City of Edmonds

Public Works Department, Engineering Division

121 5th Ave N
Edmonds, WA 98020

Checklist 11:
Permeable Pavement

Per ECDC 18.30, all Category 1 projects must comply with Minimum Requirements No. 1 through No. 5, and all Category 2 projects must comply with Minimum Requirements No. 1 through No. 9. Permeable pavement may be used to help meet Minimum Requirement Nos. 5, 6, and/or 7, if the following requirements are met. See also Addendum Checklists 1 through 3 for submittal requirements, and Addendum Appendix A for infeasibility criteria that apply to Minimum Requirement No. 5 specifically.

Permeable pavement shall be designed in accordance with the Department of Ecology's Stormwater Management Manual for Western Washington (SWMMWW), ECDC 18.30, and the requirements in the Addendum. The City of Edmonds developed the following checklist to aid project proponents and plan reviewers in complying with the applicable SWMMWW requirements for this BMP. In addition, City-specific requirements (i.e., requirements presented in ECDC 18.30, the Addendum, or other City requirements that are not included in the SWMMWW) are also included in the checklist.

This checklist reflects most, but not necessarily all, of the items that shall be documented by the project proponent, for review by the Engineering Division. It is intended to be used as an aid for developers and plan reviewers by providing a foundation for clear and consistent BMP design in the City of Edmonds. However, all items may not be applicable to every project, and all items of concern to this office may not be covered on this checklist.

Applicant:

Application #:

Within each blank cell, enter comment codes as follows:

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N/A = Not Applicable M = Missing (i.e., please include)
IC = Incomplete

		MODELING AND SIZING (SWMMWW Volume V, Section 5.3.1, BMP T5.15)
		Minimum Requirement No. 5 (List No. 1 or List No. 2)
1*		For compliance with Minimum Requirement No. 5 (List No. 1 or No. 2), "other hard surfaces" (i.e., not roofs) must be permeable pavement unless infeasible.
		Minimum Requirement No. 5 (On-site Performance Standard), Minimum Requirement No. 6, and/or Minimum Requirement No. 7
2		For compliance with Minimum Requirements No. 5 (on-site performance standard component only), No. 6, and/or No. 7; the Western Washington Hydrology Model (WWHM), MGSFlood, or other approved continuous runoff model is used to model the permeable pavement section.
3		Modeling of runoff from areas of permeable pavement conform to requirements of the 2014 Ecology Stormwater Management Manual for Western Washington, Volume III, Appendix III-C.
4		Permeable pavement is represented in the model with the "porous pavement element."
		SETBACKS (Addendum, Appendix A)
5*		The permeable pavement area is not within the North Edmonds Earth Subsidence and Landslide Hazard Area (ESLHA).
6*		The permeable pavement area is not within the buffer of the ESLHA (minimum buffer equal to the height of the steep slope or 50 feet, whichever is greater) unless a geotechnical assessment and soils report is prepared addressing the potential impact of the proposed system.
7*		The permeable pavement area is not within 50 feet of the top of slopes greater than 15 percent (unless a geotechnical assessment and soils report is prepared addressing the potential impact of the proposed system).
8*		For sites with on-site or adjacent septic systems, the discharge point is at least 30 feet upgradient, or 10 feet downgradient, of the drainfield primary and reserve areas (per WAC 246-272A-0210). This requirement can be modified by the City if site topography will clearly prohibit flows from intersecting the drainfield or where site conditions (soil permeability, distance between systems, etc.) indicate that this is unnecessary.
9*		The permeable pavement area is not within 10 feet of any underground storage tank and connecting underground pipes, regardless of tank size. As used in these criteria, an underground storage tank means any tank used to store petroleum products, chemicals, or liquid hazardous wastes of which 10 percent or more of the storage volume (including volume in the connecting piping system) is beneath the ground surface.
10		The permeable pavement area is not located where the seasonal high groundwater or an underlying impermeable/low permeable layer would create saturated conditions within 1 foot of the bottom of the lowest gravel base course.
11*		If the permeable pavement area (plus any contributing areas) is less than 5,000 square feet, the permeable pavement area is not within 5 feet from a structure without a basement and 10 feet for a structure with a basement.

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12*		If the permeable pavement area (plus any contributing areas) is greater than or equal to 5,000 square feet, the permeable pavement area is not within a 1H:1V slope line from the bottom edge of the facility to a building structure. (Minimum clearance 5 feet from a structure with a basement and 10 feet for a structure with a basement.)
13*		The permeable pavement area is not within the buffer of a Category 1 or Category 2 wetland.
14*		The permeable pavement area is not within the buffer of a Category 3 or Category 4 wetland, except for the outer 25 percent of the buffer.
		DESIGN CRITERIA (SWMMWW Volume V, Section 5.3.1, BMP T5.15; APWA GSP 2-06.3(3))
15*		Structural pavement calculations and design assumptions are provided for proposed pavement section and loading scenarios.
		Subgrade
16*		The subgrade is prepared and protected in accordance with APWA GSP 2-06.3(3). Key requirements include: Compaction of subgrade to 90 percent to 92 percent (standard Proctor, ASTM D698/AASHTO T99).Alternatively a licensed geotechnical engineer performed field test and provided written report that subgrade is in a “firm and unyielding” condition and that the subgrade is in a condition where the design infiltration rate can be achieved.
		Separation/Bottom Filter Layer (optional)
17*		If included, separation layer is a layer of sand or crushed stone (0.5 inch or smaller), graded flat.
		Pavement Base Material
18*		Pavement base shall meet the design minimums provided in the City of Edmonds Standard Details for Permeable Pavement. Key requirements are identified below.
19*		Porous Asphalt: 2-inch-minimum permeable asphalt treated base OR 3-inch-minimum crushed surfacing choker course over 5-inch-minimum permeable ballast.
20*		Pervious Concrete: 5-inch-minimum permeable ballast.
21*		Permeable Unit Pavers: 1.5-inch-minimum thickness of No. 8 stone over 3-inch-minimum crushed surfacing choker course over 5-inch-minimum thickness of permeable ballast.
22*		Permeable Grass Pavers: 4-inch-minimum pavement base per manufacturer’s recommendations.
		Impermeable Check Dams (where required)
23*		For permeable pavement applications with slopes of 3 percent or greater, the hydraulic calculations for thickness of the reservoir course consider the sloped subgrade and check dams are installed at regular intervals perpendicular to the subgrade slope as assumed in the calculations.
24*		The check dams do not impound water into the pavement matrix by extending above the top of the reservoir course or to finish grade.

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25*		Each check dam has an overflow, or allows overtopping to the next downslope check dam section without causing flows to enter the pavement matrix, express from the pavement surface, or out the sides of the base materials that are above grade.
		Wearing Layer
26*		Minimum wearing course slope is 0.5 percent and pavement drains away from structures and to a safe discharge location.
27*		Recommended maximum wearing course slopes for permeable paving surfaces are: • Porous asphalt: 5 percent • Pervious concrete: 10 percent • Permeable unit pavers: 12 percent • Permeable grass pavers: 12 percent
28*		Minimum infiltration rates, determined by ASTM C1701, are as follows: • Porous asphalt: 100 inches per hour • Pervious concrete: 100 inches per hour • Permeable unit pavers: 20 inches per hour • Permeable grass pavers: 20 inches per hour
29*		Porous asphalt meets the requirements of APWA GSP 5-04 for Porous HMA or Porous WMA. Key requirements are identified below.
30*		• Asphalt binder is performance grade (PG) 70-22ER polymer modified or higher grade.
31*		• Binder content is between 6 and 7 percent by total weight of the mix.
32*		• Drain down is 0.3 percent or less (ASTM D6390).
33*		• Void ratio is between 16 and 25 percent (ASTM D3203, Ndesign = 75 gyrations).
34*		• Aggregates for porous asphalt conform to APWA GSP 5-04.2.
35*		Pervious Concrete meets requirements of APWA GSP 5-06 for Pervious Concrete Pavement. Key requirements are identified below.
36*		• Portland cement is Type I, Type II, Type I-II, Type IP, or Type IS.
37*		• Mix incorporates hydration stabilizing admixture.
38*		• Water to cement ratio is 0.35 or less.
39*		• No more than 25 percent of portland cement in the mix, by weight, is replaced by fly ash, ground granulated blast furnace slag, or a combination of both.
40*		• Coarse aggregate conforms to WSDOT Spec. 9-03.1(4), AASHTO Grading No. 8.
41*		Permeable unit pavers meet design requirements provided in the LID Technical Guidance Manual for Puget Sound (2012) and procedures published by the Interlocking Concrete Pavement Institute.
42*		Permeable grass paver systems include moisture retaining additive in grid fill and/or pavement base as specified by the manufacturer.

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		Drainage Conveyance
43*		No runon from adjacent pervious or impervious surfaces. If minor incidental runoff comes from adjacent pervious areas, those areas are fully stabilized. Finish grade of adjacent pervious areas is 1 inch below the finish grade of the pervious pavement to prevent migration of landscaping materials onto the pervious pavement.
44*		Impervious areas are sloped away from the permeable pavement to the maximum extent practicable.
45*		Roads are designed with adequate drainage conveyance facilities as if the road surface was impermeable.
46*		An approved point of discharge is provided (e.g., via slotted drain pipe or lateral flow through the storage layer to a daylighted conveyance system).
47*		Roads with base courses that extend below the surrounding grade have a designed flow path to safely move water away from the road prism and into the roadside drainage facilities.
		Subsurface Overflow
48*		If the project is using permeable pavement with a subsurface overflow to meet Minimum Requirement No. 5, the subsurface overflow pipe is located below the structural pavement base depth, and the controlling invert is set at the maximum design ponding depth. For example, an upturned elbow may be included in a downstream structure to control water surface elevation in the facility per City of Edmonds Standard Detail for Subsurface Control Structure.
		Pavement Edge Treatments
49*		Permeable pavement edge treatments are provided at dissimilar pavement interfaces and pavement to landscape transitions.
50*		Edge treatments conform with City of Edmonds Standard Details for Edge Treatments at Pavement Interface, Edge Treatments at Landscape Interface, and Edge Treatments for Pavers.
		Runoff Treatment Layer
51*		For compliance with Minimum Requirement No. 6 (when applicable), designs must provide the following: • Native underlying soil meeting soil suitability criteria for treatment below, **or** • 6-inch media or sand filter layer meeting soil suitability criteria below or the sand filter BMP specification

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52		Soil suitability criteria: • SSC No. 4: Measured (initial) saturated hydraulic conductivity of 9 inches per hour or less. Design (long-term) saturated hydraulic conductivity of up to 3 inches per hour with correction factor. • SSC No. 6: o Cation exchange capacity (CEC): ≥5 milliequivalents/100 grams of dry soil. o Depth of treatment soil: Depth of soil below permeable pavements serving as pollution-generating hard surfaces are at least 1 foot if the permeable pavement does not accept runon from other surfaces. o Organic matter content: 1 percent minimum (ASTM D2974).
		CONSTRUCTION AND INSTALLATION (SWMMWW Volume V, Section 5.3.1, BMP T5.15, and Addendum, Section 6.1)
53*		Contractor meets minimum contractor qualifications: • Pervious Concrete: NRMCA contractor's certification per APWA GSP 5-06.SA • Permeable Unit Pavers: ICPI contractor's certification (Certified Concrete Paver Installer).
54*		The permeable pavement area is clearly identified (e.g., using flagging or high-visibility fencing) and protected prior to and throughout construction, including opening pavement to traffic.
55*		Use physical Construction SWPPP BMPs and/or grade the site to keep sediment laden runoff from contaminating permeable pavement subgrade, base, or wearing layer. The upslope areas of construction areas are stabilized and overland flow distances are minimized.
56*		Construction SWPPP sheets outline construction sequencing that will protect the permeable pavement area during construction.
57*		Appropriate quality control measures are in place to ensure aggregates, cementitious material, admixtures, and other pavement materials (as applicable) are free from contamination from deleterious material or other stockpiles/storage containers and protected from damage by equipment, vehicles, or weather.
58*		Machinery is operated outside of the permeable pavement area during construction. If machinery is operated in the permeable pavement area for excavation, lightweight, low ground-contact pressure equipment is utilized; and the base soil is scarified to a minimum of 12 inches at completion.
59*		Permeable pavement area excavated to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. If areas must be excavated before permanent site stabilization, initial excavation is conducted to no less than 6 inches of the final elevation of the facility floor.
60*		Excavation of permeable pavement areas does not occur during wet or saturated conditions.
61*		Subgrade is graded with lightweight, low ground-contact pressure (rubber tired) equipment when within 12 inches of final subgrade elevation.

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62*		Subgrade that is overcompacted is scarified (a minimum of 8 inches) and restored such that design permeability is achieved to the satisfaction of the design engineer.
63*		The bottom of the permeable pavement excavation is raked or scarified to a minimum depth of 3 inches after final excavation to restore infiltration rates.
64*		Subgrade and pavement base are prepared such that no machinery is operated on the final subgrade.
65*		To prevent compaction of subgrade when installing the aggregate base, the following steps (excavation and back-dumping) are followed: • Excavation begins at furthest point of site and proceeds out to point of access, with machinery operating outside of prepared subgrade. • The aggregate base is dumped onto the subgrade from the edge of the installation, and the aggregate is then pushed out onto the subgrade. • Trucks then dump subsequent loads from on top of the aggregate base as the installation progresses.
66*		Shaping and compaction of pavement base is in accordance with APWA GSP 4-04.3(5).
67*		Sediment-laden construction equipment is not driven on the base material or pavement. Sediment-laden runoff is not allowed to run on to permeable pavements or base materials.
68*		Installation of pavement wearing layer is in accordance with the following requirements: • Porous asphalt: APWA GSP 5-04 • Pervious concrete: APWA GSP 5-06.SA • Permeable unit pavers: ICPI and manufacturer recommendations • Permeable grass pavers: manufacturer recommendations
69*		The various aggregate base materials are prevented from intermixing with fines and sediment. All contaminated material is removed and replaced.
70*		Once the pavement is finished and set, pavement is covered with plastic and geotextile to protect from other construction activities. Pavement area is closed and protected until the site is permanently stabilized.
71*		Protective surfaces (e.g., waterproof tarps and steel plates) are placed over any permeable pavement areas used for construction staging.
72*		If using permeable pavement area for access during construction, demonstrate that alternate construction access (i.e., temporary roads) is not feasible.
73*		Measures are incorporated to protect the road subgrade from over compaction and sedimentation if permeable pavement roads are used for construction access. • The aggregate base or pavement surface is covered with protective geotextile fabric and protect fabric with steel plates or gravel. Gravel is only used to protect the fabric placed over pavement base (not directly on prepared subgrade). • Once construction is complete and the site is permanently stabilized, the protective geotextile is removed, and the pavement installation is cleaned and completed.

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		INSPECTION CRITERIA
74		The permeable pavement system meets applicable siting, design, and construction criteria (see * notations in applicable rows).
		Acceptance Test (SWMMWW Volume V, Section 5.3.1, BMP T5.15)
75*		Infiltration Rate Testing: • Permeable pavement driveway infiltration rates are tested with the bucket test. If anything other than a scant amount of puddles runs off the surface, additional testing is conducted (see testing requirements for roads). • Permeable pavement roadway infiltration rates are tested per ASTM C1701 or C1781, depending on pavement surface type.
76		The City is notified of the scheduled infiltration testing at least 2 working days in advance of the ASTM C1701 or C1781 tests.
77*		If the ASTM C1701 or C1781 tests indicated poor function (initial infiltration rate of less than 20 inches per hour), the City is informed; and testing will proceed as specified in APWA GSP 5-04.3 for porous asphalt installations and APWA GSP 5.06.SA for pervious concrete installations.
78*		Unless otherwise approved by the City, acceptance of pervious concrete pavement (as defined in APWA GSP 5-06.SA) is per APWA GSP 5-06.SA (includes approved test panel requirement). Key criteria are outlined below:
79*		• Grade: pavement shall not deviate from grade more than 0.7 inch in 10 feet.
80*		• Conformance to job mix formula (JMF).
81*		• Compacted thickness and average hardened density: three cores per lot. No single core less than 0.75 inch of design depth; average of all cores within 0.375 inch of design depth (ASTM C1542). Hardened density within +/-5 percent of average density of JMF (ASTM C1754).
82*		• Fresh Density: within +/-5 pounds per cubic foot of fresh density of JMF (ASTM C1688).
83*		• Appearance: consistent surface texture, not raveled, free of ridges or other imperfections, joints at specified locations, and free of cracks.
84*		Unless otherwise approved by the City, acceptance of porous HMA pavement (as defined in APWA 5-04.3(8)A4 is per WSDOT Standard Spec. 5-04.3(8)A with APWA GSP 5-04.3(8) amendments.

Reviewer: _____

Review Date: _____

Reviewer Phone #: _____

Reviewer Comments: