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GEOTECHNICAL DATA REPORT

Kitsap County Hauled Waste Upgrades

KITSAP COUNTY, WASHINGTON

SHANNON & WILSON

11/14/2023

Shannon & Wilson No: 110699-003

Submitted To: HDR Engineering, Inc.
835 N. Post Street
Spokane, WA 99201
Attn: Mr. Andrew Staples

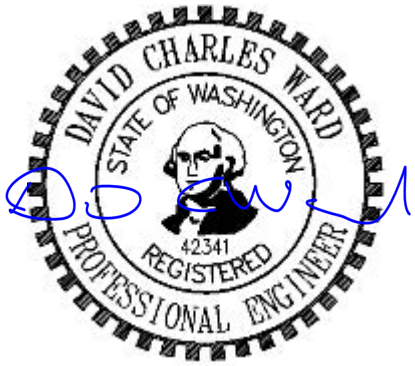
Subject: GEOTECHNICAL DATA REPORT, KITSAP COUNTY HAULED WASTE UPGRADES, KITSAP COUNTY, WASHINGTON

Shannon & Wilson, Inc. (Shannon & Wilson) prepared this report and participated in this project as a subconsultant to HDR Engineering, Inc. (HDR). Our scope of services was specified in the Geotechnical Subconsultant Agreement with HDR dated March 3, 2023. This report presents the geotechnical data collected for the project and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON



David Ward, PE
Vice President

ECS:MSK:DCW/ecs:aec

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1 INTRODUCTION

This geotechnical data report presents the results of our geotechnical explorations for the Kitsap County Hauled Waste Upgrades project (Project) in Kitsap County, Washington. Our geotechnical services included:

- Reviewing geologic information available for the Project area,
- Drilling and sampling eight boreholes,
- Installing four observation wells,
- Performing geotechnical laboratory analysis, and
- Preparing this geotechnical data report.

2 SITE AND PROJECT DESCRIPTION

The Project site is at the Central Kitsap Wastewater Treatment Plant (WWTP) located along the Brownsville Highway, northeast of Silverdale, Washington (Figure 1). The WWTP ranges from approximately 148 to 171 feet in elevation.

The purpose of the Project is to design and construct several new facilities at the Project site, including:

- A new single-story maintenance/shop building on a slab foundation;
- A new three-story digester control building, with one level of the structure below grade;
- A new 1.3-million-gallon (MG) digester structure that will be above and below grade and near the digestor control building,
- A new one-story sludge thickening building on a slab foundation; and
- A new septage receiving area.

The proposed upgrades to the Central Kitsap WWTP are all within the existing footprint of the site, and some of the upgrades will replace existing structures.

3 GEOTECHNICAL EXPLORATION PROGRAM

Our geotechnical exploration program consisted of drilling and sampling eight geotechnical borings, designated KT-1 through KT-8, and installing four observation wells in borings KT-1, KT-3, KT-5, and KT-7. The approximate locations of the borings and observation

wells are shown in the Site and Exploration Plan (Figure 2). Holt Services, Inc. under subcontract to Shannon & Wilson, performed the drilling, sampling, and observation well construction. A Shannon & Wilson field representative was on site to observe the drilling, collect soil samples, observe the observation well construction, and prepare the field boring logs.

A summary of the subsurface explorations is provided in Table A-1 in Appendix A.

3.1 Drilling

Holt used a truck-mounted, B-59 Mobile Drill to drill the borings. The borings were performed using both hollow-stem auger (HSA) and mud-rotary drilling methods. HSA uses a bit with carbide teeth and 8-inch-diameter flights to advance and temporarily case the borehole. As the HSA rotates, the flights move the cuttings up from the bottom up to the surface, where it is shoveled into drums and later removed from the site.

Mud-rotary drilling uses a 5⅞-inch drill bit to advance the borehole. While drilling, bentonite drilling mud is circulated through the borehole to flush out soil cuttings, stabilize the borehole sidewalls, and prevent heave of the borehole bottom.

Borehole locations were determined by HDR Engineering, Inc. prior to the start of drilling. Borehole locations were cleared of utilities by Kitsap Public Works using a Vactor truck down approximately 5 to 7 feet. Some of the boreholes were drilled adjacent from the original location to sample the soils in the upper 5 to 7 feet.

3.2 Soil Sampling

Soil samples were obtained in conjunction with Standard Penetration Tests (SPTs). The SPTs were performed in accordance with ASTM D1586-18e1, Standard Test Method for SPT and Split-Barrel Sampling of Soils (ASTM, 2018a). The depth at which the samples were collected, and the corresponding Standard Penetration Resistance (N-values) are recorded in the boring log in Appendix A. The SPT N-value is a useful parameter for determining the relative density or consistency of the soils. Density or consistency, as it is related to the SPT N-value, is shown in the log key in Appendix A.

3.3 Borehole Completion

After the last sample was obtained in borings with planned observation wells, Holt installed well casings with a threaded, 2-inch-inside-diameter polyvinyl chloride well casing, a slotted portion (screen) to allow for the inflow of water, and an end cap (sump) to the bottom of the slotted section. A filter pack consisting of silica sand was placed around the

screen to act as a filter against the adjacent soil. Bentonite chips were placed down the hole, above the filter pack, to create an impermeable seal. An 8-inch steel monument lid was cemented in place at the surface to protect the observation well. The installation details for the observation wells are shown graphically on the boring logs in Appendix A.

For boreholes with no well installation, after the last sample was obtained, the borehole was backfilled by Holt in accordance with applicable Washington Department of Ecology regulations and standards.

All soil cuttings generated during drilling were placed in 55-gallon drums and disposed of off-site by Holt.

3.4 Boring Logs

The project boring logs are presented in Appendix A. A boring log is a written record of the subsurface conditions encountered during drilling. It graphically shows the geologic units (layers) encountered in the boring and the Unified Soil Classification System (USCS) symbol of each geologic layer. The right-hand side of the boring log also includes the recorded N-value, as well as the measured moisture content and percent fines from laboratory testing where tests were performed. Other information shown in the boring logs are observed and measured groundwater levels, approximate ground surface elevation and northing and easting, and types and depths of sampling.

3.4.1 Geologic Units

Based on the review of the samples and the available geologic maps for the Project area, a list of geologic soils units encountered was developed. Geologic soil units were defined based on their geologic history and engineering properties. These geologic soil units are interpretive and are based on the grouping of complex sediments and soil types into units. The geologic soil unit designations are shown in conjunction with the descriptions on the boring logs. A list with descriptions of geologic soil units encountered in the current geotechnical explorations, from youngest to oldest, is presented in Table A-2 in Appendix A.

3.4.2 Groundwater Measurements

Observation wells were measured using an electronic water level indicator. These readings were converted to groundwater elevations using well installation measurements and the ground surface elevation. The measured water levels for each observation well are included in the boring logs in Appendix A.

3.5 Previous Drilling

Landau Associates drilled two boreholes in the vicinity of the existing digester tanks using HSA drilling techniques. Both boreholes, identified as LAI-1 and LAI-2, went to a depth of 50 feet (Landau, 2022). Landau also performed one hand-auger boring, identified as HA-1, to a depth of 10 feet. These logs were provided by HDR and are in Appendix B.

4 LABORATORY TESTING

Geotechnical laboratory tests were performed on selected samples retrieved from the borings to assist with classifying the soil and to provide data for our engineering analyses. The geotechnical laboratory testing was performed by Shannon & Wilson and included water content determinations and particle-size analysis. Visual classification of the soil samples was performed at the site by the field representative, and then at the laboratory by a senior geologist.

4.1 Visual Classification

We visually classified soil samples retrieved from the borings using a system based on ASTM D2487-17, Standard Practice for Classification of Soils for Engineering Purposes (USCS) (ASTM, 2020), and ASTM D2488-17e1, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure) (ASTM, 2018b). We assigned a USCS group name and symbol based on our visual classification of particles finer than 76.2 millimeters (3 inches). We revised visual classifications using results of the index tests discussed below.

4.2 Water Content Determination

We tested the water content of selected samples in accordance with ASTM D2216-19, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM, 2019). Water content test results are presented in the boring logs in Appendix A.

4.3 Grain-Size Distribution Analysis

We performed mechanical sieve analyses on selected soil specimens to determine the grain-size distribution of coarse-grained soil particles in accordance with ASTM D6913-17, Standard Test Method for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis (ASTM, 2017a). Grain-size distributions are used to classify the granular component of soils and can correlate with soil properties, including frost susceptibility, permeability, shear strength, liquefaction potential, capillary action, and sensitivity to

moisture. Grain-size distribution plots provide tabular information about each specimen, including USCS group symbol and group name, water content, constituent (i.e., cobble, gravel, sand, and fines) percentages, personnel initials, ASTM standard designation, and any applicable testing remarks. The results of the laboratory analysis are in Appendix C and fines contents are plotted as data points in the boring logs in Appendix A.

4.4 Atterberg Limits

Atterberg Limits were determined on select samples in accordance with ASTM D4318-17e1, Standard Test method for Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM 2017b). The Atterberg Limits include Liquid Limit (LL), Plastic limit (PL), and Plasticity Index (PI) ($PI = LL - PL$). They are generally used to assist in classification of the soil, to indicate soil consistency (when compared with natural water content), to provide correlation to soil properties, including compressibility and strength, and to assist with liquefaction analysis. Results of the Atterberg Limits determinations are shown in the boring log in Appendix A and in the plasticity chart in Appendix C.

4.5 Corrosion Testing

Two samples were submitted to Norton Corrosion in Woodinville, Washington, for corrosion testing. The samples were tested for moisture content, pH, resistivity, sulfides, chlorides, and redox potential. The test results are presented in Appendix C.

5 LIMITATIONS

This draft GDR presents the data from field explorations, and field and laboratory testing of subsurface conditions at the specific locations and depths indicated, using the means and methods described in this report. No other representation is made. This report should be made available to the prospective contractors for information on factual data only. Subsurface conditions that are interpreted from the data included in this report may not be construed as a guarantee or warranty of such interpreted conditions.

Natural processes or human activity may alter subsurface conditions. Because a geotechnical report is based on conditions that existed at the time of subsurface explorations, construction decisions should not be based on a report whose adequacy may have been affected by time, unless verified. Unanticipated soil conditions are commonly encountered and cannot fully be determined by merely taking soil samples from borings.

We have prepared the document "Important Information About Your Geotechnical Report" to assist you and others in understanding the use and limitations of this geotechnical data report. Please read this document to learn how you can lower your risks for this project.

6 REFERENCES

ASTM International, 2017a, Standard test method for particle-size distribution (gradation) of soils using sieve analysis, D6913-17: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 34 p., available: www.astm.org.

ASTM International, 2017b, Standard test methods for liquid limit, plastic limit, and plasticity index of soils, D4318-17e1: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 20 p., available: www.astm.org

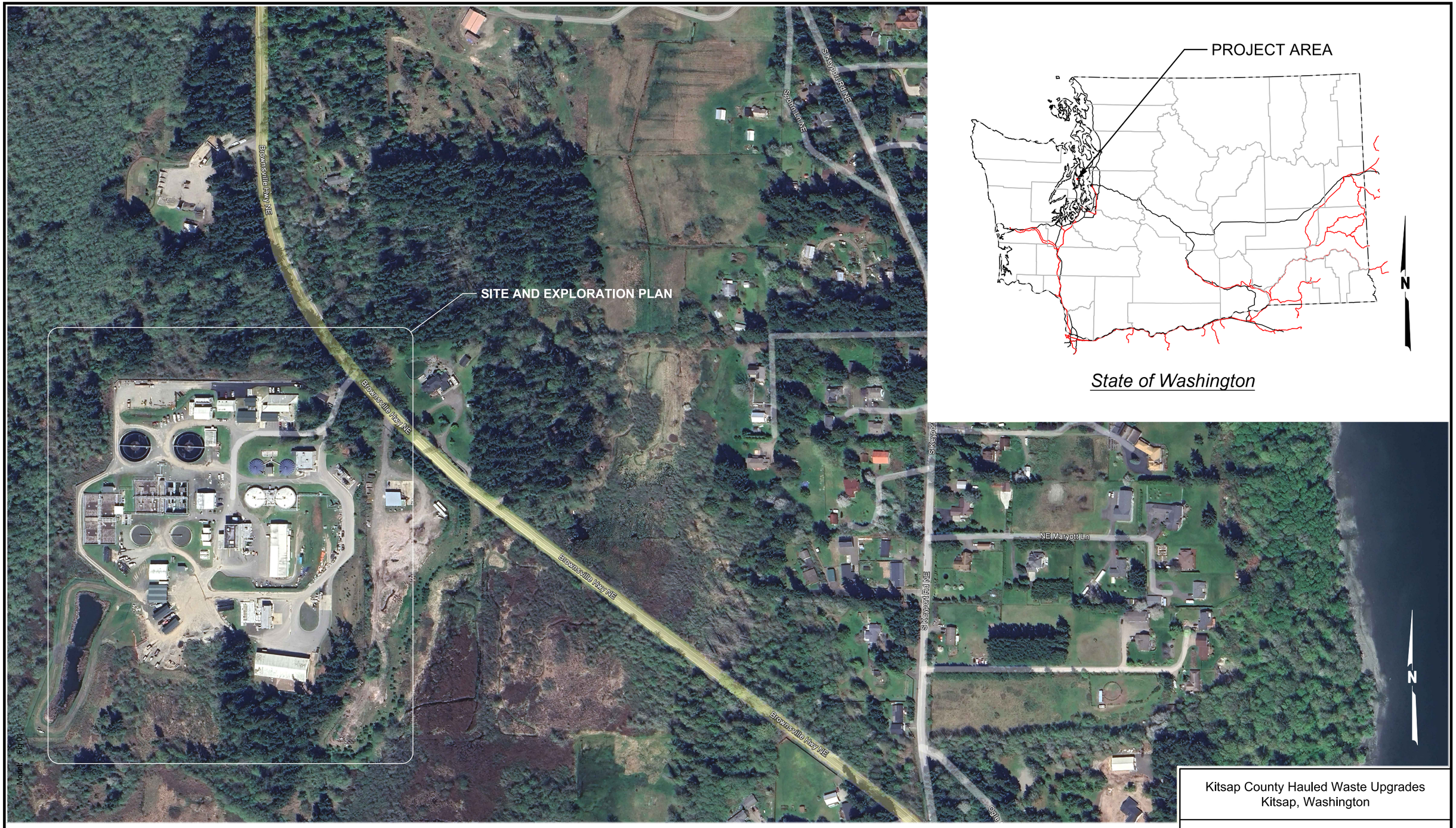
ASTM International, 2018a, Standard test method for standard penetration test (SPT) and split-barrel sampling of soils, D1586-18e1: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 26 p., available: www.astm.org.

ASTM International, 2018b, Standard practice for description and identification of soils (visual/manual procedure), D2488-17e1: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 13 p., available: www.astm.org.

ASTM International, 2019, Standard test methods for laboratory determination of water (moisture) content of soil and rock by mass, D2216-19: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 7 p., available: www.astm.org.

ASTM International, 2020, Standard practice for classification of soils for engineering purposes (unified soil classification system), D2487-17e1: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 10 p., available: www.astm.org.

Landau Associates, 2022, Central Kitsap Wastewater Treatment Plant, 12 p.



State of Washington

VICINITY MAP
SCALE: 1" = 300'

0 300' 600'

Kitsap County Hauled Waste Upgrades
Kitsap, Washington

VICINITY MAP

November 2023 110699-003

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FIG. 1

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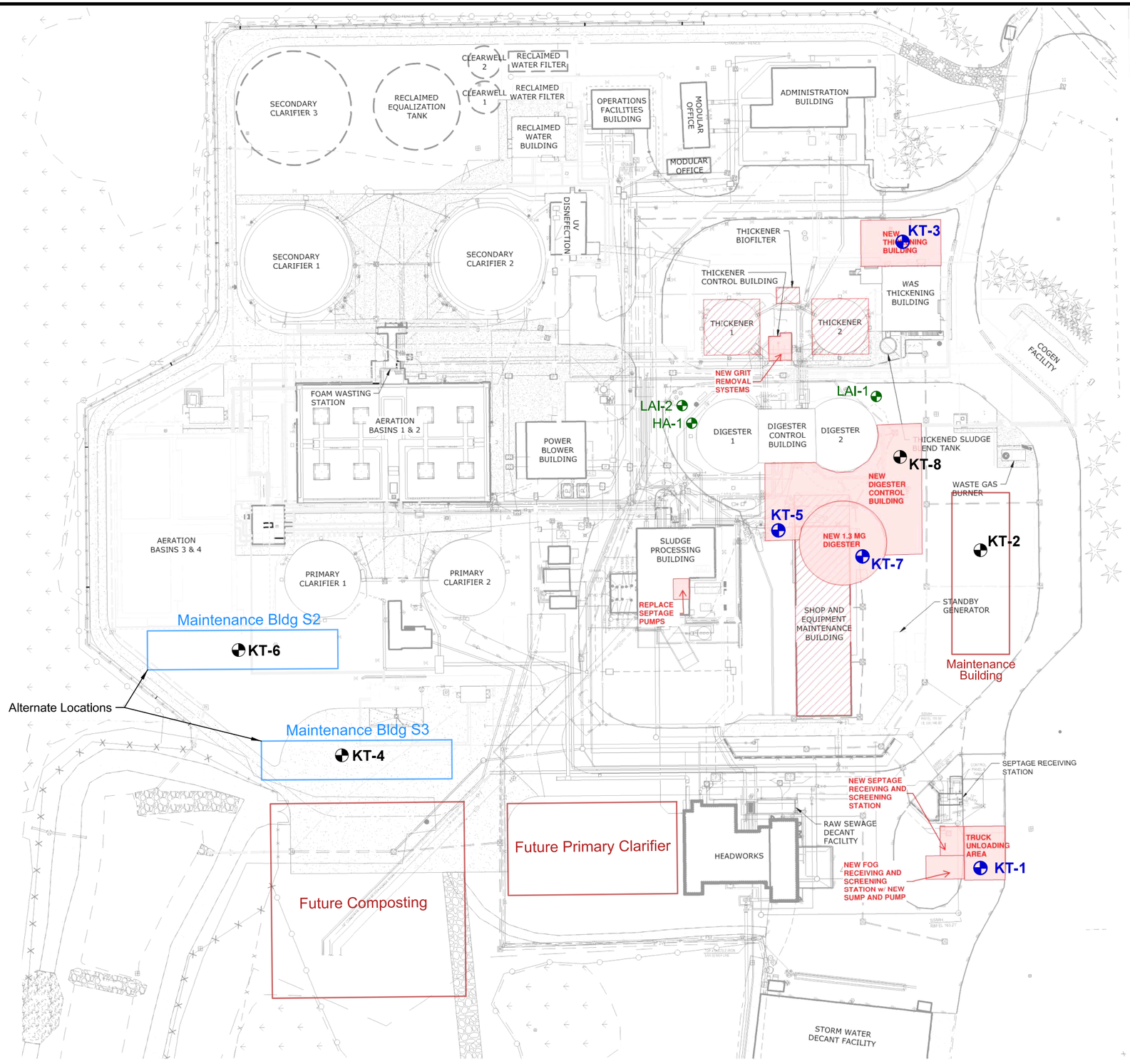

LEGEND

- KT-3 — BORING DESIGNATION AND APPROXIMATE LOCATION
- KT-3 — BORING DESIGNATION WITH MONITORING WELL AND APPROXIMATE LOCATION
- LAI-1 — PREVIOUS DRILLING

SITE PLAN
SCALE: 1" = 100'

0 100' 200'

Kitsap County Hauled Waste Upgrades
Kitsap, Washington

SITE AND EXPLORATION PLAN

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FIG. 2

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APPENDIX A: SUBSURFACE EXPLORATIONS

Appendix A

Subsurface Explorations

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Table A-1: Summary of Explorations

Borehole ID	Hole Depth (ft)	Drill Date	Drilling Method	Approximate Ground Elevation[1] (ft)	Northing[2]	Easting[2]	Well Installed	Bottom Depth of Well Screen (ft)
KT-1	25.3	5/15/2023	Hollow Stem Auger	168	250719	1198038	Yes	24.7
KT-2	25.4	5/16/2023	Mud Rotary	171.4	251010	1198045	No	-
KT-3	25.4	5/16/2023	Hollow Stem Auger	161.3	251300.115	1197984.869	Yes	19.7
KT-4	30.3	5/16/2023	Hollow Stem Auger	148.6	250842	1197451	No	-
KT-5	40.2	5/17/2023	Hollow Stem Auger	153.3	251041	1197862	Yes	38.3
KT-6	25.9	5/17/2023	Hollow Stem Auger	153.4	250944	1197362	No	-
KT-7	45.7	5/18/2023	Hollow Stem Auger	154.8	251011	1197933	Yes	44.7
KT-8	40.2	5/18/2023	Hollow Stem Auger	155.8	251099.221	1197978.343	No	-

NOTES:

1 Elevations are approximate and are in Vertical Datum NAVD88

2 Coordinates in WSP North NAD83

Table A-2 - Geologic Units and Descriptions

Unit Name	Abbreviation	General Unit Description	Soil Description
HOLOCENE UNITS			
Fill	Hf	Fill place by humans, both engineered and nonengineered	Various materials, including debris; garbage; cobbles and boulders; commonly dense to stiff if engineered, but very loose to dense or very soft to stiff in non-engineered
Peat Deposits	Hp	Depression fillings of organic materials	Peat, peaty Silt, organic Silt; very soft to medium stiff.
Lake Deposits	Hl	Depression fillings of fine-grained soils	Silt, clayey Silt, silty Clay; commonly with scattered organics; very soft to stiff or very loose to medium dense.
PRE-VASHON UNITS			
Till	Qvt	Lodgement till laid down along the base of the glacier	Silt, Clay, and Sandy Clays; scattered to abundant fine organics; dense to very dense or very stiff to hard
Ablation Till	Qvat	Heterogeneous soils deposited during the wasting of glacial ice; generally not reworked	Clean to silty Sand, gravelly Sand, sandy Gravel; very dense; scattered cobbles and boulders
Till-Like	Qvd	Glacial deposit intermediate between till and outwash; sub-glacially reworked	Silty gravelly sand, silty Sand, sandy Gravel; highly variable over short distances; cobbles and boulders common; dense to very dense.
Advance Outwash	Qva	Glaciofluvial sediment deposited as the glacial ice advanced through the Puget Lowland	Clean to silty Sand, gravelly Sand, sandy Gravel; dense to very dense.
Recessional Lacustrine	Qvrl	Glaciolacustrine sediment deposited as glacial ice retreated	Fine Sand, Silt, and Clay; dense to very dense; soft to hard.
Glaciolacustrine	Qvgl	Fine-grained glacial flour deposited in proglacial lake in the Puget Lowland	Silty Clay, clayey Silt, with interbeds of Silt and fine Sand; locally laminated; scattered organic fragments near the base; hard or dense to very dense.
Recessional Outwash	Qvro	Glaciofluvial sediment deposited as glacial ice retreated	Clean to silty Sand, gravelly Sand, sandy Gravel; cobbles and boulders common; loose to very dense.

NOTE:

The geologic units are interpretive and based on our opinion of the grouping of complex sediments and soil types into units appropriate for the project. The description of each geologic unit include only general information regarding the environment of deposition and basic soil characteristics. For example, cobbles and boulders are only included in the description of those units where they are most prominent.

SOIL CLASSIFICATION

Shannon & Wilson uses a soil identification system modified from the Unified Soil Classification System (USCS) as described on this Key. Soil descriptions are based on visual-manual procedures (ASTM D2488) and available laboratory index test results (ASTM D2487).

Exhibit A: Unified Soil Classification System (USCS)[1]

Major Divisions			Symbol	Graphic	Typical Identifications (USCS Group Names)[2,4]
COARSE-GRAINED SOILS *(> 50% of soil is retained on the No. 200 sieve[3])*	**GRAVELS** *(< 50% of coarse fraction retained on the No. 4 sieve[3])*	**Gravel** *(< 5% fines[3])*	GW		Well-graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(> 12% fines[3])*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	SANDS *(≥ 50% of coarse fraction retained on the No. 4 sieve[3])*	**Sand** *(< 5% fines[3])*	SW		Well-graded Sand; Well-graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(> 12% fines[3])*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(≥ 50% of soil passes the No. 200 sieve[3])*	**SILTS AND CLAYS** *(liquid limit < 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)*	**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: *For gravels and sands with 5 to 12% fines[3], the following are added to the Group Name:* with Silt and/or Clay or Silty Clay. *Dual Symbols are used:* GW-GM, GP-GM, SW-SM, SP-SM GW-GC, GP-GC, SW-SC, SP-SC

EXHIBIT A NOTES:
1. Adapted, with permission, from USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488.
2. Borderline symbols (symbols separated by a slash) indicate that the soil characteristics are close to the defining boundary between two groups (e.g., CL/ML = Lean Clay to Silt; SP-SM/SM = Sand with Silt to Silty Sand).
3. No. 4 size = 4.75 millimeters (mm) = 0.187 inch; No. 200 sieve size = 0.075 mm = 0.003 inch. Particles smaller 0.075 mm are termed "fines".
4. Poorly graded indicates a narrow range or missing grain sizes. Well-graded indicates a full-range and even distribution of grain sizes.
5. If cobbles and/or boulders are observed, "with cobbles" or "with boulders" or "with cobbles and boulders" is added to the Group Name.

Exhibit B-1: Standard Penetration Test (SPT)

Term	Description
Hammer	140-pound weight with a 30-inch free fall. Hammer types vary (e.g., automatic, rope and cathead). If available, the hammer type and energy ratio (E-ratio) is noted on the boring log.
Sampler	Barrel I.D. / O.D. = 1.5 inches / 2 inches (liner not used) Barrel Length = 30 inches; Shoe I.D. = 1.375 inches
N-Value (N)[1]	Sum of the count of hammer blows to penetrate the second and third 6-inch increments in blows per foot (bpf). **Refusal**: 50 blows for 6 inches or less or 10 blows for 0 inch.

EXHIBIT B NOTES:
1. N-values shown on boring logs are as recorded in the field and have not been corrected for hammer energy, overburden, or other factors. Where the hammer E-ratio is available, the N-value normalized to a ratio of 60% (N_{60}) is listed.
2. Based on ASTM Standard D1586. Relative densities/consistencies noted on the boring logs are based on uncorrected N-values.
3. PP = pocket penetrometer; TV = torvane, tsf = tons per square foot. Correlations as presented in the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2022).

Exhibit B-2: Relative Consistency of Cohesive Soils

Term	N[2] (bpf)	PP[3] (tsf)	TV[3] (tsf)
Very Soft	0 - 2	0 - 0.25	0 - 0.12
Soft	2 - 4	0.25 - 0.5	0.12 - 0.25
Medium Stiff	4 - 8	0.5 - 1	0.25 - 0.5
Stiff	8 - 15	1 - 2	0.5 - 1
Very Stiff	15 - 30	2 - 4	1 - 2
Hard	> 30	> 4	> 2

Exhibit B-3: Relative Density of Cohesionless Soils

Term	N[2] (bpf)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Exhibit C: Soil Structure[1]

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

EXHIBIT C NOTE:
1. Adapted, with permission, from ASTM D2488.

Exhibit D: Soil Plasticity[1]

Term	Description
Nonplastic	Cannot roll a 1/8-inch thread at any water content.
Low Plasticity	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.
Medium Plasticity	A thread is easy to roll and not much time in rolling 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.
High Plasticity	It takes 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.

EXHIBIT D NOTE:
1. Adapted, with permission, from ASTM D2488.

Exhibit E: Soil Moisture Content[1]

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

EXHIBIT E NOTE:
1. Adapted, with permission, from ASTM D2488 (Figure 2).

Exhibit F: Soil Cementation[1]

Term	Description
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.

EXHIBIT F NOTE:
1. Adapted, with permission, from ASTM D2488.

Exhibit G: Percentages

Term	Percent[1]
Trace	<5
Few	5 to 10
Little	15 to 25
Some	30 to 45
Mostly	>50

EXHIBIT G NOTE:
1. Percent estimated by weight for sand and gravel, and by volume for cobbles, organics, and other non-soil material (e.g., rubble, debris).

SOIL CLASSIFICATION *(continued)*

See Page 1 for Soil Classification Exhibits A through G

Exhibit H: Particle Angularity and Shape[1]

Term	Description
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 to thickness ratio > 3.
Elongated	Width to thickness ratio < 3.

EXHIBIT H NOTE:
1. Adapted, with permission, from ASTM D2488.

Exhibit I: Additional Descriptive Terms

Term	Description
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 action.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

SOIL CLASSIFICATION REFERENCES:

ASTM International, [current edition], Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, available: www.astm.org.

U.S. Army Corps of Engineers, 1953, The unified soil classification system: Vicksburg, Miss., Waterways Experiment Station, Technical Memorandum 3-357, 2 v., March.

SYMBOLOGY AND GRAPHICS

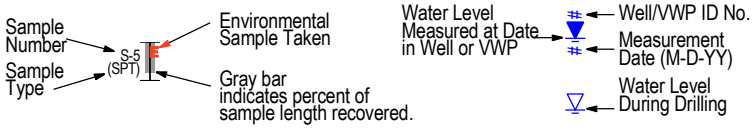
Exhibit J: Sample and Run Graphics

Graphic	Description	Graphic	Description	Graphic	Description
	SPT split spoon (2-inch OD)		Split spoon (SS) (diameters vary)		Core run (typically rock)
	Grab (GB) from cuttings or excavation		Modified California (MC) sampler		Sheath (SH) (used for geoprobes)
	Tube (TB) (e.g., Shelby, piston)		Sonic core (SC) run (typically soil)		

Exhibit K: Hole Backfill and Instrument Graphics

Graphic	Description	Graphic	Description	Graphic	Description
	Bentonite-cement grout		Surface cement seal		Blank pipe or instrument casing
	Bentonite grout		Sand filter pack		Perforated or slotted pipe
	Bentonite chips		Slough *(hole caved)*		VWP and electric lead

Exhibit L: Other Log Symbols



ROCK CLASSIFICATION

Shannon & Wilson uses a rock classification system modified from the system recommended by the International Society for Rock Mechanics (ISRM). Copyright limitations prevent us from reproducing summary tables from the ISRM system on this Key. General descriptions are provided in Exhibit M.

Exhibit M: General Rock Descriptive Terms - ISRM

Term	General Description
Strength	Ranges from extremely weak (q_u = 36 to 135 psi) to extremely strong (q_u > 36,250 psi), and is based on the ability to break the rock with a hammer or scrape the rock with a knife.
Weathering	Ranges from fresh (no visible signs of weathering) to completely weathered, based on observed degree of discoloration, decomposition, and/or disintegration. When the rock material has completely converted to soil, it is termed a residual soil.
Fabric	Describes the rock structure based on observed layering, tendency to break, and distribution of minerals (e.g., massive, bedded, foliated).
Roughness	For discontinuities: Includes rough, smooth, and slickensided, and includes other descriptive terms (e.g., stepped, undular, irregular, planar).
Spacing	For discontinuities: Ranges from extremely close (< 1 inch) to extremely wide (> 20 feet).
Persistence	For discontinuities: Ranges from very low to very high.
Other	Description of discontinuities (joints, fractures, bedding planes, etc.), observations of potential displacement, gouge, shear, etc.

REFERENCE: Brown, E. T., ed., 1981, Rock characterization, testing & monitoring: International Society of Rock Mechanics (ISRM) suggested methods: Oxford, Pergamon Press, 211 p.

Exhibit N: Rock Name Graphics

No rock names defined for this Project

Exhibit O: Recovery and RQD Equations[1]

Term	Equation
Core Recovery (REC) in %	$100\% \times \frac{\text{Length of Core Recovered}}{\text{Length of Core Run}}$
Rock Quality Designation (RQD) in %	$100\% \times \frac{\text{Length of Core in Pieces} > 4 \text{ in}}{\text{Length of Core Run}}$

REFERENCE: Loehr, J. E.; Lutenegger, A.; Rosenblad, B.; and Boeckmann, A., 2016, Geotechnical site characterization: U.S. Federal Highway Administration Report FHWA NHI-16-072, Geotechnical Engineering Circular no. 5, 1 v.

ACRONYMS AND ABBREVIATIONS

ATD	at time of drilling	N	field (uncorrected) SPT N-value	REF	refusal
bpf	blows per foot	N_{60}	SPT N-value corrected for 60% ETR	RQD	rock quality designation (ASTM D6032)
dia, diam	diameter	NA, n/a	not applicable or not available	SC	sonic core
Elev.	elevation	NE	northeast	SE	southeast
ENV	environmental sample	NP	nonplastic	SPT	Standard Penetration Test (ASTM D1586)
ETR	energy transfer ratio (hammer)	NR	no recovery	SW	southwest
FC	fines content (< 0.075 mm)	NW	northwest	TP	test pit
FeO	iron oxide	OC	organic content	tsf	tons per square foot
ft or '	foot or feet	OD	outside diameter	TV	tor vane reading
gal	gallons	OW	observation well	UCS, q_u	unconfined compressive strength
GP	geoprobe	pcf	pounds per cubic foot	USCS	Unified Soil Classification System
GWT	groundwater table	PI	plasticity index	VST	vane shear test
HSA	hollow-stem auger	PID	photoionization detector	VWP	vibrating wire piezometer
ID	inside diameter or identification	PL	plastic limit	WC	natural water content
in or "	inch	PMT	pressuremeter test	WOH	weight of hammer
incl	inclinometer	PP	pocket penetrometer reading	WOR	weight of rods
ksf	kips per square foot	ppm	parts per million		
lbs	pounds	psi	pounds per square inch		
LL	liquid limit	PT	nonstandard penetration test N-value		
mm	millimeter	REC	recovery		

SHANNON & WILSON

BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-1
Page 1 of 1

EXPLORATION INFORMATION

Total Depth:	*25.3 feet*
Top Elevation:	*~168 feet*
Vertical Datum:	*NAVD88*
Northing:	*~250,719 feet*
Easting:	*~1,198,038 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 15, 2023*
Hole Finish Date:	*May 15, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*
Well Tag No.:	*BPW 177*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type → S-5 (SPT) ← Gray bar indicates percent of sample length recovered.

Water Level During Drilling

Water Level Measured at Date in Well or VWP ← ID No. / Measurement Date (M-D-YY)

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	As-Built	Samples	Field Data	Lab Data	Multiple Items Plotted (see bottom legend on Page 1) 0 50 100	Depth (feet)
165	0	Brown, ***SILTY SAND WITH GRAVEL*** (SM); dry; fine to coarse gravel; fine to coarse sand; nonplastic. (Hf)		FLUSHMOUNT					0
	5				1 (SPT)	N = 50/6" N_{60} > 100 bpf	WC=7%		5
160		*-Hole cleared to 7.5 ft prior to drilling.*							
		Very dense, brown, ***SILTY SAND*** (SM); moist; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvt)			2 (SPT)	N = 50/6" N_{60} > 100 bpf	WC=7% FC=40%		
	10			6-8-23 #1					10
155					3 (SPT)	N = 31,50/3" N_{60} > 100 bpf	WC=8%		
	15				4 (SPT)	N = 30,50/3" N_{60} > 100 bpf	WC=8% FC=45%		15
150		Very dense, gray, ***SANDY SILT*** (ML); moist; fine to coarse, subrounded gravel; fine sand; nonplastic to high plasticity; interbedded with fat clay. (Qvgl)		5-15-23	5 (SPT)	N = 22,50/2" N_{60} > 100 bpf	WC=12%		
	20	Very dense, gray-brown, ***SILTY SAND*** (SM); wet; few fine to coarse, subrounded gravel; fine to coarse sand; nonplastic. (Qva)		8-16-23 #1	6A (SPT) 6B (SPT) 6C (SPT)	N = 15,27,32 N_{60} = 79 bpf	WC=14% FC=29% WC=20% WC=18%		20
145		*-Layer of wet silt from 20.5 to 21 feet.*							
	25	Very dense, gray, ***SILTY SAND*** (SM); moist; few fine, subrounded gravel; fine to coarse sand; nonplastic; diamict. (Qvt)		#1	7 (SPT)	N = 50/3" N_{60} > 100 bpf	WC=10%		25
	25.3	BOTTOM OF HOLE AT 25.3 FEET							

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
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- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	
Review by:	EAS
Version:	1

Job#: 110699 | Template Ver:1 | File: 110699.GPJ | Rpt: BORING LOG | Library: SW GINT LIBRARY.GLB | Date: 11/7/23

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BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

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Page 1 of 1

EXPLORATION INFORMATION

Total Depth:	*25.4 feet*
Top Elevation:	*~171 feet*
Vertical Datum:	*NAVD88*
Northing:	*~251,010 feet*
Easting:	*~1,198,045 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 16, 2023*
Hole Finish Date:	*May 16, 2023*

DRILLING INFORMATION

Drilling Method:	*Mud Rotary*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*5 7/8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type → S-5 (SPT) ← Gray bar indicates percent of sample length recovered.

Water Level During Drilling →

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	Backfill	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
170	0	Dense to very dense, gray, ***SILTY GRAVEL WITH SAND*** (GM); moist; fine to coarse, subrounded to angular gravel; fine to coarse sand; nonplastic. (Hf) [fine to coarse gravel, angular]			1 (SPT)	N = 7,6,30 N_{60} = 48 bpf	WC=7%		
	5				2 (SPT)	N = 28,50/4" N_{60} > 100 bpf	WC=9%		5
165					3 (SPT)	N = 50/6" N_{60} > 100 bpf			
	10	Very dense, gray, ***SILTY SAND*** (SM); moist; fine to coarse, subrounded to angular gravel; fine to coarse sand; nonplastic; diamict. (Qvt)			4 (SPT)	N = 18,50/4" N_{60} > 100 bpf	WC=11%		10
160					5 (SPT)	N = 38,50/3" N_{60} > 100 bpf	WC=10% FC=46%		
	15				6 (SPT)	N = 50/5" N_{60} > 100 bpf	WC=9%		15
155					7 (SPT)	N = 50/5" N_{60} > 100 bpf	WC=8%		
	20				8 (SPT)	N = 50/3" N_{60} > 100 bpf			20
150									
	25				9 (SPT)	N = 50/4" N_{60} > 100 bpf	WC=8%		25
25.4		BOTTOM OF HOLE AT 25.4 FEET							

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	ECS
Review by:	EAS
Version:	1

Job#: 110699 | Template Ver:1 | File: 110699.GPJ | Rpt: BORING LOG | Library: SW GINT LIBRARY.GLB | Date: 11/7/23

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BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

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Page 1 of 1

EXPLORATION INFORMATION

Total Depth:	*25.4 feet*
Top Elevation:	*~161 feet*
Vertical Datum:	*NAVD88*
Northing:	*~251,300 feet*
Easting:	*~1,197,985 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 16, 2023*
Hole Finish Date:	*May 16, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*
Well Tag No.:	*BPW 178*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

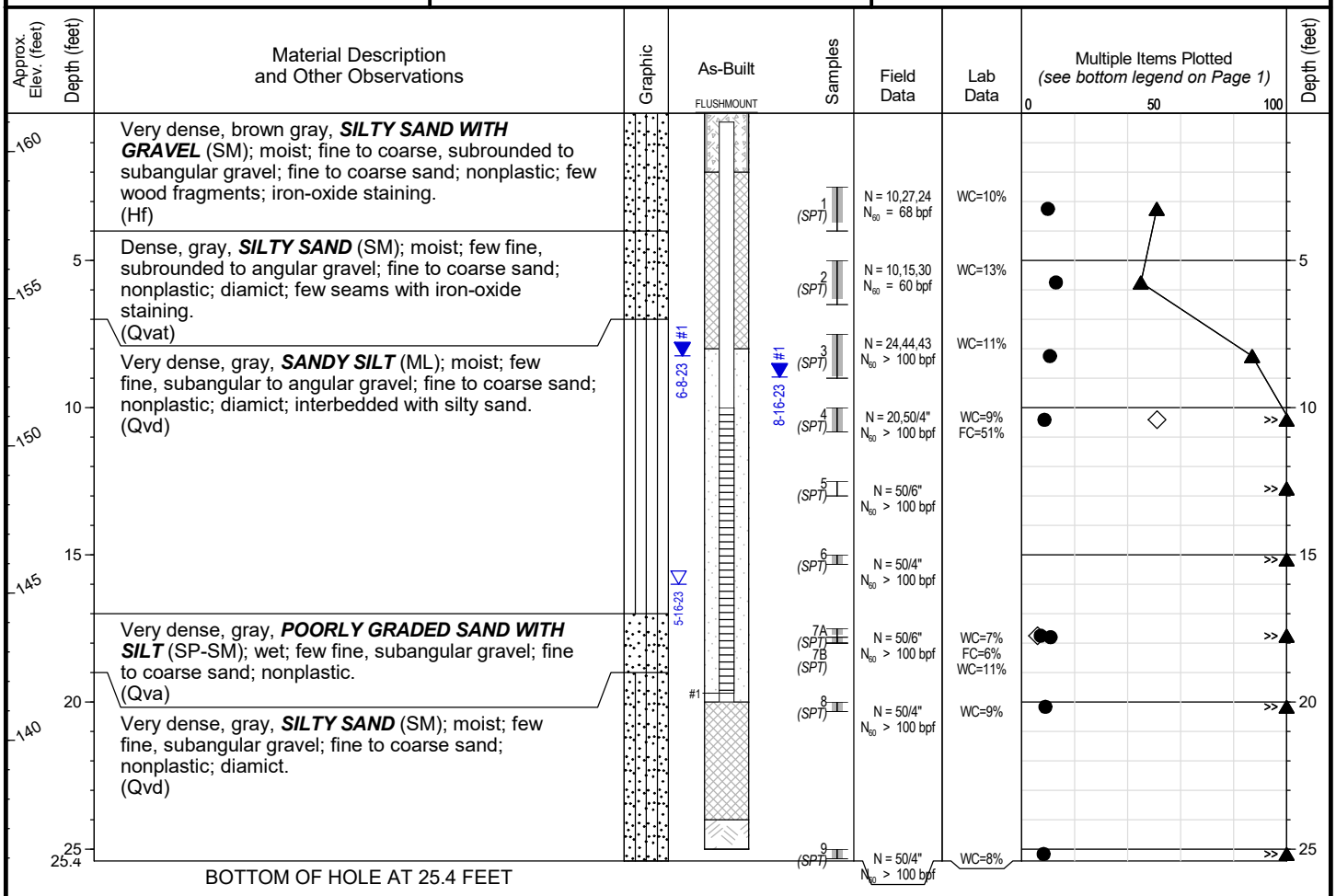
N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type: S-5 (SPT) — Gray bar indicates percent of sample length recovered.

Water Level During Drilling ▽

Water Level Measured at Date in Well or VWP # — ID No. Measurement Date (M-D-YY)



NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

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Review by:	EAS
Version:	1

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BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

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Page 1 of 1

EXPLORATION INFORMATION

Total Depth:	*30.3 feet*
Top Elevation:	*~149 feet*
Vertical Datum:	*NAVD88*
Northing:	*~250,842 feet*
Easting:	*~1,197,451 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 16, 2023*
Hole Finish Date:	*May 16, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type → S-5 (SPT) ← Gray bar indicates percent of sample length recovered.

Water Level During Drilling →

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	Backfill	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
145	0	Dark brown, ***ORGANIC SILT*** (OL/OH); wet; few fine to coarse sand; low to medium plasticity; little organics. (Hp)							0
	5	*-Hole Cleared to 5 ft.*			1A (SPT) 1B (SPT)	N = 3,3,9 N_{60} = 16 bpf	WC=35% WC=22% LL/PI=44/20		5
140		Stiff, blue-gray brown, ***LEAN CLAY*** (CL); moist; fine to medium sand; low to medium plasticity; interbedded with clayey sand; pockets with iron-oxide staining. (Hl)			2 (SPT)	N = 6,5,9 N_{60} = 19 bpf	WC=18%		
	10	Stiff to very stiff, green, ***SANDY LEAN CLAY*** (CL); moist; few fine, subrounded gravel; fine to coarse sand; low to medium plasticity; diamict. (Qvrl) *-Sand seam at 11.5 feet.*			3 (SPT)	N = 3,8,8 N_{60} = 21 bpf	WC=21% LL/PI=32/14		10
135					4 (SPT)	N = 20,16,26 N_{60} = 56 bpf	WC=21%		
	15	Hard, gray, ***SANDY LEAN CLAY*** (CL); moist; few fine, subrounded gravel; fine to coarse sand; low to medium plasticity; diamict. (Qvgl)			5 (SPT)	N = 17,25,35 N_{60} = 80 bpf	WC=12%		15
130		Very dense, brown, ***POORLY GRADED SAND WITH SILT*** (SP-SM); wet; few fine, subrounded to subangular gravel; fine to coarse sand; nonplastic. (Qva)		5-16-23	6 (SPT)	N = 50/5" N_{60} > 100 bpf	WC=12% FC=35%	>>	
	20	Very dense, gray, ***SILTY SAND*** (SM); moist to wet; few fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvd)			7 (SPT)	N = 50/5" N_{60} > 100 bpf		>>	20
125									
	25				8 (SPT)	N = 50/3" N_{60} > 100 bpf		>>	25
120									
	30	BOTTOM OF HOLE AT 30.3 FEET			9 (SPT)	N = 50/4" N_{60} > 100 bpf	WC=8%	>>	30

NOTES:
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- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%
Plastic Limit ——●—— Liquid Limit

FINAL

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Version:	1

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BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-5

EXPLORATION INFORMATION

Total Depth:	*40.2 feet*
Top Elevation:	*~153 feet*
Vertical Datum:	*NAVD88*
Northing:	*~251,041 feet*
Easting:	*~1,197,862 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 17, 2023*
Hole Finish Date:	*May 17, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*
Well Tag No.:	*BPW 179*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type: S-5 (SPT) — Gray bar indicates percent of sample length recovered.

Water Level During Drilling

Water Level Measured at Date in Well or VWP — ID No. / Measurement Date (M-D-YY)

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	As-Built	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
150	0	Brown, ***SANDY SILT*** (ML); dry to moist; fine to coarse gravel; fine to coarse sand; nonplastic. (Hf) *-Wood at 2' in pothole.*		FLUSHMOUNT					
	5	Dense, brown, ***POORLY GRADED SAND WITH SILT*** (SP-SM); moist to wet; few fine, subangular gravel; fine to coarse sand; nonplastic. (Hf) *-Hole cleared to 5 ft.*		6-8-23 #1	1 (SPT)	N = 7,13,21 N_{60} = 45 bpf	WC=14%		5
145				8-16-23 #1	2 (SPT)	N = 27,50/6" N_{60} > 100 bpf	WC=9% FC=40%		
140	10	Very dense, gray, ***SILTY SAND*** (SM); moist; few fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvt) *-Layer of wet poorly graded sand at 10 feet.*		5-17-23	3A (SPT)	N = 13,28,50/3" N_{60} > 100 bpf	WC=15%		10
					3B (SPT)		WC=15%		
					4 (SPT)	N = 29,50/3" N_{60} > 100 bpf	WC=10%		
135	15				5 (SPT)	N = 25,50/4" N_{60} > 100 bpf	WC=11% FC=36%		15
					6 (SPT)	N = 50/5" N_{60} > 100 bpf			
130	20				7 (SPT)	N = 50/6" N_{60} > 100 bpf	WC=10%		20
125	25				8 (SPT)	N = 50/3" N_{60} > 100 bpf	WC=8%		25
					9 (SPT)	N = 50/3" N_{60} > 100 bpf			
120	30								30
	35				10 (SPT)	N = 50/5"	WC=8%		35

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
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- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	
Review by:	EAS
Version:	1

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

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Page 2 of 2

See Page 1 for Hole Information and Notes

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	As-Built	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
115	40	Very dense, gray, ***SILTY SAND*** (SM); moist; few fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvt) *(starts on previous page)*		#1	11 (SPT)	N_{60} > 100 bpf N = 50/3" N_{60} > 100 bpf	WC=10%		40
74.8		BOTTOM OF HOLE AT 40.2 FEET							

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BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

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Page 1 of 1

EXPLORATION INFORMATION

Total Depth:	*25.9 feet*
Top Elevation:	*~153 feet*
Vertical Datum:	*NAVD88*
Northing:	*~250,944 feet*
Easting:	*~1,197,362 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 17, 2023*
Hole Finish Date:	*May 17, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type → S-5 (SPT) ← Gray bar indicates percent of sample length recovered.

Water Level During Drilling →

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	Backfill	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
150	0	Loose to medium dense, gray brown, ***SILTY SAND WITH GRAVEL*** (SM); moist; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; little organics; diamict. (Hf)			1 (SPT)	N = 4,5,4 N_{60} = 12 bpf	WC=10%		0
	5				2 (SPT)	N = 4,8,7 N_{60} = 20 bpf	WC=9%		5
145					3 (SPT)	N = 13,14,12 N_{60} = 35 bpf	WC=15% FC=33%		
	10	Medium dense, brown orange-brown, ***SILTY GRAVEL WITH SAND*** (GM); moist; fine to coarse, subrounded to subangular gravel; fine to coarse sand; low to medium plasticity; little wood fragments; diamict. (Hf)			4A (SPT) 4B (SPT) 4C (SPT)	N = 7,10,16 N_{60} = 35 bpf	WC=9% WC=16% WC=13%		10
140					5 (SPT)	N = 11,26,50 N_{60} > 100 bpf	WC=11%		
	15	Very dense, gray gray-brown, ***SILTY SAND WITH GRAVEL*** (SM); dry to moist; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvt)			6 (SPT)	N = 13,50/6" N_{60} > 100 bpf	WC=10%	>>	15
135					7 (SPT)	N = 30,50/4" N_{60} > 100 bpf	WC=10% FC=43%	>>	
	20				8 (SPT)	N = 50/4" N_{60} > 100 bpf	WC=6%	>>	20
130									
	25	Very dense, gray-brown, ***SILTY SAND WITH GRAVEL*** (SM); moist to wet; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict; few wet poorly graded sand with silt seams. (Qvd)		5-17-23	9 (SPT)	N = 23,50/5" N_{60} > 100 bpf	WC=13%	>>	25
	25.9	BOTTOM OF HOLE AT 25.9 FEET							

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	ECS
Review by:	EAS
Version:	1

Job#: 110699 | Template Ver:1 | File: 110699.GPJ | Rpt: BORING LOG | Library: SW GINT LIBRARY.GLB | Date: 11/7/23

SHANNON & WILSON

BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-7

EXPLORATION INFORMATION

Total Depth:	*45.7 feet*
Top Elevation:	*~155 feet*
Vertical Datum:	*NAVD88*
Northing:	*~251,011 feet*
Easting:	*~1,197,933 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 18, 2023*
Hole Finish Date:	*May 18, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*
Well Tag No.:	*BNL 590*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type: S-5 (SPT) — Gray bar indicates percent of sample length recovered.

Water Level During Drilling

Water Level Measured at Date in Well or VWP — ID No. Measurement Date (M-D-YY)

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations
		Brown, ***SILTY SAND*** (SM); dry; fine to coarse sand. (Hf)
		Very dense, gray, ***POORLY GRADED SAND WITH SILT*** (SP-SM); moist; few fine, subangular sand; fine to coarse sand; nonplastic. (Qva)
150	5	
		Very dense, gray, ***POORLY GRADED GRAVEL WITH SAND*** (GP); moist; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic. (Qva)
		Very dense, gray-brown, ***SILTY SAND WITH GRAVEL*** (SM); wet; fine, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict. (Qvd)
145	10	
		Very dense, gray, ***SILTY SAND WITH GRAVEL*** (SM); moist; fine to coarse, subrounded gravel; fine to coarse sand; nonplastic; diamict. (Qvt)
140	15	
		Very dense, gray, ***SILTY SAND*** (SM); wet; few fine, subrounded gravel; fine to coarse sand; nonplastic. (Qva)
135	20	
		Very dense, gray, ***SILTY SAND WITH GRAVEL*** (SM); moist; fine to coarse, subrounded gravel; fine to coarse sand; nonplastic; diamict. (Qvd)
		Very dense, gray, ***SILT*** (ML); wet; few fine sand; nonplastic; dilatant. (Qvgl)
130	25	
		Very dense, gray, ***SILTY SAND*** (SM); moist; fine to coarse, subrounded gravel; fine to coarse sand; nonplastic; diamict. (Qvd)
125	30	
		Very dense, gray, ***SILT*** (ML); moist to wet; few fine sand; nonplastic. (Qvgl)
120	35	

As-Built: FLUSHMOUNT; #1 6-8-23; 5-18-23; #1 8-16-23

Samples	Field Data	Lab Data
1 (SPT)	N = 7,20,35 N_{60} = 73 bpf	WC=10%
2 (SPT)	N = 24,50/5" N_{60} > 100 bpf	WC=6%
3 (SPT)	N = 22,26,41 N_{60} = 89 bpf	WC=11%
4 (SPT)	N = 46,50/2" N_{60} > 100 bpf	WC=8% FC=30%
5 (SPT)	N = 11,50/3" N_{60} > 100 bpf	WC=10%
6 (SPT)	N = 50/4" N_{60} > 100 bpf	
7 (SPT)	N = 36,41,50/2" N_{60} > 100 bpf	WC=14% FC=26%
8 (SPT)	N = 50/3" N_{60} > 100 bpf	WC=11%
9 (SPT)	N = 26,50/4" N_{60} > 100 bpf	WC=22%
10 (SPT)	N = 50/5" N_{60} > 100 bpf	WC=11% FC=42%
11 (SPT)	N = 50/4"	WC=15%

Multiple Items Plotted *(see bottom legend on Page 1)*: 0 — 50 — 100

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	ECS
Review by:	EAS
Version:	1

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-7
Page 2 of 2

See Page 1 for Hole Information and Notes

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	As-Built	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
115	40	Very dense, gray, ***SILT*** (ML); moist to wet; few fine sand; nonplastic. (Qvgl) *(starts on previous page)*			12 (SPT)	N_{60} > 100 bpf N = 50/5" N_{60} > 100 bpf	WC=17% FC=88%		40
110	45	Very dense, gray, ***POORLY GRADED SAND WITH SILT AND GRAVEL*** (SP-SM); wet; fine to coarse, subangular gravel; fine to coarse sand; nonplastic. (Qva)		#1	13 (SPT)	N = 28,50/3" N_{60} > 100 bpf	WC=13% FC=9%		45
	45.7	BOTTOM OF HOLE AT 45.7 FEET							

SHANNON & WILSON

BORING LOG

Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-8
Page 1 of 2

EXPLORATION INFORMATION

Total Depth:	*40.2 feet*
Top Elevation:	*~156 feet*
Vertical Datum:	*NAVD88*
Northing:	*~251,099 feet*
Easting:	*~1,197,978 feet*
Horizontal Datum:	*WA-N SP [NAD 1983]*
Hole Start Date:	*May 18, 2023*
Hole Finish Date:	*May 18, 2023*

DRILLING INFORMATION

Drilling Method:	*Hollow Stem Auger*
Drilling Company:	*Holt*
Drill Rig Equipment:	*B-58*
Hole Size:	*8 inch*
Rod Type/Dia.:	*NWJ 2.63 inch*
Hammer Wt. / Drop:	*140 lbs/30 inches*
Hammer ETR:	*~80% (estimated)*

BASIC LEGEND

(See separate LOG KEY for additional symbols, acronyms, and definitions)

Abbreviations

N	Standard Penetration Test (SPT) blows per 6-inch increment
PT	Penetration test (not SPT) blows per 6-inch increment
bpf	Blows per foot for penetration test
WC	Natural water content (%)
FC	Fines content (% grains smaller than 0.075 mm)
PI	Plasticity index (Atterberg Limits)

Symbols

Sample Number / Sample Type → S-5 (SPT) ← Gray bar indicates percent of sample length recovered.

Water Level During Drilling →

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	Backfill	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
155	0	Medium dense, brown mottled orange, ***SILTY SAND WITH GRAVEL*** (SM); moist; fine to coarse, subrounded gravel; fine to coarse sand; nonplastic; trace organics; iron-oxide staining. (Hf)			1 (SPT)	N = 4,8,15 N_{60} = 31 bpf	WC=9%		0
150	5	Dense, gray, ***SILTY SAND*** (SM); moist; few fine, subrounded gravel; fine to coarse sand; nonplastic. (Qvro)			2A (SPT) 2B (SPT)	N = 10,11,25 N_{60} = 48 bpf	WC=13% WC=14%		5
		Very dense, gray, ***SILTY SAND*** (SM); moist to wet; few fine, subrounded gravel; fine to coarse sand; nonplastic; diamict. (Qvd)		5-18-23	3 (SPT)	N = 11,40,50/5" N_{60} > 100 bpf	WC=12% FC=31%		
145	10	Very dense, gray, ***POORLY GRADED SAND*** (SP); wet; trace fine, subangular gravel; fine to coarse sand; nonplastic. (Qva)			4A (SPT) 4B (SPT)	N = 20,35,31 N_{60} = 88 bpf	WC=11% WC=15%		10
		Very dense, gray, ***SILTY SAND WITH GRAVEL*** (SM); moist to wet; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict; interbedded with sandy silt. (Qvd) *-Layer of wet poorly graded sand with silt at 17.5 feet.*			5A (SPT) 5B (SPT)	N = 9,20,44 N_{60} = 85 bpf	WC=17% WC=21%		
140	15				6 (SPT)	N = 50/5" N_{60} > 100 bpf	WC=13%		15
					7 (SPT)	N = 24,30,50/2" N_{60} > 100 bpf	WC=19%		
135	20				8 (SPT)	N = 48,50/3" N_{60} > 100 bpf	WC=10%		20
130	25				9 (SPT)	N = 50/4" N_{60} > 100 bpf	WC=15% FC=62%		25
125	30				10 (SPT)	N = 50/4" N_{60} > 100 bpf	WC=9%		30
120	35				11 (SPT)	N = 50/1"			35

NOTES:
- Refer to LOG KEY for explanation of symbols, codes, abbreviations, and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- Group symbol is based on visual-manual identification and selected lab testing.
- Report text contains limitations and information needed to contextually understand this log.

▲ Uncorrected N-value, bpf
▼ Uncorrected, Penetration N-value, bpf
● = WC% ◇ = FC%

FINAL

Logged by:	ECS
Review by:	EAS
Version:	1

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Kitsap County Hauled Waste Upgrades
Kitsap County, Washington

KT-8
Page 2 of 2

See Page 1 for Hole Information and Notes

Approx. Elev. (feet)	Depth (feet)	Material Description and Other Observations	Graphic	Backfill	Samples	Field Data	Lab Data	Multiple Items Plotted *(see bottom legend on Page 1)* 0 50 100	Depth (feet)
	40	Very dense, gray, ***SILTY SAND WITH GRAVEL*** (SM); moist to wet; fine to coarse, subrounded to subangular gravel; fine to coarse sand; nonplastic; diamict; interbedded with sandy silt. (Qvd) *(starts on previous page)*			12 (SPT)	N_{60} > 100 bpf N = 50/3" N_{60} > 100 bpf	WC=9%		40
		BOTTOM OF HOLE AT 40.2 FEET							

APPENDIX B: PREVIOUS DRILLING

Appendix B

Previous Drilling

CONTENTS

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15% - "with gravel," "with sand," "with silt," etc.
	≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

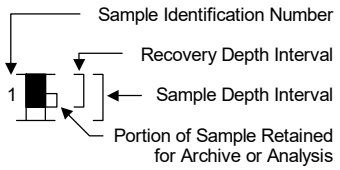
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽	Approximate water level at time of drilling (ATD)
▼	Approximate water level at time after drilling/excavation/well

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Central Kitsap Wastewater Treatment Plant
Poulsbo, Washington

Soil Classification System and Key

Figure A-1

LAI-1

LAI Project No: 1490009.010

SAMPLE DATA | **SOIL PROFILE** | **WELL DETAIL** (DOE#: BNP-032)

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 154.0 (NGVD 29)
Drilled By: Holocene Drilling Inc.
Logged By: AOF Date: 12/13/21

Moisture Content (%) — Plastic Limit — Liquid Limit (20 40 60 80)
▲ SPT N-Value ▲ △ Non-Standard N-Value △ (20 40 60 80)
× Fines Content (%) × (20 40 60 80)

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description
0							SP-SM	Brown, poorly graded SAND with silt and gravel (loose, moist) **(FILL)**
		S-1	b2	6				(no odor, no sheen, 0 ppm)
	150							
5		S-2	b2	61				- Grades to gray, gravelly and very dense (no odor, no sheen, 0 ppm)
		S-3	b2	29	W = 9 -200 = 10		GP	- Observed broken gravel in the sample tube Gray, poorly graded GRAVEL with sand (no odor, no sheen, 0 ppm) (medium dense, wet)
	145							
10		S-4	b2	81	W = 8		SM	- Observed moderate drill chatter Gray, silty, fine to coarse SAND with gravel (no odor, no sheen, 0 ppm) (very dense, moist to wet)
		S-5	b2	67	W = 12 GS			**(GLACIAL DRIFT)** - Grades to without gravel (no odor, no sheen, 0 ppm)
	140							
15		S-6a	b2	46	W = 18			
		S-6b			W = 19 -200 = 71		SP ML	Gray, fine to coarse SAND (no odor, no sheen, 0 ppm) (dense, wet)
		S-7	b2	64	W = 13 GS		SM	Light gray-brown, SILT with sand (no odor, no sheen, 0 ppm) (hard, moist to wet)
	135							
20		S-8	b2	50/ 6"	W = 14			Gray, silty, fine to coarse SAND (no odor, no sheen, 0 ppm) (very dense, wet)
		S-9	b2	50/ 3"	W = 21 GS		SP	Gray, poorly graded SAND (no odor, no sheen, 0 ppm) (very dense, wet)
	130							
25		S-10	b2	50/ 4"	W = 9		ML	Gray, sandy SILT (no odor, no sheen, 0 ppm) (very stiff, moist to wet)
		S-11	b2	50/ 6"	W = 15 GS			(no odor, no sheen, 0 ppm)
	125							
30		S-12	b2	50/ 2"			SM	Gray silty SAND (very dense, wet) (no odor, no sheen, 0 ppm)
		S-13	b2	50/ 4"	W = 15 -200 = 48			- Observed moderate drill chatter - Observed 4 inch cobbles in the drilling spoils (no odor, no sheen, 0 ppm)
35	120							

WELL DETAIL: Perched, ATD

50/6" 50/3" 50/4" 50/6" 50/2" 50/4"

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1490009.01 2/7/22 T:\1490\009.010\T\1490009.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Central Kitsap Wastewater Treatment Plant Poulsbo, Washington

Log of Boring LAI-1

Figure A-2 (1 of 2)

LAI-1

LAI Project No: 1490009.010

SAMPLE DATA | **SOIL PROFILE** | **WELL DETAIL** (DOE#: BNP-032)

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 154.0 (NGVD 29)
Drilled By: Holocene Drilling Inc.
Logged By: AOF Date: 12/13/21

Moisture Content (%) — Plastic Limit — Liquid Limit — 20 40 60 80
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 20 40 60 80
× Fines Content (%) × — 20 40 60 80

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description
35		S-14	b2	50/ 4"	W = 12		SM	Gray silty, fine to coarse SAND with gravel (no odor, no sheen, 0 ppm) (very stiff, wet)
		S-15	b2	50/ 4"	W = 10 GS			- Grades to moist to wet (no odor, no sheen, 0 ppm)
	115							- Observed moderate drill chatter
40		S-16	b2	50/ 3"	W = 12			- Grades to wet (no odor, no sheen, 0 ppm)
								- Observed heavy drill chatter and slow drilling to 50 ft bgs
	110							
45		S-17	b2	50/ 4"	W = 12 -200 = 32			(no odor, no sheen, 0 ppm)
	105							
50		S-18	b2	50/ 3"				- Grades to moist to wet (no odor, no sheen, 0 ppm)
55								
60								
65								
70								

Boring Completed 12/13/21
Total Depth of Boring = 50.3 ft.

Monitoring Well Completed 12/13/21

Moisture Content (%) / SPT N-Value / Fines Content (%) plot values: 50/4", 50/4", 50/3", 50/4", 50/3"

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1490009.01 2/7/22 T:\1490\009.010\T\1490009.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Central Kitsap Wastewater Treatment Plant Poulsbo, Washington

Log of Boring LAI-1

Figure A-2 (2 of 2)

LAI-2

LAI Project No: 1490009.010

SAMPLE DATA | **SOIL PROFILE** | **WELL DETAIL** (DOE#: BNP-033)

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 152.4 (NGVD 29)
Drilled By: Holocene Drilling Inc.
Logged By: AOF Date: 12/14/21

Moisture Content (%) — Plastic Limit — Liquid Limit (20 40 60 80)
▲ SPT N-Value ▲ △ Non-Standard N-Value △ (20 40 60 80)
× Fines Content (%) × (20 40 60 80)

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Description	Moisture Content (%)
0	150	S-1	b2	14		ML	Brown, gravelly SILT with sand (medium stiff, moist to wet)	
							(FILL)	
						SM	Gray silty, fine to coarse SAND with gravel (no odor, no sheen, 0 ppm) (medium dense, moist)	
5							- Observed minor iron staining	
		S-2	b2	4	W = 10 GS		- Grades to gray-brown, loose and wet (no odor, no sheen, 0 ppm)	
	145	S-3	b2	13	W = 15 GS	SP	Gray-brown, gravelly, poorly graded SAND (slight petroleum odor, no sheen, 0 ppm) (medium dense, wet)	
10		S-4	b2	50/ 6"	W = 7 GS	SM	- Observed granular, yellow/orange material and broken plastic debris	50/ 6"
	140	S-5	b2	50/ 4"			Gray, silty, fine to coarse SAND with gravel (no odor, no sheen, 0 ppm) (very dense, moist to wet) **(GLACIAL DRIFT)** (no odor, no sheen, 0 ppm)	50/ 4"
15		S-6	b2	50/ 5"	W = 7 GS		- Grades to moist (no odor, no sheen, 0 ppm)	50/ 5"
	135	S-7	b2	50/ 5"	W = 8		- Observed moderate drill chatter (no odor, no sheen, 0 ppm)	50/ 5"
20		S-8	b2	72	W = 11 -200 = 38		- Grades to moist to wet (no odor, no sheen, 0 ppm)	
	130	S-9	b2	50/ 5"			- Observed heavy drill chatter (no odor, no sheen, 0 ppm)	50/ 5"
25		S-10	b2	50/ 4"	W = 11 -200 = 31		(no odor, no sheen, 0 ppm)	50/ 4"
	125	S-11	b2	50/ 4"	W = 9		(no odor, no sheen, 0 ppm)	50/ 4"
30		S-12	b2	50/ 4"	W = 10 GS		(no odor, no sheen, 0 ppm)	50/ 4"
	120	S-13	b2	50/ 5"			- Grades to moist (no odor, no sheen, 0 ppm)	50/ 5"
35								

Perched

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1490009.01 2/7/22 T:\1490\009.010\T\1490009.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Central Kitsap Wastewater Treatment Plant Poulsbo, Washington

Log of Boring LAI-2

Figure A-3 (1 of 2)

LAI-2

LAI Project No: 1490009.010

SAMPLE DATA | **SOIL PROFILE** | **WELL DETAIL** (DOE#: BNP-033)

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 152.4 (NGVD 29)
Drilled By: Holocene Drilling Inc.
Logged By: AOF Date: 12/14/21

Moisture Content (%) — Plastic Limit — Liquid Limit
20 40 60 80
▲ SPT N-Value ▲
△ Non-Standard N-Value △
20 40 60 80
× Fines Content (%) ×
20 40 60 80

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description	Fines Content (%)
35		S-14	b2	50/ 3"			SM	Gray, silty, fine to coarse SAND (no odor, no sheen, 0 ppm) (very dense, moist to wet)	50/ 3"
	115	S-15	b2	50/ 3"				- Observed heavy drill chatter (no odor, no sheen, 0 ppm)	50/ 3"
40		S-16	b2	50/ 4"				(no odor, no sheen, 0 ppm) - Observed moderate drill chatter and slow drilling to 50 ft bgs	50/ 4"
	110								
45		S-17	b2	50/ 5"					50/ 5"
	105								
50		S-18	b2	50/ 3"				- Grades to with gravel (no odor, no sheen, 0 ppm)	50/ 3"
55									
60									
65									
70									

Boring Completed 12/14/21
Total Depth of Boring = 50.3 ft.

Monitoring Well Completed 12/14/21

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1490009.01 2/7/22 T:\1490\009.010\T\1490009.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Central Kitsap Wastewater Treatment Plant
Poulsbo, Washington

Log of Boring LAI-2

Figure A-3 (2 of 2)

HA-1

LAI Project No: 1490009.010

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hand Auger
Ground Elevation (ft): 165 (NGVD 29)
Drilled By: Landau Associates, Inc.
Logged By: AOF Date: 12/13/21

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description	Groundwater
0	165	S-1	d				GP	Brown to gray-brown GRAVEL with sand and trace silt (loose, moist to wet) **(FILL)**	
5	160	S-2	d		W = 7 GS				Perched
10	155								

Moisture Content (%): Plastic Limit — Liquid Limit; 20 40 60 80
▲ SPT N-Value ▲ / △ Non-Standard N-Value △; 20 40 60 80
× Fines Content (%) ×; 20 40 60 80

Boring Completed 12/13/21
Total Depth of Boring = 10.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1490009.01 2/7/22 T:\1490\009.010\T\1490009.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Central Kitsap
Wastewater Treatment Plant
Poulsbo, Washington

Log of Boring HA-1

Figure
A-4

APPENDIX C: GEOTECHNICAL LABORATORY TESTING

Appendix C

Geotechnical Laboratory Testing

CONTENTS

Kitsap WWTP
Poulsbo, WA

KT-1
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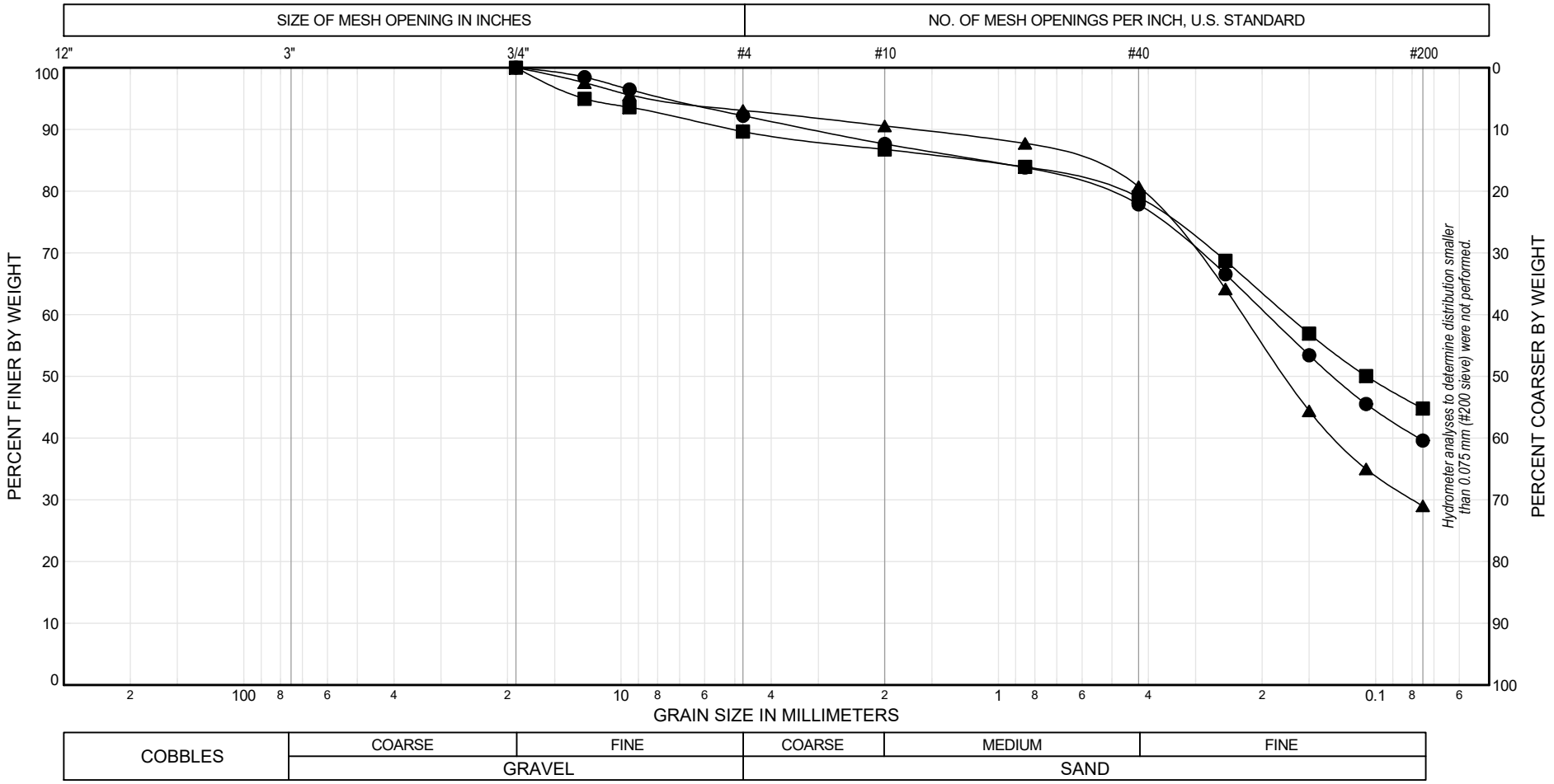


EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-1, S-2	10.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		8	53	40	7.3	SJD NLP	D6913	*Entire sample tested*
■ KT-1, S-4	15.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		10	45	45	8.0	SJD NLP	D6913	*Entire sample tested*
▲ KT-1, 6A	20.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		7	64	29	14.2	SJD NLP	D6913	*Entire sample tested*

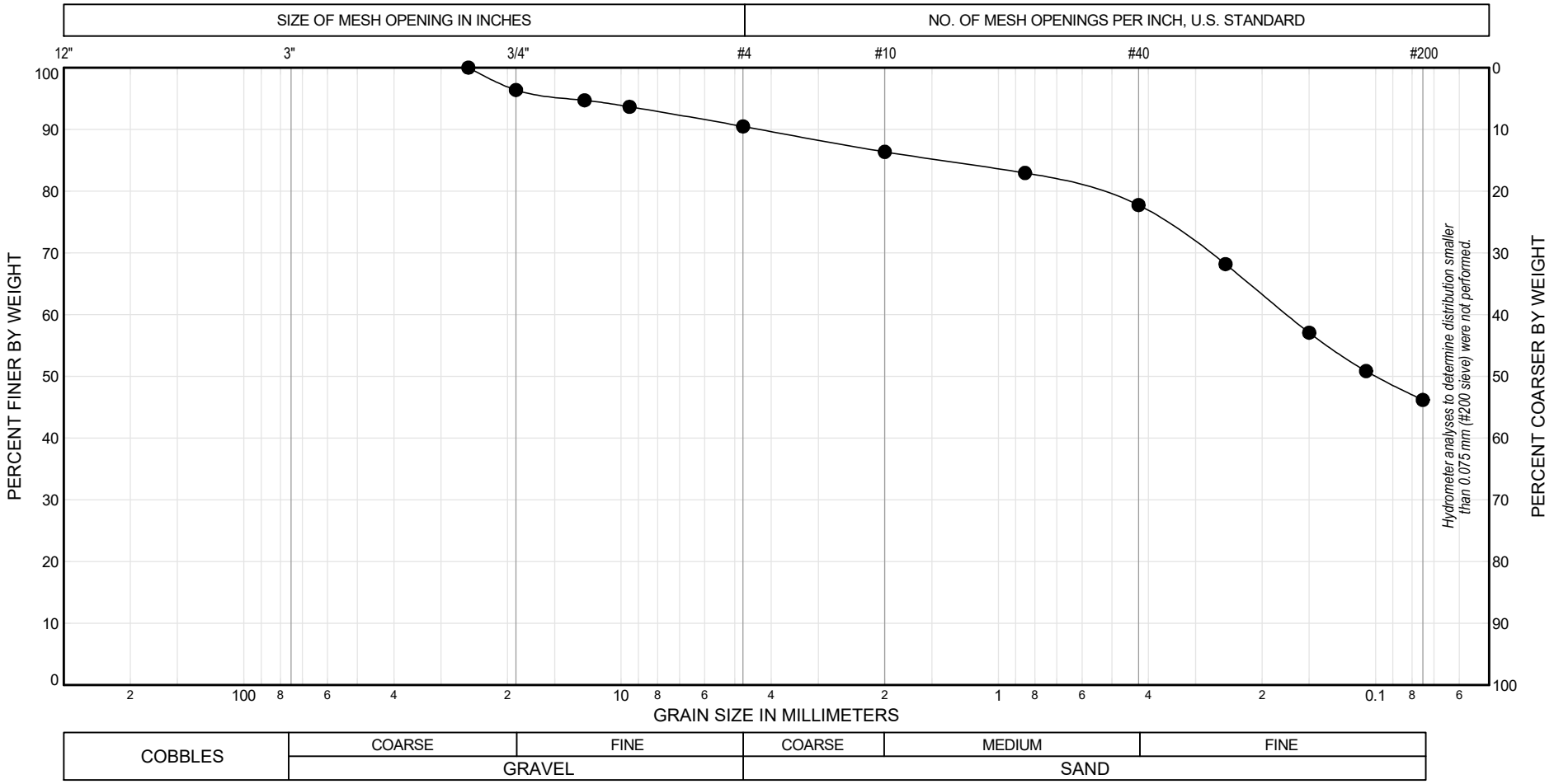
* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

SHANNON & WILSON

GRAIN SIZE DISTRIBUTION TEST RESULTS

Kitsap WWTP
Poulsbo, WA

KT-2



EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-2, S-5	12.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		10	44	46	10.2	SJD NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

KT-3
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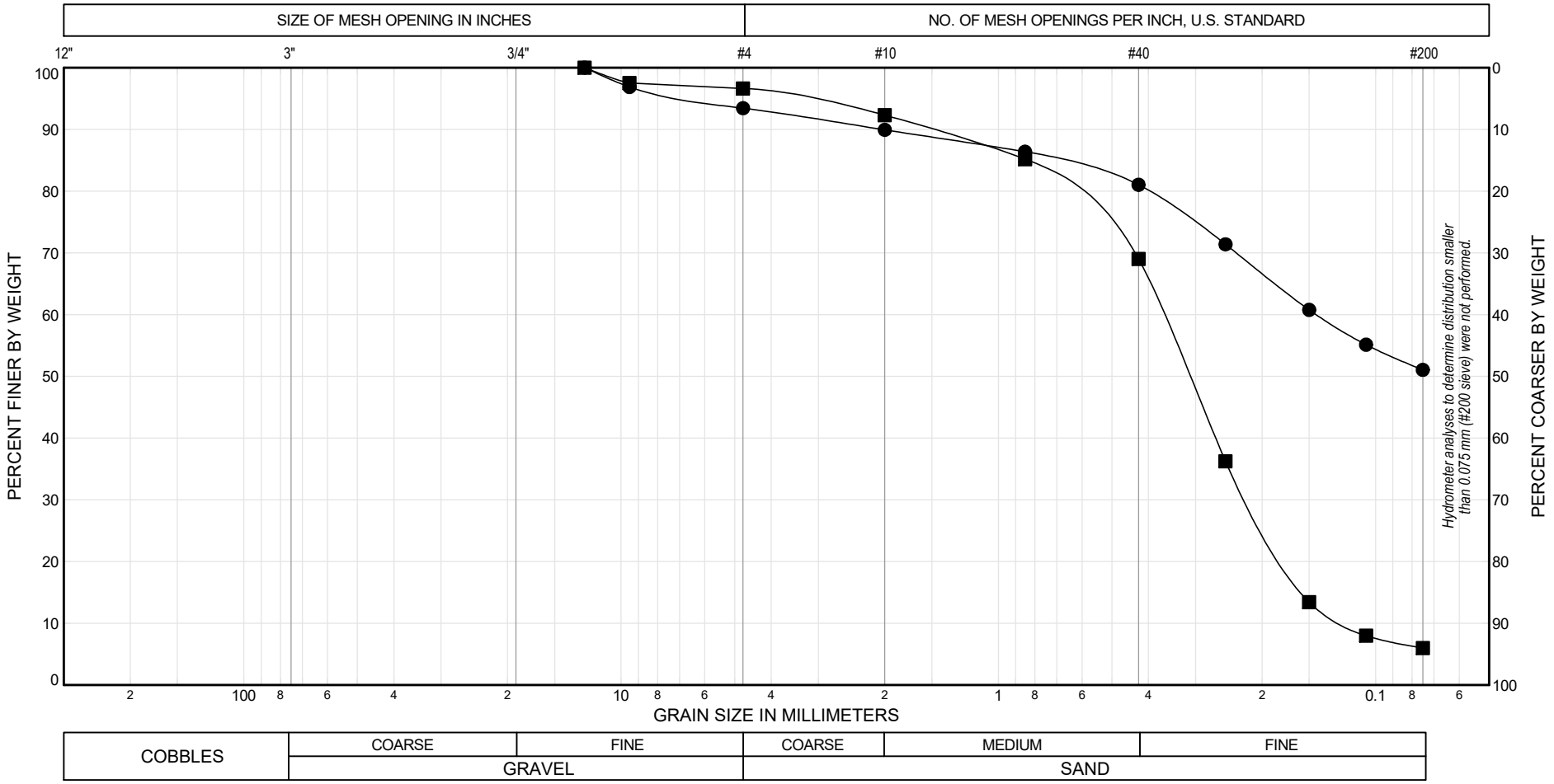

EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-3, S-4	10.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		7	42	51	8.6	KCV NLP	D6913	*Entire sample tested*
■ KT-3, 7A	17.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		3	91	6	7.2	KCV NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

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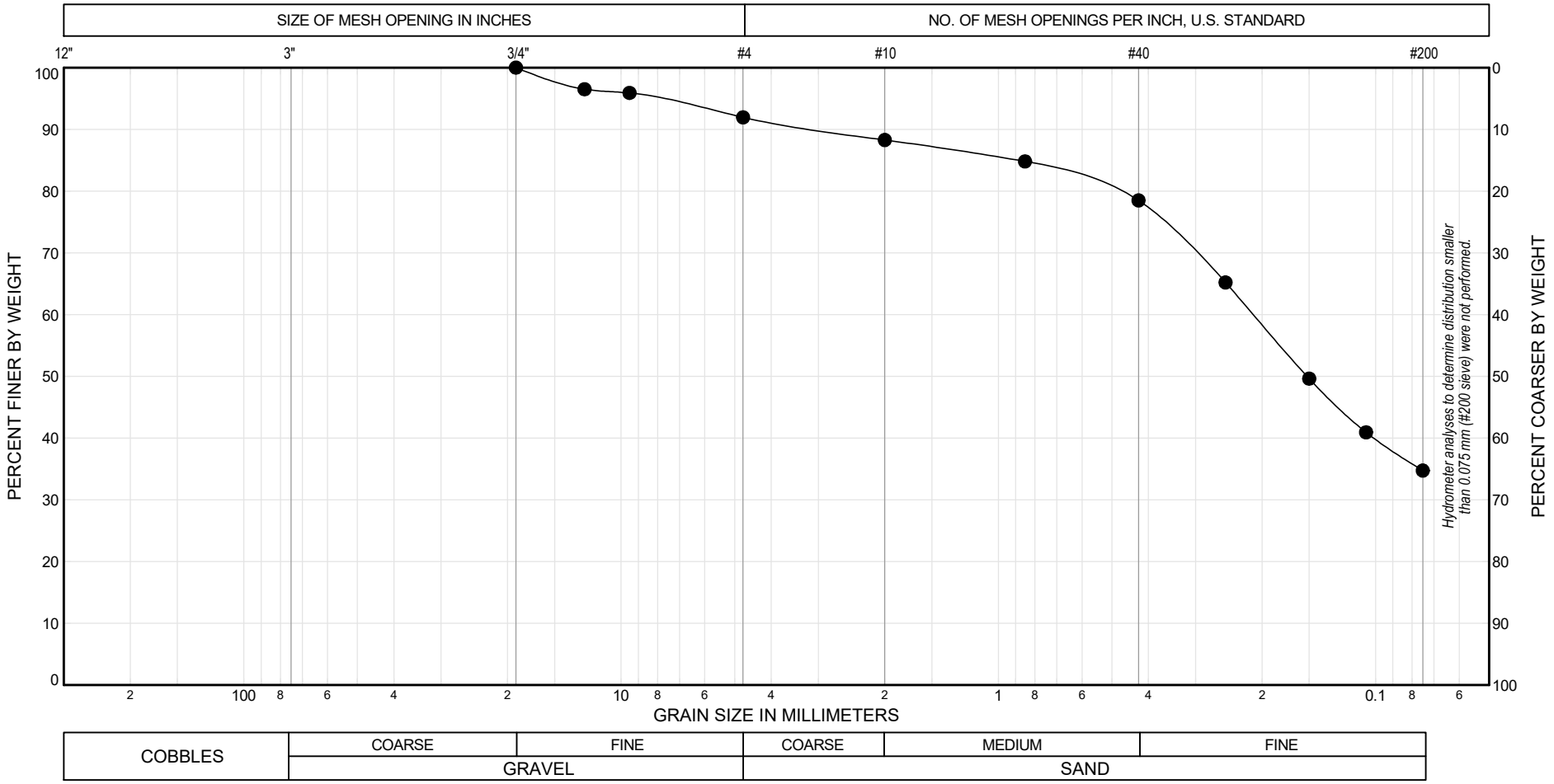

EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-4, S-6	17.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		8	57	35	11.6	SJD NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

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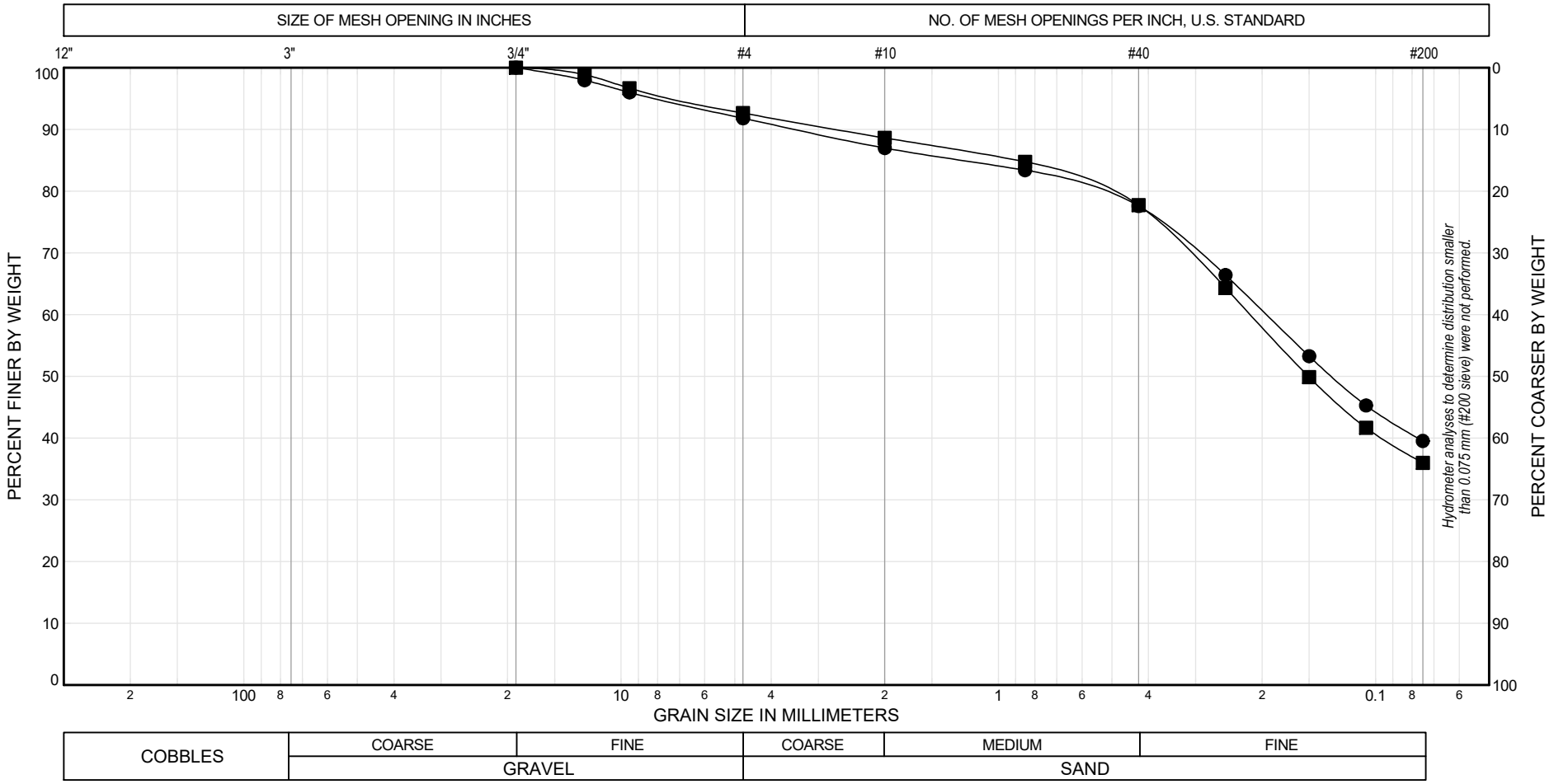

EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-5, S-2	7.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		8	52	40	9.1	KCV NLP	D6913	*Entire sample tested*
■ KT-5, S-5	15.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		7	57	36	10.6	KCV NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

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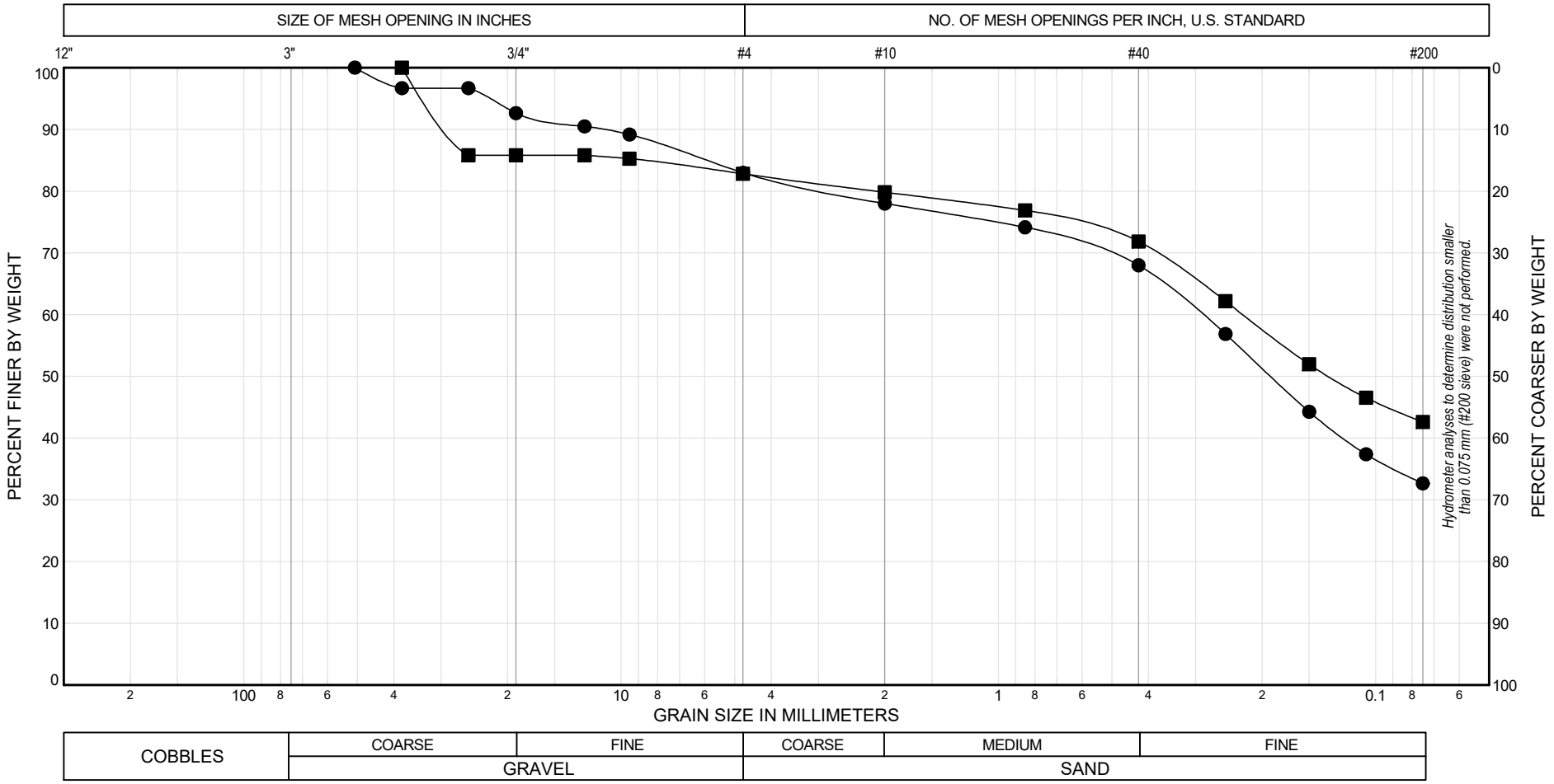


EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-6, S-3	7.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		17	50	33	15.3	KCV NLP	D6913	*Entire sample tested*
■ KT-6, S-7	17.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		17	40	43	9.7	KCV NLP	D6913	*Entire sample tested*

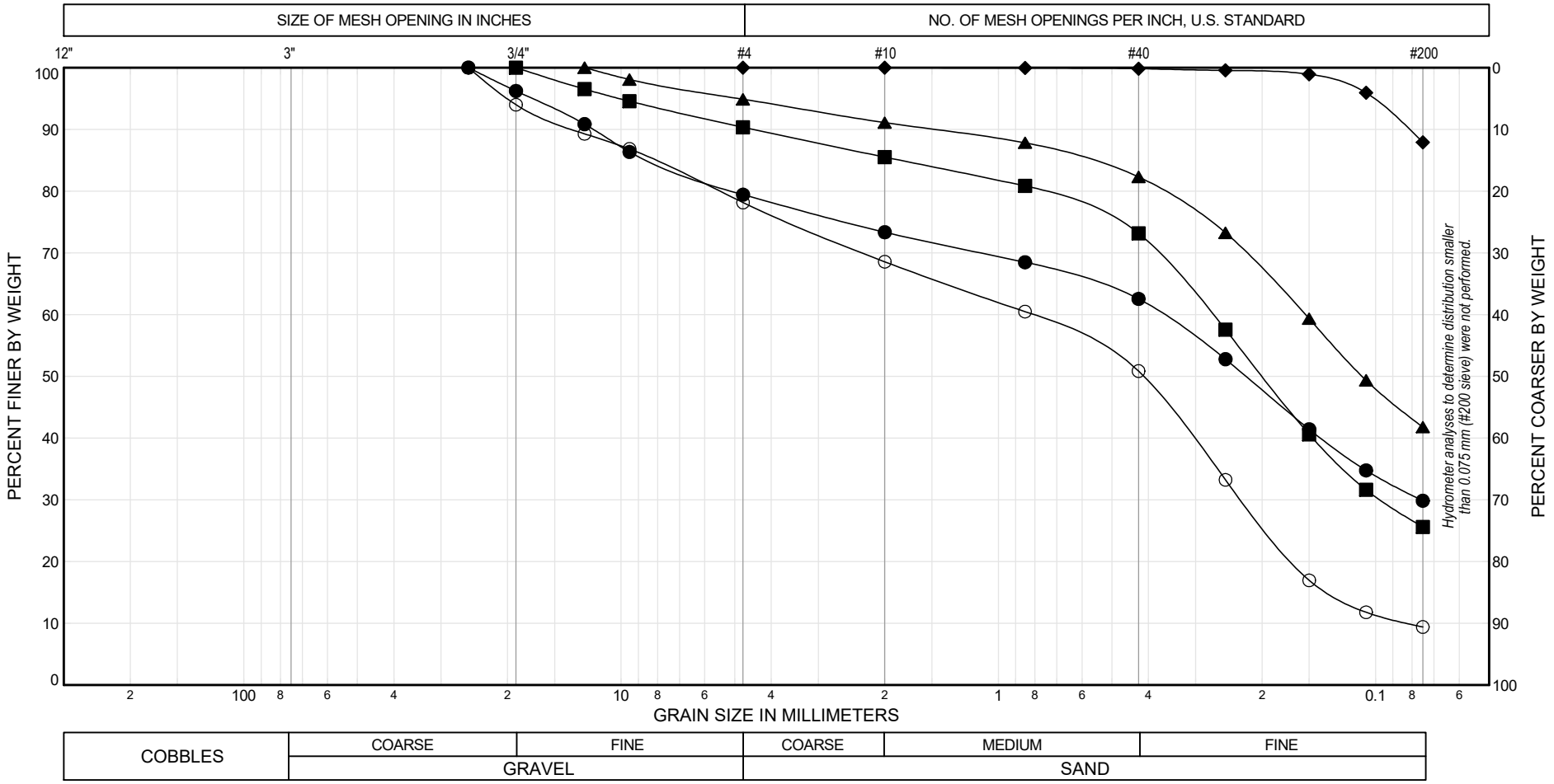
* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

SHANNON & WILSON

GRAIN SIZE DISTRIBUTION TEST RESULTS

Kitsap WWTP
Poulsbo, WA

KT-7



EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-7, S-4	10.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		21	50	30	8.5	KCV NLP	D6913	*Entire sample tested*
■ KT-7, S-7	17.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		10	65	26	13.5	KCV NLP	D6913	*Entire sample tested*
▲ KT-7, S-10	30.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		5	53	42	10.8	KCV NLP	D6913	*No dispersant used*
◆ KT-7, S-12	40.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		0	12	88	17.0	KCV NLP	D6913	*No dispersant used*
○ KT-7, S-13	45.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		22	69	9	12.6	KCV NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

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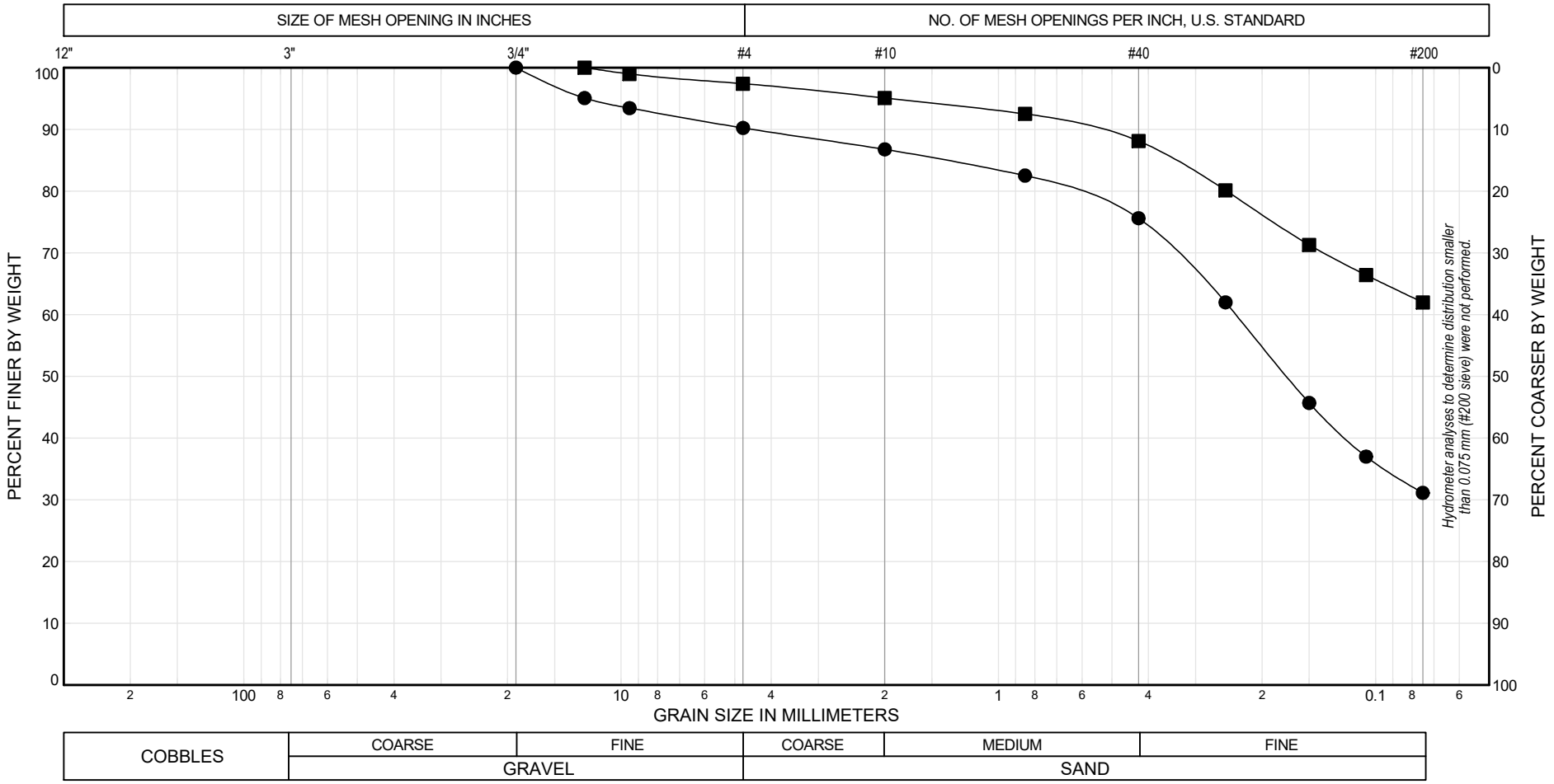

EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	GRAVEL %	SAND %	FINES %	NAT WC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-8, S-3	7.5	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		10	59	31	11.5	KCV NLP	D6913	*Entire sample tested*
■ KT-8, S-9	25.0	*Sieve analyses only - no Atterberg Limits: Group Name not estimated*		3	35	62	14.6	KCV NLP	D6913	*Entire sample tested*

* Sample was assumed to be non-plastic based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the grain size distribution only.
ABBREVIATIONS: NAT WC = natural moisture content; RVW = reviewed by; STD = Standard; USCS = Unified Soil Classification System coder; ~ = approximately (used when measured but not greater than 0.5%)

Kitsap WWTP
Poulsbo, WA

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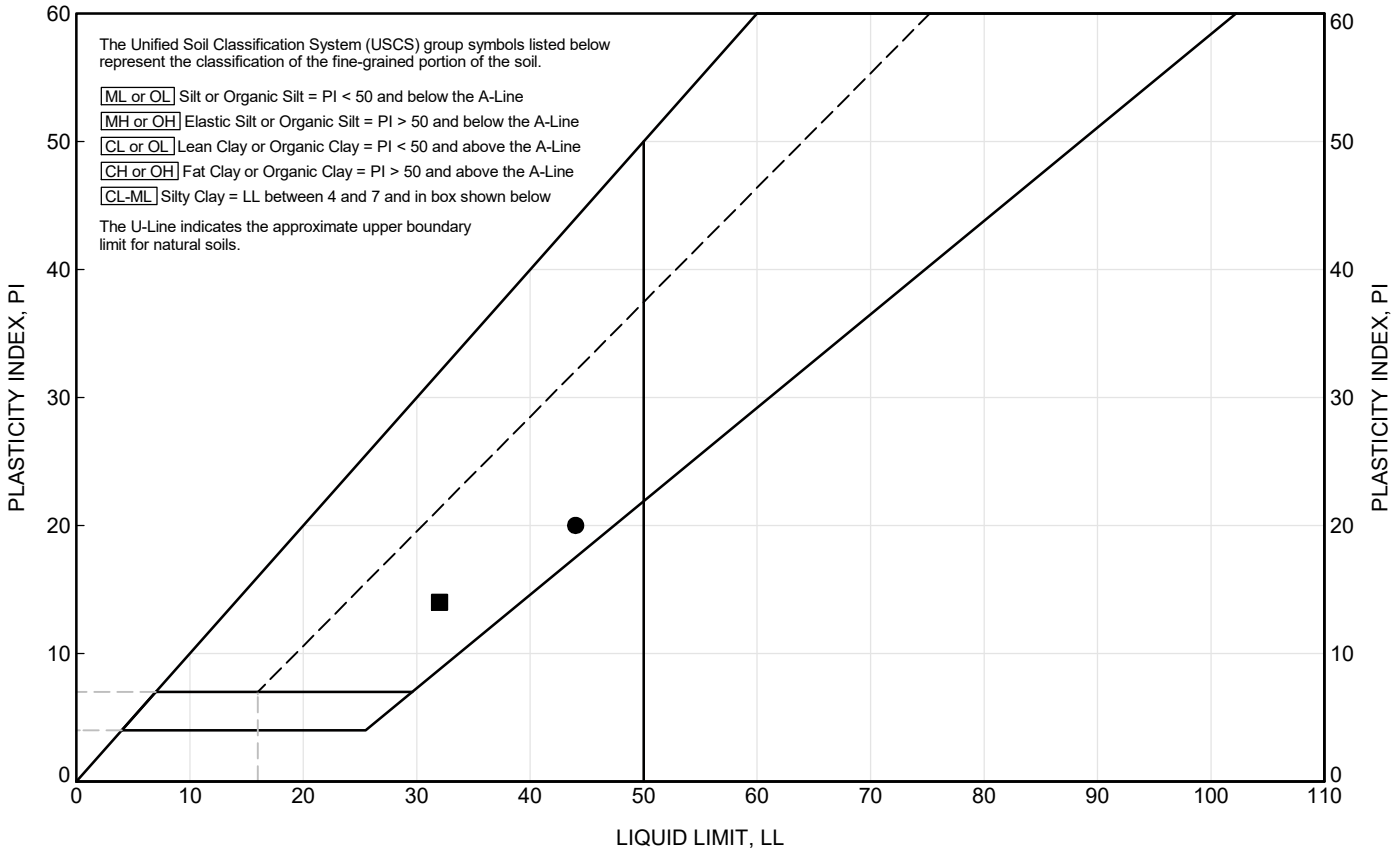

EXPLORATION AND SAMPLE NUMBER	DEPTH (feet)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP NAME	USCS SYMBOL	LL	PL	PI	FINES (%)	NAT MC %	TEST BY/RVW	TEST STD	TEST NOTE
● KT-4, 1B	5.5	LEAN CLAY	CL	44	24	20		21.7	KCV NLP	D4318	Sieved over No.40
■ KT-4, S-3	10.0	SANDY LEAN CLAY	CL	32	18	14		21.2	KCV NLP	D4318	Sieved over No.40

* Sample was assumed to have less than 15% sand/gravel based on visual-manual examination procedures. Therefore, the USCS Group Name is estimated based on the Atterberg Limits only.
ABBREVIATIONS: LL = liquid limit; NAT MC = natural moisture content; n/a = test attempted; NP = nonplastic; PI = plasticity index; PL = plastic limit; STD = standard; RVW = reviewed by; USCS = Unified Soil Classification System symbol

NORTON CORROSION LIMITED

DATA SHEET: 1 OF 1
DATE IN: 05-19-2023
DATE OUT: 06-23-2023
BY: H. DUFFY

SOIL ANALYSIS

N.C.L. Job#: E-24231
CUSTOMER: Shannon & Wilson
PROJECT: Kitsap WWTP
Client P.O.: 110699

NCL SAMPLE NO.	SAMPLE I.D.	Soil Wt. Native	Soil Wt. Dry	PERCENT MOISTURE	pH	SULFIDE SCREEN (ppm)	CHLORIDES (ppm)	REDOX (VOLTS)
1	KT-7, 0'-5'	32.74	29.67	9.38	5.2	ND	ND	380
2	KT-7, 15'-20'	58.79	49.97	15.00	6.6	ND	ND	3.4
TESTING METHOD					ASTM 4972	EPA P376.2-1 Method 376.2	EPA 300.0	ASTM D1498

ND Analyte NOT DETECTED at or above the reporting limit

IMPORTANT INFORMATION

Important Information

About Your Geotechnical Report

IMPORTANT INFORMATION

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 that 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

IMPORTANT INFORMATION

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.

IMPORTANT INFORMATION

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.