May 2, 2023

Mr. Evan Nixon
Nixon E&D, LLC
230 North 550 East
Lindon, Utah 84042

RE: Geotechnical Recommendations
Harbor View Short Plat
5130 61st Street NE
Marysville, Washington
CMT Job No. 18639

Mr. Nixon,

As you requested and authorized, this letter presents limited geotechnical recommendations for the proposed home to be constructed on the subject site in Marysville, Washington. The site is the south part of Parcel No. 00388800201500 within Snohomish County.

Surface Conditions

At the time the test pits were excavated, an existing home occupied the north portion of the parcel, with the south portion vegetated with grasses and weeds. Based upon aerial photos dating back to 1990 that are readily available on the internet, the existing home existed at that time and a detached garage also existed just north of the proposed home location but was removed between 2020 and 2021. Overall, the site is relatively flat, with a very slight slope downward to the east. The proposed home location is bordered on the north by the existing home and 61st Street NE, on the east by 52nd Avenue NE, on the south by 60th Street NE, and on the west by the backyard of a home.

Subsurface Exploration

In order to define and evaluate the subsurface soil conditions, 2 test pits were excavated by the client at the site to a depth of approximately 4 feet below the existing ground surface. Approximate locations of the test pits are shown on the attached ***Figure 1, Site Plan***. Representative soil samples were collected by obtaining disturbed "grab" samples from within the test pits. The samples were placed in plastic bags prior to transport to the laboratory. Graphical representations of the subsurface conditions encountered are presented on each individual Test Pit Log, ***Figures 2 and 3***. A Key to Symbols defining the terms and symbols used on the logs, is provided as ***Figure 4***.

Upon completion of logging and sampling, the test pits were backfilled with the excavated soils. When backfilling, minimal to no effort was made to compact the backfill and no compaction testing was performed. Thus, the test pit backfill is considered undocumented fill and settlement of the backfill in the test pits over time should be anticipated.

Laboratory Testing

Selected samples of the subsurface soils were subjected to various laboratory tests to assess pertinent engineering properties, as follows:

1. Moisture Content, ASTM D-2216, Percent moisture representative of field conditions
2. Gradation Analysis, ASTM D-1140/C-117, Grain Size Analysis

Laboratory test results are presented on the test pit logs (***Figures 2 and 3***) and in the following ***Lab Summary Table***:

LAB SUMMARY TABLE

TEST PIT	DEPTH (feet)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	DRY DENSITY (pcf)	GRADATION			ATTERBERG LIMITS			COLLAPSE(-)/ EXPANSION(+)
						GRAV.	SAND	FINES	LL	PL	PI	
TP-1	4	SP-SM	Bag	11		1	88	11				
TP-2	4	SP	Bag	9		1	96	3				

Geologic Setting

The site lies within the Puget Lowland, which is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history including at least four separate glacial advances/retreats. The Puget Lowland is bounded on the west by the Olympic Mountains and on the east by the Cascade Mountain Range.

The geology of the site was reviewed using the Washington Geologic Information Portal[1]. The surficial geology of the subject site and adjacent properties is mapped as "Vashon recessional outwash, Marysville Sand Member" (Map Unit Qvrm) dated to be Pleistocene. Unit Qvrm is described in the mapping as "These deposits fill the broad, flat, north-south valley in the quadrangle. The deposits consist of mostly well-drained stratified to massive outwash sand, a little fine gravel, and some beds of silt and clay. The sediments were deposited by meltwater flowing south from the stagnating and receding Vashon glacier. Clast composition is similar to the undivided recessional outwash. The Marysville Sand Member is bordered by till along most of the western side of the valley and part of the east side. The till underlies much of the Marysville Sand Member at increasing depth toward the middle of the valley. The member ranges from 1 m to possibly 30 m thick. The sediments are finer toward the south and silt and clay are common in the vicinity of the town of Marysville."

The Marysville City map[2] of geologic hazards indicates that the subject site is not located within an area designated as moderate to high in liquefaction potential.

Seismic Design Category

The 2014 USGS mapping utilized by the IBC provides values of peak ground, short period and long period spectral accelerations for the Site Class B/C boundary and the Risk-Targeted Maximum Considered Earthquake (MCER). This Site Class B/C boundary represents average bedrock values for the Western United States and must be

[1] https://geologyportal.dnr.wa.gov/
[2] https://www.marysvillewa.gov/326/Maps (select "Geologic Hazards" on the list of maps)

corrected for local soil conditions. The Seismic Design Categories in the International Residential Code (IRC 2018 Table R301.2.2.1.1) are based upon the Site Class. For Site Class D (default) at site grid coordinates of 48.0514 degrees north latitude and -122.1610 degrees west longitude, S_{DS} is 0.891 and the Seismic Design Category is D_2.

Subsurface Conditions

At the locations of the test pits, the surface soils encountered consisted of approximately 6 inches of topsoil at TP-2 and about 3 feet of undocumented sandy fill soils at TP-1. Based on the laboratory test results, the natural soils beneath the topsoil/fill soils consisted of SAND with varying amounts of silt (SP, SP-SM) extending to the maximum depth explored of about 4 feet below the surface. The sand soils were moist and yellowish to grayish brown in color. We estimate they will also exhibit moderate strength and low compressibility characteristics. Groundwater was not encountered in the excavations. For a detailed description of the soil profile encountered in the explorations, see the attached Test Pit Logs (***Figures 2 and 3***).

Foundation Recommendations

We recommend that footings be constructed on suitable undisturbed natural sand soils or on structural/ engineered fill which extends to natural soils. Footings may then be designed using a maximum allowable bearing pressure of 2,000 psf. The following are also recommended:

- All topsoil, organic soils, undocumented fill, loose or disturbed soils, or any other deleterious materials should be removed from the building footprint prior to the placement of foundations, floor slabs, or structural fill.
- All imported structural fill should be placed and compacted as recommended below.
- Exterior footings should be placed a minimum of 18 inches below final grade and interior footings should be placed a minimum of 12 inches below grade.
- The allowable bearing pressure may be increased by 1/3 for temporary loads such as wind and seismic forces.
- Footing excavations should be observed by a qualified geotechnical engineer prior to placing footings.

Foundations designed and constructed in accordance with our recommendations could experience some settlement, but we anticipate that settlement of footings founded as recommended above will be 1 inch or less, with differential settlements on the order of 0.5 inches over a distance of 25 feet. We expect approximately 75 percent of this settlement to take place during construction.

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.40 for natural sand soils and structural fill may be utilized for design. Passive resistance provided by properly placed and compacted structural fill above the water table may be considered equivalent to a fluid with a density of 400 pcf (ignoring the upper 2 feet with no safety factor applied).

Earthwork Recommendations

The soils at this site predominantly consisted of sand. For sandy (cohesionless) soils, temporary construction excavations not exceeding 4 feet in depth should be no steeper than one-half horizontal to one vertical (0.5H:1V). For excavations up to 8 feet and above groundwater, side slopes should be no steeper than one

horizontal to one vertical (1H:1V). Excavations encountering water/saturated cohesionless soils will be very difficult to maintain and will require very flat side slopes and/or shoring, bracing and dewatering.

If used, imported structural fill should consist of well-graded sand to gravelly material with a maximum 20% passing the #200 sieve, a minimum 70% passing the ¾-inch sieve, a maximum particle size of 4 inches, and a maximum plasticity index of 10. The on-site sandy soils appear suitable for use as structural fill.

The various types of compaction equipment available have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about 4 inches and most "trench compactors" have a maximum, consistent compaction depth of about 6 inches. Large rollers, depending on soil and moisture conditions, can achieve compaction at 8 to 12 inches. The full thickness of each lift should be compacted to at least the following percentages of the maximum dry density as determined by ASTM D-1557 (or AASHTO[3] T-180) in accordance with the following recommendations:

LOCATION	TOTAL FILL THICKNESS (FEET)	MINIMUM PERCENTAGE OF MAXIMUM DRY DENSITY
Beneath an area extending at least 4 feet beyond the perimeter of structures, and below flatwork and pavement (applies to structural fill and site grading fill) extending at least 2 feet beyond the perimeter	0 to 5	95
Site grading fill outside area defined above	0 to 5	92
Utility trenches within structural areas	--	96
Roadbase and subbase	-	96
Non-structural fill	0 to 5	90

Structural fills greater than 5 feet thick are not anticipated at the site. For best compaction results, we recommend that the moisture content for structural fill/backfill be within 2% of optimum. Field density tests should be performed on each lift as necessary to verify that proper compaction is being achieved.

Infiltration/Drainage Recommendations

An infiltration test was also performed at the site approximately midway between the two test pits in a hole that extended about 2 feet below the existing ground surface. The results of this test indicated that the sandy soils at this site have an infiltration rate of approximately 3.5 minutes per inch (17 inches per hour). This rate could increase (become slower) over time due to siltation, thus we recommend an appropriate factor of safety be applied for design.

Infiltration systems should have the bottom placed about 2 to 4 feet below existing grade and lined with gravel/rock. If more than one system is needed, the systems should be separated by a minimum 15 feet.

It is important to the long-term performance of foundations and floor slabs that water not be allowed to collect near the foundation walls and infiltrate into the underlying soils. We recommend the following:

[3] American Association of State Highway and Transportation Officials

1. All areas around the residence should be sloped to provide drainage away from the foundations. We recommend a minimum slope of 4 inches in the first 10 feet away from the structure. This slope should be maintained throughout the lifetime of the structure.

2. All roof drainage should be collected in rain gutters with downspouts designed to discharge at least 10 feet from the foundation walls or well beyond the backfill limits, whichever is greater.

3. Adequate compaction of the foundation backfill should be provided. We suggest a minimum of 90% of the maximum laboratory density as determined by ASTM D-1557. Water consolidation methods should not be used under any circumstances.

4. Other precautions that may become evident during construction.

Limitations/Closure

The recommendations provided herein were developed by evaluating the information obtained from the test pit and site exploration. Soil and groundwater conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

If you have any questions, please call.

Sincerely,
CMT Technical Services

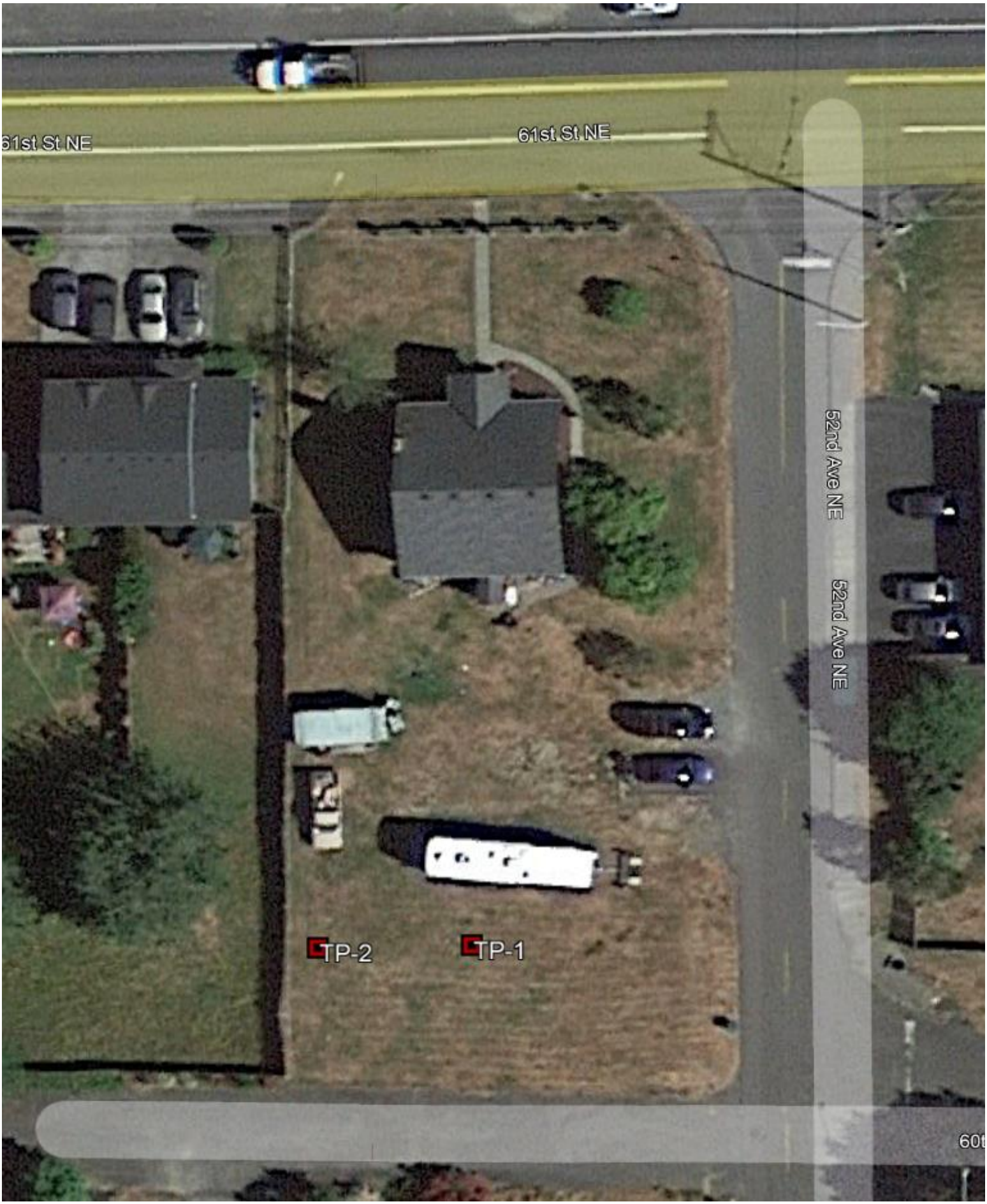
William G. Turner, P.E. (UT)
Senior Geotechnical Engineer

Reviewed By:

ANDREW MICHAEL HARRIS
STATE OF WASHINGTON
52510
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 1/21/24

Andrew M. Harris, P.E.
Geotechnical Division Manager

Encl: Figure 1, Site Map
Figures 2-3, Test Pit Logs
Figure 4, Key to Symbols



Harbor View Short Plat 5130 61st Street NE, Marysville, Washington	CMT TECHNICAL SERVICES **Site Map**	Date: 21-Jul-22 Job # 18639	Figure: 1

Harbor View Short Plat

5130 61st Street NE, Marysville, Washington

Test Pit Log TP-1

Total Depth: 4'
Water Depth: (see Remarks)

Date: 6/1/22
Job #: 18639

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Fill: dark brown to brown silty sand moist										
1												
2		pieces of glass										
3		Yellowish/Grayish Brown SAND with silt (SP-SM), trace gravel moist										
				1	11		1	88	11			
4		END AT 4'										
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Client
Excavated By: Client
Logged By: Client

CMT TECHNICAL SERVICES

Figure: 2

Harbor View Short Plat

5130 61st Street NE, Marysville, Washington

Test Pit Log TP-2

Total Depth: 4'
Water Depth: (see Remarks)

Date: 6/1/22
Job #: 18639

Depth (ft)	GRAPHIC LOG	Soil Description	Sample Type	Sample #	Moisture (%)	Dry Density(pcf)	Gradation			Atterberg		
							Gravel %	Sand %	Fines %	LL	PL	PI
0		Topsoil										
1		Yellowish/Grayish Brown SAND (SP), trace silt and gravel moist										
2												
3												
4		END AT 4'		2	9		1	96	3			
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												

Remarks: Groundwater not encountered during excavation.

Coordinates: °, °
Surface Elev. (approx): Not Given

Equipment: Client
Excavated By: Client
Logged By: Client

CMT TECHNICAL SERVICES

Figure: 3

Harbor View Short Plat

5130 61st Street NE, Marysville, Washington

Key to Symbols

Date: 6/1/22
Job #: 18639

① Depth (ft)	② GRAPHIC LOG	③ Soil Description	④ Sample Type	⑤ Sample #	⑥ Moisture (%)	⑦ Dry Density(pcf)	Gradation ⑧ Gravel %	Sand %	Fines %	Atterberg ⑨ LL	PL	PI

COLUMN DESCRIPTIONS

① **Depth (ft.):** Depth (feet) below the ground surface (including groundwater depth - see water symbol below).

② **Graphic Log:** Graphic depicting type of soil encountered (see ② below).

③ **Soil Description:** Description of soils encountered, including Unified Soil Classification Symbol (see below).

④ **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below-right.

⑤ **Sample #:** Consecutive numbering of soil samples collected during field exploration.

⑥ **Moisture (%):** Water content of soil sample measured in laboratory (percentage of dry weight of sample).

⑦ **Dry Density (pcf):** The dry density of a soil measured in laboratory (pounds per cubic foot).

⑧ **Gradation:** Percentages of Gravel, Sand and Fines (Silt/Clay), obtained from lab test results of soil passing the No. 4 and No. 200 sieves.

⑨ **Atterberg:** Individual descriptions of Atterberg Tests are as follows:

LL = Liquid Limit (%): Water content at which a soil changes from plastic to liquid behavior.

PL = Plastic Limit (%): Water content at which a soil changes from liquid to plastic behavior.

PI = Plasticity Index (%): Range of water content at which a soil exhibits plastic properties (= Liquid Limit - Plastic Limit).

STRATIFICATION	
Description	**Thickness**
Seam	Up to ½ inch
Lense	Up to 12 inches
Layer	Greater than 12 in.
Occasional	1 or less per foot
Frequent	More than 1 per foot

MODIFIERS
Trace
<5%
Some
5-12%
With
> 12%

MOISTURE CONTENT
Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp / moist to the touch, but no visible water.
Wet: Visible water, usually soil below groundwater.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS SYMBOLS	②	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	GRAVELS The coarse fraction retained on No. 4 sieve.	CLEAN GRAVELS (< 5% fines)	GW		Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP		Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (≥ 12% fines)	GM		Silty Gravels, Gravel-Sand-Silt Mixtures
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS The coarse fraction passing through No. 4 sieve.	CLEAN SANDS (< 5% fines)	SW		Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP		Poorly-Graded Sands, Gravelly Sands, Little or No Fines
		SANDS WITH FINES (≥ 12% fines)	SM		Silty Sands, Sand-Silt Mixtures
			SC		Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid Limit less than 50%		ML		Inorganic Silts and Sandy Silts with No Plasticity or Clayey Silts with Slight Plasticity
			CL		Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50%		MH		Inorganic Silts, Micacious or Diatomacious Fine Sand or Silty Soils
			CH		Inorganic Clays of High Plasticity, Fat Clays
			OH		Organic Silts and Organic Clays of Medium to High Plasticity
HIGHLY ORGANIC SOILS			PT		Peat, Soils with High Organic Contents

Note: Dual Symbols are used to indicate borderline soil classifications (i.e. GP-GM, SC-SM, etc.).

SAMPLER SYMBOLS

- Block Sample
- Bulk/Bag Sample
- Modified California Sampler 3.5" OD, 2.42" ID
- D&M Sampler
- Rock Core
- Standard Penetration Split Spoon Sampler
- Thin Wall (Shelby Tube)

WATER SYMBOL

- Encountered Water Level
- Measured Water Level (see Remarks on Logs)

1. The results of laboratory tests on the samples collected are shown on the logs at the respective sample depths.
2. The subsurface conditions represented on the logs are for the locations specified. Caution should be exercised if interpolating between or extrapolating beyond the exploration locations.
3. The information presented on each log is subject to the limitations, conclusions, and recommendations presented in this report.

CMT TECHNICAL SERVICES

Figure: 4