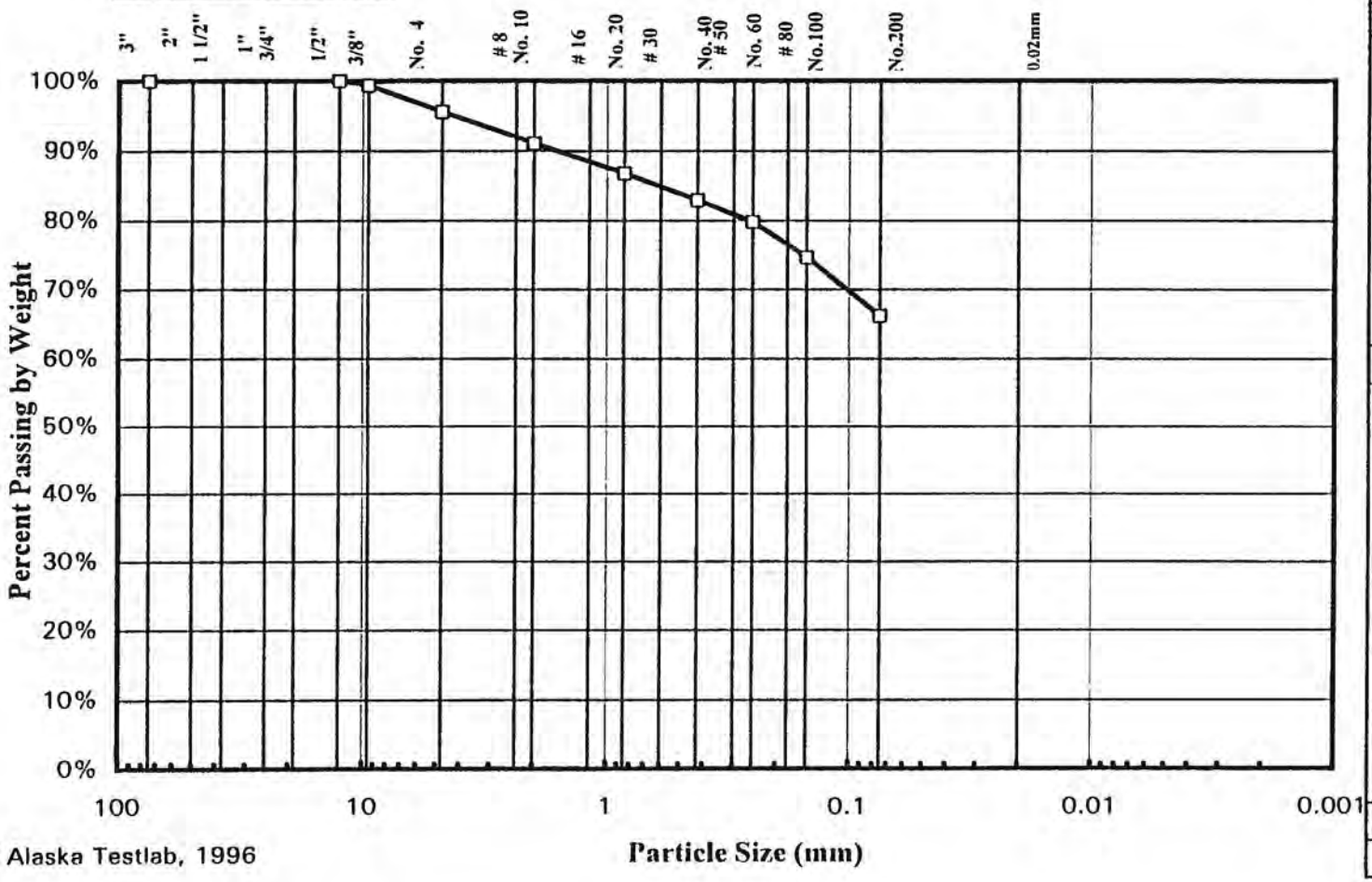
Client: Peratrovich Nottingham & Drage
Project: Petersburg Harbor GEO No. 96256.02
Location: TH-2, SA-5 @ 25.0'-26.0'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 297
Received: February 26, 1997

Engineering Classification: Sandy Silty CLAY, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"	100%	
3/8"	99%	
No. 4	96%	
Total Wt. of Coarse Fraction = 905.4g		
No. 8		
No. 10	91%	
No. 16		
No. 20	87%	
No. 30		
No. 40	83%	
No. 50		
No. 60	80%	
No. 80		
No.100	75%	
No.200	66%	
Total Wt. of Fine Fraction = 310.5g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

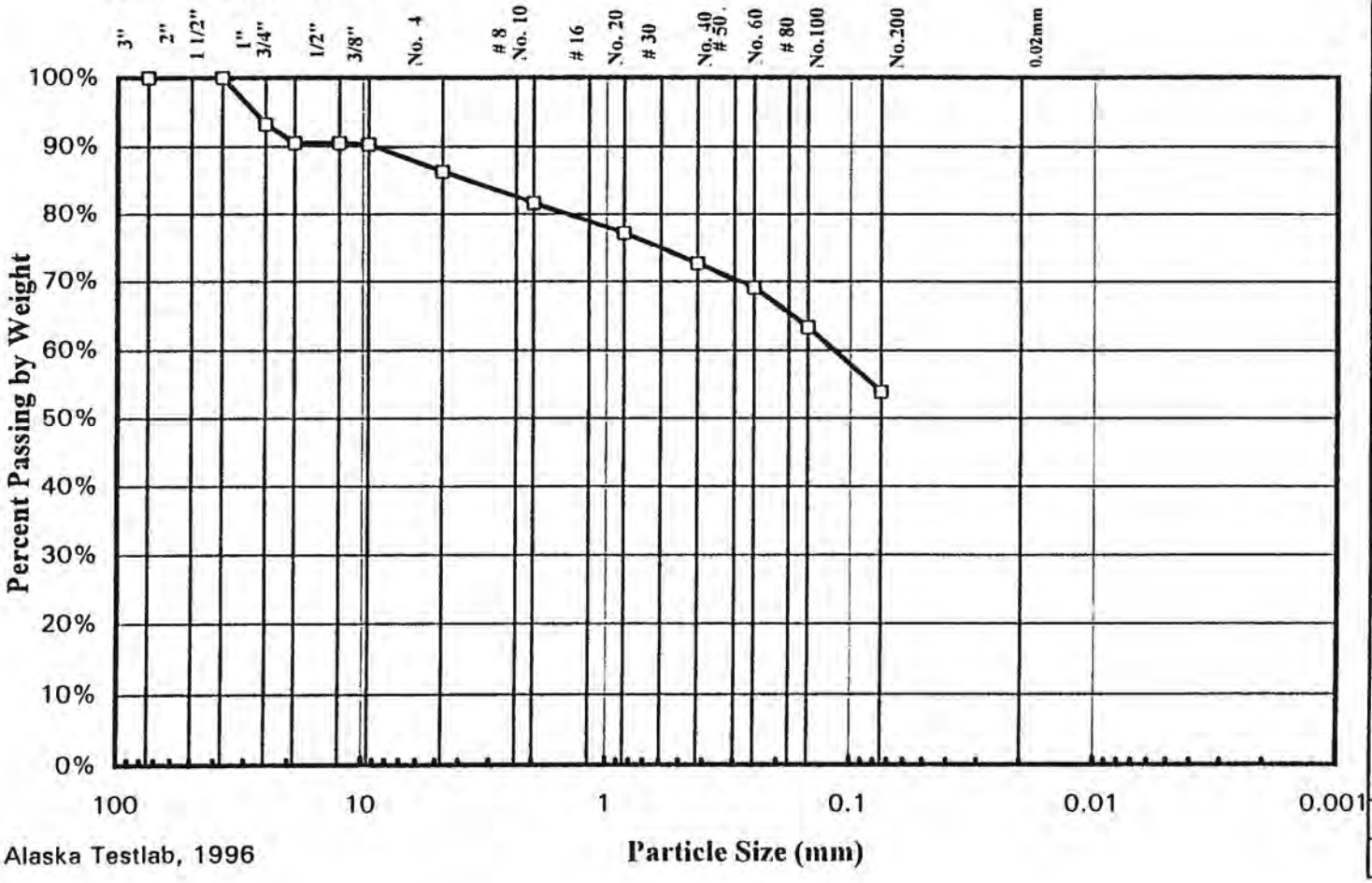
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-2, SA-6 @ 30.0'-31.0'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 298
Received: February 26, 1997

Engineering Classification: Sandy Silty CLAY, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"	100%	
1"	93%	
3/4"	90%	
1/2"	90%	
3/8"	90%	
No. 4	86%	
Total Wt. of Coarse Fraction = 782.2g		
No. 8		
No. 10	82%	
No. 16		
No. 20	77%	
No. 30		
No. 40	73%	
No. 50		
No. 60	69%	
No. 80		
No.100	63%	
No.200	54%	
Total Wt. of Fine Fraction = 331.7g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

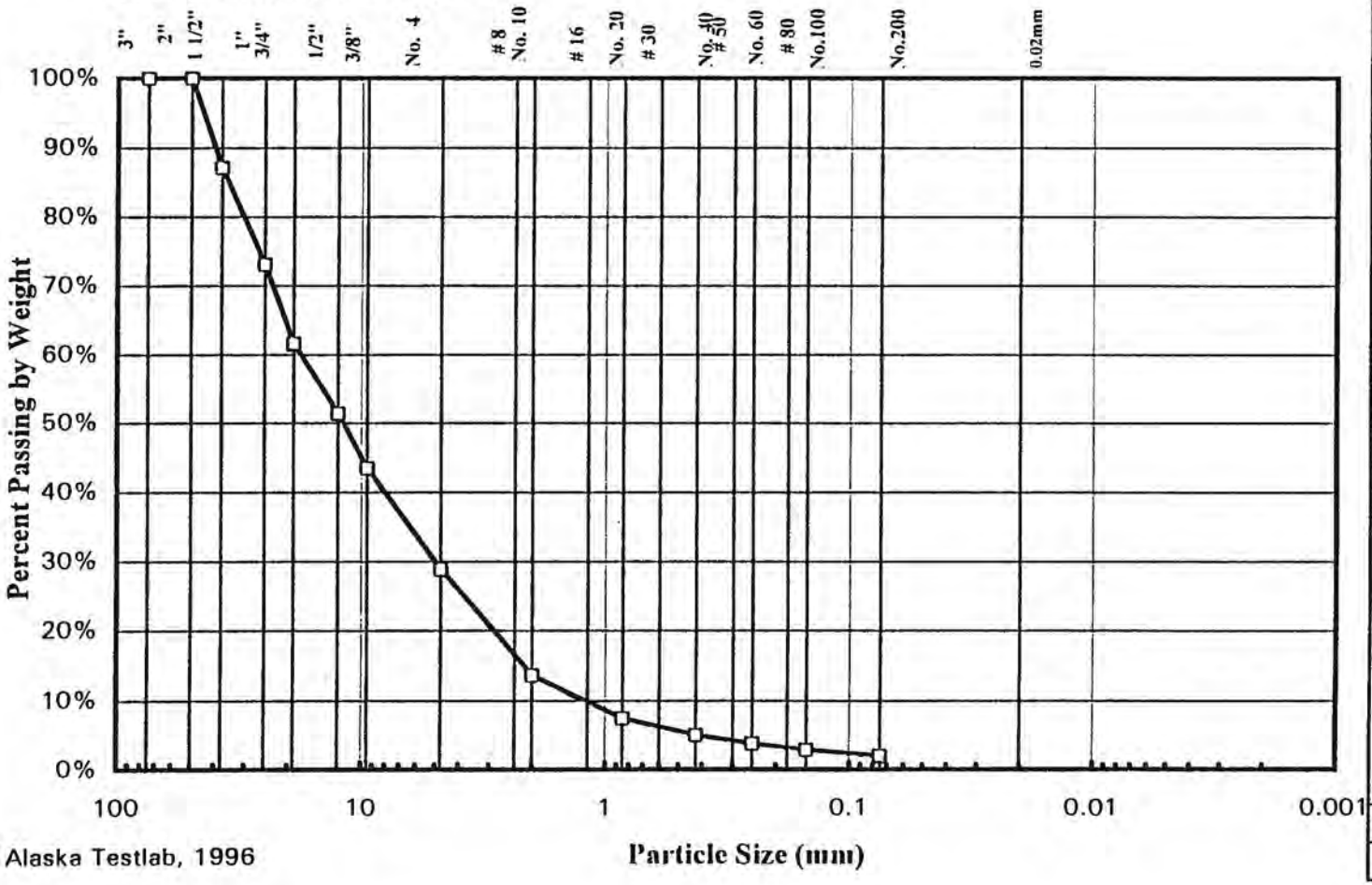
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-2, SA-7 @ 33.0'-34.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 299
Received: February 26, 1997

Engineering Classification: Well Graded GRAVEL with Sand, GW
Frost Classification: NFS (MOA)



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"	100%	
1 1/2"	87%	
1"	73%	
3/4"	62%	
1/2"	51%	
3/8"	43%	
No. 4	29%	
Total Wt. of Coarse Fraction = 1142.7g		
No. 8		
No. 10	14%	
No. 16		
No. 20	7%	
No. 30		
No. 40	5%	
No. 50		
No. 60	4%	
No. 80		
No.100	3%	
No.200	2%	
Total Wt. of Fine Fraction = 329.4g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

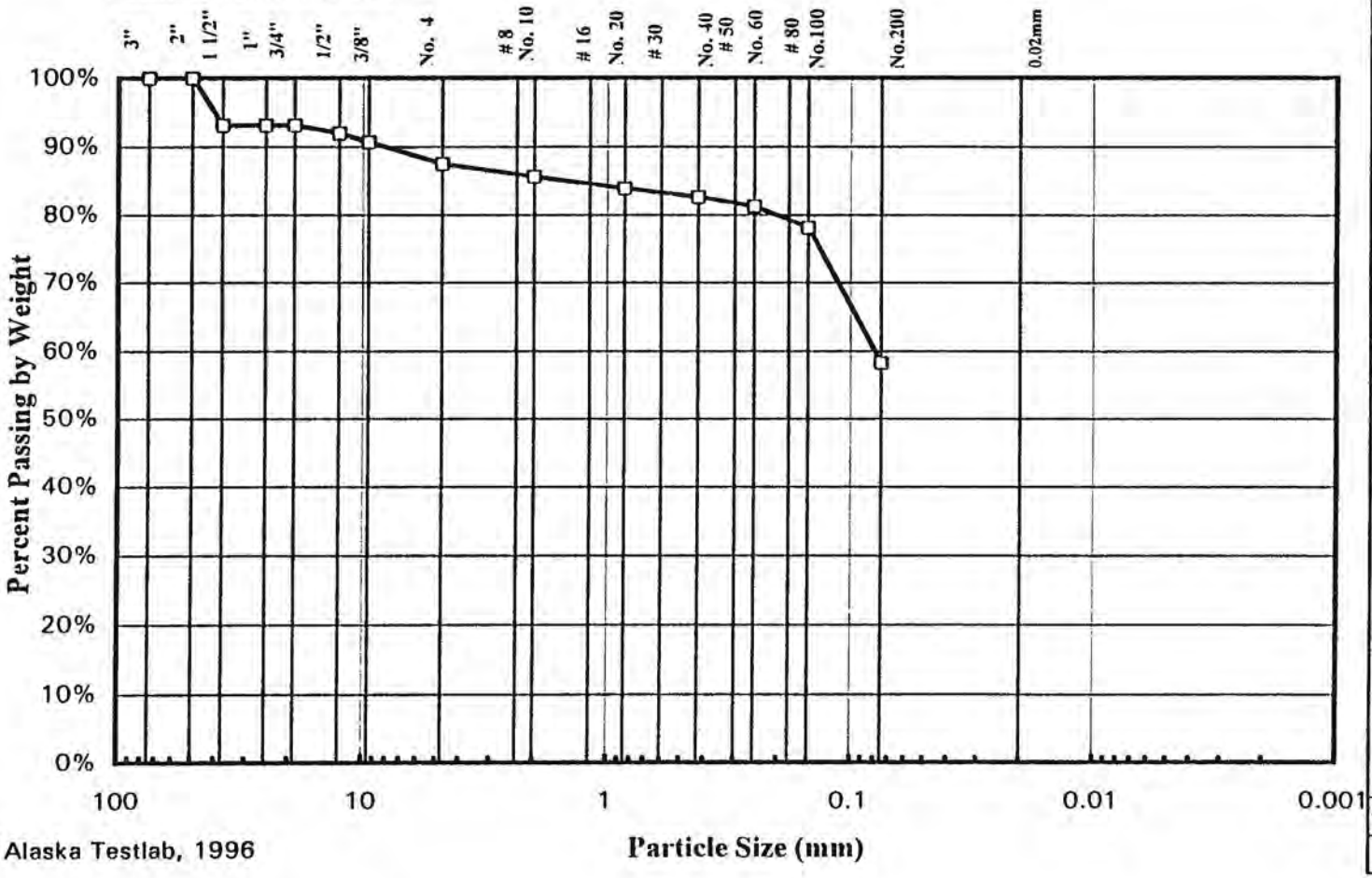
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-3, SA-3 @ 13.0'-14.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 300
Received: February 26, 1997

Engineering Classification: Sandy Silty CLAY, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
3 in Not Included in Test = ~0%		
3"		
2"	100%	
1 1/2"	93%	
1"	93%	
3/4"	93%	
1/2"	92%	
3/8"	91%	
No. 4	87%	
Total Wt. of Coarse Fraction = 1571.4g		
No. 8		
No. 10	86%	
No. 16		
No. 20	84%	
No. 30		
No. 40	83%	
No. 50		
No. 60	81%	
No. 80		
No.100	78%	
No.200	58%	
Total Wt. of Fine Fraction = 335.7g		
0.02 mm		

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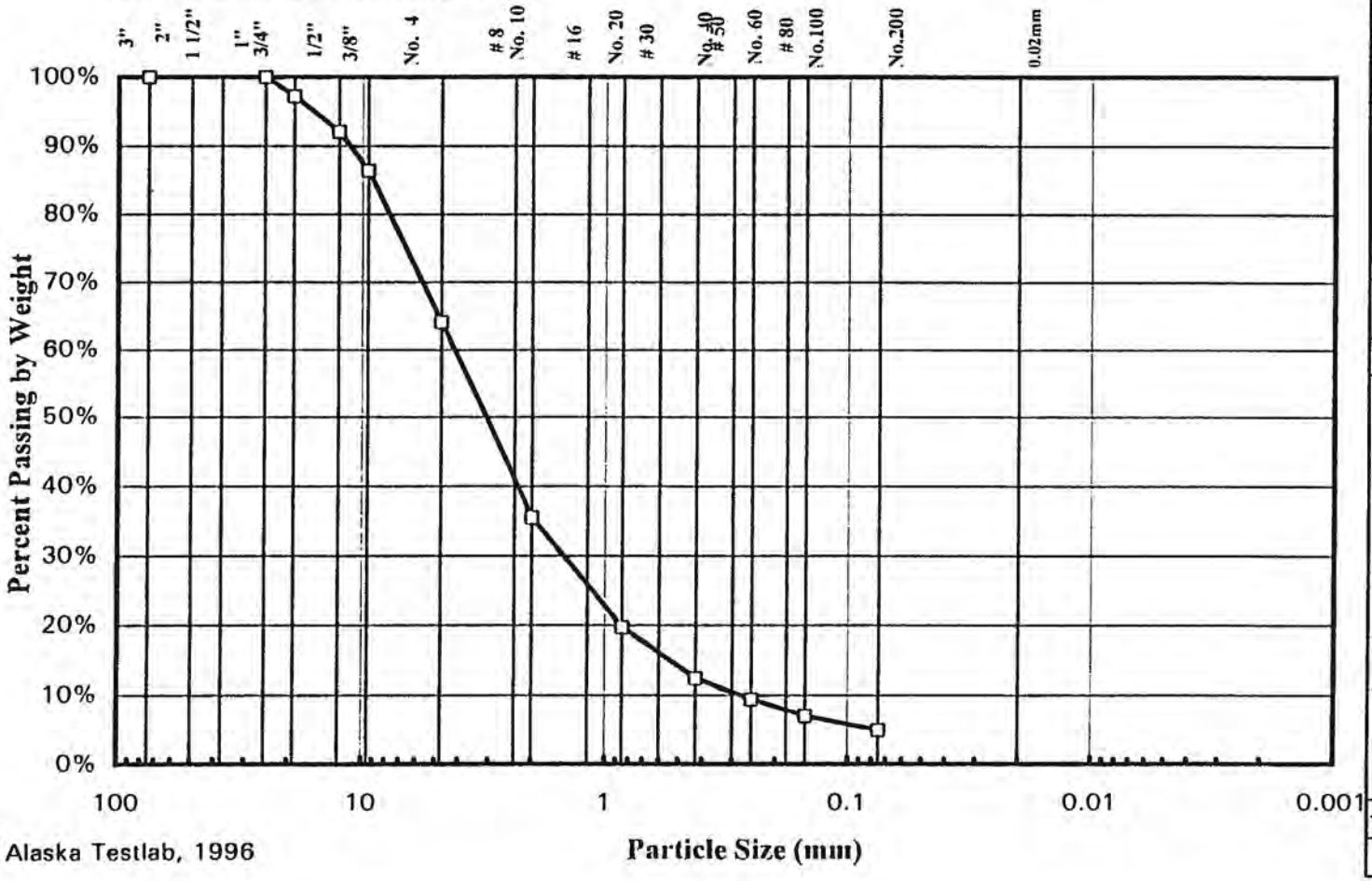
Client: Peratrovich Nottingham & Drage
Project: Petersburg Harbor GEO No. 96256.02
Location: TH-3, SA-6 @ 37.0'-38.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 301
Received: February 26, 1997

Engineering Classification: Well Graded SAND with Gravel, SW
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	97%	
1/2"	92%	
3/8"	86%	
No. 4	64%	
Total Wt. of Coarse Fraction = 1280.8g		
No. 8		
No. 10	35%	
No. 16		
No. 20	20%	
No. 30		
No. 40	12%	
No. 50		
No. 60	9%	
No. 80		
No.100	7%	
No.200	4.9%	
Total Wt. of Fine Fraction = 340.9g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

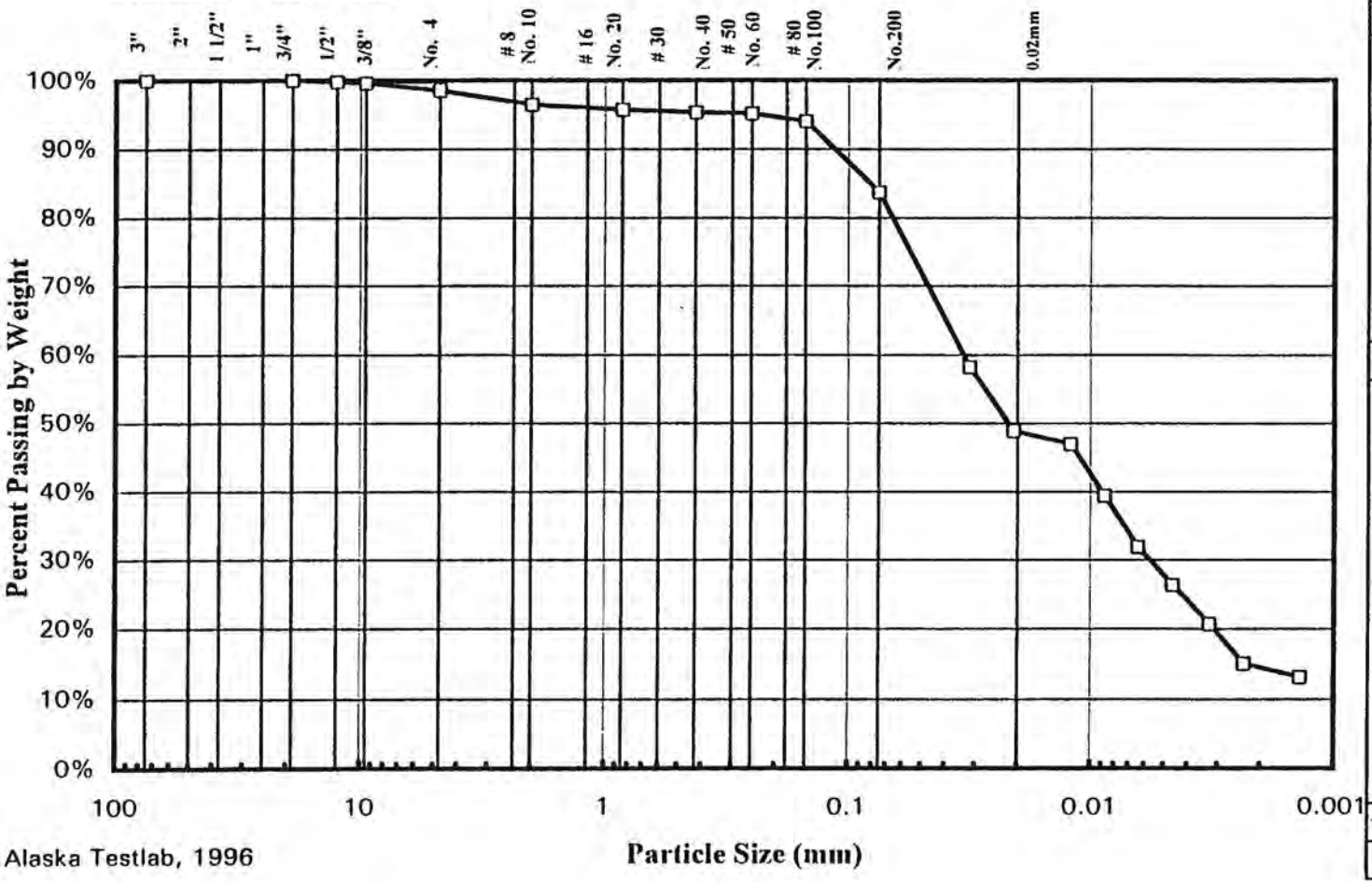
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-4, SA-1 @ 4.0'-5.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 302
Received: February 26, 1997

Engineering Classification: SILT with Sand, ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = -0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	100%	
3/8"	100%	
No. 4	99%	
Total Wt. of Coarse Fraction = 1089.3g		
No. 8		
No. 10	96%	
No. 16		
No. 20	96%	
No. 30		
No. 40	95%	
No. 50		
No. 60	95%	
No. 80		
No.100	94%	
No.200	84%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	48.7%	

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Client: Peratrovich Nottingham & Drage

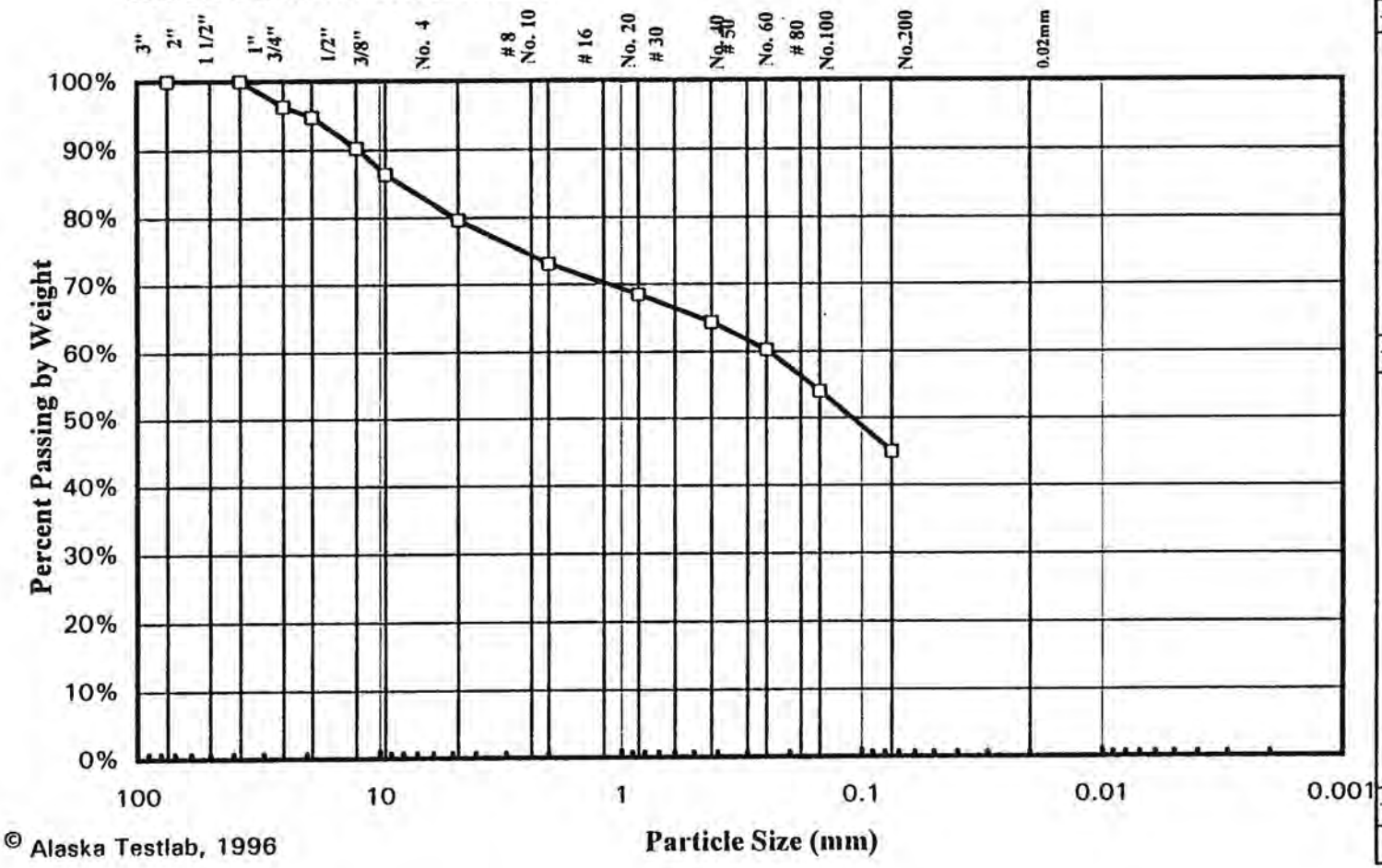
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-4, SA-3 @ 15.5'-16.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 303
Received: February 26, 1997

Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"	100%	
1"	96%	
3/4"	95%	
1/2"	90%	
3/8"	86%	
No. 4	80%	
Total Wt. of Coarse Fraction = 1313g		
No. 8		
No. 10	73%	
No. 16		
No. 20	68%	
No. 30		
No. 40	64%	
No. 50		
No. 60	60%	
No. 80		
No.100	54%	
No.200	45%	
Total Wt. of Fine Fraction = 348.1g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

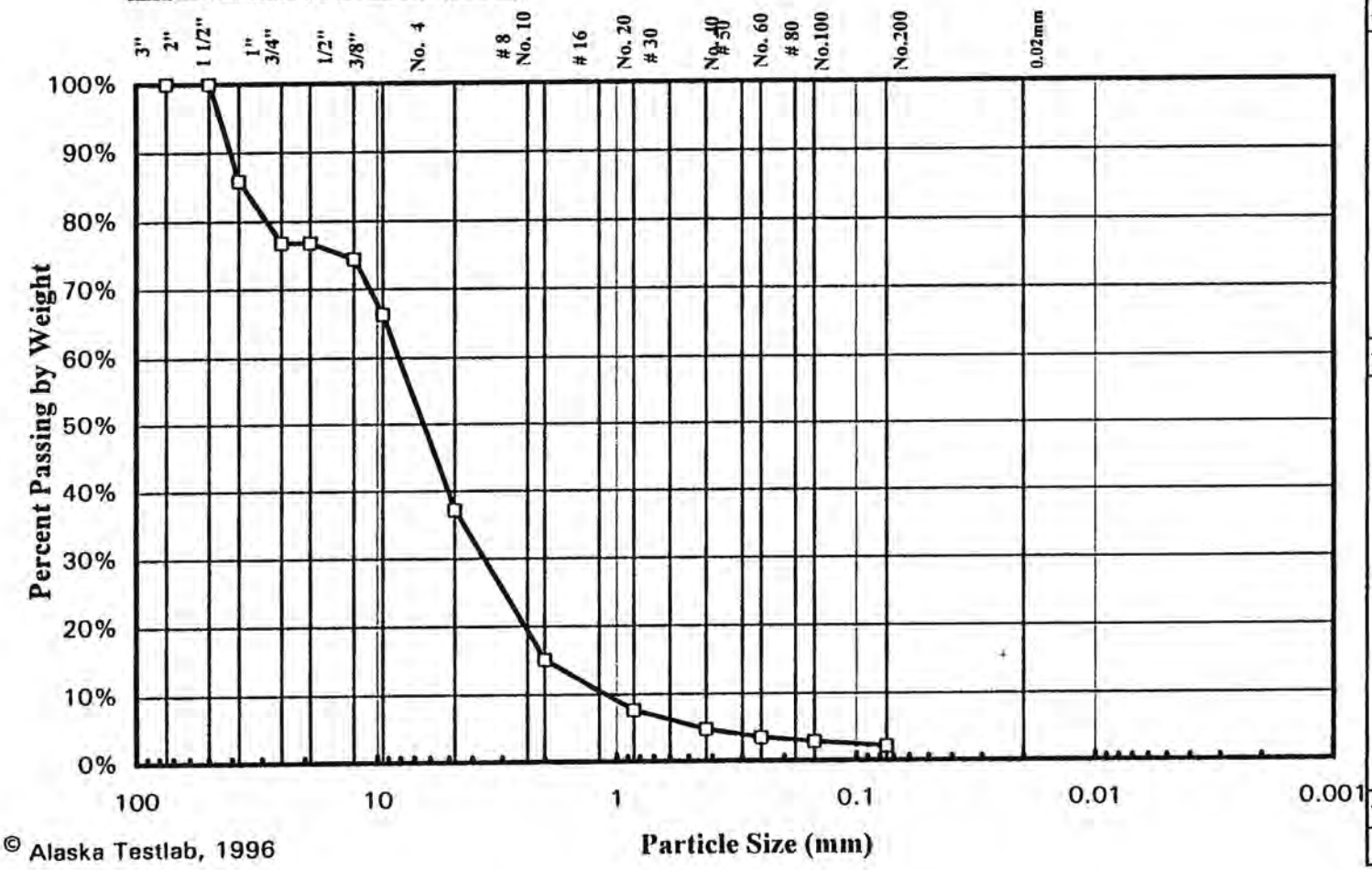
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-4, SA-9 @ 46.0'-47.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 304
Received: February 26, 1997

Engineering Classification: Well Graded GRAVEL with Sand, GW
Frost Classification: NFS (MOA)



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"	100%	
1 1/2"	86%	
1"	77%	
3/4"	77%	
1/2"	74%	
3/8"	66%	
No. 4	37%	
Total Wt. of Coarse Fraction = 774.6g		
No. 8		
No. 10	15%	
No. 16		
No. 20	8%	
No. 30		
No. 40	5%	
No. 50		
No. 60	3%	
No. 80		
No.100	3%	
No.200	2.1%	
Total Wt. of Fine Fraction = 288g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

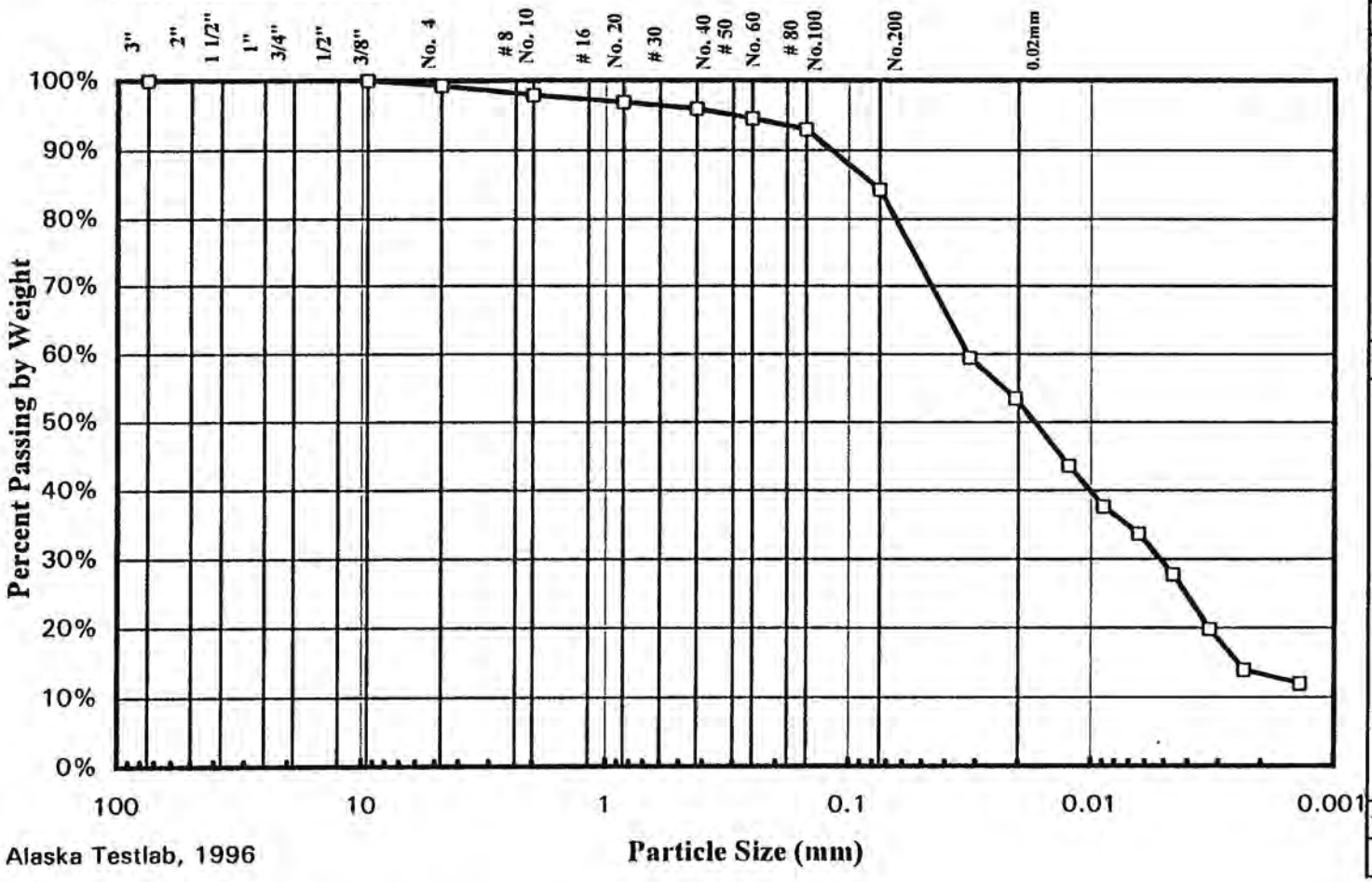
Project: Petersburg Harbor GEO No. 96256.02

Location: TII-5, SA-1B @ 0.5'-1.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 305
Received: February 26, 1997

Engineering Classification: Silty CLAY w/ Sand, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"		
3/8"	100%	
No. 4	99%	
Total Wt. of Coarse Fraction = 757.3g		
No. 8		
No. 10	98%	
No. 16		
No. 20	97%	
No. 30		
No. 40	96%	
No. 50		
No. 60	95%	
No. 80		
No.100	93%	
No.200	84%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	52.9%	

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Client: Peratrovich Nottingham & Drage

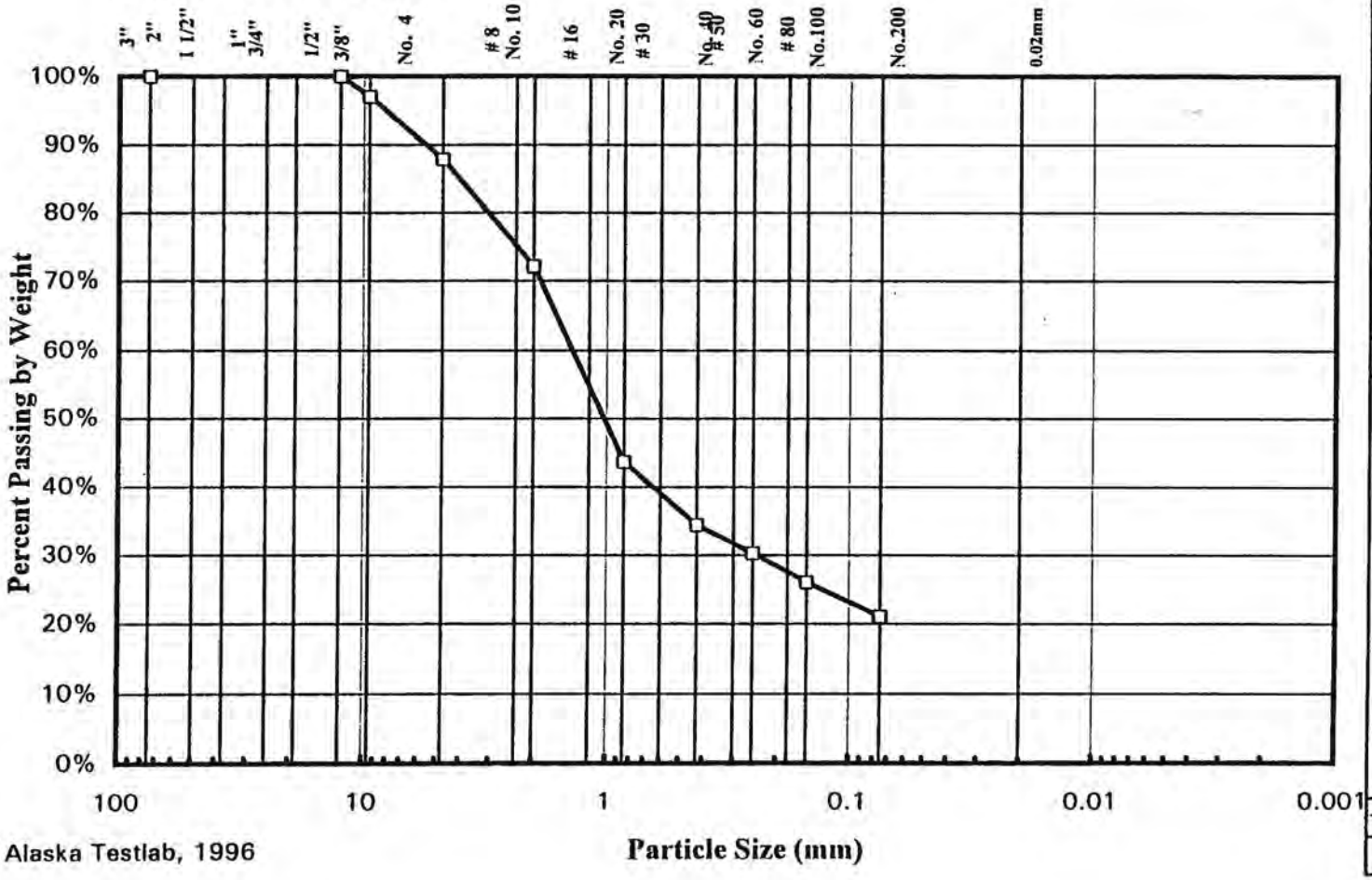
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-5, SA-6 @ 33.5'-34.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 307
Received: February 26, 1997

Engineering Classification: Silty SAND , SM
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"	100%	
3/8"	97%	
No. 4	88%	
Total Wt. of Coarse Fraction = 992.1g		
No. 8		
No. 10	72%	
No. 16		
No. 20	44%	
No. 30		
No. 40	34%	
No. 50		
No. 60	30%	
No. 80		
No.100	26%	
No.200	21%	
Total Wt. of Fine Fraction = 368.3g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

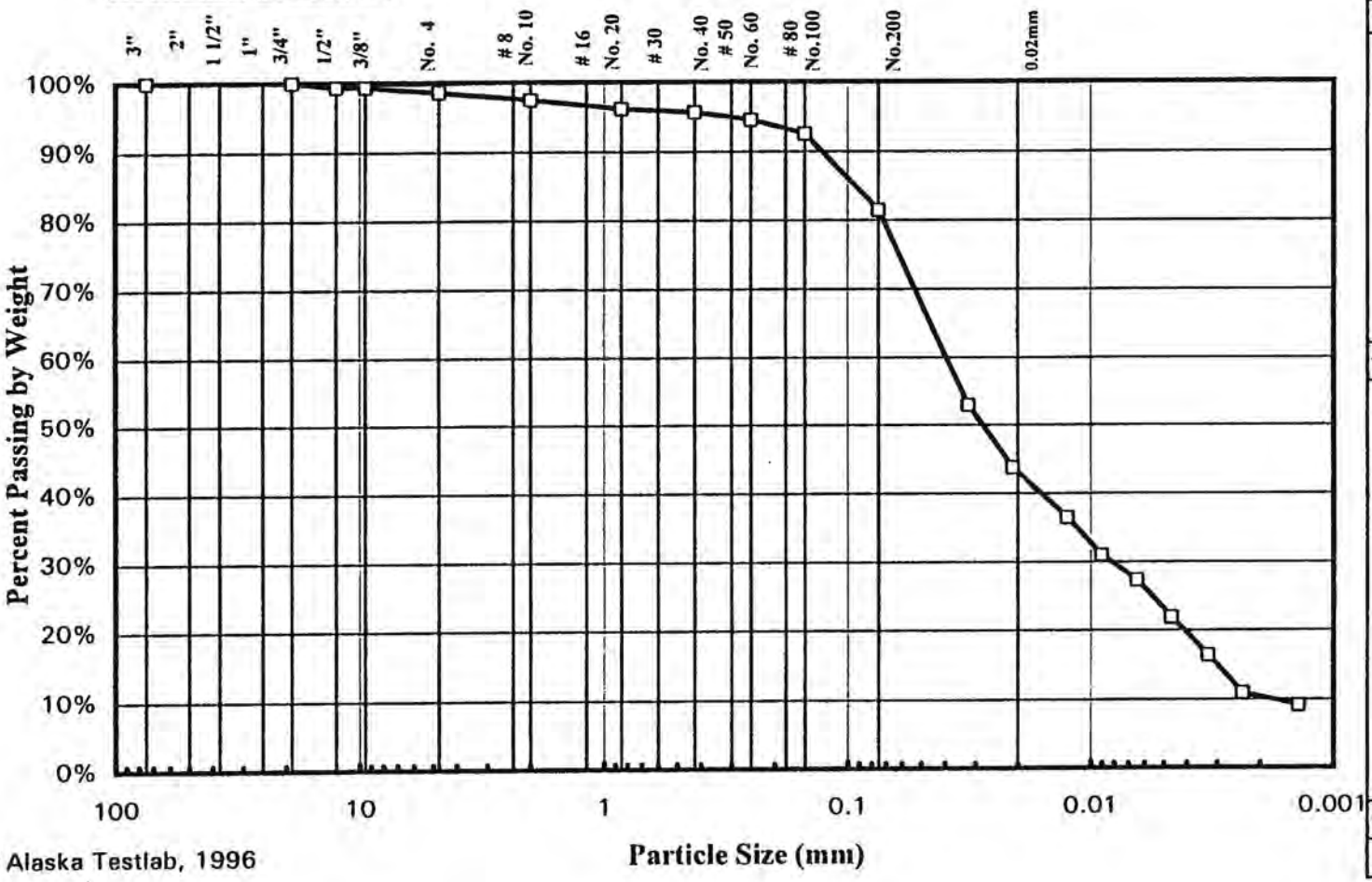
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-6, SA-1 @ 4.0'-5.0'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 308
Received: February 26, 1997

Engineering Classification: SILT with Sand, ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	99%	
No. 4	99%	
Total Wt. of Coarse Fraction = 1246.4g		
No. 8		
No. 10	97%	
No. 16		
No. 20	96%	
No. 30		
No. 40	96%	
No. 50		
No. 60	95%	
No. 80		
No.100	93%	
No.200	81%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	43.0%	

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Client: Peratrovich Nottingham & Drage

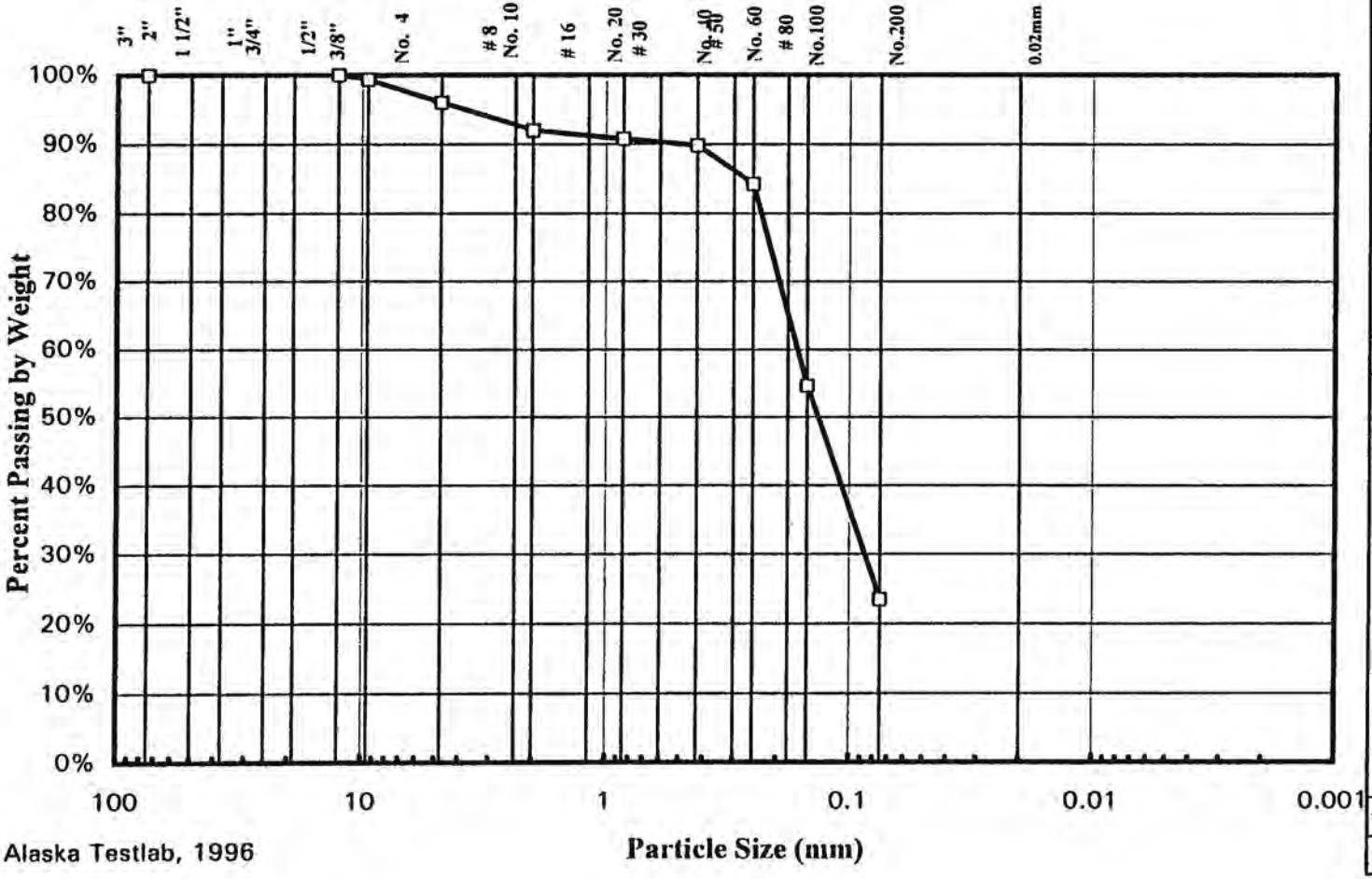
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-6, SA-4 @ 21.5'-22.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 309
Received: February 26, 1997

Engineering Classification: Silty SAND , SM
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"		
1/2"	100%	
3/8"	99%	
No. 4	96%	
Total Wt. of Coarse Fraction = 645.4g		
No. 8		
No. 10	92%	
No. 16		
No. 20	91%	
No. 30		
No. 40	90%	
No. 50		
No. 60	84%	
No. 80		
No.100	55%	
No.200	23%	
Total Wt. of Fine Fraction = 357g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

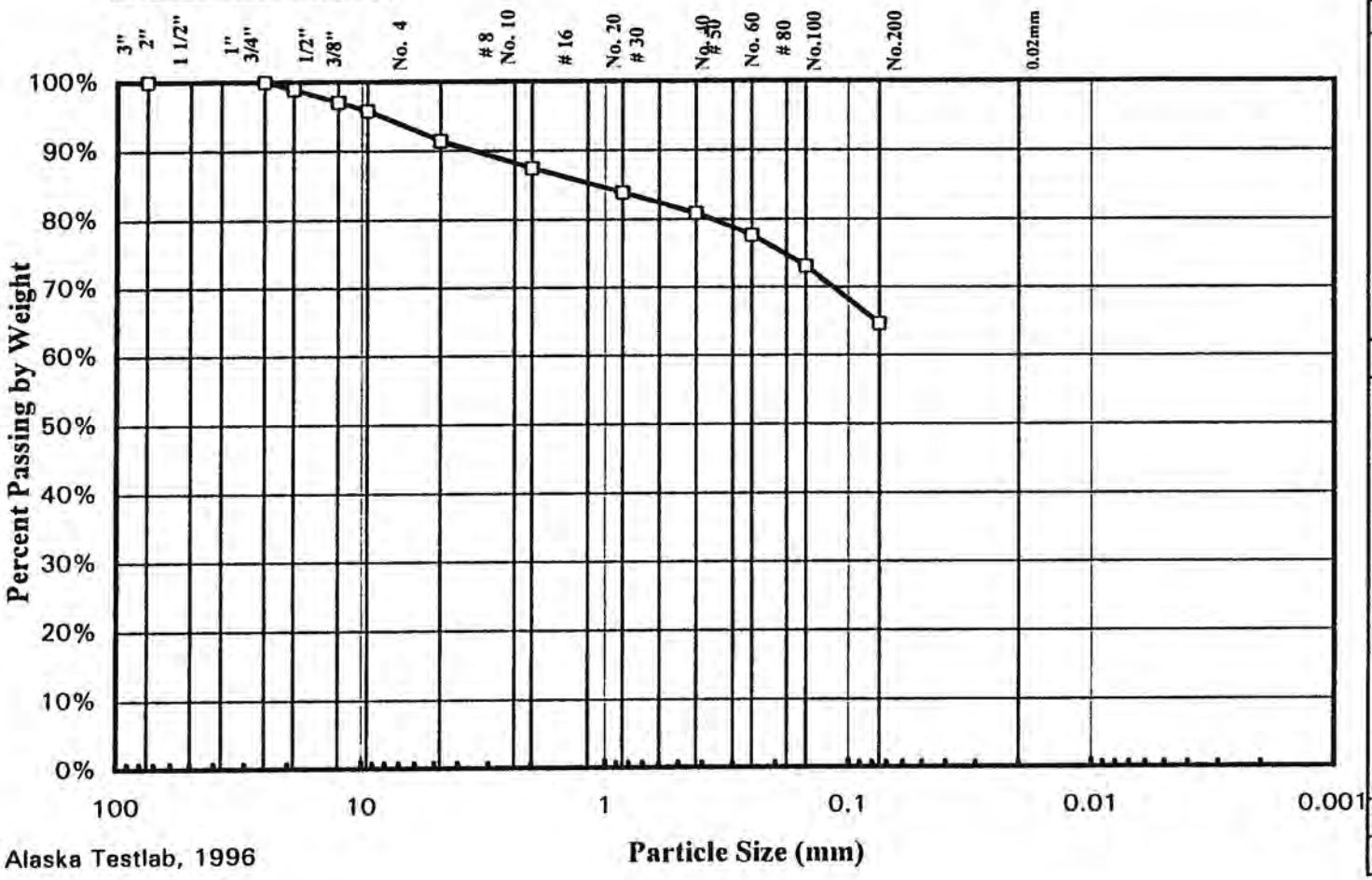
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-6, SA-6 @32.5'-33.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 310
Received: February 26, 1997

Engineering Classification: Sandy silty CLAY, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	99%	
1/2"	97%	
3/8"	96%	
No. 4	91%	
Total Wt. of Coarse Fraction = 1241.9g		
No. 8		
No. 10	87%	
No. 16		
No. 20	84%	
No. 30		
No. 40	81%	
No. 50		
No. 60	78%	
No. 80		
No.100	73%	
No.200	65%	
Total Wt. of Fine Fraction = 353.8g		
0.02 mm		

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ALASKA TESTLAB
A Division of DOWL, Incorporated
4040 B Street Anchorage, Alaska 99503
(907) 562-2000 FAX (907) 563-3953

Client: Peratrovich Nottingham & Drage

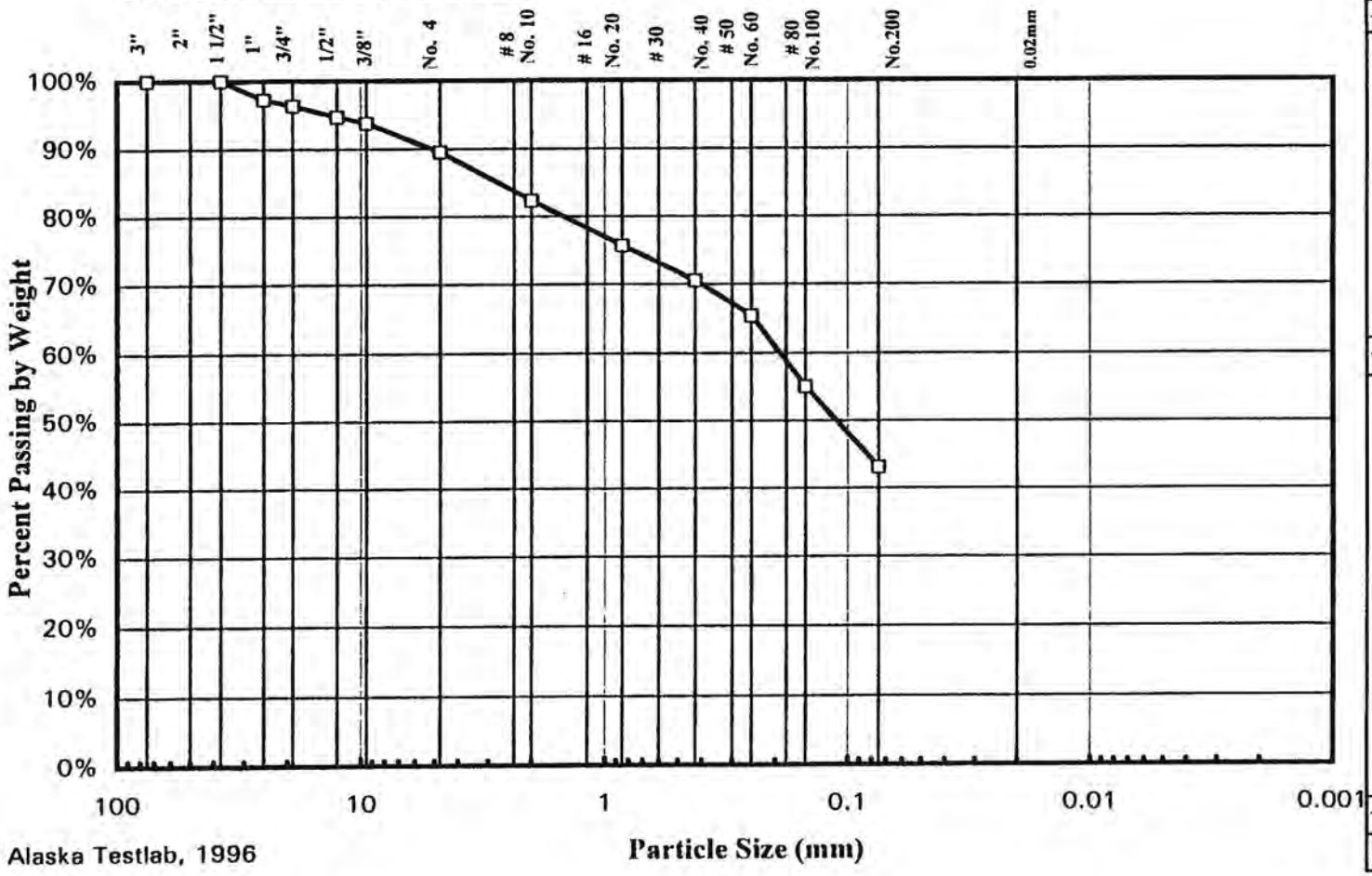
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-6, SA-7 @ 43.5'-46.0'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 311
Received: February 26, 1997

Engineering Classification: Silty SAND , SM ✓
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"	100%	
1"	97%	
3/4"	96%	
1/2"	95%	
3/8"	94%	
No. 4	89%	
Total Wt. of Coarse Fraction = 2692.9g		
No. 8		
No. 10	82%	
No. 16		
No. 20	76%	
No. 30		
No. 40	70%	
No. 50		
No. 60	65%	
No. 80		
No.100	55%	
No.200	43%	
Total Wt. of Fine Fraction = 340.7g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

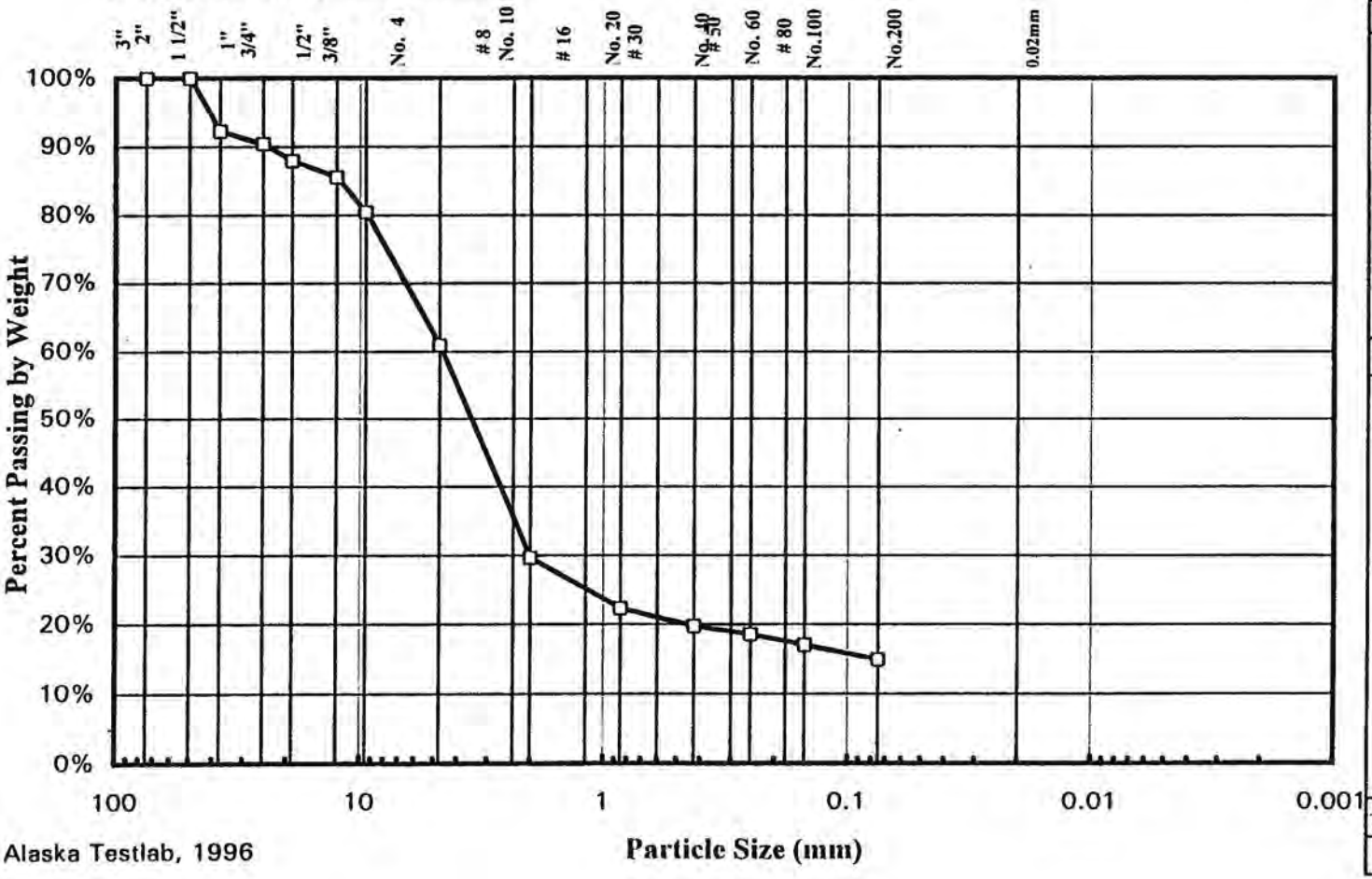
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-7, SA-4 @ 23.0'-24.0'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 312
Received: February 26, 1997

Engineering Classification: Silty SAND with Gravel, SM
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"	100%	
1 1/2"	92%	
1"	90%	
3/4"	88%	
1/2"	86%	
3/8"	80%	
No. 4	61%	
Total Wt. of Coarse Fraction = 1799.2g		
No. 8		
No. 10	30%	
No. 16		
No. 20	22%	
No. 30		
No. 40	20%	
No. 50		
No. 60	19%	
No. 80		
No.100	17%	
No.200	15%	
Total Wt. of Fine Fraction = 308.7g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

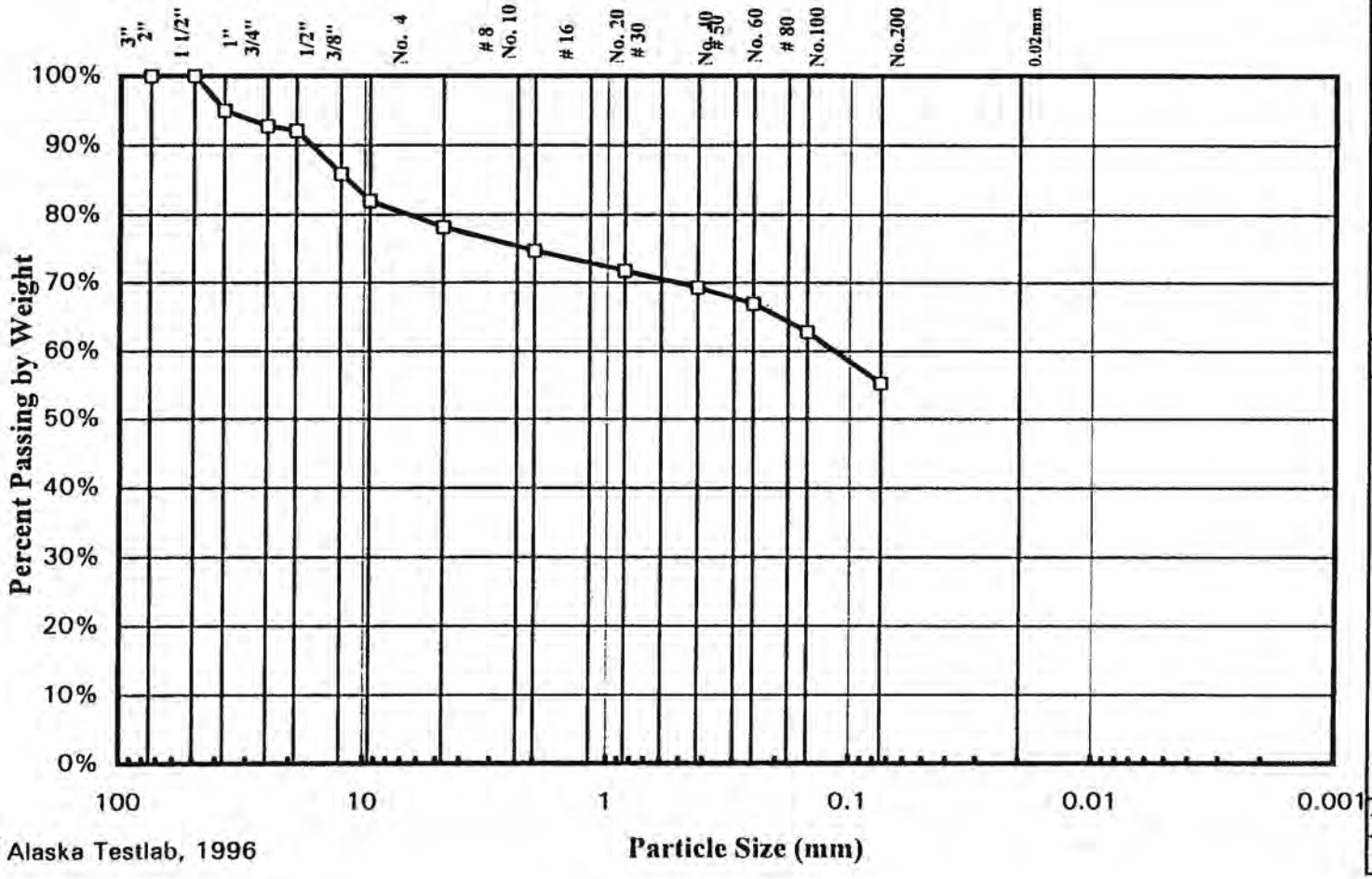
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-7, SA-6 @ 35.5'-36.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 313
Received: February 26, 1997

Engineering Classification: Sandy SILT with Gravel, ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"	100%	
1 1/2"	95%	
1"	93%	
3/4"	92%	
1/2"	86%	
3/8"	82%	
No. 4	78%	
Total Wt. of Coarse Fraction = 1689.1g		
No. 8		
No. 10	75%	
No. 16		
No. 20	72%	
No. 30		
No. 40	69%	
No. 50		
No. 60	67%	
No. 80		
No.100	63%	
No.200	55%	
Total Wt. of Fine Fraction = 320.1g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

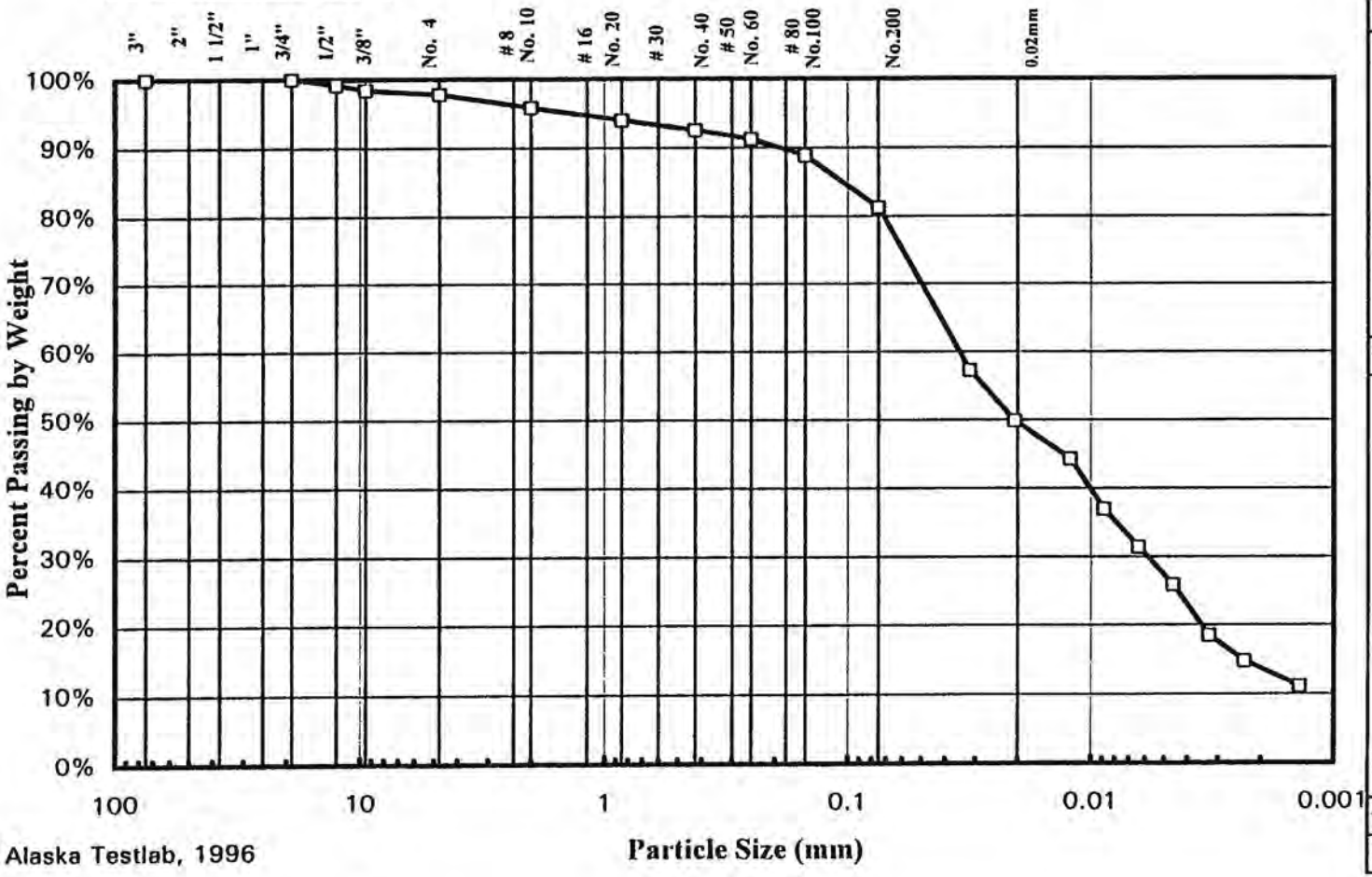
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-8, SA-1 @ 0.5'-1.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 314
Received: February 26, 1997

Engineering Classification: Silty CLAY w/ Sand, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	98%	
No. 4	98%	
Total Wt. of Coarse Fraction = 1246.2g		
No. 8		
No. 10	96%	
No. 16		
No. 20	94%	
No. 30		
No. 40	93%	
No. 50		
No. 60	91%	
No. 80		
No.100	89%	
No.200	81%	
Total Wt. of Fine Fraction = 0g		
0.02 mm	49.5%	

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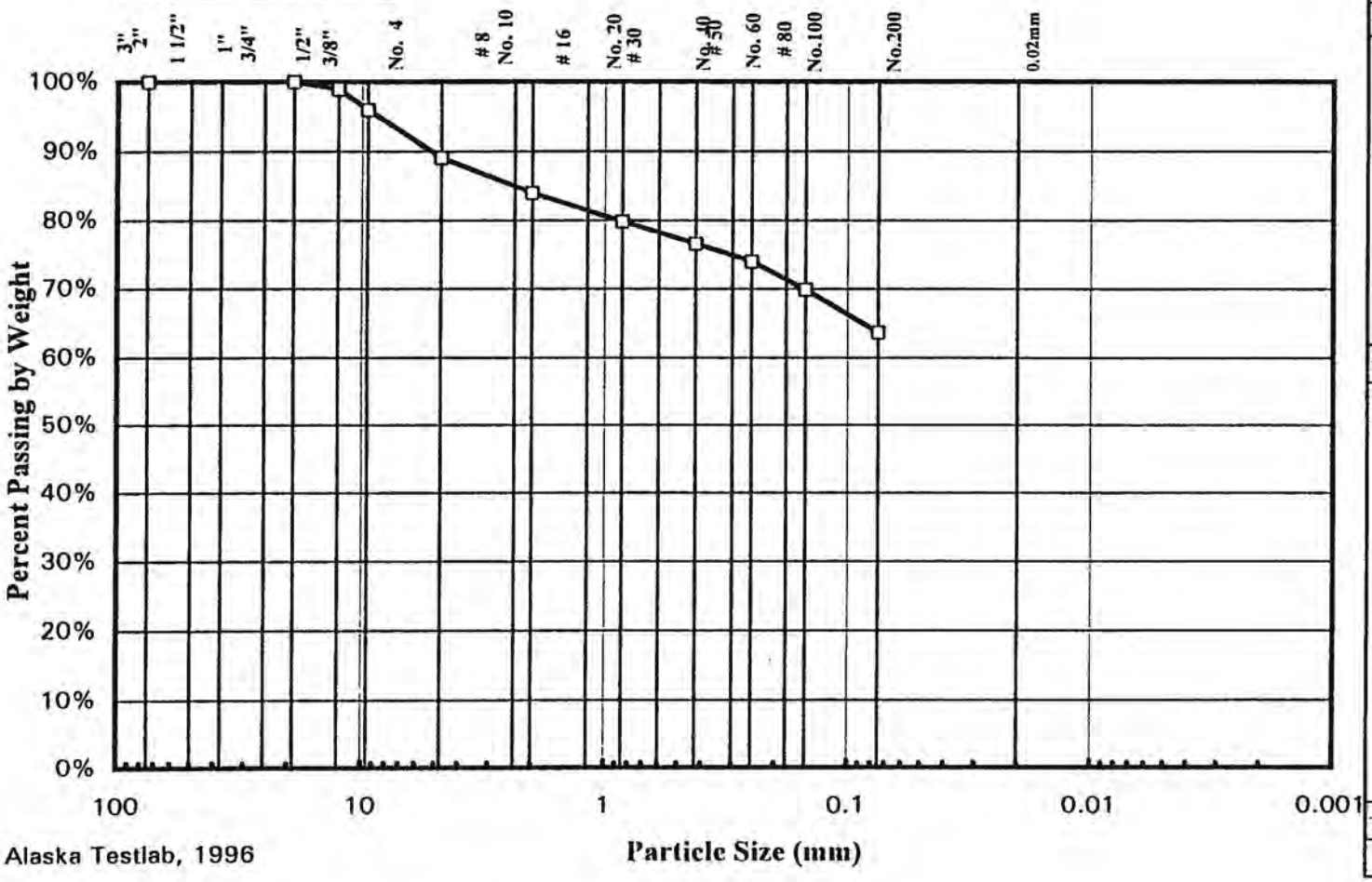
Client: Peratrovich Nottingham & Drage
Project: Petersburg Harbor GEO No. 96256.02
Location: TH-8, SA-5 @ 26.0-'-26.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 315
Received: February 26, 1997

Engineering Classification: Sandy Silty CLAY, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	99%	
3/8"	96%	
No. 4	89%	
Total Wt. of Coarse Fraction = 517.7g		
No. 8		
No. 10	84%	
No. 16		
No. 20	80%	
No. 30		
No. 40	77%	
No. 50		
No. 60	74%	
No. 80		
No.100	70%	
No.200	64%	
Total Wt. of Fine Fraction = 348.5g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

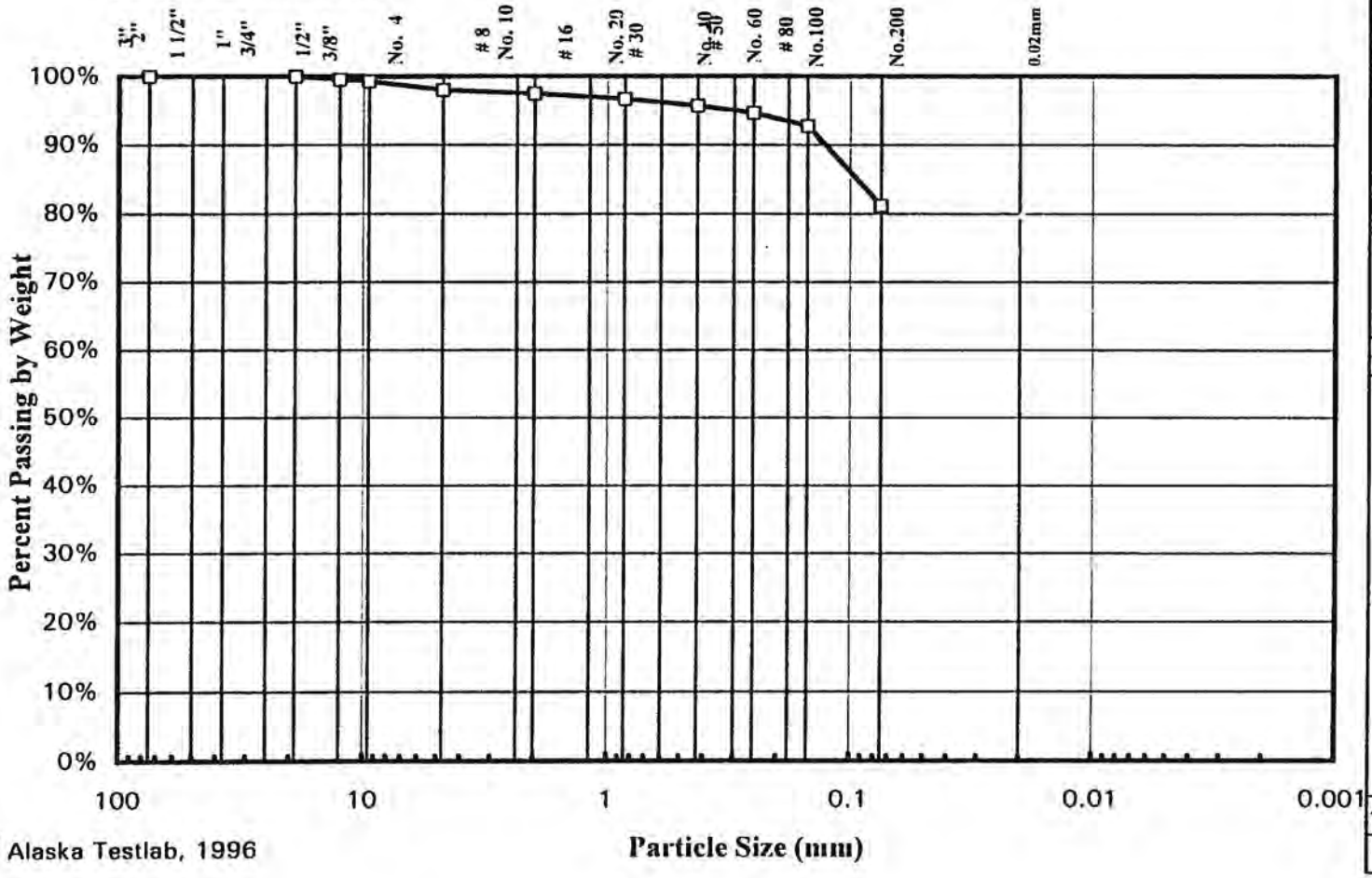
Project: Petersburg Harbor GEO No 96256.02

Location: TH-9, SA-4 @ 19.0'-20.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 316
Received: February 26, 1997

Engineering Classification: Silty CLAY w/ Sand, CL-ML
Frost Classification: F4



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"		
3/4"	100%	
1/2"	100%	
3/8"	99%	
No. 4	98%	
Total Wt. of Coarse Fraction = 902.1g		
No. 8		
No. 10	97%	
No. 16		
No. 20	97%	
No. 30		
No. 40	96%	
No. 50		
No. 60	95%	
No. 80		
No.100	93%	
No.200	81%	
Total Wt. of Fine Fraction = 350.2g		
0.02 mm		

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Client: Peratrovich Nottingham & Drage

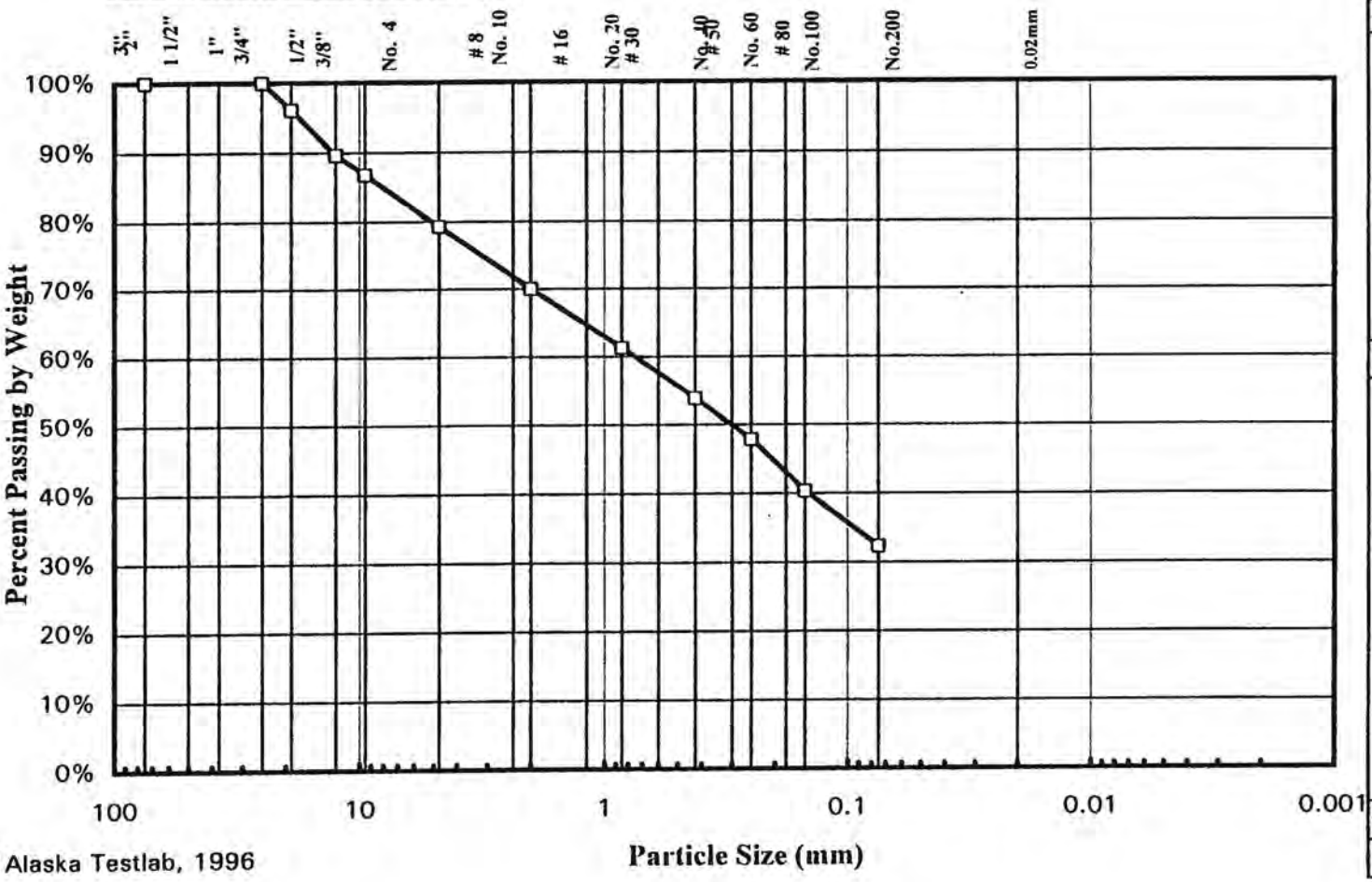
Project: Petersburg Harbor GEO No. 96256.02

Location: TH-9, SA-7 @ 34.0-35.5'
Submitted by Client

PARTICLE-SIZE DISTRIBUTION

W.O. A27160
Lab No. 317
Received: February 26, 1997

Engineering Classification: Silty SAND with Gravel, SM ✓
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"		
2"		
1 1/2"		
1"	100%	
3/4"	96%	
1/2"	90%	
3/8"	87%	
No. 4	79%	
Total Wt. of Coarse Fraction = 1367.7g		
No. 8		
No. 10	70%	
No. 16		
No. 20	61%	
No. 30		
No. 40	54%	
No. 50		
No. 60	48%	
No. 80		
No.100	40%	
No.200	32%	
Total Wt. of Fine Fraction = 332.3g		
0.02 mm		

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