



Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

June 26, 2019

Mike Mietzner
mikem@mietznergroupp.com

RE: Stormwater Feasibility Evaluation
Proposed Residential Development
7902 – 44th Avenue West
Mukilteo, Washington

Dear Mr. Mietzner,

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our stormwater feasibility evaluation at the referenced site.

The purpose of our evaluation was to determine the feasibility of utilizing infiltration devices for stormwater runoff management.

Site and Project Description

The site is located at 7902 – 44th Avenue West in Mukilteo, Washington. The site consists of one rectangular shaped parcel (No. 00611600009001) with a total area of about 1.62 acres.

The eastern portion of the property is developed with a single-family residence and driveway. The remainder of the property is undeveloped and vegetated with grasses, ivy, blackberry vines, ferns, bushes/shrubs, and variable diameter evergreen and deciduous trees.

The site slopes gently to moderately downward from east to west at magnitudes of less than 10 percent and topographic relief of about 10 feet.

The property is bordered to the north, south, and west by single-family residences, and to the east by 44th Avenue West.

The project includes construction of up to 14 new cottage homes, driveway areas, open spaces, roadway access, and utilities. The homes will have a footprint of about 800 square feet and some will have garage areas with a footprint of about 200 square feet.. Stormwater management may include dispersion, detention, or infiltration facilities depending on feasibility.

Area Geology

The Geologic Map of Washington – Northwest Quadrant indicates that the site is underlain by Vashon Glacial Till.

Vashon Glacial Till is typically characterized by an unsorted, non-stratified mixture of clay, silt, sand, gravel, cobbles and boulders in variable quantities. These materials are typically dense and relatively impermeable. The poor sorting reflects the mixing of the materials as these sediments were overridden and incorporated by the glacial ice.

Soil & Groundwater Conditions

As part of our evaluation, we excavated two test pits and three hand borings to determine the shallow soil and groundwater conditions, where accessible.

All of the explorations encountered approximately 6 to 12 inches of topsoil and vegetation underlain by approximately 2 to 4 feet of loose to medium dense, silty-fine to medium grained sand with gravel (Weathered Glacial Till). These materials were underlain by dense to very dense, silty-fine to medium grained sand with gravel (Glacial Till), which continued to the termination depth of the explorations.

There are likely areas of fill around the existing residence and yard areas. There was inadequate access to explore the subsurface soil conditions in these areas.

Groundwater was not encountered in the explorations during our investigation; however, mottled soils were observed between 2 and 4 feet below existing grades, indicating that perched groundwater may be present below the site seasonally.

Stormwater Management Feasibility

The site is underlain by very fine-grained glacial deposits. These soils have a very low permeability which decreases with depth. It is likely that there will be shallow perched groundwater throughout the property that further limits infiltration suitability.

We performed an in-situ infiltration test in TP-1 at a depth of 4 feet below grade. Following testing and application of correction factors for site variability (0.33), influent control (0.9), and testing (0.5), the infiltration rate was 0.22 inches per hour, which is lower than what the Department of Ecology considers to be feasible.

We do not recommend utilizing infiltration systems at the site. If there is adequate space, it may be feasible to utilize dispersion trenches with limited flowpaths and sheet flow dispersion for driveway areas. Detention ponds or vaults may be necessary depending on the overall anticipated volume of runoff from the new development. We can provide additional recommendations as the final plans are developed.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.

- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Closure

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above and for the current site conditions, and should not be used for any other site

Sincerely,

Cobalt Geosciences, LLC



Exp. 6/26/2020

Phil Haberman, PE, LG, LEG
Principal

PH/sc

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	< #200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Moisture Content Definitions

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

Soil Classification Chart

Figure C1







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Test Pit TP-1

Date: June 18, 2019				Depth: 10'		Groundwater: None					
Contractor: Jim				Elevation:		Logged By: PH Checked By: SC					
Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
						Plastic Limit	Liquid Limit				
						DCP Equivalent N-Value					
						0	10	20	30	40	50
1			SM	Topsoil/Vegetation							
2				Loose to medium dense, silty-fine to medium grained sand with gravel, mottled yellowish brown to reddish brown, moist. (Weathered Glacial Till)							
3			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)							
4											
5											
6											
7											
8											
9											
10				End of Test Pit 10'							

Test Pit TP-2

Date: June 18, 2019				Depth: 10'		Groundwater: None					
Contractor: Jim				Elevation:		Logged By: PH		Checked By: SC			
Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
						Plastic Limit	Moisture Content (%)			Liquid Limit	
						DCP Equivalent N-Value					
						0	10	20	30	40	50
				Topsoil/Vegetation							
1			SM	Loose to medium dense, silty-fine to medium grained sand with gravel, mottled reddish brown to yellowish brown, moist. (Weathered Glacial Till)							
2											
3											
4											
5			SM	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)							
6											
7											
8											
9											
10											
				End of Test Pit 10'							



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**Test Pit
Logs**

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Log of Hand Boring HB-1

Date: June 18, 2019	Depth: 6'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
4									
5									
6						End of Hand Boring 6'			
7									
8									
9									
10									



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**Hand
Boring
Log**

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Log of Hand Boring HB-2

Date: June 18, 2019	Depth: 6'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3									
4									
5					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
6						End of Hand Boring 6'			
7									
8									
9									
10									



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Log of Hand Boring HB-3

Date: June 18, 2019

Depth: 6'

Initial Groundwater: None

Contractor:

Elevation: N/A

Sample Type: Grab

Method: Hand Auger

Logged By: PH

Checked By: SC

Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)	
								Plastic Limit	Liquid Limit
						Vegetation/Topsoil			
1					SM	Loose to medium dense, silty-fine to medium grained sand with gravel mottled dark yellowish brown to grayish brown, moist. (Weathered Glacial Till)			
2									
3									
4					SM	Dense, silty-fine to medium grained sand with gravel, grayish brown, moist. (Glacial Till)			
5									
6						End of Hand Boring 6'			
7									
8									
9									
10									



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