# Stormwater Site Plan

Helix Design Build Mercer Island
6922 SE 33rd Street
Mercer Island, WA 98040

**October 2022**

bcra
2106 Pacific Avenue, Suite 300
Tacoma, WA 98402

# STORMWATER REPORT

October 2022

**PROJECT:**
Helix Design Build Mercer Island
6922 SE 33rd Street
Mercer Island, WA 98040

**OWNER:**
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I hereby state that this report for the Helix Design Build Mercer Island has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers.


10/05/2022

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## Section A – Project Overview and Existing Conditions Summary

The Helix Design Build Mercer Island project is a single-family home. There are single-family residences to the north, west, and east of the site, a single-family residence across SE 33rd St. on the south, as can be seen in Figure 1.1 Site Vicinity Map. Generally, the site slopes from the east to west.

There are no known existing on-site stormwater systems, but there is a catch basin at the base of the driveway within the right of way in SE 33rd St. Any stormwater not captured by this catch basin is assumed to either disperse along the lawn or flow off-site to the north-west and into a private open watercourse in the adjacent property. No run-on is anticipated from adjacent sites and all storm runoff will be managed on site in the developed condition. Subsurface geotechnical exploration did not reveal perched groundwater on the site.

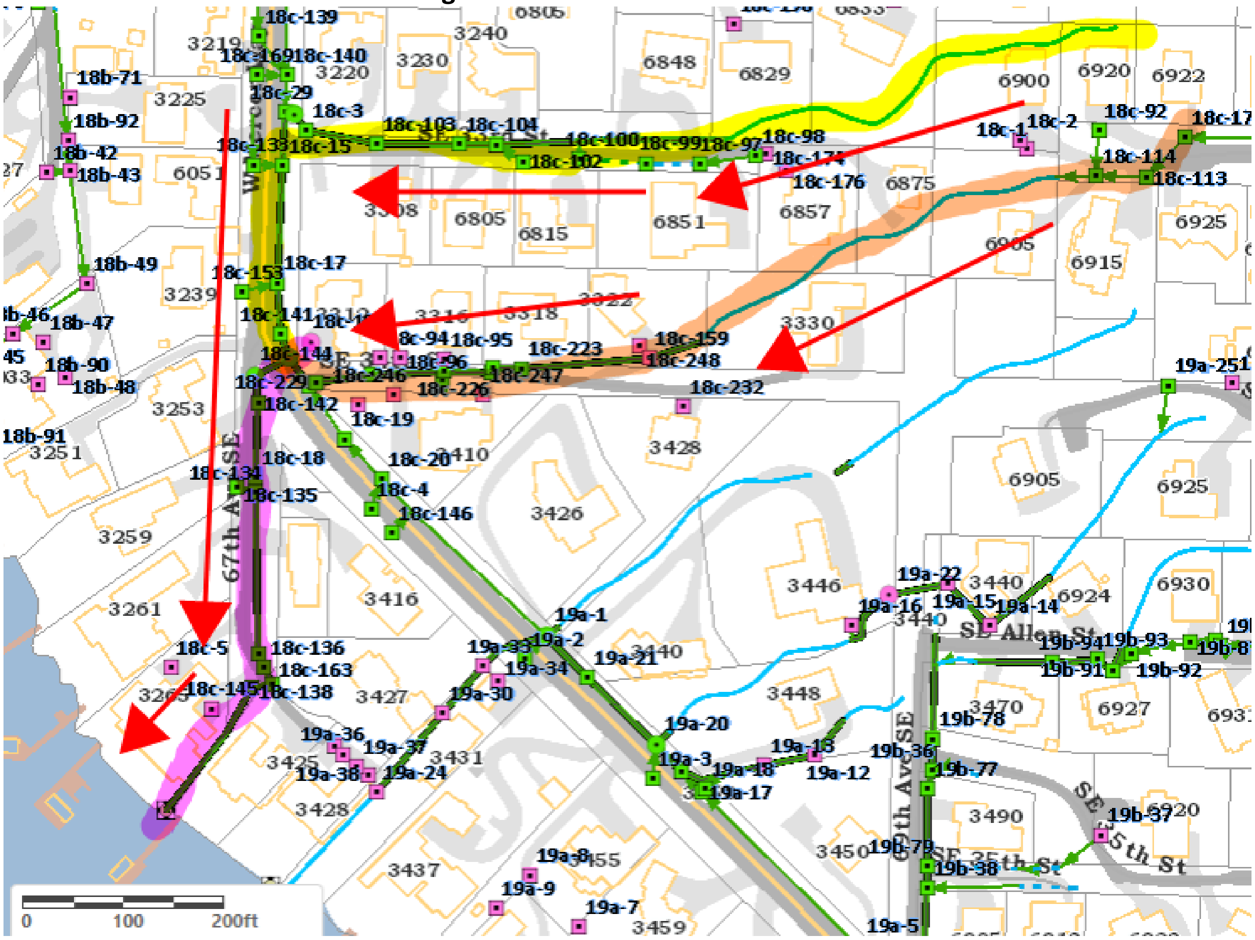
On-site improvements will include a new building and driveway. The total new impervious surface area is 4,650 sf (770 sf of driveway, 3,618 sf of roof area, and 262 sf of other miscellaneous hard surfaces (window well, top of retaining walls, utility pads, path, etc). The preliminary stormwater concept for the site proposes capturing stormwater from impervious surfaces, conveying it into the prescribed Mercer Island detention system, and releasing the detained water to the Mercer Island municipal stormwater system.

**Figure 1: Site Vicinity Map**

## Section B – Off-Site Analysis Report

Off-site water quality is not impacted due to the site's minimal addition of PGHS coming only from the new driveway (770 sf). Erosion and slope stability are not impacted as the storm water will be piped into a detention system and the site discharges all stormwater into the existing municipal storm system. No on-site infiltration is feasible because the project site is located within "Areas Infeasible for Infiltration" on Mercer Island GIS Portal. Dispersion BMPs are infeasible because minimum required flow paths cannot be met between the trench outlet and slopes greater than 15%, property lines, and structures. Drainage is not impacted as water will flow to the same catch basin as before (this catch basin coverages within 0.20 of the private watercourse to the west of the property). The site storm system on the south, east, and north runs at a downhill slope into the detention system. Water from the west, the driveway, and window well run at a downhill slope into a pump that discharges the water into the detention system. Information about the pump system can be found in a separate document within this submittal titled 'Pump Analysis'. The detention system releases water at a controlled flow rate to the municipal storm system. No run-on is anticipated from adjacent sites. Conveyance system capacity is not impacted as only a net increase of 2,018 square feet of new hard surfaces is being added. A new 12" conveyance pipe connects site storm to the municipal system, having more than enough capacity for this. Localized flooding is not a concern as the site is on a slope and storm systems catches all water from hard surfaces. Using topographic maps, GIS maps, and survey, off-site storm flows south-west through one of two routes, as can be seen in Figure 2, and ultimately discharges into Lake Washington.

**Figure 2: Off-site Water Flow Path**



## Section C – Permanent Stormwater Control Plan

- Total native vegetation retained: 855 square feet
- Total disturbed soils to be amended: 5,664 square feet
- Scale drawings are provided in the attached site plan (Appendix A).
- List approach justification is provided in Section H of this document.
- Water from the west roofs, window well to the north, and driveway is collected at a point that is too low to gravity into the detention system, thus this pumped into the detention system. Information about the pump system can be found in a separate document within this submittal titled 'Pump Analysis'.

## Section D – Construction Stormwater Pollution Prevention Plan

A CSWPPP has been prepared and will be submitted with this report.

## Section E – Special Reports and Studies

A Geotechnical Engineering Report was prepared by Cobalt Geosciences (Appendix B), dated 03/12/2022. Cobalt found Vashon Advance Outwash consisting of fine to medium grained sand with minor silt and gravel. No groundwater was encountered in any of their explorations. Cobalt did not recommend infiltration systems for this site due to the topography.

## Section F – Operations and Maintenance Manual

The prescribed Mercer Island detention tank is being used for flow control, see the On-Site Detention System Worksheet in Appendix C.

## Section G – Minimum Requirements

The land disturbing activity includes clearing, grading, filling, and excavation. The site contains a single threshold discharge area (TDA). Runoff from the TDA flows into the municipal stormwater system via the catch basin located south of the site, in SE 33rd St and through the private watercourse to the west of the site. These two discharge locations converge within a quarter mile; thus the site is only one TDA.

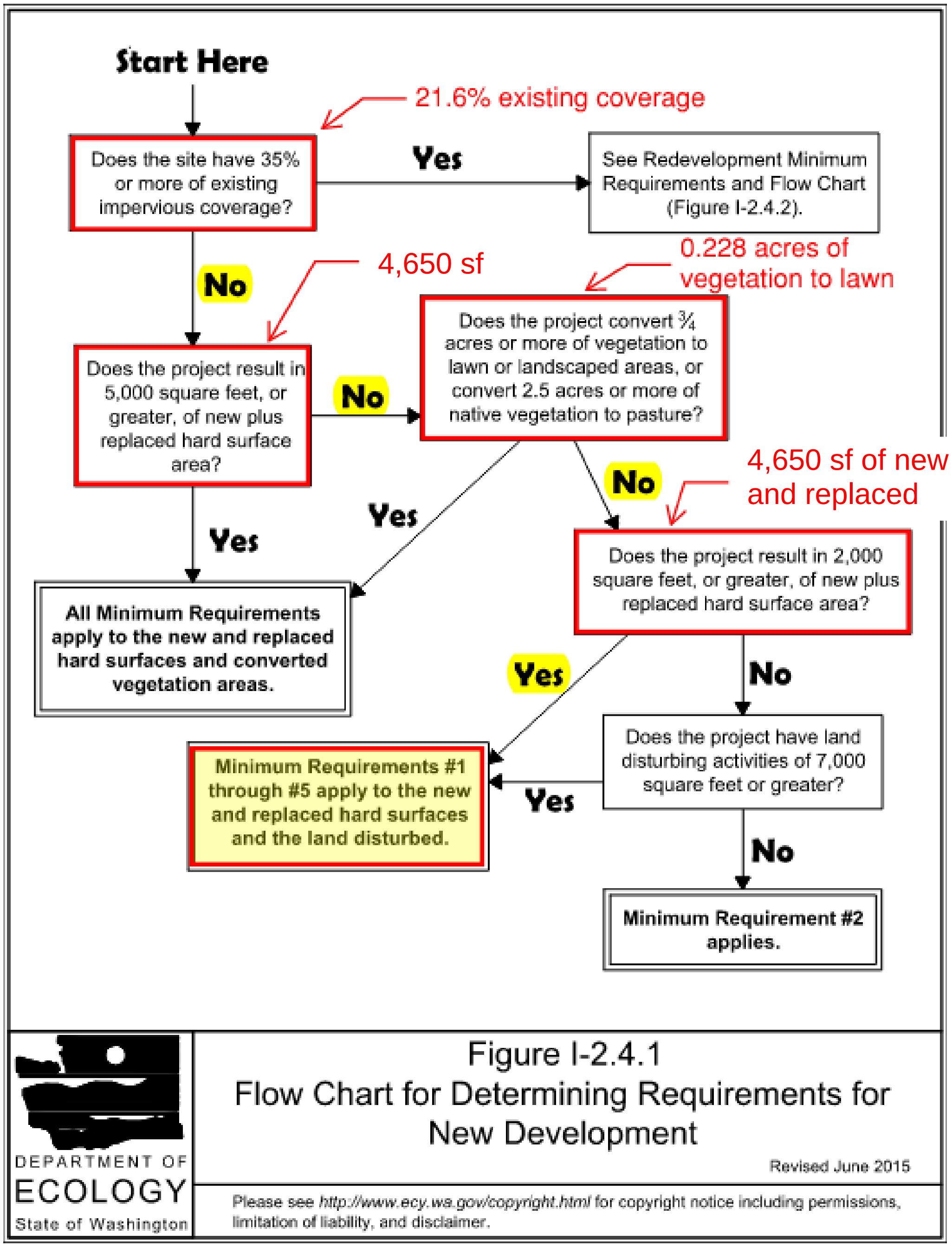
This site uses Figure 3 to determine the applicable Minimum Requirements. The results of using these figures show that the project triggers minimum requirements #1 through #5 for new and replaced hard surfaces and converted vegetation areas.

**Table 2.1 Threshold Discharge Areas**

| Area (sf) | Existing Impervious | New and Replaced Impervious | Total Land Disturbing Activity |
|---|---|---|---|
| TDA | 2,158 | 4,650 | 10,314 |

**Figure 3: Minimum Requirement Flowchart for New Development**

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




*2014 Stormwater Management Manual for Western Washington*

**Minimum Requirement #1: Preparation of Stormwater Site Plans**
The project documents include this Stormwater Site Plan (See Appendix A).

**Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)**
The project documents include this Construction Stormwater Pollution Prevention Plan (separate document).

**Minimum Requirement #3: Source Control of Pollution**
The project will meet the requirements for source control pollution by implementing the following BMPs: S454Preventative Maintenance/Good Housekeeping, S455 Spill Prevention and Cleanup, S457 Inspections, S458 Record Keeping, S417 Maintenance of Stormwater Drainage and Treatment Systems, S421 Parking and Storage of Vehicles and Equipment, S407 Dust Control at Disturbed Land Areas, S411 Landscaping and Lawn/Vegetation Management, S429 Storage or Transfer of Solid Raw Materials, Byproducts, or Finished Products, S438 Construction Demolition, S442 Labeling Storm Drain Inlets On Your Property, S451 Building, Repair, Remodeling, Painting, and Construction.

**Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls**
Runoff from pavement will be tightlined to roof drain lines, conveyed to the onsite detention system, and released into the City of Mercer Island public storm system following the existing site hydrology.

**Minimum Requirement #5: On-Site Stormwater Management**
MR #5 is satisfied per Section H of this document.

## Section H – On-Site Stormwater Management BMPs

The use of BMPs from List #1 has been selected to meet compliance of Minimum Requirements #5.

**Lawn and Landscaped Areas:**
For the lawn and landscaped areas, Post-Construction Soil Quality and Depth (BMP T.513) will be implemented per List #1 (See Appendix D).

**Roofs:**
See Appendix E.

**Other Hard Surfaces:**
See Appendix E.

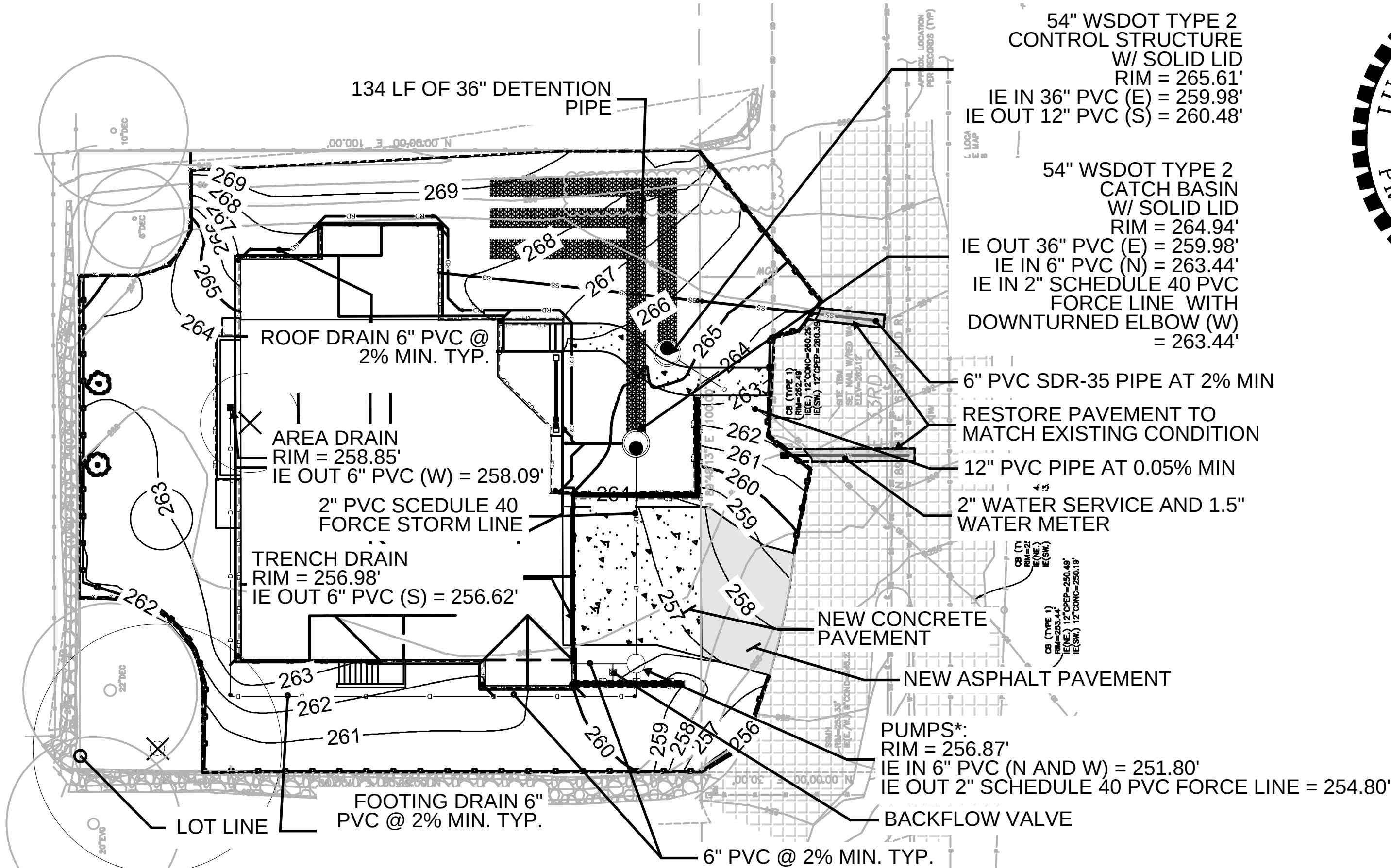
# Appendix A – Site Plan

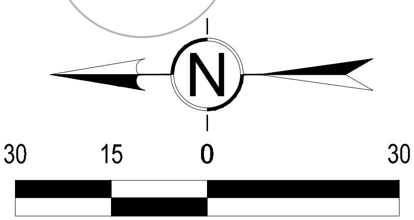
10.05.2022 / HELIX MI

# DRAINAGE & EROSION CONTROL PLAN

6922 33RD ST. MERCER ISLAND, WA 98040

bcra


SCALE: 1"=30'

PROVIDE STRAW OR PLASTIC COVER TO ANY EXPOSED SOILS THROUGHOUT CONSTRUCTION CYCLE

SOIL ON ENTIRE SITE CONSISTS OF ARENTS, ALDERWOOD MATERIAL (HSG B/D)

FOOTING DRAINS GO INTO DETENTION SYSTEM SINCE A PUMP IS NEEDED, A BACKFLOW VALVE IS PROVIDED

ALL PERVIOUS SURFACES WIHIN LIMITS OF DISTURBANCE WILL RECIEVE SOIL AMMENDMENTS

INFORMATION TAKEN FROM TOPO & BOUNDARY SURVEY DATED 02/09/2022 BY TERRANE

*PUMPS ARE A DUPLEX PUMP SYSTEM UTILIZING ZOELLER N57 SERIES PUMPS, ZOELLER DUPLEX ELECTRICAL ALTERNATOR CONTROL PANEL/ALARM, APAK Z CONTROL ALARM, AND A TYPE 2 BASIN

# Appendix B – Geotechnical Report

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

March 12, 2022

Erin Jacobsen
erin@helixdesignbuild.com

**RE: Geotechnical Evaluation**
Proposed Residence
6922 SE 33rd Street
Mercer Island, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter 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 Description

The site is located at 6922 SE 33rd Street in Mercer Island, Washington. The site consists of one rectangular parcel (No. 9359100160) with an area of about 10,000 square feet.

The central portion of the site is developed with a residence and driveway. There are local rockery walls along and near the north and west property lines. These walls are about 2 to 8 feet in height and are locally terraced on the north side of the property to the west. The north wall faces south and the west walls face west.

The site is vegetated with grasses, bushes, and variable diameter evergreen and deciduous trees. The site slopes downward from east to west at magnitudes of 5 to 10 percent (mostly) and relief of about 15 feet. There is a very steep slope extending downward to the west at the east property line. This slope is 3 to 6 feet tall and has magnitudes of 60 to 125 percent. The slope is vegetated with grasses.

The site is bordered to the north, east, and west by residential properties, and to the south by SE 33rd Street.

The proposed development includes a new residence and driveway. Stormwater will include infiltration or other systems depending on feasibility.

Site grading may include cuts and fills of 10 feet or less for basement placement 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 Mercer Island, indicates that the site is underlain by Vashon Advance Outwash.

These deposits include fine to medium grained sand and silty-sands with minor gravel. These deposits generally become denser with depth below a weathered zone. These materials are often permeable.

## Soil & Groundwater Conditions

As part of our evaluation, we excavated two test pits within the property, where accessible.

The explorations encountered approximately 6 inches of grass and topsoil underlain by approximately 2.5 to 3 feet of loose to medium dense, silty-fine to medium grained sand trace gravel (Weathered Advance Outwash). These materials were underlain by medium dense to dense, fine to medium grained sand trace gravel (Advance Outwash) which continued to the termination depths of the explorations.

Groundwater was not encountered in the explorations during our work. We anticipate that groundwater is at least 15 feet below site elevations during the wet season.

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.

## City of Mercer Island GIS Mapped Hazards

The City of Mercer Island GIS maps indicate that the site is within a potential slide and erosion hazard area. These designations are likely present due to a combination of historic mass wastage/landslide activity in steeper slope areas west of the site, proximity of the property to the contact between outwash and underlying silts (located to the west and downslope), and presence of outwash soils (erosion hazards).

Overall, the site areas appear stable at this time with no evidence of recent or ongoing erosion or landslide activity. The risk of soil movements at this site are very low at this time. The site is at least 50 feet from what we would consider to be a potentially geological hazard area, where slope magnitudes increase to about 40 percent or more and are closer to the contact between the outwash and underlying silt/clay deposits.

It is our opinion that the proposed development will not affect slope stability or other geologic hazards on the property or adjacent areas.

## Statement of Risk

Per Section 19.07.060.D.2 of the Mercer Island City Code, development within geologic hazard areas require that a Geotechnical Engineer licensed within the State of Washington provide a statement of risk with supporting documentation indicating that one of the following conditions can be met:

a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe; or

b. An evaluation of site specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area; or

c. Development practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area; or

d. The alteration is so minor as not to pose a threat to the public health, safety and welfare.

The project meets the criteria of b from above. The site soil and topographic conditions are not consistent with the mapped geologic hazards. The risk of erosion and landslide activity is very low at this site and the site appears to be at least 50 feet from a potential landslide hazard area. This proposed development will not adversely affect geologic hazards near or within the site.

We recommend that temporary erosion control system be in place during construction and that all affected/graded areas are fully surfaced following construction.

## 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 moderate 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 Hazard

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 stiff/medium dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for $S_S$, $S_1$, $F_a$, 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 | 1.409 | 0.49 | 1.0 | Null | 0.939 | Null | 0.603 |

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 soils consistent with Vashon Advance Outwash. These soils become relatively dense below a thin weathered zone. The proposed residential structure 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.

While the outwash sands are typically suitable for infiltration, the proximity of the site to steep cuts associated with rockery walls on the downslope property as well as proximity to a potential slide area (further west), we recommend perforated or direct connection of runoff collection devices to City infrastructure.

## 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 12 inches. Deeper excavations will be necessary below larger trees.

The native soils consist of silty-sand with gravel and poorly graded sand. 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 10 feet or less for foundation and utility placement. Temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill, 1H:1V in medium dense native soils and 3/4H:1V in dense to very dense native soils (if encountered at greater depths). 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 residence 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 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 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, if any are proposed.

| **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 275 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 Vashon Advance Outwash, which consist of fine to medium grained sand with minor silt and gravel.

While the outwash sands are typically suitable for infiltration, the proximity of the site to steep cuts associated with rockery walls on the downslope property as well as proximity to a potential slide area (further west), we recommend perforated or direct connection of runoff collection devices to City infrastructure. We do not recommend the use of infiltration systems at this site.

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 existing 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 210 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, 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.

## 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 Erin Jacobsen and her 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 Erin Jacobsen 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**


3/12/2022
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.

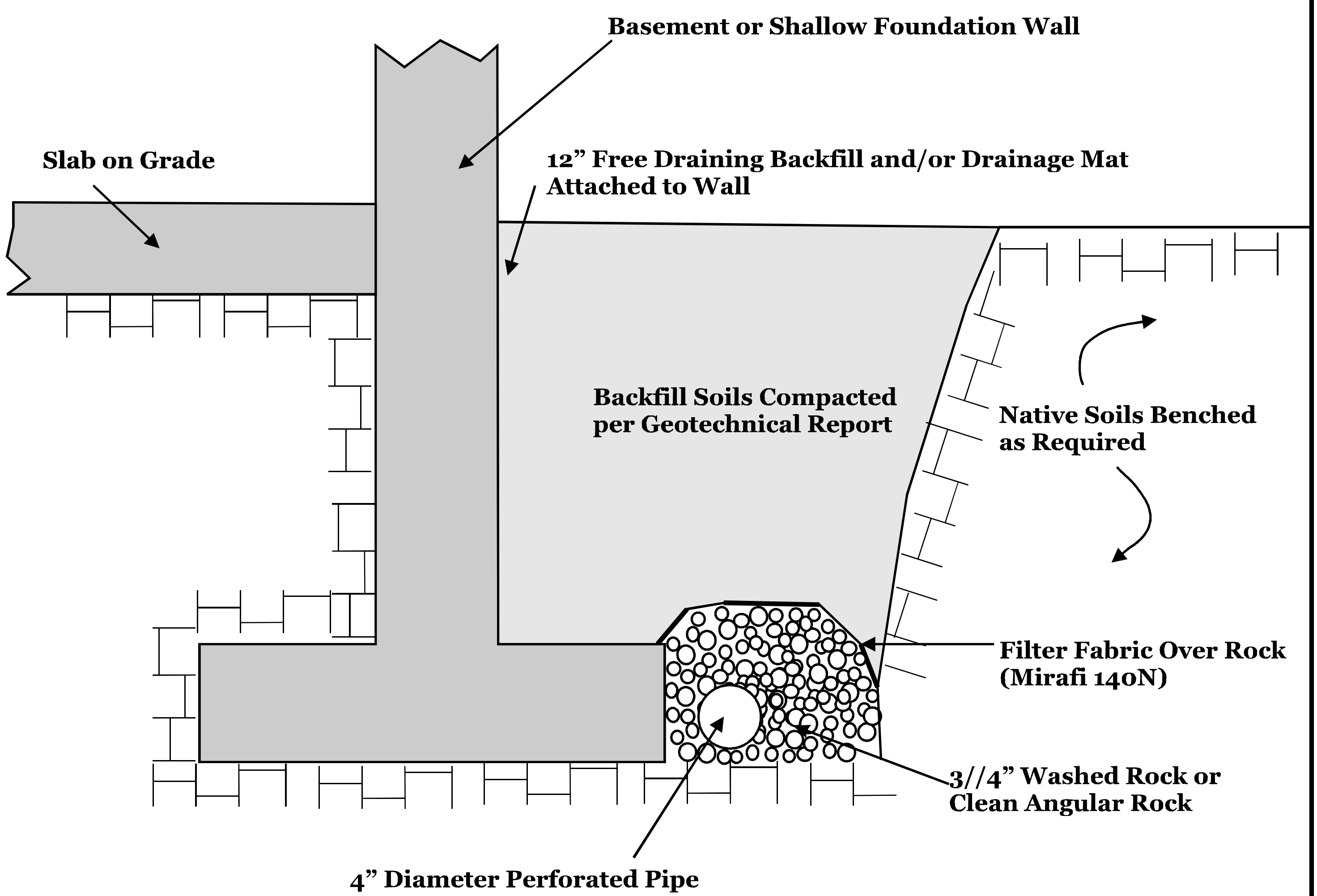
**PLANNING, DESIGN, OR CONSTRUCTION:** Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project 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.


TP-1 **Approximate Test Pit Location**

N

Not to Scale

| | | | |
|---|---|---|---|
| COBALT GEOSCIENCES | Proposed Residence<br>6922 SE 33rd Street<br>Mercer Island, Washington | **SITE PLAN**<br><br>**FIGURE 1** | Cobalt Geosciences, LLC<br>P.O. Box 82243<br>Kenmore, WA 98028<br>(206) 331-1097<br>www.cobaltgeo.com<br>cobaltgeo@gmail.com |




Not to Scale

| | | | |
|---|---|---|---|
| COBALT GEOSCIENCES | **Typical Foundation Drain Detail** | **Attachment** | Cobalt Geosciences, LLC<br>PO Box 1792<br>North Bend, WA 98045<br>(206) 331-1097<br>www.cobaltgeo.com<br>phil@cobaltgeo.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).

## 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 |

COBALT GEOSCIENCES

Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

Soil Classification Chart

**Figure C1**

# Test Pit TP-1

| | | |
|---|---|---|
| Date: March 2022 | 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) |
|---|---|---|---|---|---|---|
| | | | | Topsoil/Vegetation | | |
| 1–3 | | | SM/SP | Loose to medium dense, silty-fine to medium grained sand with gravel, yellowish brown to grayish brown, moist. (Weathered Outwash) | | |
| 3–10 | | | SP | Medium dense to dense, fine to medium grained sand trace gravel grayish brown, moist. (Advance Outwash) | | |
| 10 | | | | End of Test Pit 10' | | |

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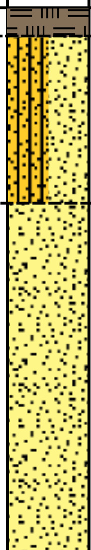
# Test Pit TP-2

| | | |
|---|---|---|
| Date: March 2022 | 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 |
|---|---|---|---|---|---|---|
| 0 | | | | Topsoil/Vegetation | | |
| 1–3 | ■ (approx. 1.5–2') | | SM/ SP | Loose to medium dense, silty-fine to medium grained sand with gravel, yellowish brown to grayish brown, moist. (Weathered Outwash) | | |
| 4–10 | ■ (approx. 6.5–7') | | SP | Medium dense to dense, fine to medium grained sand trace gravel grayish brown, moist. (Advance Outwash) | | |
| 10 | | | | End of Test Pit 10' | | |



Proposed Residence
6922 SE 33rd Street
Mercer Island, Washington

**Test Pit Logs**


Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, WA 98028
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com

# Appendix C – Detention Worksheet

# CITY OF MERCER ISLAND

**DEVELOPMENT SERVICES GROUP**
9611 SE 36TH STREET | MERCER ISLAND, WA 98040
PHONE: 206.275.7605 | www.mercergov.org
Inspection Requests: Online: www.MyBuildingPermits.com VM: 206.275.7730


# ON-SITE DETENTION DESIGN REQUIREMENTS

## General Requirements

This guidance applies only to projects that meet the thresholds specified below in "Is On-site Detention Required for My Project?" if all of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces.

## Is On-site Detention Required For My Project?

**YES**, if my project:

1) Results in 2,000 square feet, or greater, of new plus replaced hard surface area, or
2) Has a land disturbing activity or 7,000 square feet or greater, or
3) Results in a ***net increase*** of impervious surface of 500 square feet or greater.

AND

1) All of the on-site stormwater BMPs included on List #1 and List #2 are determined to be infeasible for roofs and/or other hard surfaces, and
2) Drainage from the site will be discharged to a storm and surface water system that includes a watercourse or there is a capacity constraint in the system.

**NO**, if my project:

1) Results in less than 2,000 square feet of new plus replaced hard surface area, and
2) Has a land disturbing activity less than 7,000 square feet, and
3) Results in a **net increase of less than 500 square feet** of impervious surface area.
4) The project discharges ***directly*** to Lake Washington, or findings from a ¼-mile downstream analysis confirm that the downstream system is free of capacity constraints.

## Designing Your On-Site Detention System

All on-site detention system designs must be prepared by a professional engineer registered in the State of Washington. The Standard On-site Detention System worksheet (Attachment 1) must be submitted on 18" x 24" (minimum) size sheets.

**Construction that results in 500 to 9,500 square feet of new plus replaced impervious surfaces:** Size system according to Table 1. The configuration of the on-site detention system shall be as shown on Attachment 1 (Standard On-Site Detention Systems Worksheet) or as specifically designed by the engineer for the site.

**Note:**

- The applicant may pay a fee-in-lieu-of constructing an on-site detention system when allowed by the City Engineer. The fee will not be an option when in the opinion of the City Engineer, undetained runoff from the development may adversely exacerbate an existing problem (MICC 15.11) or if flow control is required by Minimum Requirement #7.
- **Construction that results in more than 9,500 square feet of new plus replaced impervious surfaces and/or exceeds a 100-year flow frequency of 0.15 cubic feet per second (for moderate and steep sloped sites greater than a 5% slope):** Size system according to Minimum Requirement #7 (Flow Control) in the Stormwater Management Manual for Western Washington (Ecology 2014).

Per NRCS WSS: Site is 100% AmC (Arents, Alderwood Material), which is hydrologic soil group B/D

# Table 1

ON-SITE DETENTION DESIGN FOR PROJECTS BETWEEN 500 SF AND 9,500 SF NEW PLUS REPLACED IMPERVIOUS SURFACE AREA

| New and Replaced Impervious Surface Area (sf) | Detention Pipe Diameter (in) | Detention Pipe Length (ft) | | Lowest Orifice Diameter (in)[3] | | Distance from Outlet Invert to Second Orifice (ft) | | Second Orifice Diameter (in) | |
|---|---|---|---|---|---|---|---|---|---|
| | | B soils | C soils | B soils | C soils | B soils | C soils | B soils | C soils |
| **500 to 1,000 sf** | 36" | 30 | 22 | 0.5 | 0.5 | 2.2 | 2.0 | 0.5 | 0.8 |
| | 48" | 18 | 11 | 0.5 | 0.5 | 3.3 | 3.2 | 0.9 | 0.8 |
| | 60" | 11 | 7 | 0.5 | 0.5 | 4.2 | 3.4 | 0.5 | 0.6 |
| **1,001 to 2,000 sf** | 36" | 66 | 43 | 0.5 | 0.5 | 2.2 | 2.3 | 0.9 | 1.4 |
| | 48" | 34 | 23 | 0.5 | 0.5 | 3.2 | 3.3 | 0.9 | 1.2 |
| | 60" | 22 | 14 | 0.5 | 0.5 | 4.3 | 3.6 | 0.9 | 0.9 |
| **2,001 to 3,000 sf** | 36" | 90 | 66 | 0.5 | 0.5 | 2.2 | 2.4 | 0.9 | 1.9 |
| | 48" | 48 | 36 | 0.5 | 0.5 | 3.1 | 2.8 | 0.9 | 1.5 |
| | 60" | 30 | 20 | 0.5 | 0.5 | 4.2 | 3.7 | 0.9 | 1.1 |
| **3,001 to 4,000 sf** | 36" | 120 | 78 | 0.5 | 0.5 | 2.4 | 2.2 | 1.4 | 1.6 |
| | 48" | 62 | 42 | 0.5 | 0.5 | 2.8 | 2.9 | 0.8 | 1.3 |
| | 60" | 42 | 26 | 0.5 | 0.5 | 3.8 | 3.9 | 0.9 | 1.3 |
| **4,001 to 5,000 sf** | 36" | 134 | 91 | 0.5 | 0.5 | 2.8 | 2.2 | 1.7 | 1.5 |
| | 48" | 73 | 49 | 0.5 | 0.5 | 3.6 | 2.9 | 1.6 | 1.5 |
| | 60" | 46 | 31 | 0.5 | 0.5 | 4.6 | 3.5 | 1.6 | 1.3 |
| **5,001 to 6,000 sf** | 36" | 162 | 109 | 0.5 | 0.5 | 2.7 | 2.2 | 1.8 | 1.6 |
| | 48" | 90 | 59 | 0.5 | 0.5 | 3.5 | 2.9 | 1.7 | 1.5 |
| | 60" | 54 | 37 | 0.5 | 0.5 | 4.6 | 3.6 | 1.6 | 1.4 |
| **6,001 to 7,000 sf** | 36" | 192 | 128 | 0.5 | 0.5 | 2.7 | 2.2 | 1.9 | 1.8 |
| | 48" | 102 | 68 | 0.5 | 0.5 | 3.7 | 2.9 | 1.9 | 1.6 |
| | 60" | 64 | 43 | 0.5 | 0.5 | 4.6 | 3.6 | 1.8 | 1.5 |
| **7,001 to 8,000 sf** | 36" | 216 | 146 | 0.5 | 0.5 | 2.8 | 2.2 | 2.0 | 1.9 |
| | 48" | 119 | 79 | 0.5 | 0.5 | 3.8 | 2.9 | 2.2 | 1.7 |
| | 60" | 73 | 49 | 0.5 | 0.5 | 4.5 | 3.6 | 2.0 | 1.6 |
| **8,001 to 8,500 sf[1]** | 36" | 228 | 155 | 0.5 | 0.5 | 2.8 | 2.2 | 2.1 | 1.9 |
| | 48" | 124 | 84 | 0.5 | 0.5 | 3.7 | 2.9 | 1.9 | 1.8 |
| | 60" | 77 | 53 | 0.5 | 0.5 | 4.6 | 3.6 | 2.0 | 1.6 |
| **8,501 to 9,000 sf** | 36" | NA [1] | 164 | 0.5 | 0.5 | NA [1] | 2.2 | NA [1] | 1.9 |
| | 48" | NA [1] | 89 | 0.5 | 0.5 | NA [1] | 2.9 | NA [1] | 1.9 |
| | 60" | NA [1] | 55 | 0.5 | 0.5 | NA [1] | 3.6 | NA [1] | 1.7 |
| **9,001 to 9,500 sf[2]** | 36" | NA [1] | 174 | 0.5 | 0.5 | NA [1] | 2.2 | NA [1] | 2.1 |
| | 48" | NA [1] | 94 | 0.5 | 0.5 | NA [1] | 2.9 | NA [1] | 2.0 |
| | 60" | NA [1] | 58 | 0.5 | 0.5 | NA [1] | 3.7 | NA [1] | 1.7 |

**Notes:**

▪ Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.

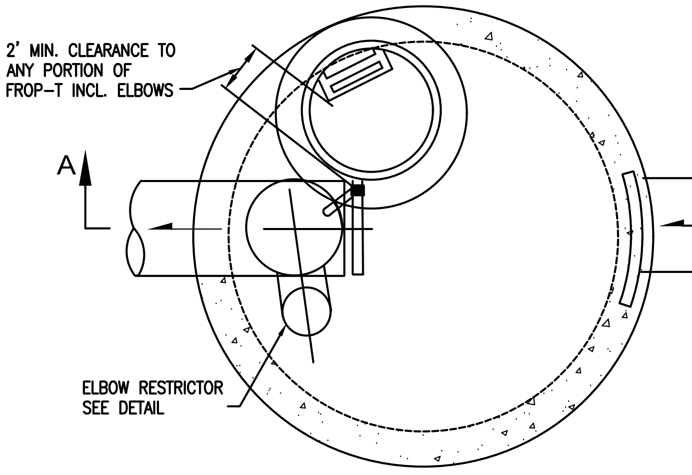
▪ Soil type to be determined by geotechnical analysis or soil map.
▪ Sizing includes a Volume Correction Factor of 120%.
▪ Upper bound contributing area used for sizing.
[1] On Type B soils, new plus replaced impervious surface areas exceeding 8,500 sf trigger Minimum Requirement #7 (Flow Control)
[2] On Type C soils, new plus replaced impervious surface areas exceeding 9,500 sf trigger Minimum Requirement #7 (Flow Control)
[3] Minimum orifice diameter = 0.5 inches
in = inch
ft = feet
sf = square feet

**Basis of Sizing Assumptions:**
Sized per MR#5 in the Stormwater Management Manual for Puget Sound Basin (1992 Ecology Manual)
SBUH, Type 1A, 24-hour hydrograph
2-year, 24-hour storm = 2 in; 10-year, 24-hour storm = 3 in; 100-year, 24-hour storm = 4 in
Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)
Developed = impervious (CN = 98)
0.5 foot of sediment storage in detention pipe
Overland slope = 5%

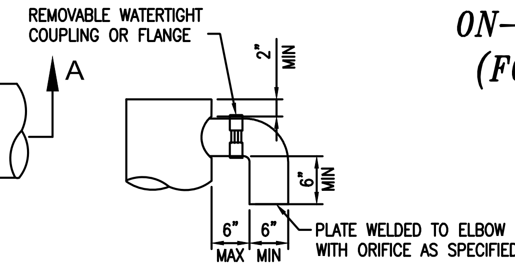
# *ATTACHMENT 1*
# *CITY OF MERCER ISLAND*
# *ON-SITE DETENTION SYSTEM WORKSHEET*
## *(FOR NEW PLUS REPLACED IMPERVIOUS AREA OF 9,500 SF OR LESS)*

OWNER: Erin Jacobsen
PERMIT #: 2205-096
ADDRESS: 6922 33RD ST SE, MERCER ISLAND, WA
PREPARED BY: JUSTIN GOROCH, P.E.
PHONE: (253) 627 - 4367
DATE: 10/05/2022

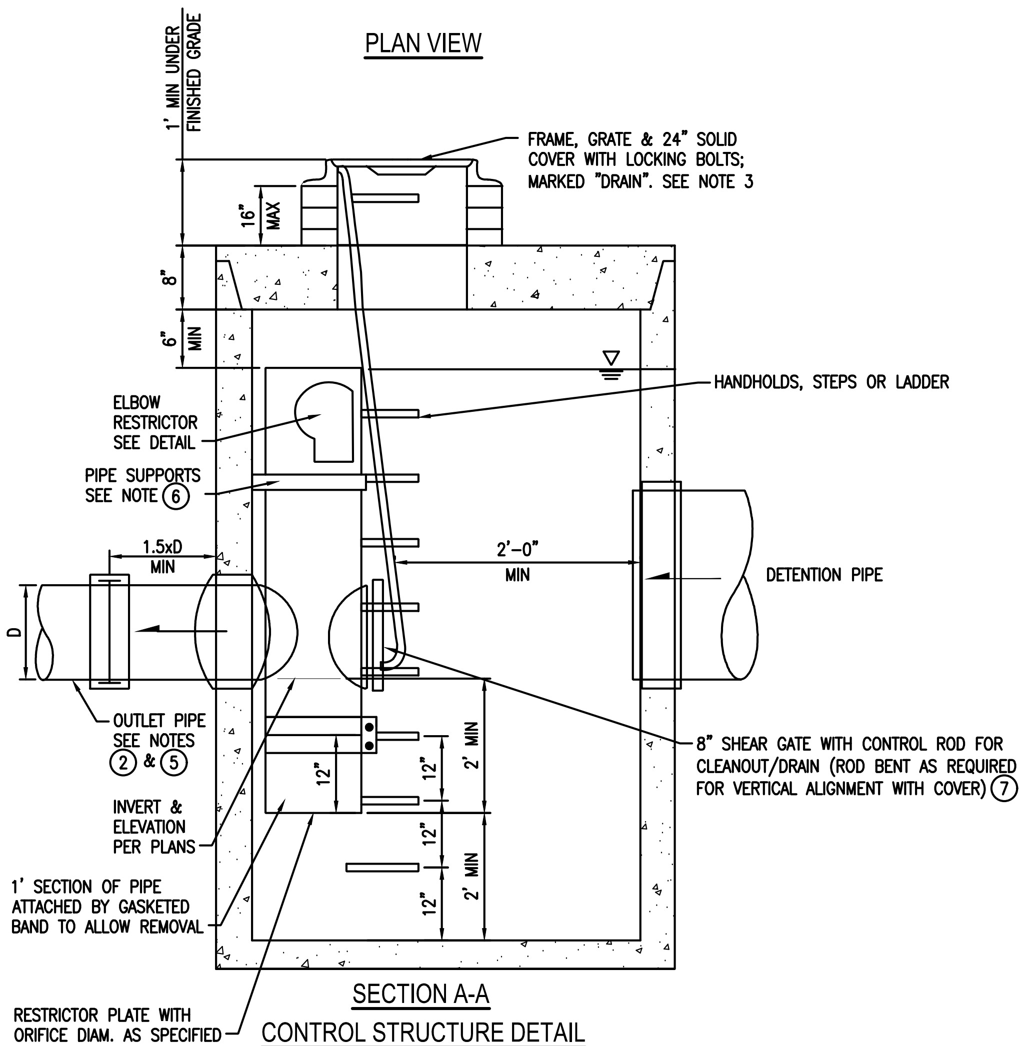
NEW PLUS REPLACED IMPERVIOUS SURFACE AREA (SF): 4,650
SOIL TYPE: ARENTS, ALDERWOOD MATERIAL (HSG B/D)
DETENTION PIPE DIA (INCH): 36
PIPE MATERIAL: CMP
DETENTION PIPE LENGTH (FT): 134
ORIFICE #1 DIA 0.5 INCH, ELEV 260.48
ORIFICE #2 DIA 1.7 INCH, ELEV 263.28'



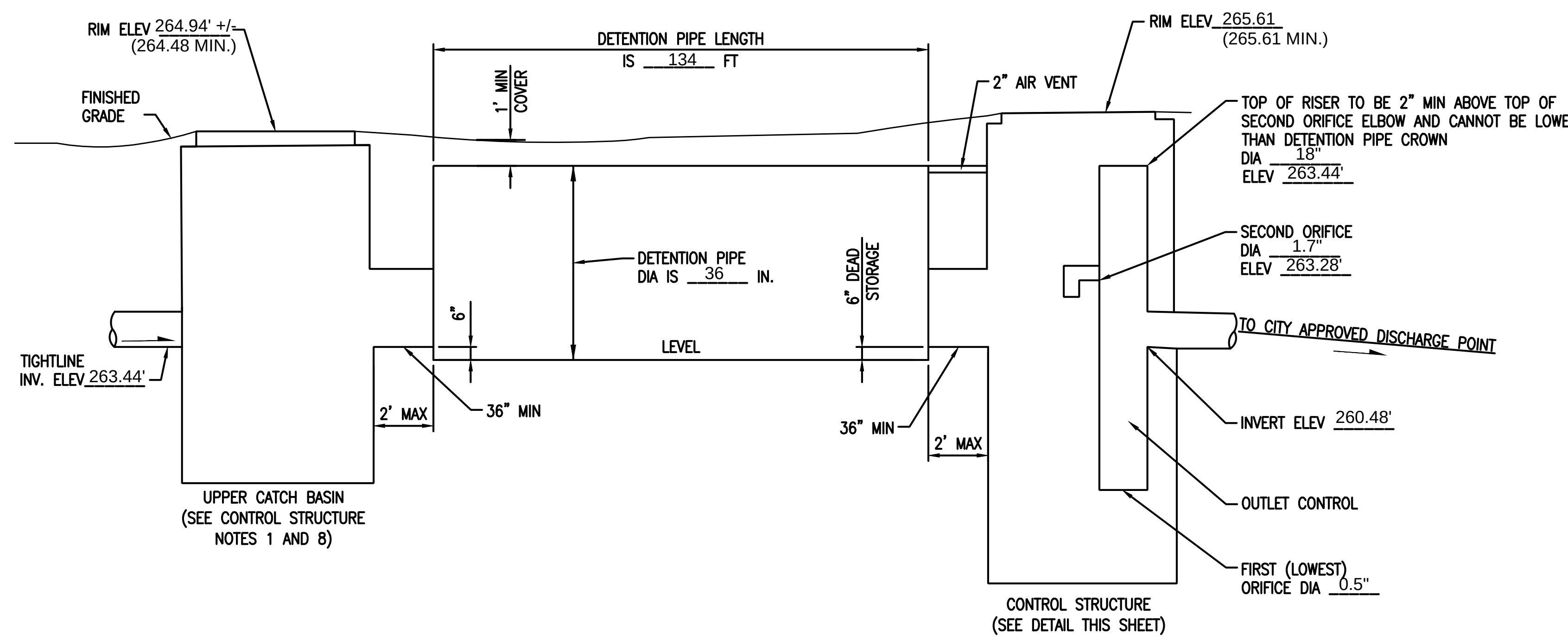

PLAN VIEW




ELBOW RESTRICTOR DETAIL




SECTION A-A
CONTROL STRUCTURE DETAIL
NOT TO SCALE




ON-SITE DETENTION SYSTEM
NOT TO SCALE (ENGINEER TO FILL IN BLANKS)

## CONTROL STRUCTURE NOTES:

1. USE A MINIMUM OF A 54 IN. DIAM. TYPE 2 CATCH BASIN. THE ACTUAL SIZE IS DEPENDENT ON CONNECTING PIPE MATERIAL AND DIAMETER.
2. OUTLET PIPE: MIN. 6 INCH.
3. METAL PARTS: CORROSION RESISTANT. NON-GALVANIZED PARTS PREFERRED. GALVANIZED PIPE PARTS TO HAVE ASPHALT TREATMENT 1.
4. FRAME AND LADDER OR STEPS OFFSET SO:
   A. CLEANOUT GATE IS VISIBLE FROM TOP;
   B. CLIMB-DOWN SPACE IS CLEAR OF RISER AND CLEANOUT GATE;
   C. FRAME IS CLEAR OF CURB.
5. IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE, OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS 1/4 IN.
6. PROVIDE AT LEAST ONE 3 X 0.090 GAUGE SUPPORT BRACKET ANCHORED TO CONCRETE WALL WITH 5/8 IN. STANLESS STEEL EXPANSION BOLTS OR EMBEDDED SUPPORTS 2 IN. INTO CATCH BASIN WALL (MAXIMUM 3'-0" VERTICAL SPACING).
7. THE SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION ZG32A; OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B.
   THE LIFT HANDLE SHALL BE MADE OF A SIMILAR METAL TO THE GATE (TO PREVENT GALVANIC CORROSION), IT MAY BE OF SOLID ROD OR HOLLOW TUBING, WITH ADJUSTABLE HOOK AS REQUIRED.
   A NEOPRENE RUBBER GASKET IS REQUIRED BETWEEN THE RISER MOUNTING FLANGE AND THE GATE FLANGE.
   INSTALL THE GATE SO THAT THE LEVEL-LINE MARK IS LEVEL WHEN THE GATE IS CLOSED.
   THE MATING SURFACES OF THE LID AND THE BODY SHALL BE MACHINED FOR PROPER FIT.
   ALL SHEAR GATE BOLTS SHALL BE STAINLESS STEEL.
8. THE UPPER CATCH BASIN IS REQUIRED IF THE LENGTH OF THE DETENTION PIPE IS GREATER THAN 50 FT.

## ON-SITE DETENTION SYSTEM NOTES:

1. CALL DEVELOPMENT SERVICES (206-275-7605) 24 HOURS IN ADVANCE FOR A DETENTION SYSTEM INSPECTION BEFORE BACKFILLING AND FOR FINAL INSPECTIONS.
2. RESPONSIBILITY FOR OPERATION AND MAINTANANCE OF DRAINAGE SYSTEMS ON PRIVATE PROPERTY IS RESPONSIBILITY OF THE PROPERTY OWNER. MATERIAL ACCUMULATED IN THE STORAGE PIPE MUST BE REMOVED FROM CATCH BASINS TO ALLOW PROPER OPERATION. THE OUTLET CONTROL ORIFICE MUST BE KEPT OPEN AT ALL TIMES.
3. PIPE MATERIAL, JOINT, AND PROTECTIVE TREATMENT SHALL BE IN ACCORDANCE WITH SECTION 7.04 AND 9.05 OF THE WSDOT STANDARD SPECIFICATION FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, LATEST VERSION. SUCH MATERIALS INCLUDE THE FOLLOWING, LINED CORRUGATED POLYETHYLENE PIPE (LCPE), ALUMINIZED TYPE 2 CORRUGATED STEEL PIPE AND PIPE ARCH (MEETS AASHTO DESIGNATIONS M274 AND M36), CORRUGATED OR SPIRAL RIB ALUMINUM PIPE, OR REINFORCED CONCRETE PIPE. CORRUGATED STEEL PIPE IS NOT ALLOWED.
4. FOOTING DRAINS SHALL NOT BE CONNECTED TO THE DETENTION SYSTEM.

# Appendix D – Post-Construction Soil Management

# CITY OF MERCER ISLAND

## SECTION D: POST-CONSTRUCTION SOIL MANAGEMENT

### Attachments Required *(Check off required items that are attached)*

- [x] Site Plan showing, to scale:
  - [ ] Areas of undisturbed native vegetation (no amendment required)
  - [ ] New planting beds (amendment required)
  - [ ] New turf areas (amendment required)
  - [ ] Type of soil improvement proposed for each area
- [ ] Soil test results (required if proposing custom amendment rates)
- [ ] Product test results for proposed amendments

### Total Amendment / Topsoil / Mulch for All Areas

Calculate the quantities needed for the entire site based on all of the areas identified on the Site Plan and the calculations on the following page(s):

| Product | Total Quantity (CY) | Test Results |
|---|---|---|
| Product #1: CEDAR GROVE COMPOST | ______ CY | 53.1 % organic matter<br>18:1 C:N ratio<br>"Stable"? yes [x] no [ ] |
| Product #2: ______ | ______ CY | ______ % organic matter<br>______ C:N ratio<br>"Stable"? yes [ ] no [ ] |
| Product #3: ______ | ______ CY | ______ % organic matter<br>______ C:N ratio<br>"Stable"? yes [ ] no [ ] |

CY = cubic yards, C:N = Carbon:Nitrogen

# CITY OF MERCER ISLAND

## SECTION D: POST-CONSTRUCTION SOIL MANAGEMENT

### Amendment / Topsoil / Mulch by Area

For each identified area on your Site Plan, provide the following information: (Use additional sheets if necessary)

Area # 1 (should match identified Area # on Site Plan)

Planting type: ☐ Turf ☐ Undisturbed native vegetation
☐ Planting Beds ☐ Other: ______

| Pre-Approved Amendment Method | | |
|---|---|---|
| ☐ Amend with compost | Turf:______ SF x 5.4 CY ÷ 1,000 SF = ______CY<br>Planting beds:______ SF x 9.3 CY ÷ 1,000 SF= ______CY<br>Total Quantity = ______CY<br>Scarification depth: 8 inches | Product: ______ |
| ☑ Stockpile and amend | Turf: 5,664 SF x 5.4 CY ÷ 1,000 SF = 30.59 CY<br>Planting beds: 0 SF x 9.3 CY ÷ 1,000 SF= 0 CY<br>Total Quantity = TBD CY<br>Scarification depth: 8 inches | Product: CEDAR GROVE |
| ☐ Topsoil import | Turf:______ SF x 18.6 CY÷1,000 SF = ______CY<br>Planting beds:______ SF x 18.6 CY ÷ 1,000 SF= ______CY<br>Total Quantity = ______CY<br>Scarification depth: 6 inches | Product: ______ |
| **Custom Amendment** | | |
| ☐ Amend with compost | Attach information on bulk density, percent organic matter, moisture content, C:N ratio, and heavy metals analysis to support custom amendment rate and scarification depth.<br>Total Quantity = ______CY<br>Scarification depth: ______inches | Product: ______ |
| ☐ Stockpile and amend | Attach information on bulk density, percent organic matter, moisture content, C:N ratio, and heavy metals analysis to support custom amendment rate and scarification depth.<br>Total Quantity = ______CY<br>Scarification depth: ______inches | Product: ______ |
| **Mulch** | | |
| ☐ Amend with compost | Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= ______CY<br>Total Quantity = ______CY | Product: ______ |
| ☐ Stockpile and amend | Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= ______CY<br>Total Quantity = ______CY | Product: ______ |
| ☐ Topsoil import | Planting beds: ______ SF x 12.4 CY ÷ 1,000 SF= ______CY<br>Total Quantity = ______CY | Product: ______ |

CY = cubic yards, C:N = Carbon:Nitrogen

CEDAR GROVE®

# Why is Our Product ORGANIC?

**Cedar Grove makes a high quality, consistent compost through a patented process using controlled aeration, temperature monitoring, curing, and screening.**

**Compost supplies a natural feeding system with microbes, increasing activity in the soil. Our product is 100% soil!**

US Composting Council Seal of Testing Assurance®

CLOSE THE LOOP 100% RECYCLED SUPPORT LOCAL MADE BY YOU

## HOW IT WORKS:

**1** Cedar Grove compost is made from locally recycled garden prunings, food products and vegetable trimmings from residential curbside and commercial collection programs across the Puget Sound region. At our facilities, we double-screen the material to remove any non-compostable items.

**2** We use a state-of-the-art computer controlled system to ensure that the compost is heated to 150 - 170 degrees to remove pathogens, pesticides and weed seeds. The naturally occurring microbes and heat break down toxic chemicals into safe compounds.

**3** Our finished compost is sent to certified third party laboratories to guarantee that our product meets all standards. Cedar Grove, in compliance with the US Composting Council Seal of Testing, tests our compost prior to sale to ensure compliance with regulations.

# Cedar Grove Compost Quality Assurance Program

Cedar Grove Compost facilities are in compliance with Washington Department of Ecology (WDOE) requirements for compost process and product quality (WAC 173-350-220). Cedar Grove also voluntarily meets the US Composting Council's Seal of Testing Assurance (STA) and Washington Department of Transportation (WDOT) standards. Results of tests for horticultural values and applicable WDOT standards are shown in Chart 1. WDOE compost quality requirements and Cedar Grove Compost results are in Chart 2.

**Chart 1. Cedar Grove Fine Grade Compost Horticultural Values**

| | WDOT Standard | Cedar Grove |
|---|---|---|
| **Organic Matter** | >40% | **53.1%** |
| **Carbon to Nitrogen Ratio** | | **18** |
| **Conductivity** | <4 mmhos/cm | **3.1 mmhos/cm** |
| **Seedling Emergence** | >80% of purified water | **100%** |
| **Seedling Vigor** | >80% of purified water | **88%** |
| **Weed Seeds** | | **No weed germination** |
| **Compost Stability** | <7 mg $CO_2$/gr. OM/day | **3.2 "Stable"** |
| **Dry weight** | | **21 lbs / cu. ft.** |
| **Major Nutrients** Total Nitrogen | | **1.6%** |
| Phosphorous ($P_2O_5$) | | **.55%** |
| Potassium ($K_2O$) | | **.89%** |
| Sulfate | | **40 mg/kg** |
| Calcium | | **1.6%** |
| Magnesium | | **0.34%** |

**Chart 2. Compost Quality Requirements - Washington Administrative Code *173-350 Sect. 220***

| | WAC 173-350-220 Standard | Cedar Grove |
|---|---|---|
| **Metals** | ***Parts per million (mg/kg), dry wt.*** | |
| Arsenic | <=20 | **7.8** |
| Cadmium | <=10 | **<1.0** |
| Copper | <=750 | **42** |
| Lead | <=150 | **29** |
| Mercury | <=8 | **<1.0** |
| Molybdenum | <=9 | **2.3** |
| Nickel | <=210 | **18** |
| Selenium | <=18 | **<1** |
| Zinc | <=1400 | **160** |
| pH | 5-10 (range) | **8.06** |
| Salmonella (Pathogen indicator) | < 3 MPN / 4 grams of total solids | **Pass** |
| Sharps | 0 percent | **None Detected** |
| Manufactured Inerts | < 0.5 percent | **< 0.5 percent** |

**Chart 3. WDOT Particle Size Specifications by Compost Grade**

| Sieve size | WDOT "Fine" Compost | Cedar Grove |
|---|---|---|
| 1" | 95-100% | **100%** |
| 5/8" | 90-100% | **97.7%** |
| ¼" | 75-100% | **93%** |

**All tests performed by Soil Control Laboratories, Watsonville, CA; using TMECC/STA specified methods.**

# Appendix E – Infeasibility Criteria

## Minimum Requirement #5 (On-Site Stormwater Management)

The following tables summarize infeasibility criteria that can be used to justify not using various on-site stormwater management best management practices (BMPs) for consideration for Minimum Requirement #5. This information is also included under the detailed descriptions of each BMP in the 2014 Stormwater Management Manual for Western Washington (Stormwater Manual), but is provided here in this worksheet for additional clarity and efficiency. Where any inconsistencies or lack of clarity exists, the requirements in the main text of the Stormwater Manual shall be applied. If a project is limited by one or more of the infeasibility criteria specified below, but an applicant is interested in implementing a specific BMP, a functionally equivalent design may be submitted to the City for review and approval. Evaluate the feasibility of the BMPs in priority order based on List #1 or #2 (Small Project Stormwater Requirements Tip Sheet and Stormwater Manual). Select the first BMP that is considered feasible for each surface type. Document the infeasibility (narrative description and rationale) for each BMP that was not selected. Only one infeasibility criterion needs to be selected for a BMP before evaluating the next BMP on the list. Attach additional pages for supporting information if necessary.

Note: If your project discharges directly to Lake Washington (flow control exempt) or a downstream analysis confirms that the downstream system is free of capacity constraints for a minimum of ¼ mile and a maximum of 1 mile, then you do not need to complete this worksheet, but should still refer to the infeasibility criteria when selecting BMPs.

| Lawn and Landscaped Areas | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Post-construction Soil Quality and Depth<br><br>List #1 and #2 | ☐ Siting and design criteria provided in BMP T5.13 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved.<br><br>☐ Lawn and landscape area is on till slopes greater than 33 percent. | |

| Roofs | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Full Dispersion<br><br>List #1 and #2 | ☐ Site setbacks and design criteria provided in BMP T5.30 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved.<br><br>☑ A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.<br><br>☑ A minimum forested or native vegetation flowpath length of 100 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved. | |
| Downspout Full Infiltration<br><br>List #1 and #2 | ☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards.<br><br>☑ Site setbacks and design criteria provided in BMP T5.10A (**Stormwater Manual** Volume III, Section 3.1.1) cannot be achieved.<br><br>☐ The lot(s) or site does not have out-wash or loam soils.<br><br>☐ There is not at least 3 feet or more of permeable soil from the proposed final grade to the seasonal high groundwater table or other impermeable layer.<br><br>☐ There is not at least 1 foot or more of permeable soil from the proposed bottom of the infiltration system to the seasonal high groundwater table or other impermeable layer. | |

| Roofs (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Bioretention or Rain Gardens<br><br>List #1 (both) and List #2 (bioretention only) | *Note: Criteria with setback distances are as measured from the bottom edge of the bioretention soil mix.*<br><br>Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist):<br><br>☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or down-gradient flooding.<br><br>☐ Within an area whose ground water drains into an erosion hazard, or landslide hazard area.<br><br>☐ Where the only area available for siting would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, pre-existing structures, or pre-existing road or parking lot surfaces.<br><br>☐ Where the only area available for siting does not allow for a safe overflow pathway to stormwater drainage system or private storm sewer system.<br><br>☐ Where there is a lack of usable space for bioretention areas at re-development sites, or where there is insufficient space within the existing public right-of-way on public road projects.<br><br>☑ Where infiltrating water would threaten existing below grade basements.<br><br>☐ Where infiltrating water would threaten shoreline structures such as bulkheads.<br><br>The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br><br>☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards<br><br>☑ Within setback provided for BMP T7.30 (**Stormwater Manual** Volume V, Section 7.4)<br><br>☐ Where they are not compatible with surrounding drainage system as determined by the city (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning bioretention area). | |

| Roofs (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Bioretention or Rain Gardens (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br><br>☑ Where land for bioretention is within an erosion hazard, or landslide hazard area (as defined by MICC 19.07.060).<br><br>☐ Where the site cannot be reasonably designed to locate bioretention areas on slopes less than 8 percent.<br><br>☑ Within 50 feet from the top of slopes that are greater than 20 percent and over 10 feet of vertical relief.<br><br>☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under the Model Toxics Control Act [MTCA]):<br>• Within 100 feet of an area known to have deep soil contamination.<br>• Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater.<br>• Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area.<br>• Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW.<br><br>☐ Within 100 feet of a closed or active landfill.<br><br>☐ Within 10 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is 1,100 gallons or less. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface.<br><br>☐ Within 100 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is greater than 1,100 gallons. | |

| Roofs (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Bioretention or Rain Gardens (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br><br>☐ Where field testing indicates potential bioretention/rain garden sites have a measured (a.k.a., initial) native soil saturated hydraulic conductivity less than 0.30 inches per hour. A small-scale or large-scale PIT in accordance with **Stormwater Manual** Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to demonstrate infeasibility of bioretention areas. If the measured native soil infiltration rate is less than 0.30 in/hour, bioretention/rain garden BMPs are not required to be evaluated as an option in List #1 or List #2. In these slow draining soils, a bioretention area with an underdrain may be used to treat pollution-generating surfaces to help meet Minimum Requirement #6, Runoff Treatment. If the underdrain is elevated within a base course of gravel, it will also provide some modest flow reduction benefit that will help achieve Minimum Requirement #7.<br><br>☐ Where the minimum vertical separation of 3 feet to the seasonal high groundwater elevation or other impermeable layer would not be achieved below bioretention that would serve a drainage area that exceeds the following thresholds (and cannot reasonably be broken down into amounts smaller than indicated):<br>o 5,000 square feet of pollution-generating impervious surface (PGIS)<br>o 10,000 square feet of impervious area<br>o 0.75 acres of lawn and landscape.<br><br>☐ Where the minimum vertical separation of 1 foot to the seasonal high groundwater or other impermeable layer would not be achieved below bioretention that would serve a drainage area less than the above thresholds.<br><br>☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply.<br><br>☐ Within 10 feet of small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a "large on-site sewage disposal system," see Chapter 246-272B WAC. | |

| Roofs (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Downspout Dispersion Systems<br><br>List #1 and #2 | ☑ Site setbacks and design criteria provided in BMP T5.10B (**Stormwater Manual** Volume III, Section 3.1.2) cannot be achieved.<br><br>☑ For splash blocks, a vegetated flowpath at least 50 feet in length from the downspout to the downstream property line, structure, stream, wetland, slope over 15 percent, or other impervious surface is not feasible.<br><br>☑ For trenches, a vegetated flowpath of at least 25 feet in between the outlet of the trench and any property line, structure, stream, wetland, or impervious surface is not feasible. A vegetated flowpath of at least 50 feet between the outlet of the trench and any slope steeper than 15 percent is not feasible. | |
| Perforated Stub-Out Connections<br><br>List #1 and #2 | ☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards<br><br>☐ For sites with septic systems, the only location available for the perforated portion of the pipe is located up-gradient of the drainfield primary and reserve areas. This requirement can be waived if site topography will clearly prohibit flows from intersecting the drainfield or where site conditions (soil permeability, distance between systems, etc.) indicate that this is unnecessary.<br><br>☑ Site setbacks and design criteria provided in BMP T5.10C (**Stormwater Manual** Volume III, Section 3.1.3) cannot be achieved.<br><br>☐ There is not at least 1 foot of permeable soil from the proposed bottom (final grade) of the perforated stub-out connection trench to the highest estimated groundwater table or other impermeable layer.<br><br>☐ The only location available for the perforated stub-out connection is under impervious or heavily compacted soils. | |
| On-site Detention<br><br>List #1 and #2 | ☐ Project discharges directly to Lake Washington.<br><br>☐ Findings from a 1/4 mile downstream analysis confirm that the downstream system is free of capacity constraints.<br><br>☐ Site setbacks and design criteria provided in the **Stormwater Manual** (Volume III, Section 3.2.2) cannot be achieved. | |

| Other Hard Surfaces | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Full Dispersion<br><br>List #1 and #2 | ☑ Site setbacks and design criteria provided in BMP T5.30 (**Stormwater Manual** Volume V, Section 5.3) cannot be achieved.<br><br>☑ A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.<br><br>☑ A minimum forested or native vegetation flowpath length of 100 feet (25 feet for sheet flow from a non-native pervious surface) cannot be achieved. | |
| Permeable Pavement<br><br>List #1 and #2 | Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist):<br><br>☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or downgradient flooding.<br><br>☑ Within an area whose ground water drains into an erosion hazard, or landslide hazard area.<br><br>☐ Where infiltrating and ponded water below the new permeable pavement area would compromise adjacent impervious pavements.<br><br>☑ Where infiltrating water below a new permeable pavement area would threaten existing below grade basements.<br><br>☐ Where infiltrating water would threaten shoreline structures such as bulkheads.<br><br>☐ Down slope of steep, erosion prone areas that are likely to deliver sediment.<br><br>☐ Where fill soils are used that can become unstable when saturated.<br><br>☐ Excessively steep slopes where water within the aggregate base layer or at the subgrade surface cannot be controlled by detention structures and may cause erosion and structural failure, or where surface runoff velocities may preclude adequate infiltration at the pavement surface.<br><br>☐ Where permeable pavements cannot provide sufficient strength to support heavy loads at industrial facilities such as ports.<br><br>☐ Where installation of permeable pavement would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, or pre-existing road subgrades. | |

| Other Hard Surfaces (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Permeable Pavement (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br><br>☑ Evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards<br><br>☑ Within an area designated as an erosion hazard, or landslide hazard.<br><br>☐ Within 50 feet from the top of slopes that are greater than 20 percent.<br><br>☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under MTCA):<br>• Within 100 feet of an area known to have deep soil contamination.<br>• Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater.<br>• Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area.<br>• Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW.<br><br>☐ Within 100 feet of a closed or active landfill.<br><br>☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply, if the pavement is a pollution-generating surface.<br><br>☐ Within 10 feet of a small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a "large on-site sewage disposal system," see Chapter 246-272B WAC.<br><br>☐ Within 10 feet of any underground storage tank and connecting underground pipes, regardless of tank size. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface.<br><br>☐ At multi-level parking garages, and over culverts and bridges.<br><br>☐ Where the site design cannot avoid putting pavement in areas likely to have long-term excessive sediment deposition after construction (e.g., construction and landscaping material yards). | |

| Other Hard Surfaces (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Permeable Pavement (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br><br>☐ Where the site cannot reasonably be designed to have:<br>• Porous asphalt surface < 5% slope<br>• Pervious concrete surface < 10% slope<br>• Permeable interlocking concrete pavement surface < 12% slope<br>• Grid systems < 6-12% slope (check with manufacturer and local supplier to confirm maximum slope)<br><br>☐ Where the subgrade soils below a pollution-generating permeable pavement (e.g., road or parking lot) do not meet the soil suitability criteria for providing treatment. See soil suitability criteria for treatment in the **Stormwater Manual** Volume III, Section 3.3.7. Note: In these instances, the city may approve installation of a 6 inch sand filter layer meeting city specifications for treatment as a condition of construction.<br><br>☐ Where underlying soils are unsuitable for supporting traffic loads when saturated. Soils meeting a California Bearing Ratio of 5 percent are considered suitable for residential access roads.<br><br>☐ Where replacing existing impervious surfaces unless the existing surface is a non-pollution generating surface over an outwash soil with a saturated hydraulic conductivity of 4 inches per hour or greater.<br><br>☐ Where appropriate field testing indicates soils have a measured (a.k.a., initial) subgrade soil saturated hydraulic conductivity less than 0.3 inches per hour. Only small-scale PIT or large-scale PIT methods in accordance with **Stormwater Manual** Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to evaluate infeasibility of permeable pavement areas. (Note: In these instances, unless other infeasibility restrictions apply, roads and parking lots may be built with an underdrain, preferably elevated within the base course, if flow control benefits are desired.)<br><br>☐ Roads that receive more than very low traffic volumes, and areas having more than very low truck traffic. Roads with a projected average daily traffic volume of 400 vehicles or less are very low volume roads (AASHTO 2001) (U.S. Department of Transportation, 2013). Areas with very low truck traffic volumes are roads and other areas not subject to through truck traffic but may receive up to weekly use by utility trucks (e.g., garbage, recycling), daily school bus use, and multiple daily use by pick-up trucks, mail/parcel delivery trucks, and maintenance vehicles. (Note: This infeasibility criterion does not extend to sidewalks and other non-traffic bearing surfaces associated with the collector or arterial). | |

| Other Hard Surfaces (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Permeable Pavement (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br>☐ At sites defined as "high-use sites" (refer to the Glossary in the **Stormwater Manual** Volume I).<br>☐ In areas with "industrial activity" as identified in 40 CFR 122.26(b)(14).<br>☐ Where the risk of concentrated pollutant spills is more likely such as gas stations, truck stops, and industrial chemical storage sites.<br>☐ Where routine, heavy applications of sand occur in frequent snow zones to maintain traction during weeks of snow and ice accumulation.<br>☐ Where the seasonal high groundwater or an underlying impermeable/ low permeable layer would create saturated conditions within 1 foot of the bottom of the lowest gravel base course. | |
| Bioretention or Rain Gardens<br><br>List #1 (both) and List #2 (bioretention only) | *Note: Criteria with setback distances are as measured from the bottom edge of the bioretention soil mix.*<br><br>Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist):<br>☐ Where professional geotechnical evaluation recommends infiltration not be used due to reasonable concerns about erosion, slope failure, or down-gradient flooding.<br>☐ Within an area whose ground water drains into an erosion hazard, or landslide hazard area.<br>☐ Where the only area available for siting would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, pre-existing structures, or pre-existing road or parking lot surfaces.<br>☑ Where the only area available for siting does not allow for a safe overflow pathway to stormwater drainage system or private storm sewer system.<br>☐ Where there is a lack of usable space for bioretention areas at re-development sites, or where there is insufficient space within the existing public right-of-way on public road projects.<br>☑ Where infiltrating water would threaten existing below grade basements.<br>☐ Where infiltrating water would threaten shoreline structures such as bulkheads. | |

| Other Hard Surfaces (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Bioretention or Rain Gardens (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br>☑ Where evaluation of infiltration is not required per the Infiltration Infeasibility Map due to steep slopes, erosion hazards, or landslide hazards.<br>☑ Within setback provided for BMP T7.30 (**Stormwater Manual** Volume V, Section 7.4)<br>☐ Where they are not compatible with surrounding drainage system as determined by the city (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning bioretention area).<br>☑ Where land for bioretention is within an erosion hazard, or landslide hazard area (as defined by MICC 19.07.060).<br>☐ Where the site cannot be reasonably designed to locate bioretention areas on slopes less than 8 percent.<br>☐ Within 50 feet from the top of slopes that are greater than 20 percent and over 10 feet of vertical relief.<br>☐ For properties with known soil or groundwater contamination (typically federal Superfund sites or state cleanup sites under the Model Toxics Control Act [MTCA]):<br>• Within 100 feet of an area known to have deep soil contamination.<br>• Where groundwater modeling indicates infiltration will likely increase or change the direction of the migration of pollutants in the groundwater.<br>• Wherever surface soils have been found to be contaminated unless those soils are removed within 10 horizontal feet from the infiltration area.<br>• Any area where these facilities are prohibited by an approved cleanup plan under the state MTCA or Federal Superfund Law, or an environmental covenant under Chapter 64.70 RCW.<br>☐ Within 100 feet of a closed or active landfill.<br>☐ Within 10 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is 1,100 gallons or less. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface. | |

| Other Hard Surfaces (cont.) | | |
|---|---|---|
| **BMP and Applicable Lists** | **Infeasibility Criteria** | **Infeasibility Description and Rationale for Each BMP Not Selected** |
| Bioretention or Rain Gardens (cont.) | The following criteria can be cited as reasons for infeasibility without further justification (though some require professional services to make the observation):<br>☐ Within 100 feet of an underground storage tank and connecting underground pipes when the capacity of the tank and pipe system is greater than 1,100 gallons.<br>☐ Where field testing indicates potential bioretention/rain garden sites have a measured (a.k.a., initial) native soil saturated hydraulic conductivity less than 0.30 inches per hour. A small-scale or large-scale PIT in accordance with **Stormwater Manual** Volume III, Section 3.3.6 (or an alternative small scale test specified by the City) shall be used to demonstrate infeasibility of bioretention areas. If the measured native soil infiltration rate is less than 0.30 in/hour, bioretention/rain garden BMPs are not required to be evaluated as an option in List #1 or List #2. In these slow draining soils, a bioretention area with an underdrain may be used to treat pollution-generating surfaces to help meet Minimum Requirement #6, Runoff Treatment. If the underdrain is elevated within a base course of gravel, it will also provide some modest flow reduction benefit that will help achieve Minimum Requirement #7.<br>☐ Where the minimum vertical separation of 3 feet to the seasonal high groundwater elevation or other impermeable layer would not be achieved below bioretention that would serve a drainage area that exceeds the following thresholds (and cannot reasonably be broken down into amounts smaller than indicated):<br>o 5,000 square feet of pollution-generating impervious surface (PGIS)<br>o 10,000 square feet of impervious area<br>o 0.75 acres of lawn and landscape.<br>☐ Where the minimum vertical separation of 1 foot to the seasonal high groundwater or other impermeable layer would not be achieved below bioretention that would serve a drainage area less than the above thresholds<br>☐ Within 100 feet of a drinking water well, or a spring used for drinking water supply.<br>☐ Within 10 feet of small on-site sewage disposal drainfield, including reserve areas, and grey water reuse systems. For setbacks from a "large on-site sewage disposal system," see Chapter 246-272B WAC. | |