COMMUNITY DEVELOPMENT

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Residential Permeable Pavement Design & Construction Guide

ELIGIBILITY

This handout is intended to aid applicants using the Stormwater Permit Application for Small Projects who have determined that permeable pavement is a feasible method for managing stormwater on their site.

This design guidance may be used for areas of permeable pavement that are less than 5,000 sq. ft., relatively level, and planned for either pedestrian uses (e.g. patios, walkways) or driveways and parking areas for passenger vehicles. Permeable pavements in the City rights-of-way, on slopes greater than 12%, placed on fill material, and driveways more than 150 feet in length must be designed by a Professional Engineer and are not covered in this guide.

WHAT IS PERMEABLE PAVEMENT?

Permeable pavement is a type pavement that allows rain to pass through the surface and be absorbed into the soil. Permeable pavements are hard and strong enough to support vehicles. Three types of permeable pavement are allowed for residential uses such as driveways and patios:

Example of porous asphalt

- Porous asphalt is similar to standard hot-mix or warm-mix asphalt, but sand and fine materials are reduced, and a special binder is used. Rain water passes through voids in the asphalt.
  - Porous asphalt may be used if the surface slope of the pavement is less than 5%.

This guidance is intended for use by property owners and is not a substitute for Washougal Municipal Code. We have substituted some technical language with plainer terms. In case of conflict, the meaning and intent adopted in the Washougal Municipal Code and the Washougal Engineering Standards for Public Works Construction shall prevail.

Example of pervious concrete

- Pervious concrete is similar to standard concrete used for driveways, but the fine aggregate component is reduced or eliminated, and a different binder is used. Rain water passes through voids in the concrete.
  - Pervious concrete may be used if the surface slope of the pavement is less than 10%.
- Permeable interlocking concrete pavers (PICP) are solid impermeable concrete pavers. Joints between pavers are filled with a permeable rock mix that allows rain water to pass through the spaces between pavers.
  - PICP may be used if the surface slope of the pavement is less than 12%.

Example of permeable interlocking conrete pavers

WHAT ARE THE BENEFITS OF PERMEABLE PAVEMENT?

As cities and suburbs grow, they replace forests and other open spaces with roofs, pavement, and other impervious surfaces. Most rain that falls on native forests and prairies is quickly absorbed into the soil or evaporated. When rain falls on impervious surfaces, it cannot be absorbed and quickly runs off. Runoff can cause erosion and flooding and carries pollutants such as pesticides, oil, and metals into lakes and streams. Permeable pavement mimics some aspects of natural conditions. Permeable pavements can help recharge aquifers and help protect streams and lakes from pollution.

WHERE CAN I USE PERMEABLE PAVEMENT?

This design guidance is for design and construction of permeable pavement driveways, patios, pathways, and parking areas on residential (single-family or duplex) construction sites.

The detailed feasibility requirements for permeable pavement can be found in the Stormwater Permit Application for Small Projects, the Infeasibility Checklist for Other Hard Surfaces and the design guidelines of the *Stormwater Management Manual for Western Washington.*

GENERALLY PERMEABLE PAVEMENT CANNOT BE USED:

- **Over utilities –** Make sure to have all utilities located and marked before digging. Contact utility locate services by calling 811.
- **Near the edge of steep slopes or bluffs –** The additional water soaking into the ground on steep slopes can cause landslides or unwanted settling. Do not place permeable pavement within 50 feet of a slope steeper than 20%.
- **Near a septic tank, septic drainfield, or reserve drainfield area –** Provide at least 10 feet between the rain garden and an existing or planned septic system.
- **In low spots that do not drain well.**
- **Where there is high groundwater or bedrock within 1 foot of the bottom of the excavated area.**
- **Near wells –** permeable pavement must be set back a minimum of 10 feet from drinking water wells or 100 feet if vehicles will park or drive on the pavement.
- **Downslope of steep, erosion-prone areas that are likely to deliver sediment.**

HOW ARE PERMEABLE PAVEMENTS DESIGNED?

1. **FEASIBILITY.** Ensure permeable pavement is feasible before beginning your design. Feasibility is established when filling out the Stormwater Permit Application for Small Projects.

2. **SOIL INFILTRATION RATE:** Get the soil infiltration rate and the hydrologic soil group for your proposed location from the Infiltration / Percolation Evaluation report completed as part of the Stormwater Permit Application for Small Projects.

Soil infiltration rate = _____ inches/hour

Hydrologic soil group = ☐ A ☐ B ☐ C ☐ D

3. **SELECT PAVING MATERIAL:** For residential driveways and patios discussed in this handout, porous asphalt, pervious concrete, or PICP may be selected.

Material = ☐ porous asphalt ☐ pervious concrete ☐ PICP

4. **DETERMINE DEPTH OF STORAGE RESERVOIR:** A drain rock storage reservoir beneath the paving layer temporarily holds water, allowing it to drain slowly into the ground. The minimum required depth of the storage reservoir depends on the soil infiltration rate and the paving material.

PAVING MATERIAL	SOIL INFILTRATION RATE	
	Greater than or equal to 1 in/hr	Between 0.3 and 1 in/hr
	MINIMUM STORAGE RESERVOIR DEPTH*	
Porous asphalt	4 inches	6 inches
Pervious concrete	4 inches	6 inches
PICP	6 inches	6 inches

**Storage reservoir depths are minimums. Suppliers of PICP and ready-mix concrete suppliers with proprietary designs for pervious concrete mixes may recommend or require greater reservoir depths with their products.*

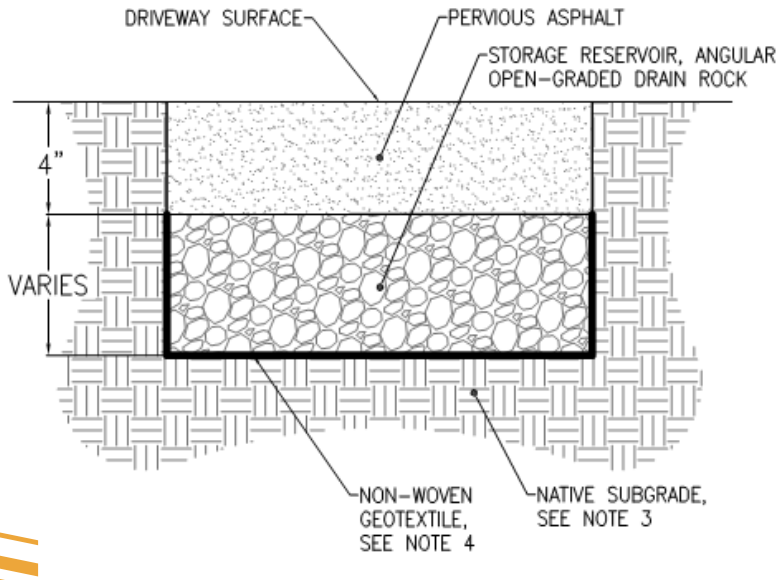
Storage reservoir depth = _____ inches

5. **GEOTEXTILE.** If the subgrade is in hydrologic soil group "C," a non-woven geotextile is required between the prepared subgrade and the storage reservoir.

6. **OVERFLOW PATH**. In case of a large storm that exceeds the capacity of the storage reservoir or in case the pavement stops draining, a safe overflow path must be identified. Providing a 2% minimum slope toward lawn or landscaping or to the street is acceptable. If sloped to lawn or landscaping, a minimum 10 foot width of vegetated area is required for each 20-foot width of permeable pavement. The overflow path should not result in runoff entering neighboring properties. (For example, a driveway that is 18 feet wide can slope at 2% toward a 10-foot wide area of lawn or landscaping on the property.)

7. **DRAINAGE ONTO PERMEABLE PAVEMENT.** Drainage from other surfaces adjacent to the permeable pavement – such as lawn and impermeable pavements – is discouraged. Drainage from roof downspouts or other concentrated flows onto the pavement is not allowed. Slope adjacent surfaces away from the permeable pavement, and direct roof downspouts to an appropriate location.

PERMEABLE PAVEMENT DESIGN DRAWINGS



STORAGE RESERVOIR DEPTH:

INFILTRATION RATE	MINIMUM DEPTH
≥ 1"/hr	4"
≥ 0.25" TO < 1"/hr	6"

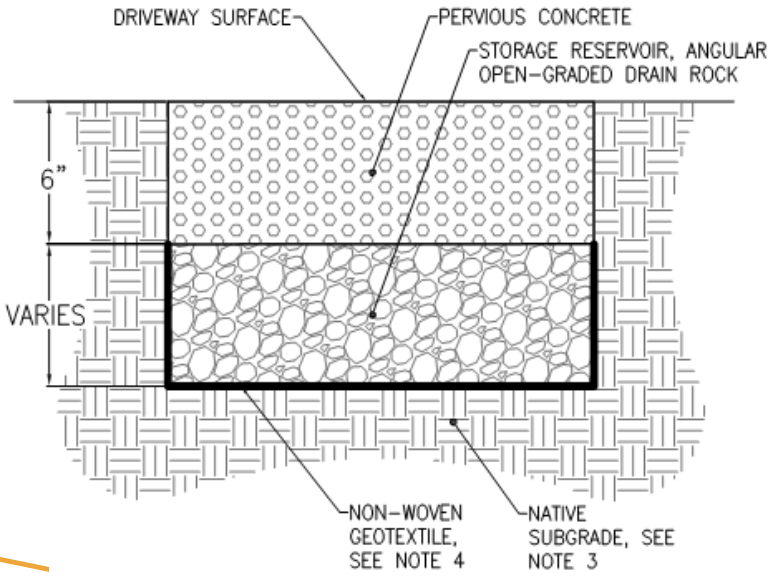
NOTES:
1. FOR PERMEABLE PAVEMENT DRIVEWAYS LESS THAN 5,000 S.F.

2. LIMIT RUN-ON TO PERMEABLE PAVEMENT SURFACES TO THE MAXIMUM EXTENT PRACTICABLE. RUN-ON SHALL ONLY BE ALLOWED FROM FULLY STABILIZED AREAS

3. NATIVE SUB-GRADE MUST MEET TREATMENT REQUIREMENTS

4. IF NATIVE SUBGRADE IS A HYDROLOCIC SOIL GROUP "C," NON-WOVEN GEOTEXTILE IS REQUIRED

Porous Asphalt Driveway Section



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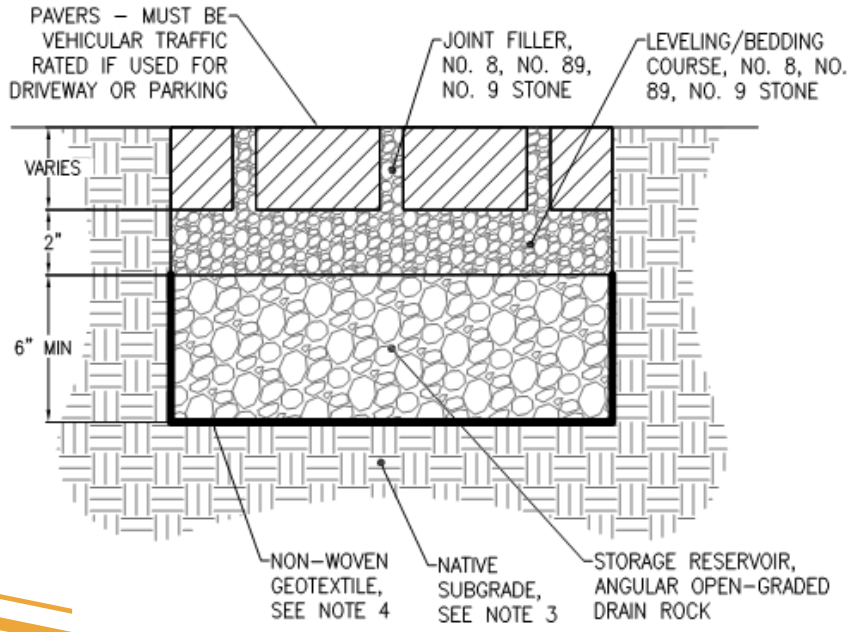
3. NATIVE SUB-GRADE MUST MEET TREATMENT REQUIREMENTS

4. IF NATIVE SUBGRADE IS A HYDROLOCIC SOIL GROUP "C," NON-WOVEN GEOTEXTILE IS REQUIRED

Pervious Concrete Driveway Section



NOTES:

1. FOR PERMEABLE PAVEMENT AREAS LESS THAN 5,000 S.F.

2. LIMIT RUN–ON TO PERMEABLE PAVEMENT SURFACES TO THE MAXIMUM EXTENT PRACTICABLE. RUN–ON SHALL ONLY BE ALLOWED FROM FULLY STABILIZED AREAS

3. NATIVE SUB–GRADE MUST MEET TREATMENT REQUIREMENTS IF PAVEMENT IS USED FOR VEHICLES

4. IF NATIVE SUBGRADE IS A HYDROLOCIC SOIL GROUP "C," NON–WOVEN GEOTEXTILE IS REQUIRED

Permeable Interlocking Concrete Paver Section for Patios or Driveways

CONSTRUCTION SEQUENCE

1. **PROTECT AREA.** Areas designated for permeable pavement must be protected from compaction and muddy construction runoff. Prior to construction, ensure the temporary erosion and sediment controls selected to protect LID BMPs, shown on the Erosion Control Plan for Small Projects, have been properly installed.
2. **EXCAVATION AND GRADING**. Excavate and grade the area where permeable pavement will be installed to the proper depth. If possible, avoid using excavating equipment inside the footprint of the permeable pavement.
3. **PREPARE SUBGRADE.** Compact the subgrade to the minimum necessary for structural stability. Compaction may be specified as "firm and unyielding" or "90 to 92% Standard Proctor." These specifications maintain the permeability of the soil. (Note: these specifications result in less compaction than many contractors are accustomed to.)
4. **INSTALL GEOTEXTILE.** If required, install the non-woven geotextile.
5. **INSTALL STORAGE RESERVOIR.** To avoid further compacting the prepared subgrade, use the back-dumping method to install the storage reservoir. Dump drain rock onto the subgrade (or geotextile layer) starting at the forward edge of the installation (the edge where the dump truck or equipment first approaches the prepared subgrade). Push the drain rock out without walking or driving on the subgrade. For subsequent loads, repeat from the edge of the placed drain rock, working toward the far edge of the installation.
6. **INSTALL LEVELING COURSE.** For PICP, place the levelling course.
7. **INSTALL PAVEMENT.** Install pavement using methods appropriate for the materials chosen.
8. **CURING.** Pervious concrete requires a 7-day curing period using proper methods before pedestrian or vehicular traffic is allowed.

RECOMMENDATIONS

For permeable pavement to function properly, both paving material specifications and correct installation are vital. Construction methods are different than for traditional asphalt and concrete.

The following **recommendations** can help ensure your permeable pavement functions well:

- **HIRE A QUALIFIED CONTRACTOR TO INSTALL THE PAVEMENT.**
  - **Pervious Concrete.** The National Ready Mix Contractor Association (NRMCA) certifies pervious concrete technicians, installers, and craftsmen. We recommend the contractor be a certified installer or craftsman.
  - **Porous asphalt.** Request to see examples of successful porous asphalt installations, or hire a contractor who has completed the Washington State Low Impact Development Certificate Program or has received the LID Design Certificate.
  - **PICP.** Request to see examples of successful PICP installations.
- **PRODUCTS/MATERIALS**
  - **Pervious Concrete.** We recommend pervious concrete products meet the current version of American Concrete Institute (ACI) specifications 522.
  - **Porous asphalt.** We recommend products meet the performance grade (PG) 70-22.
  - **PICP.** If used for a driveway or parking area, pavers must be rated for vehicular traffic.
- **CONSTRUCTION CONTRACT**
  - Incorrect installation or poorly designed concrete/asphalt mix can cause a permeable pavement to fail (not drain). Your contract with a contractor can protect you. Before closing out your permits at the end of your construction project, a City Inspector will verify the permeable pavement can drain water at a minimum of 20 inches/hour. We recommend your construction contract provide for re-installation if the pavement does not pass the acceptance test.