

~~APPENDIX~~ APPENDIX E

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# Additional Design Requirements



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Appendix E includes additional design requirements for the following:

- Flow control structures (Section E-1)
- Flow splitters (Section E-2)
- Flow spreaders (Section E-3)
- Level spreaders (Section E-4)
- Pipe slope drains (Section E-5)
- Outlet protection (Section E-6)
- Facility liners (Section E-7)
- Geotextiles (Section E-8)
- Plant Lists for [Bioretention](#), Biofiltration Swales, Sand Filters, and Wet Ponds (Section E-9)
- [Drywell sizing tables \(Section E-10\)](#)



## E.1. Flow Control Structures

~~Control~~ Flow control structures are catch basins or ~~manholes~~ maintenance holes with a restrictor device for controlling outflow from a facility to meet the desired performance. Riser type restrictor devices (“tees” ~~or “FROP-Ts”~~) also provide some incidental oil/water separation to temporarily detain oil or other floatable pollutants in runoff due to accidental spill or illegal dumping.

The restrictor device usually consists of two or more orifices and/or a weir section sized to meet performance requirements. Standard control structure details are shown in Figures E-1 and E-2.

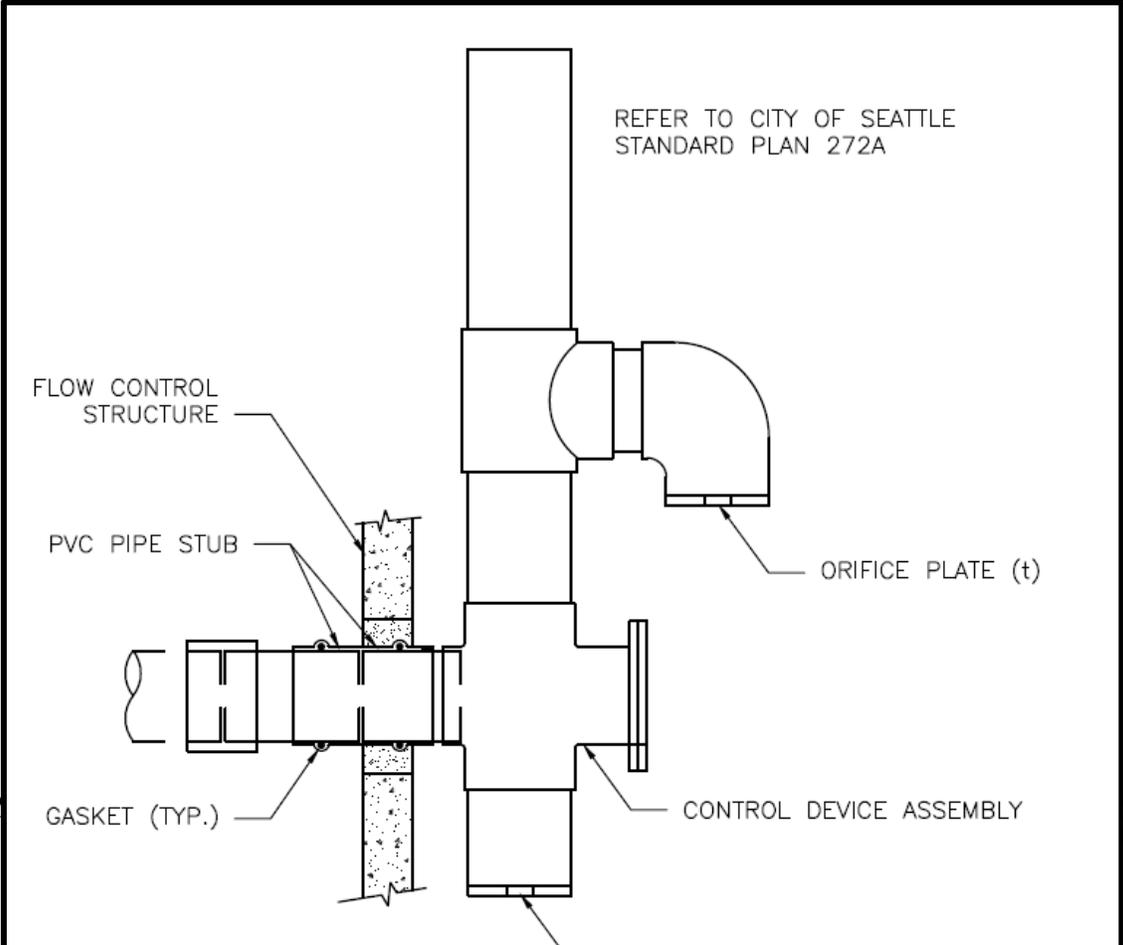
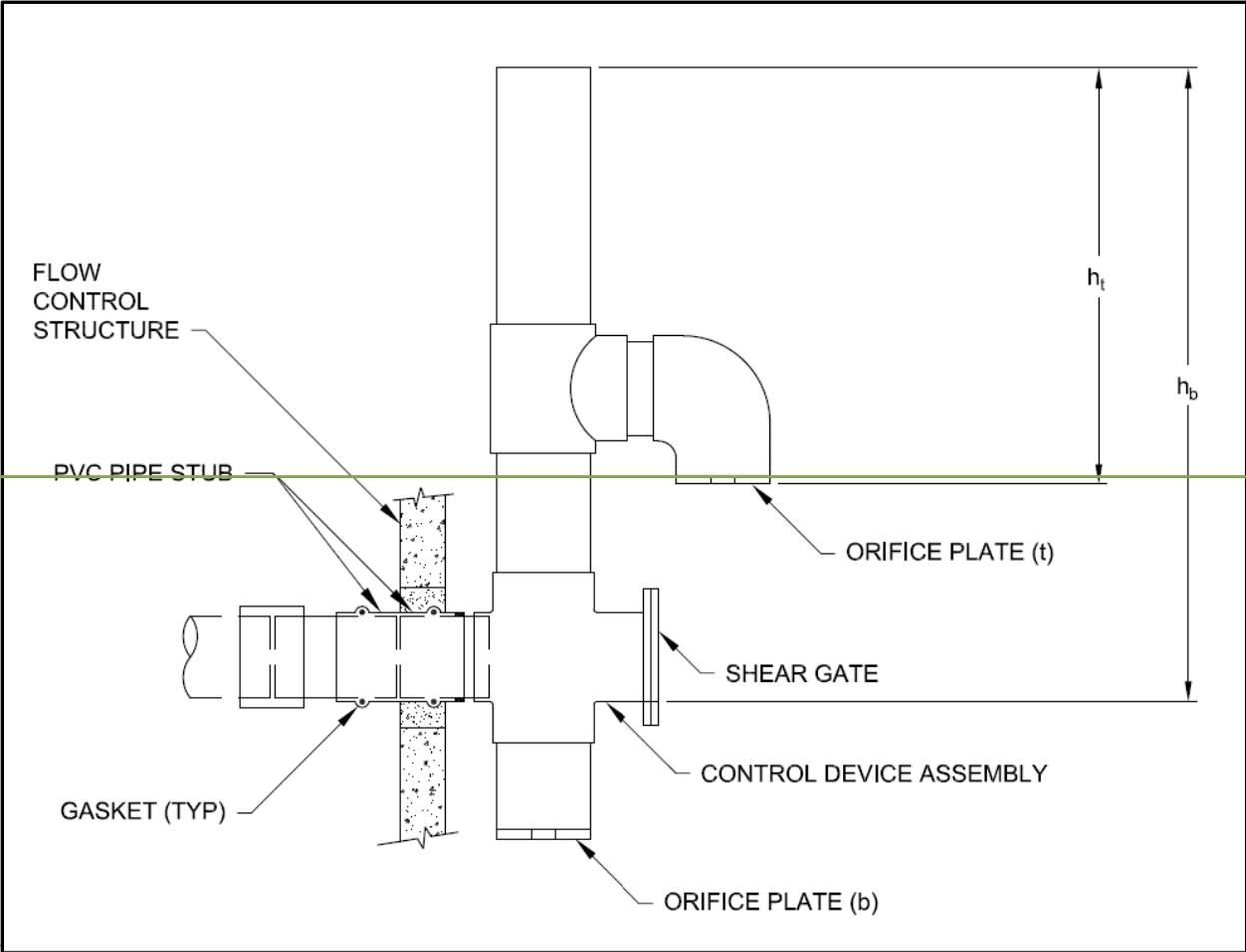
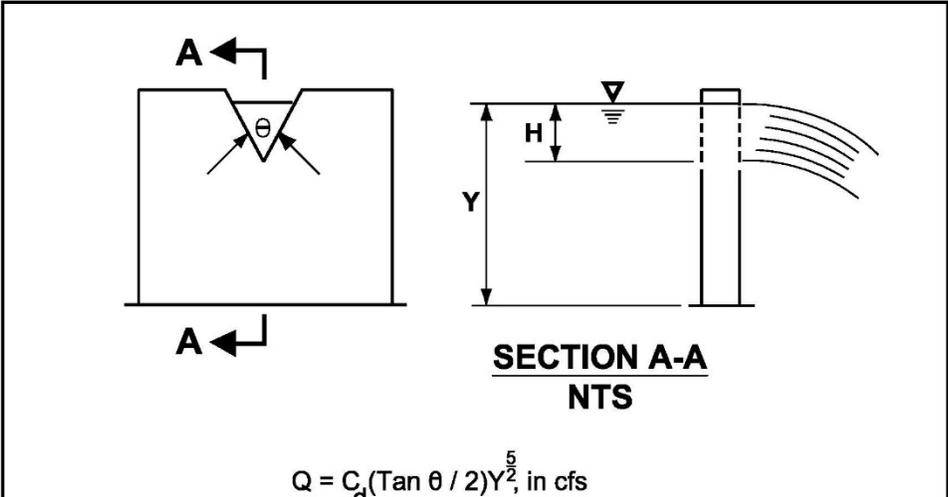
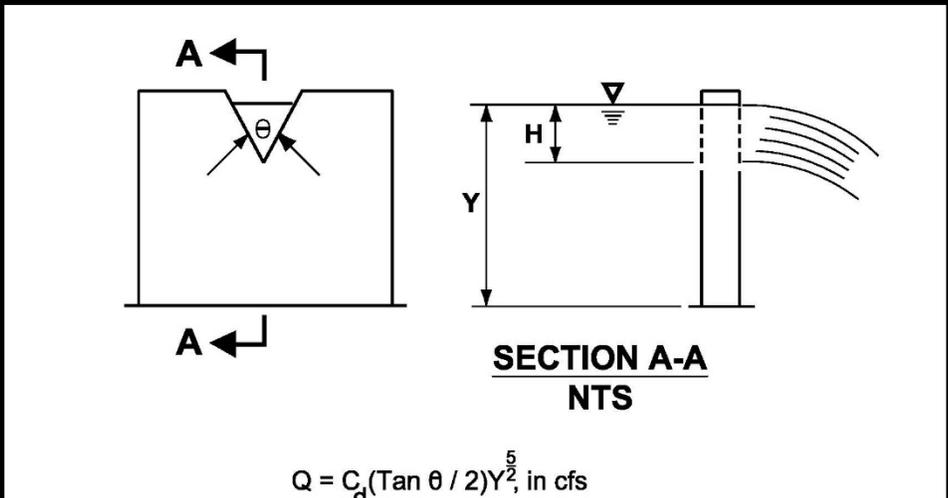
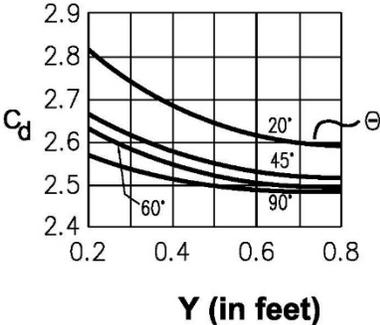


Figure E-.1. Simple Orifice.

For design requirements related to conveyance and drainage refer to *Volume 3—Project Stormwater Control, Chapter, Section 4.4.3.*



Where values of  $C_d$  may be taken from the following chart:



Where values of  $C_d$  may be taken from the following chart:

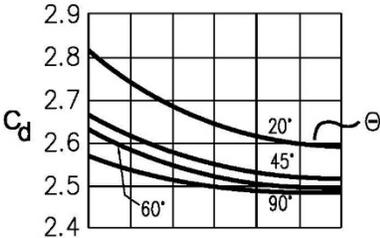


Figure E-2. V-Notch, Sharp-Crested Weir.

## General Requirements

Flow control structures ~~must~~**shall** comply with the specifications outlined in the City's Standard Plans numbers 270 and 272A. Additional general requirements are presented below.

~~Permit submittal must~~**Plans submitted for a permit shall** include flow control structure rim elevation, the storage pipe invert elevation, the outlet pipe invert elevation, ~~and,~~ the elevation of the top of the storage pipe, ~~and~~ the elevation of the top of the overflow pipe, ~~the orifice diameter(s), and the orifice elevation(s).~~

## Access

The following access requirements apply to control structures:

- Access ~~must~~**shall** be provided to the flow control structure from the ground surface with a three bolt locking maintenance hole ring and cover (refer to ~~City Requirements for Design and Construction of Seattle Standard Plan 230~~**Side Sewer Director's Rule**). Rim elevations ~~must~~**shall** match proposed finish grade. A rectangular cover, or a cover that allows water to enter through the top of the flow control structure, ~~may~~**shall** not be used. The ring and cover ~~must~~**shall** be set so the flow control device or the ladder is visible at the edge of the access opening.
- The inside diameter of the flow control structure ~~must~~**shall** be at least 4 feet to allow maintenance and repair access, and to accommodate stormwater overflow.
- ~~Manholes~~**Maintenance holes** and catch basins ~~must~~**shall** meet the OSHA and WISHA confined space requirements, which include, but are not limited to, clearly marking entrances to confined space areas. This may be accomplished by hanging a removable sign in the access riser, just under the access lid.
- The flow control device ~~must~~**shall** be PVC, not Corrugated Metal Pipe (CMP). The mounting straps and the outlet adapter ~~must~~**shall** be installed in a manner that will make the flow control device easily removable for maintenance, repair, or replacement. The flow control device ~~must~~**shall** be designed and located under the maintenance hole ring and cover for inspection from the surface. The outlet pipe adapter may be a plastic, bell-end pipe or a plastic coupling with rubber gaskets. The outside of the pipe or coupling ~~must~~**shall** be sanded, epoxy coated, and sand impacted to bond with the flow control structure. ~~This preparation must be done by the manufacturer or supplier, not in the field.~~

## Information Plate

~~A brass or stainless steel plate must be permanently attached inside each control structure with the following information engraved on the plate:~~

- ~~• Name and file number of project~~
- ~~• Name and company of 1) developer, 2) engineer, and 3) contractor~~
- ~~• Date constructed~~

- ~~Date of manual used for design~~
- ~~Flow performance criteria~~
- ~~Release mechanism size, type, and invert elevation~~
- ~~List of stage, discharge, and volume at 1-foot increments~~
- ~~Elevation of overflow~~
- ~~Required frequency of maintenance~~

## Design Criteria

### Multiple Orifice Restrictor

In most cases, control structures need only two orifices: one at the bottom and one near the top of the riser, although additional orifices may best utilize detention storage volume. Several orifices may be located at the same elevation if necessary to meet performance requirements.

Design requirements for multiple orifice flow restrictors are presented below.

- The minimum allowable orifice diameter is 0.5 inches for ~~below ground outlets~~ **underground tanks or vaults** and 0.25 inches for aboveground ~~outlets~~ **cisterns**. In some instances, a 0.5-inch bottom orifice will be too large to meet target release rates, even with minimal head. In these cases, the live storage depth need not be reduced to less than 3 feet in an attempt to meet the performance standards. Also, under such circumstances, flow-throttling devices may be a feasible option. These devices will throttle flows while maintaining a plug-resistant opening.
- Orifices may be constructed on a tee section as shown in City of Seattle Standard Plan 270 or on a baffle.
- In some cases, performance requirements may require the top orifice/elbow to be located too high on the riser to be physically constructed (e.g., a 13-inch-diameter orifice positioned 0.5 feet from the top of the riser). In these cases, a notch weir in the riser pipe may be used to meet performance requirements.
- ~~Consideration must be given to the~~ **For ponding facilities, backwater effects shall be included in designing the height** of ~~water surface elevations in the~~ downstream conveyance system. High tailwater elevations may affect performance of the restrictor system and reduce live storage volumes. ~~Backwater calculations may be required.~~

### ~~Riser and Weir Restrictor~~

Design requirements for multiple orifice flow restrictors are presented below.

- ~~Properly designed weirs~~ **Weirs** may be used as flow restrictors. However, they ~~must~~ **shall** be designed to provide for primary overflow of the developed 100-year peak flow discharging to the detention facility. ~~(Figure E-3).~~

- The combined orifice and riser (or weir) overflow may be used to meet performance requirements; however, the design must still provide for primary overflow of the developed 100-year peak flow assuming all orifices are plugged. Figure E-3 can be used to calculate the head in feet above a riser of given diameter and flow.

## Flow Control Device Sizing

### Orifices

Flow through orifice plates in the standard tee section or ~~turn-down~~-turned elbow may be approximated by the general equation:

$$Q = CA\sqrt{2gh} \quad \underline{Q = CA\sqrt{2gh}}$$

where Q = flow (cfs)

C = coefficient of discharge (0.62 for plate orifice)

A = area of orifice (ft<sup>2</sup>)

h = hydraulic head (ft)

g = gravity (32.2 ft/sec<sup>2</sup>)

Figure E-3 illustrates this simplified application of the orifice equation.

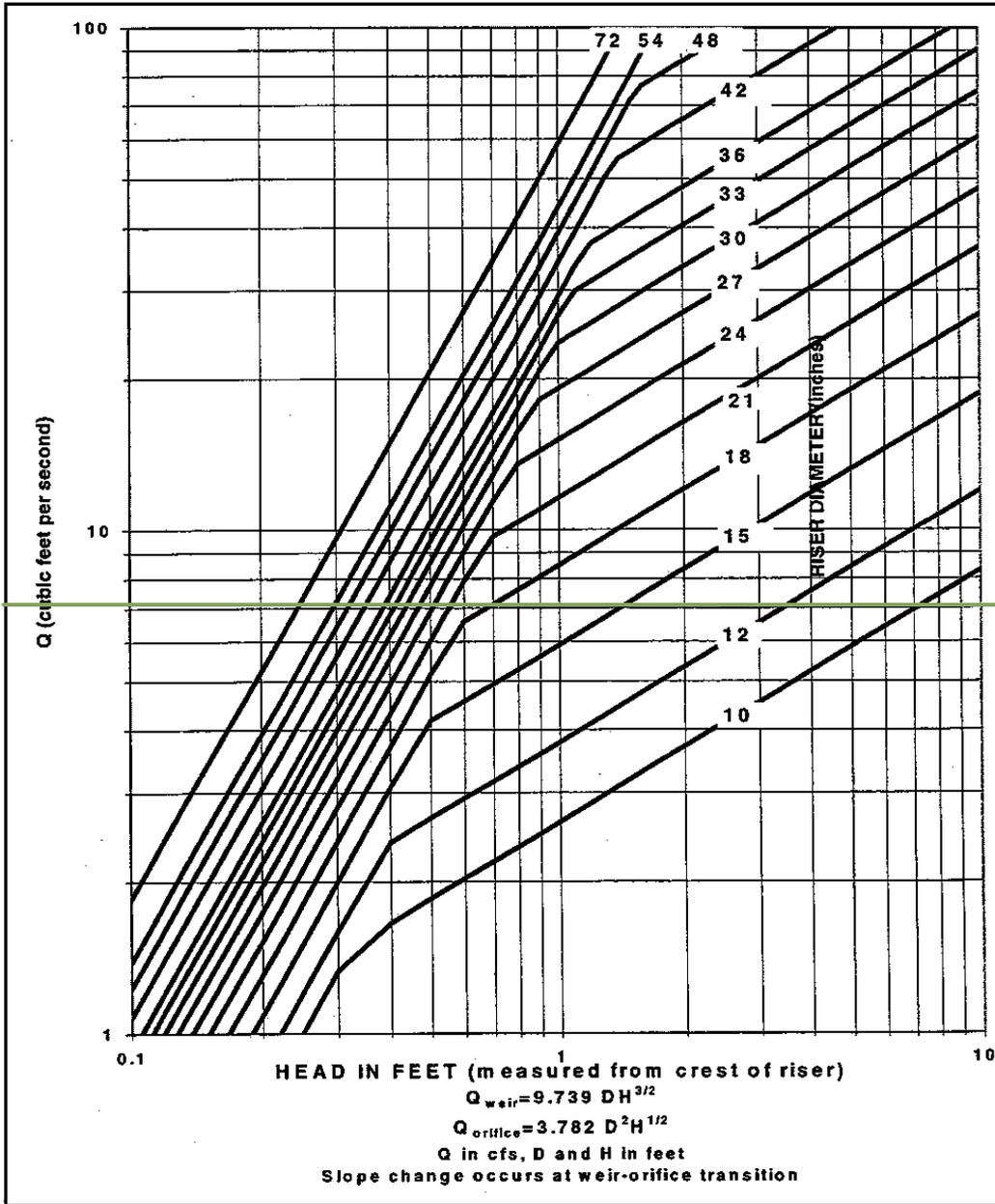
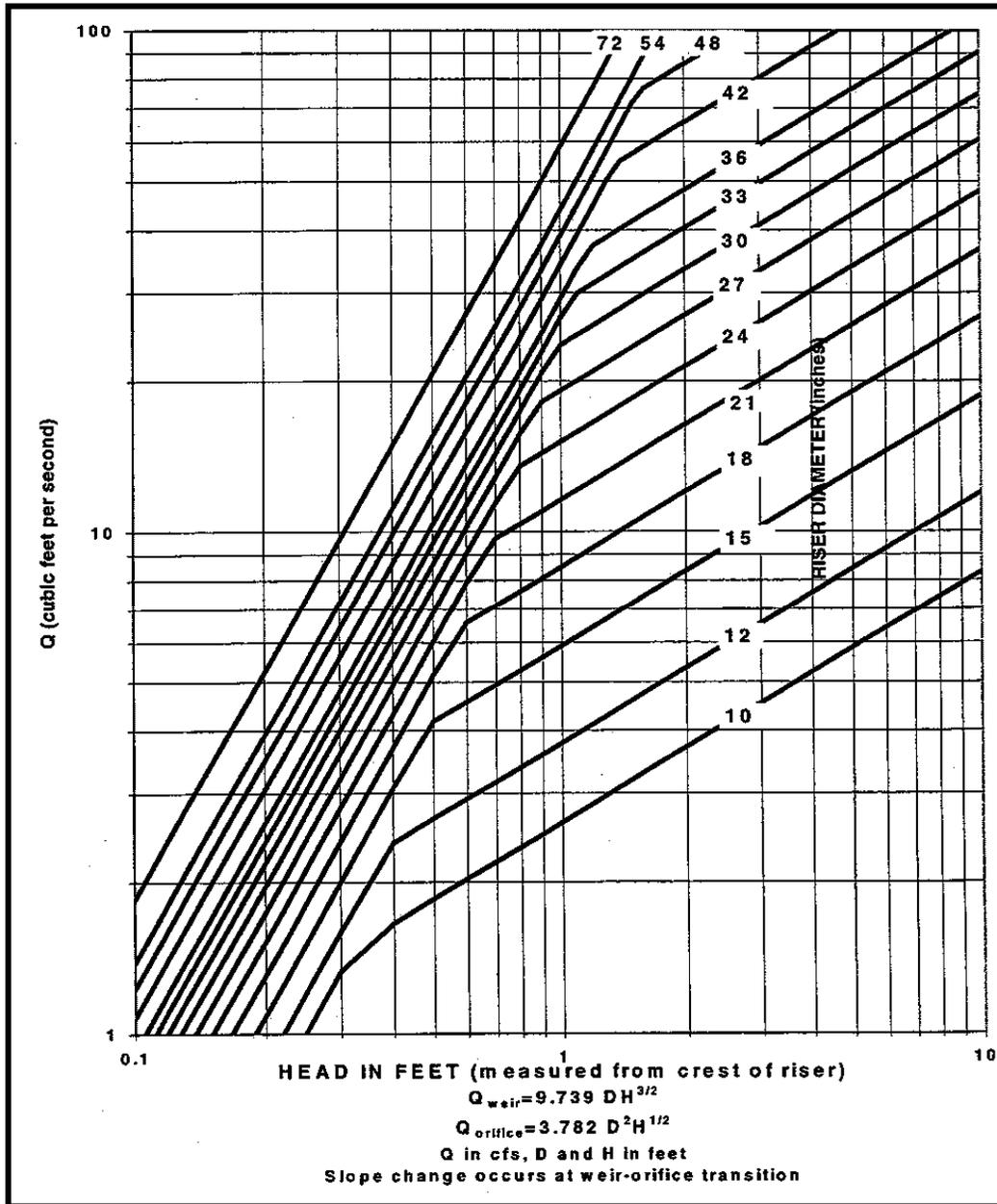


Figure E-3. Riser Inflow Curves.

The diameter of the orifice is calculated from the flow. The orifice equation is often useful when expressed as the orifice diameter in inches.

$$d = \sqrt{\frac{36.88Q}{\sqrt{h}}} \quad d = \sqrt{\frac{36.88Q}{\sqrt{h}}}$$

where  $d$  = orifice diameter (inches)  
 $Q$  = flow (cfs)  
 $h$  = hydraulic head (ft)



**Figure E.3. Riser Inflow Curves.**

***Riser Overflow***

The combined orifice and riser (or weir) overflow may be used to meet performance requirements; however, the design **must/shall** still provide for primary overflow of the developed 100-year peak flow assuming all orifices are plugged. **Figure E-3 can be used to calculate the head in feet above a riser of given diameter and flow.**

### *Riser Overflow*

The nomograph in Figure E-3 can be used to determine the head (in feet) above a riser of given diameter and for a given flow (usually the 100-year peak flow for developed conditions).

## E-2. Flow Splitters

Many water quality facilities can be designed as flow through or on-line systems with flows above the water quality design flow simply passing through the facility at a lower pollutant removal efficiency. However, it is sometimes desirable to restrict flows to water quality treatment facilities and bypass the remaining higher flows around them (i.e., offline facilities). This can be accomplished by splitting flows in excess of the water quality design flow upstream of the facility and diverting higher flows to a bypass pipe or channel. The bypass typically enters a detention pond or the downstream receiving drainage system, depending on applicable flow control requirements. In most cases, it is a designer's choice whether water quality facilities are designed as on-line or offline; an exception is oil/water separators and sand filters, which must be designed offline.

A crucial factor in designing flow splitters is to ensure that low flows are delivered to the treatment facility up to the water quality design flow rate. Above this rate, additional flows are diverted to the bypass system with minimal increase in head at the flow splitter structure to avoid surcharging the water quality treatment facility under high flow conditions.

Flow splitters are typically ~~manholes or vaults~~ **structures** with concrete baffles. ~~In place of baffles, the splitter mechanism may be a half tee section with a solid top and an~~, **weirs or orifice** in the bottom of the tee section. A full tee option may also be used as described below under General Design Criteria. **controls**. Two examples for manhole based **of maintenance hole** flow splitters are shown in Figure E-4 and Figure E-5. Other equivalent designs ~~that achieve the result of~~ **for** splitting low flows and diverting higher flows around the facility may also be acceptable.

### *General Design Criteria*

A flow splitter must be designed to deliver the water quality design flow rate specified in this volume to the water quality treatment facility. For the basic size sand filter, which is sized based on volume, use the water quality design flow rate to design the splitter. For the large sand filter, use the flow rate that corresponds with treating 95 percent of the runoff volume predicted by an approved continuous runoff model.

The top of the weir **must shall** be located at the water surface for the design flow. ~~Remaining flows enter the bypass line.~~ Flows modeled using a continuous simulation model **must shall** be at a 15-minute time step or less.

The maximum head **must shall** be minimized for flow in excess of the water quality design flow. Specifically, flow to the water quality treatment facility at the 100-year water surface **must shall** not increase the design water quality flow by more than 10 percent.

As an alternative to using a solid top plate in Figure E-5, a full tee section may be used with the top of the tee at the 100-year water surface. This alternative would route emergency overflows (if the overflow pipe were plugged) through the water quality treatment facility rather than generate back up from the maintenance hole.

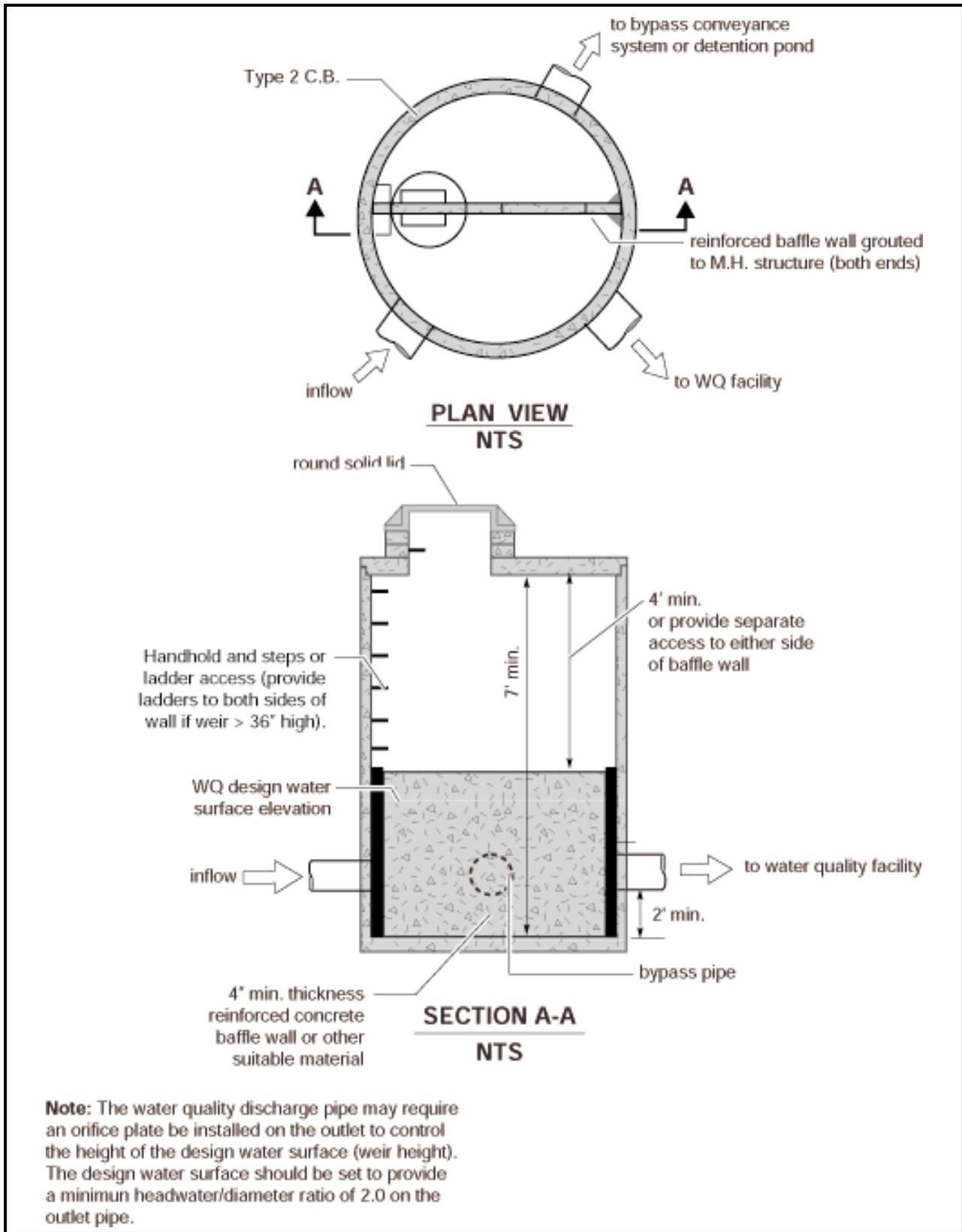


Figure E-4. Flow Splitter Example A.

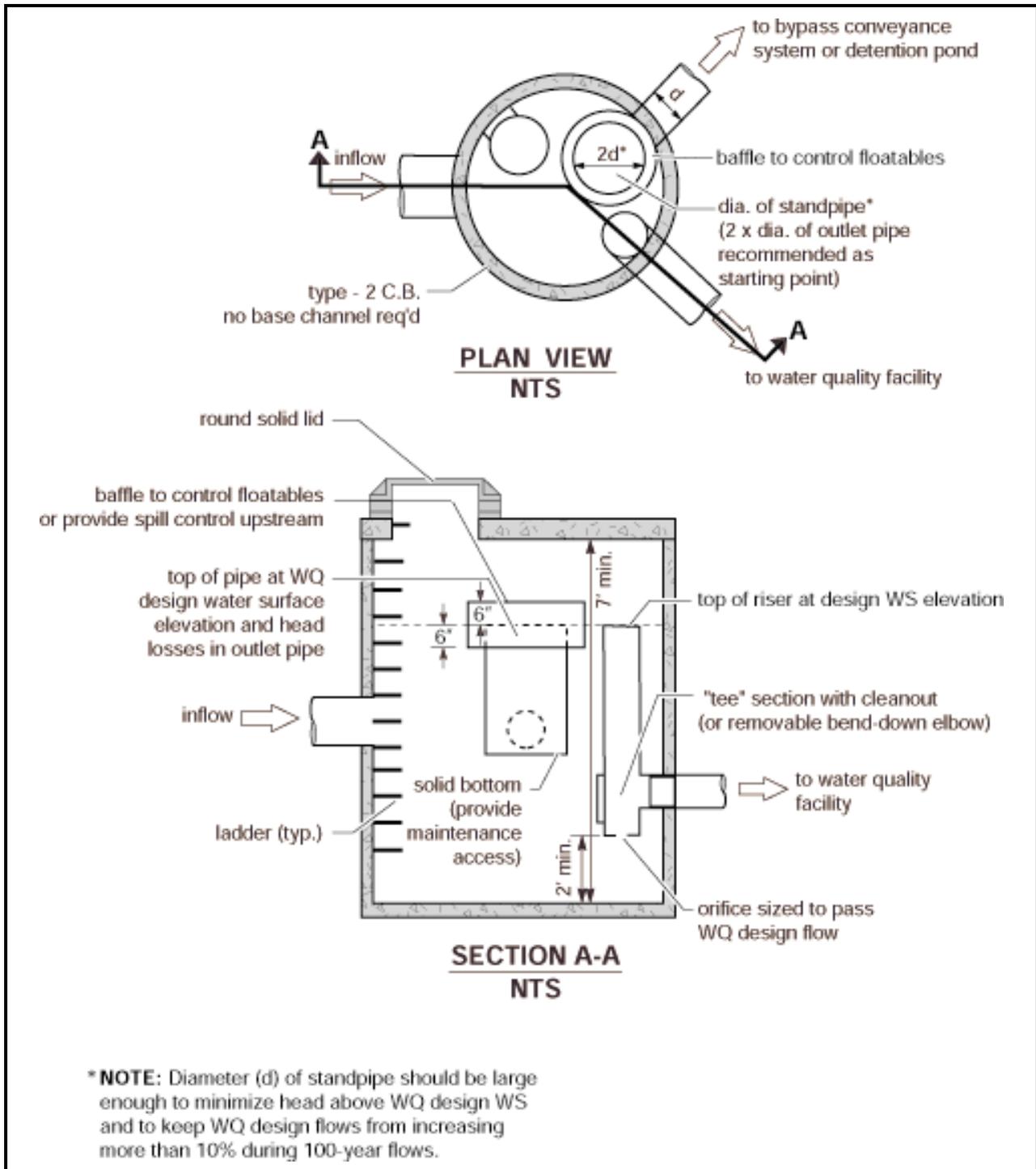


Figure E-5. Flow Splitter Example B.

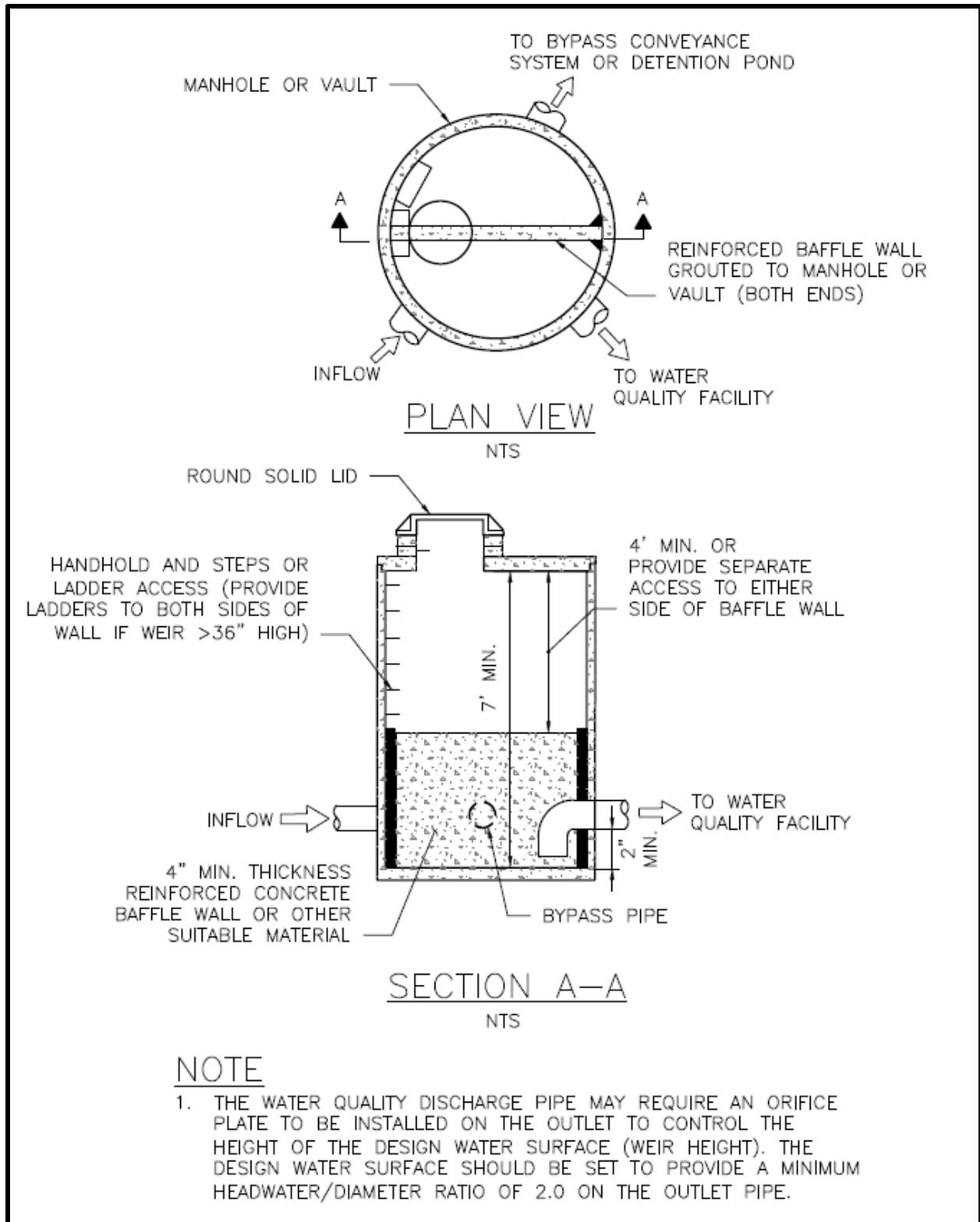
Special applications, such as roads, may require the use of a modified flow splitter. The baffle wall may be fitted with a notch and adjustable weir plate to proportion runoff volumes other than high flows.

~~For ponding facilities, backwater~~ **Backwater** effects ~~must~~ **shall** be included in ~~designing~~ the ~~height~~ **design** of the standpipe ~~height~~ in the ~~manhole~~.

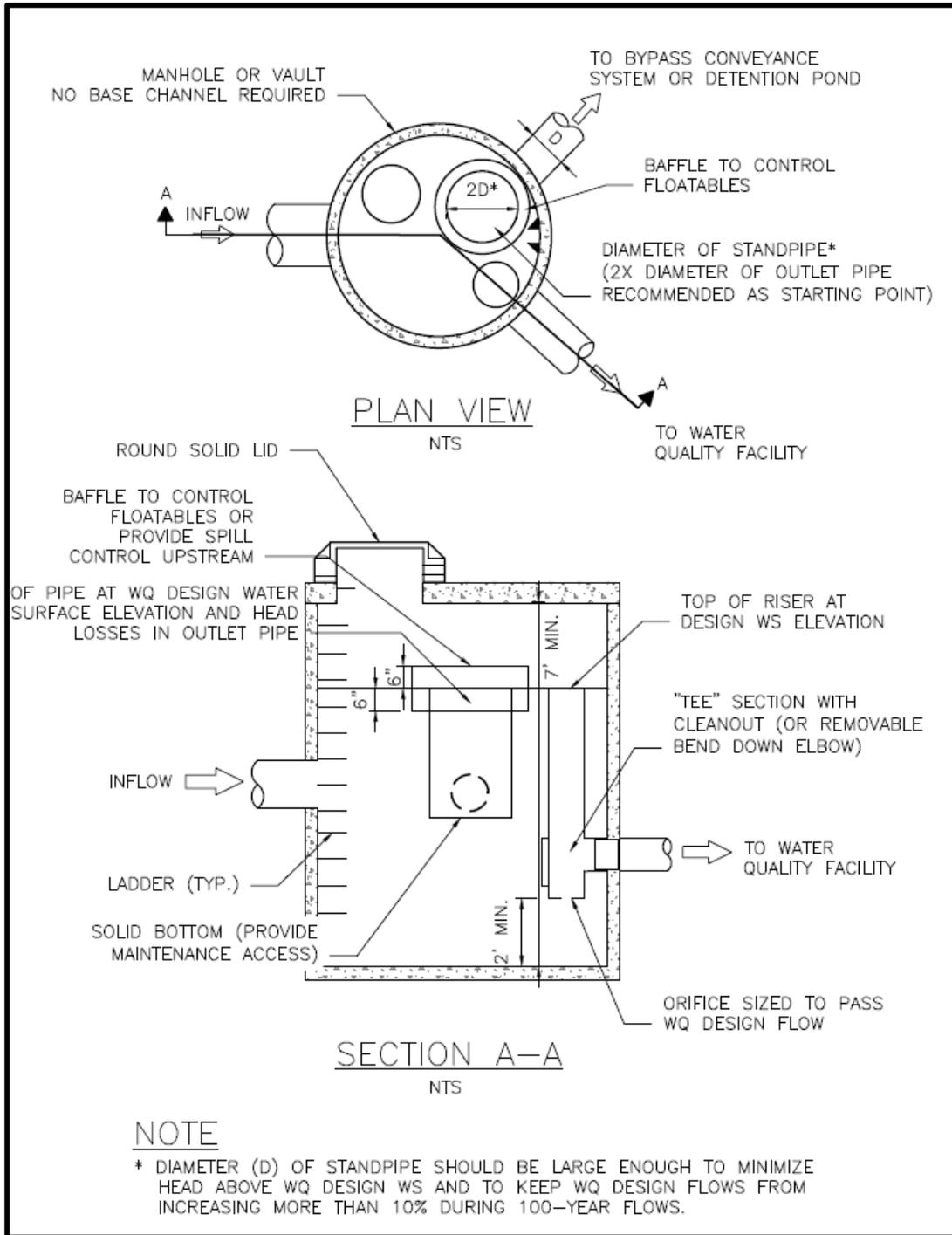
~~Ladder or step and handhold access must be provided. If the baffle wall is higher than 36 inches, two ladders, one to either side of the wall, must be used. The minimum clearance between the top of the baffle wall and the bottom of the manhole cover must be 4 feet; otherwise, dual access points should be provided~~ **maintenance hole**.

## **Materials**

- The splitter baffle may be installed in a ~~Type 2 manhole~~ **maintenance hole** or vault.
- The baffle wall ~~must~~ **shall** be made of reinforced concrete or another suitable material resistant to corrosion, and have a minimum 4-inch thickness.
- All metal parts ~~must~~ **shall** be corrosion resistant. Examples of ~~preferred~~ **required** materials include aluminum, stainless steel, and plastic. Zinc and galvanized materials are prohibited because of aquatic toxicity. Painted metal parts ~~should~~ **not** be used because of poor longevity.



**Figure E.4. Flow Splitter Example A.**



**Figure E.5. Flow Splitter Example B.**

## E-3. Flow Spreaders

Flow spreaders uniformly spread flows across the inflow portion of non-infiltrating BMPs (e.g., sand filter, biofiltration swale, or filter strip). There are five flow spreader options presented in this section:

- Option A - Anchored plate
- Option B - Concrete sump box
- Option C - Notched curb spreader
- Option D - Through-curb ports
- Option E - Interrupted curb

Options A through C can be used for spreading flows that are concentrated. Any one of these options can be used when spreading is required by the facility design criteria. Options A through C can also be used for unconcentrated flows, and in some cases **mustshall** be used, such as to correct for moderate grade changes along a filter strip.

Options D and E are only for flows that are already unconcentrated and enter a filter strip or continuous inflow biofiltration swale. Other flow spreader options are possible with prior approval by the Director.

### *General Design Criteria*

Where flow enters the flow spreader through a pipe, it is recommended that the pipe be submerged to the extent practical to dissipate energy as much as possible. For higher inflows (greater than 5 cfs for the 100-year storm), a Type 1 catch basin should be positioned in the spreader and the inflow pipe should enter the catch basin with flows exiting through the top grate. The top of the grate should be lower than the level spreader plate, or if a notched spreader is used, lower than the bottom of the v-notches.

### *Option A - Anchored Plate*

- An anchored plate flow spreader **mustshall** be preceded by a sump having a minimum depth of 8 inches and minimum width of 24 inches. If not otherwise stabilized, the sump area **mustshall** be lined to reduce erosion and to provide energy dissipation.
- The top surface of the flow spreader plate **mustshall** be level, projecting a minimum of 2 inches above the ground surface of the water quality treatment facility, or v-notched with notches 6 to 10 inches on center and 1 to 6 inches deep (use shallower notches with closer spacing). Alternative designs may also be considered.
- A flow spreader plate **mustshall** extend horizontally beyond the bottom width of the facility to prevent water from eroding the side slope. The horizontal extent should be such that the bank is protected for all flows up to the 100-year flow, or the maximum flow that will enter the water quality treatment facility.
- Flow spreader plates **mustshall** be securely fixed in place.

- Flow spreader plates may be made of either wood, metal, fiberglass reinforced plastic, or other durable material. If wood, pressure treated 4- by 10-inch lumber or landscape timbers are acceptable.
- Anchor posts must shall be 4-inch square concrete, tubular stainless steel, or other material resistant to decay. Refer to Volume V of the Stormwater Management Manual for Western Washington, Volume V, Figure 4.5.3 for an example of an anchored plate flow spreader.

### **Option B – Concrete Sump Box**

- The wall of the downstream side of a rectangular concrete sump box must shall be level and shall extend a minimum of 2 inches above the treatment bed. This serves as a weir to spread the flows uniformly across the bed.
- The downstream wall of a sump box must shall have “wing walls” at both ends. Side walls and returns must shall be slightly higher than the weir so that erosion of the side slope is minimized.
- Concrete for a sump box can be either cast-in-place or precast, but the bottom of the sump must shall be reinforced with wire mesh for cast-in-place sumps.
- Sump boxes must shall be placed over bases that consists of 4 inches of crushed rock, 5/8-inch minus to help assure the sump remains level. Refer to Volume V of the Stormwater Management Manual for Western Washington, Volume V, Figure 4.5.4 for an example of a concrete sump box flow spreader.

### **Option C – Notched Curb Spreader**

Notched curb spreader sections must shall be level and made of extruded concrete laid side-by-side and level. Typically, five “teeth” per 4-foot section provide good spacing. The space between adjacent teeth forms a v-notch.

### **Option D – Through-Curb Ports**

Unconcentrated flows from paved areas entering filter strips or continuous inflow biofiltration swales can use curb ports or interrupted curbs (Option E) to allow flows to enter the strip or swale. Curb ports use fabricated openings that ~~allow concrete curbing to be poured or extruded while still providing~~ provide an opening through the curb to admit water to the ~~water quality treatment~~ facility.

Openings in the curb must shall be at regular intervals but at least every 6 feet (minimum). The width of each curb port opening must shall be a minimum of 11 inches. Approximately 15 percent or more of the curb section length should be in open ports, and no port should discharge more than about 10 percent of the flow. Refer to Volume V of the Stormwater Management Manual for Western Washington, Volume V, Figure 4.5.6, for an example of a through-curb port flow spreader.

### **Option E – Interrupted Curb**

Interrupted curbs are sections of curb placed to have gaps spaced at regular intervals along the total width (or length, depending on the facility) of the treatment facility area. At a

minimum, gaps ~~must~~shall be every 6 feet to allow distribution of flows into the treatment facility before they become too concentrated. The opening ~~must~~shall be a minimum of 11 inches. As a general rule, no opening should discharge more than 10 percent of the overall flow entering the facility.

## E-4. Level Spreaders

### *Definition*

A level spreader is ~~an outlet for dikes and diversions consisting of an excavated depression constructed at zero percent grade across a slope and can also be used to distribute water concentrated runoff to sheet flow. Level spreaders can be used as either entering a temporary or exiting a flow control or treatment facility permanent BMP.~~

### *Purpose*

To convert concentrated runoff to a thin layer of sheet flow, which releases onto a stable receiving area. For example, an existing vegetated area or a vegetated strip.

### *Condition Where Practice Applies*

~~To be constructed on undisturbed areas that are stabilized by existing vegetation and where concentrated flows are anticipated to occur at zero percent grade (Figure E-6).~~



**Figure E-6. Level Spreader Prior to Backfill.**

None identified for this BMP.

### *Planning Considerations*

When properly constructed, the level spreader will significantly reduce the velocity of concentrated stormwater and spread it uniformly over a stable stabilized or undisturbed area.

Particular care must shall be taken during construction to ensure that the lower downslope side (or the lip) of the structure is level and on grade. If there are any depressions in the lip, flow will tend to concentrate at these points and erosion will occur, resulting in failure of the outlet. This problem may be avoided by using a grade board or a gravel lip over which the runoff must shall flow when exiting the spreader. Regular maintenance is essential for this practice.

Level spreaders should be constructed on undisturbed areas that are stabilized by existing vegetation, or areas which have been properly stabilized in accordance with the requirements of the Construction Stormwater and Erosion Control section of this manual (Volume 2), and where concentrated flows will be dissipated at zero percent grade (Figure E-6).

### *Design Criteria*

- The grade of the pipe and/or ditch for the last 20 feet before entering the level spreader shall be less than or equal to 1 percent if feasible. If the grade is steeper,

provide a flow dissipation device. The grade of the level spreader shall be zero percent to ensure uniform spreading of stormwater runoff.

- An 8-inch high gravel berm placed across the level lip shall consist of washed crushed rock, 2 to 4 inch or 3/4 inch to 1.5 inch size.
- The temporary level spreader length will be determined by estimating the flow expected from the 10-year, 24-hour design storm (Q10), and selecting the appropriate length from Table E-21. Alternatively, use the 10 percent annual probability flow (10-year recurrence interval) using a 5-minute time step, indicated by an approved continuous runoff model. Use multiple spreaders for higher flows. If the level spreader will be permanent, level spreader length will be determined by estimating the flow expected from the 25-year, 24-hour design storm (Q25). Alternatively, an approved continuous runoff model should be used to model the 25-year recurrence interval.
- The depth of the spreader as measured from the lip should be at least 8 inches and it should be uniform across the entire length.
- The discharge area below the level spreader outlet must shall be relatively undisturbed with stabilized and have a slope of less than 11 percent.



Figure E.6. Level Spreader Prior to Backfill and Downstream Stabilization.

Table E-2.1. Spreader Length Based on 10-year, 24-hour Storm.

Q <sub>10</sub> in cfs	Minimum Length (in feet)
0 – 0.1	15
0.1 – 0.2	25
0.2 – 0.3	35
0.3 – 0.4	45
0.4 – 0.5	55

cfs = cubic feet per second

Q<sub>10</sub> = 10-year, 24-hour design storm

## Maintenance

The spreader should be inspected ~~after every runoff event~~ regularly to ensure that it is functioning correctly. ~~The contractor should avoid the placement of~~ Do not place any material on ~~or it and~~ prevent ~~construction traffic across~~ from crossing the structure. If the spreader is damaged ~~by construction traffic~~, it shall be immediately repaired.

## E-5. Pipe Slope Drains

### Definition

A slope drain consists of a pipe extending from the top to the bottom of a cut or fill slope and discharging into a stabilized watercourse or a sediment trapping device or onto a stabilization area. It can also be used for water discharging from a flow control or treatment facility, or to safely convey water past the toe of the slope. Pipe slope drains can be used as either a temporary or a permanent BMP.

### Purpose

To carry concentrated runoff down steep slopes without causing gullies, channel erosion, or saturation of landslide-prone soils (Figure E-7).

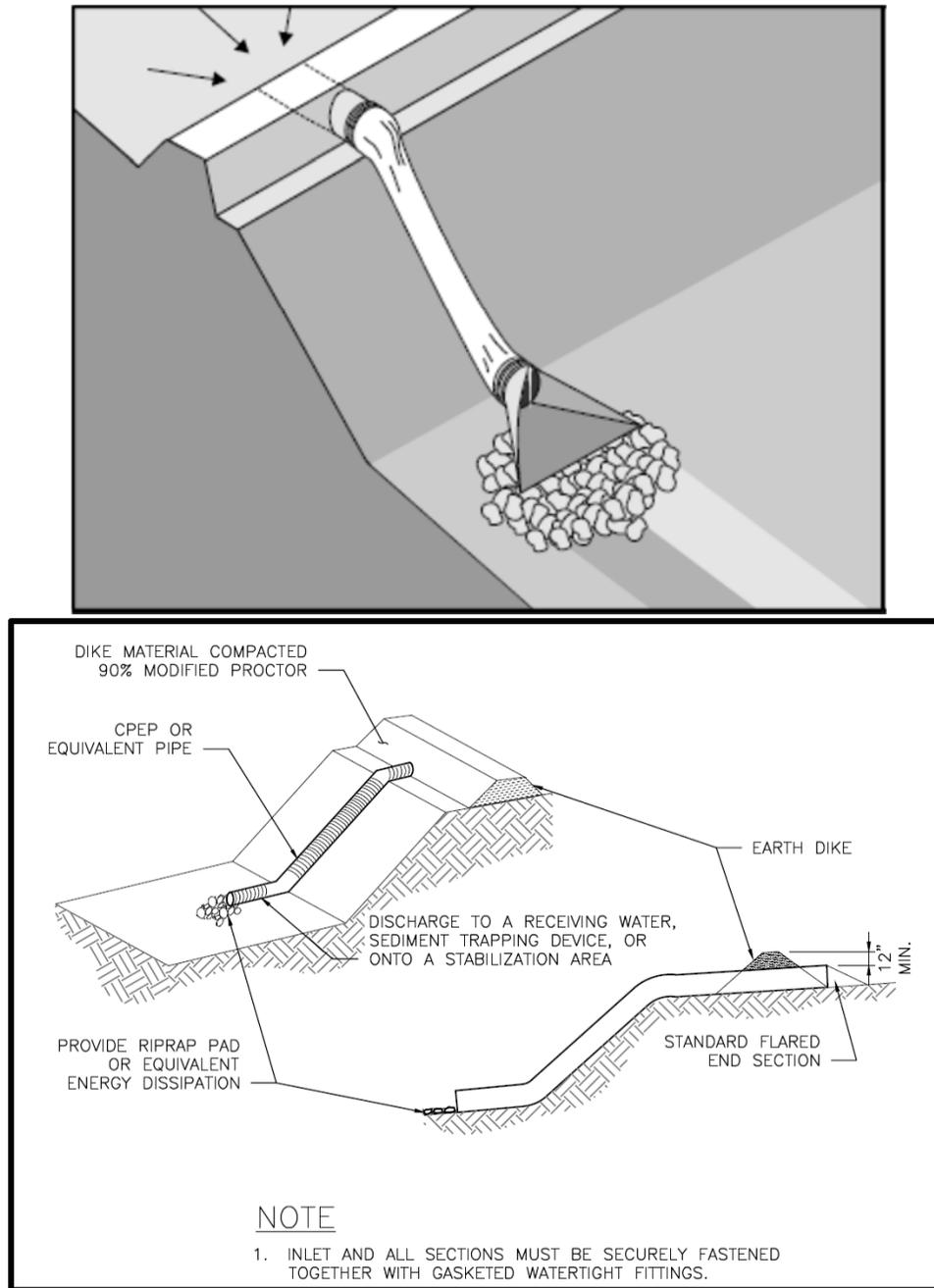


Figure E-.7. Schematic of a Pipe Slope Drain Details.

### Conditions Where Practice Applies

Conveying runoff down a slope without causing erosion. A permanent measure requires inclusion in the project drainage plan and must be designed by a Professional Engineer.

On highway projects, pipe slope drains should be used at bridge ends to collect runoff and pipe it to the base of the fill slopes along bridge approaches.

## Planning Considerations

There is often a ~~significant~~ lag between the time a cut or fill slope is completed and the time a permanent drainage system can be installed. During this period, the slope is usually not stabilized and is particularly vulnerable to erosion. ~~This situation also occurs on slope construction that is temporarily delayed before final grade is reached.~~ Temporary slope drains can provide valuable protection of exposed slopes until permanent drainage structures can be installed. ~~When used in conjunction with diversion dikes, temporary slope drains can be used to convey stormwater from the entire drainage area above a slope to the base of the slope without erosion. It is very important that these temporary structures be installed properly since their failure will often result in severe gully erosion.~~ The entrance section ~~must~~shall be securely entrenched, all connections ~~must~~shall be watertight, and the conduit ~~must~~shall be staked securely.

Additional protection requirements for steep slopes are included in the Environmentally Critical Area Ordinance (SMC, Section 25.09.180).

## Design Criteria

- Permanent slope drains ~~should~~shall be designed by ~~an~~a licensed engineer and may have additional criteria for flow and water quality treatment requirements. Variations or alterations to the minimum BMP requirements outlined below require ~~an~~a licensed engineer's approval.
- The capacity for temporary drains shall be sufficient to handle a 10-year, 24-hour peak flow. Alternatively, use the 10 percent annual probability flow (10-year recurrence interval) using a 5-minute time step, indicated by an approved continuous runoff model. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using WWHM, bare soil areas should be modeled as "landscaped area." Refer to *Appendix F* for additional information on stormwater modeling.
- Re-establish cover immediately on areas disturbed by installation.
- Ensure that the entrance area is stable and large enough to direct flow into the pipe.
- The entrance shall consist of a standard flared end section for culverts 12 inches and larger with a minimum 6-inch metal toe plate to prevent runoff from undercutting the pipe inlet. The slope of the entrance shall be at least 3 percent (Figure E-8).
- Pipe slope drain size should be no greater than 6 inches. Intercept flow frequently by using multiple pipe slope drains. Multiple pipes should be no closer than 10 feet.
- The soil around and under the pipe and entrance section shall be thoroughly compacted to prevent undercutting.
- The flared inlet section shall be securely connected to the slope drain and have watertight connecting bands.

- Slope drain sections shall be securely fastened together and have gasketed watertight fittings, and be securely anchored into the soil.
- Thrust blocks should be installed any time 90 degree bends are utilized. Depending on size of pipe and flow, these can be constructed with sand bags, straw bales staked in place, "t" posts and wire, or ecology blocks.
- Pipe needs to be secured along its full length to prevent movement. This can be done with steel "t" posts and wire. A post is installed on each side of the pipe and the pipe is wired to them. This should be done every 10 to 20 feet of pipe length ~~or so~~, depending on the size of the pipe and quantity of water diverted.
- Earth dikes shall be used to direct runoff into a slope drain. The height of the dike shall be at least ~~1 foot~~ 12 inches higher at all points than the top of the inlet pipe.
- ~~Any excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.~~
- The area below the outlet ~~must~~ shall be stabilized with a riprap apron ~~- (refer to Section E-6 for outlet protection).~~
- If the pipe slope drain is conveying sediment-laden water, direct all flows into the sediment trapping facility.
- Refer to the City of Seattle Standard Specifications for all material specifications ([http://www.seattle.gov/util/Engineering/Standard\\_Plans\\_&\\_Specs/index.asp](http://www.seattle.gov/util/Engineering/Standard_Plans_&_Specs/index.asp) ~~www.seattle.gov/util/engineering/standard\_plans\_&\_specs~~).

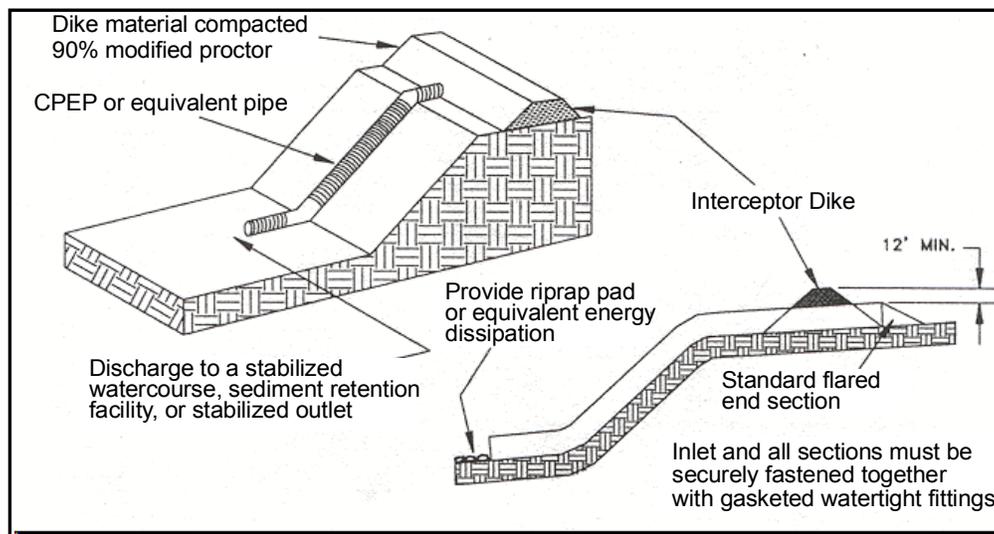


Figure E-8. Pipe Slope Drain Details.

## Maintenance

- Check inlet and outlet points regularly, especially after heavy storms. The inlet should be free of undercutting, and no water should be going around the point of entry. If there are problems, reinforce the headwall with compacted earth or sand bags. The outlet point should be free of erosion and installed with appropriate outlet protection.

- For permanent installations, inspect pipe periodically for vandalism and physical distress such as slides and wind-throw.
- Normally the pipe slope is so steep that clogging is not a problem with smooth wall pipe; however, debris may become lodged in the pipe or at the inlet.

## E-6. Outlet Protection

### *Definition*

~~Structurally lined aprons or other acceptable energy~~ **Energy** dissipating materials or devices placed at concentrated flow outlets, such as the outlets of pipes or paved channel sections. Outlet protection can be used as either a temporary or a permanent BMP.

### *Purpose*

To prevent scour at stormwater outlets, and to minimize the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

### *Condition Where Practice Applies*

Outlet protection is required ~~at the outlets of all ponds, pipes, ditches, or other conveyances, and where~~ wherever concentrated runoff is conveyed to a natural or manmade drainage feature such as a stream, wetland, or ditch could cause scour or erosion.

### *Planning Considerations*

None identified for this BMP.

### *Design Criteria*

~~An outfall is defined as a concentrated discharge point that directs collected surface water flows into an open drainage feature, natural or manmade. These drainage features include ditches, channels, swales, closed depressions, wetlands, streams, rivers, ponds, lakes, or other open bodies of water. In nearly every case, the outfall will consist of a pipe discharging flows from a drainage system, a culvert, or a detention facility.~~

### *~~Design Criteria~~*

- Permanent BMPs ~~should~~ **shall** be designed by ~~an~~ **a licensed** engineer and may have additional criteria for flow and water quality treatment requirements. Variations and/or alterations to the minimum BMP requirements require ~~an~~ **a licensed** engineer's approval.
- ~~Permanent applications may have additional requirements, as specified in~~ **Volume 3 Project Stormwater Control**.
- ~~No outfall should be allowed without proper permits and approvals.~~

- ~~The surface water ultimately receiving drainage water at the outlet of a culvert shall be protected.~~ At culvert outlets, protect from erosion by rock lining the downstream and extending up the channel sides above the maximum tail water elevation.
- ~~For large pipes (more than 18 inches in diameter), the outlet protection lining of the channel is lengthened as much as four times the diameter of the culvert.~~
- Standard wing walls, and tapered outlets and paved channels should also be considered when appropriate for permanent culvert outlet protection.
- Organic or synthetic erosion blankets, with or without vegetation, are usually more effective than rock, ~~cheaper~~ less expensive, and easier to install. However, materials can be chosen using manufacturer product specifications ~~and cross-checked with the City of Seattle Standard Specifications for erosion control materials Section 9-14.~~
- With low flows, vegetation (including sod) can be effective. ~~riprap~~ Riprap outlet protection is also appropriate in some situations.
- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), an engineered energy dissipater shall be used with filter fabric or erosion control blankets under riprap to prevent scour and channel erosion.

## Maintenance

Check for evidence of erosion, scour or channeling. Rock may need to be added if sediment builds up in the pore spaces of the outlet pad. Vegetation, erosion control blankets or rock pads may need replacement. Partial blocking of an outlet with a protective measure is not allowed unless designed by a licensed engineer.

## E-7. Facility Liners

Liners discussed in this section are intended to reduce the likelihood that pollutants in stormwater will reach groundwater when runoff treatment facilities are constructed. In addition to groundwater protection considerations, some facility types require permanent standing water for proper functioning. An example is the first cell of a wet pond.

There are two types of facility liners:

1. **Treatment liners** amend the soil with materials that treat stormwater before it reaches more freely draining soils. They have slow rates of infiltration, generally less than 2.4 inches per hour ~~( $1.7 \times 10^{-3}$  cm/s)~~, but not as slow as low permeability liners. Treatment liners may use in-place native soils or imported soils, provided that the design criteria outlined below are met.
2. **Low permeability liners** reduce infiltration to a very slow rate, generally less than 0.02 inches per hour ~~( $1.4 \times 10^{-5}$  cm/s)~~. These types of liners are often used for industrial or commercial sites with a potential for high pollutant loading in the stormwater runoff. Low permeability liners may be ~~fashioned~~ constructed from compacted till, clay, geomembrane, or concrete.

Liners may also be required in areas where infiltration is not permitted (e.g., ~~sloped~~ landslide-prone areas).

Table E-42 shows the type of liner required for use with various runoff treatment facilities (detention, non-infiltrating, and pretreatment BMPs). Other liner configurations may be used with prior approval from the Director.

Liners shall be evenly placed over the bottom and/or sides of the treatment area of the facility as indicated in Table E-42. Areas above the treatment volume that are required to pass flows greater than the water quality treatment flow (or volume) need not be lined. However, the lining must shall be extended to the top of the interior side slope and be anchored if it cannot be permanently secured by other means.

**Table E.2. Lining Types Required by BMP Type.**

<u>Facility</u>	<u>Area to be Lined</u>	<u>Type of Liner Required</u>
<u>Presettling basin</u>	<u>Bottom and sides</u>	<u>Low permeability liner or treatment liner</u>
<u>Wet pond</u>	<u>First cell: bottom and sides to WQ design water surface</u>	<u>Low permeability liner or treatment liner</u>
	<u>Second cell: bottom and sides to WQ design water surface</u>	<u>Treatment liner</u>
<u>Combined detention/non-infiltrating BMP</u>	<u>First cell: bottom and sides to WQ design water surface</u>	<u>Low permeability liner or treatment liner</u>
	<u>Second cell: bottom and sides to WQ design water surface</u>	<u>Treatment liner</u>
<u>Stormwater wetland</u>	<u>Bottom and sides, both cells</u>	<u>Low permeability liner</u>
<u>Sand filter basin</u>	<u>Required if over a critical aquifer recharge area, otherwise not required. Refer to Volume 3, Section 5.8.5.</u>	<u>Low permeability or treatment liner</u>
<u>Sand filter vault</u>	<u>Not applicable</u>	<u>No liner needed</u>
<u>Linear sand filter</u>	<u>Not applicable if in vault</u>	<u>No liner needed</u>
	<u>Bottom and sides of presettling cell if not in vault</u>	<u>Low permeability or treatment liner</u>
<u>Media filter (in vault)</u>	<u>Not applicable</u>	<u>No liner needed</u>
<u>Wet vault</u>	<u>Not applicable</u>	<u>No liner needed</u>
<u>Non-infiltrating bioretention</u>	<u>Bottom and sides</u>	<u>Low permeability liner</u>

Note: The Director may approve native soils as a low permeability liner based on measured infiltration rates and the recommendation of a licensed professional. The Director may also require low permeability liner based on infiltration setbacks or site constraints.

## *Design Criteria for Treatment Liners*

This section presents the design criteria for treatment liners.

- A 2-foot thick layer of soil with a minimum organic content of 1 percent AND a minimum cation exchange capacity (CEC) of 5 milliequivalents/100 grams can be used as a treatment layer beneath a water quality or detention facility.
- To demonstrate that in-place soils meet the above criteria, one sample per 1,000 square feet of facility area shall be tested. Each sample shall be a composite of

subsamples collected throughout the depth of the treatment layer ~~(usually 2 to 6 feet below the expected facility invert).~~

- Typically, side wall seepage is not a concern if the seepage flows through the same stratum as the bottom of the treatment BMP. However, if the treatment soil is an engineered soil or has very low permeability, the potential to bypass the treatment soil through the side walls may be significant. In those cases, the treatment BMP side walls should be lined with at least 18 inches of treatment soil, as described above, to prevent untreated seepage. This lesser soil thickness is based on unsaturated flow as a result of alternating wet-dry periods.
- Organic content shall be measured on a dry weight basis using ASTM D2974.
- Cation exchange capacity (CEC) shall be tested using EPA laboratory method 9081.
- Certification by a soils testing laboratory that imported soil meets the organic content and CEC criteria above shall be provided to the City.
- Animal manures used in treatment soil layers ~~must~~ **shall** be sterilized because of potential for bacterial contamination of the groundwater.
- ~~• If a treatment liner will be below the seasonal high water level, the pollutant removal performance of the liner and facility must be evaluated by a geotechnical or groundwater specialist and found to be as protective as if the liner and facility were above the level of the groundwater.~~

~~Table E-4. Lining Types Required for Pretreatment, Detention, and Non-infiltrating BMPs.~~

<b>Facility</b>	<b>Area to be Lined</b>	<b>Type of Liner Required</b>
Presettling basin	Bottom and sides	Low permeability liner or treatment liner (If the basin will intercept the seasonal high groundwater table, a treatment liner may be recommended.)
<del>Wet pond</del>	<del>First cell: bottom and sides to WQ design water surface</del>	<del>Low permeability liner or treatment liner</del>
	<del>Second cell: bottom and sides to WQ design water surface</del>	<del>Treatment liner</del>
Combined detention/non-infiltrating BMP	First cell: bottom and sides to WQ design water surface	Low permeability liner or treatment liner
	Second cell: bottom and sides to WQ design water surface	Treatment liner
Stormwater wetland	Bottom and sides, both cells	Low permeability liner
Sand filter basin	If over a critical aquifer recharge area. Refer to Volume 3, Section 5.8.5.	Low permeability or treatment liner
Sand filter vault	Not applicable	No liner needed
Linear sand filter	Not applicable if in vault Bottom and sides of presettling cell if not in vault	No liner needed Low permeability or treatment liner
<del>Media filter (in vault)</del>	<del>Not applicable</del>	<del>No liner needed</del>

Wet vault	Not applicable	No liner needed
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## Design Criteria for Low Permeability Liners

This section presents the design criteria for each of the following four low permeability liner options: compacted till liners, clay liners, geomembrane liners, and concrete liners. For low permeability liners, the following criteria apply:

- Where the seasonal high groundwater elevation is likely to contact a low permeability liner, liner buoyancy may be a concern. In these instances, use of a low permeability liner shall be ~~evaluated and recommended~~ designed by a geotechnical engineer.
- Where grass ~~must be~~ planted over a low permeability liner per the facility design, a minimum of 6 inches of ~~good~~ topsoil of sufficient organic content and depth or compost-amended native soil ~~(2 inches compost tilled into 6 inches of native till soil)~~ must shall be placed over the liner in the area to be planted. Native underlying soils may be suitable for planting if amended per Soil Amendment BMP requirements in Volume 3, Section 5.1. Twelve inches of cover is preferred.

### Compacted Till Liners

- Liner thickness shall be 18 inches after compaction.
- Soil shall be compacted to 95 percent minimum dry density, modified proctor method (ASTM D-1557).
- A different depth and density sufficient to ~~retard~~ slow the infiltration rate to  $2.4 \times 10^{-5}$  inches per minute ~~( $1 \times 10^{-6}$  cm/s)~~ may also be used instead of ~~Criteria 1 and 2~~ the above criteria if designed by a geotechnical engineer.
- Soil shall be placed in maximum 6-inch lifts.
- Soils ~~must~~ shall meet the gradation outlined in Table E-~~5~~ 3 unless otherwise designed by a geotechnical engineer.

Table E-~~5~~ 3. Compacted Till Liners.

Sieve Size	Percent Passing
6-inch	100
4-inch	90
#4	70 – 100
#200	20

### Clay Liners

- Liner thickness shall be 12 inches after compaction.
- Clay shall be compacted to 95 percent minimum dry density, modified proctor method (ASTM D-1557).
- A different depth and density sufficient to ~~retard~~ slow the infiltration rate to  $2.4 \times 10^{-5}$  inches per minute ~~( $1 \times 10^{-6}$  cm/s)~~ may also be used instead of the above criteria, if designed by a geotechnical engineer and approved by the Director.

- Plasticity index shall not be less than 15 percent (ASTM D-423, D-424).
- Liquid limit of clay shall not be less than 30 percent (ASTM D-2216).
- Clay particles passing shall not be less than 30 percent (ASTM D-422).
- The slope of clay liners ~~must~~shall be restricted to 3H: 1V for all areas requiring soil cover; otherwise, the soil layer ~~must~~shall be stabilized by another method so that soil slippage into the facility does not occur. Any alternative soil stabilization method ~~must~~shall take maintenance access into consideration.
- ~~• Where clay liners form the sides of ponds, the interior side slope shall not be steeper than 3H: 1V, irrespective of fencing. This restriction is to ensure that anyone falling into the pond may safely climb out.~~

### Geomembrane Liners

- Geomembrane liners shall be ultraviolet (UV) light resistant and have a minimum thickness of 30 mils. A thickness of 40 mils shall be used in areas of maintenance access or where heavy machinery ~~must~~will be operated over the membrane.
- The geomembrane fabric shall be protected from puncture, tearing, and abrasion by installing geotextile fabric on the top and bottom of the geomembrane ~~determined to~~. The geotextile fabric shall have a high survivability per the WSDOT Standard Specifications ~~as Amended, specifically~~ Section 9-33 Construction Geotextile. Equivalent methods for protecting the geomembrane liner may be permitted, subject to approval by Director. Equivalency will be ~~judged~~based on the ~~basis of ability of the~~ fabric to protect the geomembrane from puncture, tearing, and abrasion.
- Geomembranes shall be bedded according to the manufacturer's recommendations.
- Liners ~~must~~shall be covered with 12 inches of top dressing forming the bottom and sides of the water quality treatment facility, except for linear sand filters. Top dressing shall consist of 6 inches of crushed rock covered with 6 inches of topsoil of sufficient organic content and depth or compost-amended native soil. The rock layer is to mark the location of the liner for future maintenance operations. As an alternative to crushed rock, 12 inches of native soil may be used if orange plastic "safety fencing" or another highly-visible, continuous marker is embedded 6 inches above the membrane.
- If possible, liners should be of a contrasting color so that maintenance workers are aware of any areas where a liner may have become exposed when maintaining the facility.
- ~~Geomembrane~~Non-textured geomembrane liners shall not be used on slopes steeper than 5H:1V to prevent the top dressing material from slipping. Textured liners may be used on slopes up to 3H:1V upon ~~recommendation~~design by a geotechnical engineer that the top dressing will be stable for all site conditions, including maintenance.

### Concrete Liners

- Concrete liners may also be used for sedimentation chambers and for sedimentation and filtration basins less than 1,000 square feet in area. Concrete shall be 5-inch-thick

Class 3000 or better and shall be reinforced by steel wire mesh. The steel wire mesh shall be 6 gage wire or larger and 6 inch by 6 inch mesh or smaller. An "Ordinary Surface Finish" is required ~~per City of Seattle Standard Specification 6-02.3(14)~~. When the underlying soil is clay or has an unconfined compressive strength of 0.25 ton per square foot or less, the concrete shall have a minimum 6 inch compacted aggregate base consisting of coarse sand and river stone, crushed stone or equivalent with diameter of 0.75 to 1 inch. Where visible, the concrete shall be inspected annually and all cracks shall be sealed.

- Portland cement liners are allowed irrespective of facility size, and shotcrete may be used on slopes. However, specifications ~~must~~ **shall** be ~~developed~~ **designed** by a ~~professional~~ **licensed** engineer who certifies the liner against cracking or losing water retention ability under expected conditions of operation, including facility maintenance operations. Weight of maintenance equipment can be up to 80,000 pounds when fully loaded.
- Asphalt concrete may not be used for liners due to its permeability to many organic pollutants.
- If grass is to be grown over a concrete liner, slopes ~~must~~ **shall** be no steeper than 5H:1V to prevent the top dressing material from slipping. Textured liners may be used on slopes up to 3H:1V upon ~~recommendation~~ **recommended design** by a geotechnical engineer that the top dressing will be stable for all site conditions, including maintenance.

## E-8. Geotextiles

The following recommended applications are provided courtesy of Tony Allen (Geotechnical Engineer-WSDOT) with references provided to the relevant tables in the City of Seattle Standard Specifications:

- For sand filter drain strip between the sand and the drain rock or gravel layers ~~specify~~ **use** Geotextile Properties for Underground Drainage, moderate survivability, Class A, from Tables 1 and 2 in the City of Seattle Standard Specifications 9-37.
- For sand filter matting located immediately above the impermeable liner and below the drains, the function of the geotextile is to protect the impermeable liner by acting as a cushion. The specification provided in Table 4 in the City of Seattle Standard Specifications 9-37 ~~should~~ **be** used to specify survivability properties for the liner protection application. Table 2 in the City of Seattle Standard Specifications 9-37, Class C ~~should~~ **be** used for filtration properties. Only nonwoven geotextiles are appropriate for the liner protection application.
- For ~~an~~ infiltration ~~drain~~ ~~specify~~ **drains use** Geotextile for Underground Drainage, low survivability, Class C, from Tables 1 and 2 in the City of Seattle Standard Specifications 9-37.
- For a sand bed cover a geotextile fabric is placed exposed on top of the sand layer to trap debris brought in by the stormwater and to protect the sand, facilitating easy cleaning of the surface of the sand layer. ~~However, a geotextile is not the best product for this application.~~ A polyethylene or polypropylene geonet ~~would~~ **shall** be ~~better~~ **used in lieu of geotextile fabric**. The geonet material ~~should~~ **be** have high UV

resistance (90 percent or more strength retained after 500 hours in the weatherometer, ASTM D4355), and high permittivity (ASTM D4491, 0.8 sec<sup>-1</sup> or more) and percent open area (CWO-22125, 10 percent or more). Tensile strength should be on the order of 200 pounds grab (ASTM D4632) or more.

## E-9. Plant Lists for **Bioretention**, Biofiltration Swales, Sand Filters, and Wet Ponds

### Biofiltration Swales

~~Table E.5. — Plants Tolerant of Frequent Saturated Soil Conditions or Standing Water.~~  
 The following plant lists were developed as a guide for bioretention (infiltrating and non-infiltrating), biofiltration swales, sand filters, and wet ponds. For information regarding planting for other BMPs, refer to *Volume 3, Chapter 5*. More stringent requirements have been developed for facilities sited in the right-of-way and can be found in the Seattle Right-of-Way Improvements Manual.

### ***Bioretention***

The Seattle Right-of-Way Improvements Manual establishes height limits for non-street tree plantings in rights-of-way. Maximum plant height within 30 feet of an intersection (as measured from the corner of the curb) is 24 inches. Elsewhere in the right-of-way, plantings are allowed to be 30 inches with the exception of accent shrubs as directed.

The following planting zone codes apply to Tables E.4 through E.19:

- Zone 1: designation for plants that are used for water quality in the bottoms of the bioretention facilities
- Zone 2: designation for plants that are used for water quality in the lower slopes/wetted/ponded area of the bioretention facilities
- Zone 3: species appropriate for planting at the tops and upper slopes of the of bioretention areas that are used as a border and as accents along the sidewalk, including vertical and accent plants and trees
- Zone 4: low, durable plants (under 24 inches) that are used in sight clearance areas or as accents at the edge of the facility
- Zone 5: designation for steppable plants used in the crossing zones and access areas along the curb - these plants may need to tolerate foot traffic, depending on their location

The following operations and maintenance/special needs code (O&M code) apply to Tables E.4 through E.10:

- A = Cut back perennials to 3 inches above ground in fall (October/November)
- B = Leave foliage and seedheads for winter interest and cut back if foliage collapses. Cut back in spring (Mid-January to Mid-March) before new growth emerges.

- C = Hand-rake in spring (Mid-January to Mid-March) before new growth emerges. Cut back to ground or thin every 2-3 years as needed.
- DS = Deadhead perennials in spring/summer to encourage reblooming and for neater appearance. Deadheading not required for function.
- DF = Deadhead perennials in fall for neater appearance and to prevent resowing. Deadheading not required for function.
- E = Cut back or prune of over sidewalk or clear zones. Remove deadwood anytime fall to spring.
- F = May need replacing every 5+/- years. (Replacement not required if vegetation coverage meets requirements)
- G = May need dividing every few years. Reasons for division include dieback in center and to increase coverage

Table E.4. Part Shade List.

EG	DT	NWN	Agg <sup>†</sup> Height from Ground	Scientific Name	Common Name	Planting Zone	Suggested Size/ Spacing	Urban Frontage	Exposure	BMP Design Comments	O&M Code	Additional O&M Comments
SEMI			< 24"	<i>Abelia x grandiflora</i> 'Prostrata'	Prostrate white abelia	3,4	1 Gal./ 30" o.c.	UF	☀,∅		E	-
	DT	-	18"-30"	<i>Aster divaricatus</i>	White wood aster	3	1 Gal./ 24" o.c.	-	∅		B	-
	-	-	< 24"	<i>Carex elata</i> 'Bowles Golden'	Bowles Golden sedge	1,2	10 Cu. In. Plug/ 9" o.c.	UF	☀,∅	Limit to areas of approx. 36"x36"	B	-
EG	-	-	< 24"	<i>Carex laxiculmis</i> 'Hobb'	Bunny Blue sedge	1,2	10 Cu. In. Plug/ 9" o.c.	UF	∅	-	C	-
EG	DT	NWN	24"-48"+	<i>Carex obnupta</i>	Slough sedge	1,2	10 Cu. In. Plug/ 9" o.c.	-	☀,∅	Do not intermix with other emergents. Do not plant near intersections.	C	Can be sheared more frequently if overcrowding other occurs.
	-	NWN	24"-36"	<i>Carex stipata</i>	Beaked sedge	1,2	10 Cu. In. Plug/ 9" o.c.	UF	☀,∅	Limit to areas of approx. 36"x36"	B	-
EG	-	-	24"-30"	<i>Carex testacea</i> or <i>dispacea</i>	Orange New Zealand or Autumn Sedge	1,2	10 Cu. In. Plug/ 9" o.c.	UF	☀,∅	-	C	-
	DT	-	24"-36"	<i>Cornus sericea</i> 'Kelseyii'	Kelsey redstem dogwood	1,2,3	2 Gal./ 30" o.c.	UF	☀,∅		E	Stems fragile until established.
-	-	NWN	24"-40"	<i>Deschampsia caespitosa</i>	Tufted Hair Grass	1,2	10 Cu. In. Plug/ 9" o.c.	-	☀,∅	Limit to areas of approx. 36"x36"	B	LOS A: For neater appearance trim seedheads.

Inserted  
Split Cell  
Inserted  
Inserted  
Split Cell  
Split Cell  
Inserted  
Split Cell  
Inserted  
Split Cell  
Split Cell

Table E.4 (continued). Part Shade List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
			< 24"	<i>Deschampsia flexuosa</i> 'Aurea'	Golden crinkled hair grass	1,2	10 Cu. In. Plug/ 9" o.c.	UF	☀,∅	Limit to areas of approx. 36"x36"	B	LOS A: For neater appearance trim seedheads.
			24"	<i>Fuchsia magellanica</i> 'Aurea'	Dwarf Hardy Fuchsia	3,4	2 Gal./ 30" o.c.	UF	∅	-	E	-
			< 24"	<i>Galanthus elwesii</i>	Giant Snowdrop	3,4	Bulb	UF	☀,∅	Prefers part shade. May be short-lived if too hot.	F	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	24"-36"+	<i>Gaultheria shallon</i>	Salal	3	1 Gal./ 24" o.c.	UF	☀,∅		E	If height is a problem, Salal can be sheared with hedge trimmer.
<u>EG</u>			< 24"	<i>Geum florepulena</i> 'Blazing Sunset'	Blazing Sunset Avens	3,4	1 Gal./ 10" o.c.	UF	☀,∅		DS	
-			24"-36"	<i>Iris pallida</i> 'Variegata'	Variegated sweet iris	3	1 Gal./ 18" o.c.	UF	☀,∅		A	
<u>EG</u>	<u>DR</u>	<u>NWN</u>	< 24"	<i>Mahonia repens</i>	Creeping Oregon holly-grape	3,4	1 Gal./ 18" o.c.	UF	☀,∅		E	
<u>EG</u>	<u>DR</u>	<u>NWN</u>	24"-36"	<i>Polystichum munitum</i>	Western swordfern	3	2 Gal./ 24" o.c.	UF	∅	Limit to group of 3	B	Cut back before fronds appear.
<u>EG</u>	<u>DT</u>	-	24"-36"	<i>Prunus laurocerasus</i> 'Mount Vernon'	Mount Vernon cherry laurel	3	2 Gal./ 24" o.c.	UF	☀,∅	-	E	-

Table E.4 (continued). Part Shade List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	-	-	<u>36"</u>	<u>Rhododendron Yak Hybrids, such as 'Ken Janeck'</u>	<u>Yak Hybrid</u>	<u>3</u>	<u>2 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀️/∅</u>	<u>Several other Yak hybrids stay low and neat</u>	<u>E</u>	<u>LOS A: May produce more flowers if pruned and/or deadheaded after blooming</u>
<u>EG</u>	<u>DT</u>	-	<u>&lt; 24"</u>	<u>Sarcococca hookeriana humilis</u>	<u>Himalayan Sweet Box</u>	<u>3</u>	<u>2 Gal./ 24" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>Winter fragrance</u>	<u>E</u>	-
<u>EG</u>	-	-	<u>30"</u>	<u>Taxus 'Emerald Spreader'</u>	<u>Emerald Spreader Yew</u>	<u>3</u>	<u>2 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀️/∅</u>	-	<u>E</u>	-
-	-	<u>NWN</u>	<u>&lt; 24"</u>	<u>Tolmiea menziesii</u>	<u>Youth on Age</u>	<u>1,2,3</u>	<u>1 Gal./ 10" o.c.</u>		<u>∅</u>	-	<u>G</u>	-
<u>EG</u>	<u>DT</u>	-	<u>&lt; 24"</u>	<u>Veronica liwanensis</u>	<u>Speedwell</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀️/∅</u>	-	<u>E</u>	<u>LOS A: Cut back for neater appearance.</u>

EG = Evergreen

SEMI = Semi-evergreen

DT = Drought Tolerant

DR = Drought Resistant

NWN = Northwest Natives or Cultivars

UF = Urban Frontage (Mixed Use/Commercial) appropriate plants

☀️ = Full Sun

∅ = Part Sun/Part Shade

LOS = Level of Service

Table E.5. Sun List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>SEMI</u>	-	-	< 24"	<u><i>Abelia x grandiflora</i></u> 'Prostrata'	<u>Prostrate white abelia</u>	3,4	1 Gal./ 30" o.c.	<u>UF</u>		-	<u>E</u>	-
-	<u>DT</u>	-	< 24"	<u><i>Aster novi-belgii</i></u> 'Wood's Blue'	<u>Wood's Blue New York Aster</u>	3	1 Gal./ 18" o.c.	<u>UF</u>		-	<u>B, G</u>	-
-	-	-	24"-36"	<u><i>Carex muskingumensis</i></u>	<u>Palm sedge</u>	1,2	10 Cu. In. Plug/ 9" o.c.	<u>UF</u>		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
-	-	-	24"-36"	<u><i>Carex elata</i></u> 'Bowles Golden'	<u>Bowles Golden Sedge</u>	1,2,3	10 Cu. In. Plug/ 9" o.c.	<u>UF</u>		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
-	-	-	24"-36"+	<u><i>Carex grayi</i></u>	<u>Gray's sedge</u>	1,2	10 Cu. In. Plug/ 9" o.c.	<u>UF</u>		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
-	-	<u>NWN</u>	24"-36"	<u><i>Carex stipata</i></u>	<u>Beaked sedge</u>	1,2	10 Cu. In. Plug/ 9" o.c.	<u>UF</u>		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
<u>EG</u>	-	-	24"-30"	<u><i>Carex testacea</i></u> <u>or <i>dispacea</i></u>	<u>Orange New Zealand or Autumn Sedge</u>	1,2,3	10 Cu. In. Plug/ 9" o.c.	<u>UF</u>		-	<u>C</u>	-
-	<u>DT</u>	-	24"-36"	<u><i>Caryopteris incana</i></u> 'Sunshine Blue'	<u>Sunshine Blue Bluebeard</u>	3,4	1 Gal./ 18" o.c.	<u>UF</u>		-	<u>B OR DF</u>	<u>Cut back to about 18" above the ground or by half in early spring after new leaves are visible</u>

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
	<u>DT</u>	<u>NWN</u>	<u>24"-30"</u>	<u><i>Cornus sericea</i></u> <u>'Kelseyii'</u>	<u>Kelsey redstem dogwood</u>	<u>1,2,3</u>	<u>2 Gal./ 30" o.c.</u>	<u>UF</u>	<u>☀,∅</u>		<u>E</u>	<u>Stems fragile until established.</u>

Table E.5 (continued). Sun List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>-</u>	<u>-</u>	<u>NWN</u>	<u>24"-40"</u>	<u><i>Deschampsia caespitosa</i></u>	<u>Tufted Hair Grass</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>-</u>	<u>☀,∅</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>LOS A: For neater appearance trim seedheads.</u>
<u>-</u>	<u>-</u>	<u>-</u>	<u>&lt; 24"</u>	<u><i>Deschampsia flexuosa</i></u> <u>'Aurea'</u>	<u>Golden crinkled hair grass</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>LOS A: For neater appearance trim seedheads.</u>
<u>-</u>	<u>DT</u>	<u>-</u>	<u>24"-36"</u>	<u><i>Echinacea purpurea</i></u>	<u>Coneflower</u>	<u>3</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>-</u>	<u>B</u>	<u>LOS A: For neater appearance deadhead.</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>24"-36"+</u>	<u><i>Gaultheria shallon</i></u>	<u>Salal</u>	<u>3</u>	<u>1 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>-</u>	<u>E</u>	<u>If height is a problem, Salal can be sheared with hedge trimmer.</u>
<u>EG</u>	<u>DT</u>	<u>-</u>	<u>24"-36"</u>	<u><i>Hebe</i></u> <u>'Red Edge'</u>	<u>Red Edge Hebe</u>	<u>3,4</u>	<u>1 Gal./ 24" o.c.</u>	<u>-</u>	<u>☀</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>-</u>	<u>&lt; 24"</u>	<u><i>Hemerocallis</i></u> <u>-</u> <u>Later Flowering Varieties</u>	<u>Later Flowering Daylily varieties</u>	<u>3,4</u>	<u>1 Gal./ 15" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Later flowering varieties are not as susceptible to Daylily gall midge.</u>	<u>A</u>	<u>LOS A: For neater appearance deadhead.</u>

Table E.5 (continued). Sun List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Geranium x cantabrigiense</i></u> <u>'Cambridge'</u>	<u>Perennial Geranium</u>	3,4	1 Gal./ 15" o.c.	<u>UF</u>	<u>☀️</u>	-	<u>B</u>	-
<u>SEMI</u>	<u>DT</u>	-	< 24"	<u><i>Helianthemum</i></u> <u>'Henfield Brilliant'</u>	<u>Sunrose</u>	3,4	1 Gal./ 10" o.c.	<u>UF</u>	<u>☀️</u>	-	<u>B</u>	-
<u>EG</u>	<u>DT</u>	-	24"-36"	<u><i>Helictotrichon sempervirens</i></u>	<u>Blue oat grass</u>	3	1 Gal./ 18" o.c.	<u>UF</u>	<u>☀️</u>		<u>C</u>	
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Ilex x 'Mondo'</i></u>	<u>Little Rascal Holly</u>	3,4	1 Gal./ 18" o.c.	<u>UF</u>	<u>☀️</u>		<u>E</u>	
<u>EG</u>	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Iris douglasiana</i></u>	<u>Pacific Coast Iris</u>	3,4	1 Gal./ 18" o.c.	<u>UF</u>	<u>☀️</u>	<u>Many colors available.</u>	<u>G</u>	<u>LOS A: For neater appearance cut back dead leaves and flower stalks.</u>
<u>SEMI</u>	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Iris missouriensis</i></u>	<u>Rocky Mountain Iris</u>	1,2	1 Gal./ 12" o.c.	<u>UF</u>	<u>☀️</u>		<u>G</u>	<u>LOS A: For neater appearance cut back dead leaves and flower stalks.</u>
-	-	-	24"-36"	<u><i>Iris sibirica</i></u> <u>cultivars such as 'Bennerup Blue'</u>	<u>Siberian Iris</u>	1,2,3	1 Gal./ 18" o.c.	<u>UF</u>			<u>G</u>	<u>LOS A: For neater appearance cut back dead leaves and flower stalks.</u>

Table E.5 (continued). Sun List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juncus balticus</i></u>	<u>Baltic rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀</u>		<u>C</u>	<u>LOS A: Can be sheared more frequently if foliage collapses.</u>
<u>EG</u>	<u>-</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Juncus effusus</i> 'Quartz Creek'</u>	<u>Quartz Creek Soft Rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀,☀</u>		<u>C</u>	<u>LOS A: Can be sheared more frequently if foliage collapses.</u>
<u>EG</u>	<u>DT</u>	<u>-</u>	<u>&lt; 24"</u>	<u><i>Juniperus conferta</i> 'Blue Pacific'</u>	<u>Blue Pacific Shore juniper</u>	<u>3,4</u>	<u>1 Gal./ 3' o.c.</u>	<u>UF</u>	<u>☀</u>		<u>E</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>NWN</u>	<u>36"</u>	<u><i>Leersia oryzoides</i></u>	<u>Rice Cutgrass</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>-</u>	<u>☀</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>LOS A: For neater appearance trim seedheads.</u>
<u>EG</u>	<u>DR</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Mahonia repens</i></u>	<u>Creeping Oregon holly-grape</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,☀</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>DR</u>	<u>-</u>	<u>36"</u>	<u><i>Miscanthus sinensis</i> 'Little Kitten'</u>	<u>Little Kitten Maiden Grass</u>	<u>3</u>	<u>1 Gal./15" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>-</u>	<u>B</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>-</u>	<u>30"</u>	<u><i>Nepetax</i> 'Walker's Low'</u>	<u>Catmint</u>	<u>3</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,☀</u>	<u>-</u>	<u>B</u>	<u>-</u>
<u>EG</u>	<u>-</u>	<u>-</u>	<u>36"</u>	<u><i>Rhododendron</i> Yak Hybrids, such as 'Ken Janeck'</u>	<u>Yak Hybrid</u>	<u>3,4</u>	<u>2 Gal./ 30" o.c.</u>	<u>UF</u>	<u>☀,☀</u>	<u>Several other Yak hybrids stay low and neat</u>	<u>E</u>	<u>LOS A: May produce more flowers if pruned and/or deadheaded after blooming</u>

Table E.5 (continued). Sun List.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
-	<u>DT</u>	-	<u>24"–36"</u>	<u><i>Rudbeckia fulgida</i></u> <u>'Goldsturm'</u>	<u>Black-Eyed Susan</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Late season color accent.</u>	<u>A OR B</u>	-
-	<u>DT</u>	-	<u>&lt; 24"</u>	<u><i>Sedum</i></u> <u>'Autumn Joy'</u> or <u>'Matrona'</u>	<u>Stonecrop</u>	<u>3.4</u>	<u>1 Gal./ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>G</u>	<u>LOS A: Can be cut back by half in June to prevent flopping.</u>
-	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Solidago canadensis</i></u> <u>'Baby Gold'</u> or <u><i>Solidago hybrida</i></u> <u>'Dansolitem'</u>	<u>Baby Gold</u> or <u>Little Lemon Goldenrod</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	-	<u>☀</u>	<u>Late season color accent.</u>	<u>A</u>	-
-	-	<u>NWN</u>	<u>24"–48"</u>	<u><i>Spiraea betulifolia</i></u> or <u><i>Spiraea betulifolia</i></u> <u>'Tor'</u>	<u>Birchleaf spirea</u>	<u>3</u>	<u>1 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>E</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Sedum oregonum</i></u>	<u>Stonecrop</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-
<u>EG</u>	<u>DT</u>	-	<u>&lt; 24"</u>	<u><i>Teucrium chamaedrys</i></u>	<u>Wall germander</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>E</u>	<u>LOS A: For neater appearance trim spent flowers in spring.</u>
<u>EG</u>	<u>DT</u>	-	<u>&lt; 24"</u>	<u><i>Thymus serpyllum</i></u> <u>'Elfin'</u>	<u>Elfin creeping thyme</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>F</u>	-

EG = Evergreen

SEMI = Semi-evergreen

DT = Drought Tolerant

April 2014 Review Draft

~~E-18~~

21-2015/DWW-200

City of Seattle Directors' Rule  
Stormwater Manual

E-44

September 2015 Final Draft

DR = Drought Resistant

NWN = Northwest Natives or Cultivars

UF = Urban Frontage (Mixed Use/Commercial) appropriate plants

☀ = Full Sun

☀ = Part Sun/Part Shade

LOS = Level of Service

Table E.6. Native List (Sun to Part Shade includes cultivars).

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
-	<u>DR</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Aquilegia formosa</i></u>	<u>Western Columbine</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	-		-	<u>DF</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Arctostaphylos uva-ursi</i></u> <u>'Massachusetts'</u> <u>or 'Pt. Reyes'</u>	<u>Kinnikinnick</u>	<u>3.4</u>	<u>1 Gal./ 12" o.c.</u>	<u>UF</u>		<u>Possible use at vertical wall or single use low accent. Requires approval by Project Manager and Maintenance prior to use.</u>	<u>E</u>	-
-	<u>DR</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Camus leichtlinii</i></u> <u>or <i>Camus quamash</i></u>	<u>Great Camus or Common Camus</u>	<u>3.4</u>	<u>1 Gal./ 12" o.c.</u>	-		<u>Plant for in groups for effect. Can be planted as a bulb</u>	<u>DF</u>	-
<u>EG</u>	-	<u>NWN</u>	<u>30"</u>	<u><i>Carex densa</i></u>	<u>Dense sedge</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>		-	<u>C</u>	-
-	<u>DR</u>	<u>NWN</u>	<u>24"-48"</u>	<u><i>Carex deweyana</i></u>	<u>Dewey's sedge</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	-		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>24"-48"+</u>	<u><i>Carex obnupta</i></u>	<u>Slough sedge</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	-		<u>Do not intermix with other emergents. Do not plant near intersections</u>	<u>C</u>	<u>Can be sheared more frequently if overcrowding other occurs.</u>
-	<u>DT</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Carex pachystachya</i></u>	<u>Chamisso sedge</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	-		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-
-	-	<u>NWN</u>	<u>24"-36"</u>	<u><i>Carex stipata</i></u>	<u>Beaked sedge</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>		<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	-

Table E.6 (continued). Native List (Sun to Part Shade includes cultivars)

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
	<u>DT</u>	<u>NWN</u>	<u>24"–30"</u>	<u><i>Cornus sericea</i></u> <u>'Kelseyii'</u>	<u>Kelsey redstem dogwood</u>	<u>1,2,3</u>	<u>2 Gal./ 30" o.c.</u>	<u>UF</u>	<u>☀,☐</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>E</u>	<u>Stems fragile until established.</u>
-	-	<u>NWN</u>	<u>24"–40"</u>	<u><i>Deschampsia caespitosa</i></u>	<u>Tufted Hair Grass</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	-	<u>☀,☐</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>LOS A: For neater appearance trim seedheads.</u>
-	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Erigeron peregrinus</i></u>	<u>subalpine fleabane daisy</u>	<u>3,4</u>	<u>1 Gal./ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>DF</u>	-
-	<u>DT</u>	<u>NWN</u>	<u>36"</u>	<u><i>Festuca idahoensis</i></u>	<u>Idaho fescue</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	-	<u>☀</u>	-	<u>DF</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Gaultheria ovatifolia</i></u>	<u>Oregon wintergreen</u>	<u>3,4</u>	<u>1 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀,☐</u>	<u>If Gaultheria shallon is substituted see additional O&amp;M notes</u>	<u>E</u>	<u>If height is a problem, can be sheared with hedge trimmer.</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Iris douglasiana</i></u>	<u>Pacific Coast Iris</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Many colors available.</u>	<u>G</u>	<u>LOS A: For neater appearance cut back dead leaves and flower stalks.</u>
<u>SEMI</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Iris missouriensis</i></u>	<u>Rocky Mountain Iris</u>	<u>1,2</u>	<u>1 Gal./ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>G</u>	<u>LOS A: For neater appearance cut back dead leaves and flower stalks.</u>

Table E.6 (continued). Native List (Sun to Part Shade includes cultivars)

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juncus balticus</i></u>	<u>Baltic rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>-</u>	<u>C</u>	<u>LOS A: Can be sheared more frequently if foliage collapses.</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>24"–48"+</u>	<u><i>Juncus effusus</i></u>	<u>Common rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>-</u>	<u>☀, ☁</u>	<u>Do not intermix with other emergents. Do not plant near intersections</u>	<u>C</u>	<u>-</u>
<u>EG</u>	<u>-</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juncus ensifolius</i></u>	<u>Dagger-leaf rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀, ☁</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>-</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juncus tenuis</i></u>	<u>Path rush</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀, ☁</u>	<u>-</u>	<u>C</u>	<u>-</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juniperus communis</i> 'Mondap'</u>	<u>Alpine carpet juniper</u>	<u>4</u>	<u>1 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>-</u>	<u>E</u>	<u>May require pruning</u>
<u>EG</u>	<u>-</u>	<u>NWN</u>	<u>36"</u>	<u><i>Ledum glandulosum</i></u>	<u>Pacific or trapper's tea</u>	<u>1,2,3</u>	<u>5 Gal./ 36" o.c.</u>	<u>UF</u>	<u>☀, ☁</u>	<u>Plant near the bottom of swale</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>NWN</u>	<u>36"</u>	<u><i>Leersia oryzoides</i></u>	<u>Rice Cutgrass</u>	<u>1,2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>-</u>	<u>☀</u>	<u>Limit to areas of approx. 36"x36"</u>	<u>B</u>	<u>LOS A: For neater appearance trim seedheads.</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Lewisia cotyledon</i> or cultivars</u>	<u>Siskiyou lewisia</u>	<u>3,4</u>	<u>1 Gal./ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>EG</u>	<u>-</u>	<u>NWN</u>	<u>36"</u>	<u><i>Mahonia aquifolium</i> 'Orange Flame' or 'Compacta'</u>	<u>Compact tall Oregon grape</u>	<u>3</u>	<u>1 Gal./36" o.c.</u>	<u>UF</u>	<u>☀, ☁</u>	<u>-</u>	<u>E</u>	<u>-</u>

Table E.6 (continued). Native List (Sun to Part Shade includes cultivars)

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DR</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Mahonia repens</i></u>	<u>Creeping Oregon grape</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Maianthemum dilatatum</i></u>	<u>False Lily of the Valley</u>	<u>1,2,3,4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>Note tendency to spread</u>	<u>E</u>	<u>LOS A: Remove dead foliage in fall.</u>
<u>-</u>	<u>-</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Mimulus guttatus</i></u>	<u>Yellow monkey-flower</u>	<u>1,2</u>	<u>1 Gal./ 18" o.c.</u>	<u>-</u>	<u>☀,∅</u>	<u>-</u>	<u>DF</u>	<u>-</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>36"</u>	<u><i>Pachistima myrsinites</i></u>	<u>Oregon Boxwood</u>	<u>3</u>	<u>1 Gal./36" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>-</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Potentilla fruticosa</i> 'Sunset'</u>	<u>Frosty potentilla</u>	<u>3,4</u>	<u>2 Gal./ 30" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>-</u>	<u>E</u>	<u>-</u>
<u>-</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Potentilla glandulosa</i> or <i>Potentilla gracilis</i></u>	<u>Sticky cinquefoil or slender cinquefoil</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	<u>-</u>	<u>☀,∅</u>	<u>-</u>	<u>DF</u>	<u>-</u>
<u>EG</u>	<u>-</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Polystichum imbricans</i> or <i>Polystichum lonchitis</i></u>	<u>Narrow-leaf sword fern or Northern holly fern</u>	<u>3,4</u>	<u>2 Gal./ 30" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>If Polystichum munitum is substituted limit groups to 3 and prune yearly</u>	<u>B</u>	<u>Cut back before fronds appear.</u>
<u>-</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Solidago canadensis</i> 'Baby Gold' or <i>Solidago hybrida</i> 'Dansolitem'</u>	<u>Baby Gold or Little Lemon Goldenrod</u>	<u>3,4</u>	<u>1 Gal./ 18" o.c.</u>	<u>-</u>	<u>☀</u>	<u>Late season color accent.</u>	<u>A</u>	<u>-</u>

Table E.6 (continued). Native List (Sun to Part Shade includes cultivars)

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
	-	<u>NWN</u>	<u>24"-36"</u>	<u><i>Spiraea betulifolia</i> or <i>Spiraea betulifolia</i> 'Tor'</u>	<u>Birchleaf spirea</u>	<u>3</u>	<u>1 Gal./ 24" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>E</u>	
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Sedum divergens</i></u>	<u>Stonecrop</u>	<u>3,4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	<u>LOS A: For neater appearance deadhead.</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Sedum oreganum</i></u>	<u>Stonecrop</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>24"-36"</u>	<u><i>Xerophyllum tenax</i></u>	<u>Bear grass</u>	<u>3</u>	<u>1 Gal/ 18" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-

EG = Evergreen

SEMI = Semi-evergreen

DT = Drought Tolerant

DR = Drought Resistant

NWN = Northwest Natives or Cultivars

UF = Urban Frontage (Mixed Use/Commercial) appropriate plants

☀ = Full Sun

∅ = Part Sun/Part Shade

LOS = Level of Service

**Table E.7. Intersection and View Restriction Palette (under 24 inches in height).**

<b>EG</b>	<b>DT</b>	<b>NWN</b>	<b>Height from Ground</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Planting Zone</b>	<b>Suggested Size/ Spacing</b>	<b>Urban Frontage</b>	<b>Exposure</b>	<b>Design Comments</b>	<b>O&amp;M Code</b>	<b>Additional O&amp;M Comments</b>
-	-	-	< 24"	<i>Chrysanthemum</i> 'Peach Centerpiece' or 'Bienchen'	Peach Centerpiece or golden chrysanthemum	3,4	1 Gal./ 15" o.c.	-	☀	Late season color accent.	B & G	Pull if scraggly.
-	DT	-	< 24"	<i>Coreopsis lanceolata</i> 'Sterntaler'	Tickseed	3,4	1 Gal./ 15" o.c.	UF	☀	-	B & G	-
	DT	-	24"-30"	<i>Cornus sericea</i> 'Kelseyii'	Kelsey redstem dogwood	1,2,3	1 Gal./ 30" o.c.	UF	☀, ☁	Plant in bottom areas for sightlines.	E	Stems fragile until established.
EG	DT	-	< 24"	<i>Epimedium rubrum</i> or <i>sulphurescens</i>	Barrenwort	3,4	4" Pot/ 12" o.c.	UF	☁	Part shade to shade only without irrigation.	B	Cut back before flower stalks appear.
EG	DT	-	< 24"	<i>Euonymus fortunei</i> 'Interbolwi'	Blondy winter-creeper	3,4	1 Gal./ 18" o.c.	UF	☀, ☁	-	E	-
-	DT	-	< 24"	<i>Geranium</i> 'Gerwat' <i>Rozanne</i>	Rozanne geranium	3,4	1 Gal./ 24" o.c.	-	☀, ☁	-	A	LOS A: Can be sheared for neater appearance.
EG	-	-	< 24"	<i>Geum flore pleno</i> 'Blazing Sunset'	Blazing Sunset Avens	3,4	1 Gal./ 18" o.c.	UF	☀, ☁	-	DS	-
EG	-	-	< 24"	<i>Hebe x</i> 'Champion'	Champion Hebe	3,4	1 Gal./ 18" o.c.	UF	☀, ☁	-	E	-
SEMI	DT	-	< 24"	<i>Helianthemum nummularium</i> 'Wisley Primrose'	Yellow Sunrose	3,4	1 Gal./ 12" o.c.	UF	☁	-	B	-

Table E.7 (continued). Intersection and View Restriction Palette (under 24 inches in height).

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	-	<u>24"-36"</u>	<u><i>Helictotrichon sempervirens</i></u>	<u>Blue oat grass</u>	<u>3</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>36" height only when in flower. Airy flowers. Groups of 3 maximum.</u>	<u>C</u>	-
<u>EG</u>	<u>DT</u>	-	<u>&lt; 24"</u>	<u><i>Ilex x 'Mondo'</i></u>	<u>Little Rascal Holly</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>E</u>	-
<u>EG</u>	-	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Juncus effusus</i> 'Carmen's Japan'</u>	<u>Carmen's Japanese Rush</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>C</u>	-
<u>EG</u>	-	-	<u>&lt; 24"</u>	<u><i>Juncus effusus</i> 'Spiralis'</u>	<u>Corkscrew soft rush</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>C</u>	<u>LOS A: Can be sheared more frequently if foliage collapses.</u>
<u>EG</u>	-	-	<u>24"-30"</u>	<u><i>Juncus patens</i> or <i>Juncus patens</i> 'Elk blue'</u>	<u>California gray rush</u>	<u>1.2</u>	<u>10 Cu. In. Plug/ 9" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Plant in bottom areas for sightlines</u>	<u>C</u>	<u>LOS A: Can be sheared more frequently if foliage collapses.</u>
<u>EG</u>	-	-	<u>&lt; 24"</u>	<u><i>Liriope muscari</i> and cultivars</u>	<u>Lily Turf</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>C</u>	<u>OK to pull clumps for ease of weed control.</u>
<u>EG</u>	<u>DR</u>	<u>NWN</u>	<u>&lt; 24"</u>	<u><i>Mahonia repens</i></u>	<u>Creeping Oregon holly-grape</u>	<u>3</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>E</u>	-
-	<u>DT</u>	-	<u>&lt; 24"</u>	<u><i>Narcissus</i> 'Dutch Master' or 'King Alfred'</u>	<u>Daffodil</u>	<u>3.4</u>	<u>Bulb/ As Shown</u>	<u>UF</u>	<u>∅</u>	-	<u>DS</u>	<u>Cut back foliage in summer.</u>

**Table E.7 (continued). Intersection and View Restriction Palette (under 24 inches in height).**

<b>EG</b>	<b>DT</b>	<b>NWN</b>	<b>Height from Ground</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Planting Zone</b>	<b>Suggested Size/ Spacing</b>	<b>Urban Frontage</b>	<b>Exposure</b>	<b>Design Comments</b>	<b>O&amp;M Code</b>	<b>Additional O&amp;M Comments</b>
	-	<u>NWN</u>	< 24"	<u>Potentilla fruticosa 'Sunset'</u>	<u>Frosty potentilla</u>	3.4	2 Gal./ 30" o.c.	<u>UF</u>	∅	-	<u>E</u>	-
<u>EG</u>	<u>DT</u>	-	< 24"	<u>Veronica liwanensis</u>	<u>Speedwell</u>	3,4,5	4" Pot/ 12" o.c.	<u>UF</u>	∅	-	<u>E</u>	<u>LOS A: Cut back for neater appearance.</u>

SEMI = Semi-evergreen

DT = Drought Tolerant

DR = Drought Resistant

NWN = Northwest Natives or Cultivars

UF = Urban Frontage (Mixed Use/Commercial) appropriate plants

☀ = Full Sun

∅ = Part Sun/Part Shade

LOS = Level of Service

Table E.8. Vertical Shrubs and Accent Plants.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
-	-	<u>NWN</u>	<u>25'</u>	<u><i>Amelanchier alnifolia</i></u>	<u>Service Berry</u>	<u>1,2,3</u>	<u>Multi-stem, B&amp;B, 5'-6' ht.</u>		<u>∅</u>	<u>Multi-stems are common.</u>	<u>E</u>	<u>May need windowing/ thinning.</u>
-	-	-	<u>5'</u>	<u><i>Cornus sanguinea</i> 'Midwinter Fire'</u>	<u>Midwinter Fire Dogwood</u>	<u>1,2,3</u>	<u>5 gal</u>		<u>☀,∅</u>		<u>E</u>	<u>Prune 2/3 of all (older) branches to 8" above ground in March to keep in bounds &amp; to maintain yellow twigs.</u>
-	-	<u>NWN</u>	<u>6' to 8'</u>	<u><i>Cornus sericea</i> 'Flaviramea'</u>	<u>Yellow-Twig Dogwood</u>	<u>1,2,3</u>	<u>5 gal</u>		<u>∅</u>		<u>E</u>	<u>Prune 2/3 of all (older) branches to 8" above ground in March to keep in bounds &amp; to maintain red twigs.</u>
-	-	-	<u>10'</u>	<u><i>Hamamelis x intermedia</i> 'Pallida'</u>	<u>Witch Hazel</u>	<u>3</u>	<u>10 gal</u>		<u>☀,∅</u>	<u>Vase-shaped open growing form</u>	<u>E</u>	<u>-</u>
-	-	-	<u>5'</u>	<u><i>Hydrangea quercifolia</i> 'Pee Wee'</u>	<u>Oak-Leaf Hydrangea</u>	<u>3</u>	<u>5 gal</u>		<u>∅</u>	<u>Late summer flowers. Fall color. Bold leaves in winter.</u>	<u>E</u>	<u>May need windowing/ thinning.</u>
<u>EG</u>	-	-	<u>3'-4'</u>	<u><i>Ilex glabra</i> 'Shamrock'</u>	<u>Inkberry</u>	<u>1,2</u>	<u>5 gal.</u>		<u>☀,∅</u>	<u>-</u>	<u>E</u>	<u>Female plants need a male pollinator to produce berries.</u>

Table E.8 (continued). Vertical Shrubs and Accent Plants.

EG	DT	NWN	Height from Ground	Scientific Name	Common Name	Planting Zone	Suggested Size/ Spacing	Urban Frontage	Exposure	Design Comments	O&M Code	Additional O&M Comments
-	-	-	3'-12'	<i>Ilex verticillata</i> & cultivated varieties	Winterberry	1,2	5 gal.		☀,☐	-	E	Female plants need a male pollinator to produce berries.
EG	-	-	8'-12'	<i>Mahonia</i> 'Arthur Menzies'	Ornamental Mahonia	3	5 gal.		☀,☐	Upright multi-stemmed.	E	-
EG	-	NWN	6'-10'	<i>Mahonia aquifolium</i>	Oregon grape	3	5 gal.		☀,☐	Upright multi-stemmed.	E	-
EG	-	-	5'	<i>Osmanthus</i> 'Goshiki'	Variegated Osmanthus	3	5 gal.		☐	4' wide. Considered dwarf. New foliage is colorful.	E	May need windowing/ thinning.
-	-	-	6'	<i>Physocarpus opulifolius</i> 'Nanus'	Dwarf Ninebark	1,2,3	5 gal.		☀,☐	Even dwarf form may be tall & wide.	E	May need windowing/ thinning.
EG	-	-	4'	<i>Pieris japonica</i> 'Little Heath'	Little Heath Lily of the Valley	3	3 gal.		☐	Variegated foliage that emerges pink in spring. Flowers in winter	E	May need windowing/ thinning.
-	-	NWN	8'	<i>Ribes sanguineum</i> & cultivated varieties	Red Flowering Currant	3	5 gal.		☐	Attracts hummingbirds	E	May need windowing/ thinning.
-	-	-	15'-20'	<i>Salix integra</i> 'Hakuro Nishiki'	Dappled Willow	1,2,3	5 gal.		☀,☐	-	E	Specify tree form; Prune to ground every other year to keep smaller

Table E.8 (continued). Vertical Shrubs and Accent Plants.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
-	-	-	8'-15'	<i>Sambucus nigra</i> 'Gerda'	Black Beauty Black Elder	1,2,3	5 gal.		☀,∅	-	E	-
-	-	NWN	6'	<i>Symphoricarpos albus</i>	Snowberry	1,2,3	5 gal		☀,∅	Forms thickets.	E	May need windowing/ thinning.
-	-	-	6'	<i>Taxodium distichum</i> 'Peve Minaret'	Dwarf bald cypress	1,2,3	-		-	-	E	-
<u>EG</u>	-	NWN	6'	<i>Vaccinium ovatum</i>	Evergreen Huckleberry	1,2,3	5 gal		☀,∅	-	E	-
-	-	-	6'	<i>Vaccinium</i> 'Sunshine Blue'	Blueberry	3	5 gal		☀,∅	Self-pollinating edible fruits. Good fall color.	E	-
<u>EG</u>	-	-	10'	<i>Viburnum cinnamomifolium</i>	Cinnamon Viburnum	3	10 gal		☀,∅	-	E	May need windowing/ thinning.
-	-	NWN	7'-12'	<i>Viburnum edule</i>	Highbush cranberry	1,2,3	5 gal.		☀,∅	-	E	-

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**Table E.9. Groundcovers if Low Profile is Required.**

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Ajuga reptans</i></u>	<u>Bugleweed</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>		<u>E</u>	<u>Can be pulled if grows beyond desired boundaries.</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Epimedium rubrum</i> or <i>sulphurescens</i> or cultivars</u>	<u>Barrenwort</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>		<u>B</u>	<u>Cut back foliage before flower stalks appear.</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Euonymus fortunei</i> 'Kewensis'</u>	<u>Winter- creeper euonymous</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,∅</u>		<u>E</u>	<u>Can be mowed to keep low.</u>
<u>SEMI</u>	<u>DT</u>	-	< 24"	<u><i>Geranium macrorrhizum</i> 'Album' or other cultivars</u>	<u>Hardy Geranium</u>	<u>3.4</u>	<u>1 Gal./ 18" o.c.</u>	<u>UF</u>	<u>☀,∅</u>		<u>B</u>	
-	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Maianthemum dilatatum</i></u>	<u>False Lily of the Valley</u>	<u>1,2,3,4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>Note tendency to spread</u>	<u>E</u>	<u>LOS A: Remove dead foliage in fall.</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Pachysandra terminalis</i></u>	<u>Japanese Spurge</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>		<u>C</u>	
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Sibbaldiopsis tridentata</i> (= <i>Potentilla tridentata</i>)</u>	<u>Three-toothed Cinquefoil</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>		<u>E</u>	
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Rubus tricolor</i></u>	<u>Creeping Chinese Bramble</u>	<u>3.4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>	<u>Tolerates deep shade. Not as aggressive or spiny as other <i>Rubus</i> groundcovers. Red fuzzy stems &amp; shiny leaves.</u>	<u>E</u>	

Table E.9 (continued). Groundcovers if Low Profile is Required.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Sedum divergens</i></u>	<u>Stonecrop</u>	<u>3,4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	<u>LOS A: For neater appearance deadhead.</u>
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Sedum requienii</i></u>	<u>Miniature Stonecrop</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-
-	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Vancouveria hexandra</i></u>	<u>Inside Out Flower</u>	<u>3,4</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>	-	<u>E</u>	-
<u>SEMI</u>	-	-	< 24"	<u><i>Potentilla neumanniana</i></u> <u>'Nana'</u>	<u>Dwarf cinquefoil</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>E</u>	-
<u>EG</u>	-	-	< 24"	<u><i>Ophiopogon japonicus</i></u> <u>'Nanus'</u>	<u>Dwarf mondo grass</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Can space at 15" o.c. for cost saving</u>	<u>E</u>	-

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Table E.10. Steppable Plants.

<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Height from Ground</u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Planting Zone</u>	<u>Suggested Size/ Spacing</u>	<u>Urban Frontage</u>	<u>Exposure</u>	<u>Design Comments</u>	<u>O&amp;M Code</u>	<u>Additional O&amp;M Comments</u>
<u>EG</u>	-	-	< 24"	<u><i>Ophiopogon japonicus</i></u> <u>'Nanus'</u>	<u>Dwarf mondo grass</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Can space at 15" o.c. for cost saving</u>	<u>E</u>	-
<u>SEMI</u>	-	-	< 24"	<u><i>Potentilla neumanniana</i></u> <u>'Nana'</u>	<u>Dwarf cinquefoil</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	-	<u>E</u>	-
<u>EG</u>	<u>DT</u>	<u>NWN</u>	< 24"	<u><i>Sedum oregonum</i></u>	<u>Stonecrop</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Sedum requienii</i></u>	<u>Miniature Stonecrop</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀,∅</u>	<u>Tolerates hot dry sites.</u>	<u>E</u>	-
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Thymus serpyllum</i></u> <u>'Elfin'</u>	<u>Elfin creeping thyme</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>☀</u>	-	<u>F</u>	-
<u>EG</u>	<u>DT</u>	-	< 24"	<u><i>Veronica liwanensis</i></u>	<u>Speedwell</u>	<u>3,4,5</u>	<u>4" Pot/ 12" o.c.</u>	<u>UF</u>	<u>∅</u>	-	<u>E</u>	<u>LOS A: Cut back for neater appearance.</u>

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Table E.11. Conifers (Deciduous and Evergreen).

<u>Scientific and Common Name</u>	<u>Mature Urban Height</u>	<u>Spread</u>	<u>Under Wires?</u>	<u>Min Strip Width</u>	<u>Planting Zone</u>	<u>Fall Color</u>	<u>SDOT List</u>	<u>Design Comments</u>
<u><i>Calocedrus decurrens</i>, Incense Cedar</u>	<u>75</u>	<u>15</u>	<u>No</u>	<u>8</u>	<u>3</u>			
<u><i>Metasequoia glyptostroboides</i>, Dawn Redwood</u>	<u>50</u>	<u>25</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>		<u>Fast growing deciduous conifer.</u>
<u><i>Pinus contorta</i>, Shore Pine</u>	<u>45</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>			
<u><i>Taxodium distichum</i>, Bald Cypress</u>	<u>55</u>	<u>35</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>Yes</u>		<u>A deciduous conifer, broadly spreading when mature – columnar when young.</u>
<u><i>Taxodium distichum</i> 'Mickelson', Shawnee Brave Bald Cypress</u>	<u>55</u>	<u>20</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Deciduous conifer – tolerates city conditions.</u>
<u><i>Thuja plicata</i> 'Excelsa' or 'Hogan', Western Red Cedar</u>	<u>40</u>	<u>15-20</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>			<u>Narrow columnar form.</u>

Table E.12. Medium/Large Broad-leaved Evergreen Trees.

<u>Scientific and Common Name</u>	<u>Mature Height</u>	<u>Spread</u>	<u>Under Wires?</u>	<u>Min Strip Width</u>	<u>Planting Zone</u>	<u>Fall Color</u>	<u>SDOT List</u>	<u>Design Comments</u>
<u><i>Lithocarpus densiflorus</i>, Tanoak</u>	<u>50</u>	<u>20</u>	<u>No</u>	<u>6</u>	<u>3</u>			
<u><i>Quercus Ilex</i>, Holly Oak</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Underside of leaf is silvery-white. Often has a prominent umbrella form. Prune for form.</u>
<u><i>Umbellularia californica</i>, Oregon Myrtlewood</u>	<u>60</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>			<u>Drought tolerant native in S. OR. Fruit looks like miniature limes.</u>

**Table E.13. Large Deciduous Columnar Trees.**

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u><i>Acer nigrum</i> 'Green Column', Green Column Black Sugar Maple</u>	<u>50</u>	<u>10</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	
<u><i>Ginkgo biloba</i> 'Princeton Sentry', Princeton Sentry Ginkgo</u>	<u>40</u>	<u>15</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Prune for form</u>
<u><i>Quercus robur</i> 'fastigiata', Skyrocket Oak</u>	<u>40</u>	<u>15</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	

Table E.14. Large Deciduous Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u><i>Acer saccharum</i> 'Commemoration' or 'Bonfire' Commemoration or Bonfire Sugar Maple</u>	<u>50</u>	<u>35</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Resistant to leaf tatter.</u>
<u><i>Fagus sylvatica</i>, Green Beech</u>	<u>50</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Silvery-grey bark. Can't handle root disturbance.</u>
<u><i>Fagus sylvatica</i> 'Asplenifolia', Fernleaf Beech</u>	<u>60</u>	<u>50</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Can't handle root disturbance.</u>
<u><i>Ginkgo biloba</i> 'Magyar', Magyar Ginkgo</u>	<u>50</u>	<u>25</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>More upright and narrow than 'Autumn Gold'. Needs training when young.</u>
<u><i>Liriodendron tulipifera</i>, Tulip Tree</u>	<u>60+</u>	<u>30</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Fast-growing tree.</u>
<u><i>Platanus x acerifolia</i> 'Bloodgood', Bloodgood London Planetree</u>	<u>50+</u>	<u>40</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>N/A</u>	<u>x</u>	<u>More anthracnose resistant than other varieties – large tree that needs space.</u>
<u><i>Quercus bicolor</i>, Swamp White Oak</u>	<u>60</u>	<u>45</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>N/A</u>	<u>x</u>	<u>Shaggy peeling bark. Wet-soil tolerant.</u>
<u><i>Quercus coccinea</i>, Scarlet Oak</u>	<u>60</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Good fall color.</u>
<u><i>Quercus imbricaria</i>, Shingle Oak</u>	<u>60</u>	<u>50</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Leaves can persist throughout the winter.</u>
<u><i>Quercus rubra</i>, Red Oak</u>	<u>60</u>	<u>45</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Fast growing oak – large tree that needs space. Heavy acorn producer.</u>
<u><i>Tilia tomentosa</i>, Silver Linden</u>	<u>60</u>	<u>50</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>Larger leaves than Littleleaf Linden. Fragrant flowers.</u>
<u><i>Ulmus</i> 'Frontier' or 'Morton Glossy', Frontier or Triumph Elm</u>	<u>50</u>	<u>35</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Resistant to Dutch elm disease.</u>
<u><i>Zelkova serrata</i> 'Greenvase' or 'Village Green' Green Vase or Village Green Zelkova</u>	<u>45</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Exfoliating bark. Dark green leaves turn orange-red and purple in fall.</u>

**Table E.15. Medium/Large Deciduous Trees.**

<u>Scientific and Common Name</u>	<u>Mature Height</u>	<u>Spread</u>	<u>Under Wires?</u>	<u>Min Strip Width</u>	<u>Planting Zone</u>	<u>Fall Color</u>	<u>SDOT List</u>	<u>Design Comments</u>
<u><i>Acer campestre</i> 'Evelyn', Queen Elizabeth Hedge Maple</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>More upright branching than the species.</u>
<u><i>Acer freemanii</i> 'Autumn Blaze', Autumn Blaze Maple</u>	<u>50</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Cross between red and silver maple – fast growing with good fall color.</u>
<u><i>Acer rubrum</i> 'Scarsen', Scarlet Sentinel Maple</u>	<u>40</u>	<u>25</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Leaves are darker green and larger than those of other Red Maples and hold up well in summer heat. Upright branch habit.</u>
<u><i>Aesculus x carnea</i> 'Briotii', Red Horsechestnut</u>	<u>30</u>	<u>35</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Do not use near greenways or bicycle routes due to litter. Resists heat and drought better than other horse chestnuts.</u>
<u><i>Betula nigra</i>, River Birch</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>-</u>	<u>Excellent flaky bark. Resistant to Bronze Birch Borer.</u>
<u><i>Cercidiphyllum japonicum</i>, Katsura tree</u>	<u>45</u>	<u>40</u>	<u>No</u>	<u>8</u>	<u>1,2,3</u>	<u>Yes</u>	<u>-</u>	
<u><i>Eucommia ulmoides</i>, Hardy Rubber Tree</u>	<u>50</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Dark green, very shiny leaves – insignificant fall color.</u>
<u><i>Fagus sylvatica</i> 'Rohanii', Purple Oak Leaf Beech</u>	<u>50</u>	<u>30</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Purple leaves with wavy margins.</u>
<u><i>Ginkgo biloba</i> 'Autumn Gold', Autumn Gold Ginkgo</u>	<u>45</u>	<u>35</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Narrow when young.</u>
<u><i>Nothofagus antarctica</i>, Antarctic Beech</u>	<u>50</u>	<u>35</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>No</u>	<u>x</u>	<u>Rugged twisted branching and petite foliage.</u>
<u><i>Quercus frainetto</i>, Italian Oak</u>	<u>50</u>	<u>30</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Drought resistant – green, glossy leaves in summer.</u>
<u><i>Sophora japonica</i> 'Regent', Japanese Pagodatree</u>	<u>45</u>	<u>40</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Has a rapid growth rate and tolerates city conditions, heat, and drought.</u>
<u><i>Tilia cordata</i> 'Greenspire', Greenspire Linden</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Symmetrical, pyramidal form. Fragrant flowers.</u>
<u><i>Ulmus parvifolia</i> 'Emer II', Allee Elm</u>	<u>45</u>	<u>35</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Exfoliating bark and good fall color – Resistant to Dutch Elm Disease.</u>

Table E.16. Medium Columnar Deciduous Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u><i>Acer rubrum</i> 'Bowhall', Bowhall Maple</u>	<u>40</u>	<u>20</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Upright, pyramidal form.</u>
<u><i>Carpinus betulus</i> 'Fastigiata', Pyramidal European Hornbeam</u>	<u>40</u>	<u>15</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Broadens when older.</u>
<u><i>Fagus sylvatica</i> 'Dawyck Purple', Dawyck Purple Beech</u>	<u>40</u>	<u>12</u>	<u>No</u>	<u>6</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Purple foliage.</u>
<u><i>Oxydendron arboreum</i>, Sourwood</u>	<u>35</u>	<u>12</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Consistent and brilliant fall color.</u>
<u><i>Nyssa sylvatica</i>, Tupelo</u>	<u>40</u>	<u>20</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Chunky bark. Takes standing water and drought.</u>

Table E.17. Medium Deciduous Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u><i>Acer rubrum</i> 'Karpick', Karpick Maple</u>	<u>40</u>	<u>20</u>	<u>No</u>	<u>6</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Finer texture than other narrow forms of columnar maple.</u>
<u><i>Acer truncatum</i> x <i>A. platanoides</i> 'Keithsform' or 'Warrenred', Norwegian or Pacific Sunset Maple</u>	<u>35</u>	<u>25</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Reliable reddish orange fall color.</u>
<u><i>Cladrastis kentukea</i>, Yellowwood</u>	<u>40</u>	<u>40</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>White flowers in spring, resembling wisteria flower – blooms profusely only every 2 to 4 years – yellow/gold fall color</u>
<u><i>Cornus controversa</i> 'June Snow', Giant Dogwood</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Frothy, 6-inch clusters of white flowers in June.</u>
<u><i>Corylus colurna</i>, Turkish Filbert</u>	<u>40</u>	<u>25</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Tight, formal, dense crown – Nice central leader. Not for mixed use areas with high pedestrian traffic dues to significant debris from nuts. Drought tolerant. Plant smaller sizes in order to facilitate establishment.</u>
<u><i>Magnolia denudata</i>, Yulan Magnolia</u>	<u>40</u>	<u>40</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>6" inch fragrant white flowers in spring.</u>
<u><i>Ostrya virginiana</i>, Ironwood</u>	<u>40</u>	<u>25</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Hop like fruit – slow growing</u>
<u><i>Pterostyrax hispida</i>, Fragrant Epaulette Tree</u>	<u>40</u>	<u>30</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Pendulous creamy white flowers – fragrant</u>
<u><i>Ulmus parvifolia</i> 'Emer I', Athena Classic Elm</u>	<u>30</u>	<u>35</u>	<u>No</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>High resistance to Dutch Elm Disease. Drought resistant. Cinnamon colored exfoliating bark.</u>

Table E.18. Small Conifer/Broad-leaved Evergreen Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<i>Chamaecyparis obtusa gracilis</i> , Slender Hinoki False Cypress	<u>15</u>	<u>6</u>	<u>Yes</u>	<u>5</u>	<u>3</u>			<u>Drought tolerant when established.</u>
<i>Embothrium coccineum</i> , Chilean Flame Tree	<u>30</u>	<u>15</u>	<u>No</u>	<u>5</u>	<u>3</u>			<u>Brilliant orange red flowers in late spring.</u> <u>Tree can sucker.</u>
<i>Eucryphia glutinosa</i> , Brushbush	<u>25</u>	<u>15</u>	<u>Yes</u>	<u>5</u>	<u>3</u>			<u>Semi-evergreen. Best in part shade.</u>
<i>Magnolia grandiflora</i> 'Edith Bogue', Edith Bogue Magnolia	<u>18</u>	<u>12</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>			<u>Excellent BLE magnolia due to</u> <u>hardiness.</u>
<i>Magnolia grandiflora</i> 'Victoria', Victoria Evergreen Magnolia	<u>25</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>N/A</u>	<u>x</u>	
<i>Magnolia maudiae</i> (= <i>Michelia maudiae</i> ), NCN	<u>25</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>			
<i>Magnolia virginiana</i>	<u>35</u>	<u>35</u>		<u>5</u>	<u>1,2,3</u>		<u>x</u>	
<i>Quercus hypoleucoides</i>	<u>30</u>	<u>15</u>	<u>No</u>	<u>5</u>	<u>3</u>			
<i>Quercus myrsinifolia</i> , Chinese Evergreen Oak	<u>30</u>	<u>15</u>	<u>No</u>	<u>5</u>	<u>3</u>			

Table E.19. Small Deciduous Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u><i>Acer buegerianum</i>, Trident Maple</u>	<u>30</u>	<u>30</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Must train to a single stem – interesting bark.</u>
<u><i>Acer circinatum</i>, Vine Maple</u>	<u>25</u>	<u>25</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Avoid using on harsh sites – native tree.</u>
<u><i>Acer griseum</i>, Paperbark Maple</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Peeling cinnamon colored bark.</u>
<u><i>Acer tartaricum</i>, Tartarian Maple</u>	<u>20</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>-</u>
<u><i>Acer triflorum</i>, Three-Flower Maple</u>	<u>25</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Multi seasonal interest with tan, exfoliating bark and red, orange/red fall color.</u>
<u><i>Amelanchier laevis</i> 'Snowcloud', Snowcloud Serviceberry</u>	<u>25</u>	<u>15</u>	<u>Yes</u>	<u>4</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>-</u>
<u><i>Asimina triloba</i>, Paw</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>N/A</u>	<u>x</u>	<u>Burgundy flower in spring before leaves.</u>
<u><i>Betula nigra</i> 'Little King', Little King River Birch</u>	<u>10</u>	<u>12</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>-</u>	<u>Suitable for enclosed vertical walls</u>
<u><i>Carpinus caroliniana</i>, American Hornbeam</u>	<u>25</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Good fall color (variable – yellow, orange, red)</u>
<u><i>Cornus kousa x nuttallii</i> 'Starlight', Starlight Dogwood</u>	<u>20</u>	<u>20</u>	<u>Yes</u>	<u>4</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>-</u>
<u><i>Lagerstroemia 'tuscarora'</i>, Tuscarora Hybrid Crape Myrtle</u>	<u>20</u>	<u>20</u>	<u>Yes</u>	<u>4</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Light cinnamon brown bark lends year round interest – drought resistant – likes a warm site</u>
<u><i>Maackia amurensis</i>, Amur Maackia</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Exfoliating bark – flowering in June or July – varies in intensity from year to year</u>
<u><i>Magnolia</i> 'Elizabeth', Elizabeth Magnolia</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>N/A</u>	<u>x</u>	<u>Yellowish to cream colored flower in spring.</u>

Table E.19 (continued). Small Deciduous Trees.

<b>Scientific and Common Name</b>	<b>Mature Height</b>	<b>Spread</b>	<b>Under Wires?</b>	<b>Min Strip Width</b>	<b>Planting Zone</b>	<b>Fall Color</b>	<b>SDOT List</b>	<b>Design Comments</b>
<u>Magnolia 'Galaxy', Galaxy Magnolia</u>	<u>25</u>	<u>25</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Suitable for enclosed vertical walls. Showy pink flowers.</u>
<u>Magnolia kobus 'Wada's Memory', Wada's Memory Magnolia</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Drought tolerant. Does not flower well when young.</u>
<u>Malus 'Lancelot' ('Lanzam'), Lancelot Crabapple</u>	<u>15</u>	<u>15</u>	<u>Yes</u>	<u>4</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Red flower buds, blooming white – red persistent fruit</u>
<u>Parrotia persica, Persian Parrotia</u>	<u>30</u>	<u>20</u>	<u>No</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>Blooms before it leafs out – drought tolerant – Varied fall color – reds, oranges and yellows.</u>
<u>Rhamnus purshiana, Cascara</u>	<u>30</u>	<u>20</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>x</u>	<u>Suitable for enclosed vertical walls</u>
<u>Salix matsudana 'Tortuosa', Corkscrew willow</u>	<u>30</u>	<u>15</u>	<u>Yes</u>	<u>5</u>	<u>1,2,3</u>	<u>Yes</u>	<u>-</u>	<u>Do not use with underdrain.</u>
<u>Stewartia pseudocamellia, Japanese Stewartia</u>	<u>25</u>	<u>15</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>-</u>	<u>Camellia-like flowers in summer. Interesting bark. Slow grower.</u>
<u>Styrax japonica, Japanese Snowbell</u>	<u>25</u>	<u>25</u>	<u>Yes</u>	<u>5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Reliable and easy to grow, it has plentiful, green ½" inch seeds. Flowers similar to lily in the valley.</u>
<u>Tilia cordata 'Chancole' or 'De Groot', Chancellor or De Groot Littleleaf Linden</u>	<u>30+</u>	<u>20</u>	<u>No</u>	<u>C = 6, D = 5</u>	<u>3</u>	<u>Yes</u>	<u>x</u>	<u>Pyramidal when young. Fragrant flowers that attract bees. One of the smaller stature littleleaf lindens.</u>



Table E.621. Plants Suitable for the Upper Side Slopes of a Biofiltration Swale.

				Grasses (drought-tolerant, minimum mowing)				
EG	DT	NWN	Agg <sup>1</sup> a	Scientific Name	Common Name	Application	Mowable	
							<i>Buchloe dactyloides</i>	Buffalo grass
							<i>Festuca</i> spp. (e.g., Many Comments)	Dwarf fescue
							<i>Festuca amethystina</i>	Tufted fescue
<b>Groundcovers</b>						A	<i>Festuca arundinacea</i>	tall fescue
EG	DT	NWN	A	<i>Achillea millefolium</i>	Common yarrow		<i>Festuca ovina duriuscula</i> (e.g., Reliant, Aurora)	Sheep fescue
	DT	NWN		<i>Arctostaphylos uva-ursi</i>	Kinnikinnick		<i>Festuca idahoensis</i>	Idaho fescue
	DT	NWN		<i>Allium Cernum</i>	Nodding onion		<i>Festuca rubra</i>	Creeping red fescue
SEMI	DT			<i>Epimedium grandiflorum</i>	Epimedium	A	<i>Festuca rubra var. commutata</i>	Chewing fescue
EG	DT			<i>Euonymus fortunei</i>	Wintercreeper	A		
EG	DT	NWN	A	<i>Fragaria chiloensis</i>	Beach strawberry		<i>Helictotrichon sempervirens</i>	Blue fescue
		NWN		<i>Lupinus latifolius</i>	Broadleaf lupine			
	DT			<i>Omphalodes verna</i>	Creeping forget me-not			
EG	DT		A	<i>Rubus calycinoides</i>	Strawberry vine			
EG	DT	NWN		<i>Sedum oreganum</i>	Oregon stonecrop			
EG	DT	NWN		<i>Sedum divergens</i>	Cascade stonecrop			
EG	DT		A	<i>Trifolium repens</i>	White lawn clover	S	M	

M = Mowable

<sup>1</sup>a Aggressive category indicates plants to be used with caution or avoided in confined sites (e.g., right-of-way plantings), near greenbelts, etc. due to maintenance concerns

Note: Plants with mature height over 3' should be grouped in masses no wider than 12' mature width with openings of minimum 10' between tall plant masses.

Note: Designer needs to respond to the size and aspect of the individual facility when selecting plants to be used.

Table E.722. Recommended Plants for Wet Biofiltration Swales.

EG	DT	NWN	Agg <sup>1a</sup>	Scientific Name	Common Name	Application	Mowable	Comments
SEMI	DT	NWN		<i>Agrostis exarata</i>	Spike bentgrass	S		
EG	DT		A	<i>Agrostis tenuis</i> or <i>capillaris</i>	Colonial bentgrass	S		
				<i>Alopecurus aequalis</i>	Shortawn foxtail	S	M	
				<i>Alopecurus geniculatus</i>	Water foxtail	S	M	
				<i>Eleocharis</i> spp.	Spike rush			
SEMI				<i>Carex densa</i>	Dense sedge			
EG		NWN		<i>Carex obnupta</i>	SloUGH sedge			
SEMI		NWN		<i>Carex stipata</i>	Sawbeak sedge			
				<i>Carex</i> spp.	Sedge			
EG	DT		A	<i>Festuca arundinacea</i> var.	Tall fescue grass	S	M	
EG	DT	NWN	A	<i>Festuca rubra</i>	Creeping red fescue	S	M	
				<i>Glyceria occidentalis</i>	Western mannagrass			
EG	DT		A	<i>Juncus effusus</i>	Soft (common) rush			

<sup>1a</sup> Aggressive category indicates plants to be used with caution or avoided in confined sites (e.g., right-of-way plantings), near greenbelts, etc. due to maintenance concerns

Note: Plants with mature height over 3' should be grouped in masses no wider than 12' mature width with openings of minimum 10' between tall plant masses.

Note: Designer needs to respond to the size and aspect of the individual facility when selecting plants to be used.

## Sand Filters

Table E.823. Recommended Plants for Sand Filters.

EG	DT	NWN	Agg <sup>†</sup>	Scientific Name	Common Name	BMP Comments	
<u>EG</u>	<u>DT</u>	<u>NWN</u>	<u>Agg<sup>a</sup></u>	<u>Scientific Name</u>	<u>Common Name</u>	<u>Application</u>	<u>Mowable</u>
<b>Basin Sides</b>							
	DT	NWN		<i>Achillea millefolium</i>	Yarrow	S	
EG	DT			<i>Agrostis alba</i>	Redtop	S	M
EG	DT	NWN		<i>Agrostis exerata</i>	Spike bentgrass	S	M
EG	DT			<i>Agrostis palustris</i>	Creeping bentgrass	S	M
	DT			<i>Alopecurus pratensis</i>	Meadow foxtail	S	M
EG	DT	NWN		<i>Bromus carinatus</i>	California Brome	S	M
	DT	NWN		<i>Calamagrostis nutkaensis</i>	Pacific reed grass		
EG	DT	NWN		<i>Elymus glaucus</i>	Blue wildrye	S	M
EG	DT	NWN		<i>Elymus mollis</i>	Dune wildrye	S	M
EG	DT	NWN	A	<i>Juncus effusus</i>	Soft rush	S	
	DT	NWN		<i>Lupinus albicaulus</i>	Sickle keeled lupine	S	
EG	DT	NWN		<i>Luzula multiflora</i>	Field woodrush	S	
	DT		A	<i>Poa palustris</i>	Fowl bluegrass	S	M
EG			A	<i>Poa pratensis</i>	Kentucky bluegrass	S	M
<b>Pond Bottom (Sand Surface)</b>							
EG	DT			<i>Agrostis tenuis</i>	Colonial bentgrass (Highland strain good)	S	M
	DT			<i>Buchloe dactyloides</i>	Buffalo grass	S	M
	DT	NWN		<i>Camassia leichlinii</i> or <i>quamash</i>	camas		
EG	DT	NWN		<i>Carex mertensii</i>	Merten's sedge	S	
EG	DT	NWN		<i>Festuca elatior</i> (arundinacea)	Tall fescue	S	M
EG	DT	NWN		<i>Festuca elatior</i> "Many Mustang", "Silverado"	Dwarf tall fescues	S	M
EG	DT	NWN		<i>Fescue roemerii</i> (idahoensis)	Roemer's or Idaho fescue	S	
EG	DT	NWN		<i>Festuca rubra</i>	Red fescue	S	M
SEMI	DT	NWN		<i>Iris missouriensis</i>	Rocky Mountain iris		
EG	DT	NWN		<i>Juncus tenuis</i>	Slender rush	S	
EG	DT			<i>Lolium perenne</i>	Perennial ryegrass	S	M
EG	DT	NWN		<i>Luzula parviflora</i>	Small flowered woodrush	S	
EG	DT			<i>Trifolium repens</i>	White lawn clover	S	M
EG	DT			<i>Zoysia tenuifolia</i>	Korean grass	S	M

EG = Evergreen

SEMI = Semi-Evergreen

DT = Drought Tolerant/Resistant

NWN = Northwest Natives or Cultivars

~~DT = Drought Tolerant/Resistant~~

~~S = Allowable as seed~~

~~NWN = Northwest Natives or Cultivars~~

A = Aggressive

S = Allowable as seed

M = Mowable

~~M = Mowable~~

<sup>a</sup> Aggressive category indicates plants to be used with caution or avoided in confined sites (e.g., right-of-way plantings), near greenbelts, etc., due to maintenance concerns

Note: Plants with mature height over 3' should be grouped in masses no wider than 8' mature size with openings of min. 10' between tall plant masses.

Note: Designer needs to respond to the size and aspect of the individual facility when selecting plants to be used.

## Wet Ponds

Table E.924. Plants for Wet Pond Peripheries.

EG	DT	NWN	Agg <sup>1</sup>	Scientific Name	Common Name	BMP Comments	
						Application <sup>2</sup>	Mature Height
<b>Trees to Provide Shading<sup>3</sup></b>							
EG	DT	NWN	Agg <sup>a</sup>	Scientific Name	Common Name	BMP Comments	
						Application <sup>b</sup>	Mature Height
<b>Trees to Provide Shading<sup>c</sup></b>							
	DT	NWN		<i>Acer circinatum</i>	Vine maple	W	25'
				<i>Betula nigra</i>	River birch	W	40'
EG		NWN		<i>Myrica californica</i>	Pacific wax myrtle		18'
				<i>Nyssa Sylvatica</i>	Tupelo	W	40'
		NWN		<i>Oemleria cerasiformis</i>	Indian plum		10'
		NWN		<i>Prunus emarginata</i>	Wild cherry		40'
				<i>Taxus brevifolia</i>	Pacific yew		40'
EG	DT	NWN		<i>Thuja plicata</i>	Western red cedar	W	40'
<b>Small Trees / High Shrubs with Fibrous Roots for Berms</b>							
		NWN		<i>Acer circinatum</i>	Vine maple	W	25'
		NWN		<i>Amelanchier alnifolia</i>	Serviceberry		25'
EG	DT			<i>Arbutus unedo</i>	Strawberry tree		25'
		NWN		<i>Comus Stolonifera</i>	Red twig dogwood	W	20'
		NWN		<i>Corylus comuta</i> var. <i>cornuta</i>	Filbert		20'
		NWN		<i>Physocarpus capitatus</i>	Pacific ninebark		12'
		NWN	A	<i>Rubus spectabilis</i>	Salmonberry	W	8'
		NWN		<i>Sambucus racemosa</i>	Red elderberry		10'
				<i>Vaccinium opulus</i>	Highbush cranberry		10'
				<i>Vaccinium</i> spp.	Blueberry		4'–12'
<b>Low Shrubs and Grasses with Fibrous Roots for Berms</b>							
EG		NWN		<i>Arctostaphylos uva-ursi</i>	Kinnikinnick		0.5'
				<i>Cistus</i> spp.	Rock rose		2'–4'
SEMI		NWN		<i>Deschampsia cespitosa</i>	Tufted hairgrass		3'
EG	DT			<i>Festuca arundinacea</i>	tall fescue grass		3'
EG	DT			<i>Festuca ovina duriuscula</i> (e.g., Reliant, Aurora)	Sheep fescue		1'
		NWN		<i>Festuca rubra</i>	red fescue	W	0.5'
EG		NWN		<i>Gaultheria shallon</i>	Salal		4'
				<i>Helictotrichon sempervirens</i>	blue oatgrass		3'
EG		NWN		<i>Ledum groenlandicum</i>	Labrador tea	W	5'
				<i>Polystichum munitum</i>	sword fern	W	4'

		NWN	A	<i>Symphoricarpus albus</i>	Snowberry		5'
			(A)	e.g., <i>Miscanthis</i> , <i>Pennisetum</i>	Ornamental grasses		varies

EG = Evergreen

NWN = Northwest Natives or Cultivars

SEMI = Semi-Evergreen

A = Aggressive

DT = Drought Tolerant/Resistant

W = Wet Tolerant

<sup>a</sup> Aggressive category indicates plants to be used with caution or avoided in confined sites (e.g., right-of-way plantings), near greenbelts, etc., due to maintenance concerns

<sup>b</sup> Tolerant of occasional saturated soils or minimal inundation (< 6" depth) for short periods (< 72 hours).

<sup>c</sup> If BMP has a liner, designer should review plants accordingly; trees generally are not appropriate to liner conditions.

Note: Plants with mature height over 3' should be grouped in masses no wider than 8' mature size with openings of min. 10' between tall plant masses.

Note: Designer needs to respond to the size and aspect of the individual facility when selecting plants to be used.

Note: Many factors contribute to waterfowl use of ponds and adjacent areas. Designers should investigate site-specific conditions and best practice methods to discourage waterfowl use as necessary.

## E-10. Drywell Sizing Tables

The City has determined that the most common small project overflow scenario consists of a drywell situated downstream of a bioretention cell or a permeable pavement facility.

Table E.25 and Table E.26 specify the required area for drywells of 4-foot and 6-foot depths to be used as overflow/point of discharge downstream of a bioretention cell or a permeable pavement facility for parcel-based and single-family residential projects, respectively.

**Table E.25. Parcel-Based Projects: Drywell Sizing Downstream of Bioretention Sized for 91% Infiltration or Permeable Pavement Facility.**

Contributing Area (sf)	Drywell Area (sf) <sup>a, b, c</sup>	
	Drywell Depth = 4 ft	Drywell Depth = 6 ft
500	27	19
1,000	98	67
1,500	164	115
2,000	240	169
2,500	314	222
3,000	390	278
3,500	468	336
4,000	548	396
4,500	630	459
5,000	713	524

<sup>a</sup> Sizing was performed using a 5-minute computational time-step and the "Seattle 38" 158-year synthetic precipitation series.

<sup>b</sup> Drywell was sized to minimize the 25-year peak flow target to no more than 0.0001 cfs. Drywell design/modeling representation included a 4-foot or 6-foot depth, 25 percent porosity, 0.25 in/hr native soil infiltration rate, and a variable length and width.

<sup>c</sup> Bioretention design/modeling representation included 6 inches of ponding, 0.25 in/hr native soil infiltration rate, 3H:1V BMP side slopes, 12-inch bioretention soil thickness, 40 percent porosity, 3 in/hr bioretention soil infiltration rate, and a 12-inch overflow structure diameter.

**Table E.26. Single-Family Residential Projects: Drywell Sizing Downstream of Bioretention Sized for 95% Infiltration or Permeable Pavement Facility**

<b>Contributing Area (sf)</b>	<b>Drywell Area (sf)</b>	
	<b>Drywell Depth = 4 ft</b>	<b>Drywell Depth = 6 ft</b>
<u>500</u>	<u>14</u>	<u>9</u>
<u>1,000</u>	<u>71</u>	<u>49</u>
<u>1,500</u>	<u>130</u>	<u>90</u>
<u>2,000</u>	<u>200</u>	<u>137</u>
<u>2,500</u>	<u>260</u>	<u>184</u>
<u>3,000</u>	<u>326</u>	<u>234</u>
<u>3,500</u>	<u>393</u>	<u>286</u>
<u>4,000</u>	<u>462</u>	<u>341</u>
<u>4,500</u>	<u>532</u>	<u>399</u>
<u>5,000</u>	<u>605</u>	<u>458</u>

<sup>a</sup> Sizing was performed using a 5-minute computational time-step and the “Seattle 38” 158-year synthetic precipitation series.

<sup>b</sup> Drywell was sized to minimize the 25-year peak flow target to no more than 0.0001 cfs. Drywell design/modeling representation included a 4-foot or 6-foot depth, 25 percent porosity, 0.25 in/hr native soil infiltration rate, and a variable length and width.

<sup>c</sup> Bioretention design/modeling representation included 6 inches of ponding, 0.25 in/hr native soil infiltration rate, 3H:1V BMP side slopes, 12-inch bioretention soil thickness, 40 percent porosity, 3 in/hr bioretention soil infiltration rate, and a 12-inch overflow structure diameter.

Drywells that do not meet the above design criteria and the assumptions outlined below shall be sized to meet the Peak Control Standard per *Volume 3, Section 5.4.3*. For projects that discharge directly to a drywell (if a bioretention cell or permeable pavement facility are not feasible upstream), the drywell shall be sized to meet the Peak Control Standard per *Volume 3, Section 5.4.3*.