Stormwater Drainage Report
4537 90th Avenue SE
Mercer Island, Washington
KC Tax Parcel #019110-0195

Prepared For:

JayMarc Homes, LLC
Marc Russo
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March 15, 2022

Prepared By:

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Darrell.Offe@comcast.net

3/15/2022

Narrative:

The subject property is located on the west side of 90th Avenue SE between SE 45th Street and dead end of the street at Ellis Pond. The property slopes gently from west to east towards 90th Avenue SE; west property line 363.40 towards the east property line (90th Avenue SE) 358.60. The subject property is currently covered with an existing house, several large trees, heavy brushed understory, and patio areas to the west. All of the existing hard surfaces will be removed and replaced with a new residence and driveway. The current runoff from the property sheet flows into 90th Avenue SE along the east side of the property towards the southeast corner.

The site soils are characterized between Vashon Glacial Till and infeasible for infiltration type BMP's.

The property was visited in November 2021 and again in January 2022 to verify runoff patterns and possible storm water discharge options.

The project will be evaluated for storm water treatment and control using the Amended December 2014 SWMMWW (DOE Manual).

SITE CHARACTERISTICS

Total Lot Area = 10,125 square feet

EXISTING CONDITIONS

Impervious:

Roof area = 3,150 sq. feet
Uncovered walkways/patio = 633 sq. feet
Uncovered driveway = 647 sq. feet
Subtotal: 4,430 sq. feet

Pervious:

Lawn, trees = *5,695 sq. feet*

DEVELOPED CONDITIONS

Impervious (hard) surfaces:

House roof area w/overhang = 2,756 sq. feet
Uncovered driveway = 1,148 sq. feet
Uncovered walkways = 241 sq. feet
Total Impervious (Hard) Surfaces = 4,145 sq. feet

Pervious Surfaces:

Landscaping = 5,980 sq. feet
Total Pervious Surfaces = 5,980 square feet

Summary of Project Information

Project Site Area	10,125 square feet
Existing Impervious Area	4,430 sq. feet
Existing Impervious Coverage	43.8%
New Impervious Area	<285> sq. feet
Replaced Impervious Area	4,145 sq. feet
New plus Replaced Impervious	4,145 square feet
Proposed Impervious Area	4,145 square feet
Converted pervious: Native to lawn	0 sq. feet
Converted pervious: Native to pasture	0 sq. feet
Total Area of Land Disturbance	7,200 square feet

The existing property has greater than 35% (43.8%) imperious coverage and the total proposed project new plus replaced impervious surfaces will be less than 5,000 (4,145) square feet; using Figure I-2.4.2 – *"Flow Chart for Determining Minimum Requirements for Redevelopment"* page 38, 2014 Stormwater Management Manual for Western Washington, Minimum Requirements #1 – #5 apply to this project.

FLOW CHART FIGURE II-2.4.1

4537 90th Avenue SE

Figure I-2.4.1 Flow Chart for Determining Requirements for New Development

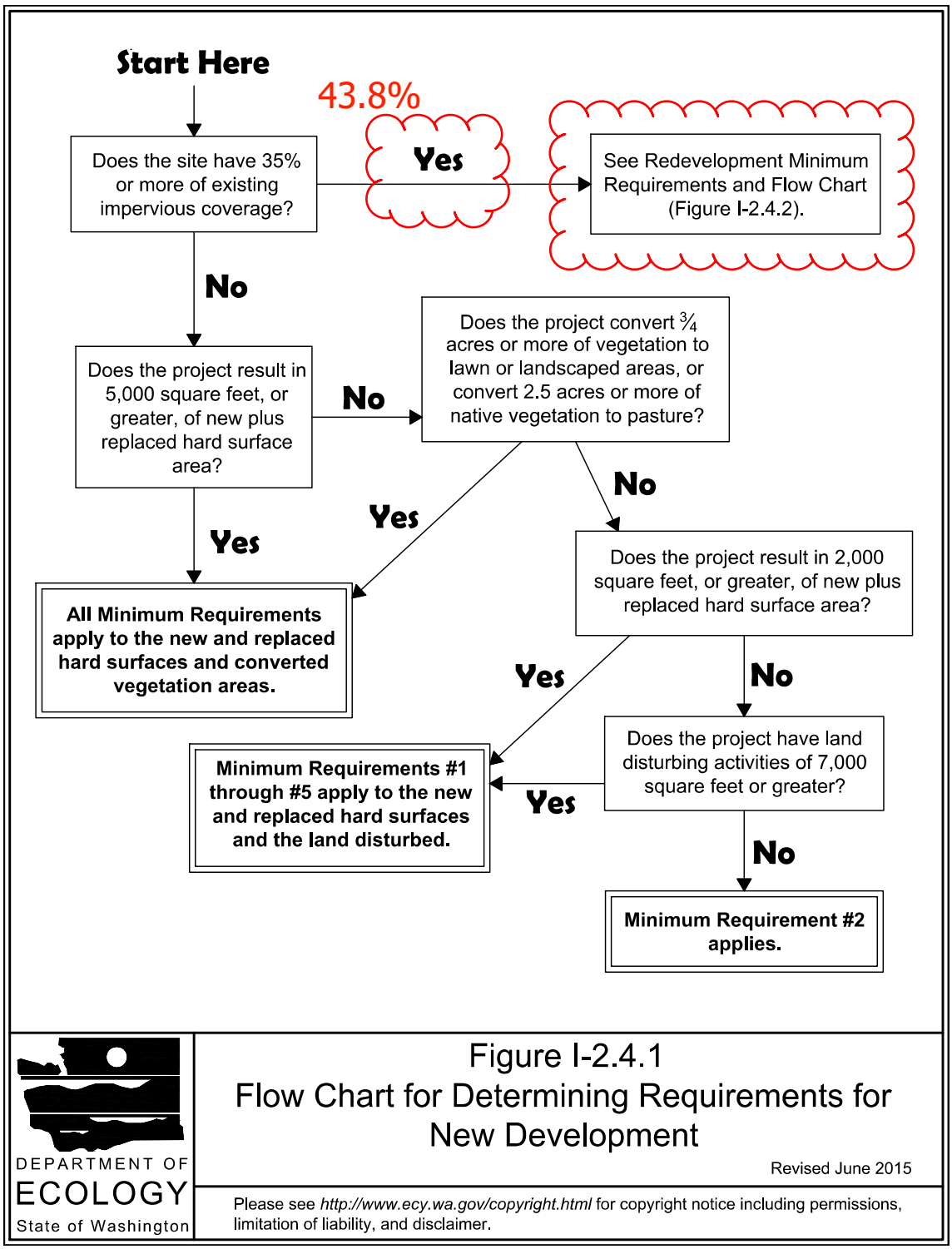
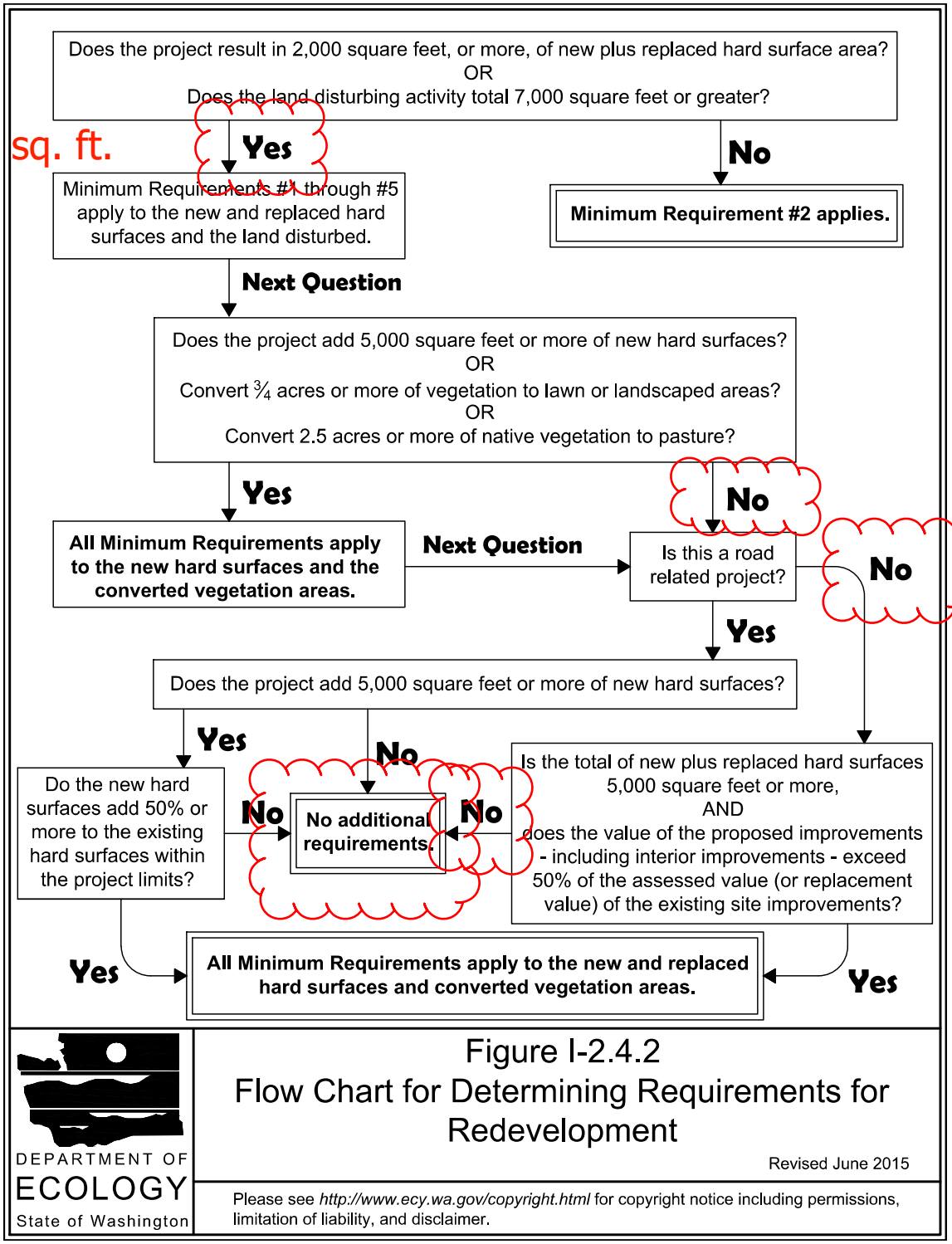


Figure I-2.4.2 Flow Chart for Determining Requirements for Redevelopment



Based upon the Flow Chart Figure I-2.4.1 and I-2.4.2 (Amended December 2014 SWMMWW, DOE Manual), the Minimum Requirements 1-5 apply to this project, see attached Flow Chart.

I-2.5.1 Minimum Requirement #1 – Preparation of Stormwater Site Plans

A Stormwater site plan (drainage plan) has been prepared for this project together with construction details for installation of the proposed drainage control system. The Stormwater site plans and drainage narrative shall be submitted and reviewed by the City of Mercer Island as part of the building permit application.

I-2.5.2 Minimum Requirement #2 - Construction Storm Water Pollution Prevention Plan (CSWPP)

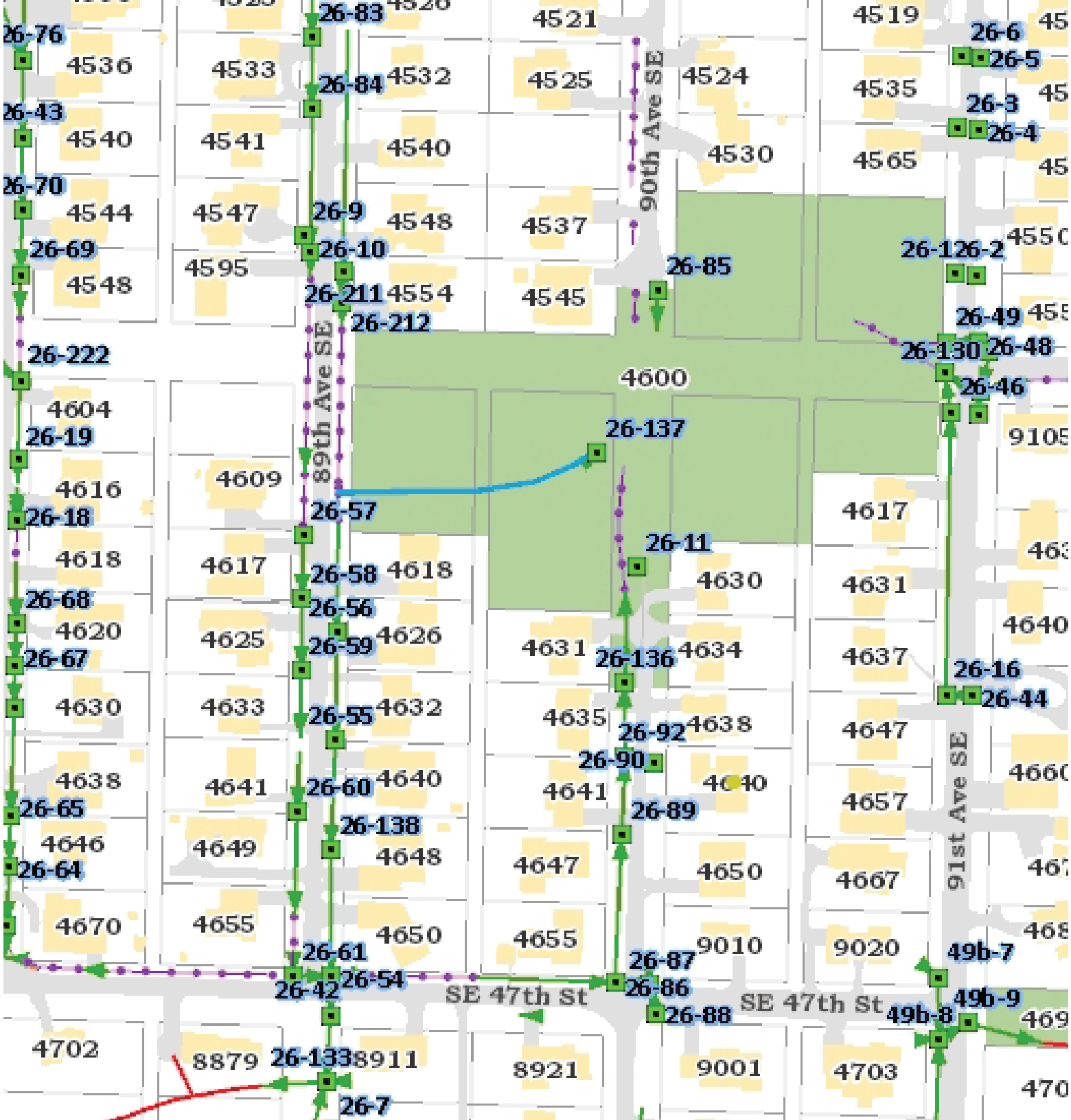
The Stormwater site plan (Minimum Requirement #1) shall include construction installation of erosion control, establish a construction access, preservation of existing vegetation during construction, and protection of existing drainage inlets. This will include but not limited to: constructing a new rocked construction entry off of 90th Avenue SE; installing filter fabric silt fencing along the down gradient property lines (east and south); installation of filter socks within the public catch basins located within 90th Avenue SE; retention of native vegetated areas including tree retention within the rear yard (east); and the use straw or chipped materials placed over exposed disturbed soils to prevent runoff from carrying solids.

I-2.5.3 Minimum Requirement #3 - Source Control of Pollution

Source control BMP's will be utilized to contain pollution generating runoff. No concrete washout will be allowed on the property during construction. No fuel materials will be placed or stored on site during construction.

I-2.5.4 Minimum Requirement #4 - Preservation of Natural Drainage Systems and Outfalls

The property was visited in January 2022, during a storm-event to verify drainage patterns. The subject property slopes gently from the west towards the east. The existing property is covered with heavy vegetation. The drainage sheet flows from the subject property into 90th Avenue SE, then turns south, and flows into a catch basin at the south end of a dead-end cul-de-sac on 90th Avenue SE. The drainage then enters a large ponding area, called Ellis Pond. Ellis Pond overflows towards the west and into an open ditch on the east side of 89th Avenue SE. The drainage then continues south within closed 12" conveyance pipes towards SE 47th Street. The drainage then crosses SE 47th Street flowing south approximately 200 feet before entering an open channel flowing west. The channel was flowing with heavy flow during site visit; there were no sings of overtopping or capacity problems within the downstream system.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I-2.5.5 Minimum Requirement #5 - On-Site Stormwater Management
The proposed project discharge shall be evaluated using *"List #1, On-Site Stormwater Management BMPs for projects triggering Minimum Requirements #1 - #5"* – DOE Volume 1, chapter 2, pages 56 and 57.

The subject property is located within an infiltration infeasibility area as shown the attached City of Mercer Island "*Infiltration Infeasibility Map*". A soils evaluation is not required.

List #1
Lawn and landscape areas – ***feasible -*** The use of Post-Construction Soil Quality and Depth shall be implemented within areas of the property that are not covered by hard surfaces and were disturbed during condition.

Roofs:

1.a. Full Dispersion – ***infeasible*** due to lack of available 100' of vegetated flow path downgradient from the roof area.

1.b. Full Infiltration – ***infeasible*** due to lack of permeable soils.

2. Rain Garden/Bioretention – ***infeasible*** due to lack of available area on the downgradient portion of the property (east side). Can not remove trees in this area nor work under.

3. Downspout Dispersion System – ***infeasible*** due to lack of available 50' flow path downgradient of the downspout leaders.

Other Hard Surfaces:

1. Full Dispersion – ***infeasible*** due to the lack of available 100' of vegetated flow path length.

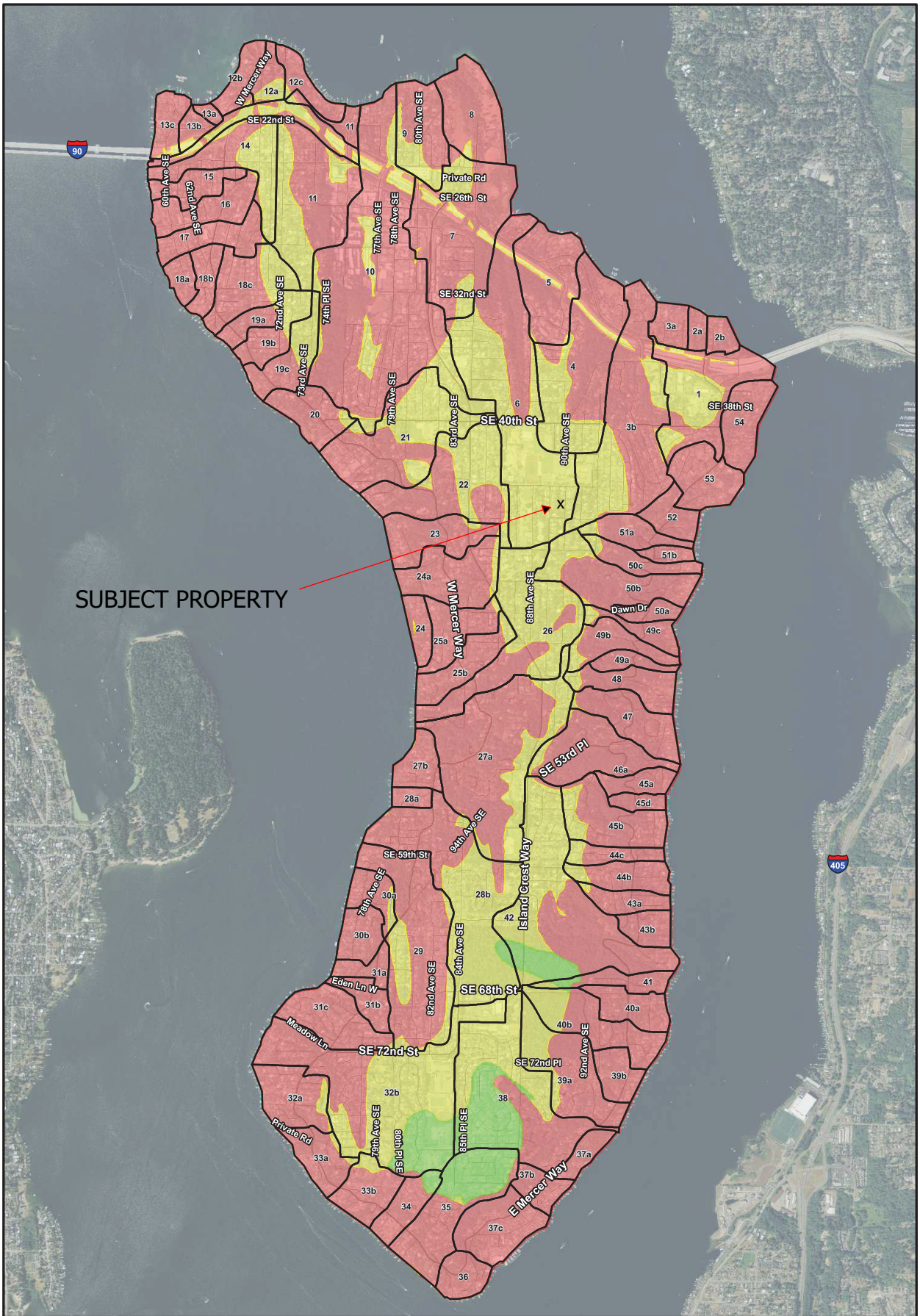
2.a. Permeable Pavement – ***infeasible*** infiltration type BMP not recommended by City of Mercer Island Infiltration Infeasibility Map.

2.b. Rain Garden/Bioretention – ***infeasible*** due to lack of available space on the downgradient portion of the property (east side).

3. Sheet Flow Dispersion – ***infeasible*** due to lack of available 25 feet of flow path downgradient from driveway.

There are no available BMPs to provide treatment of the roof area or other hard surfaces. Therefore, connection the public storm system within 90th Avenue SE will be provided.

The roof area shall be collected using downspouts and a 4" downspout conveyance pipe flowing east towards the southeast corner of the property. The footing drain shall be collected using a perforate 4" pipe and conveying to the southeast corner connection into the downspout line near the public right-of-way on 90th Avenue SE. The driveway shall slope towards the east and sheet flow into 90th Avenue SE then flow south into the conveyance storm conveyance system on the west side of 90th Avenue SE.



Legend

- Infiltrating LID facilities may be feasible, and soil has high infiltration potential
- Infiltrating LID facilities may be feasible, and soil has moderate infiltration potential
- Infiltrating LID facilities are not permitted
- 36 Storm drainage basin

* Map is intended to be used for planning purposes only. Site-specific analysis is required prior to design and construction of LID facilities.

INFILTRATION INFEASIBILITY MAP

N

0 950 1,900 3,800 Feet

HERRERA

Aerial photography: USDA (2009)

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GEOTECHNICAL EVALUATION by COBALT GEOSCIENCES

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

July 22, 2021

JayMarc Homes
C/O Darrell Offe
Darrell.offe@comcast.net

RE: Limited Geotechnical Evaluation
Proposed Residential Development
4537 & 45xx 90th Avenue SE
Mercer Island, Washington

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

The purpose of our evaluation was to determine the feasibility of utilizing infiltration devices for stormwater runoff management along with providing recommendations for foundation and retaining wall design.

Site and Project Description

The site is located at 4537 and 45xx 90th Avenue SE in Mercer Island, Washington. The site consists of two rectangular parcels (No. 0191100190 & 0191100195) with a total area of about 20,250 square feet.

The southern parcel is developed with a single-family residence and driveway. The remainder of the property and the northern parcel are undeveloped and vegetated with grasses, bushes, ferns, ivy, blackberry vines, and variable diameter trees. The site is nearly level to slightly sloping downward to the southeast.

The property is bordered to the north, west, and south by residential properties and to the east by 90th Avenue SE.

The project includes construction of a new residence within each of the two parcels. Stormwater management may include dispersion, detention, or infiltration facilities depending on feasibility.

Area Geology

The Geologic Map of King County & Geologic Map of Mercer Island indicates that the site is underlain by Vashon Glacial Till.

Vashon Glacial Till consists of dense mixtures of silt, sand, clay, and gravel. These deposits are typically impermeable below a weathered zone.

Soil & Groundwater Conditions

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

The explorations encountered about 6 inches of topsoil and grass underlain by approximately 3 to 4 feet of loose to medium dense, silty-fine to medium grained sand trace to with gravel (Weathered Glacial Till).

This layer was underlain by dense to very dense, silty-fine to medium grained sand trace silt with gravel (Glacial Till), which continued to the termination depth of the explorations.

Groundwater was not encountered during the investigation work; however, the shallow soils were mottled, indicating that perched groundwater may develop on the denser till materials during the wet season.

Stormwater Management Feasibility

The site is underlain by relatively dense glacial till. The till was locally mottled and the unweathered till acts as a restrictive layer.

We performed a small scale pilot infiltration test in a larger excavation near HB-1 at a depth of 3 feet below grade. Following saturation, testing, and application of correction factors for site variability (0.7), influent control (0.9), and testing (0.5), the infiltration rate was 0.18 inches per hour. This is lower than what is considered to be feasible.

We recommend collecting runoff and routing it into City infrastructure in 90th Avenue SE. A perforated or solid connection may be utilized. If there is adequate space, rock pads and/or dispersion systems could be feasible. We can provide additional recommendations once the civil plans have been prepared.

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.

Foundation Design

The proposed residences may be supported on shallow spread footing foundation systems bearing on undisturbed dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 2 inches in size.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 225 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Concrete Retaining Walls

The following table, titled **Wall Design Criteria**, presents the recommended soil related design parameters for retaining walls with a level backslope. Contact Cobalt if an alternate retaining wall system is used. This has been included for new cast in place walls.

Wall Design Criteria	
"At-rest" Conditions (Lateral Earth Pressure – EFD[+])	55 pcf (Equivalent Fluid Density)
"Active" Conditions (Lateral Earth Pressure – EFD[+])	35 pcf (Equivalent Fluid Density)
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	21H* (Uniform Distribution) 1 in 2,500 year event
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	14H* (Uniform Distribution) 1 in 500 year event
Seismic Increase for "Active" Conditions (Lateral Earth Pressure)	7H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 250 pcf EFD[+]
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.40

[*]H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),
[+]EFD – Equivalent Fluid Density

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls. Uniform horizontal lateral active and at-rest pressures on the retaining walls from vertical surcharges behind the wall may be calculated using active and at-rest lateral earth pressure coefficients of 0.3 and 0.5, respectively. A soil unit weight of 125 pcf may be used to calculate vertical earth surcharges.

To reduce the potential for the buildup of water pressure against the walls, continuous footing drains (with cleanouts) should be provided at the bases of the walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, with perforations placed down and enveloped by a minimum 6 inches of pea gravel in all directions.

The backfill adjacent to and extending a lateral distance behind the walls at least 2 feet should consist of free-draining granular material. All free draining backfill should contain less than 3 percent fines (passing the U.S. Standard No. 200 Sieve) based upon the fraction passing the U.S. Standard No. 4 Sieve with at least 30 percent of the material being retained on the U.S. Standard No. 4 Sieve. The primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls, which require interior moisture sensitive finishes.

We recommend that the backfill be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. In place density tests should be performed to verify adequate compaction. Soil compactors place transient surcharges on the backfill. Consequently, only light hand operated equipment is recommended within 3 feet of walls so that excessive stress is not imposed on the walls.

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

7/22/2021
Phil Haberman, PE, LG, LEG
Principal

PH/sc

HB-1 **Approximate Hand Boring/Excavation Location**

N

COBALT GEOSCIENCES	Prop. Residential Development 4537 & 45xx 90th Avenue SE Mercer Island, Washington	**SITE PLAN FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com

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).

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)

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

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

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Soil Classification Chart

Figure C1

Hand Boring HB-1

Date: June 2021	Depth: 6'	Groundwater: None
Contractor: Cobalt	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
				Topsoil/Grass		
1			SM	Loose to medium dense, silty-fine to fine grained sand with gravel, mottled yellowish brown to grayish brown, dry to moist. (Weathered Glacial Till)		
2	■					
3						
4			SM	Dense, silty-fine to fine grained sand with gravel trace cobbles, yellowish brown to grayish brown, moist. (Glacial Till)		
5						
6	■			End of Hand Boring 6'		
7						
8						
9						
10						

Hand Boring HB-2

Date: June 2021	Depth: 6'	Groundwater: None
Contractor: Cobalt	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
				Topsoil/Grass		
1			SM	Loose to medium dense, silty-fine to fine grained sand with gravel, mottled yellowish brown to grayish brown, dry to moist. (Weathered Glacial Till)		
2	■					
3						
4						
5			SM	Dense, silty-fine to fine grained sand with gravel trace cobbles, yellowish brown to grayish brown, moist. (Glacial Till)		
6	■			End of Hand Boring 6'		
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10						

COBALT GEOSCIENCES

Proposed Res. Development
4537 & 45xx 90th Avenue SE
Mercer Island, Washington

Hand Boring Logs

Cobalt Geosciences, LLC
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