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GEOTECH

US Army Corps of Engineers
Alaska District
Soils and Geology Section

GEOTECHNICAL FINDINGS REPORT
DOUGLAS SMALL BOAT HARBOR
Douglas, Alaska

January 2005

GEOTECHNICAL FINDINGS REPORT
DOUGLAS SMALL BOAT HARBOR
DOUGLAS, ALASKA

JANUARY 2005

1. Introduction

The results of a geotechnical investigation performed for the planned breakwater improvements for the Small Boat Harbor at Douglas, Alaska are presented in this report.

The purpose of the investigation was to identify subsurface conditions; specifically the depth to bedrock below mud-line. This report presents a summary of the findings based on site observations and results of the field exploration and laboratory testing program.

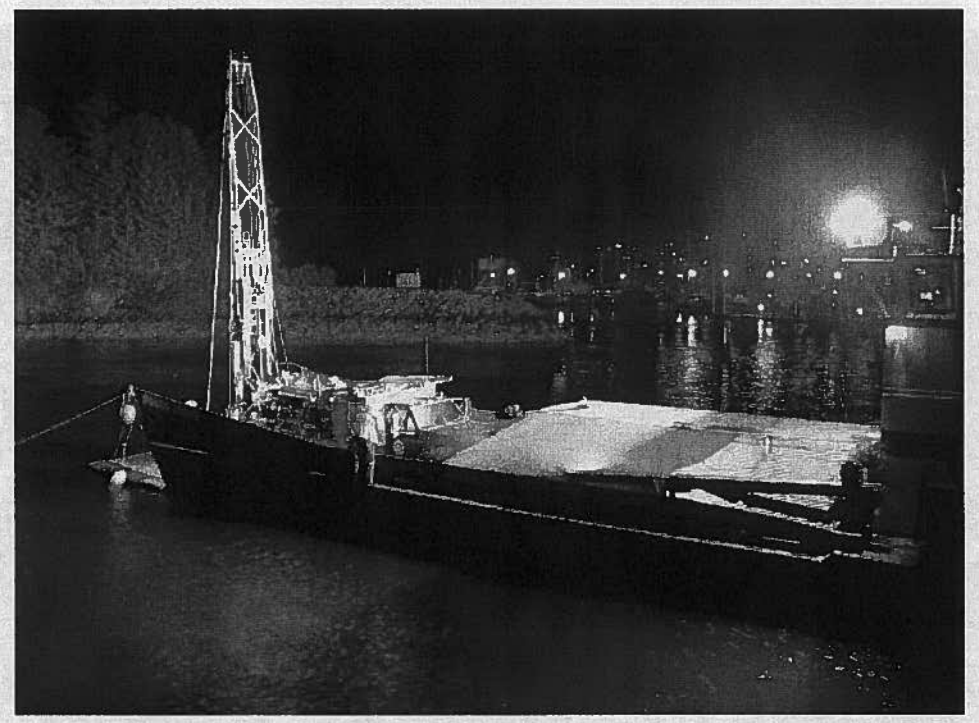

Photo 1. Drilling operation at night in the harbor.

2. Project Description and Location

This project consists of constructing a breakwater at the entrance to the Small Boat Harbor. The breakwater is to consist of two arms extending into the entrance area from opposite sides. The current design calls for driven piles supporting sheet piling extending from above water-line to below mud-line. A Project Location and Vicinity Map is enclosed as Figure 1.

3. Field Exploration

The subsurface exploration for the project was conducted from 4 through 11 October 2004. A total of eight test borings were drilled to bedrock and then cored for a distance of about 10 feet to confirm the presence of bedrock and not a large cobble or boulder. These borings have been designated AP-1 to AP-8.

Denali Drilling Inc., under contract with the U.S. Army Corps of Engineers-Alaska District (USACE-AD), drilled the test borings using a truck-mounted CME-85 and a landing craft as the offshore drilling platform. The borings were advanced using wash rotary drilling with a 4-inch steel casing. Two engineers with the USACE-AD supervised the 24-hour per day drilling operation and logged the test borings in accordance with ASTM D-2488-93, "Description and Identification of Soils (Visual - Manual Procedure)."

The test boring locations were determined at the time of drilling using standard survey techniques by DOWL Engineers, LLC under a contract with the Corps. The coordinates are Alaska State Plane, Zone 1 in feet. Elevations are measured in feet above Mean Low Lower Water (MLLW). The test boring locations are shown on the enclosed Test Boring Location Map, Figure 2.

Soil samples were procured using a 2.5-inch inside diameter split spoon sampler driven with a 340-pound auto-hammer falling 30 inches. Samples were collected at the bottom of the casing and at 5-foot intervals, thereafter. The sampler was driven 18 inches ahead of the casing or the bottom of the open hole or to refusal. The number of blows required to drive each 6-inch increment or to refusal is recorded on the exploration logs. The blow count is an indication of the relative density or consistency of the soil. When drilling action indicated the presence of possible bedrock, the drill rig was set up for rock coring.

4. Laboratory Testing and Soils Classification

A laboratory testing program was established to classify and determine physical properties of the soils encountered. The testing program consisted of a total of 21 sieve analyses, and seven Atterberg Limit tests. These tests were performed in accordance with the latest version of the following test methods:

- ASTM D 422, "Standard Test Method for Particle size Analysis of Soils".
- ASTM D 2487, "Standard Practice for Classification of Soils for Engineering Purposes (Uniform soil Classification System)".
- ASTM D 4318, "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils". Use Method A.

The soil descriptions and classifications contained in this report and presented

on the final exploration logs are the project engineer's interpretation of the field logs and results of the laboratory testing program. The stratification lines represent approximate boundaries between soil types; the transitions are often gradual or not discernible by drill action. The exploration logs are enclosed as Appendix A, grain-size distribution curves and other laboratory test results are enclosed as Appendix B.

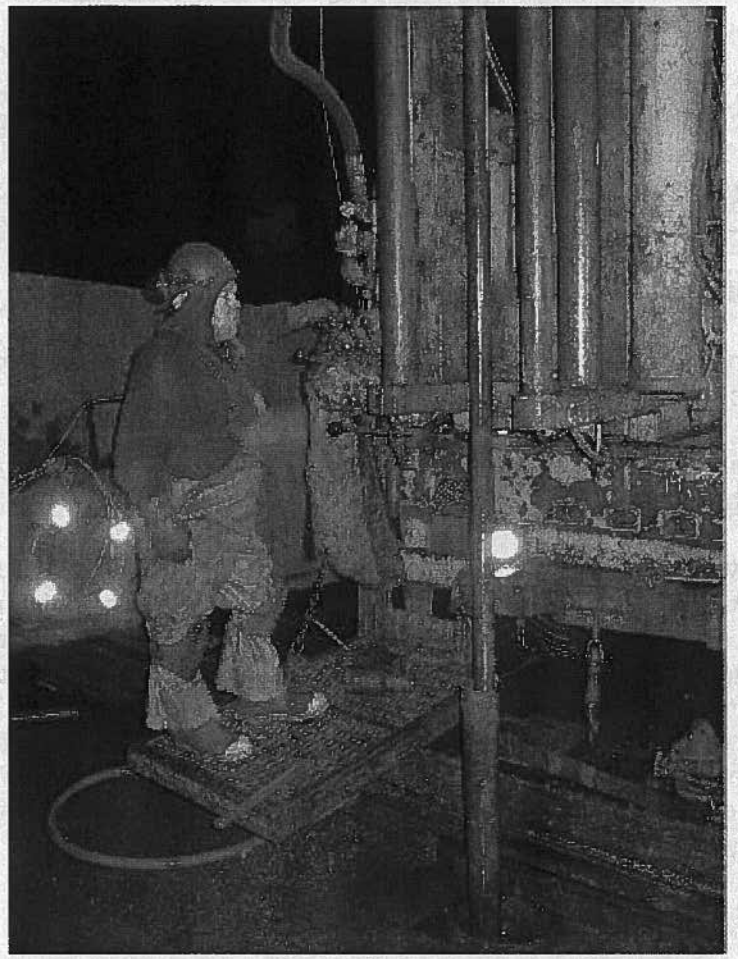

Photo 2. Drilling operation showing 4-inch casing through the moonpool.

5. Regional Geology

Physiographically, the Juneau area consists of three units-mountains, coastal benches along the fiords and bays and floors of stream and river valleys. The slopes of the mountains are generally steep; 35- to 40-degree slopes are prevalent, but even steeper slopes are common. The steep slopes merge into more gentle slopes near sea level along the fiords. The valleys have the appearance of having recently been glacially shaped and smoothed, however, the U-shape was developed as a result of lower mountain slopes being covered by valley-filling surficial deposits. These deposits fill the deep bedrock-walled

fiord containing Gastineau Channel and provide the valley with a flat floor. Glacial ice did smooth at least the upper part of the fiord walls, but seismic data indicate the mountainsides continue downward at the same slope angle to form a bedrock V-shape at depth. The original floor of the valley is shown to be as much as 600 feet below the floor of the modern channel.

Well-defined and prominent topographic benches extend south of Douglas northward to Outer Point. Two surfaces separated by bedrock ridges or knobs that project through the surficial deposits provide a stair step appearance to the lower slopes of the mountains on Douglas Island along Gastineau Channel. These benches are the refaces on bedrock followed by uplift of the land as the weight of melting glaciers decreased. The deposits below sea level in Gastineau Channel consist of recent organic deposits above dense glacial deposits overlying bedrock.

6. Site Conditions

The project site is underlain by significantly varying subsurface conditions. This variance resulted primarily from the depositional processes, weathering of the bedrock, previous land use, and dredging.

Access:

All borings for this project were drilled off-shore. Access and positioning of the landing craft was complicated by two log booms at the entrance of and within the harbor, miscellaneous piling and submerged debris, and a pile supported dock facility restricting the northwest portion of the harbor entrance. Also, an additional restriction placed on the drilling operation was to maintain unhindered access to and from the harbor during the entire drilling operation.

Subsurface:

In the harbor entrance area, the subsurface conditions have been impacted by previous dredging operations. The soils generally consist of a soft layer of black organic silt (OL) that ranges in thickness from five to ten feet over a very dense glacial till that predominately classifies as a silty sand with gravel or silty gravel with sand (SM, GM). The glacial till is very dense. So dense that the surface of the underlying weathered rock could be identified when drilling became easier. The glacial till contains cobbles and boulders. The rock consists of shale (or slate) with quartz veins. The formation dips at a steep angle of 70 to 80 degrees. The weathered surface of the bedrock can be drilled with a tri-cone bit and varies in thickness. Along the proposed breakwater alignments, the elevation of the weathered bedrock rock surface varies from –50 to –73 feet MLLW.

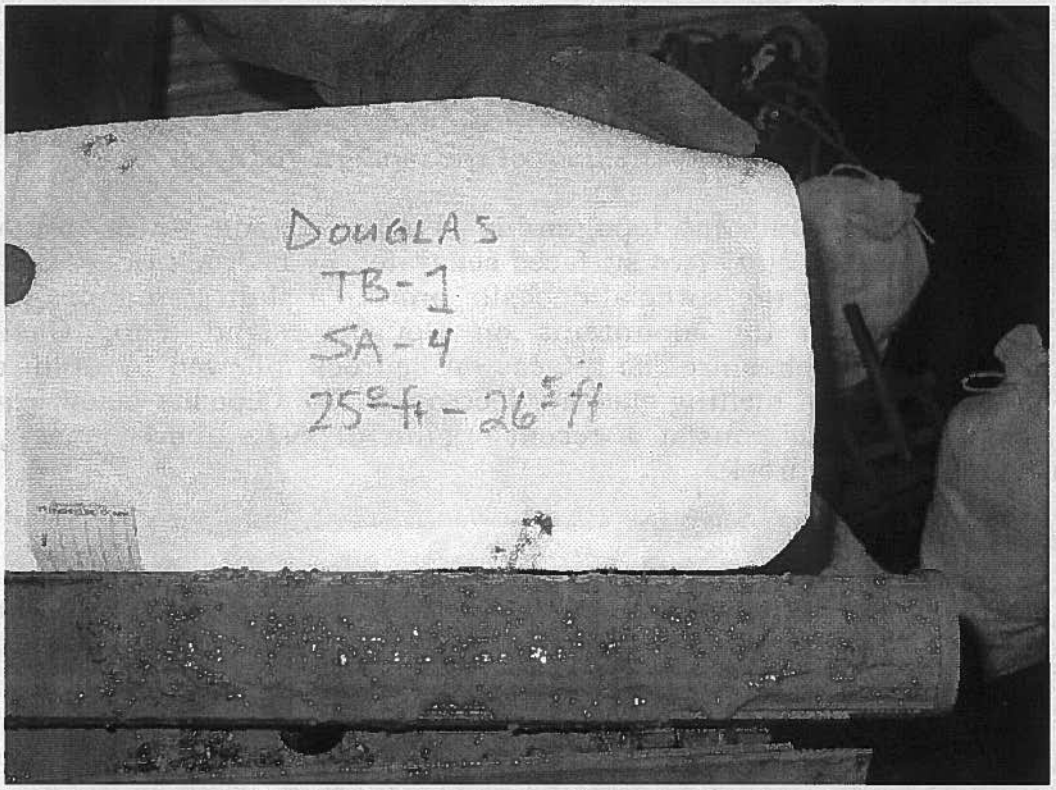

Photo 3. Sample of the glacial till underlying the harbor entrance.

Photo 4. Core in the bottom of this photo is taken from within the till and the core in the top of the photo is from the weathered rock.

Photo 5. Rock core showing the steep angle of dip.

Enclosures:

1. Figure 1 - Project Location and Vicinity Map
2. Figure 2 - Test Boring Location Map
3. Appendix A - Exploration Logs
4. Appendix B - Laboratory Results for Selected Soil Samples

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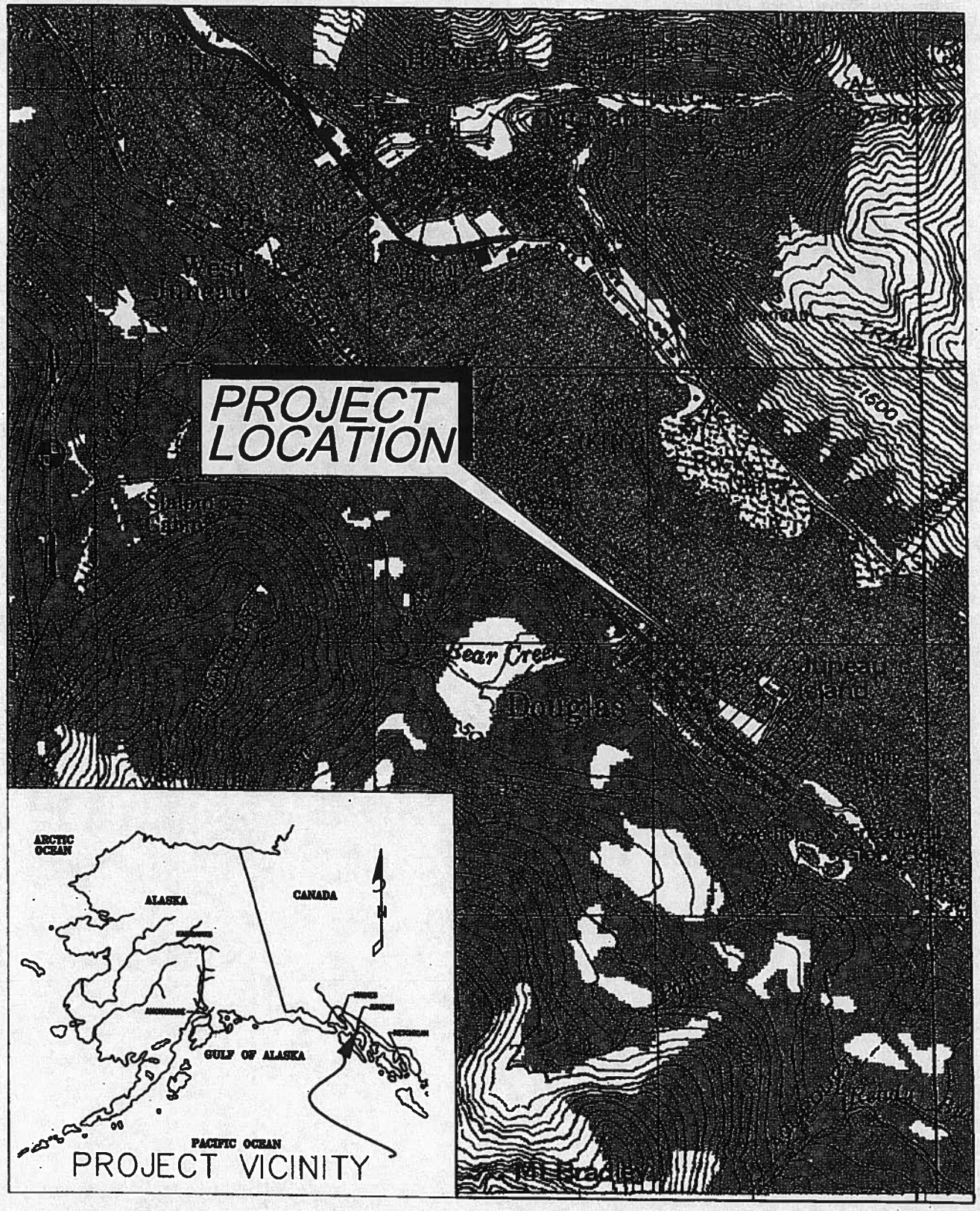
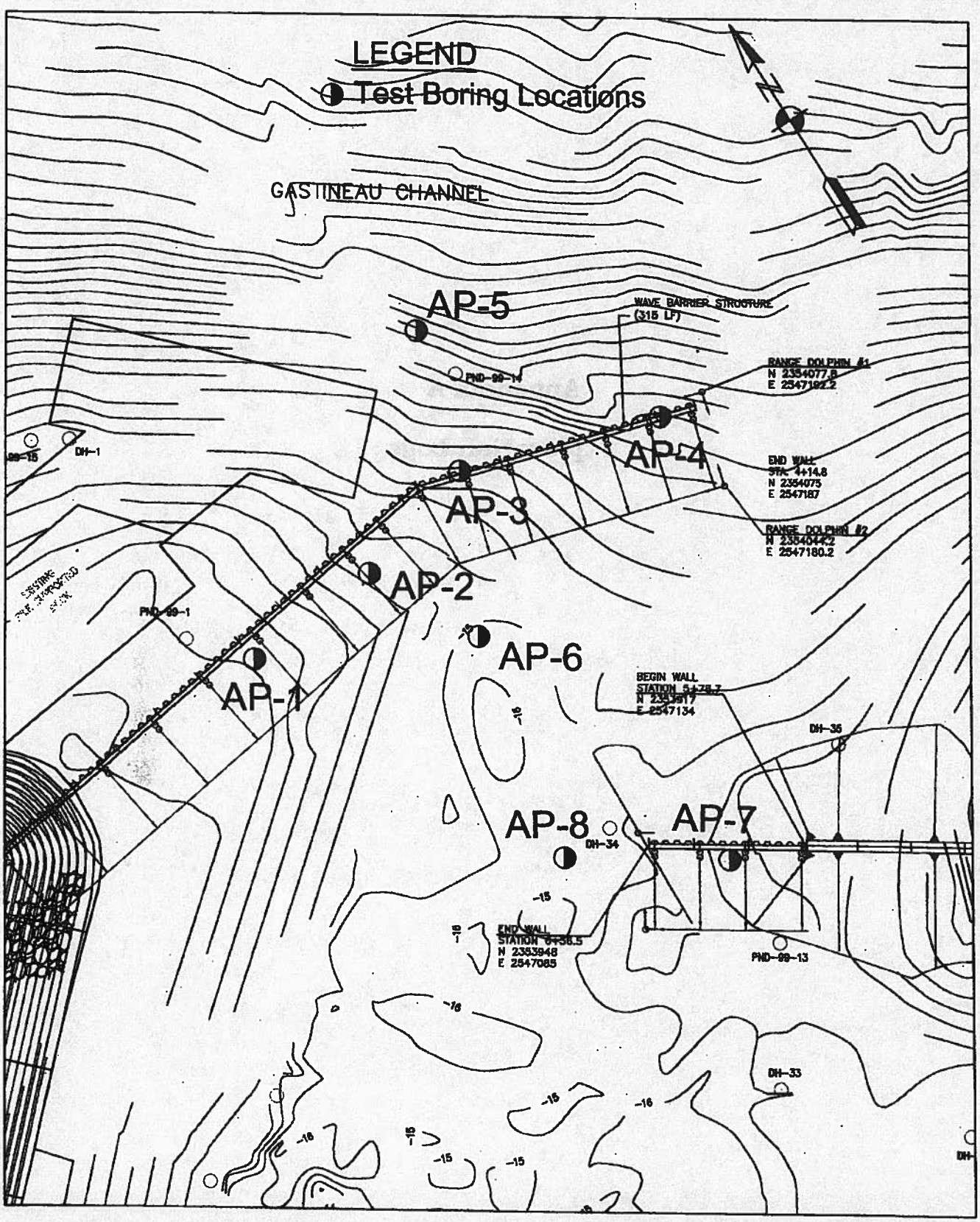


ALASKA DISTRICT
CORPS OF ENGINEERS
SOILS AND GEOLOGY

PROJECT LOCATION AND VICINITY MAP
DOUGLAS SMALL BOAT HARBOR
DOUGLAS, ALASKA

SCALE: NTS
DATE: JANUARY 2005
DRAWN/RVW: EMA/CRW
FIGURE 1



ALASKA DISTRICT
CORPS OF ENGINEERS
SOILS AND GEOLOGY SECTION

TEST BORING LOCATION MAP
DOUGLAS SMALL BOAT HARBOR
DOUGLAS, ALASKA

SCALE: 1 inch = 50 ft
DATE: JANUARY 2005
DRAWN/RVW: EMA/CRW
Figure 2

Appendix A

Exploration Logs

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 10 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,090 ft. Easting: 2,546,999 ft.

Top of Hole Elevation: -5.4 ft.

Hole Number, Field:	Permanent:	Operator:	Inspector:
TB1	AP-1	Mike Stockton/ Lyle Cain	Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater:	Depth Drilled:	Total Depth:
NA	75.3 ft.	75.3 ft.

Hammer Weight:	Split Spoon I.D.:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	2.5 in.	4 in. Tri-cone/Diamond	CME-85 w/ autohammer	Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
0														
2														
4														
6														
8														
10														
12		1			1 1 1	ML	SILT	0	3	97	0.25			Black and gray, wet, fine sand, LL=27, PI=1, organic odor
14														
16		2			6 6 8	SM	Silty SAND with Gravel	21	46	33	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
18														
20														
22		3			3 7 10	SM	Silty SAND with Gravel	25	42	33	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
24														
26		4			10 13 15	SM	Silty SAND with Gravel				2			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
28														
30		5			11 22 31	SM	Silty SAND with Gravel	15	42	43	0.75			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
32														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 10 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,090 ft. Easting: 2,546,999 ft.

Top of Hole Elevation: -5.4 ft.

Hole Number, Field: TB1

Permanent: AP-1

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 75.3 ft.

Total Depth: 75.3 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 In. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
36		6			50	GM	Silty GRAVEL with Sand				2.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
38														
40		7			50	GM	Silty GRAVEL with Sand and Cobbles	37	36	27	>3			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
42														
44														
46		8			50/4in	GM	Silty GRAVEL with Sand and Cobbles				>3			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
48														
50		9			50/3in	GM	Silty GRAVEL with Sand and Cobbles				>3			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
52														
54														
56		10			50/2in	GM	Silty GRAVEL with Sand				2			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
58														
60		11			50/4in	Bx	Weathered Rock							Dark gray shale with quartz veins, weathered, dipping at about 70 degrees
62														
64														
66		Run1				Bx	Weathered Rock							Run 1: cored 60 inches, recovered 0 inches

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 10 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,090 ft. Easting: 2,546,999 ft.

Top of Hole Elevation: -5.4 ft.

Hole Number, Field: TB1 Permanent: AP-1

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 75.3 ft.

Total Depth: 75.3 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	Grain Size %Sand	Grain Size %Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
68		Run1												
70														
72		Run2				Bx	BEDROCK							Run 2: cored 30 inches, recovered 12 inches Dark gray shale with quartz veins, dipping at about 70 degrees
74		Run3				Bx	BEDROCK							Run 3: cored 10 inches, recovered 10 inches Dark gray shale with quartz veins, dipping at about 70 degrees
76														Bottom of Hole 75.3 ft.
78														Groundwater Measurement Not Applicable
80														PID = (Cold/Hot) Photo Ionization Detector
82														Coordinates are Alaska State Plane, Zone 1, NAD83
84														
86														
88														
90														
92														
94														
96														
98														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 10 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,098 ft. Easting: 2,547,048 ft.

Top of Hole Elevation: -12.6 ft.

Hole Number, Field: TB2 Permanent: AP-2

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 62.5 ft.

Total Depth: 62.5 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Sample	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
10	1	0 1 3	OL	Organic SILT							Black, wet, fine to medium sand, nonplastic fines, organic odor
16	2	2 2 4	GC-GM	Silty, Clayey GRAVEL with Sand	38	33	29	1.5			Gray, wet, angular to rounded gravel, fine to coarse sand, low plasticity fines, LL=20, PI=6, till
20	3	11 17 21	GM	Silty GRAVEL with Sand				1.5			Gray, wet, angular to rounded gravel, fine to coarse sand, till
26	4	55/6in	SM	Silty SAND with Gravel	25	50	25	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
30	5	50/4in	GM	Silty GRAVEL with Sand				1			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/19/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 10 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,098 ft. Easting: 2,547,048 ft.

Top of Hole Elevation: -12.6 ft.

Hole Number, Field:	Permanent:	Operator:	Inspector:
TB2	AP-2	Mike Stockton/ Lyle Cain	Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 62.5 ft.

Total Depth: 62.5 ft.

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
		6			50	GM	Silty GRAVEL with Sand				1			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
36														
38														
		7			40 50/4in	Bx	Weathered Rock							Dark gray, shale with quartz veins, very weathered, material can be broken with fingers
40														
42														
44														
		8			30 50/3in	Bx	Weathered Rock							Dark gray shale with quartz veins, very weathered
46														
48														
50						Bx	BEDROCK							Run 1: cored 60 inches, recovered 26 inches Dark gray shale with quartz veins, dipping at about 70 degrees
52		Run1												
54														
56		Run2				Bx	BEDROCK							Run 2: cored 30 inches, recovered 6 inches Dark gray shale with quartz veins, dipping at about 70 degrees
58						Bx	BEDROCK							Run 3: cored 60 inches, recovered 26 inches Dark gray shale with quartz veins, dipping at about 70 degrees
60		Run3												
62														Bottom of Hole 62.5 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
64														
66														Coordinates are Alaska State Plane, Zone 1, NAD83

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 5 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,099 ft. Easting: 2,547,011 ft.

Top of Hole Elevation: -21.0 ft.

Hole Number, Field:	Permanent:	Operator:	Inspector:
TB3	AP-3	Mike Stockton/ Lyle Cain	Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 59.2 ft.

Total Depth: 59.2 ft.

Hammer Weight:	Split Spoon I.D:	Size and Type of Bit:	Type of Equipment:	Type of Samples:
340 lbs	2.5 in.	4 in. Tri-cone/Diamond	CME-85 w/ autohammer	Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
10		1			0/18in	OL	Organic SILT							Sampler penetrated 18 inches under the weight of the hammer No recovery (Black organic silt on outside of sampler)
16		2			22 13 50/2in	GM	Silty GRAVEL with Sand				2.5			Gray, wet, angular gravel, fine to coarse sand, nonplastic (NP) fines, till
20		3			50/4in	SM	Silty SAND with Gravel				1.5			Gray, wet, angular gravel, fine to coarse sand, NP fines, till
26		4			25 40 23	SC-SM	Silty, clayey SAND with Gravel	21	47	32	1.5			Gray, wet, angular gravel, fine to coarse sand, LL=18, PI=5, till
30		5			6 11 21	SM	Silty SAND	11	58	31	.2			Gray, wet, angular gravel, fine to coarse sand, NP to low plasticity fines, till

EXPLORATION LOG DOUGLAS SBH.GPJ ACE ANC.GDT 1/19/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 5 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,099 ft. Easting: 2,547,011 ft.

Top of Hole Elevation: -21.0 ft.

Hole Number, Field: TB3

Permanent: AP-3

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 59.2 ft.

Total Depth: 59.2 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	Grain Size %Sand	Grain Size %Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
36		6			6 50/5in	SM	Silty SAND							Gray, wet, angular gravel, fine to coarse sand, till
38						GM	Silty GRAVEL with Sand							Run 1: cored 48 inches, recovered 1 inch - (not bedrock) Gray, wet, angular gravel, fine to coarse sand, till
40		Run1												
42		Run2				GM	Silty GRAVEL with Sand							Run 2: cored 24 inches, recovered 0 inches - (not bedrock)
44														
46						GM	Silty GRAVEL with Sand							Run 3: cored 57 inches, recovered 0 inches - (not bedrock) Black to gray and white, wet, angular gravel, coarse sand
48		Run3												
50														
52		7 Run4			6 35/3in	GP Bx	Poorly graded GRAVEL with Sand BEDROCK							Black and gray, wet, angular gravel, coarse sand Run 4: plugged, no recovery Run 5: cored 60 inches, recovered 28 inches Gray shale with white quartz veins, dipping at about 70 degrees
54		Run5												
56														
58		Run6				Bx	BEDROCK							Run 6: cored 26 inches, recovered 26 inches Dark gray shale with quartz veins, dipping at about 70 degrees
60														Bottom of Hole 59.2 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
62														
64														Coordinates are Alaska State Plane, Zone 1, NAD83
66														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 8 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,075 ft. Easting: 2,547,187 ft.

Top of Hole Elevation: -30.0 ft.

Hole Number, Field: TB4

Permanent: AP-4

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 36.5 ft.

Total Depth: 36.5 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Sample	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	%Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
0–8	1	3 3 5	OL	Organic SILT							Black to gray, wet, fine to medium sand, nonplastic (NP) fines, organic odor
8–12	2	7 8 17	SM	Silty SAND with Gravel	23	45	32	0.75			Gray, wet, angular gravel, fine to coarse sand, NP to low plasticity fines, till
12–18	3	13 50/5in	GM	Silty GRAVEL with Sand				0.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
18–22	4	8 35 30/2in	GP-GM	Poorly graded GRAVEL with Silt and Sand	47	44	9	2			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
22–28	5	10 11 27	SP-SM	Poorly graded SAND with Silt and Gravel	42	50	8	1.5			Gray, wet, angular gravel, fine to coarse sand, NP fines, till
28–32	Run1		Bx	BEDROCK							Run 1: cored 60 inches, recovered 60 inches Dark gray shale with white quartz veins, dipping at about 70 degrees

EXPLORATION LOG DOUGLAS SBH.GPJ ACE ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 8 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,075 ft. Easting: 2,547,187 ft.

Top of Hole Elevation: -30.0 ft.

Hole Number, Field: TB4

Permanent: AP-4

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 36.5 ft.

Total Depth: 36.5 ft.

Hammer Weight: 340 lbs

Split Spoon I.D: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	Grain Size %Sand	Grain Size %Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34		Run2				Bx	BEDROCK							Run 2: cored 36 inches, recovered 36 inches Dark gray shale with white quartz veins, dipping at about 70 degrees
36														
38														Bottom of Hole 36.5 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
40														Coordinates are Alaska State Plane, Zone 1, NAD83
42														
44														
46														
48														
50														
52														
54														
56														
58														
60														
62														
64														
66														

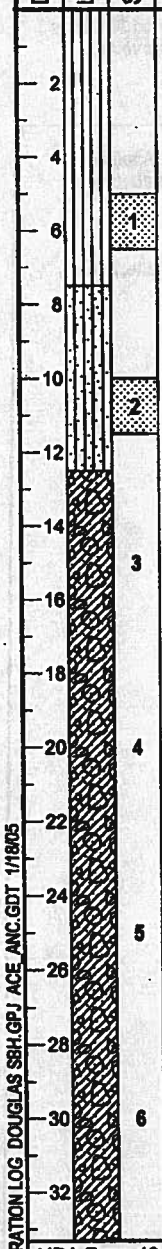
EXPLORATION LOG DOUGLAS SBH.GPJ ACE ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska		Page 1 of 2; Date: 4 Oct 2004
Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling		Elevation Datum: MLLW ☐ MSL ☒ other
Location: Northing: 2,354,143 ft. Easting: 2,547,114 ft.		Top of Hole Elevation: -37.6 ft.
Hole Number, Field: TB5	Permanent: AP-5	
Operator: Mike Stockton/ Lyle Cain		Inspector: Gregory Carpenter/Robert Weakland
Type of Hole: ☒ other Wash Rotary/Core; ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: NA	Depth Drilled: 55.5 ft. / Total Depth: 55.5 ft.
Hammer Weight: 340 lbs	Split Spoon I.D.: 2.5 in.	Size and Type of Bit: 4 in. Tri-cone/Diamond
Type of Equipment: CME-85 w/ autohammer		Type of Samples: Drive and Core



Depth (ft.)	Sample	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Max Size (in.)	Description and Remarks
2–6	1	0/18in	ML	SILT	0.25	Black, wet, fine to coarse sand, nonplastic fines (NP) fines, organic odor
8–12	2	1/2 1/2 1	SM	Silty SAND		Dark gray, wet, fine to medium sand, NP fines, shell fragments
14–16	3					No sample attempted due to heave
18–20	4					No sample attempted - lost circulation
22–26	5					No sample attempted
28–32	6					No sample attempted

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 4 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,143 ft. Easting: 2,547,114 ft.

Top of Hole Elevation: -37.6 ft.

Hole Number, Field: TB5

Permanent: AP-5

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 55.5 ft.

Total Depth: 55.5 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	Grain Size %Sand	Grain Size %Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
		7												No sample attempted
36														
38		8			4 5 36/3in	SM	Silty SAND							Dark gray to black, angular gravel, fine to coarse sand, NP fines, till
40														
42														
44														
46														
48														
						Bx	BEDROCK							Run 1: cored 42 inches, recovered 36 inches Dark gray shale with white quartz veins, dipping at about 70 degrees
50		Run 1												
52						Bx	BEDROCK							Run 2: cored 42 inches, recovered 36 inches Dark gray shale with quartz veins, dipping at about 70 degrees
54		Run 2												
56														Bottom of Hole 55.5 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
58														
60														Coordinates are Alaska State Plane, Zone 1, NAD83
62														
64														
66														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 6 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,036 ft. Easting: 2,547,084 ft.

Top of Hole Elevation: -15.6 ft.

Hole Number, Field: TB6

Permanent: AP-6

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 62.1 ft.

Total Depth: 62.1 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
0-6						OL	Organic SILT							Black, wet, nonplastic (NP) fines, organic odor
10		1			8 12 12	GC-GM	Silty, Clayey GRAVEL with Sand	45	34	21	1.5			Gray, wet, subangular gravel, fine to coarse sand, LL=18, PI=4, till
16		2			10 20 35	SM	Silty SAND with Gravel	20	45	35	1.5			Gray, wet, subangular gravel, fine to coarse sand, NP fines, till
20		3			18 30 50/3in	SM	Silty SAND with Gravel	23	45	32	1.5			Gray, wet, angular gravel, fine to coarse sand, NP fines, till
24		4			50/4in	SM	Silty SAND with Gravel				0.25			Gray to black, wet, fine to coarse sand, NP fines, till
30		5			18 50/3in	SP-SM	Poorly graded SAND with Silt and Gravel	39	51	10	1.5			Gray to black, wet, angular gravel, fine to coarse sand, NP fines, till

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 6 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,354,036 ft. Easting: 2,547,084 ft.

Top of Hole Elevation: -15.6 ft.

Hole Number, Field: TB6

Permanent: AP-6

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 62.1 ft.

Total Depth: 62.1 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
36		6			4 5 8 40	ML	Sandy SILT with Gravel				0.5			Dark gray, wet, angular gravel, fine to coarse sand, NP fines, till
38														
40														
42		7			40/2in	GM	Silty GRAVEL with Sand							No recovery
44														
46														
48		8		F4	18 50/3in	ML	Sandy SILT							Gray, wet, fine to coarse sand, NP fines
50														
52		9			6 31/1in	Bx Bx	BEDROCK BEDROCK							Dark gray, shale with quartz veins, weathered Run 1: cored 60 inches, recovered 12 inches Dark gray shale with quartz veins to 1 inch, dipping at about 80 degrees
54		Run 1												
56														
58						Bx	BEDROCK							Run 2: cored 60 inches, recovered 36 inches Dark gray shale with white quartz veins, dipping at about 80 degrees
60		Run 2												
62														Bottom of Hole 62.1 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
64														
66														Coordinates are Alaska State Plane, Zone 1, NAD83

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 8 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,353,895 ft. Easting: 2,547,167 ft.

Top of Hole Elevation: -13.0 ft.

Hole Number, Field: TB7

Permanent: AP-7

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 63.0 ft.

Total Depth: 63.0 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
12		1			35 29 28	SM	Silty SAND with Gravel	30	42	28	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
16		2			11 18 17	GC-GM	Silty, Clayey GRAVEL with Sand	43	37	20	1.5			Gray, wet, angular gravel, fine to coarse sand, LL=19, PI=5, till
22		3			8 10 50/3in	GC-GM	Silty, Clayey GRAVEL with Sand				0.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
26		4			15 50/5in	GM	Silty GRAVEL with Sand				0.5			Gray, wet, angular gravel, fine to coarse sand, nonplastic (NP) fines, till
28–30		Run 1				GM	Silty GRAVEL with Sand				2.5			Run 1: cored 48 inches, recovered 24 inches (not bedrock) Gray, angular gravel, fine to coarse sand, NP fines, till

EXPLORATION LOG: DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section

EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 8 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,353,895 ft. Easting: 2,547,167 ft.

Top of Hole Elevation: -13.0 ft.

Hole Number, Field: TB7

Permanent: AP-7

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core
☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 63.0 ft.

Total Depth: 63.0 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
36		Run 2			50/2in						6			No recovery Run 2: cored 28 inches, recovered 6 inches; cored through cobbles and till
38														
40		Run 3									18			Run 3: cored 60 inches,recovered 24 inches; cored through an 18-inch boulder
42														
44														
46														
48		Run 4			50/5 in	Bx Bx	BEDROCK BEDROCK							Appears to be bedrock-gray shale with vertical white quartz veins Run 4: cored 48 inches, recovered 4 inches Dark gray shale and white quartz veins
50														
52		Run 5				Bx	BEDROCK							Run 5: cored 12 inches, no recovery
54														Tri-coned to 58 feet
56														
58						Bx	BEDROCK							Run 6: cored 60 inches, recovered 37 inches Gray shale with quartz veins, dipping nearly vertical
60		Run 6												
62														
64														Bottom of Hole 63.0 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector Coordinates are Alaska State Plane, Zone 1, NAD83
66														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska

Date: 9 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,353,948 ft. Easting: 2,547,085 ft.

Top of Hole Elevation: -15.0 ft.

Hole Number, Field: TB8

Permanent: AP-8

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 74.0 ft.

Total Depth: 74.0 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
10–12		1			10 22 32	SM	Silty SAND with Gravel	20	48	32	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
16–18		2			25 80/5in	SC-SM	Silty, clayey SAND with Gravel	21	48	31	1			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
20–22		3			50/3in	GM	Silty GRAVEL with Sand				2			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
26–28		Run 1				GM	Silty GRAVEL with Sand and Cobbles				>3			Run 1: cored 60 inches, recovered 48 inches (not bedrock) Gray, wet, angular to rounded gravel, fine to coarse sand, low plasticity fines, till

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor
Douglas, Alaska

Date: 9 Oct 2004

Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling

Elevation Datum: MLLW ☐ MSL ☒ other

Location: Northing: 2,353,948 ft. Easting: 2,547,085 ft.

Top of Hole Elevation: -15.0 ft.

Hole Number, Field: TB8

Permanent: AP-8

Operator: Mike Stockton/ Lyle Cain

Inspector: Gregory Carpenter/Robert Weakland

Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer

Depth to Groundwater: NA

Depth Drilled: 74.0 ft.

Total Depth: 74.0 ft.

Hammer Weight: 340 lbs

Split Spoon I.D.: 2.5 in.

Size and Type of Bit: 4 in. Tri-cone/Diamond

Type of Equipment: CME-85 w/ autohammer

Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
34														
36		4			50/2in	GM	Silty GRAVEL with Sand				0.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
38														
40														
42		5			28 50/3in	SM	Silty SAND with Gravel	22	53	25	1.5			Gray, wet, angular gravel, fine to coarse sand, low plasticity fines, till
44														
46														
48		6			28 40/3in	Bx	Weathered Rock				1.5			Dark gray shale, crumbles easily, quartz pieces, breaks down to SM
50														
52														
54		7			4 32 30/1in	Bx	Weathered Rock				1			Dark gray shale, crumbles easily, quartz pieces, breaks down to SM
56														
58		Run 2				Bx	Weathered Rock							Run 2: cored 60 inches, recovered 4 inches gray shale, crumbles easily, quartz veins
60														
62														
64						Bx	Weathered Rock							Tri-coned from 62 to 69 feet
66														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/19/05

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: Douglas Small Boat Harbor, Douglas, Alaska		Page 3 of 3; Date: 9 Oct 2004
Drilling Agency: ☐ Alaska District ☒ Other Denali Drilling		Elevation Datum: MLLW ☐ MSL ☒ other
Location: Northing: 2,353,948 ft. Easting: 2,547,085 ft.		Top of Hole Elevation: -15.0 ft.
Hole Number, Field: TB8	Permanent: AP-8	
Operator: Mike Stockton/ Lyle Cain		Inspector: Gregory Carpenter/Robert Weakland
Type of Hole: ☒ other Wash Rotary/Core ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☐ Piezometer	Depth to Groundwater: NA	Depth Drilled: 74.0 ft. / Total Depth: 74.0 ft.
Hammer Weight: 340 lbs	Split Spoon I.D: 2.5 in.	Size and Type of Bit: 4 in. Tri-cone/Diamond
Type of Equipment: CME-85 w/ autohammer		Type of Samples: Drive and Core

Depth (ft.)	Lithology	Sample	Frozen ASTM D 4083	Frost Class. TM 5-822-5	Blow Count	Symbol	Classification ASTM: D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	Max Size (in.)	PID (ppm)	% Water	Description and Remarks
68														
70						Bx	BEDROCK							Run 3: cored 54 inches, recovered 24 inches Black shale with quartz veins, dipping at about 70 degrees
72		Run 3												
74														Bottom of Hole 74.0 ft. Groundwater Measurement Not Applicable PID = (Cold/Hot) Photo Ionization Detector
76														Coordinates are Alaska State Plane, Zone 1, NAD83
78														
80														
82														
84														
86														
88														
90														
92														
94														
96														
98														

EXPLORATION LOG DOUGLAS SBH.GPJ ACE_ANC.GDT 1/18/05

Appendix B

Laboratory Results for Selected Soil Samples

801 East 82nd Avenue, #A-9
Anchorage, AK 99518

TERRA FIRMA INC.

Laboratory Testing / Construction Monitoring

Telephone: (907) 344-5934
Fax: (907) 344-5993
terrafirma@alaska.com

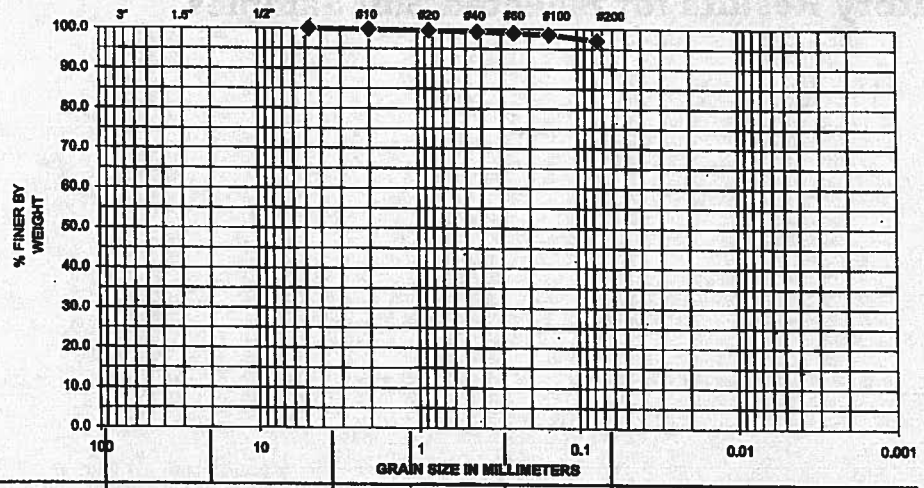
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB1
SAMPLE NO/ DEPTH	SA-1 @ -11.0' Depth
DESCRIPTION:	Silt
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Selmer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	0.0	USC:	ML
% SAND:	2.8	FC:	
% SILT/CLAY:	97.2	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	33.0

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

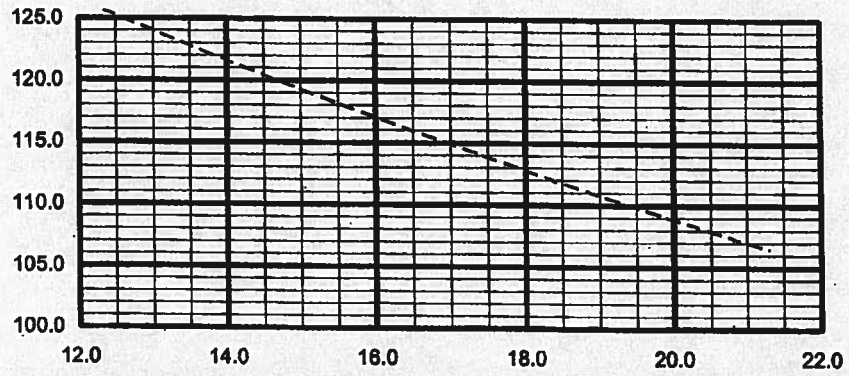
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"		
19.05	3/4"		
12.7	1/2"		
9.5	3/8"		
4.75	# 4	100	
2	#10	100	
0.85	#20	100	
0.425	#40	99	
0.25	# 60	99	
0.015	#100	99	
0.075	#200	97.2	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=27 PL=26 PI=1

The testing services reported herein have been performed to recognized industry standards, unless otherwise noted. No other warranty is made.

801 East 82nd Avenue, #A-9
Anchorage, AK 99518

TERRA FIRMA INC.

Laboratory Testing / Construction Monitoring

Telephone: (907) 344-5934
Fax: (907) 344-5993
terrafirma@alaska.com

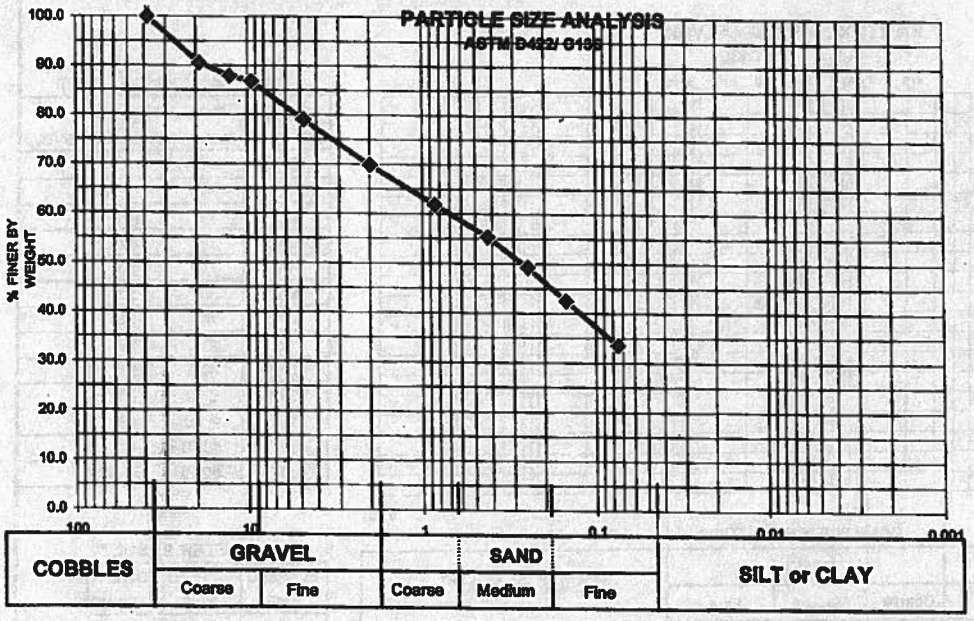
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB1
SAMPLE NO/ DEPTH	SA2 @ -16.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	21.0	USC:	SM
% SAND:	45.5	FC:	
% SILT/CLAY:	33.5	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	8.8

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



SIEVE ANALYSIS RESULT

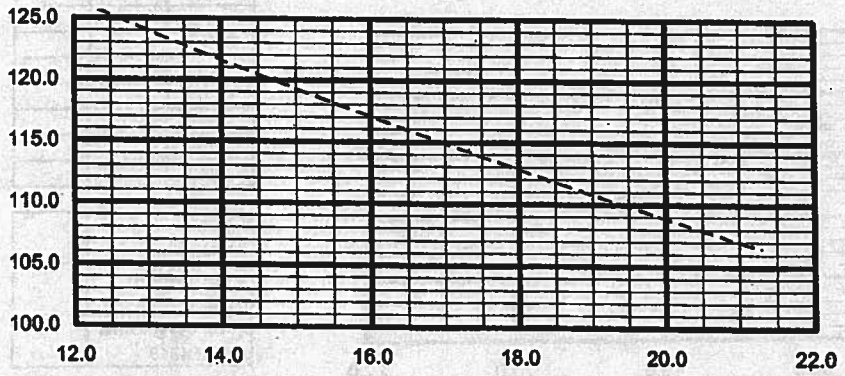
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	91	
12.7	1/2"	88	
9.5	3/8"	87	
4.75	# 4	79	
2	#10	70	
0.85	#20	62	
0.425	#40	55	
0.25	# 60	49	
0.015	#100	43	
0.075	#200	33.5	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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TERRA FIRMA INC.

Laboratory Testing / Construction Monitoring

Telephone: (907) 344-5934
Fax: (907) 344-5993
terrafirma@alaska.com

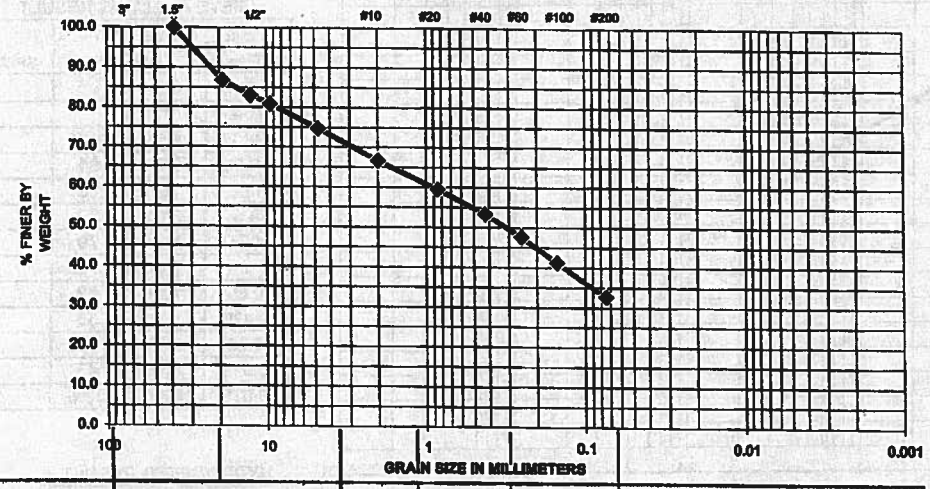
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB1
SAMPLE NO/ DEPTH	SA3 @ -21.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	25.3	USC:	SM
% SAND:	42.0	FC:	
% SILT/CLAY:	32.7	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	8.9

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

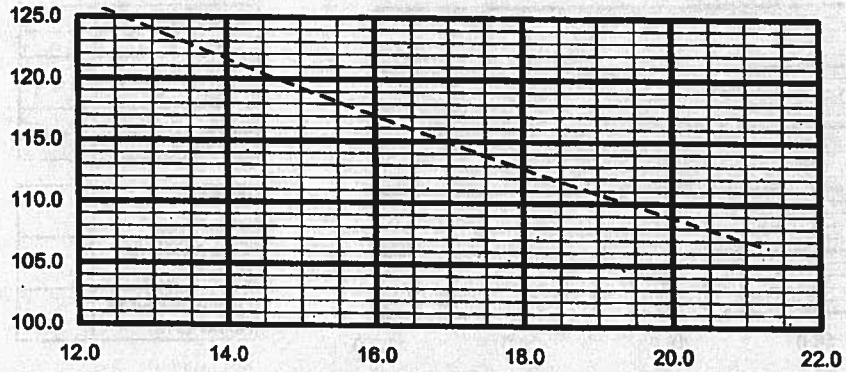
SIEVE SIZE (mm)	SIEVE SIZE (In.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	87	
12.7	1/2"	83	
9.5	3/8"	81	
4.75	# 4	75	
2	#10	67	
0.85	#20	60	
0.425	#40	53	
0.25	# 60	48	
0.015	#100	41	
0.075	#200	32.7	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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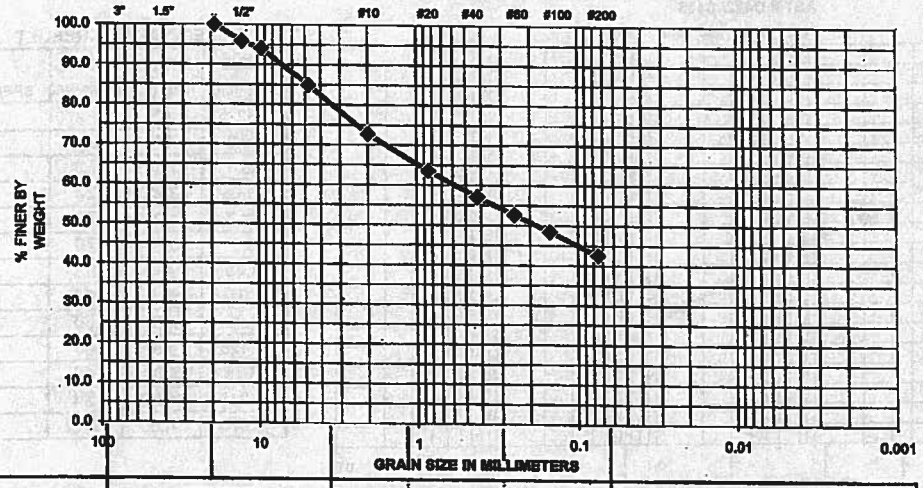
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB1
SAMPLE NO/ DEPTH	SA5 @ -30.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	15.1	USC:	SM
% SAND:	42.4	FC:	
% SILT/CLAY:	42.5	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.1

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

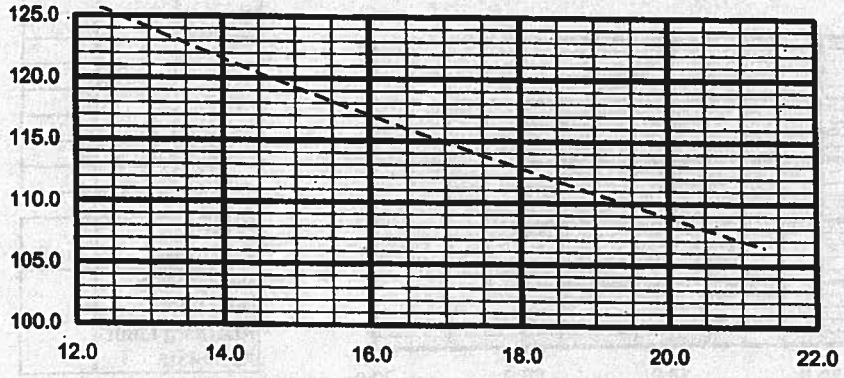
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"		
19.05	3/4"	100	
12.7	1/2"	96	
9.5	3/8"	94	
4.75	# 4	85	
2	#10	73	
0.85	#20	64	
0.425	#40	57	
0.25	# 60	53	
0.015	#100	48	
0.075	#200	42.5	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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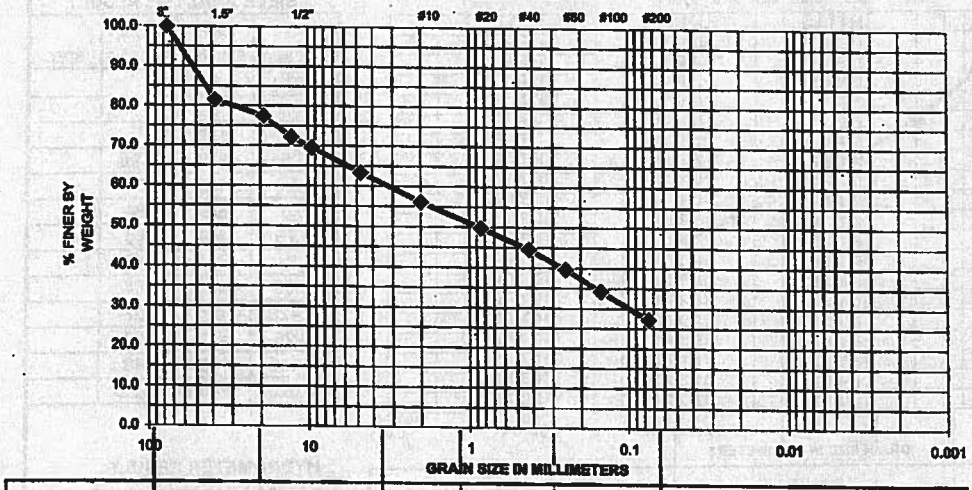
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB1
SAMPLE NO/ DEPTH	SA7 @ -40.0' Depth
DESCRIPTION:	Silty gravel w/ sand
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	36.7	USC:	GM
% SAND:	36.1	FC:	
% SILT/CLAY:	27.2	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	23.7

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



SIEVE ANALYSIS RESULT

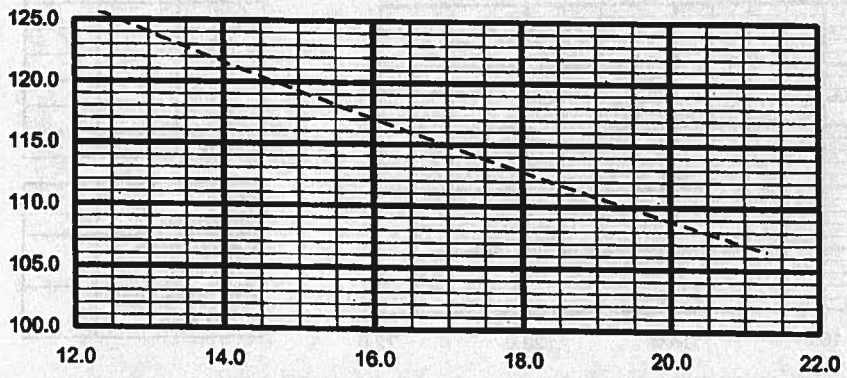
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"	100	
38.1	1.5"	82	
19.05	3/4"	77	
12.7	1/2"	72	
9.5	3/8"	70	
4.75	# 4	63	
2	#10	56	
0.85	#20	50	
0.425	#40	44	
0.25	# 60	40	
0.015	#100	34	
0.075	#200	27.2	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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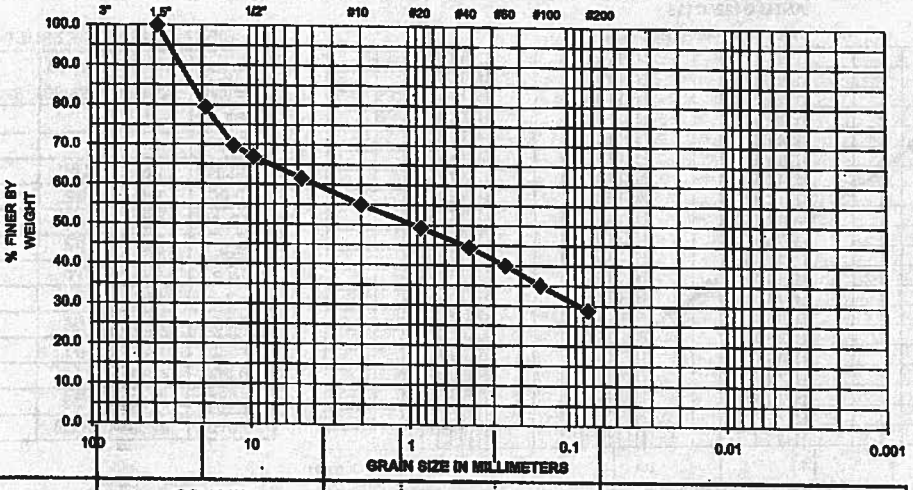
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB2
SAMPLE NO/ DEPTH	SA-2 @ -15.0' Depth
DESCRIPTION:	Silty clayey gravel w/ sand
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Selmer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	38.5	USC:	GC-GM
% SAND:	32.7	FC:	
% SILT/CLAY:	28.8	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	10.4

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

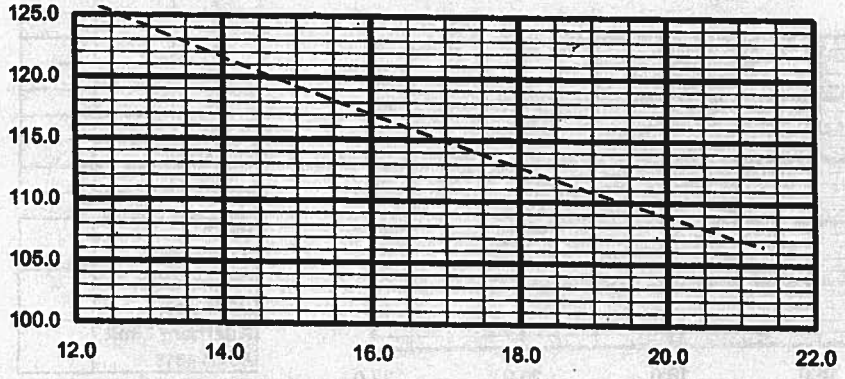
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	79	
12.7	1/2"	70	
9.5	3/8"	67	
4.75	# 4	62	
2	#10	55	
0.85	#20	49	
0.425	#40	44	
0.25	# 60	40	
0.015	#100	35	
0.075	#200	28.8	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=20 PL=14 PI=6

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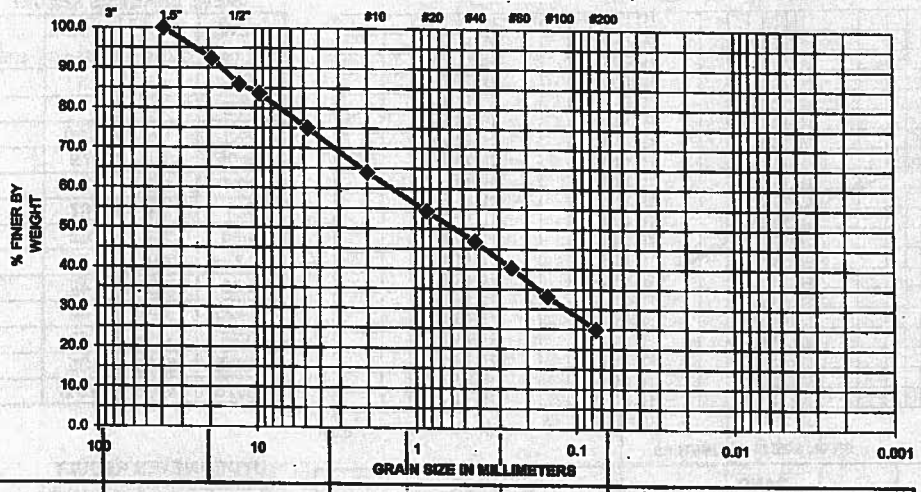
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB2
SAMPLE NO/ DEPTH	SA4 @ -25.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	24.9	USC:	SM
% SAND:	50.2	FC:	
% SILT/CLAY:	24.9	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	6.6

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

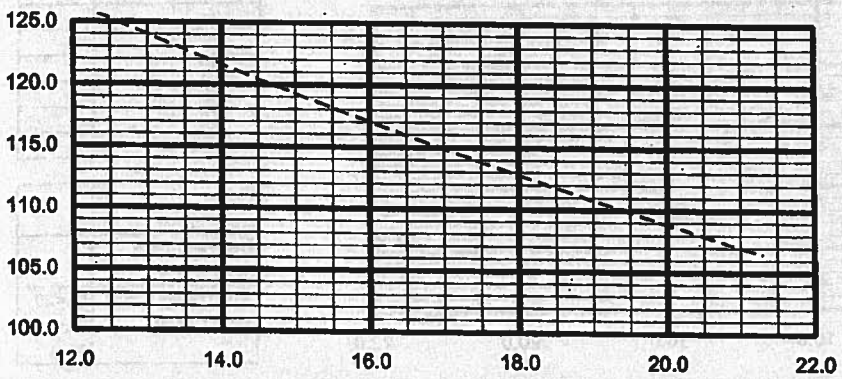
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	92	
12.7	1/2"	86	
9.5	3/8"	84	
4.75	# 4	75	
2	#10	64	
0.85	#20	54	
0.425	#40	47	
0.25	# 60	40	
0.015	#100	33	
0.075	#200	24.9	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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Laboratory Testing / Construction Monitoring

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terrafirma@alaska.com

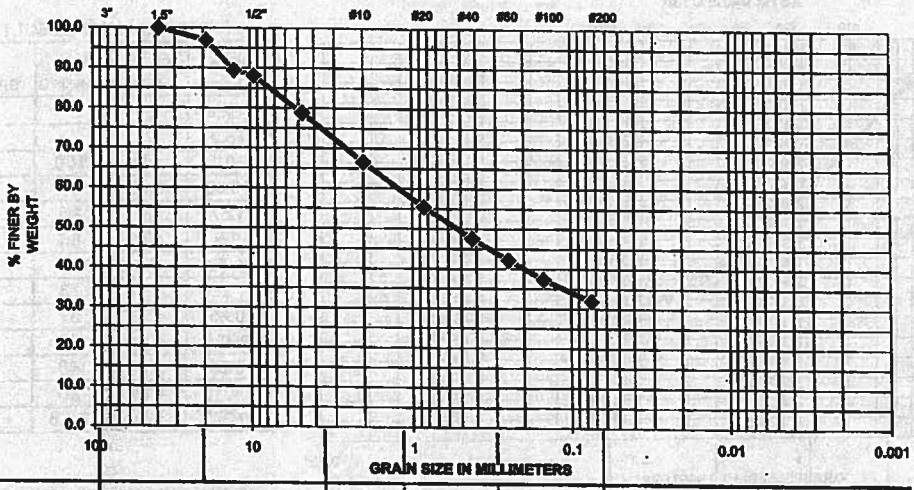
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB3
SAMPLE NO/ DEPTH	SA-4 @ -25.0' Depth
DESCRIPTION:	Silty clayey sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Selmer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	21.2	USC:	SC-SM
% SAND:	46.9	FC:	
% SILT/CLAY:	31.9	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	6.6

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

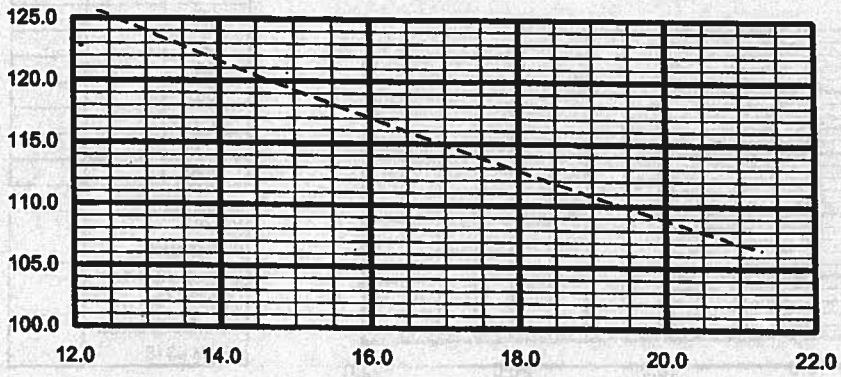
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	97	
12.7	1/2"	89	
9.5	3/8"	88	
4.75	# 4	79	
2	#10	67	
0.85	#20	55	
0.425	#40	48	
0.25	# 60	42	
0.015	#100	37	
0.075	#200	31.9	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=18 PL=13 PI=5

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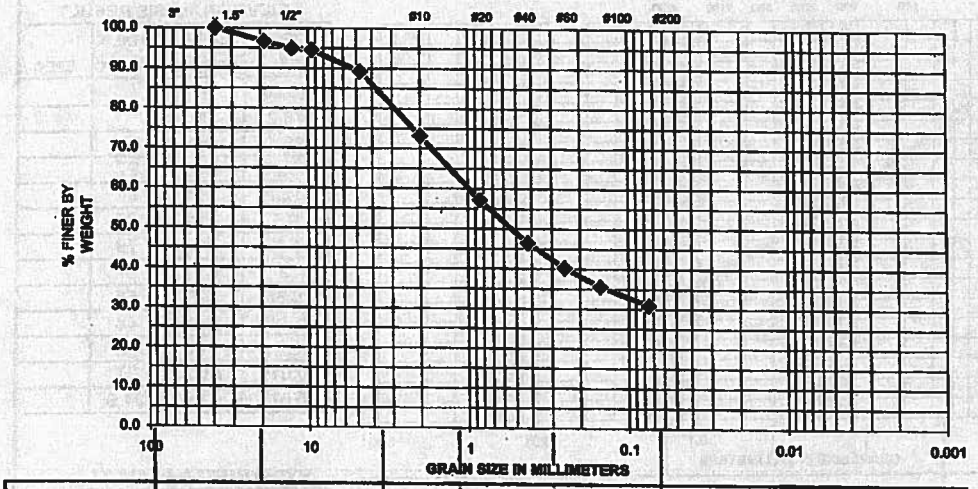
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB3
SAMPLE NO/ DEPTH	SA5 @ -30.0' Depth
DESCRIPTION:	Silty sand.
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	10.7	USC:	SM
% SAND:	58.4	FC:	
% SILT/CLAY:	30.9	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	10.4

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

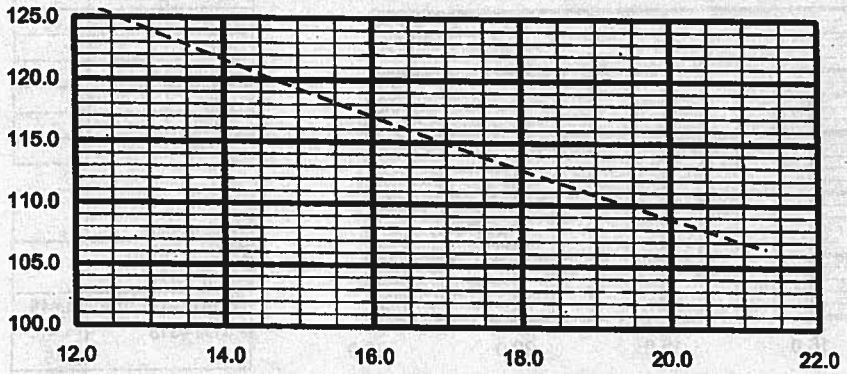
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	97	
12.7	1/2"	95	
9.5	3/8"	95	
4.75	# 4	89	
2	#10	73	
0.85	#20	57	
0.425	#40	46	
0.25	# 60	40	
0.015	#100	36	
0.075	#200	30.9	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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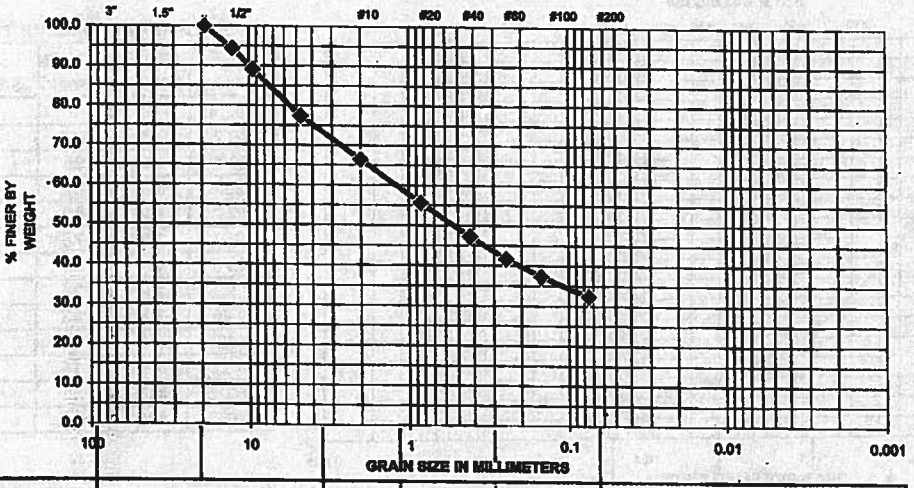
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB4
SAMPLE NO/ DEPTH	SA2 @ -12.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	22.6	USC:	SM
% SAND:	45.0	FC:	
% SILT/CLAY:	32.4	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	9.2

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

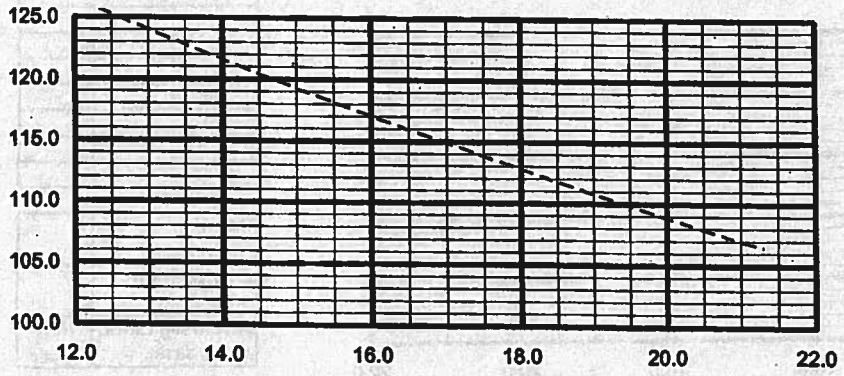
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"		
19.05	3/4"	100	
12.7	1/2"	94	
9.5	3/8"	89	
4.75	# 4	77	
2	#10	67	
0.85	#20	56	
0.425	#40	47	
0.25	# 60	42	
0.015	#100	37	
0.075	#200	32.4	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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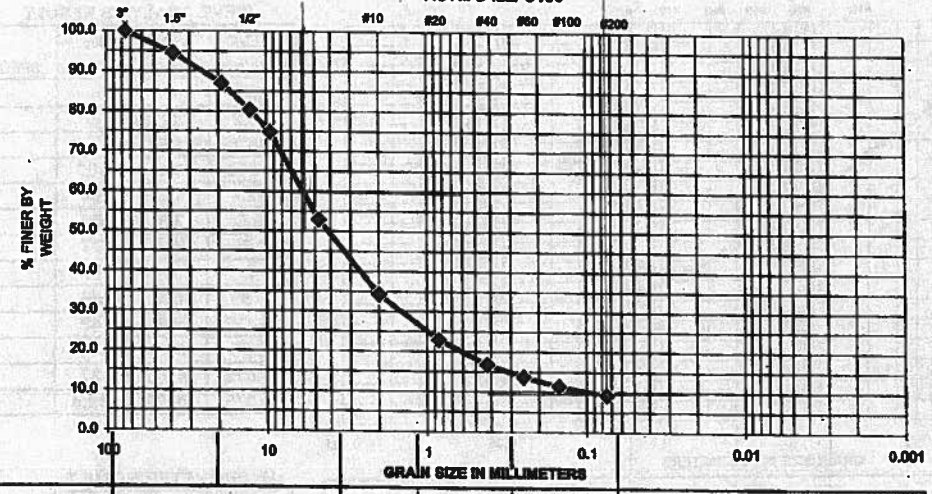
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB4
SAMPLE NO/ DEPTH	SA4 @ -22.0' Depth
DESCRIPTION:	Poorly grd. gravel w/ silt & sand.
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	47.1	USC:	GP-GM
% SAND:	43.7	FC:	
% SILT/CLAY:	9.2	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.8

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

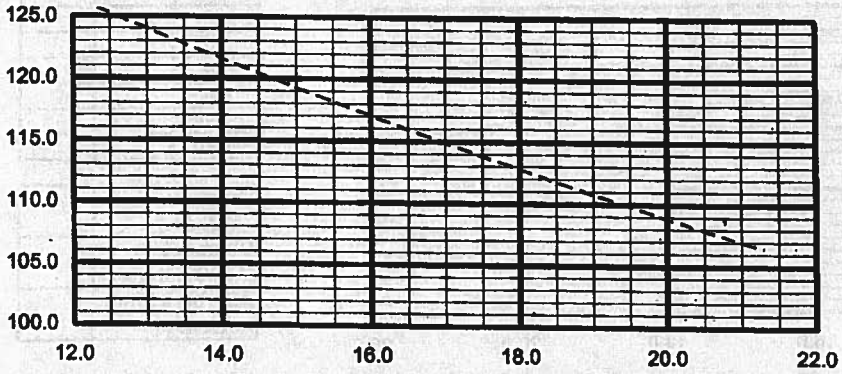
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"	100	
38.1	1.5"	95	
19.05	3/4"	87	
12.7	1/2"	80	
9.5	3/8"	75	
4.75	# 4	53	
2	#10	34	
0.85	#20	23	
0.425	#40	17	
0.25	# 60	14	
0.015	#100	11	
0.075	#200	9.2	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	Non-Plastic

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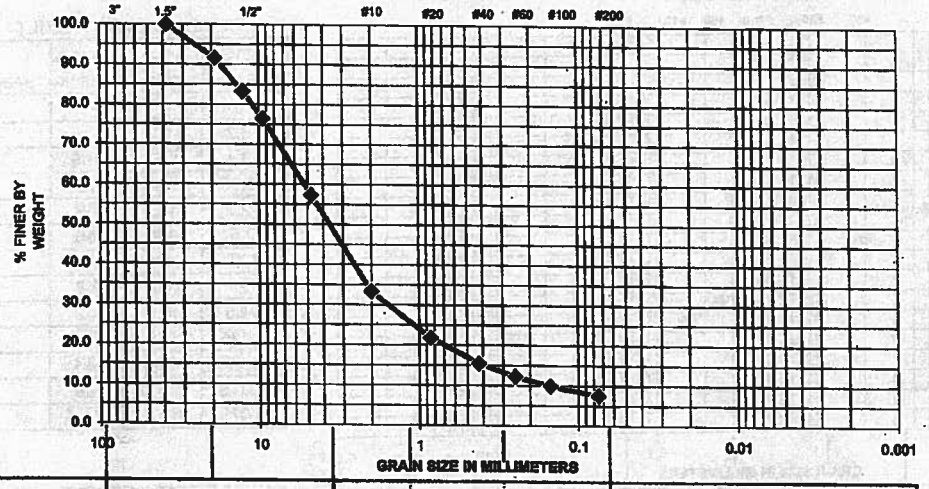
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB4
SAMPLE NO/ DEPTH	SA5 @ -27.0' Depth
DESCRIPTION:	Poorly grd. sand w/ silt & gravel.
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	42.6	USC:	SP-SM
% SAND:	49.8	FC:	
% SILT/CLAY:	7.6	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	8.2

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

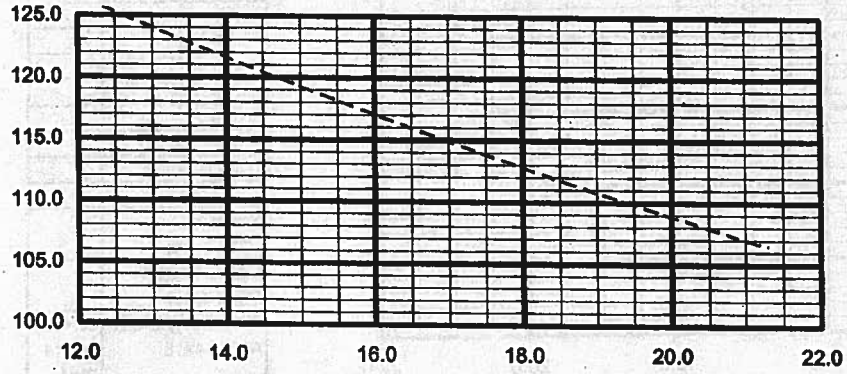
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	92	
12.7	1/2"	83	
9.5	3/8"	76	
4.75	# 4	57	
2	#10	33	
0.85	#20	22	
0.425	#40	15	
0.25	# 60	12	
0.015	#100	10	
0.075	#200	7.6	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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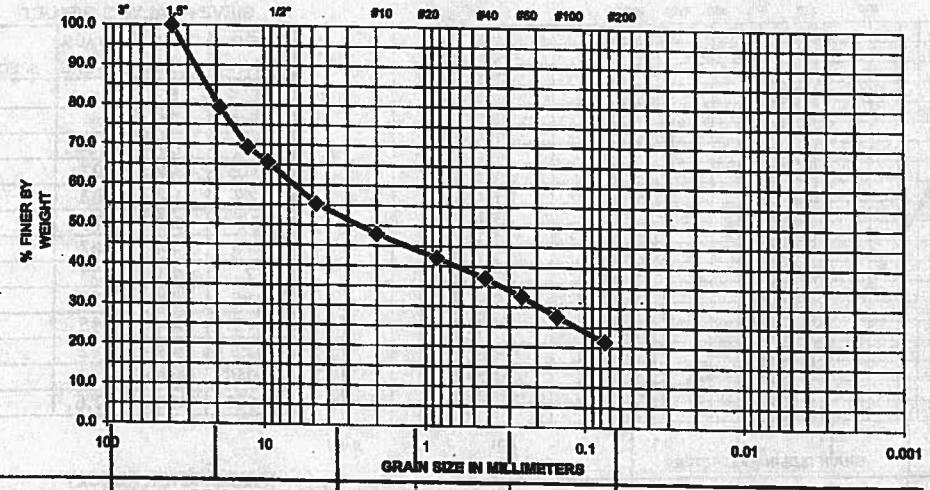
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB6
SAMPLE NO/ DEPTH	SA-1 @ -7.0' Depth
DESCRIPTION:	Silty clayey gravel w/ sand
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Selmer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	44.7	USC:	GC-GM
% SAND:	33.9	FC:	
% SILT/CLAY:	21.4	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.4

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



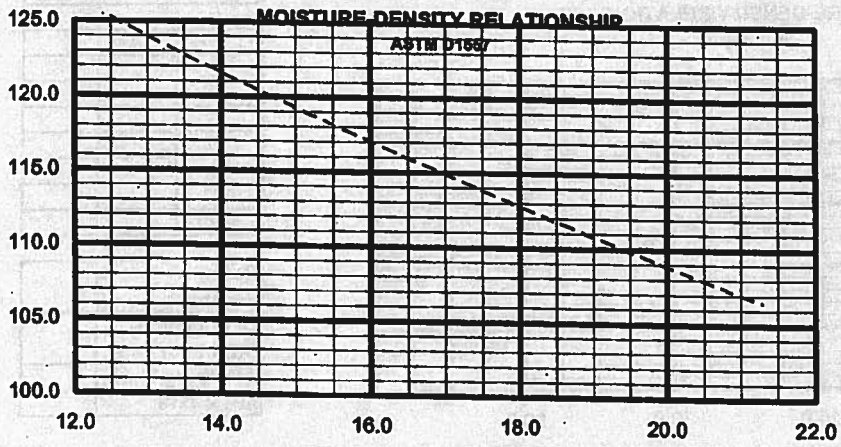
COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	79	
12.7	1/2"	69	
9.5	3/8"	66	
4.75	# 4	55	
2	#10	48	
0.85	#20	42	
0.425	#40	37	
0.25	# 60	33	
0.015	#100	28	
0.075	#200	21.4	

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



HYDROMETER RESULT

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

Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=18 PL=14 PI=4

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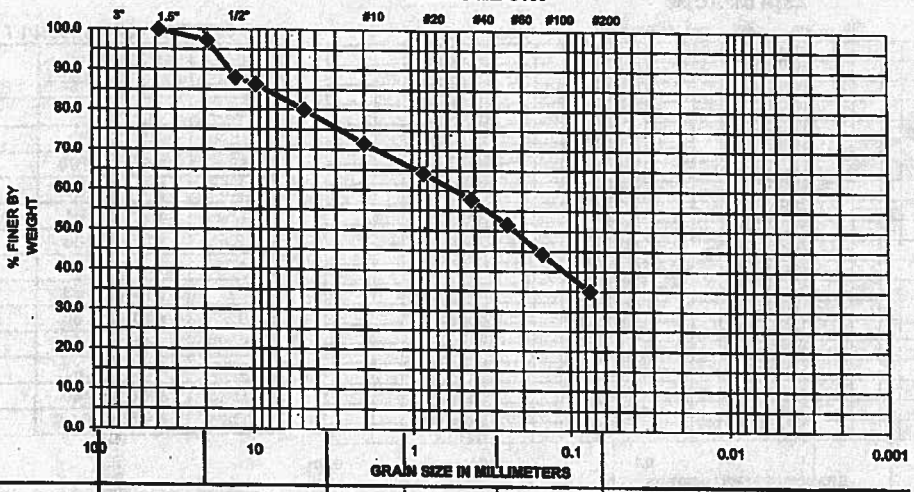
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB6
SAMPLE NO/ DEPTH	SA2 @ -12.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	20.1	USC:	SM
% SAND:	45.0	FC:	
% SILT/CLAY:	34.9	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	8.4

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

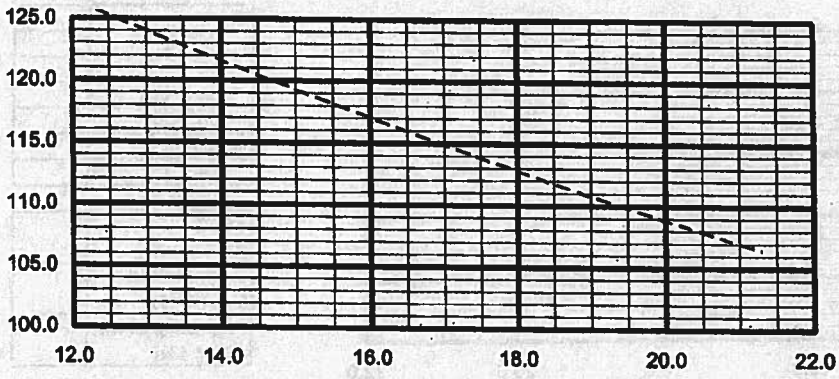
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	97	
12.7	1/2"	88	
9.5	3/8"	86	
4.75	# 4	80	
2	#10	72	
0.85	#20	64	
0.425	#40	58	
0.25	# 60	52	
0.015	#100	44	
0.075	#200	34.9	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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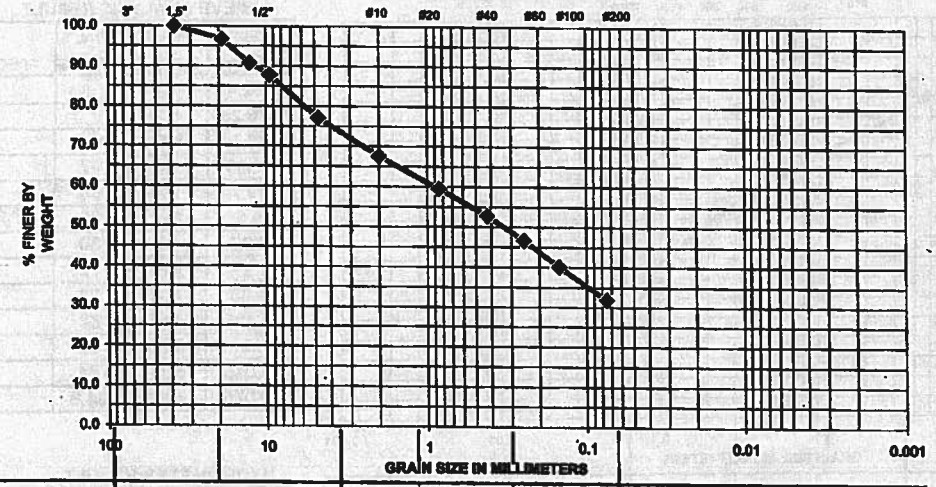
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB6
SAMPLE NO/ DEPTH	SA3 @ -17.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	22.9	USC:	SM
% SAND:	45.2	FC:	
% SILT/CLAY:	31.9	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	6.5

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

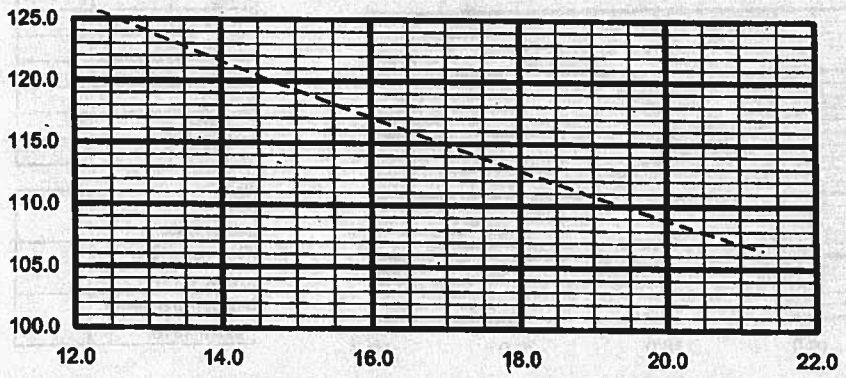
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	97	
12.7	1/2"	91	
9.5	3/8"	88	
4.75	# 4	77	
2	#10	68	
0.85	#20	60	
0.425	#40	53	
0.25	# 60	47	
0.015	#100	40	
0.075	#200	31.9	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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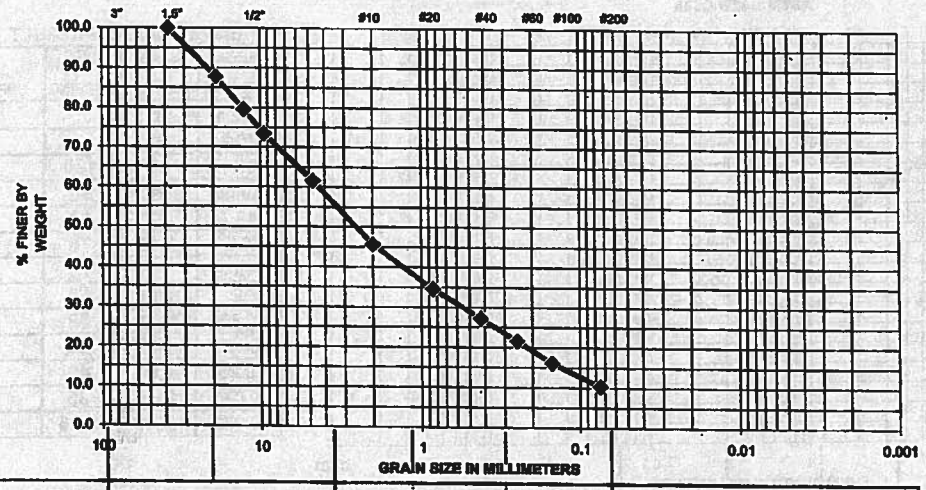
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB6
SAMPLE NO/ DEPTH	SA5 @ -27.0' Depth
DESCRIPTION:	Poorly grd. sand w/ silt & gravel.
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	38.4	USC:	SP-SM
% SAND:	51.3	FC:	
% SILT/CLAY:	10.3	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	9.0

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

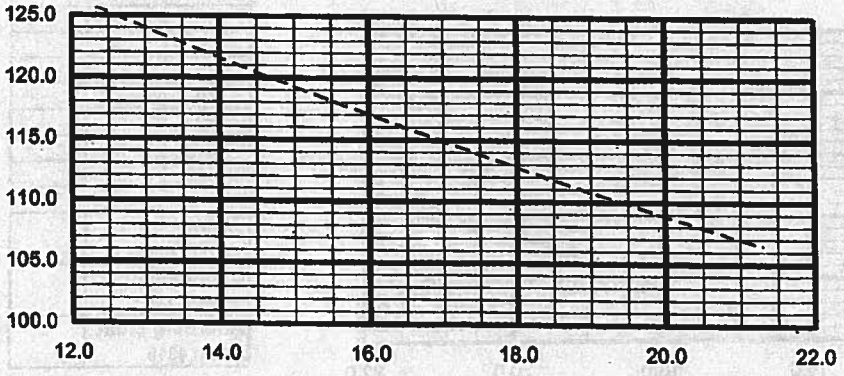
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	88	
12.7	1/2"	80	
9.5	3/8"	73	
4.75	# 4	62	
2	#10	46	
0.85	#20	35	
0.425	#40	27	
0.25	# 60	22	
0.015	#100	16	
0.075	#200	10.3	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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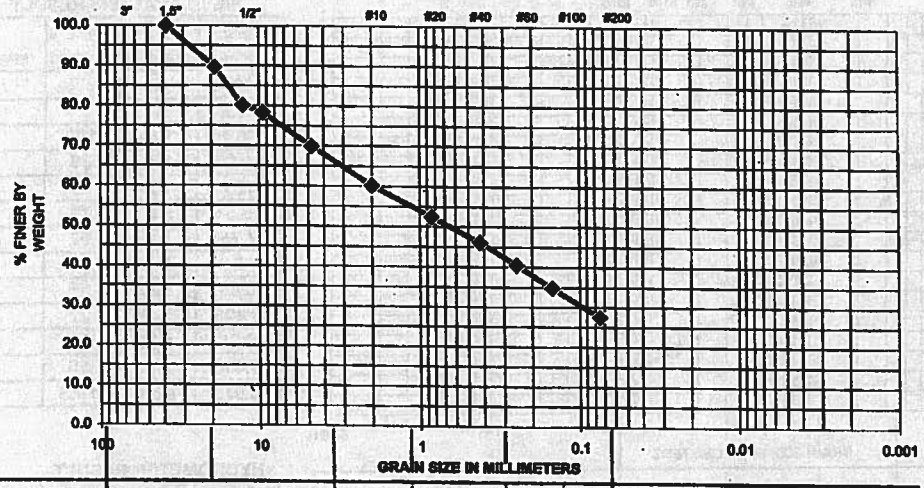
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB7
SAMPLE NO/ DEPTH	SA1 @ -12.5' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	30.1	USC:	SM
% SAND:	42.4	FC:	
% SILT/CLAY:	27.5	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	9.1

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

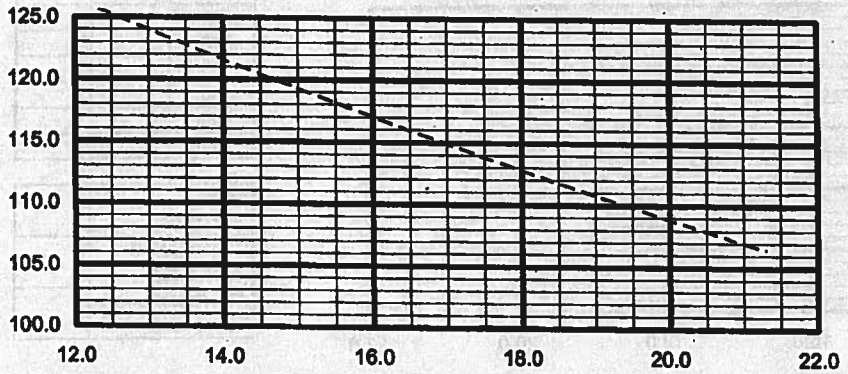
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	90	
12.7	1/2"	80	
9.5	3/8"	78	
4.75	# 4	70	
2	#10	60	
0.85	#20	52	
0.425	#40	46	
0.25	# 60	40	
0.015	#100	35	
0.075	#200	27.5	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

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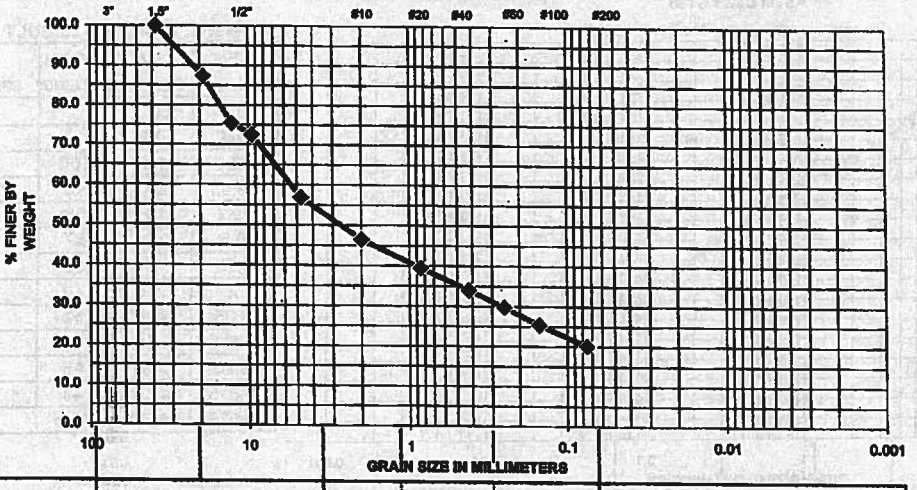
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB7
SAMPLE NO/ DEPTH	SA-2 @ -17.5' Depth
DESCRIPTION:	Silty clayey gravel w/ sand
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Seimer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	43.2	USC:	GC-GM
% SAND:	36.7	FC:	
% SILT/CLAY:	20.1	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.8

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

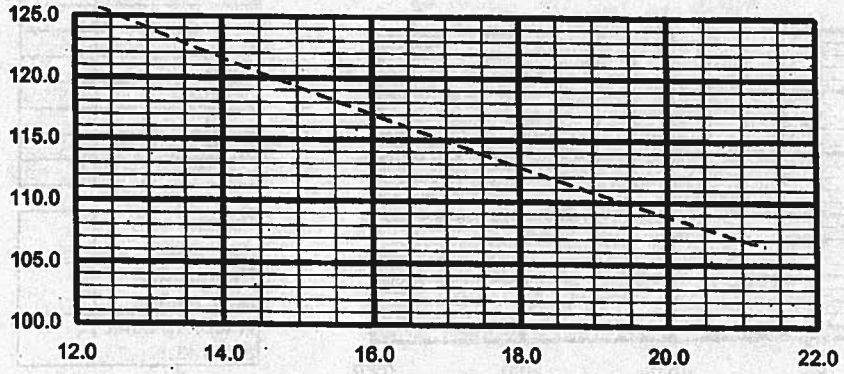
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	87	
12.7	1/2"	75	
9.5	3/8"	73	
4.75	# 4	57	
2	#10	46	
0.85	#20	39	
0.425	#40	34	
0.25	# 60	30	
0.015	#100	25	
0.075	#200	20.1	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=19 PL=14 PI=5

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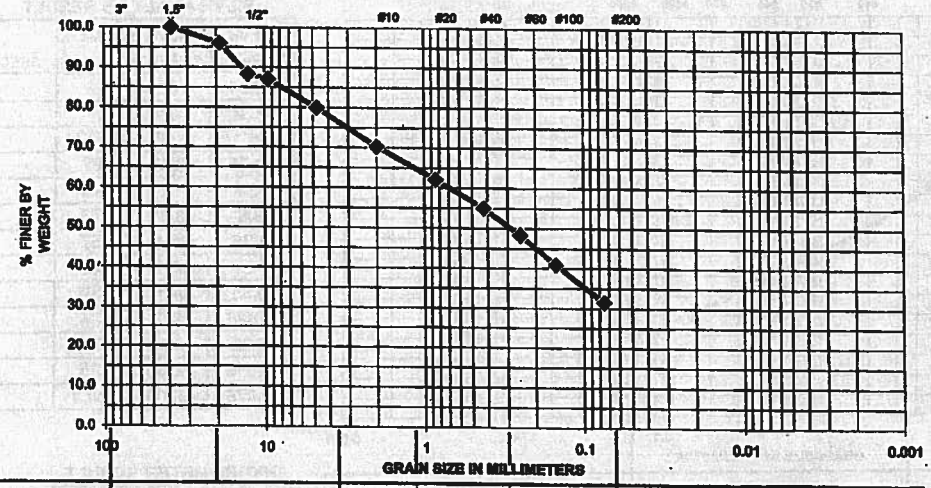
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB8
SAMPLE NO/ DEPTH	SA1 @ -11.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	20.1	USC:	SM
% SAND:	48.4	FC:	
% SILT/CLAY:	31.5	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.5

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

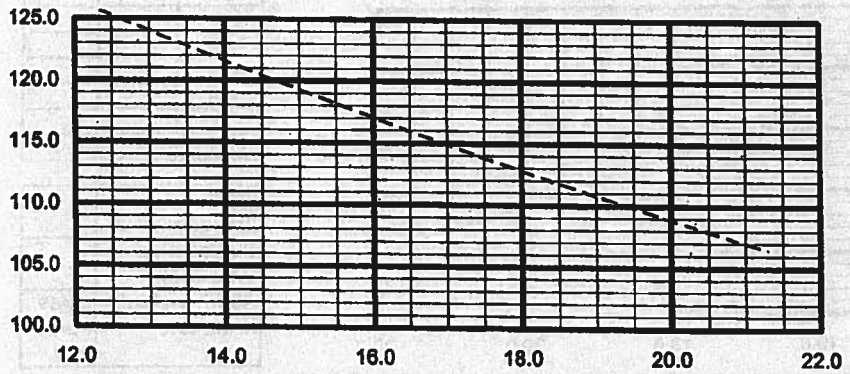
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	96	
12.7	1/2"	88	
9.5	3/8"	87	
4.75	# 4	80	
2	#10	70	
0.85	#20	62	
0.425	#40	55	
0.25	# 60	48	
0.015	#100	41	
0.075	#200	31.5	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	

801 East 82nd Avenue, #A-9
Anchorage, AK 99518

TERRA FIRMA INC.

Laboratory Testing / Construction Monitoring

Telephone: (907) 344-5934
Fax: (907) 344-5993
terrafirma@alaska.com

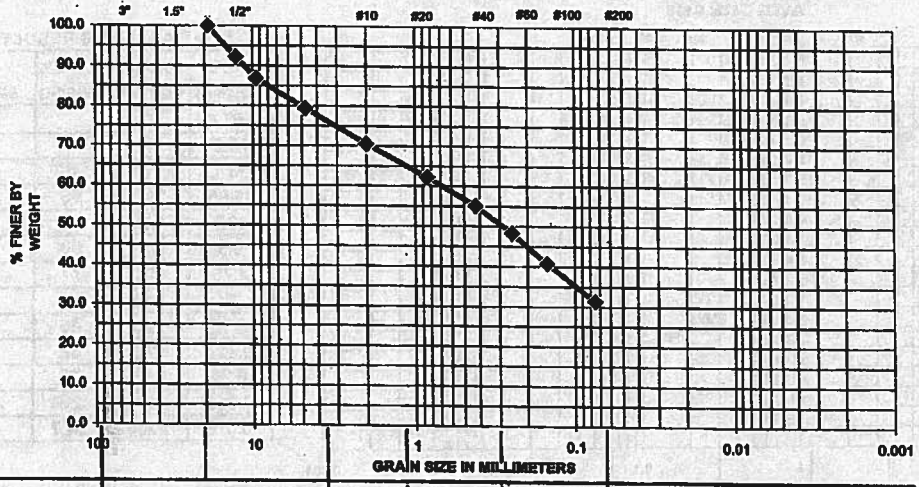
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	Coe 1621
SAMPLE LOCATION:	TB8
SAMPLE NO/ DEPTH	SA-2 @ -16.0' Depth
DESCRIPTION:	Silty clayey sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T. / T. Selmer
REVIEWED BY:	Ron Caron C.E.T.

% GRAVEL:	20.6	USC:	SC-SM
% SAND:	48.1	FC:	
% SILT/CLAY:	31.3	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	7.8

PARTICLE SIZE ANALYSIS

ASTM D422/ C136

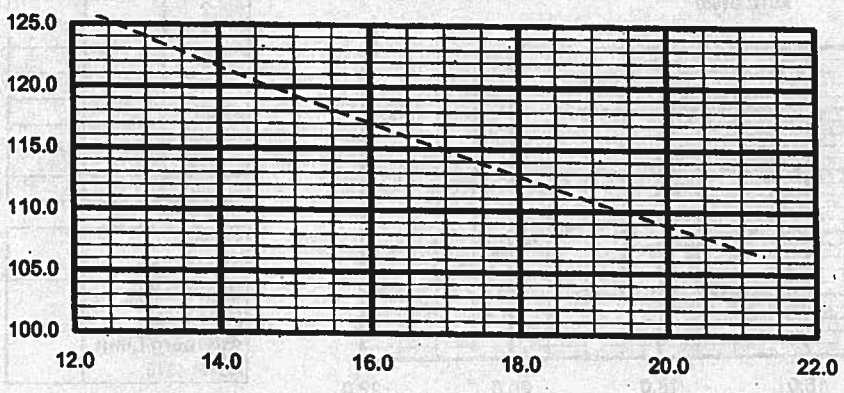


SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"		
19.05	3/4"	100	
12.7	1/2"	92	
9.5	3/8"	87	
4.75	# 4	79	
2	#10	70	
0.85	#20	62	
0.425	#40	55	
0.25	# 60	48	
0.015	#100	41	
0.075	#200	31.3	

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



HYDROMETER RESULT

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

Perm. (ASTM D2438)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	LL=18 PL=14 PI=4

801 East 82nd Avenue, #A-9
Anchorage, AK 99518

TERRA FIRMA INC.

Laboratory Testing / Construction Monitoring

Telephone: (907) 344-5934
Fax: (907) 344-5993
terrafirma@alaska.com

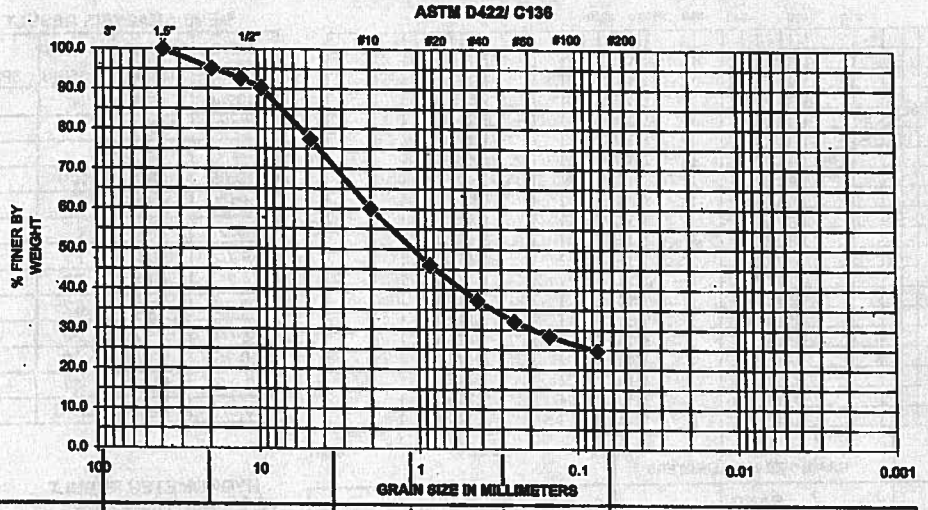
PROJECT CLIENT:	COE - Alaska District
PROJECT NAME:	Douglas Harbor Lab Testing
PROJECT NO.:	COE 1621
SAMPLE LOCATION:	TB8
SAMPLE NO/ DEPTH	SA5 @ -41.0' Depth
DESCRIPTION:	Silty sand w/ gravel
DATE TESTED:	10/15/2004
TESTED BY:	R. Caron, C.E.T.
REVIEWED BY:	Ron Caron C.E.T. / T. Selmer

% GRAVEL:	22.5	USC:	SM
% SAND:	52.8	FC:	
% SILT/CLAY:	24.7	.02 mm:	

ASTM D1557(uncorrected)	pcf
ASTM D4718 (corrected)	pcf
OPTIMUM M.C.% (corrected)	
NATURAL M.C. %	8.0

PARTICLE SIZE ANALYSIS

ASTM D422/ C136



COBBLES	GRAVEL		SAND			SILT or CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SIEVE ANALYSIS RESULT

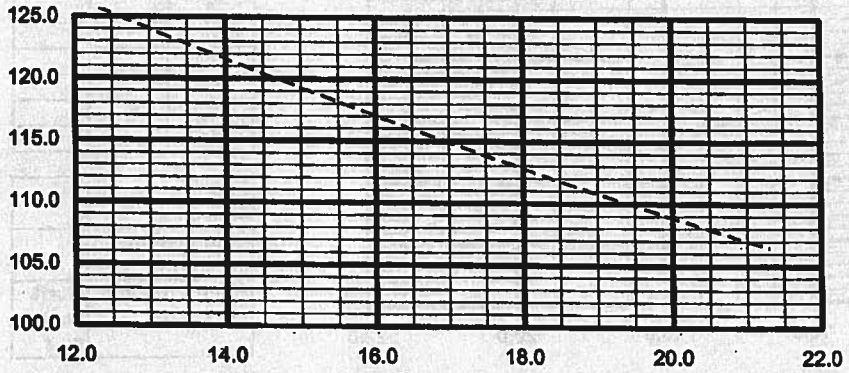
SIEVE SIZE (mm)	SIEVE SIZE (in.)	TOTAL % PASSING	SPEC
152.4	6"		
76.2	3"		
38.1	1.5"	100	
19.05	3/4"	95	
12.7	1/2"	93	
9.5	3/8"	90	
4.75	# 4	77	
2	#10	60	
0.85	#20	46	
0.425	#40	37	
0.25	# 60	32	
0.015	#100	28	
0.075	#200	24.7	

HYDROMETER RESULT

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

MOISTURE-DENSITY RELATIONSHIP

ASTM D1557



Perm. (ASTM D2434)	
Degradation (ATM T-13)	
Atterberg Limit ASTM 4318	