



Stormwater Site Plan

Hackett Residence - New Single-Family Home

2965 74th Ave SE
Mercer Island, WA 98040

Prepared by Axea Civil, LLC

March 2025

STORMWATER SITE PLAN

PROJECT:
Hackett Residence

OWNER:
Patricia Hackett
2965 74th Ave SE
Mercer Island, WA 98040

ENGINEER:
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I hereby certify that this Storm Drainage Report for the Hackett Residence redevelopment project has been prepared by me or under my supervision and meets minimum standards of the City of Mercer Island and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.



07/01/2025

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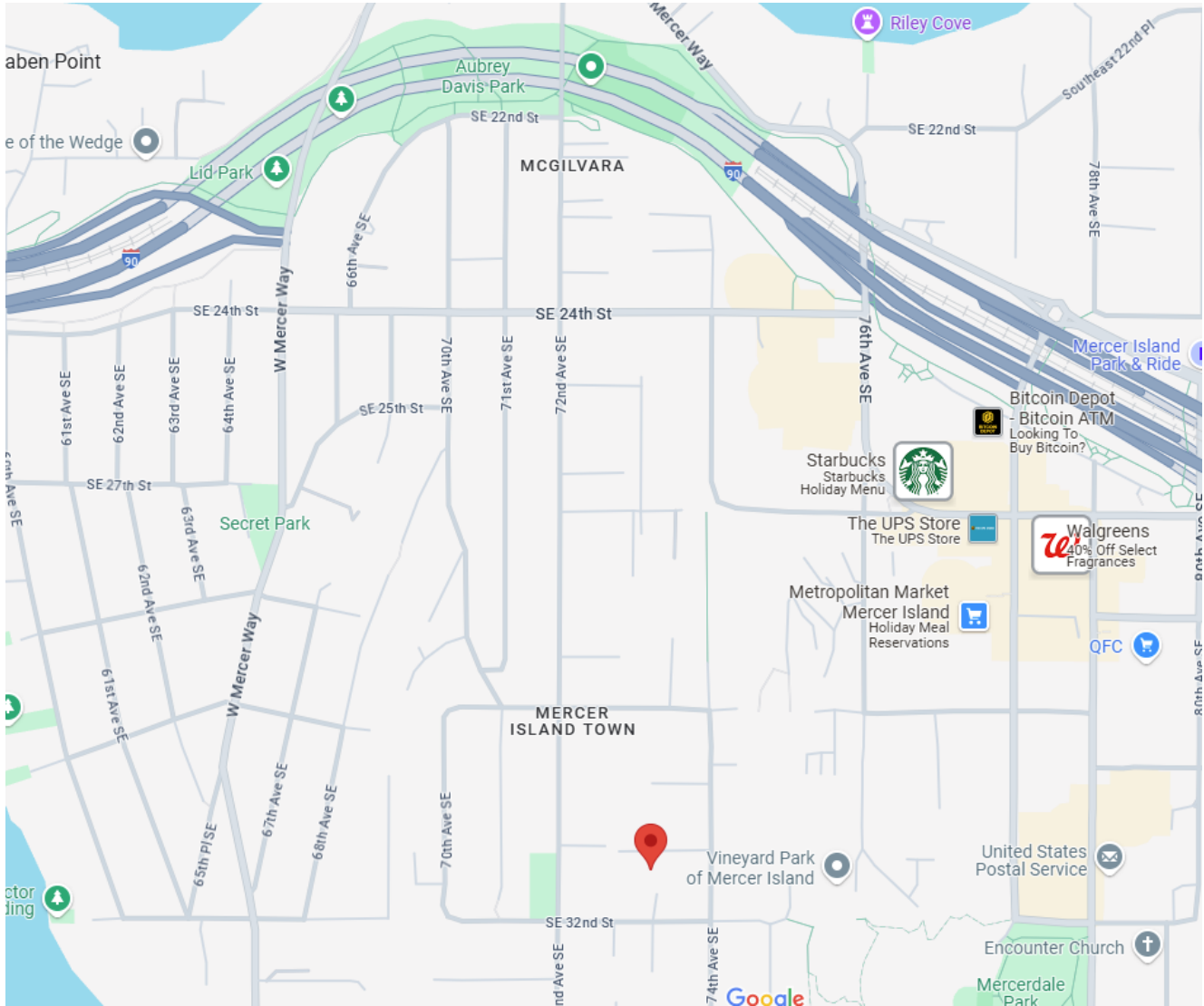
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SECTION 1 – PROJECT OVERVIEW

The Hackett Residence project will include a new single-family home. The site is located in northwest Mercer Island at 2965 74th Ave SE, Mercer Island, WA 98040 on King County parcel number 531510-0756. Proposed work includes demolition of all existing buildings on site and addition of a new driveway, new single-family residence, and associated site improvements.

FIGURE 1.1 - SITE VICINITY MAP



In the developed condition of the site, stormwater from the roof, area drain, and driveway will be collected and conveyed to the on-site stormwater management system, which consists of two infiltration drywells.

SECTION 2 – EXISTING CONDITION SUMMARY

The 13,729 square foot existing site contains a single-family home, concrete driveway, and concrete patio. The parcel is surrounded by single family residential development to the south, west, and east, with a private drive

along the northern property line that leads to 74th Ave SE to the east. The project site is approximately 0.9 miles south of I-90.

The site slopes to the west with approximately 2.5 feet of elevation change over approximately 140 ft. The downspouts of the (asphalt shingle) roof for the existing home appear to be splash blocked. There is no existing public or private stormwater facilities on-site, or within the existing private drive along the north side of the parcel. Stormwater appears to infiltrate or disperse across the project site. The project is contained within and will be considered as one Threshold Discharge Area (TDA).

The site contains 6 existing trees, of which 5 will remain in the proposed design. There are no existing on-site storm systems. No critical areas were observed for the proposed site. Table 1 below contains the existing site land cover areas that are shown on the existing land cover map in Appendix D.

There are no critical areas on or adjacent to the project site per City of Mercer Island GIS.

Per the geotechnical report conducted by Cobalt Geosciences, dated November 2024, the Geologic Map of Mercer Island indicated that the site is underlain by Vashon Glacial Till. Vashon Glacial till includes mixtures of silt, sand, clay, and gravel. Soil test pits conducted on-site encountered approximately 6 inches of grass and topsoil underlain by approximately 4 feet of loose to medium dense, silty-fine to medium grained sand trace gravel (Weathered Advance Outwash). The geotechnical report can be found in Appendix A.

SECTION 3 – OFFSITE ANALYSIS

An initial visual offsite analysis concludes that there is no run-on to the site and all stormwater runoff generated on-site infiltrates or disperses across the site.

SECTION 4 – MINIMUM REQUIREMENTS

The project is required to comply with the minimum requirements of the *Mercer Island Municipal Code (MIMC) Title 15 Chapter 15.09.050 Standards for New Development and Redevelopment* and the *2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMM)*. Sections outlined in this chapter describe the existing and the developed hydrology, the applicable minimum requirements and how they are met.

In the existing condition, runoff drains from east to west and appears to infiltrate or disperse across the project site.

In the developed condition of the site, stormwater from the roof, area drain, and driveway will be collected and conveyed to the on-site stormwater management system, which consists of two infiltration drywells. Runoff from replaced surfaces will maintain the existing site hydrology.

PERFORMANCE GOALS AND STANDARDS

This redevelopment project adds or replaces greater than 5,000 SF of hard surfaces. Based on Mercer Island Municipal Code as well as the 2019 SWMM, Figure I-3.2 “*Flow Chart for Determining Requirements for Redevelopment*,” the project will be required to apply Minimum Requirements 1-9 for the new and replaced hard surfaces and the land disturbed. Refer to Figure 4.1 for the Flow Chart.

The following describes the applicability for each Minimum Requirement:

Minimum Requirement #1: Preparation of Stormwater Site Plans

In accordance with the SWMM, the project documents include Stormwater Site Plans.

Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)

The Construction SWPPP for this project is attached under a separate cover.

Minimum Requirement #3: Source Control of Pollution

This project is located on a developed site and does not have pollutants of concern. Pollution from sediment produced during site work will be mitigated. The project will also employ specific source controls to prevent any illicit discharges of sediment laden stormwater to groundwater or any other on-site system. The Construction SWPPP will identify any specific BMPs selected to control sediment on-site.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

An existing storm drainage system does not exist on site. Runoff appears to infiltrate or disperse across the site. Runoff from replaced surfaces will maintain the existing site hydrology.

Minimum Requirement #5: Onsite Stormwater Management

See Figure 4.2 for the flowchart of how this project will meet MR#5. On-site detention is not required as the project site is under the TDA threshold of 10,000 square feet of effective impervious area.

The project chooses to utilize List #2 Approach per the SWMM:

- **Lawn and landscaped areas** will receive post-construction soil quality and depth (BMP T5.13).
- **Roofs** will be infiltrated using downspout full infiltration systems, which is the infiltration drywells (BMP T5.10A).
- **The driveway** will drain to an infiltration drywell (BMP T5.10A).
 - Dispersion infeasible – minimum flowpath requirements cannot be met.
 - Raingarden and bioretention infeasible – site layout prevents achieving the minimum horizontal requirements.
 - Note: driveway area is 1,010SF and therefore does not trigger minimum requirement #6 – runoff treatment.

Site improvements will not significantly alter the drainage patterns of the existing site.

Minimum Requirement #6: Runoff Treatment

Driveway area is 1,010SF and is less than the 5,000 square feet of pollution generating hard surfaces, and therefore does not trigger minimum requirement #6.

Minimum Requirement #7: Flow Control

Per the “On-Site Detention Design Requirements” provided by the City of Mercer Island, on-site detention is not required because the proposed stormwater management system is utilizing BMPs from List #2 for roofs and hard surfaces. Flow Control is not required as the project site is under the TDA threshold of 10,000 square feet of effective impervious area, per the SWMM.

Minimum Requirement #8: Wetlands Protection

No wetlands were observed onsite or adjacent to the project site.

Minimum Requirement #9: Operation and Maintenance

The Operation and Maintenance manual for this project is attached under Appendix B.

FIGURE 4.1 - FLOW CHART FOR DETERMINING REQUIREMENTS FOR REDEVELOPMENT

Figure 4.1: Flow Chart for Determining Requirements for Redevelopment

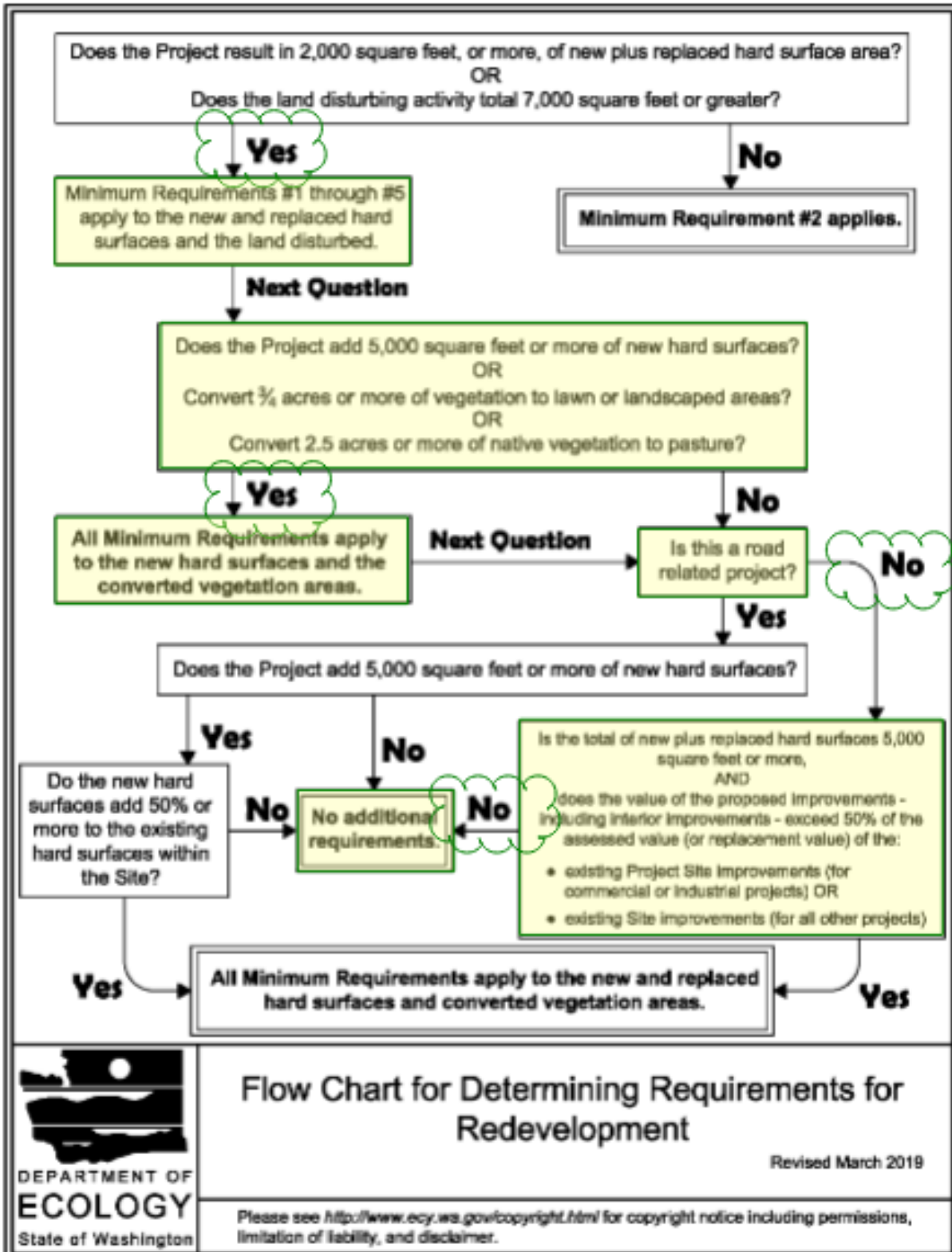
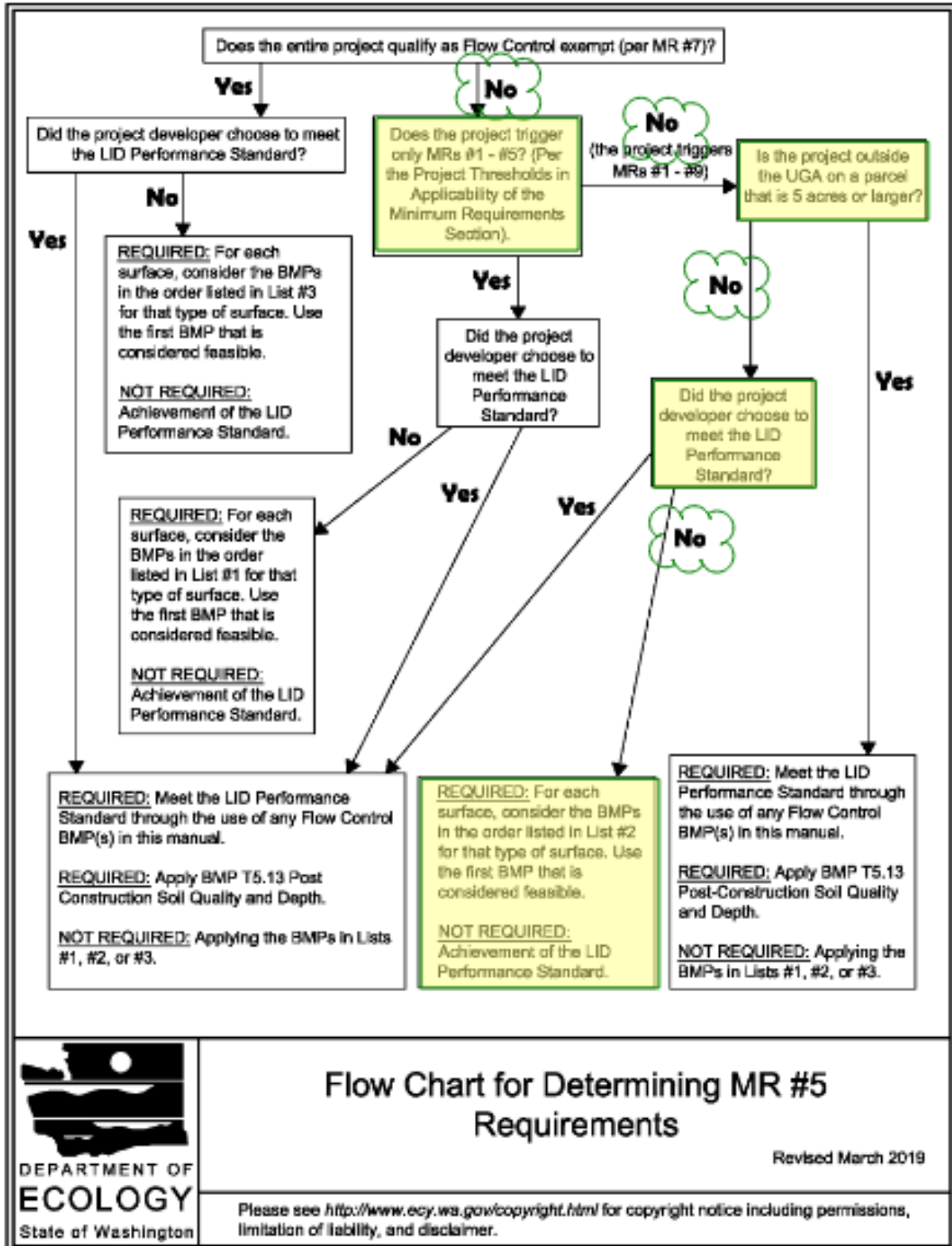


FIGURE 4.2 - FLOW CHART FOR DETERMINING MR#5 REQUIREMENTS

Figure 4-3.3: Flow Chart for Determining MR #5 Requirements



SECTION 5 – INFILTRATION BMP DESIGN & HYDROLOGIC/HYDRAULIC ANALYSIS

It has been determined that widespread infiltration of runoff is feasible in the outwash soils that underlie the area. Infiltration drywells are being proposed for the on-site stormwater management system. The site is underlain by advance outwash below a zone of silty-sands. A small-scale pilot infiltration test (PIT) was conducted on site. Design infiltration rates were determined as prescribed in Volume III of the SWMM, and the drywells will be sized using the “medium sands” designation per the USDA Textural Triangle and the SWMM.

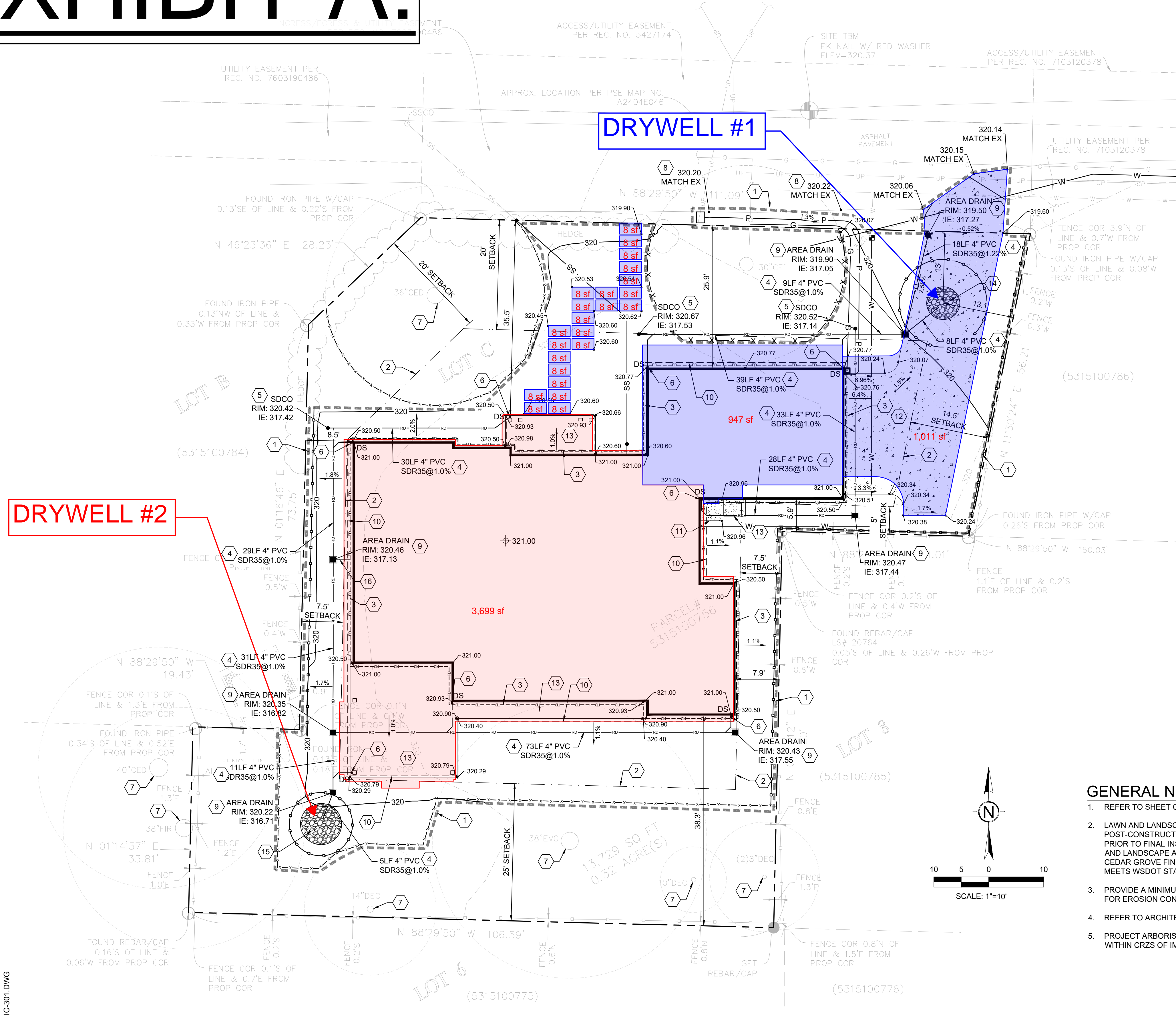
The infiltration drywells systems are sized in accordance with the 2019 SWMM BMP T5.10A. Per the geotechnical report by Cobalt Geosciences, dated November 2024, no groundwater or impermeable soil layers were encountered during the explorations. Therefore, the proposed infiltration drywells will not be within 1 foot minimum from groundwater level. The drywells are sized to provide a gravel storage volume of 90 cubic feet per 1,000 square feet of impervious surface served, meeting the requirement for medium sands. One drywell has a diameter of 6 feet and another drywell has a diameter of 7.5 ft and is deep enough to contain the required gravel volume. Please refer to table below for design depths of the drywells. Filter fabric will be installed on top of the drain rock and along the drywell walls prior to backfilling. A minimum spacing of 10 feet between drywells is maintained (located about 13 feet from the property line). The drywells are not located on slopes exceeding 25%, nor within or above any mapped landslide hazard areas. The site slope is approximately 6-15%, according to the Geotechnical report. The system is designed to manage runoff onsite and avoid adverse impacts to downstream properties.

Using this information and the contributing roof area, it was calculated that 526 cubic feet of trench would be required to infiltrate the 5,841 square feet of roof and other tributary impervious areas. Refer to a summary of the infiltration drywell calculations below and Figure 5.1 in the following page for the tributary impervious areas for the infiltration drywells and calculations:

Drywell #	Contributing Area (SF)	Volume Needed (CF)	Diameter (FT)	Depth (FT)	Drywell Volume Provided (CF)
1	2142	204.66	6	7.5	212
2	3699	321.03	7.5	7.5	331
Total	5841	526			543

FIGURE 5. 1: TRIBUTARY IMPERVIOUS AREAS FOR INFILTRATION DRYWELLS AND CALCULATIONS

EXHIBIT A:



Drywell #1	
Tributary impervious area =	2142 sf
SWMM Sizing =	90 cf/1000sf
Req. Volume =	192.78 cf
Radius =	3 ft
Drywell X-Sect Area =	28.27433 sf
Req. Depth =	7.5 ft
# of Drywells =	1
Depth/Drywell =	7.50 ft
Volume Provide =	212.0575 cf

Drywell #2	
Tributary impervious area =	3699 sf
SWMM Sizing =	90 cf/1000sf
Req. Volume =	332.91 cf
Radius =	3.75 ft
Diameter =	7.5 ft
Drywell X-Sect Area =	44.17865 sf
Req. Depth =	7.5 ft
# of Drywells =	1
Depth/Drywell =	7.50 ft
Volume Provide =	331.3399 cf

DRYWELL #2

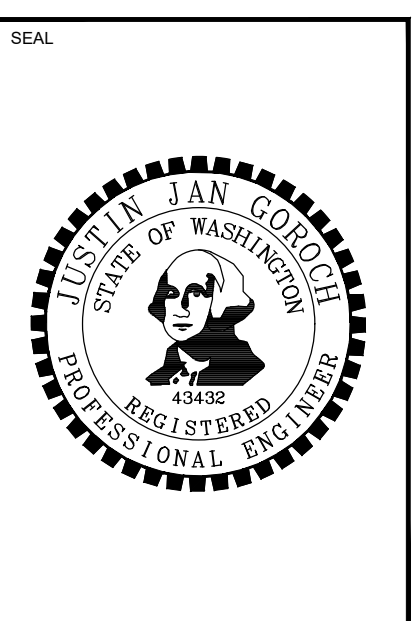
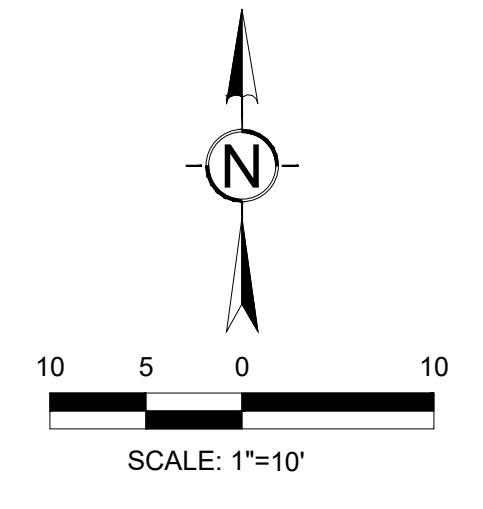
DRYWELL #1

GENERAL NOTES

- REFER TO SHEET C-102 FOR STANDARD ESC PLAN NOTES.
- LAWN AND LANDSCAPE AREAS SHALL MEET THE POST-CONSTRUCTION SOIL QUALITY AND DEPTH REQUIREMENTS PRIOR TO FINAL INSPECTION OF THE PROJECT. PROPOSED LAWN AND LANDSCAPE AREAS SHALL RECEIVE TOPSOIL AMENDED WITH CEDAR GROVE FINE GRADE COMPOST OR OTHER COMPOST THAT MEETS WSDOT STANDARD SPEC 9-14.5(B).
- PROVIDE A MINIMUM 2 INCH LIFT OF MULCH IN ALL PLANTING AREAS FOR EROSION CONTROL.
- REFER TO ARCHITECTURAL PLANS FOR DOWNSPOUT LOCATIONS.
- PROJECT ARBORIST SHALL BE ON-SITE TO OBSERVE ALL WORK WITHIN CRZS OF IMPACTED TREES.

SHEET NOTES

- LIMITS OF DISTURBANCE.
- BUILDING SETBACK.
- 4" PVC PERFORATED FOOTING DRAIN PIPE PER DETAIL. SURROUND WITH MINIMUM 6" OF DRAIN ROCK WRAPPED IN A NON-WOVEN GEOSYNTHETIC FILTER FABRIC.
- PVC SDR35 ROOF DRAIN AT 1.0% MINIMUM SLOPE.
- ROOF DRAIN CLEANOUT PER DETAIL.
- DOWNSPOUT CONNECTION PER DETAIL.
- PROTECT EXISTING TREES PER DETAIL AND ARBORIST REPORT.
- MATCH GRADES AT EXISTING ROADWAY.
- AREA DRAIN PER DETAIL. PROVIDE INLET PROTECTION DURING CONSTRUCTION.
- ROOF OVERHANG. REFER TO ARCHITECTURAL PLANS.
- PAD FOR HVAC EQUIPMENT. REFER TO ARCHITECTURAL PLANS.
- CEMENT CONCRETE PAVEMENT
- CEMENT CONCRETE WALKWAY/PATIO/STOOP
- INFILTRATION DRYWELL AND AREA DRAIN PER DETAIL. TRIBUTARY IMPERVIOUS AREA: 2142SF. SIZING (SOIL MEDIUM SANDS): 90CF/1000SF OF TRIBUTARY AREA. REQUIRED VOLUME: 204.66CF. VOLUME PROVIDED: 212CF (6" DIA HOLE, 7.5' DEEP).
- INFILTRATION DRYWELL AND AREA DRAIN PER DETAIL. TRIBUTARY IMPERVIOUS AREA: 3699SF. SIZING (SOIL MEDIUM SANDS): 90CF/1000SF OF TRIBUTARY AREA. REQUIRED VOLUME: 321.03CF. VOLUME PROVIDED: 331CF (7.5" DIA HOLE, 7.5' DEEP).
- 4" PVC SDR35 FOOTING DRAIN TIGHT-LINE. CONNECT TO AREA DRAIN MINIMUM 1" BELOW BOTTOM OF FOOTING.



PROJECT
HACKETT RESIDENCE
 2965 74TH AVE SE
 MERCER ISLAND, WA 98040

REVISIONS



DRAWN BY: BDS
 DESIGNED BY: RB
 REVIEWED BY: RB
 TITLE
GRADING AND DRAINAGE PLAN

DATE
 12.18.2024
 PROJECT NUMBER
 24021
 SHEET
C-301
 PERMIT SET



APPENDIX A

Geotechnical Report by Cobalt Geosciences, dated November 2024



Cobalt Geosciences, LLC
P.O. Box 1792
North Bend, WA 98045

November 11, 2024
Updated June 12, 2025

Hackett SFR
C/O Megan Atkinson
megan@nwlifestylehomes.com

RE: Geotechnical Evaluation
Proposed Residence
2965 74th Avenue SE
Mercer Island, Washington

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

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork.

Site and Project Description

The site is located at 2965 74th Avenue SE in Mercer Island, Washington. The site consists of one irregularly shaped parcel (No. 5315100756) with a total area of about 13,731 square feet.

The site is developed with a residence, detached garage, and driveway. The remainder of the site is vegetated with grasses, bushes, and sparse trees.

The site is nearly level and bordered to the south, east, and west by residential properties, and to the north by an access easement.

The proposed development includes a new residence and a driveway. Stormwater will be infiltrated if determined to be feasible. Site grading may include cuts and fills of 3 feet or less and foundation loads are expected to be light.

We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

Area Geology

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

Vashon Glacial Till includes mixtures of silt, sand, clay, and gravel. These materials are usually impermeable and are typically dense to very dense below a weathered zone.

Vashon Glacial Till is typically underlain by Vashon Advance Outwash. The outwash includes fine to medium grained sands with minor gravel. These deposits are permeable in most areas.

Soil & Groundwater Conditions

As part of our evaluation, we excavated a test pit, where accessible. We returned in June 2025 to advance a deep hand boring in the area of the planned infiltration system closer to the roadway.

The explorations encountered approximately 6 inches of grass and topsoil underlain by approximately 4 to 4.5 feet of loose to medium dense, silty-fine to medium grained sand trace gravel (Weathered Advance Outwash). These materials Advance Outwash), which continued to the termination depth of the explorations.

Groundwater was not encountered in the explorations. Groundwater may be present at greater depths in this area if the outwash is underlain by finer grained deposits.

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project.

Erosion Hazard

The Natural Resources Conservation Services (NRCS) maps for King County indicate that the site is underlain by Arents, Alderwood material (6 to 15 percent slopes). These soils would have a slight to severe erosion potential in a disturbed state depending on the slope magnitude.

It is our opinion that soil erosion potential at this project site can be reduced through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt fences, hay bales, mulching, control ditches and diversion trenches. The typical wet weather season, with regard to site grading, is from October 31st to April 1st. Erosion control measures should be in place before the onset of wet weather.

Seismic Parameters

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the International Building Code (IBC). A Site Class *D* applies to an overall profile consisting of medium dense to very dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_s , S_i , F_a , and F_v . The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.405	0.489	1.0	Null	0.937	Null	0.601

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The site has a relatively low likelihood of liquefaction. For items listed as “Null” see Section 11.4.8 of the ASCE.

Conclusions and Recommendations

General

The site is underlain by weathered and unweathered outwash-like deposits which becomes denser with depth. There may be areas of fill above the native soils in yard areas around the residence.

The proposed residence may be supported on a shallow foundation system bearing on medium dense or firmer native soils or on structural fill placed on the native soils. Local overexcavation or recompaction of loose weathered native soils may be necessary depending on the proposed elevations and locations of the new footings.

Widespread infiltration of runoff is feasible in the outwash soils that underlie the area. Drywells may be sized using the medium sand designation per the USDA Textural Triangle and King County Surface Water Design Manual or provided rate.

Dispersion systems and permeable pavements are also generally feasible if required. We can provide additional recommendations once a civil plan with planned grading and building elevations has been prepared.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 18 inches. Deeper excavations will be necessary in areas of existing foundation systems (where present), below larger trees, and in any areas underlain by undocumented fill.

The native soils consist of silty-sand with gravel and poorly graded sand trace to with gravel. Most of the native soils may be used as structural fill provided they achieve compaction requirements and are within 3 percent of the optimum moisture. Some of these soils may only be suitable for use as fill during the summer months, as they will be above the optimum moisture levels in their current state. These soils are variably moisture sensitive and may degrade during periods of wet weather and under equipment traffic.

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 3 feet or less for foundation and most of the utility placement. Any deeper temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill and 1H:1V in medium dense to dense native soils. If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

Foundation Design

The proposed structure may be supported on a shallow spread footing foundation system bearing on undisturbed medium dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill and/or loose native soils should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 4 inches in size. We should verify soil conditions during foundation excavation work.

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 3,000 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 1/2 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 250 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)	14H* (Uniform Distribution)
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 12 inches, 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.

Stormwater Management Feasibility

The site is underlain by advance outwash below a zone of silty-sands. We performed a small scale pilot infiltration test (PIT) in TP-1. The test was performed in general accordance with the Washington State Department of Ecology stormwater manual.

We returned in June 2025 to advance a deeper hand boring in the area of the planned infiltration system, which was unknown during our previous exploration work. The soils were consistent at this location with the previous test pit. It is our opinion that the rate noted below and soil classifications are consistent with the new location.

The area was excavated to a testing depth of approximately 5 feet below the ground surface. The design infiltration rate was determined by applying correction factors to the measured infiltration rate as prescribed in Volume III, Section 3.3.6 of the DOE. The measured rate must be reduced through appropriate correction factors for site variability (CF_V), uncertainty of test method (CF_T), and degree of influent control (CF_M) to prevent siltation and bio-buildup.

It should be noted that construction traffic or other disturbance to the target infiltration area could compact the soil, which may decrease the effective infiltration rates. The correction factors and resulting design infiltration rate are also shown in the table below.

Test Number	Test Depth (ft)	Measured Infiltration Rate (in/hr)	Correction Factors			Design Infiltration Rate (in/hr)
			CF_V	CF_T	CF_M	
TP-1	5.0	4.5	0.7	0.5	0.9	1.42

Widespread infiltration of runoff is feasible in the outwash soils that underlie the area. Drywells may be sized using the medium sand designation per the USDA Textural Triangle and King County Surface Water Design Manual or provided rate. We must verify soil conditions at system locations since soil conditions may vary across the site. Overexcavation may be locally required.

Dispersion systems and permeable pavements are also generally feasible if required. We can provide additional recommendations once a civil plan with planned grading and building elevations has 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.

Slab-on-Grade

We recommend that the upper 18 inches of the native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 180 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from the building and preferably with a relatively impermeable surface cover immediately adjacent to the building.

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.

Utilities

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The contractor is responsible for the safety of open trenches. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

In general, silty and sandy soils were encountered at shallow depths in the explorations at this site. These soils have low cohesion and density and will have a tendency to cave or slough in excavations. Shoring or sloping back trench sidewalls is required within these soils in excavations greater than 4 feet deep.

All utility trench backfill should consist of imported structural fill or suitable on site soils. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. Depending on the depth and location of the proposed utilities, we anticipate the need to re-compact existing fill soils below the utility structures and pipes. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction procedures.

Pavements

The near surface subgrade soils generally consist of silty sand with gravel. These soils are rated as good for pavement subgrade material (depending on silt content and moisture conditions). We estimate that the subgrade will have a California Bearing Ratio (CBR) value of 10 and a modulus of subgrade reaction value of $k = 200$ pci, provided the subgrade is prepared in general accordance with our recommendations.

We recommend that at a minimum, 12 inches of the existing subgrade material be moisture conditioned (as necessary) and re-compacted to prepare for the construction of pavement sections. Deeper levels of recompaction or overexcavation and replacement may be necessary in areas where fill and/or very poor (soft/loose) soils are present.

The subgrade should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Test Method D1557. In place density tests should be performed to verify proper moisture content and adequate compaction.

The recommended flexible and rigid pavement sections are based on design CBR and modulus of subgrade reaction (k) values that are achieved, only following proper subgrade preparation. It should be noted that subgrade soils that have relatively high silt contents will likely be highly sensitive to moisture conditions. The subgrade strength and performance characteristics of a silty subgrade material may be dramatically reduced if this material becomes wet.

Based on our knowledge of the proposed project, we expect the traffic to range from light duty (passenger automobiles) to heavy duty (delivery trucks). The following tables show the recommended pavement sections for light duty and heavy duty use.

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT

LIGHT DUTY

Asphaltic Concrete	Aggregate Base*	Compacted Subgrade* **
2.5 in.	6.0 in.	12.0 in.

HEAVY DUTY

Asphaltic Concrete	Aggregate Base*	Compacted Subgrade* **
3.5 in.	6.0 in.	12.0 in.

PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT

Min. PCC Depth	Aggregate Base*	Compacted Subgrade* **
6.0 in.	6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*

*** A proof roll may be performed in lieu of in place density tests*

The asphaltic concrete depth in the flexible pavement tables should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) 1/2 inch HMA. The rigid pavement design is based on a Portland Cement Concrete (PCC) mix that has a 28 day compressive strength of 4,000 pounds per square inch (psi). The design is also based on a concrete flexural strength or modulus of rupture of 550 psi.

CONSTRUCTION FIELD REVIEWS

Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at foundation locations
- Observe slab-on-grade preparation
- Monitor foundation drainage placement
- Observe excavation stability

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

CLOSURE

This report was prepared for the exclusive use of Megan Atkinson and their appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of Megan Atkinson who is identified as “the Client” within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

Sincerely,

Cobalt Geosciences, LLC



6/12/2025
Phil Haberman, PE, LG, LEG
Principal

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.



 **Approximate Test**
TP-1 Pit and Hand Boring Location
HB-1

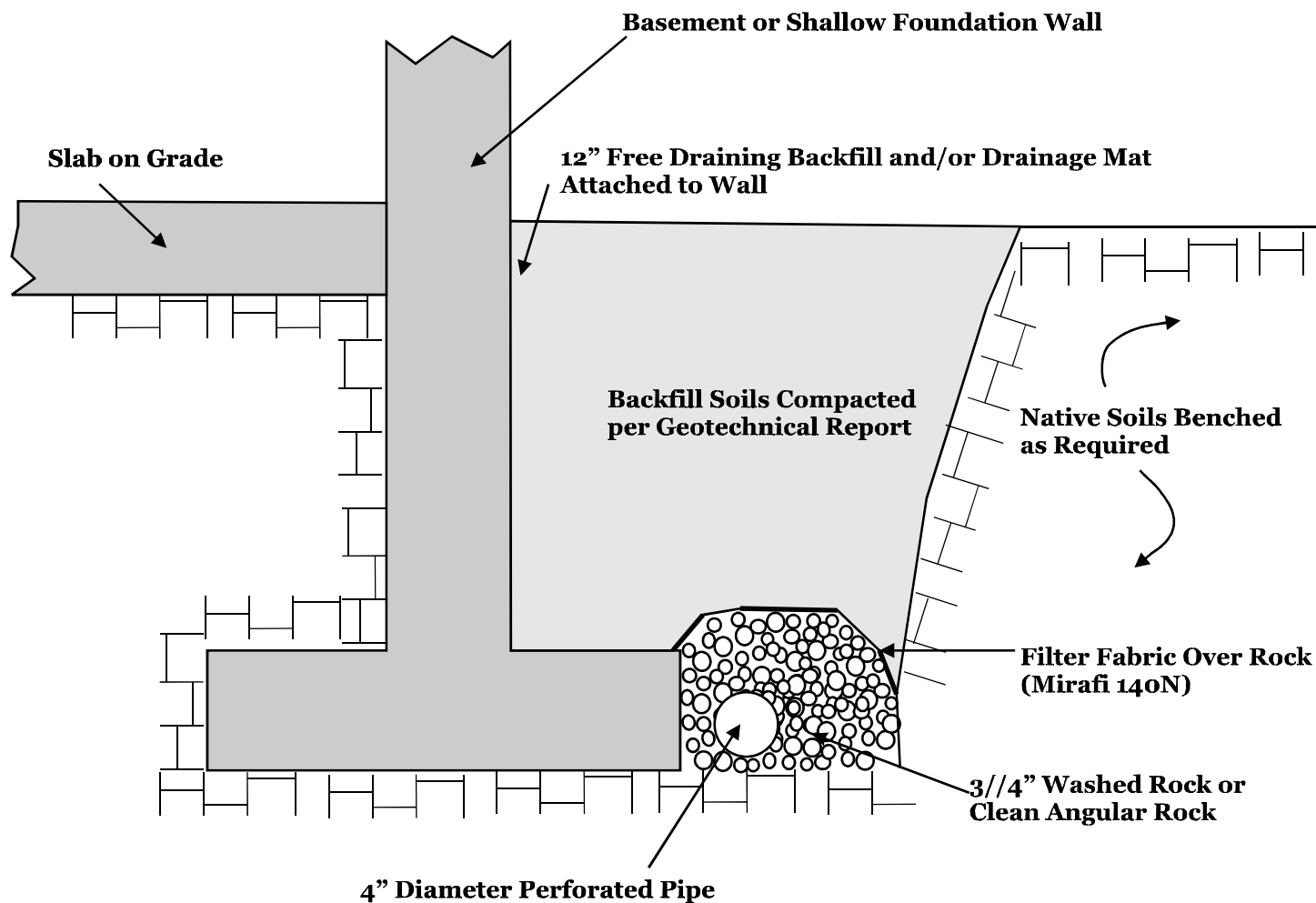
King County Imap Image



Proposed Development
 2965 74th Ave SE
 Mercer Island, Washington

Site Image
Figure 1

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 Kenmore, WA 98028
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Not to Scale



Typical Foundation Drain Detail

Attachment

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 North Bend, WA 98045
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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	
		Gravels with Fines (more than 12% 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	
		Gravels with Fines (more than 12% fines)	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	
		Sands with Fines (more than 12% fines)	SP	Poorly graded sand, gravelly sands, little or no fines	
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures	
		Sands with Fines (more than 12% fines)	SC	Clayey sands, sand-clay mixtures	
		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
			Inorganic	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	
	Inorganic	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	PT	Peat, humus, swamp soils with high organic content (ASTM D4427)	

Classification of Soil Constituents
<p>MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).</p> <p>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).</p> <p>Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).</p>

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

Relative Density (Coarse Grained Soils)		Consistency (Fine Grained Soils)	
N, SPT, Blows/FT	Relative Density	N, SPT, Blows/FT	Relative Consistency
0 - 4	Very loose	Under 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	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




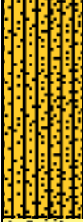
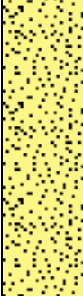
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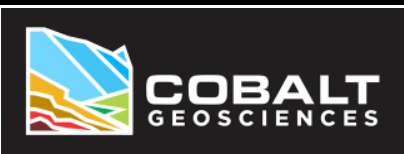
Soil Classification Chart

Figure C1

Test Pit TP-1

Date: October 2024	Depth: 10'	Groundwater: None
Contractor: Cobalt	Elevation:	Logged By: PH Checked By: PH

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/Vegetation							
1			SM	Loose to medium dense, silty-fine to medium grained sand trace gravel, yellowish brown to grayish brown, moist. (Weathered Advance Outwash)							
2											
3	■										
4											
5	■		SP	Medium dense to dense, fine to medium grained sand trace gravel, grayish brown, moist. (Advance Outwash)							
6											
7											
8											
9											
10											
				End of Test Pit 10'							



Proposed Development
2965 74th Ave SE
Mercer Island, Washington


**Exploration
Logs**

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cobaltgeo@gmail.com

Hand Boring HB-1

Date: June 2025	Depth: 10'	Groundwater: None
Contractor: Cobalt	Elevation:	Logged By: PH Checked By: PH

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/Vegetation											
1			SM	Loose to medium dense, silty-fine to medium grained sand trace gravel, yellowish brown to grayish brown, moist. (Weathered Advance Outwash)									
2													
3													
4													
5													
6			SP	Medium dense to dense, fine to medium grained sand trace gravel, grayish brown, moist. (Advance Outwash)									
7													
8													
9													
10													
				End of Hand Boring 10'									

	<p>Proposed Development 2965 74th Ave SE Mercer Island, Washington</p>	<p>Exploration Logs</p>	<p>Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com</p>
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APPENDIX B

Operations and Maintenance Manual

OPERATIONS & MAINTENANCE MANUAL

December 2024

PROJECT:

Hackett Residence
Parcel No: 531510-0756
2965 74th Ave SE
Mercer Island, WA 98040

OWNER:

Patricia Hackett
2965 74th Ave SE
Mercer Island, WA 98040

ENGINEER:

Axea Civil, LLC
1102 A Street, Suite 317
Tacoma, WA 98402

PREPARED BY:

Ryan Baltazar
rbaltazar@axeacivil.com

REVIEWED BY:

Justin Goroch, PE
jgoroch@axeacivil.com

Section 1 –Project Description

The Hackett Residence project will include a new single-family home. The site is located in northwest Mercer Island at 2965 74th Ave SE, Mercer Island, WA 98040 on King County parcel number 531510 0756. The proposed project includes the removing existing improvements and constructing a new single-family home and associated site, utility, and stormwater management facilities. Stormwater on this site, including run-off from the roof, area drain, and driveway will be collected and conveyed to the on-site stormwater management system, which consists of two infiltration drywells.

Section 2 – Maintenance Importance and Intent

The importance of maintenance for the proper functioning of stormwater control facilities cannot be over-emphasized. A substantial portion of failures (clogging of filters, resuspension of sediments, loss of storage capacity, etc.) are due to inadequate maintenance. Stormwater BMP maintenance is essential to ensure that BMPs function as intended throughout their full life cycle. The fundamental goals of maintenance activities are to insure the entire flow regime and treatment train designed for this site continue to fully function. For this site these include: (engineer can delete non applicable BMPs listed below):

- Maintain designed stormwater infiltration capacity
- Maintain designed stormwater detention/retention volume
- Maintain ability of storm facility to attenuate flow rates
- Maintain ability to safely convey design stormwater flows
- Maintain ability to treat stormwater runoff quality
- Preserve soil and plant health, as well as stormwater flow contact with plant and soil systems
- Clearly identify systems so they can be protected
- Keep maintenance costs low
- Prevent large-scale or expensive stormwater system failures
- Prevent water quality violations or damage to downstream properties.

The intent of this section and manual is to pass on to the responsible party(s) all the information critical to understand the design of the system, risks and considerations for proper use, suggestions for maintenance frequencies, and cost so that realistic budgets can be established.

Section 3 – Responsible Parties

The property owner shall be responsible for maintaining all stormwater facilities.

Section 4 – Facilities Requiring Maintenance

The following is a list of facilities requiring maintenance:

- (2) Infiltration Drywells
- (6) area drains
- ~290 feet drain pipe

Section 5 – Maintenance instructions

The parties responsible for maintenance must review and apply the maintenance requirements contained herein. These maintenance instructions outline conditions for determining if maintenance actions are required, as identified through inspection. However, they are not intended to be measures

of the facility's required condition at all times between inspections. Exceedance of these conditions at any time between inspections or maintenance activity does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance presented in the checklists shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action. For facilities not owned and maintained by the City, a log of maintenance activity that indicates what actions were taken must be kept on site and be available for inspection by the City.

See the maintenance checklists provided at the end of this manual

Section 6 – Vegetation Maintenance

Maintain established vegetation in all all areas to prevent erosion of exposed soils.

Section 7 – Pollution Source Control Measures

Refer to Volume IV Chapter 3 of the Western Washington Stormwater Management manual for a detailed description of best management practices to prevent pollution at its source. That chapter contains information on automobile washing and maintenance, storage of hazardous materials, yard maintenance, and septic system maintenance.

Section 8 – Annual Cost of Maintenance

See Section 4 for a list of the facilities requiring maintenance. The average annual cost of maintenance is estimated to be \$100 - \$350 per year.