

SECTION 9

STORMWATER SITE PLAN (SSP) AND TEMPORARY CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP) REQUIREMENTS

9 - 01 SSP AND SWPPP DESIGN REQUIREMENTS

SSP AND SWPPP water quality and quantity facilities shall be prepared in accordance with the Washington State Department of Ecology's *Stormwater Management Manual for Western Washington (SWMMWW)* as amended in *BIMC 15.20*. Follow Chapter 3 Volume I of the SWMMWW and the Low Impact Development Technical Guidance Manual for Puget Sound for – "Preparation of Stormwater Site Plans". Follow "Construction Stormwater Pollution Prevention" in Volume 2 of the SWMMWW to prepare the Temporary Construction SWPPP.

In addition, the applicable "General Requirements" of Section 3 shall be met. The following additional design requirements shall also apply:

1. Cross-sections of fill/grading may be required on the plans through all properties and at least 30 feet beyond the property lines or 100 feet beyond the limit of construction, whichever is less. Cross-sections shall be shown at 50 feet minimum intervals or as appropriate across the total width/length of the property. These are minimum requirements and additional cross-sections may be warranted depending upon site conditions.
2. The fill/grading plan shall be designed so as not to affect any public right-of-way or adjacent properties.
 3. No fill or cut side slopes exceeding 4 feet in height shall be steeper than two (2) horizontal to one (1) vertical unless a geotechnical report dictates otherwise.
 4. Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
 - During the dry season (May 1-September 30): 7 days
 - During the wet season (October 1- April 30): 2 days.

9 - 02 SSP PLAN REQUIREMENTS

The applicable "General Plan Requirements" in Section 3 shall be shown on the plans. The following applicable fill and grading plan requirements shall also be shown on the plans:

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1. Easement widths and locations.
2. The fill and/or excavation quantities in cubic yards.
2. The type of fill material and compaction requirements.
4. If required cross-sections at 50 feet (50') minimum intervals showing the fill/grading shall be shown on the plans through all properties, and 30 feet (30') beyond the property lines or 100 feet (100') beyond the limit of construction, whichever is less. Scale shown shall be consistent with requirements of Section 3.
5. Show all existing and proposed storm pipes including locations, lengths, materials, slopes, elevations, sizes, rims, and inverts.
6. Manholes and catch basins including locations, types, and rim and invert elevations. All new and existing manholes and catch basins shall be numbered consecutively.
7. The distance from the center line of pipes or edge of any stormwater facility to any building structure, in close proximity.
8. All manholes and catch basins in public right-of-way or easements shall be adjusted to final grade during or after final paving, in accordance with the City's standard.
9. Indicate the minimum groundwater depth.
10. Existing utilities and identification of possible utility conflicts
11. An all-weather maintenance access to all structures, ditches, ponds, etc., including typical cross-section of said access road.

9 - 03 SWPPP PLAN REQUIREMENTS

Refer to the City's standard Stormwater Pollution Prevention Plan (SWPPP) made available for residential and small sites.

9 - 07 CONVEYANCE SYSTEMS - GENERAL

A conveyance system includes all portions of the surface water system, either natural or man-made, that transport storm and surface water runoff. The purpose of the conveyance system is to drain surface water from properties, up to a specific design flow, so as to provide protection to property and the environment.

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Properly designed pipe systems will maximize hydraulic efficiency by utilizing proper material, slope, and pipe size. An ideal channel section will be sized to provide adequate capacity for design flows while minimizing erosion and allowing for aesthetics, habitat preservation, and enhancement of water quality.

A man-made conveyance system should emulate the natural conveyance system to the maximum extent feasible. Inflow to the system and discharge from the system should occur at the natural drainage points as determined by topography and existing drainage patterns.

From a water quality standpoint, bioswales the preferred method of conveyance.

However, there are several parameters which will affect the type of conveyance system chosen. Some of these, in addition to water quality, are road capacity, parking requirements, sidewalks, planter strips, topography, available right-of-way, etc.

Developers are encouraged to use innovative designs that will meet on-site stormwater management and water quality treatment requirements, yet still make provisions for the roadway section design parameters as listed above. For more information see the *stormwater manual as amended in BIMC 15.20*.

9 - 08 CONVEYANCE SYSTEMS - OPEN CHANNELS

Vegetation-lined channels (including "bio-engineered" vegetation a.k.a. "Biofiltration Swales") are the preferred type of constructed channels when properly designed and constructed. The vegetation stabilizes the slopes of the channel, controls erosion of the channel surface, and removes pollutants. The channel storage, low velocities, water quality benefits, and greenbelt multiple-use benefits create significant advantages over other constructed channels. The presence of vegetation in channels creates turbulence which results in loss of energy and increased flow retardance; therefore, the design engineer must consider sediment deposition and scour, as well as flow capacity.

Vegetation-lined channels or ditches as depicted on Standard Drawing 9-010 are intended to treat runoff from the applicable road or street. They are not intended to treat runoff from abutting properties unless specifically approved by the Engineer.

Rock-lined channels are necessary where a vegetative lining will not provide adequate protection from erosive velocities. They may be constructed with quarry spall riprap, gabions, or slope mattress linings. The rock lining increases the turbulence, resulting in a loss of energy and increased flow retardance.

Rock lining also permits a higher design velocity and therefore a steeper design slope than in grass-lined channels. Rock linings are also used for erosion control at culvert/storm drain outlets, at sharp channel bends, channel confluences, and locally steepened channel sections. Rock lined

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channels should only be used when careful consideration has shown that vegetated channels are not feasible.

On grades up to 6%, open, vegetation-lined channels (biofiltration or bioretention swales) are the preferred method of conveyance.

Where the grade is over 6% but not over 8%, the city engineer may require use of a standard rock-lined ditch (check dams) or alternatively a closed (pipe) drainage system under a paved shoulder with asphalt thickened edge or turnpike shoulder.

1. Rock lining for ditches shall be in accordance with section 9-13.1(5) of the *WSDOT/APWA Specifications*. Rock gradation shall be as follows:

Passing 8-inch square sieve	100%
Passing 3-inch square sieve	40% max.
Passing 3/4-inch square sieve	10% max.

Under exceptional conditions of erodibility or water velocity, the Engineer may require more stringent methods to control erosion. In conditions of low flow, which limit water volume and velocity, the Engineer may permit less stringent methods of control.

Open systems shall be designed with sided slopes no steeper than 1 vertical to 3 horizontal and back slopes no steeper than 1 vertical to 2 horizontal with adequate slope stabilization and a minimum freeboard of one foot (1').

Ditches may be either "V" shaped or trapezoidal.

Open ditches designed at 2 to 5 fps shall be hydro-seeded with a grass approved by the city engineer. Steep grades (5 to 15 fps) will require rock spills, (check dams) riprap, or other approved energy dissipation methods.

Ditch cross-sections may be required to be provided at a minimum of every fifty feet (50') on separate sheets.

Biofiltration and bioretention swales shall meet the requirements of the *stormwater manual as amended in BIMC 15.20*.

9 - 09 CONVEYANCE SYSTEMS - PIPE SYSTEMS

See WSDOT Standard Plans B60.40-00, B60.20-00, B-55.20-00 and City of Bainbridge Standard Drawings 9-020, 9-030, 9-230,

Pipe systems are networks of storm sewer or drain pipes, catch basins, manholes, inlets and outfalls designed and constructed to convey storm and surface water.

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Where required a pipe system shall be provided for curb street sections whenever the length of surface drainage on road grade extends either direction from crest vertical curves 150 feet for road grades under 1%, 200 feet for road grades from 1% to 3%, or 300 feet for road grades 3% and greater. For inlet and catch basin spacing, see Section 9-13.

Minimum Size

Storm sewer or drain pipes shall be minimum 12-inch diameter. Runoff shall be computed and, if the flow requires it, larger pipe shall be used.

The minimum pipe size diameter for private storm lines shall be 4 inches (4"). The minimum pipe size diameter for public storm lines shall be 12 inches (12"), and 8 inches (8") for laterals. The pipe shall be extended full width of the property to be served.

Special Cases

Pipes connecting single inlets to main storm sewer by structure (i.e., catch basins) shall be 12-inch diameter minimum, and single inlets shall be catch basins with sumps. In special cases, such as shallow gradients or conflicts with underground utilities, pipe may be 8-inch diameter minimum, to a maximum length of 60 feet and inlets may be concrete inlets as shown on Standard Drawing 9-020. Wyes or Tees

In general, connections to a pipe system should be made only at catch basins or manholes. Wyes or Tees will be allowed on roof/footing/yard drain systems for pipes 8 inches in diameter, or less, with adequate cleanouts to maintain the system. Other uses of wyes or tees will be evaluated by the Engineer on a case-by-case basis.

Pipe Placement & Materials

Placement requirements for culverts and storm sewer installation shall be as indicated in the *WSDOT/APWA Specifications* Sections 7-02 and 7-04, respectively, and AASHTO Specifications. Pipe materials including concrete, CMP, and PVC shall comply with Section 9-05 of the *WSDOT/APWA specifications* with the following additions and clarifications:

1. Double walled (smooth interior) corrugated polyethylene pipe, meeting the requirements of AASHTO M 252 in 8-inch size and AASHTO M 294 in sizes 12" through 36", is an acceptable alternative for schedule A culvert pipe for storm sewers in accordance with these Standards. Bedding for this pipe must be carefully placed in accordance with manufacturers specifications.

The ends of the pipe shall be beveled to match the slope. Corrugated polyethylene pipe shall not be used when beveled slopes are flatter than 4:1. For any pipe length

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section that is to be beveled on the end, the minimum length of the unbeveled portion of the pipe shall be 6 feet.

The pipe shall be installed in a design A trench as shown on Standard Drawing 9-240 and WSDOT Standard Plan B-55.20-00. For burial depths exceeding 15 feet, the pipe shall be installed in accordance with the manufacturer's recommendations and these Standards.

2. Galvanized corrugated steel pipe shall have asphalt coating Treatment 1 as specified in *WSDOT/APWA Specification* Section 9-05.4(3). Aluminum and Aluminized steel pipe may be used without treatment where alternate materials are permissible (i.e., different types of storm sewer pipe, polyethylene, etc.), such alternate materials shall be clearly denoted on the road construction plans. Alternate materials may be substituted in the field subject to written approval of the Engineer in accordance with these Standards.

Pipe Joints

Generally, all pipe shall be tightly joined. Concrete pipe shall be rubber-gasketed in accordance with Section 9-05.7(3) of the *WSDOT/APWA Specifications*. Metal pipe shall be gasketed and securely banded. *WSDOT/APWA Plans B-60.40-00* apply. Corrugated Polyethylene Pipe (CPP) shall be joined by split corrugated couplings, with gaskets, which fully engage at least two corrugations on each side of the pipe joint and exceed the soil tightness requirements of the *AASHTO Standard Specifications for Highway Bridges, Section 23(2.23.3)*. Where a watertight joint is required for CPP, pipe and couplings shall have received approval from the *WSDOT New Products Committee* and upon installation, meet the low pressure air test requirements of *WSDOT/APWA Specification Section 7-04.3*.

Leak Testing

Leak testing as set forth in Section 7-04.3 of the *WSDOT/APWA Specifications* will not be required unless specified by the Engineer or the developer's engineer. Examples of where leak testing may be warranted include but are not limited to areas where significant leakage would cause instability in fill slopes, or areas where sewers are to be installed below the water table, or areas where significant amounts of ground percolation or ground water intrusion are anticipated.

Where leak testing for sewer pipe is deemed necessary by the Engineer or by the developer's engineer, it shall be determined during the design/review process prior to approval of plans for construction and shall be clearly called out on the road construction plans.

Gradients

Storm drain gradients shall provide a minimum flowing full velocity of 2 fps and a maximum of 10 fps.

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Pipe Ends

On driveway culverts, cross culverts, and pipe ends projecting from driveway or roadway side slopes that could create a hazard or restrict flow shall be beveled as shown on Standard Drawing 9-030.

All exposed storm line ends 15 inches (15") in diameter and larger may be required to have trash racks at both the inlet and outlet ends, in accordance with the City's Standard Drawing No. 9-290. Verify the requirement with the city engineer.

Exposed live storm lines shall have rock riprap at both the inlet and outlet ends.

Culverting of Streams

Natural streams should not be placed in pipes except for essential roadway crossings as determined by the Engineer and subject to review by the Washington State Department of Fisheries and Wildlife and other State & Federal Agencies which have jurisdiction.

9 - 10 DRAINS

Drains, including underdrains, shall conform to Section 7-01 of the WSDOT/APWA Specifications. Authorized pipe materials shall be as specified in section 7-01.2 of the WSDOT/APWA Specifications and the current revisions of the AASHTO M 252 or M 294 Specifications.

9 - 11 GEOTEXTILE FABRIC FOR DRAINS

Geotextile filter fabric shall be placed in underdrain trenches in accordance with the manufacturer's recommendations and Section 2-12 Construction Geosynthetic of the WSDOT Standard Specifications.

9 - 12 CATCH BASINS, MANHOLES, AND INLETS

Maximum spacing on surface drainage courses between inlets or catch basins shall be 150 feet on road grades less than 1.0% and 200 feet on grades from 1% up to 3.0%. When road grades are 3.0% or greater, maximum spacing shall be 300 feet. Additional catch basins shall be installed as needed to confine drainage to the gutter and prevent street drainage from sheet flowing across roadways or intersections.

On storm sewers with depths less than five feet to the invert of the lowest pipe, catch basins may be one of the following or premanufactured catch basin of appropriate size and capacity meeting WSDOT/APWA specifications:

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CB Type 1	WSDOT Standard Plan B-5.20-01
CB Type 1-L	WSDOT Standard Plan B-5.40-01
CB Type 2	WSDOT Standard Plan B-10.20-01

On storm sewers with depths five feet and over to invert of the lowest pipe, joining or inlet structures shall be CB Type 2. Where a structure is needed for access or for juncture of storm sewers, but not for catchment of silt, the structure shall be one of the following types of manhole in suitable size:

MH Type 1	WSDOT Standard Plan B-15.20-01
MH Type 2	WSDOT Standard Plan B-15.40-01

Reinforcing details for manhole top slabs are shown on WSDOT Standard Plan B-30.90-01.

Extension sections or risers shall be installed as indicated on the above referenced standard drawings for catch basins and manholes.

Catch basin and manhole ladders, steps, and handholds shall conform to WSDOT Standard Plan B-30.90-01.

Section 7-05 of the WSDOT/APWA Specifications shall apply, unless otherwise specified, to catch basins, curb inlets, and manholes.

On new subdivisions with curb and/or sidewalks, adequate measures shall be taken to control surface drainage from yards and roof drains so that sheet flow across roadways and walkways is avoided.

Match pipe crown at manholes and catch basins.

The minimum longitudinal gutter slope shall be 0.5 percent (0.5%).

Catch basins or manholes shall be installed at all junctions of two or more connecting storm drainage pipes, changes in direction, slope, and pipe size for all pipes larger than 6 inches (6").

Catch basins shall be installed at all low points in the surface drainage area.

At gutter line low points, insure positive flow to catch basins. In some situations, this may require variation from the vertical curve at the low point in the gutter line.

Inlet capacity shall be provided in accordance with the WSDOT's hydraulic manual.

9 - 13 FRAMES, GRATES, AND COVERS

See WSDOT Standard Plans B-30.30-01, B-30.20-02, B-30.70-03 or their successor(s).

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When a structure does not function as an inlet, a Solid Metal Cover for Catch Basin, shall be used.

On new catch basins Type 2 not serving as inlets and on manholes functioning exclusively as access structures, a round locking cover and frame shall be used.

Block lettering shall be embossed on the top surfaces of grates and covers as follows:

1. "DRAIN" - 3" letters on all solid covers.
2. "OUTFALL TO STREAM DUMP NO POLLUTANTS" - 1/2" letters on all grates.
3. "CONFINED SPACE" as directed by the city engineer.

If required all solid covers and grates shall be secured with 5/8" Stainless Steel Socket Head Cap Screws as depicted on the Standard Drawings.

A light coating of anti-seize thread compound shall be applied to the screws at the time of installation. The anti-seize compound used shall be Loctite 767 or approved equal. Anti-seize compound shall be applied according to the manufacturer's recommendations.

Other locking devices are acceptable subject to approval by the Engineer.

Unless otherwise specified, cast (gray) iron products shall conform to ASTM Designation A48 Class 30 and ductile iron to ASTM Designation A526 Grade 80-55-06. Strength requirements of Federal Specification RR-F-621D will apply.

9 - 14 OTHER TYPES AND MATERIALS

Subject to approval by the city engineer, other types and materials of pipe, geotextile fabric, drainage structures, and drainage hardware may be used provided that recognized specifications are available to control quality and acceptable user experience with the product can be shown.

9 - 15 FLOW RESTRICTOR/OIL POLLUTION CONTROL (FROP)

See WSDOT Standard Plan B-10.40-00 or its successor.

When necessary, a flow restrictor/oil pollution control device (FROP) may be required. The FROP shall be located at a point where it can function and be maintained effectively. The FROP shall be provided with a solid, round, locking lid. It shall be so located and installed such that no storm drainage will enter the structure through the access hole or the top slab or risers.

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9 - 16 ROOF DOWNSPOUT CONTROLS

Roof downspout infiltration and dispersion shall be in accordance with the requirements in the SWMMWW. Refer to Volume 3, Figures 3.1.2, 3.1.3, 3.1.4, 3.1.5, and 3.1.6 and their successor(s) are approved for use. Infiltration may not be allowed in all locations. Verify acceptability with the city engineer.

9 - 17 DETENTION FACILITIES

Open detention pond shall be in accordance with the requirements in the SWMMWW. Refer to Volume 3, Figures III-3.2.1, III-3.2.2, III-3.2.3, III-3.2.5, III-3.2.9, V-10.3.1a, and V-10.3.1b and their successor(s) are approved for use.

Underground closed detention system requirements in the SWMMWW. Refer to Volume 3, Figures III-3.2.6, III-3.2.7, and III-3.2.8 and their successor(s) are approved for use.

9 - 18 INFILTRATION FACILITIES

Infiltration Basins shall be in accordance with the requirements in the SWMMWW. Refer to Volume 3, Figure 3.3.1.

Infiltration Trenches shall be in accordance with the requirements in the SWMMWW. Refer to Volume 3, Figure 3.3.4 and 3.3.5, and 3.3.7 and their successor(s) are approved for use.

For design of infiltration with permeable paving refer to the Puget Sound Partnership Low Impact Development Technical Guidance Manual for Puget Sound.

Infiltration may not be allowed in all locations. Verify acceptability with the city engineer.

9 - 19 WATER QUALITY DESIGN REQUIREMENTS

Water quality treatment shall be provided for locations designated in the Storm-water Management Manual for Western Washington (SWMMWW) as high use by providing oil/ water separators. For other locations with pollution generating impervious surfaces BMP's in accordance with the SWMMWW shall be utilized. The City requires spill control separation prior to discharge to the MS4.

9 - 20 FACILITY ACCEPTANCE REQUIREMENTS

All stormwater facilities require special inspection by Public Works Operations and Maintenance prior to submitting for Final Acceptance. Piped conveyances, structures, and detention and/or water quality facilities require cleaning and testing in accordance with Section 7-04.3 of the WSDOT Standard Specifications. Following cleaning and testing, video inspection is required unless otherwise approved by the City Engineer.

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The development Contractor is responsible for maintenance up until obtaining Final Acceptance by Public Works. The City uses Contech “Storm Filters” for water quality applications. If the City determines that these filters have been degraded, the Contractor will be required to replace them, prior to Final Acceptance.

Following final acceptance, a two-year maintenance bond is required for detention, infiltration, and water quality facilities.