SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

ALASKA
CALIFORNIA
COLORADO
FLORIDA
MISSOURI
OREGON
WASHINGTON
WISCONSIN

October 27, 2014

CRW Engineering Group, LLC
3940 Arctic Boulevard, Suite 300
Anchorage, Alaska 99503

Attn: Mr. Michael Leguineche, P.E.

RE: PRESSURE REDUCING STATION 15 VAULT UPGRADE, MACINNES STREET AND TUDOR ROAD, ANCHORAGE, ALASKA

This letter presents a summary of the field exploration, laboratory testing, and dewatering evaluation conducted in support of the above project. The MacInnes pressure reducing vault (PRV) is located on the south side of Tudor Road near the intersection with MacInnes Street as shown on Figure 1. This work was conducted in accordance with our September 2014 proposal which was authorized by Mr. Pete Bellezza on September 17, 2014.

SUBSURFACE EXPLORATIONS

Subsurface explorations consisted of drilling and sampling two borings, designated Borings B-1 and B-2 on September 29, 2014. Boring locations, shown on Figure 2, were recorded with a handheld GPS device and cloth tape measurements from existing site features. The surface elevations shown on the boring logs were estimated from drawings provided by CRW. Boring locations shown on the site plan and the elevations reported on the boring logs should be considered approximate.

Drilling services for this project were provided by GeoTek Drilling of Anchorage, Alaska, using a track mounted Geoprobe 8040 drill rig. An experienced geologist from our firm was present during drilling to locate the borings, observe drill action, collect samples, log subsurface conditions, and observe groundwater conditions.

The borings were advanced with 3 1/4-inch inner diameter (ID), continuous flight, hollow-stem augers to between approximately 21.5 feet below ground surface (bgs). As the borings were advanced, samples were typically recovered using Standard Penetration Test (SPT) methods at 2.5-foot intervals to 10 feet bgs then at 5-foot intervals to the bottom of the boring. In the SPT method, samples are recovered by driving a 2-inch outer diameter (OD) split-spoon sampler into the bottom of the advancing hole with blows of a 140-pound hammer free falling 30 inches onto the drill rods. For each sample, the number of blows required to drive the sampler the final 12 inches of an 18-inch penetration into undisturbed soil is recorded. Blow counts are shown graphically on the boring log figures as "penetration resistance" and are displayed adjacent to sample depth. Where the sampler could not be driven 18 inches, the length of penetration and number of blows is shown on the boring logs to indicate sampler refusal. The penetration resistance values give a measure of the relative density (compactness) or consistency (stiffness) of cohesionless or cohesive soils, respectively. In addition to the split spoon samples, a grab sample of the near-surface soils was collected from the auger cuttings in the upper 2 feet of the each boring. At the completion of the borings, 2-inch poly vinyl chloride (PVC), machine slotted casing was installed to facilitate static groundwater level measurements. The annulus around the casing was backfilled with drill cuttings.

Soil samples recovered during drilling were visually classified in the field using the Unified Soil Classification System, presented in Figure 3. The field soil classifications were verified through laboratory analysis for selected samples. Summary logs of the borings are presented in Figures 4 and 5.

LABORATORY TESTING

Laboratory tests were performed on selected samples recovered from the borings to confirm field classifications and to estimate the index properties of the typical materials encountered. The laboratory testing was formulated with emphasis on estimating the material gradation and in-situ water content.

Water content tests were performed in general accordance with ASTM International (ASTM) D2216. The results of the water content measurements are presented graphically on the boring logs in Figures 4 and 5.

Grain size classification (gradation) testing was performed to estimate the particle size distribution of selected samples from the borings. The gradation testing generally followed the procedures described in ASTM C117/C136 and D422. The test results are presented in Figure 6 and summarized on the boring logs as percent gravel, percent sand, and percent fines. Percent fines on the boring logs are equal to the sum of the silt and clay fractions indicated by the percent passing the No. 200 sieve. Note that hydrometer testing indicates particle size only and visual classification under USCS designates the entire fraction of soil finer than the No. 200 sieve as silt. Plasticity characteristics (Atterberg Limits results) are required to differentiate between silt and clay soils under USCS.

SUBSURFACE CONDITIONS

The subsurface conditions encountered are presented graphically on the boring logs included in Figures 4 and 5. In Boring B-1, we encountered approximately 4 feet of fill material consisting of well-graded sand with gravel. Beneath this, we found silty sand with gravel to approximately 7 feet bgs, and below 7 feet bgs found interbedded silt, silt with sand, and silty sand. Fines content ranged between 78 and 59 percent for the samples tested at 7.5 and 15 feet bgs, respectively.

In Boring B-2, we encountered approximately 8 feet of well-graded sand and gravel with a fines content of 10 percent (for the sample tested at approximately 5 feet bgs). Below 8 feet bgs, we found silt to the bottom of the boring with a fines content of approximately 76 percent.

Granular material from both borings was medium dense with blow counts ranging from 13 to 21 blows per foot (bpf). Fine grained material ranged from medium stiff to hard with blow counts between 7 and 30 bpf.

Groundwater was encountered at approximately 10 feet bgs in Boring B-1 and 15 feet bgs in Boring B-2 during drilling. On October 2, 2014, static water levels were measured at approximately 7.2 feet bgs and 7.6 feet bgs in Borings B-1 and B-2, respectively. Note that water levels may fluctuate by several feet seasonally and may vary during periods of high precipitation and rapid snow melt.

CONSTRUCTION DEWATERING

Shannon & Wilson has conducted a brief study to estimate the volume of water that may be discharged during the construction activities. Our analyses are based on the subsurface information described above and the project drawings provided by CRW. These estimates are based on:

- The entire excavation (approximately 23 feet by 13 feet measured at the base) will be dewatered at once.
- Assumed hydraulic conductivity (K) of 10^{-3} centimeters per second (cm/s) based on evaluation of two grainsize samples from the aquifer.
- The aquifer has a uniform thickness of 3 feet and will be dewatered to the native silts.
- No vertical recharge of groundwater through the underlying silt.
- No positive boundary effects are encountered.

Based on these assumptions, we estimate a pumping rate on the order of 0.5 to 1 gallons per minute (gpm) will be required after about 12 hours of pumping. We estimate that the pumping rate will stabilize at about two thirds of the initial rates within about one week of pumping assuming continuous dewatering activities. The evaluation is complicated by the existing utilities and PRV structure. If the original PRV excavation was backfilled with MOA Type II material, the initial rates will be higher than our estimates. However this material should drain quickly and the longer term pumping rates should be similar to our estimate. Similarly, if the existing water line is bedded in material coarser than the aquifer, a significant amount of additional water could enter the excavation and persist throughout construction.

We recommend that the dewatering volumes and rates be closely watched during the first 12 to 24 hours of dewatering. If the backfill or bedding material is contributing to the excavation inflow, we expect the initial dewatering rates to be on the order of 10 to 25 gpm. After a period of time the MOA Type II should drain. If the dewatering rates do not drop to those predicted with 12 hours or 1,000 gallons of discharge, the water line bedding is likely contributing to the groundwater inflow. In addition to the flow monitoring, visual observations should be made of the excavation to evaluate where the greatest amount of infiltration is occurring. If the water line bedding is contributing significant amounts of water to the excavation, seepage should be observable in the north sidewalls of the excavation. Pumping should continue to dewater the bedding material as long as the rates are reasonable and there is no migration of the bedding sand. Alternately bentonite can be used to mitigate flow from the water line bedding.

Based on our evaluation, we anticipate approximately 10,000 gallons of water will be generated during the three weeks of dewatering. The radius of influence after three weeks is on the order of 50 feet. To evaluate the sensitivity of our calculations we increased the hydraulic conductivity by an order of magnitude. With this hydraulic conductivity the initial pumping rates increased to 6 to 10 gpm and again dropped by about two thirds after seven days of pumping. The total discharge volume is on the order of 110,000 gallons over the three week period and the calculated radius of influence is on the order of 200 feet. In our opinion, the additional recharge from the water line bedding will not contribute to the expected radius of influence.

CONTAMINATED SITE SUMMARY

Fire Station No. 4 is located at the northwest corner of the Tudor Road and MacInnes Street intersection in Anchorage, Alaska at 4350 MacInnes Street, as shown in Figure 2. A 500-gallon No. 1 and No. 2 diesel underground storage tank (UST) and a 1,000-gallon gasoline UST were removed from the site in 1994 (File 2100.26.315). Soil and groundwater contamination were identified following the removal of the USTs. The former USTs were located beneath the current northeast corner of the building. Based on the most recent groundwater sampling conducted in April 2013, the groundwater flow direction is to the northwest and away from the construction site.

As of April 2013, free phase diesel is present in one well and diesel range organics (DRO) exceeds the Alaska Department of Conservation's (ADEC's) cleanup level in a second well. The closest contamination is 300 feet from the north side of the PRV. Based on our estimates of radius of influence, our knowledge of the geology and contamination at Fire Station No. 4, it is our opinion that it is unlikely that dewatering at the MacInnes PRV will affect the contamination at Fire Station No. 4 as long as the pumping duration is less than approximately 45 days.

CLOSURE AND LIMITATIONS

The analyses and conclusions contained in this report are based on site conditions as they presently exist and further assume that the soil boring and laboratory test results are representative of the subsurface conditions across the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the test wells.

Within the limitation of scope, schedule, and budget, the conclusions and recommendations presented in this report were prepared in accordance with generally accepted professional hydrological and geotechnical engineering principles and practices in the area at the time this report was prepared. We make no other warranty, either expressed or implied. Because steady-state conditions were not reached during the pumping tests, we can only offer our opinion on the long term pumping characteristics.

If, during subsequent well installation or development work at the site, subsurface conditions different from those described herein are observed or appear to be present, we should be advised at once so we can review these conditions and reconsider our recommendations, where necessary.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we recommend that this report be reviewed to determine the applicability of our conclusions and recommendations considering the changed conditions and time lapse.

This report was prepared for the exclusive use of the AWWU. We appreciate the opportunity to work with you on this project. We have prepared Attachment A, *Important Information About Your Geotechnical/Environmental Report* to assist you and others in understanding the use and limitations of our report.

Copies of documents that may be relied upon by our client are limited to the printed copies (also known as hard copies) that are signed or sealed by Shannon & Wilson with a wet, blue ink signature. Files provided in electronic media format are furnished solely for the convenience of the client. Any conclusion or information obtained or derived from such electronic files shall be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, or you question the authenticity of the report please contact the undersigned.

We appreciate this opportunity to be of service. Please contact the undersigned at (907) 561-2120 with questions or comments concerning the contents of this report.

Sincerely,

SHANNON & WILSON, INC.

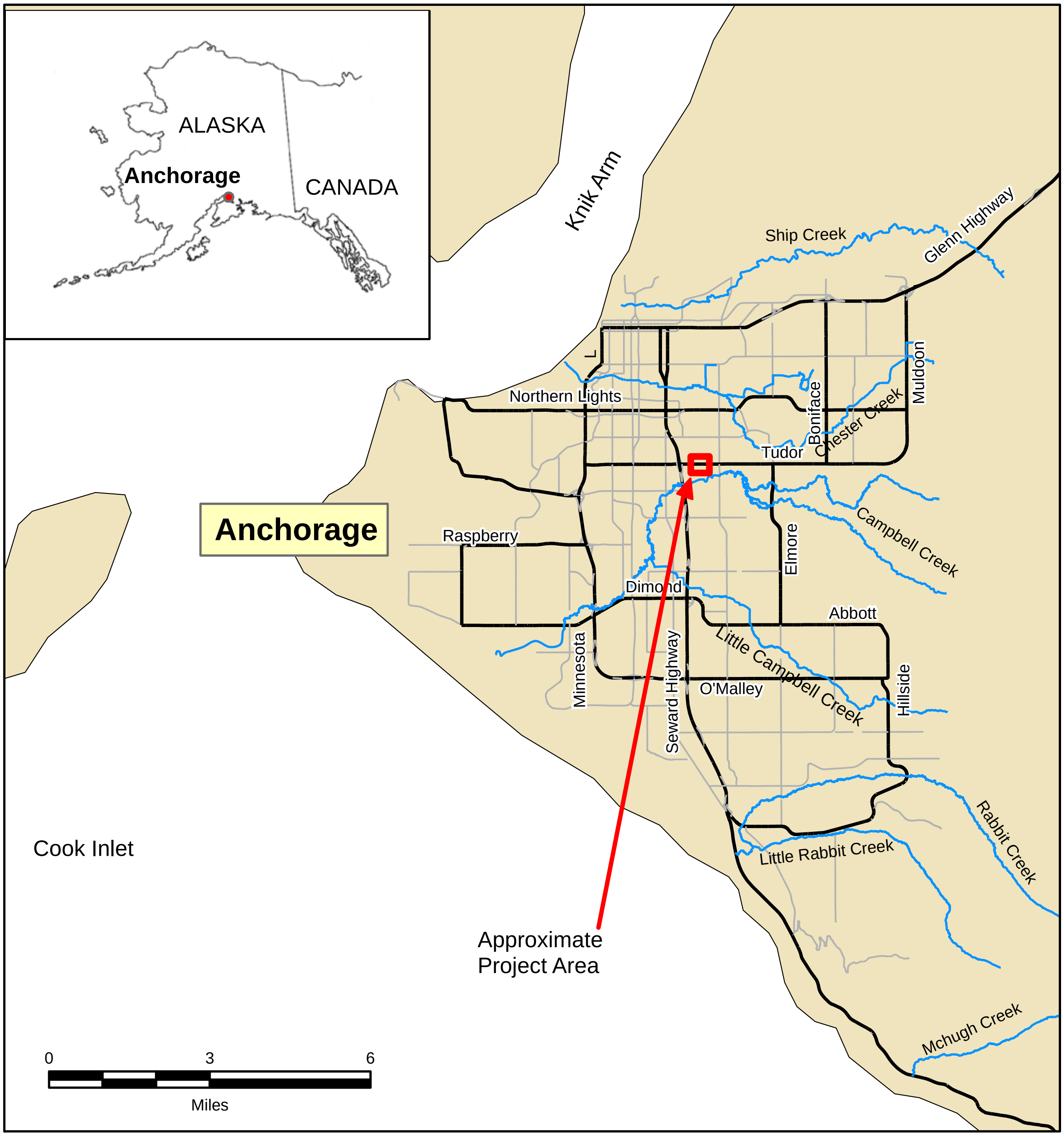
By:

for Katra Wedeking, C.P.G.
Senior Geologist

Stafford Glashan, P.E.
Vice President

Encl:

- Figure 1 – Vicinity Map
- Figure 2 – Site Plan
- Figure 3 – Soil Description and Log Key
- Figure 4 – Log of Boring B-1
- Figure 5 – Log of Boring B-2
- Figure 6 – Grain Size Classification
- Attachment A - Important Information About Your Geotechnical/ Environmental Report



Map adapted from files provided by the Municipality of Anchorage, Geographical Information Systems website

N

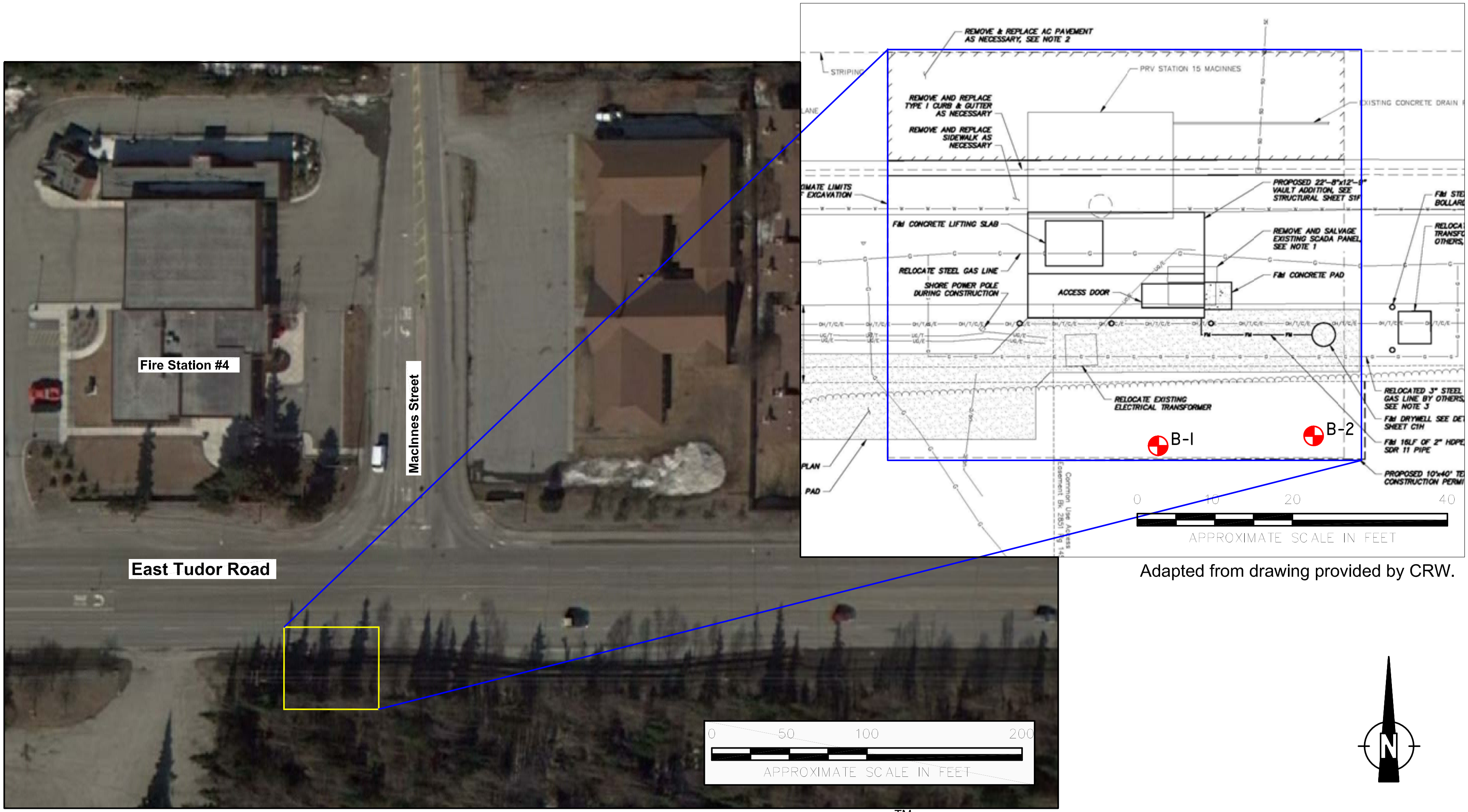
PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

VICINITY MAP

October 2014 | 32-1-02311

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1



Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth™ Mapping Service.

Adapted from drawing provided by CRW.

LEGEND

B-I — Approximate Location of Boring B-1, Advanced by Shannon & Wilson, September 2014.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

SITE PLAN

October 2014 | 32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

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

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

Bentonite Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Inclinometer or Non-perforated Casing
Perforated or Screened Casing	Vibrating Wire Piezometer

PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

SOIL DESCRIPTION AND LOG KEY

October 2014 | 32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3
Sheet 1 of 3

2013 BORING CLASS1 02311 MACINNES LOGS.GPJ SWNEW.GDT 27/10/14

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

SOIL DESCRIPTION AND LOG KEY

October 2014 32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3
Sheet 2 of 3

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

SOIL DESCRIPTION AND LOG KEY

October 2014 32-1-02311

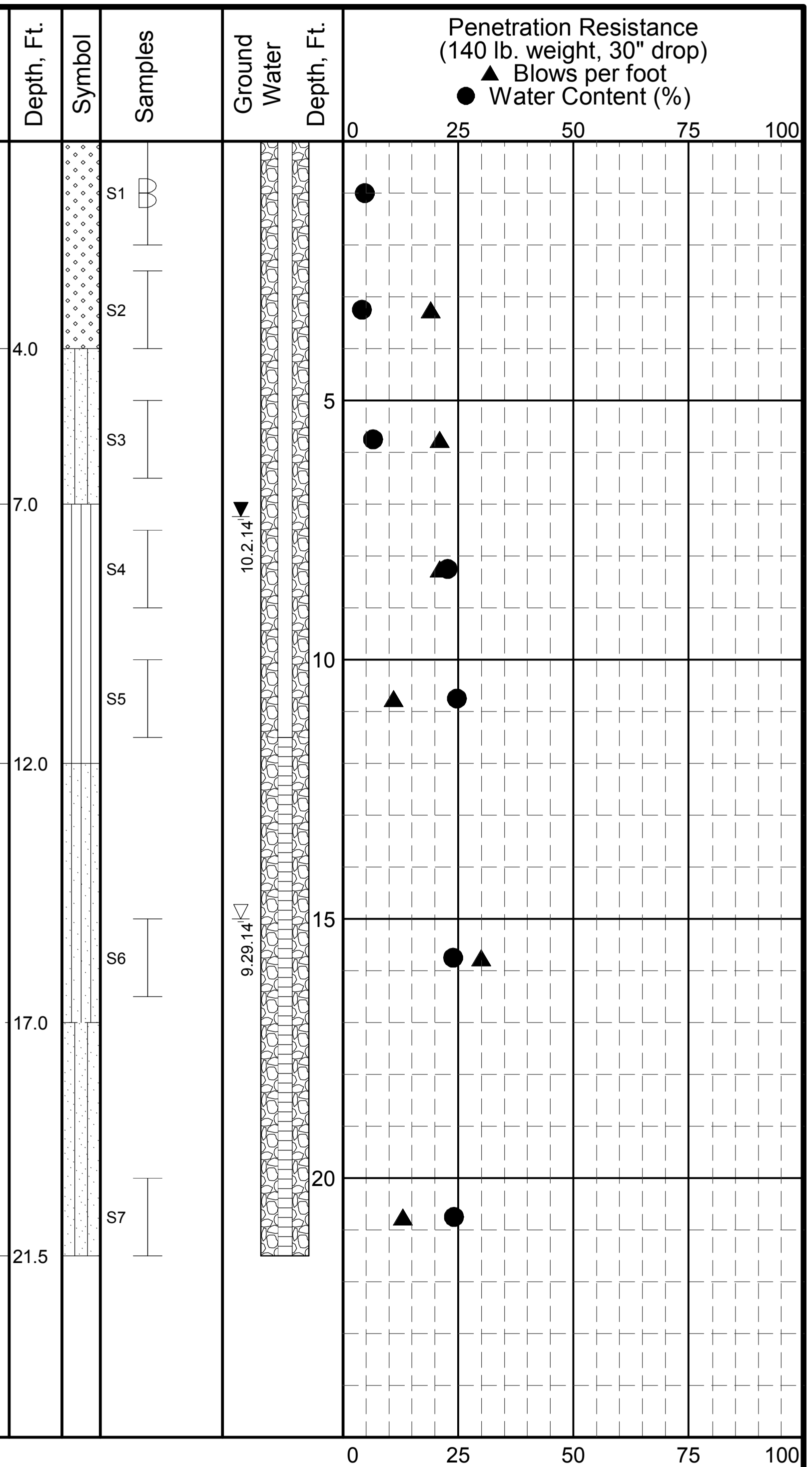
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

MATERIAL DESCRIPTION

Approx. Elevation: 135.5 Ft.

Depth, Ft.	Material Description
0.0–4.0	Medium dense, brown, *Well-Graded Sand with Gravel (SW)*; moist [FILL]
4.0–7.0	Medium dense, tan, *Silty Sand with Gravel (SM)*; moist
7.0–12.0	Stiff to very stiff, brown and gray, *Silt with Sand (ML)*; moist S4: 0% Gravel, 22% Sand, 78% Fines (F4)
12.0–17.0	Hard, gray, *Sandy Silt (ML)*; moist to wet S6: 0% Gravel, 41% Sand, 59% Fines (F4)
17.0–21.5	Medium dense, gray, *Silty Sand/Sandy Silt (SM/ML)*; moist to wet
21.5	Bottom of Boring Boring Completed 9.29.14



LEGEND

* Sample Not Recovered
B Auger Cuttings
2" O.D. Split Spoon Sample
Ground Water Level At Time Of Drilling
Static Water Level
Blank Section, Cuttings Backfill
Slotted Section, Cuttings Backfill

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

LOG OF BORING B-1

October 2014 32-1-02311

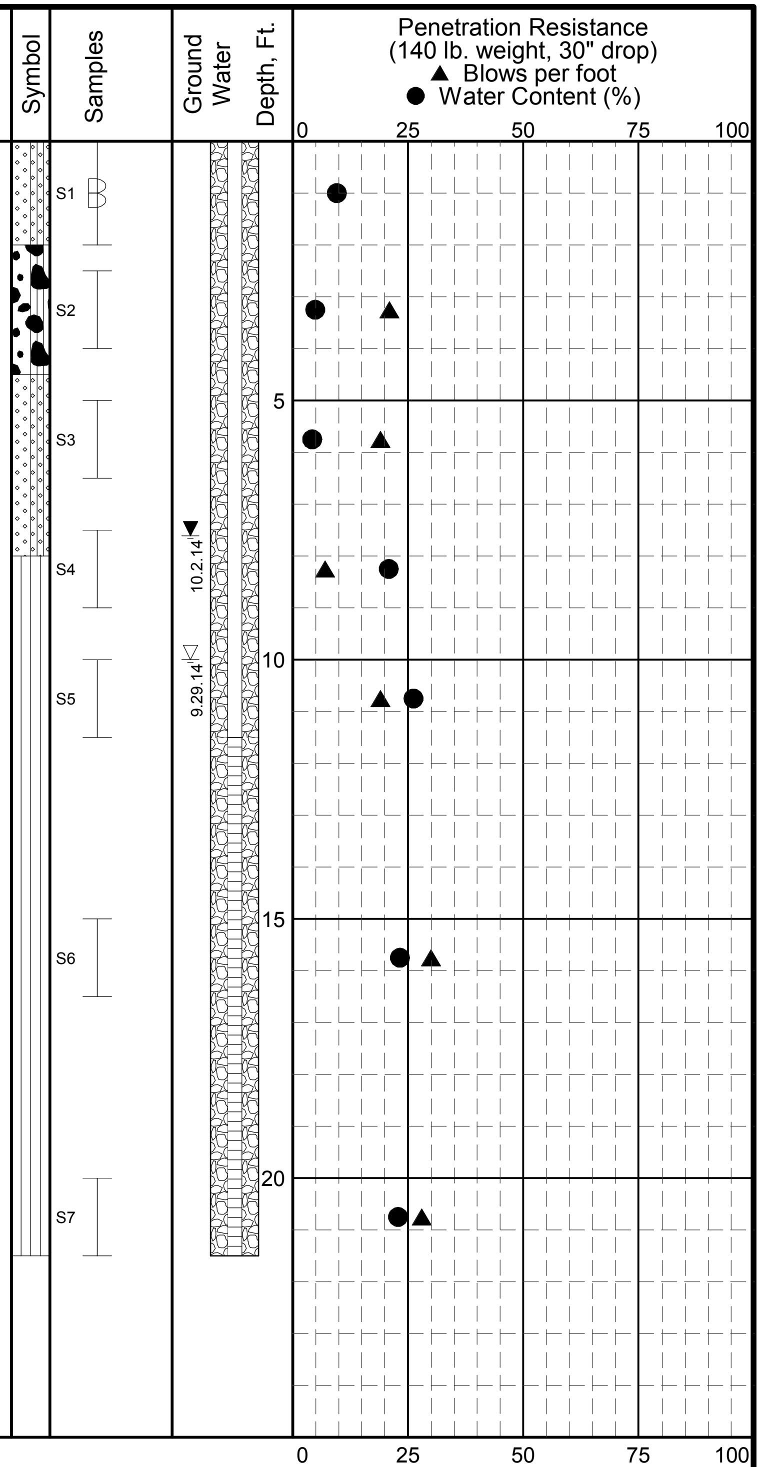
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4

REV 3 - Approved for Submittal

GEOTECHNICAL LOG 02311 MACINNES LOGS.GPJ S&W GEO1.GDT 27/10/14

MATERIAL DESCRIPTION Approx. Elevation: 135.5 Ft.	Depth, Ft.
Medium dense, brown, *Well-Graded Sand with Gravel and Silt (SW-SM)*; moist	
Medium dense, orange and brown, *Well-Graded Gravel with Sand and Silt (GW-GM)*; moist	2.0
Medium dense, gray, *Well-Graded Sand with Silt (SW-SM)*; moist S3: 2% Gravel, 89% Sand, 10% Fines (F2)	4.5
Medium stiff to hard, gray *Silt with Sand (ML)*; moist to wet S5: 0% Gravel, 24% Sand, 76% Fines (F4)	8.0
Bottom of Boring Boring Completed 9.29.14	21.5



GEOTECHNICAL LOG 02311 MACINNES LOGS.GPJ S&W GEO1.GDT 27/10/14

LEGEND

*	Sample Not Recovered	▽	Ground Water Level At Time Of Drilling
B	Auger Cuttings	▼	Static Water Level
⌶	2" O.D. Split Spoon Sample		Blank Section, Cuttings Backfill
			Slotted Section, Cuttings Backfill

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

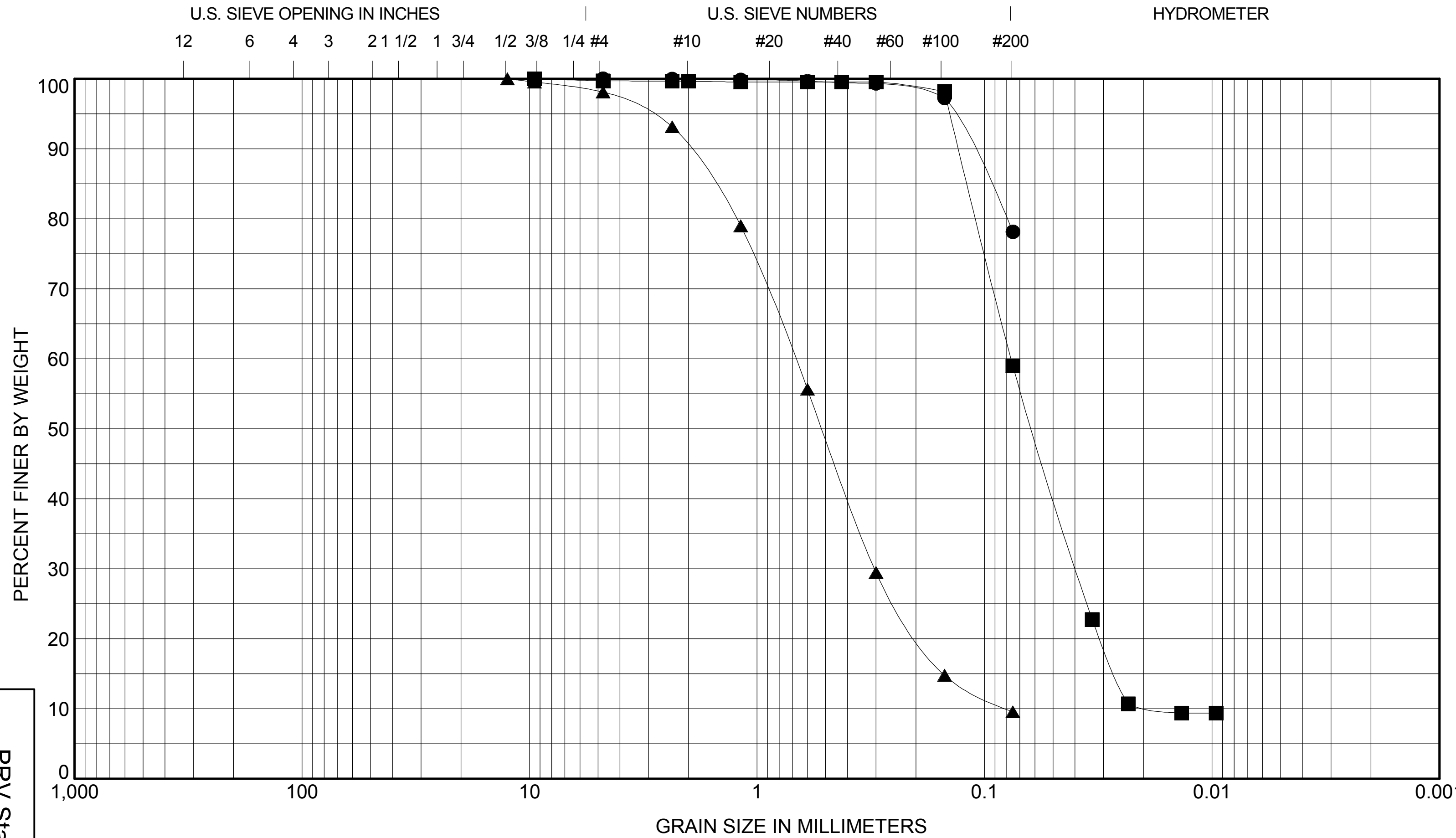
LOG OF BORING B-2

October 2014 32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 5

REV 3 - Approved for Submittal



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-1 S4**	**7.5 - 9.0**	**SILT with Sand (ML)**					
■	**B-1 S6**	**15.0 - 16.5**	**Sandy SILT (ML)**				**1.2**	**4.4**
▲	**B-2 S3**	**5.0 - 6.5**	**Well-Graded SAND with Silt (SW-SM)**				**1.7**	**8.6**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-1 S4**	**7.5 - 9.0**	**4.75**				**0**	**22**	**78**	
■	**B-1 S6**	**15.0 - 16.5**	**9.5**	**0.08**	**0.04**	**0.02**	**0**	**41**	**59**	
▲	**B-2 S3**	**5.0 - 6.5**	**12.5**	**0.68**	**0.3**	**0.08**	**2**	**89**	**10**	

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

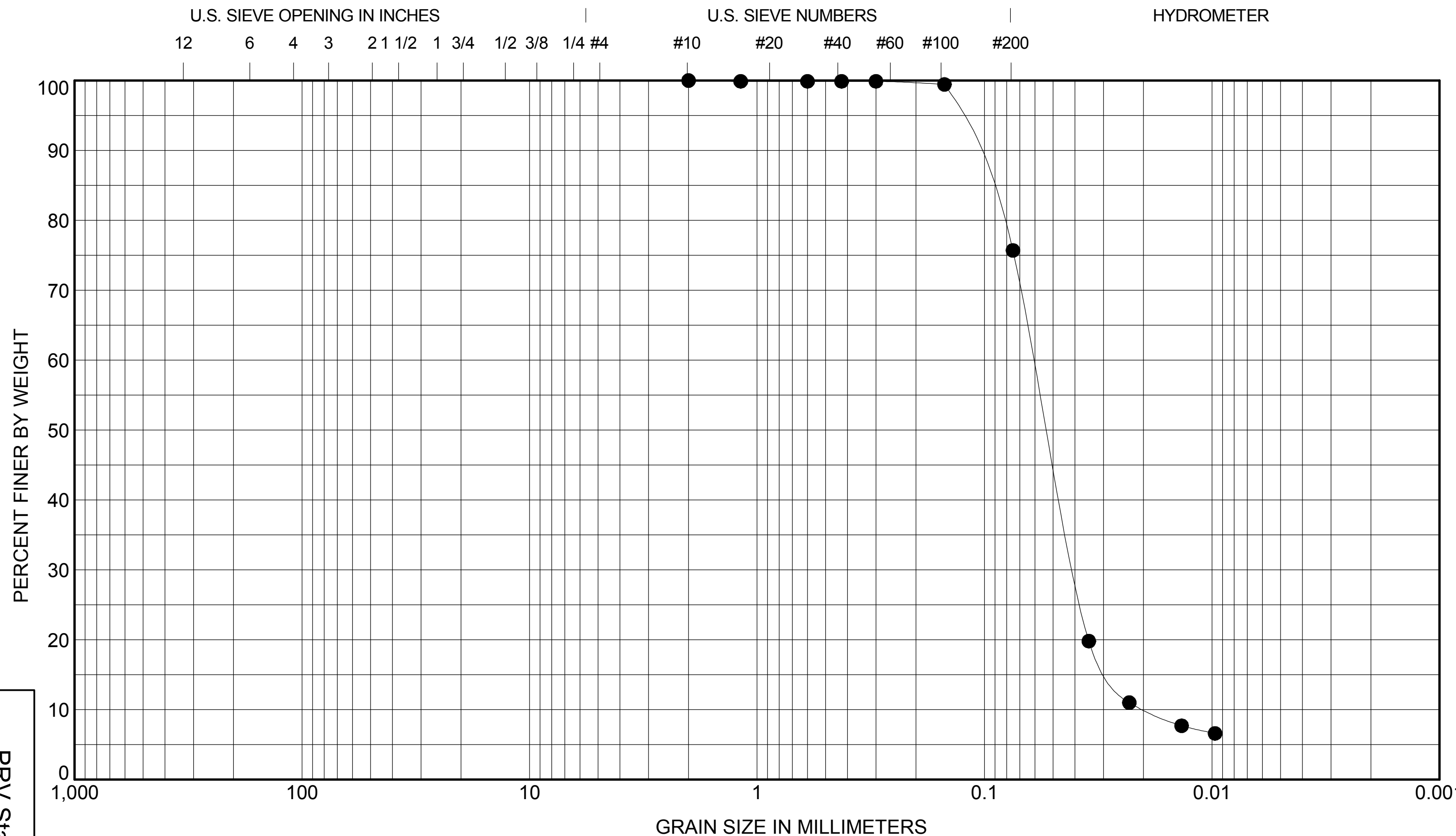
GRAIN SIZE CLASSIFICATION

October 2014

32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 6
Sheet 1 of 2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-2 S5**	**10.0 - 11.5**	**SILT with Sand (ML)**				**1.3**	**3.1**

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-2 S5**	**10.0 - 11.5**	**2**	**0.06**	**0.04**	**0.02**	**0**	**24**	**76**	

PRV Station 15, Tudor and MacInnes
Anchorage, Alaska

GRAIN SIZE CLASSIFICATION

October 2014

32-1-02311

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 6
Sheet 2 of 2

ATTACHMENT A

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors, which were considered in the development of the report, have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland