Puyallup High School New Portables
Operation and Maintenance Manual

Stormwater from the Puyallup High School (PHS) New Portables development project area is collected and infiltrated using an infiltration gallery and permeable pavement. Roof downspouts will collect stormwater and be routed to an infiltration gallery on the west side of the site. Runoff from the new asphalt walkway will infiltrate below permeable asphalt pavements section on site.

This document provides guidelines for operation and maintenance of the stormwater management facilities at the PHS New Portables site. Much of this O&M Manual is adapted from the Puget Sound Partnership's *Low Impact Development Technical Guidance Manual for Puget Sound, December 2012* (LID Manual) and the Department of Ecology's 2019 *Stormwater Management Manual for Western Washington* (DOE Manual).

Infiltration Gallery

Design

The proposed infiltration trenches on site are designed to provide stormwater flow control through the infiltration of stormwater runoff generated on site. The infiltration trenches receive runoff from the proposed portables roof, which is collected through stormwater pipes and conveyed to the infiltration trenches.

The infiltration trench has been sized using DOE Manual pre-sized standard based of the following criteria:

- Soil Type: Fine sand, loamy sand
- Min. Trench Length Required: 435 LF (75 LF per 1,000 SF of Roof Area)
- Trench Width x Depth: 2-feet x 1.5-feet

An overflow pipe located at roof downspouts will convey and sheet flow any runoff, that exceeds a 100-year storm, to the lawn space around the site. Runoff will then infiltrate into native soil or surface flows into the City's stormwater system.

Operation and Maintenance

Infiltration basins require periodic maintenance to prevent clogging and maintain infiltration capacity, including:

- Clearing debris from pipe inlets.
- Clearing accumulated trash, debris, excessive vegetation and sediment from inlet pipes.
- Maintain emergency overflow free of debris and vegetation.
- Clearing sediment from drain pipes/cleanouts

See Appendix A for infiltration basins maintenance standards, procedures, and tracking log.

Inspection

Infiltration Basins should be inspected annually during a storm event for infiltration capacity. The overflow control structure should be monitored for water levels at or above the outfall pipe and tracked in the log. Water levels in the overflow manhole should be checked during the storm event and the 3 days following the storm event and tracked in the log. If high water levels remain 3 days after a storm event the system is not operating properly and should be evaluated for potential causes.

Roof leader sumps should be visually inspected for the accumulation of sediment and debris that could restrict stormwater from reaching the infiltration basins. Accumulated debris shall be removed regularly.

Permeable Pavement

Design

The proposed permeable pavement on site is designed to provide stormwater flow control through the infiltration of stormwater runoff generated on site. The permeable asphalt will infiltrate the runoff generated from the permeable asphalt.

The Permeable Pavement has been sized using WWHM based on the following criteria:

- 4” Permeable Asphalt
- 6” Permeable Ballast
- Corrected Design Infiltration Rate of 0.64 in/hr
- Infiltrate 100% of runoff up to of the 100-year storm

Operation and Maintenance

Permeable Pavement require periodic maintenance to prevent clogging and maintain infiltration capacity, including:

- Check if elevation of adjacent planted area is too high, or slopes towards pavement and can be regraded (protect permeable pavement with temporary plastic prior to regrading)
- Mulch and/or plant all of the exposed soils that may erode to the pavement surface
- Clean surface debris from pavement surface using one or a combination of the following methods:
    - Vacuum/sweep permeable paved walkways and paved parking lot with brush brooms and high efficiency regenerative air or vacuum sweeper, respectively.
    - Clearing deposited soil, sediment, debris, trash, vegetation and/or other materials from permeable pavement or adjacent surfacing.
    - Wash permeable pavement with hand held pressure washers with rotating brushes.
- Fill potholes or small cracks with patching mixes.
- Cut and replace areas with large cracks and settlement.

See Appendix A for permeable pavement maintenance standards, procedures, and tracking log.

Inspection

Permeable pavement should be inspected annually during a storm event for infiltration capacity. The permeable pavement should be monitored for ponding on the surface or if the water flows off the permeable pavement surface during a rain event. If this occurs, the permeable pavement should be evaluated for potential causes.

Permeable pavement should be evaluated annually during non-storm events or after a storm event for deposited soil, sediment, debris, trash, vegetation and/or other materials. Permeable pavement should also be evaluated annually for major cracks or trip hazards and concrete spalling and raveling.

During the Summer, permeable pavement should be checked for moss growth that could inhibit infiltration or pose a safety hazard.

Sources:

Puget Sound Partnership Low Impact Development Technical Guidance Manual for Puget Sound, December 2012
Department of Ecology Stormwater Management Manual for Western Washington 2019

Appendix A

Log Sheet

Use copies of this log sheet to keep track of when maintenance checks occur and what items, if any, are repaired or altered. The completed sheets will serve as a record of past maintenance activities and will provide valuable information on how your facilities are operating. This information will be useful for future requirements regarding the types of facilities that are installed. It helps to keep all log sheets in a designated area so that others can easily access them.

Date Checked: _____/____/_____
Checked By:
Name: _____
Position: _____
Address: _____ City: _____ State: _____ Zip: _____
Phone Number: (_____) _____

Part of Facility Checked	***Observations (List things that should be done)***	***Follow-up Actions Taken***	***Date Action Taken***

Table V-A.2: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Poisonous/Noxious Vegetation	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Contaminants and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Rodent Holes	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Piping	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway	Rock Missing	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

Table V-A.6: Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

Table V-A.22: Maintenance Standards - Permeable Pavement

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course				
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ◦ Walk-behind vacuum (sidewalks) ◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ◦ ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A_b		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods:

Table V-A.22: Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				◦ Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. ◦ Hand held pressure washer or power washer with rotating brushes ◦ Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ◦ Walk-behind vacuum (sidewalks) ◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ◦ ShopVac or brush brooms (small areas) Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A_b		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability.

Table V-A.22: Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				• Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). • Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A_b		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.

Table V-A.22: Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	A[b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from under-drain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface
Aggregate Storage Reservoir				
Observation port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.

Table V-A.22: Maintenance Standards - Permeable Pavement (continued)

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation				
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	• Sweep leaf litter and sediment to prevent surface clogging and ponding • Prevent large root systems from damaging subsurface structural components
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

a Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

b Inspection should occur during storm event.