THE SEAL OF THE STATE OF ALASKA

Department of Environmental Conservation
Village Safe Water Program

Invitation to Bid (ITB)
ITB # VSW-NUP-2019-38

Addendum One

Water Treatment Plant Foundation
City of Nunapitchuk, Alaska

Date of Issue: July 3, 2019

The ITB Package is hereby clarified or changed as follows:

1. Submittal deadline has not been changed.
2. Attachments

The attachments begin on page two. This Addendum is hereby made part of the ITB and is a total of two pages, not including attachment.

All other terms and conditions for this ITB remain unchanged.

Issued by: Fred Parrish
Procurement Officer
(907) 269-7674

2. Attachments

Attachment D was not included with the original ITB PDF packet.

1. Attachment D, Geotechnical Report (28 pages).

Bidders must acknowledge receipt of this addendum prior to the submittal deadline.

The bid documents require acknowledgment individually of all addenda to the drawings and/or specifications. This is a **mandatory requirement** and any bid received without acknowledgment of receipt of addenda may be classified as not being a responsive bid.

End of Addendum

Attachment D

Golder Associates

August 22, 2016 1529871

Andrea Meeks, PE
CRW Engineering Group, LLC
3940 Arctic Blvd. Ste. 300
Anchorage, AK 99503

RE: FINAL FOUNDATION RECOMMENDATIONS, NUNAPITCHUK WASHETERIA AND WATER TREATMENT PLANT, NUNAPITCHUK, ALASKA

Dear Andrea:

Golder Associates Inc. (Golder) completed a geotechnical site investigation April 13-14, 2016 in Nunapitchuk, Alaska (Figure 1). All field work was conducted by Ms. Cara Shonsey, PE of Golder. A timber frame, single story community building currently occupies a portion of the site for the proposed development. The community building appears to be founded at-grade on timber bearing members set on the tundra surface with a nominal 2 foot blow-through space. The area under and around the community building is tundra with some nearby at-grade timber boardwalks. The community building will be relocated as part of the development. A gravel fill pad is not present under or near the proposed development.

1.0 PROPOSED DEVELOPMENT

The planned development includes a nominal 80 foot by 32 foot single story structure. The structure will include a washeteria and a water treatment plant. Utilities will be provided to the structure from the nearby existing water treatment plant and water storage tank facility. Once completed, this structure will replace the existing WTP. Current building design includes an under soffit utilidor for gravity flow to a common lift station inside the structure. The utilidor may extend at least 28 inches below the soffit in areas. A new 20,000 gallon above grade fuel storage tank for heating oil is planned as part of the development. The fuel storage tank is expected to be a skid mounted and double walled for spill containment designed for pile foundations.

The building is intended to be pile supported with adequate clear space (blow-through) under the building to maintain thermal integrity of the underlying permafrost. At this time, a gravel fill pad and rigid insulation is not planned as part of the proposed development

2.0 FIELD EXPLORATION PROGRAM

Three geotechnical boreholes (G16-01, G16-02 and G16-03) were advanced between 30 to 50 feet below ground surface at the time of the field effort (bgs) with a track mounted GeoProbe 6620 DT drill rig (Figure 2). Two borings were advanced near and within the footprint of the proposed washeteria and one boring was advanced at the planned fuel tank location. In addition to the geotechnical borings, a shallow probe was advanced approximately eight feet below ground surface (bgs) within the footprint of the current community building to estimate the ground thermal states under the existing structure.

The geotechnical boreholes were advanced with a GeoProbe drill rig with continuous core MC5 Macro-Core® samplers advanced with a percussion hammer. Disturbed but representative soil samples were collected at 2.5 and 5 feet intervals to the depth explored. The soil lithology and thermal state were visually classified and logged in the field according to the Unified Soil Classification System (USCS) and procedures provided in ASTM D4083, Frozen Soil Classification (Appendix A). Upon completion of drilling, a 1-inch diameter schedule 80 PVC standpipe was installed in each borehole for ground temperature measurements.

Recovered soil samples were retained for additional classification and laboratory testing in double sealed polyethylene bags and shipped to our Anchorage laboratory.

The shallow probe was advanced from the interior of the community building by creating a small diameter opening through the floor and subfloor. The hole was located near an interior wall approximately 11 feet from the southwest exterior wall of the community building and 8.5 feet from the north exterior wall of the community building. A pilot hole was initially drilled with a 2-inch diameter auger bit and the 3/8-inch diameter steel probe was advanced using a Hilti TE-70 Combi-Hammer rotary-percussion drill in five foot lengths with couplers. One 5-foot length of the 3/8-inch steel probe was left in the ground approximately 2 feet bgs due to limitations on our ability to remove pipe under the floor. The sub-floor and main floor were temporarily patched with steel plates and floor insulation was replaced.

Recovered soil samples were re-examined in our Anchorage laboratory to verify field classifications and to select samples for index testing. Soil index property testing included soil moisture content, grain size distribution, and pore water salinity analysis on select soil samples. Laboratory testing followed the standards established by the American Society for Testing Materials (ASTM) except for pore water salinity. Pore water salinity was determined using conductivity methods. A summary of the geotechnical test results is provided in Appendix B and are noted on the borehole logs (Appendix A).

A photo log has also been provided as Appendix C to depict the field summary described above.

3.0 GENERALIZED SURFACE AND SUBSURFACE CONDITIONS

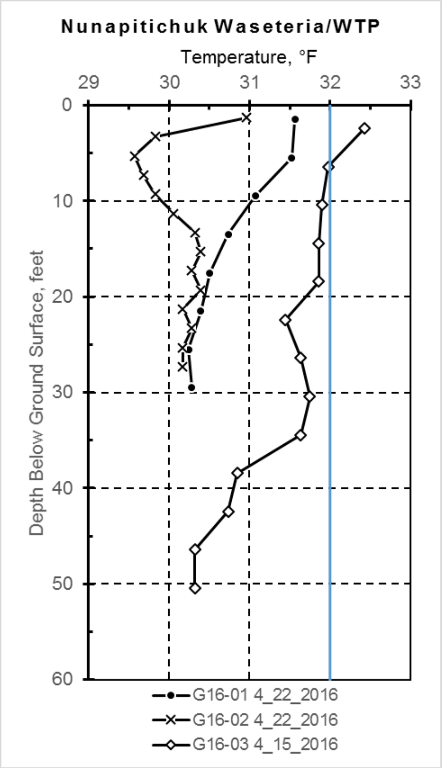
Exposed ground surface was mostly tundra mat with some isolated surface ice/water in lower lying depressions and limited snow cover during our field work. In general the tundra mat appeared to be relatively intact with some disturbance along ATV traffic areas. A review of recent imagery indicates some ATV and foot traffic has occurred in the area but most local traffic appears to use the nearby boardwalks.

Based on the recovered soil samples, the soil lithology is relatively consistent across the site. A layer of peat and organic silt overlay the site to a depth of approximately 1 to 5 feet bgs; generally considered the active and relict tundra mat. Below the peat and organic silt, a layer of grey silt with little sand was observed that extended to approximately 32.5 feet bgs. A nominal 4 foot thick layer of mixed sand and silt layers with few organics was observed at the base of the grey silt. A poorly graded fine grained sand with low fines content (material passing the US Number 200 standard sieve size) was observed beneath the mixed sand and silt layer that extended to the depth explored, 50 feet bgs.

All three boreholes identified bonded, frozen soil to the depth explored. Visible ice content in the field recovered silt samples ranged from 10 to 30 percent by volume as layers and inclusions with an occasional zones of non-visible ice. The sandier material below 40 feet bgs appeared to have less pore ice than the overlying grey silt soil, approximately 10-15 percent by volume. When thawed, all soil samples had water in excess of saturation.

Owning to the community building geometry, the potential for building heat transfer into the underlying permafrost was a geotechnical consideration. The probe within the community building was advanced to estimate the ground thermal state under the structure. Based on the probe rate of advancement and behavior, deeper thawed soils within the existing building footprint are not inferred.

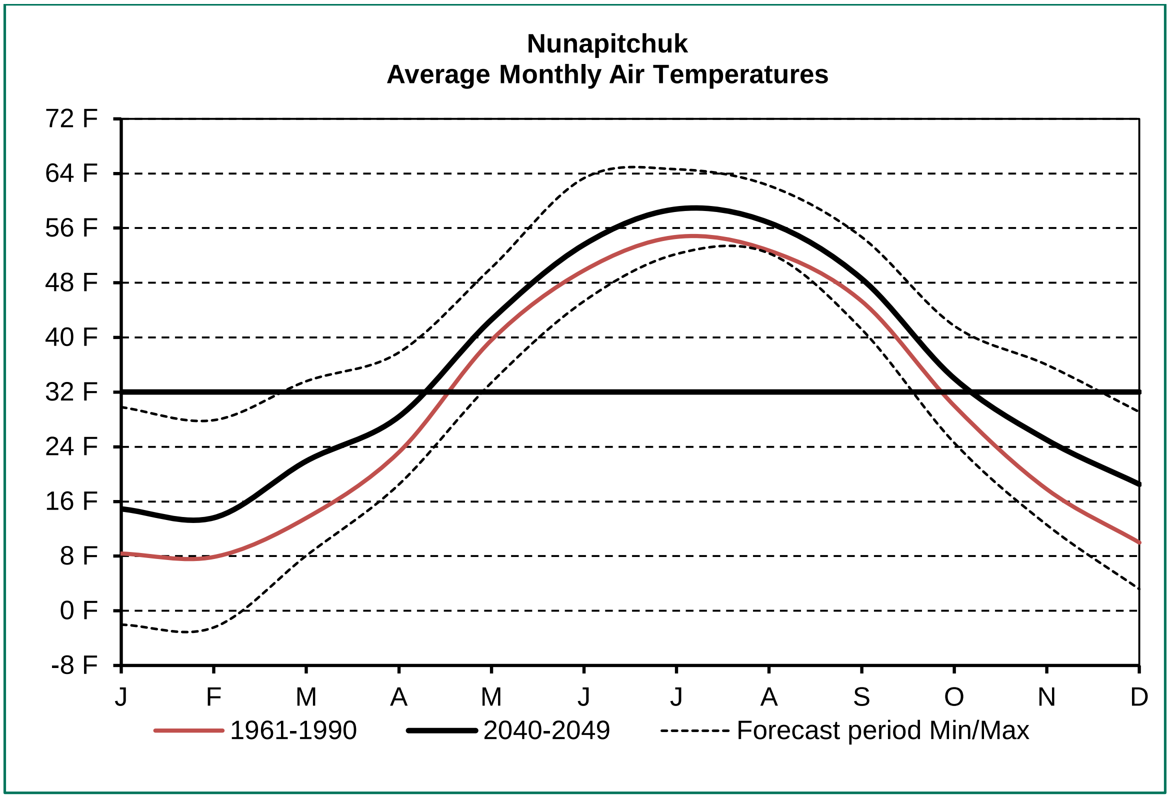
Preliminary ground temperatures were measured the same day of the geotechnical drilling. However, these temperatures reflect drilling induced heat. Golder returned to the village April 22, 2016, approximately 8 days after drilling, to measure temperatures. Unfortunately, the PVC standpipes were damaged. However, with some effort we were able to access PVC standpipes in borings G16-01 and G16-02. The standpipe in boring G16-03 was too extensively damaged for our use and only the ground temperatures measured April 15, 2016 soon after drilling are available. Based on ground temperature data, a relatively wide spread in ground temperatures are noted. Ground temperature variations are probably related to the level of PVC damage, nearby structure influences, snow cover, and possibly continued stabilization from drilling induced heat. However, it appears ground temperatures trend toward 30.5°F with depth, as summarized in the flowing plot. These ground temperatures are in general agreement with historic ground temperatures measured by us in the area.



Regional climate impacts within the expected service life of this structure are expected to result in warmer permafrost temperatures, increased active layer (seasonal thaw depth) and possible permafrost degradation in some areas throughout the Yukon-Kuskokwim region.

4.0 CLIMATE

Nunapitchuk is located north of Bethel, AK along the Johnson River. Climate, and in particular, air temperature changes are expected to continue to occur in the Nunapitchuk area. For our analysis, we have relied on air temperature forecast data developed by the University of Alaska, Scenarios Network for Alaska & Arctic Planning (SNAP). The SNAP group has developed publically available air temperature forecast models for Alaska, including the Barrow area, based on Global Circulation Models (GCM) and various carbon emission scenarios the SNAP group considers most applicable for Alaska.



Period		Average Air Temperature	Freeze Index	Thaw Index
1961-1990	Mean	29.4 F	3,410 F-days	2,600 F-days
2040-2049	5 Model Mean	34.7 F	2,090 F-days	3,140 F-days
2040-2049	Maximum	44.2 F	270 F-days	4,780 F-days
2040-2049	Minimum	23.9 F	4,860 F-days	1,980 F-days

Maximum: Warmest Values from all 5 GCM Models
Minimum: Coldest Values from all 5 GCM Models

DESIGN (AVE 5 MODEL AVE AND MAX)	3,470 F-days	3,960 F-days

The passive subgrade cooling system design should be based, in part, on a freeze index that reflects the forecast warmer winter air temperature conditions. We recommend a maximum 2,000°F-day freeze index for passive subgrade cooling design.

5.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

Based on the field data, a pile supported foundation is recommended for the Washeteria/WTP and fuel storage tank. A driven H-pile with passive subgrade cooling is recommended for the building and fuel storage tank foundations. Two pile/passive subgrade cooling options are provided. Both options are based on HP10x57 driven piles. The structural engineer will need to evaluate the axial and lateral stability for these piles. Larger dimensioned H-piles or pipe piles can be considered if needed, pending the structural engineer's analysis.

Option 1: HP10x57 embedded at least 45 feet below grade and at least 10 feet into the frozen sand layer. With this option, all piles will require passive subgrade cooling installed directly alongside the piles. Passive subgrade cooling for this option should consist of Arctic Foundations Inc. (AFI) Thermoprobes with a nominal 1.5 inch diameter evaporator and a minimum 35 square foot (SF) condenser sections. The condenser section will most likely require a slight bend or offset to accommodate the pile and pile cap geometry. Sloping condensers should be oriented normal to the expected prevailing winter wind direction. The Thermoprobes for this option should be installed in an appropriate sleeve permanently attached to the H-pile prior to driving. A cement grout backfill is recommended between the Thermoprobe and the sleeve.

Option 2: HP10x57 embedded at least 40 feet below grade and at least 7 feet into the frozen fine sand layer. The piles will also require passive subgrade cooling. The passive subgrade cooling for Option 2 should be AFI Thermoprobes with a nominal 3-inch diameter evaporator and a minimum 70 SF foot condenser sections installed as standalone units within 3 to 4 horizontal feet from the perimeter H-piles. A sand and potable water slurry or cement grout is recommended for Thermoprobe backfill if installed directly in the soil. If the Thermoprobes are installed in a sleeve, grout backfill is required. All perimeter piles should have this passive cooling geometry. The proposed utilidor may restrict the available clear space under the building and thus the prevailing winds from reaching the interior pile. 1.5-inch nominal diameter evaporators with a minimum 35 SF condenser Thermoprobes should be used along interior piles, installed as recommended for Option 1.

For both options, a sustained axial capacity of 35 kips per pile can be used with a point of fixity at 4 feet below the tundra surface. For geotechnical purposes, sustained loads are considered full dead load and 50-percent of the live load, excluding snow load.

We recommend the under soffit utilidors remain at least 18 inches above finish grade and include sloped sides to aid in improving air flow around the utilidor sections. A minimum 8-inch vertical clearance is recommended between the base of the lift station and finish grade.

6.0 USE OF REPORT

These preliminary recommendations were prepared for CRW Engineering Group, LLC and their design team for use in the preliminary design of the proposed washeteria and water treatment plant. We will need to review the building, structural and civil plans as they are developed. This is particularly important regarding the building orientation to prevailing winds, under soffit obstructions and general constructability considerations since a gravel pad is not planned for this facility.

If there are significant changes in the nature, design, or location of the facilities, we should be notified so that we may review our conclusions and recommendations with consideration of the proposed changes and provide a written modification or verification of the changes.

Unanticipated soil conditions are commonly encountered and cannot fully be determined by a limited number of explorations or soil samples. Such unexpected conditions frequently result in additional project costs in order to build the project as designed. Therefore, a contingency for unanticipated conditions should be included in the construction budget and schedule.

The work program followed the standard of care expected of professionals undertaking similar work in Alaska under similar conditions. No warranty expressed or implied is made.

We appreciate the opportunity to provide work on this project. Please contact Richard Mitchells at 907-865-2537 if you have questions or comments.

GOLDER ASSOCIATES INC.

Cara W. Shonsey

Cara W. Shonsey, PE
Project Engineer

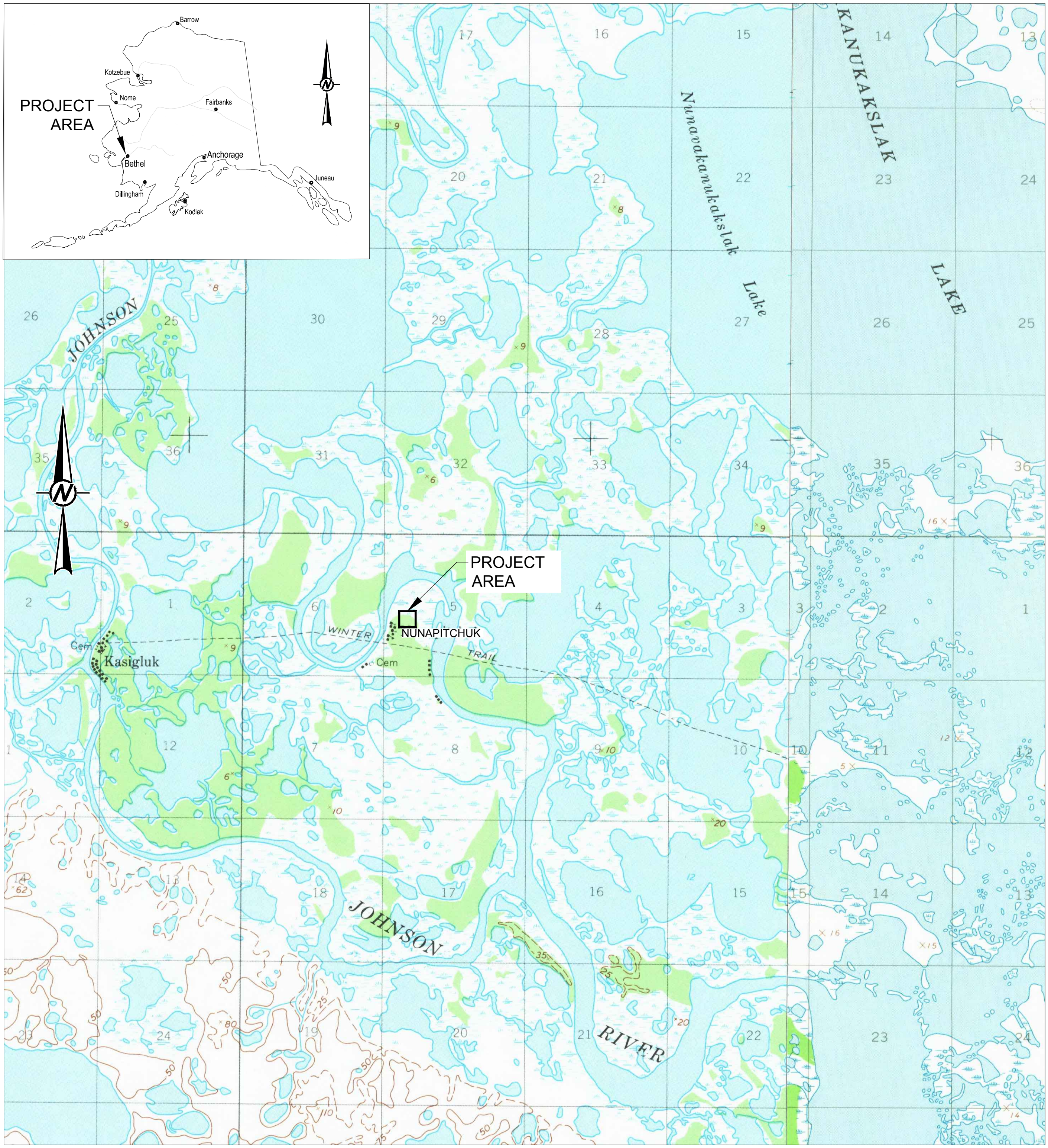
Richard Mitchells

Richard A. Mitchells, PE
Principal and Senior Geotechnical Engineer

Attachments:
Figure 1: Vicinity Map
Figure 2: Borehole Location Map
Appendix A: Borehole Logs
Appendix B: Laboratory Testing
Appendix C: Photo Log

CWS/RAM/mlp

FIGURES



REFERENCE(S)

1:63,360 SCALE TOPOGRAPHIC MAP WAS PRODUCED AND DISTRIBUTED BY U.S.G.S. QUADRANGLES USED INCLUDED BAIRD INLET (D-1), ALASKA (1954), AND BAIRD INLET (D-2), ALASKA (1954).

0 1/2 1

1" = 1 mi MILES

CLIENT

CRW ENGINEERING GROUP, LLC

PROJECT

NUNAPITCHUK WASHETERIA

NUNAPITCHUK, ALASKA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-08-15
DESIGNED	-
PREPARED	APG
REVIEWED	CWS
APPROVED	RAM

TITLE

VICINITY MAP

PROJECT NO.	CONTROL	REV.	FIGURE
1529871		A	1

Path: \Anchorage\Public\Geomatics\CRW\Nunapitchuk\99_PROJECTS\1529871 CRW Nunapitchuk Washeteria\200_REPORT\02_PRODUCTION\DWG\ | File Name: 1529871.001.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

1 in

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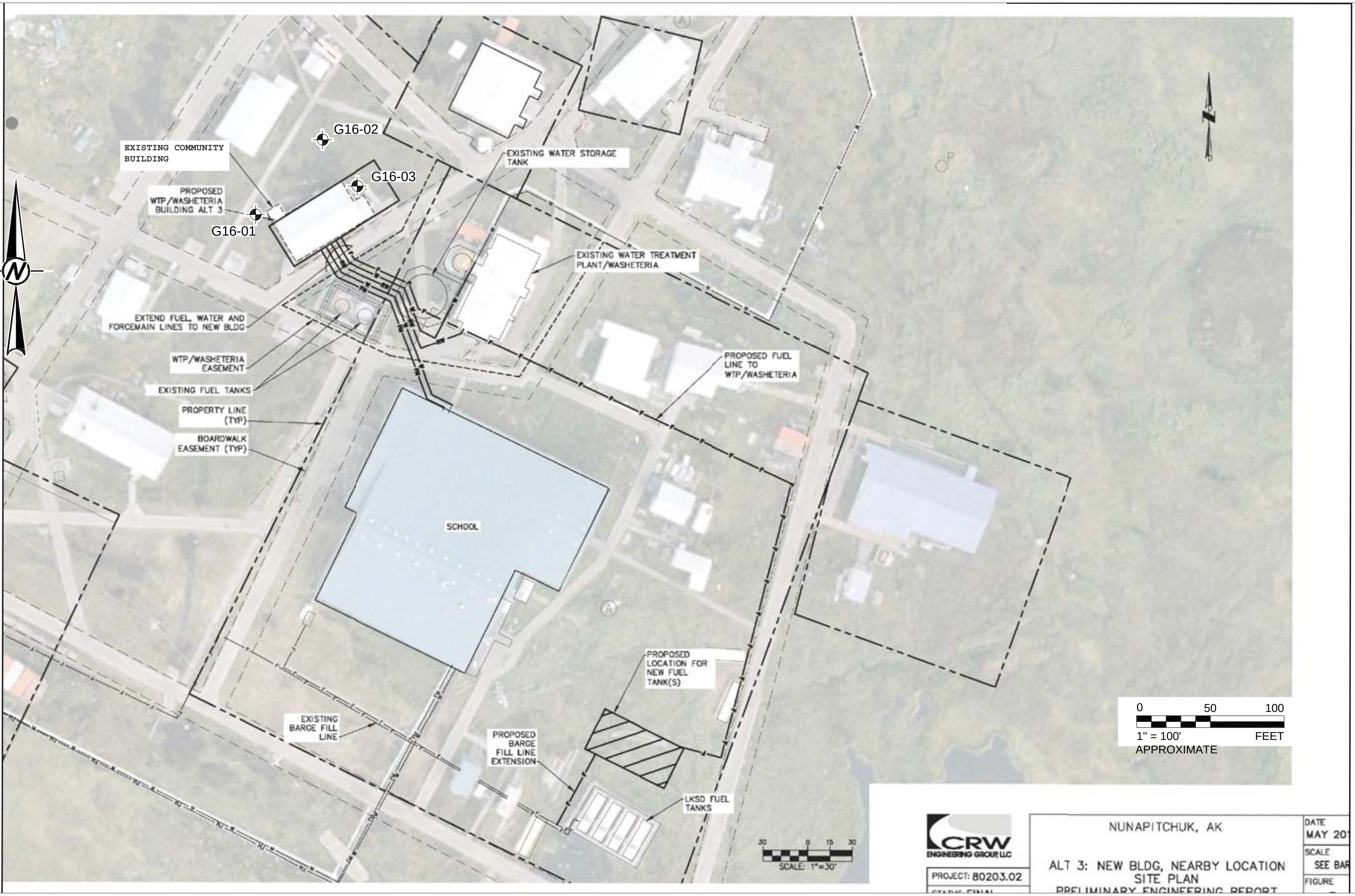


REFERENCE(S)

BASEMAP PROVIDED IN PDF FORMAT BY CRW ENGINEERING GROUP, LLC ON 2016-03-21.

LEGEND

⌖ G16-BH-##	2016 GOLDER BOREHOLE NAME & LOCATION

CLIENT
CRW ENGINEERING GROUP, LLC

CONSULTANT

YYYY-MM-DD	2016-08-15
DESIGNED	-
PREPARED	APG
REVIEWED	CWS
APPROVED	RAM

Golder Associates

PROJECT
NUNAPITCHUK WASHETERIA

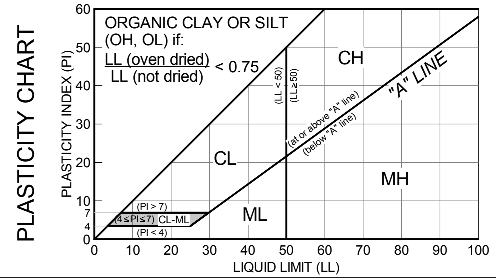
NUNAPITCHUK, ALASKA

TITLE
BOREHOLE LOCATION MAP

PROJECT NO.	CONTROL	REV.	FIGURE
1529871		A	2

APPENDIX A
BOREHOLE LOGS

UNIFIED SOIL CLASSIFICATION (adapted from ASTM D2487)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES AND GROUP SYMBOLS USING LABORATORY TESTS			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND		
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >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 GRAVEL	▨	If soil contains ≥15% sand, add "with sand"
			$C_U < 4$ AND/OR [$C_C < 1$ OR $C_C > 3$]	GP	POORLY GRADED GRAVEL	▨	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR MH	GM	SILTY GRAVEL	▨	
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL	▨	
	SANDS ≥50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	$C_U \geq 6$ AND $1 \leq C_C \leq 3$	SW	WELL-GRADED SAND	▨	If soil contains ≥15% gravel, add "with gravel"
			$C_U < 6$ AND/OR [$C_C < 1$ OR $C_C > 3$]	SP	POORLY GRADED SAND	▨	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND	▨	
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	▨	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT <50			CL	LEAN CLAY	▨	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	SILT	▨	
				OL	ORGANIC CLAY OR SILT	▨	
	SILTS AND CLAYS LIQUID LIMIT ≥50			CH	FAT CLAY	▨	
				MH	ELASTIC SILT	▨	
				OH	ORGANIC CLAY OR SILT	▨	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	▨	

$$C_U = \frac{D_{60}}{D_{10}} \qquad C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

NOTES:
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. The coefficient of uniformity, C_U, and coefficient of curvature, C_C equations are given above where $D_{(X\%)}$ is soil particle diameter where X% is % finer. *Optional Abbeviations:* Lower case "s" after USCS group symbol denotes either "sandy" or "with sand" while "g" denotes either "gravelly" or "with gravel"

RELATIVE DENSITY / CONSISTENCY ESTIMATE USING STANDARD PENETRATION TEST (SPT) VALUES
(adapted from Terzaghi and Peck 1967 and NAVFAC DM 7.1)

COHESIONLESS SOILS [a]		COHESIVE SOILS[b]		
RELATIVE DENSITY	$(N_1)_{60}$ (blows/ft)[c]	CONSISTENCY	$(N_1)_{60}$ (blows/ft)[c]	UNCONFINED COMPRESSIVE STRENGTH (TSF)[d]
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
COMPACT (MEDIUM DENSE)	10 - 30	FIRM	4 - 8	0.50 - 1.0
		STIFF	8 - 15	1.0 - 2.0
DENSE	30 - 50	VERY STIFF	15 - 30	2.0 - 4.0
VERY DENSE	OVER 50	HARD	OVER 30	OVER 4.0

(a) Soils consisting of gravel, sand, and silt, either separately or in combination possessing no characteristics of plasticity, and exhibiting drained behavior.
(b) Soils possessing the characteristics of plasticity, and exhibiting undrained behavior.
(c) Refer to ASTM D1586 for a definition of N value. $(N_1)_{60}$ is the N value corrected for hammer energy and overburden pressure, and is detailed in ASTM D6066. N values may be affected by a number of factors including: material size, sampler size, hammer weight and type, depth, drilling method, and borehole disturbance. N values are only an approximate guide for cohesive soil and do not apply to frozen soil.
(d) Undrained shear strength, s_u= 1/2 unconfined compression strength, U_c. Note that Torvane (TV) measures s_u and pocket penetrometer (PP) measures U_c

CRITERIA FOR DESCRIBING MOISTURE CONDITION
(adapted from 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

COMPONENT DEFINITIONS BY GRADATION

COMPONENT	SIZE RANGE
BOULDERS	GREATER THAN 12 in.
COBBLES	12 in. to 3 in.
GRAVEL	3 in. to #4 Sieve (4.76 mm)
COARSE GRAVEL	3 in. to 3/4 in.
FINE GRAVEL	3/4 in. to #4 (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)	SMALLER THAN #200 (0.074 mm)

SAMPLER ABBREVIATIONS

SS	SPT Sampler (2 in. OD, 140 lb hammer)			**C**	Core (Diamond Bit)
HD	Large Split Spoon (3 in. OD, 300/340 lb hammer)			**TW**	Thin Wall (Shelby Tube)
-BL	Brass Liners used in Split Spoon			**TP**	Thin Wall Piston Sampler
R	Refusal when driving Split Spoon			**MS**	Modified Shelby
CA	Continous Core (Soil in Hollow-Stem Auger)			**MC**	Geoprobe Macro-Core
GS	Grab Sample from Surface / Test Pit			**RC**	Air Rotary Cuttings
AC	Auger Charge	**AW**	Auger Wash	**AG**	Auger Cuttings

DESCRIPTIVE TERMINOLOGY FOR PERCENTAGES (ASTM D2488)

DESCRIPTIVE TERMS	RANGE OF PROPORTION
TRACE	0 - 5%
FEW	5 - 10%
LITTLE	10 - 25%
SOME	30 - 45%
MOSTLY	50 - 100%

LABORATORY TEST AND NOTES ABBREVIATIONS / SYMBOLS

Con	Consolidation	**PID**	Photoionization Detector	**TXCD**	Triaxial, Consolidated Drained
Dd	Dry Density	**PM**	Modified Proctor (D1557)	**TXCU**	Triaxial, Consolidated Undrained
K	Thermal Conductivity	**PP**	Pocket Penetrometer (Field)	**TXUU**	Triaxial, Unconsolidated Undrained
MA	Sieve and Hydrometer	**PTLD**	Point Load	W_L	Liquid Limit (LL)
NP	Non-plastic	**SA**	Sieve Analysis	W_P	Plastic Limit (PL)
OLI	Organic Loss	**SpG**	Specific Gravity	**Ω**	Soil Resistivity (Res.)
P200	Passing #200 Sieve (D1140)	**TC**	Thaw Consolidation/Strain	▼	Water Level
pH	Soil pH	**TV**	Torvane (Field)	▽	Water Level While Drilling
PI	Plasticity Index (D4318)				

Golder Associates

SOIL CLASSIFICATION / LEGEND

Figure
A-1

FROZEN SOIL CLASSIFICATION (ASTM D4083)

1. DESCRIBE SOIL INDEPENDENT OF FROZEN STATE	CLASSIFY SOIL BY THE UNIFIED SOIL CLASSIFICATION SYSTEM				
	MAJOR GROUP		SUBGROUP		
	DESCRIPTION	DESIGNATION	DESCRIPTION		DESIGNATION
2. MODIFY SOIL DESCRIPTION BY DESCRIPTION OF FROZEN SOIL	Segregated ice not visible by eye	N	Poorly bonded of friable		Nf
			Well bonded	No excess ice	Nbn
				Excess ice	Nbe
	Segregated ice visible by eye (ice less than 25 mm thick)	V	Individual ice crystals or inclusions		Vx
			Ice coatings on particles		Vc
			Random or irregularly oriented ice formations		Vr
			Stratified or distinctly oriented ice formations		Vs
			Uniformly distributed ice		Vu
3. MODIFY SOIL DESCRIPTION BY DESCRIPTION OF SUBSTANTIAL ICE STRATA	Ice greater than 25 mm thick	ICE	Ice with soil inclusions		ICE+soil type
			Ice without soil inclusions		ICE

FROST DESIGN SOIL CLASSIFICATION (1)

FROST GROUP	GENERAL SOIL TYPE	% FINER THAN 0.02 mm BY WEIGHT	TYPICAL USCS SOIL CLASS
NFS (non-frost suceptable)	(a) Gravels Crushed stone Crushed rock	0 to 1.5	GW, GP
	(b) Sands	0 to 3	SW, SP
NFS [PFS(3)](2)	(a) Gravels Crushed stone Crushed rock	1.5 to 3	GW, GP
F1 [S1](2)	Gravelly soils	3 to 6	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
F1	Gravelly soils	6 to 10	GM, GC, GM-GC, GW-GM, GP-GM, GW-GC, GP-GC
F2 [PFS(3)/S2](2)	Sandy soils	3 to 6	SW, SP, SW-SM, SP-SM, SW-SC, SP-SC
F2	(a) Gravelly soils	10 to 20	GW, GP, GW-GM, GP-GM, GW-GC, GP-GC
	(b) Sands	6 to 15	SM, SW-SM, SP-SM, SC, SW-SC, SP-SC, SM-SC
F3	(a) Gravelly soils	Over 20	GM, GC, GM-GC
	(b) Sands, except very fine silty sands	Over 15	SM, SC, SM-SC
	(c) Clays, PI>12	--	CL, CH
F4	(a) Silts	--	ML, MH, ML-CL
	(b) Very fine silty sands	Over 15	SM, SC, SM-SC
	(c) Clays, PI<12	--	CL, ML-CL
	(d) Varved clays or other fine-grained banded sediments	--	CL or CH layered with ML, MH, ML-CL, SM, SC, or SM-SC

(1) From Municipality of Anchorage (MOA) Design Criteria Manual (DCM), 2007 and 2014; Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5320-6E; U.S. Army Corps of Engineers (USACE) "Arctic and Subarctic Construction, Runway and Road Design," Technical Manual TM 5-852-3, 1965; and USACE "Military Soils Engineering" Field Manual FM 5-410, 1997

(2) PFS, S1, and S2 frost groups from USACE, EM 1110-3-138, "Pavement Criteria for Seasonal Frost Conditions," April 1984

(3) Possibly frost susceptible, requires lab test for void ratio to determine frost design soil classification. Gravel with void ratio > 0.25 would be NFS; Gravel with void ratio < 0.25 would be S1; Sands with void ratio > 0.30 would be NFS; Sands with void ratio < 0.30 would be S2 or F2

ICE BONDING SYMBOLS

☐	No ice-bonded soil observed
▤	Poorly bonded or friable
■	Well bonded

DEFINITIONS

Candled Ice is ice which has rotted or otherwise formed into long columnar crystals, very loosely bonded together.

Clear Ice is transparent and contains only a moderate number of air bubbles.

Cloudy Ice is translucent, but essentially sound and non-pervious

Friable denotes a condition in which material is easily broken up under light to moderate pressure.

Granular Ice is composed of coarse, more or less equidimensional, ice crystals weakly bonded together.

Ice Coatings on particles are discernible layers of ice found on or below the larger soil particles in a frozen soil mass. They are sometimes associated with hoarfrost crystals, which have grown into voids produced by the freezing action.

Ice Crystal is a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in a combination with other ice formations.

Ice Inclusions are individual ice masses visible in the face of a soil mass. Inclusions may be present alone or in a combination with other ice formations.

Ice Lenses are lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss and commonly in repeated layers.

Ice Segregation is the growth of ice as distinct lenses, layers, veins and masses in soils, commonly but not always oriented normal to direction of heat loss.

Massive Ice is a large mass of ice, typically nearly pure and relatively homogeneous.

Poorly-bonded signifies that the soil particles are weakly held together by the ice and that the frozen soil consequently has poor resistance to chipping or breaking.

Porous Ice contains numerous voids, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

Thaw-Stable frozen soils do not, on thawing, show loss of strength below normal, long-time thawed values nor produce detrimental settlement.

Thaw-Unstable frozen soils show on thawing, significant loss of strength below normal, long-time thawed values and/or significant settlement, as a direct result of the melting of the excess ice in the soil.

Well-Bonded signifies that the soil particles are strongly held together by the ice and that the frozen soil possesses relatively high resistance to chipping or breaking.

Golder Associates

FROZEN SOIL CLASSIFICATION / LEGEND

Figure A-2

RECORD OF BOREHOLE G16-01

SHEET 1 of 1

PROJECT: Nunapitchuk Washeteria
PROJECT NUMBER: 1529871
LOCATION: Nunapitchuk, AK

CLIENT: CRW Engineering Group, LLC
DRILLING DATE: 4/14/2016
EQUIPMENT: Geoprobe 66200T

DATUM: WGS 84
ELEVATION: n/a
COORDS: 60.89706° N 162.45732° W

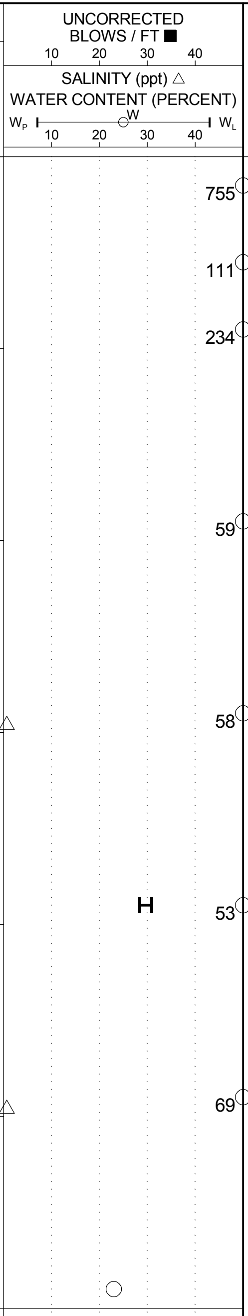
VEGETATION: tundra, swampy, near disturbed tundra

BORING METHOD: Direct Push

DESCRIPTION	ICE BOND	USCS	ELEV. / DEPTH (ft)
0.0 - 1.5 Frozen, red brown, PEAT; well bonded with approximately 15% visible ice by volume as white inclusions up to 0.25 inch thick (PT, Vx)	■	PT	1.5
1.5 - 4.0 Frozen, gray to red brown, SILT; trace fine-grained sand, few organics as fibers, well bonded with approximately 10% visible ice by volume as white inclusions up to 0.06 inch thick (ML, Vx)	■	ML	4.0
4.0 - 5.0 Frozen, red brown, PEAT; trace silt, well bonded with approximately 15% visible ice by volume as inclusions up to 0.25 inch thick (PT, Vx)	■	PT	5.0
5.0 - 30.0 Frozen, gray, SILT with sand; few to some fine-grained sand, sand content increases with depth, trace organics as fiberous peat layers and inclusions to 1 inch, well bonded with approximately 10-25% visible ice by volume as colorless to white inclusions and stratified formations up to 1.5 inch thick (ML, Vx-Vs)	■	ML	

Borehole completed at 30.0 ft.

SAMPLE DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in 140 lb Hammer (Reciprocating/Automatic) 30 Drop	BLOWS PER FT	REC / ATT (inch)
0 - 5	1-A, 1-B, & 1-C	MC5			60 / 60
5 - 10	2	MC5			60 / 60
10 - 15	3	MC5			60 / 60
15 - 20	4	MC5			60 / 60
20 - 25	5	MC5			60 / 60
25 - 30	6	MC5			60 / 60



DEPTH (ft)	NOTES, TESTS, WATER LEVELS
1.5	OLI = 8%
19.5	Gravel = 0%, Sand = 24%, Fines = 76%, MA

Notes
1) Representative samples taken at select intervals from 5 ft continuous core runs
2) 1-inch schedule 80 PVC installed to depth
3) No groundwater observed
4) Backfilled with surrounding surface material

DEPTH SCALE: 1 inch to 5 feet
DRILLING CONTRACTOR: GeoTek Alaska, Inc.
DRILLER: Tim

LOGGED: C. Shonsey
CHECKED: R. Mitchells
CHECK DATE: 8/15/2016

Figure A-3

RECORD OF BOREHOLE G16-02

SHEET 1 of 1

PROJECT: Nunapitchuk Washeteria	CLIENT: CRW Engineering Group, LLC	DATUM: WGS 84
PROJECT NUMBER: 1529871	DRILLING DATE: 4/14/2016	ELEVATION: n/a
LOCATION: Nunapitchuk, AK	EQUIPMENT: Geoprobe 66200T	COORDS: 60.89719° N 162.45711° W

BORING METHOD: Direct Push

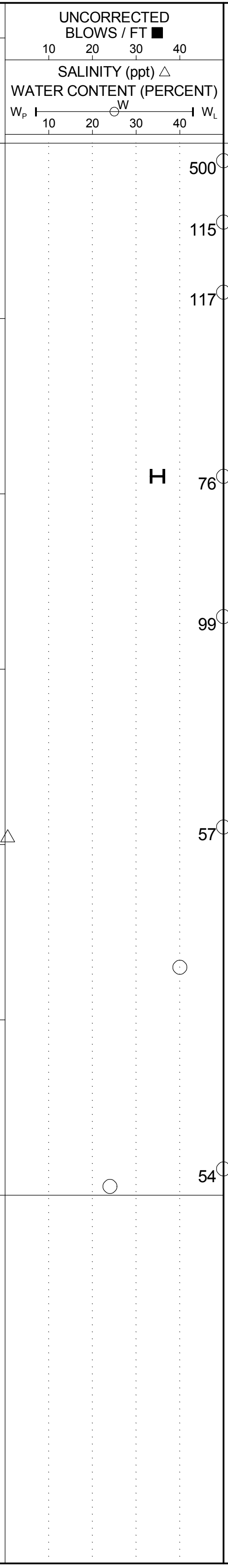
VEGETATION: grassy tundra

SOIL PROFILE

DEPTH (ft)	DESCRIPTION	ICE BOND	USCS	ELEV. / DEPTH (ft)
0.0 - 1.0	Frozen, reddish brown, PEAT; trace silt, well bonded with approximately 15-20% visible ice by volume as colorless inclusions up to 0.06 inch thick (PT, Vx)	■	PT	
1.0 - 7.5	Frozen, reddish brown to gray, SILT; few fine-grained sand, trace to few organics as fiberous peat (3 inch layer at 3.5 feet bgs), well bonded with approximately 10% visible ice by volume as colorless and white inclusions up to 0.5 inch thick (ML, Vx)	■	ML	1.0
7.5 - 30.0	Frozen, gray, SILT; trace to little fine-grained sand, sand increasing with depth, trace organics as fiberous peat and wood to 0.25 inches, well bonded with approximately 10-25% visible ice by volume as colorless and white inclusions and stratified formations (ML, Vx-Vs) increasing ice content around 24-25 feet bgs increasing organic content starting at 28 feet bgs	■	ML	7.5
30.0	Borehole completed at 30.0 ft.			

SAMPLES

NUMBER	TYPE	BLOWS per 6 in Hammer (Reciprocating) Drop	BLOWS PER FT	REC / ATT (inch)
1-A, 1-B, & 1-C	MC5			60 / 60
2	MC5			60 / 60
3	MC5			60 / 60
4	MC5			60 / 60
5	MC5			60 / 60
6-A & 6-B	MC5			60 / 60



NOTES / TESTS / WATER LEVELS

Gravel = 0%, Sand = 8%, Fines = 92%, MA

Gravel = 0%, Sand = 24%, Fines = 76%
OLI = 3%

Notes
1) Representative samples taken at select intervals from 5 ft continuous core runs
2) 1-inch schedule 80 PVC installed to depth
3) No groundwater observed
4) Backfilled with surrounding surface material

DEPTH SCALE: 1 inch to 5 feet	LOGGED: C. Shonsey	Figure A-4
DRILLING CONTRACTOR: GeoTek Alaska, Inc.	CHECKED: R. Mitchells	
DRILLER: Tim	CHECK DATE: 8/15/2016	

Golder Associates

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC BOREHOLE] CShonsey 8/22/16

RECORD OF BOREHOLE G16-03

SHEET 1 of 2

PROJECT: Nunapitchuk Washeteria
PROJECT NUMBER: 1529871
LOCATION: Nunapitchuk, AK

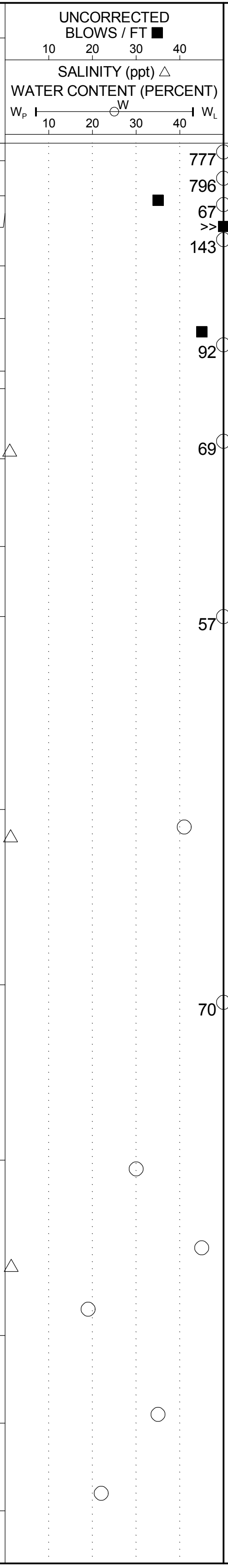
CLIENT: CRW Engineering Group, LLC
DRILLING DATE: 4/14/2016
EQUIPMENT: Geoprobe 66200T

DATUM: WGS 84
ELEVATION: n/a
COORDS: 60.89711° N 162.45699° W

VEGETATION: tundra, swampy, near disturbed tundra

BORING METHOD	DESCRIPTION	ICE BOND	USCS	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (Hammer (Reciprocating) Drop)	BLOWS PER FT	REC / ATT (inch)	NOTES TESTS WATER LEVELS
Hollow Stem Auger	0.0 - 1.5 Frozen, red brown, PEAT; trace silt, ice decreases with depth, well bonded with approximately 5-45% visible ice by volume as colorless and white inclusions (PT, Vx)	■	PT		1 2-A	GS SS	 9		 12/12	
	1.5 - 17.0 Frozen, gray, SILT; few fine-grained sand, trace to few organics as fiberous peat inclusions to 0.5 and 3 inch layers, ice decreases with depth, well bonded with approximately 15-35% visible ice by volume as white inclusions and irregularly oriented formations up to 0.25 inch thick (ML, Vx-Vr)	■	ML	1.5	2-B 3	SS SS	-18-17 23-23-28	35 51	6/6 18/18	
					4	SS	17-25-20	45	24/18	Gravel = 0%, Sand = 8%, Fines = 92%, SA
Direct Push					5	MC5			30/24	
					6	MC5			30/24	
	17.0 - 29.5 Frozen, gray to reddish brown, SILT; trace to few fine-grained sand, well bonded with approximately 5-25% visible ice by volume as white and cloudy inclusions and stratified formations up to 0.5 inch thick (ML, Vx-Vs)	■	ML	17.0	7	MC5			60/60	
	trace organics as fibers starting at 24 feet bgs, increasing with depth				8	MC5			60/60	Gravel = 0%, Sand = 2%, Fines = 98%
										OLI = 5%
	29.5 - 30.5 Frozen, gray, poorly graded SAND; trace silt, well bonded with approximately 15% visible ice by volume as colorless inclusions (SP, Vx)	■	SP	29.5	9-A, 9-B, & 9-C	MC5			60/60	
	30.5 - 32.5 Frozen, red brown, SILT; few fine-grained sand, well bonded with approximately 10% visible ice by volume as colorless inclusions (ML, Vx)	■	ML	30.5						Gravel = 0%, Sand = 96%, Fines = 4%
	32.5 - 36.0 Frozen, gray, poorly graded SAND; trace silt, well bonded with approximately 15% visible ice by volume as colorless inclusions (SP, Vx)	■	SP	32.5	10	MC5			60/30	
	36.0 - 36.5 Frozen, gray, SILT; little fine-grained sand, trace organics as OL inclusions to 0.75 inches, well bonded with approximately 10% visible ice by volume as white inclusions up to 0.1 inch thick (ML, Vx)	■	ML	36.0						Gravel = 0%, Sand = 13%, Fines = 87%
		■	SP	36.5	11	MC5			30/30	Gravel = 0%, Sand = 96%, Fines = 4%, SA
		■				MC5			60/60	

Log continued on next page



DEPTH SCALE: 1 inch to 5 feet
DRILLING CONTRACTOR: GeoTek Alaska, Inc.
DRILLER: Tim

LOGGED: C. Shonsey
CHECKED: R. Mitchells
CHECK DATE: 8/15/2016

Golder Associates

Figure A-5

RECORD OF BOREHOLE G16-03

SHEET 2 of 2

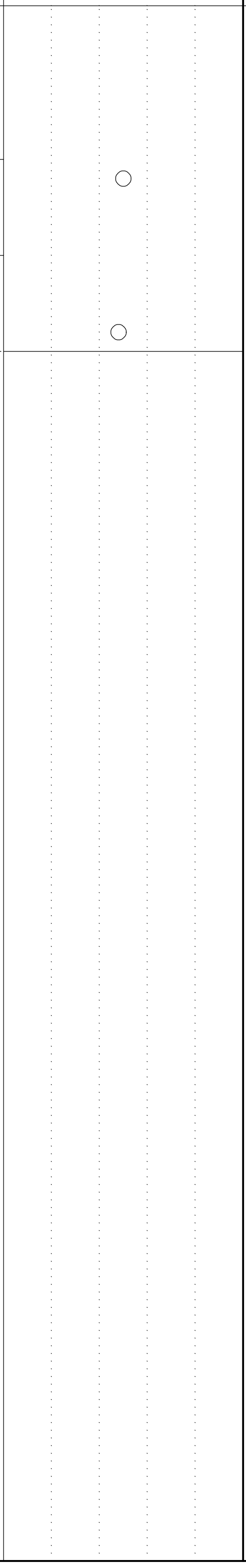
PROJECT: Nunapitchuk Washeteria
PROJECT NUMBER: 1529871
LOCATION: Nunapitchuk, AK

CLIENT: CRW Engineering Group, LLC
DRILLING DATE: 4/14/2016
EQUIPMENT: Geoprobe 66200T

DATUM: WGS 84
ELEVATION: n/a
COORDS: 60.89711° N 162.45699° W

VEGETATION: tundra, swampy, near disturbed tundra

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	ICE BOND	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (Hammer (Reciprocating) Drop)	BLOWS PER FT	REC / ATT (inch)	UNCORRECTED BLOWS / FT ■ / SALINITY (ppt) △ / WATER CONTENT (PERCENT) W_P ⊢ W ○ ⊣ W_L (10 20 30 40)	NOTES TESTS WATER LEVELS
40	Direct Push	36.5 - 49.0 Frozen, light gray, poorly graded SAND; trace to few silt, trace organics as fiberoius peat to wood fibers, well bonded with approximately 10-20% visible ice by volume as colorless inclusions (SP, Vx) *(Continued)*	■	SP	▨			MC5			60 / 60		
45							12 & 13	MC5			36 / 30	○	
												○	Gravel = 0%, Sand = 95%, Fines = 5%, SA
49		Borehole completed at 49.0 ft.											
50													
55													
60													
65													
70													
75													
80													



Notes
1) Representative samples taken at select intervals from 5 or 2.5 ft continuous core runs
2) 1-inch schedule 80 PVC installed to depth
3) No groundwater observed
4) Backfilled with surrounding surface material

Golder Associates

DEPTH SCALE: 1 inch to 5 feet
DRILLING CONTRACTOR: GeoTek Alaska, Inc.
DRILLER: Tim

LOGGED: C. Shonsey
CHECKED: R. Mitchells
CHECK DATE: 8/15/2016

Figure A-5

APPENDIX B
LABORATORY DATA

TABLE B-1: SAMPLE SUMMARY

Client: CRW Engineering Group, LLC
Project No.: 1529871
Project: Nunapitchuk Washeteria
Location: Nunapitchuk, AK
Reviewed By: M. Faulise
Date: 6/8/2016

SAMPLING DATA							CLASSIFICATION AND INDEX TEST RESULTS										
SAMPLE LOCATION	SAMPLE NUMBER	DEPTH (ft)		RECOVERY (%)	SAMPLE TYPE	BLOWS PER FOOT	NATURAL MOISTURE CONTENT (%)	LIQUID LIMIT (LL) (%)	PLASTIC LIMIT (PL) (%)	PLASTICITY INDEX (PI) (%)	GRADATION (%)			ORGANIC CONTENT (%)	SALINITY (ppt) [$^{(d)}$is directly meas.]	DESCRIPTION (USCS)	TESTS / OTHER TESTS
		TOP	BOTTOM								GRAVEL	SAND	FINES (SILT & CLAY)				
G16-01	1-A	0.0	1.5	100	MC5		755										
G16-01	1-B	1.5	4.0				111							8			
G16-01	1-C	4.0	5.0				234										
G16-01	2	9.0	10.0	100	MC5		59										
G16-01	3	14.0	15.0	100	MC5		58								1		
G16-01	4	19.0	20.0	100	MC5		53	31	28	3	0	24	76			ML	MA
G16-01	5	24.0	25.0	100	MC5		69								1		
G16-01	6	29.0	30.0	100	MC5		23										
G16-02	1-A	0.0	1.0	100	MC5		500										
G16-02	1-B	1.0	3.5				115										
G16-02	1-C	3.5	5.0				117										
G16-02	2	9.0	10.0	100	MC5		76	36	33	3	0	8	92			ML	MA
G16-02	3	13.0	14.0	100	MC5		99										
G16-02	4	19.0	20.0	100	MC5		57								1		
G16-02	5	23.0	24.0	100	MC5		40										
G16-02	6-A	29.0	29.5				54				0	24	76			ML	
G16-02	6-B	29.5	30.0				24							3			
G16-03	1	0.0	0.5	100	GS		777										
G16-03	2-A	0.5	1.5	100	SS		796										
G16-03	2-B	1.5	2.0	100	SS	35	67										
G16-03	3	2.0	3.5	100	SS	51	143										
G16-03	4	5.0	6.5	133	SS	45	92				0.0	8.3	91.7			ML	SA
G16-03	5	8.0	9.0	125	MC5		69								1		
G16-03	6	13.0	14.0	125	MC5		57										
G16-03	7	19.0	20.0	100	MC5		41								1		
G16-03	8	24.0	25.0	100	MC5		70				0	2	98			ML	
G16-03	9-A	29.0	29.5	100	MC5		30							5			
G16-03	9-B	30.5	32.5				45								1		
G16-03	9-C	32.5	34.0				19				0	96	4			SP	
G16-03	10	36.0	36.5	200	MC5		35				0	13	87			ML	
G16-03	11	38.0	39.0	100	MC5		22				0	96	4			SP	SA
G16-03	12	44.0	45.0	120	MC5		25										

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC_SAMPLE_SUMMARY] CShonsey 8/22/16

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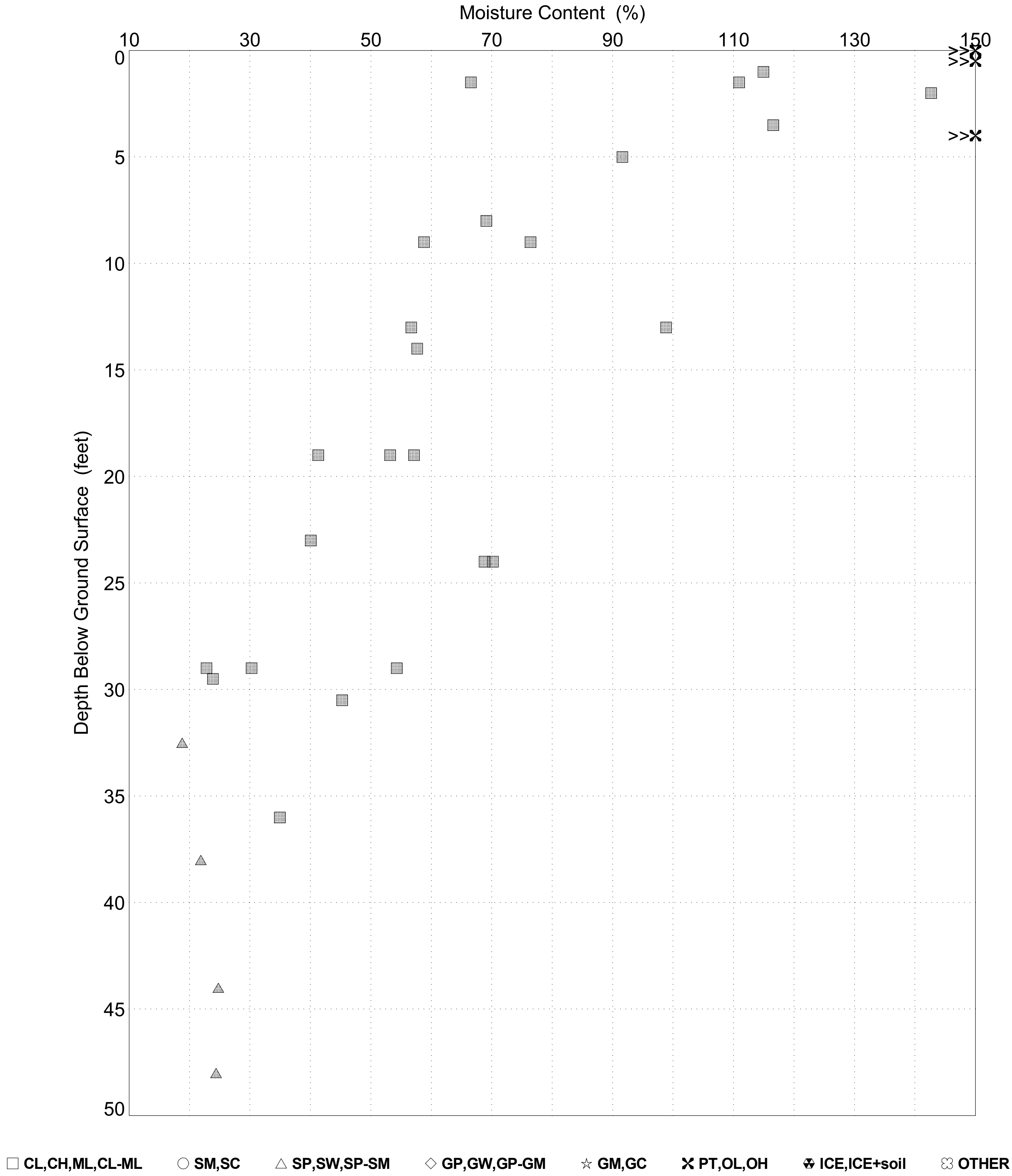
TABLE B-1: SAMPLE SUMMARY

Client: CRW Engineering Group, LLC
Project No.: 1529871
Project: Nunapitchuk Washeteria
Location: Nunapitchuk, AK
Reviewed By: M. Faulise
Date: 6/8/2016

SAMPLING DATA							CLASSIFICATION AND INDEX TEST RESULTS										
SAMPLE LOCATION	SAMPLE NUMBER	DEPTH (ft)		RECOVERY (%)	SAMPLE TYPE	BLOWS PER FOOT	NATURAL MOISTURE CONTENT (%)	LIQUID LIMIT (LL) (%)	PLASTIC LIMIT (PL) (%)	PLASTICITY INDEX (PI) (%)	GRADATION (%)			ORGANIC CONTENT (%)	SALINITY (ppt) [$^{(d)}$is directly meas.]	DESCRIPTION (USCS)	TESTS / OTHER TESTS
		TOP	BOTTOM								GRAVEL	SAND	FINES (SILT & CLAY)				
G16-03	13	48.0	49.0				24				0	95	5			SP-SM	SA

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC_SAMPLE_SUMMARY] CShonsey 8/22/16



NOTE: FILLED SOIL SYMBOL INDICATES FROZEN AND BONDED CONDITION

CLIENT
CRW ENGINEERING GROUP, LLC

PROJECT
NUNAPITCHUK WASHETERIA

NUNAPITCHUK, AK

CONSULTANT

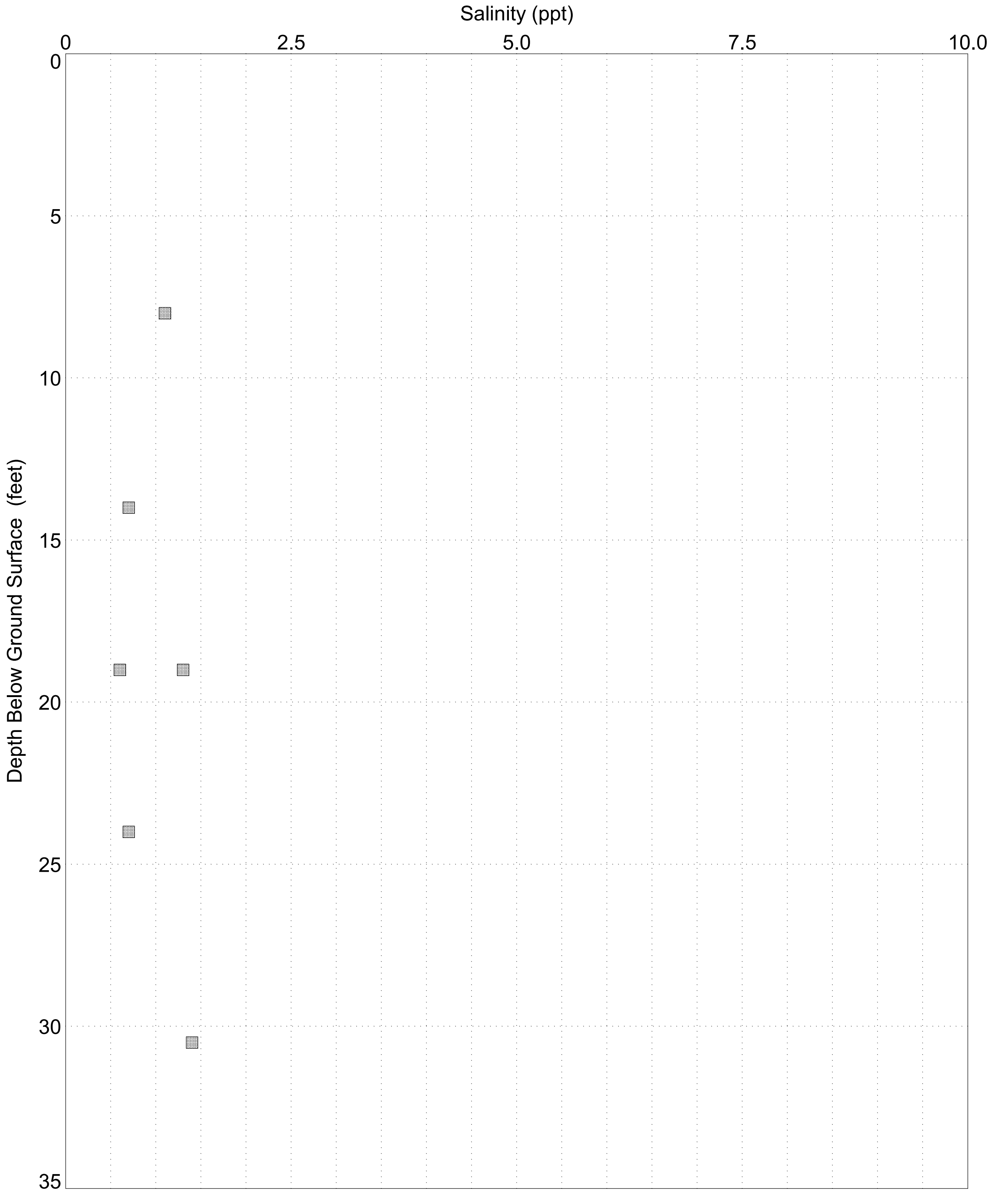
Golder Associates

YYYY-MM-DD	2016-08-22
PREPARED	CShonsey
DESIGN	N/A
REVIEW	RAM
APPROVED	RAM

TITLE
MOISTURE CONTENT VS. DEPTH

PROJECT No.	CONTROL	Rev.	FIGURE
1529871		----	B-1

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC WATER CONTENT] CShonsey 8/22/16



☐ **CL,CH,ML,CL-ML** ○ **SM,SC** △ **SP,SW,SP-SM** ◇ **GP,GW,GP-GM** ☆ **GM,GC** ✕ **PT,OL,OH** ☢ **ICE,ICE+soil** ✿ **OTHER**

NOTE: FILLED SOIL SYMBOL INDICATES FROZEN AND BONDED CONDITION

CLIENT
CRW ENGINEERING GROUP, LLC

PROJECT
NUNAPITCHUK WASHETERIA

NUNAPITCHUK, AK

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-08-22
PREPARED	CShonsey
DESIGN	N/A
REVIEW	RAM
APPROVED	RAM

TITLE
SALINITY VS. DEPTH

PROJECT No.	CONTROL	Rev.	FIGURE
1529871		----	B-2

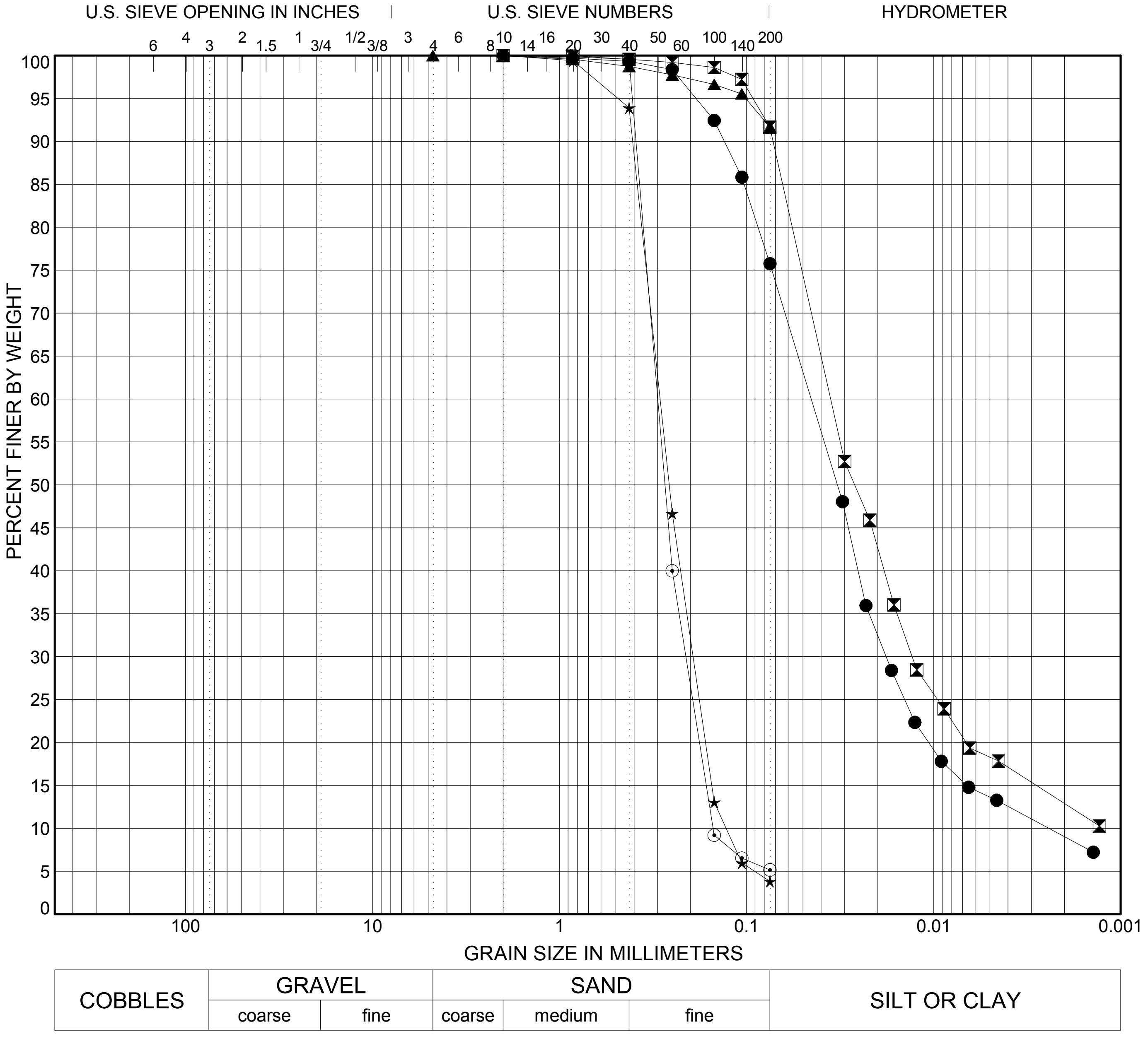
NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC SALINITY] CShonsey 8/22/16

Golder Associates

FIGURE B-3: SUMMARY OF PARTICLE SIZE DISTRIBUTION RESULTS

Reference(s)
ASTM D422
ASTM D6913

Client:	CRW Engineering Group, LLC	**Project No.:**	1529871		
Project:	Nunapitchuk Washeteria	**QA/QC By:**	J. Randazzo	**Date:**	5/3/2016
Location:	Nunapitchuk, AK	**Reviewed By:**	M. Faulise	**Date:**	6/8/2016



	Sample Location	Sample Number	Depth (ft)	USCS Classification	Cc	Cu	% Gravel	% Sand	% Fines	% < 0.02 mm
●	G16-01	4	19.0	silt with sand (ML)	3.0	18.7	0	24	76	33
⧗	G16-02	2	9.0	silt (ML)	-	-	0	8	92	43
▲	G16-03	4	5.0	silt (ML)	-	-	0.0	8.3	91.7	
★	G16-03	11	38.0	poorly graded sand (SP)	1.0	2.3	0	96	4	
⊙	G16-03	13	48.0	poorly graded sand with silt (SP-SM)	1.0	2.0	0	95	5	

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC LAB GRAIN SIZE] CShonsey 8/22/16

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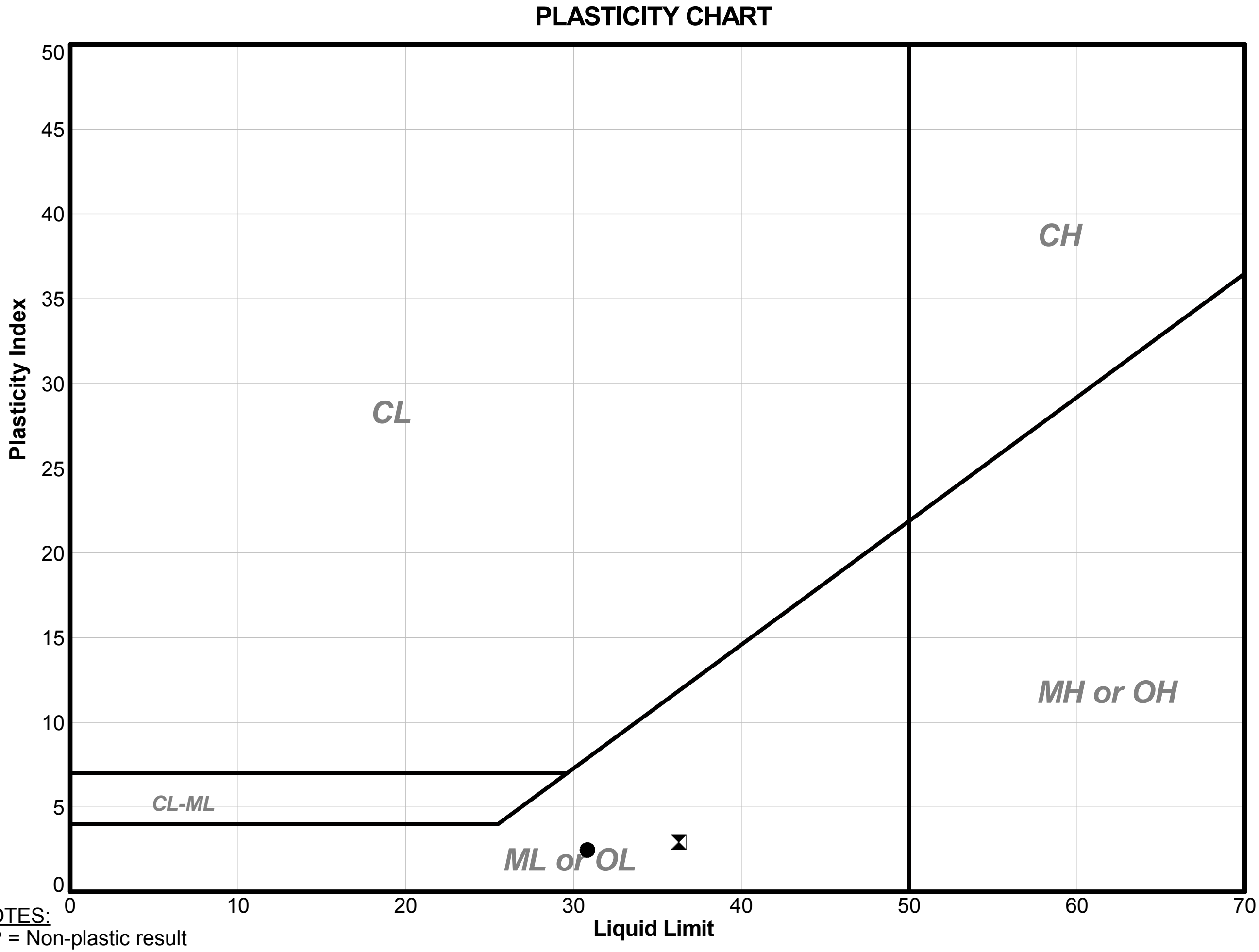
FIGURE B-4: LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Reference(s)
ASTM D4318

Client:	CRW Engineering Group, LLC	**Project No.:**	1529871		
Project:	Nunapitchuk Washeteria	**QA/QC By:**	J. Randazzo	**Date:**	5/3/2016
Location:	Nunapitchuk, AK	**Reviewed By:**	M. Faulise	**Date:**	6/8/2016



NOTES:
NP = Non-plastic result
Plastic Limit test performed by hand rolling
Liquid Limit test performed using mechanical device

	Sample Location	Sample Number	Depth (ft)	Bottom (ft)	Passing #40 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	USCS	Natural Moisture Content (%)
●	G16-01	4	19.0	20.0	99	31	28	3	ML	53
⧗	G16-02	2	9.0	10.0	100	36	33	3	ML	76

NUNAPITCHUCK WASHETERIA.GPJ LIBRARY-ANC(7-27-16).GLB [ANC LAB ATTERBERG CASAGRANDE MULTI (10)] CShonsey 8/22/16

APPENDIX C
PHOTO LOG

Project Title: Nunapitchuk Washeteria

PHOTO 1

Current community building on the site and the site prior to drilling

PHOTO 2

Closer view of the current community building at-grade timber foundation

PHOTO 3 Helicopter move of the drill rig in pieces from the airport to near the project site	
PHOTO 4 Example of a 5-foot long direct push sample recently extracted from Macro-Core® sampler (G16-01, 0-5 feet bgs)	

PHOTO 5 Finished temperature conduits at G16-02 (background) and G16-01 (foreground)	
PHOTO 6 Small diameter hole cut through floor and subfloor of existing community building for shallow probing	

PHOTO 7 Close up of temporary patch placed over floor (similar over subfloor)	
PHOTO 8 Temporary patch placed over floor in background