Lake Whatcom
Homeowner Incentive Program

CONTRACTOR MANUAL

Program Details and Best Management Practices (BMP) Design Guidelines

Lake Whatcom Cooperative Management Program

Version 2—March 2018

Part I:

Overview

1 Introduction

Lake Whatcom, the drinking water source for more than 100,000 Whatcom County residents, has seen a marked decline in water quality over the past 50 years. Excess nutrients, particularly phosphorus, generated by residential properties and conveyed to the lake through public infrastructure, have caused a significant decrease in dissolved oxygen levels deep in the water column as well as seasonal algal blooms on the surface. In April, 2016, the Environmental Protection Agency finalized the Lake Whatcom Total Maximum Daily Load study, which has set in motion a 30- to 50-year cleanup effort focused on reducing phosphorus inputs to Lake Whatcom by nearly 87%, compared to current conditions. In order to address part of this water quality issue, the City of Bellingham and Whatcom County use public funds to manage runoff from some of the areas around the Lake. However, much of the developed land lies outside of the reach of infrastructure projects, especially along the lake shore and adjacent to the many tributaries.

The Homeowner Incentive Program (HIP) approaches the problem from a complimentary angle, by providing technical and financial assistance to property owners in the Lake Whatcom watershed, especially those owning properties that are difficult to address through infrastructure projects. Homeowners are encouraged to make changes on their private property to reduce phosphorus entering the public infrastructure or the lake.

This manual describes the process for developing HIP-eligible project designs that will qualify for streamlined permitting and program incentives. The manual is divided into sections that address individual components of the HIP but is not intended to represent the entirety of resources available to assist in the successful design and implementation of a HIP-eligible project. Designers should check the HIP website for more information and updates to accompany this guidance document.

The HIP has been developed based on guiding principles approved by City of Bellingham and Whatcom County Councils and vetted by the Lake Whatcom Policy Group and representatives of the Lake Whatcom Management Program.

- **HIP projects must provide a public benefit to qualify for use of public funds**
- **HIP projects must comply with all applicable current regulations**
- **HIP BMPs must be designed according to Washington State Department of Ecology approved methodology**

HIP rules and BMP design standards were developed to abide by these principles. Conformance with the standards described in this manual equates to conformance with regulations and pre-approved programmatic permits and ensures public benefits are achieved.

Questions in regard to the content of this manual should be directed to HIP Staff. Contact information for relevant and current staff can be found under the "Contact Us" tab on the HIP website.

2 Homeowner Incentive Program Overview

HIP Process Overview

Homeowners who live in the area draining to Lake Whatcom basins 1 and 2 (see map below) are eligible to participate in the HIP. These property owners voluntarily complete projects that improve the quality or reduce the amount of runoff generated by surfaces on their private property. In return, HIP provides streamlined permitting, technical assistance, and financial reimbursement to encourage and facilitate these projects.

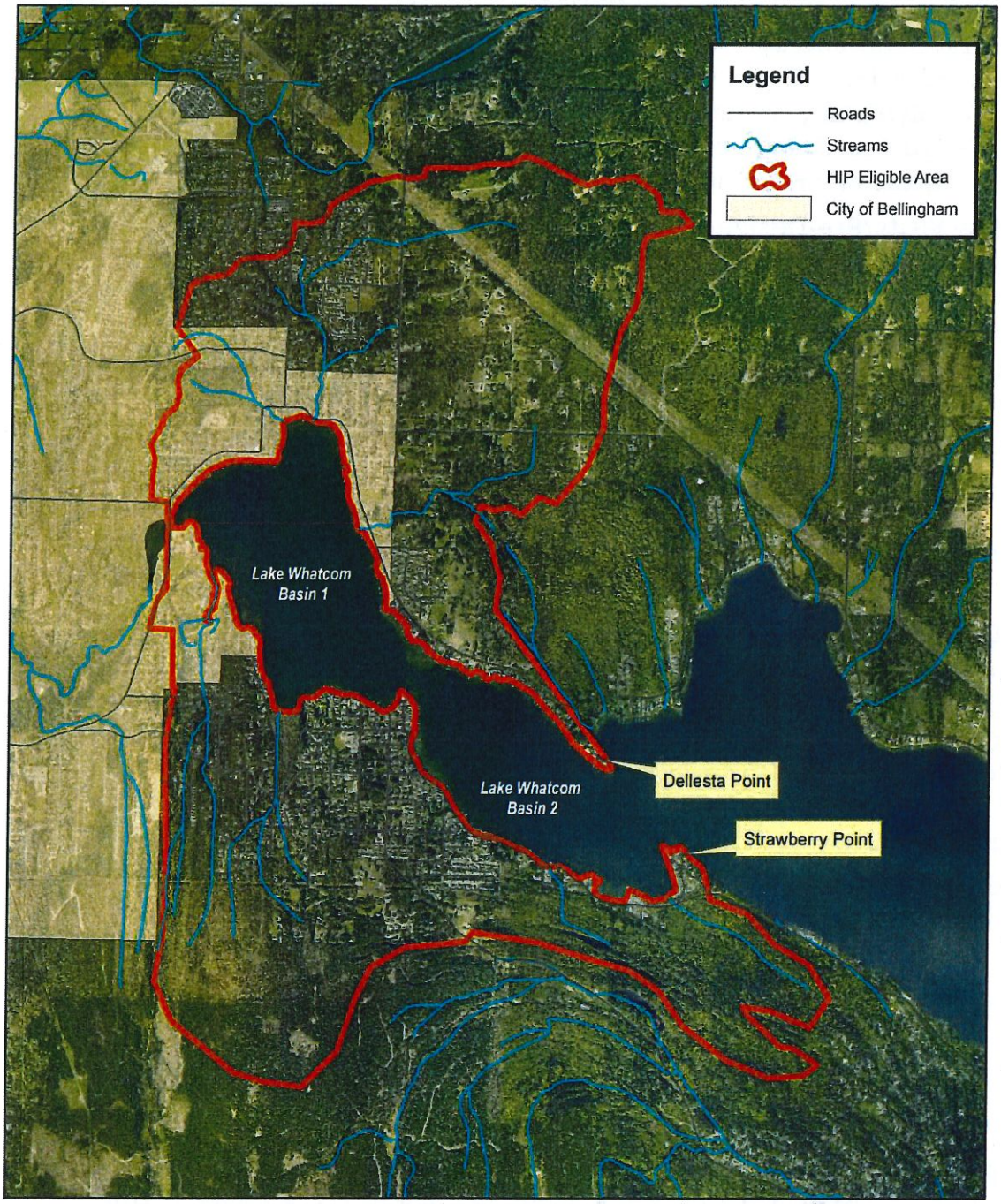
Property owners interested in HIP first receive a site visit that provides them with a baseline of understanding about how the program works, its conditions, and the types of projects available for them to complete. Working with HIP staff and private professionals, the homeowners then evaluate strategies for improving their property based on their budget, aesthetics, and the unique characteristics of their lot.

Once the homeowner has narrowed down their preferred options and signed an acknowledgement form, they are directed to engage a designer of their choice to complete a design and the application submittal packet necessary to permit and build the project and ensure reimbursement for project expenses. HIP staff are available, as needed, to support the homeowner and designer as they navigate the permitting process. The City and County issue permits to the homeowner and the permitted plans are used to solicit bids from construction contractors, landscape installers, or other professionals qualified to construct the project as designed.

The HIP promotes and encourages best management practices (BMPs) that most effectively reduce phosphorus runoff to protect Lake Whatcom, are cost-effective for residential-scale installations, and result in property improvements that appeal to homeowners. The BMPs included in this manual have been reviewed and approved by the Washington State Department of Ecology. They include native landscaping, infiltration trenches, media filter drains, dispersion systems, and Lake Whatcom rain gardens. Within each of these BMPs are aesthetic design options that can be adapted to homeowner preferences. In addition to these primary BMPs, homeowners are able to include accessory features, such as permeable pavement and rainwater cisterns that improve the overall benefit of the project.

At the completion of construction, with the assistance of HIP staff, reimbursement is provided toward applicable project expenses including design fees, contractor invoices, material receipts, and other necessary expenditures made on behalf of the project. The amount of reimbursement eligible for each project is wholly based on the property area that has been improved at $1.30 per square foot. In order to receive reimbursement homeowners sign and record an easement and maintenance agreement that requires periodic inspection and minor maintenance actions. Program staff is available to provide technical support to homeowners to help them complete maintenance actions.

Program staff will be working with homeowners, designers, contractors, and community partners to periodically update the HIP with new features, tools, and revised criteria for participation as the program evolves over time.



HIP Process—10 Steps

Step 1: Contact

- Homeowner hears about the program and either visits www.lakewhatcomHIP.org and schedules site visit or contacts the HIP Coordinator at the Whatcom Conservation District (WCD) directly

The players and their roles:

- **City/County** - maintains website
- **HIP Coordinator** - responds to inquiries and schedules site visits
- **Homeowner** - inquires and schedules site visit

Step 2: Site Visits/Pre-Design

- HIP Coordinator visits site, explains program, provides options for projects, and identifies red flags
- Eligibility and acknowledgement forms are signed
- HIP Coordinator develops pre-design report with information on site-specific design considerations/constraints and critical areas delineations, as applicable

The players and their roles:

- **HIP Coordinator** - conducts site visit and provides point of contact for ongoing communications; signs eligibility form, coordinates critical areas delineations if applicable, develops pre-design & provides to homeowner
- **Homeowner** - attends site visit and asks questions; signs acknowledgement form

Step 3: Designer Interviews

- Homeowner expresses interest in moving forward
- HIP Coordinator provides list of certified professional designers and offers to attend meeting with designers
- Homeowner meets with designers and makes selection
- If non-certified professional selected, HIP Coordinator confirms eligibility for reimbursement

The players and their roles:

- **Homeowner** - confirms interest in moving forward, contacts and interviews designers
- **HIP Coordinator** - provides list of certified designers, attends meetings (if invited), confirms business eligibility of non-listed designers, communicates important details to both designer and homeowner
- **Designer** - attends meeting, reviews pre-design report, provides feedback on project ideas

Step 4: Project Design

- Designer completes design/permitting paperwork and plans and submits to HIP Coordinator for initial review
- HIP Coordinator provides reimbursement estimate and signs off on plans
- Homeowner or designated agent/contact submits to appropriate jurisdiction and follows through as necessary

The players and their roles:

- **Homeowner** – participates in design scoping and provides input to designer
- **Designer** - completes site-specific design work, including plans and narrative portions of HIP submittal requirements. Submits completed project design for review and permitting
- **HIP Coordinator** - ensures design is complete and meets minimum requirements for reimbursement through HIP, provides reimbursement budget estimate, signs off on completed design

Step 5: Review and Approval

- Permit staff reviews plans and provides comments to homeowner or designated agent/contact if additional information is needed
- Jurisdiction issues project permit to homeowner

The players and their roles:

- **Jurisdiction Permitting Staff** - reviews plans, provides comments, requests amendments, and issues permits to homeowner
- **Homeowner** – responds to comments asking for assistance from the designer and HIP Coordinator as needed
- **Designer** - responds to comments as needed, provides revised plans and submittal forms if needed
- **HIP Coordinator** - reviews approved permit and plans, preps homeowner for hiring a contractor if needed, takes "before" photos if agreed to by homeowner

Step 6: Contractor Interviews

- HIP Coordinator provides list of certified contractors to homeowner and offers to attend meetings with homeowners and contractors

The players and their roles:

- **HIP Coordinator** - provides list of certified contractors, attends meetings (if invited), communicates important details to both contractor and homeowner
- **Homeowner** - contacts and interviews contractors
- **Contractor** - reviews homeowner's approved plans and permit, attends meeting, listens to homeowner's unique situation, and asks questions as needed to prepare bid

Step 7: Bids and Contracting

- Contractors bid project, homeowner makes selection, and enters into private contract with contractor
- If non-certified contractor selected, HIP Coordinator confirms eligibility for reimbursement

The players and their roles:

- **Homeowner** - reviews bids, selects contractor, negotiates private contract
- **Contractor** - provides detailed bid, negotiates private contract for work, confirms ability to complete project per plan and with approved materials
- **HIP Coordinator** - confirms business eligibility of non-listed contractors, attends meetings with contractor and homeowner if invited

Step 8: Construction

- BMPs installed according to approved plan and permit conditions
- HIP Coordinator inspects and helps with plan amendments/changes as needed
- Homeowner makes payment to contractor and/or vendors

The players and their roles:

- **Homeowner** - manages project, directs contractor, contacts HIP Coordinator if issues arise, and makes payment for work completed and/or materials
- **Contractor** - builds the project per plans and specifications, arranges inspections, contacts HIP Coordinator if issues with design or construction arise, and adaptively manages project to maintain compliance with rules, regulations, guidelines, and limitations
- **HIP Coordinator** - inspects project regularly, takes construction photos if agreed to by homeowner

Step 9: Reimbursement

- HIP Coordinator inspects completed project and issues final inspection form
- Homeowner signs Easement and Maintenance Agreement and submits this agreement with their reimbursement paperwork to HIP Coordinator and then to County

The players and their roles:

- **Homeowner** - allows final inspection, signs the Easement and Maintenance agreement, completes and submits reimbursement request to HIP Coordinator and then County
- **HIP Coordinator** - confers with jurisdiction regarding project specifics, inspects and signs off on completed project, takes "After" photos if agreed to by homeowner, assures proper completion of Easement and Maintenance Agreement, and approves invoices and receipts for reimbursement payment
- **County** – Receives completed reimbursement request with original signed Easement and Maintenance agreement , invoices, and final inspection form; records easement and processes reimbursement to homeowner

Step 10: Close Out

- HIP Coordinator follows up to close out project and get feedback from property owner, contractor, and designer; issues post-project survey.

The players and their roles:

- **Homeowner** - provides feedback on process and experience
- **Contractor** - provides feedback on process and experience
- **Designer** - provides feedback on process and experience
- **HIP Coordinator** - issues surveys, collects feedback, closes out project, and records data and outcomes in format necessary to report progress and project impacts

Part II:

HIP Best Management Practices

4 Primary Best Management Practices

Native Landscaping

Infiltration Trench

Media Filter Drain (MFD)

- MFD Sheet Flow Configuration
- MFD End-of-Pipe Configuration
- MFD Clean Beach (shoreline only)

Dispersion

Lake Whatcom Rain Garden

BMP Introduction

This section of the manual details approved best management practices (BMPs) supported by HIP designed specifically for maximizing phosphorus reduction on residential sites in the Lake Whatcom watershed These BMPs were vetted by a team of professional experts, including engineers, landscape designers/architects, and construction contractors. If proposed HIP projects follow these prescriptive instructions and guidelines without variation, no additional paperwork, justification, or analysis will be necessary.

Designers are strongly encouraged to develop HIP projects following the design standards, construction methods, material specifications, and example plans for HIP BMPs provided in this manual. Following the prescriptive instructions and guidelines provided without variation ensures compliance with program reimbursement requirements and pre-approved permits obtained for HIP projects by the City of Bellingham and Whatcom County Public Works.

Technical Background

Native Landscaping BMP
The HIP-specific Native Landscaping BMP was developed using the best available guidance for watershed-friendly landscaping from Washington State University (WSU). Methodology for landscape design and installation was based on guidance from WSU Whatcom County Extension as well as King County's Native Plant Guide, and modified to minimize phosphorus inputs as required in the Lake Whatcom watershed. Additional input on best practices was provided by the International Society of Arboriculture (ISA) -certified arborists and other landscape professionals convened during the creation of the City of Bellingham's Lake Whatcom development regulations.

The HIP Native Landscaping BMP represents a reduction in requirements compared to non-voluntary conservation planting projects. Allowances for native planting activities outside of the regulated Lake Whatcom watershed work window were developed using erosion control principles found in the Washington State Department of Ecology's (Ecology) Stormwater Management Manual for Western Washington (2012) supplemented with other specific strategies that reduce the risk of phosphorus migration off site.

Infiltration, Treatment & Dispersion BMPs
The Infiltration Trench, Lake Whatcom Rain Garden, Media Filter Drain (MFD), and Dispersion BMPs were developed based on design guidelines and requirements from the Ecology's Stormwater Management Manual for Western Washington (2012), modified slightly for constructability in residential retrofit applications and maximization of phosphorus reduction.

Variations on the MFD BMP were based on the Washington State Department of Transportation's Highway Runoff Manual (2014) and information found in the MFD approval published by Ecology through the Technology Assessment Protocol - Ecology (TAPE) process.

Further guidelines on soil testing and rain garden design were derived from the Rain Garden Handbook for Western Washington (2013) published by Ecology and WSU. Standard details, material specifications, and modifications for constructability and phosphorus reduction were made by a private civil engineering firm retained by the Lake Whatcom Management Program.

BMPs and specifications were reviewed and further refined with input from a private sector technical stakeholders group assembled specifically for HIP in December 2016.

Modifications

Minor modifications to HIP BMP standards that don't result in a change in BMP size, location, or ability to use standard cross sections provided may be submitted for review and approval on a case-by-case basis. Alternative materials or design modifications must be clearly described in the application materials. **These project components are subject to additional conditions and permit review with no guarantee of approval.** Longer review time will be required for projects not conforming to the standards as described in this manual.

Designers with suggestions for new HIP BMPs or significant design modifications to the current primary BMPs are encouraged to share their suggestions with the HIP Coordinator. Any HIP BMP not part of this manual must be vetted internally by staff before HIP funding may be used toward design or construction of that BMP. All new BMPs accepted must meet minimum requirements for phosphorus reduction, cost effectiveness, and maintenance procedures. Demonstrating compliance with these minimum requirements is the responsibility of the professional making the proposal.

Design Standards and Permitting Requirements

Native Landscaping

DESCRIPTION

Vegetated areas consisting of a thick mulch layer and a minimum density of plants common to forests of the Pacific Northwest. Native plants are generally defined as those found west of the Cascade Range prior to the arrival of European settlers, along with cultivars of those species and a few regionally-common species that are adapted to our climate.

Above: HIP Native Landscape Installed in 2016

METHOD OF PHOSPHORUS REDUCTION

Native landscaping re-creates the natural soil chemistry and biology found in forested areas. Plants and mulch in the vegetated area capture, neutralize, and recycle phosphorus, turning extra nutrients into healthy plants and soil. Up to 40% of rainfall is captured by plants prior to reaching the ground, resulting in less runoff.

Example of computer-generated native landscaping design

ADDITIONAL DESIGN FEATURES

Enhance your native landscape with one or more of the following site-specific options:

"Wet Garden" where moisture-loving native plants are installed in wet areas and thrive where other plants may struggle.

"Vegetated Berm" where strategically-placed soil piles are used to create visual complexity in the design.

"Riparian Buffer" a native plant garden that separates outdoor living spaces from streams, creeks, or shorelines.

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Native Landscaping projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- At least 4" of low-P mulch throughout
- Minimum density of plants (use plant density calculator) divided between at least two layers (trees, shrubs, and groundcover)
- At least 90% of plants must be native to the Pacific Northwest, based on USDA PLANTS Database or equivalent*

LOCATION

- No trees or shrubs within 5' of a known utility on private property or within 10' of a known utility in the public rights-of-way.
- No trees on or adjacent to septic tanks, drainfields, and reserve areas
- Planting area is not on or next to a slope >35%

CONSTRUCTION METHOD/ CRITICAL PATH

1. Define planting area. If desired, install edging material or a hand-dug trench around the perimeter to keep new mulch in place. Digging trenches is limited to summer months only.
2. Recommended: Place a single layer of cardboard over all flat, lawn-covered areas, leaving existing lawn in place. Cardboard is not recommended on slopes or landscaped areas without an existing lawn.
3. Install mulch to a depth of 4" on flat areas or 6" on sloped areas
4. Prepare hole for planting. Push mulch away. Cut an "X" in the cardboard (if any) and fold it back, exposing the ground below. Dig a hole as deep as the root mass and twice as wide.
5. Install plants. Remove potting media from the roots. Spread roots out and backfill gently with native soil.
6. Replace mulch to within 6" of plant stems.
7. Optional: Install irrigation system and rain barrels.
8. Water plants well.
9. Optional: Install temporary deer fencing.
10. Sweep any impervious surfaces that may have been dirtied by mulch or soil

NOTES ON SEQUENCING

- Construction step order may be adjusted to meet individual project needs.
- To phase the work, mulch first in the spring or summer then plant during the fall.
- If planting and mulching at the same time, during the summer months, plant first then immediately mulch. In winter, mulch must be spread first before planting is allowed.

NATIVE LANDSCAPING ON THE SHORELINE

Installing native landscaping along the Lake Whatcom shoreline is an effective way to reduce direct phosphorus runoff into the lake and provides an opportunity to create pleasing landscapes combined with other HIP BMPs and existing landscape features. When working on a native landscaping project next to the shoreline, make sure to:

- Assess soil conditions prior to plant selection and select appropriate native plants for the conditions. Many shoreline areas are affected by a high water table.
- Identify the high water mark and install a barrier like a straw wattle above it prior to starting work.
- Take extra care to keep exposed soil and sediment from coming into contact with water.

Infiltration Trench

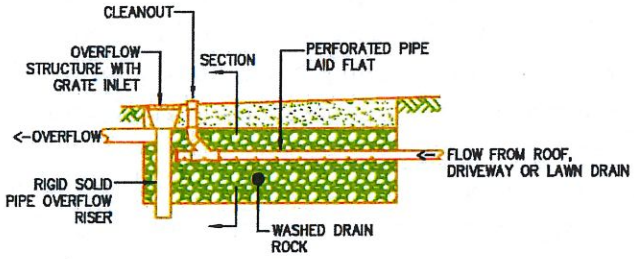
DESCRIPTION

An underground drainage facility, consisting of washed rock and constructed with a flat bottom, intended to capture and infiltrate runoff from impervious and pervious surfaces. This facility does not have an underdrain or bypass structure, so it requires a dedicated and protected overflow structure.

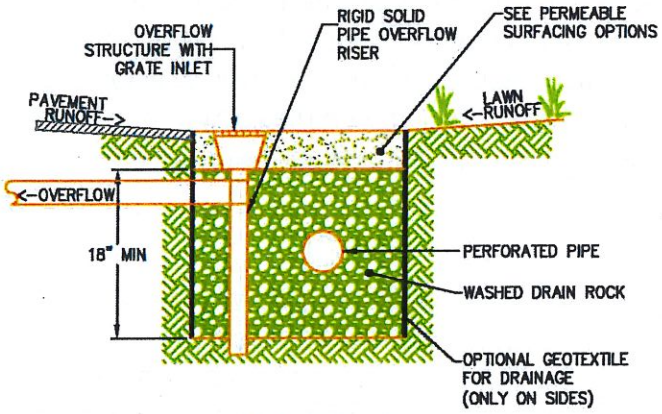
METHOD OF PHOSPHORUS REDUCTION

Treatment via infiltration through native soils. Runoff entering the infiltration trench is detained and allowed to slowly pass through subsoils, where phosphorus is bound by, captured within, and recycled into the soil matrix.

Above: HIP infiltration trench installed in 2016



PROFILE VIEW



SECTION VIEW

ADDITIONAL DESIGN FEATURES

Enhance your infiltration trench with one or more of the following site-specific options:

"Dry Creek Bed" where river rock creates the look of a stream channel in the landscape.

"Patio Drywell" where spaced pavers* with gaps create a useable outdoor living space.

"Walkway Trench" where pea gravel or spaced pavers* create durable pathways.

"Garden Path" where low-P mulch provides a way to access and enjoy the landscape (only allowed through landscaped areas).

* See Design Standards for HIP Permeable Pavement Surfacing. Restrictions and limitations apply to certain properties.

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All infiltration trench projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

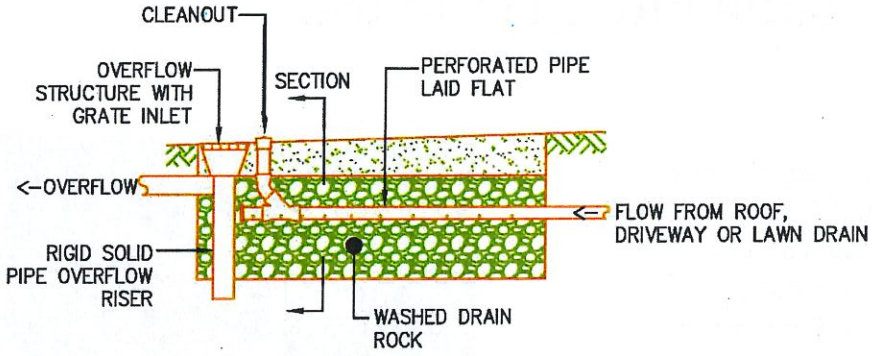
- At least 18" wide in all locations
- At least 18" deep, on average
- Total slope of trench less than 2%
- Bottom of trench more than 1' from groundwater or bedrock
- Only clean rock (no fines) is allowed in any layer

LOCATION

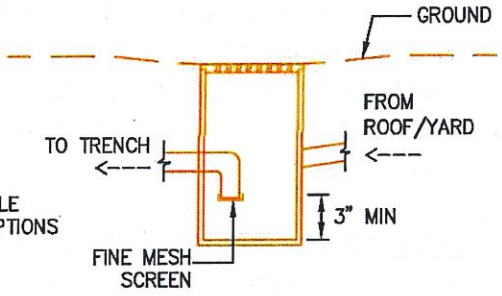
- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, trenches cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%.
- **Separation:** at a minimum, all infiltration facilities must be at least: 25' from shorelines or creeks, 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas.
- **Property Lines:** trenches cannot be located in public rights-of-way and should be placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

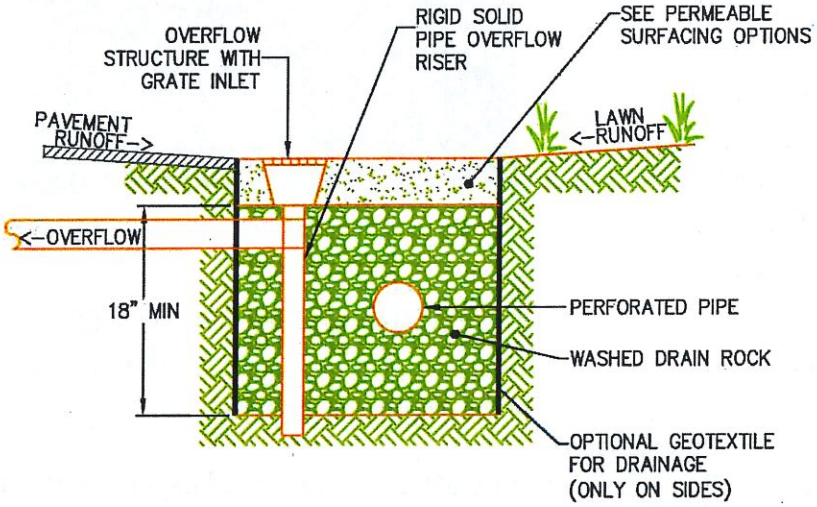
1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install 75% base rock in first lift
5. Install elevated distribution pipe
6. Install overflow riser and pipe
7. Connect overflow pipe to downstream drainage system
8. Install drains and conveyance into trench from site surfaces
9. Connect conveyance to distribution pipe
10. Install second lift of rock (25%) to reach final grade
11. Install surfacing (optional)
12. Stabilize disturbed soils
13. Remove erosion controls



PROFILE VIEW



JUNCTION BOX



SECTION VIEW

ROCK-FILLED INFILTRATION TRENCH
HIP BMP "B" TYPICAL NTS

Construction Criteria for Infiltration Facilities

Initial basin excavation should be conducted to within 1-foot of the final elevation of the basin floor. Excavate infiltration trenches and basins to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. The final phase of excavation should remove all accumulation of silt in the infiltration facility before putting it in service. After construction is completed, prevent sediment from entering the infiltration facility by first conveying the runoff water through an appropriate pretreatment system such as a pre-settling basin, wet pond, or sand filter.

Infiltration facilities should generally not be used as temporary sediment traps during construction. If an infiltration facility is to be used as a sediment trap, it must not be excavated to final grade until after the upgradient drainage area has been stabilized. Any accumulation of silt in the basin must be removed before putting it in service.

Traffic Control Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. The use of draglines and trackhoes should be considered for constructing infiltration basins. The infiltration area should be flagged or marked to keep heavy equipment away.

Design Standards and Permitting Requirements

Media Filter Drain (MFD)

DESCRIPTION

An underground drainage facility, consisting of specially-mixed media (MFD mix), intended to treat runoff from hard surfaces and lawn and landscaped areas. Configurations are slightly different depending on how runoff enters the facility (via pipe or sheet flow). This facility does have an underdrain and requires either a controlled bypass structure or an overflow to function properly.

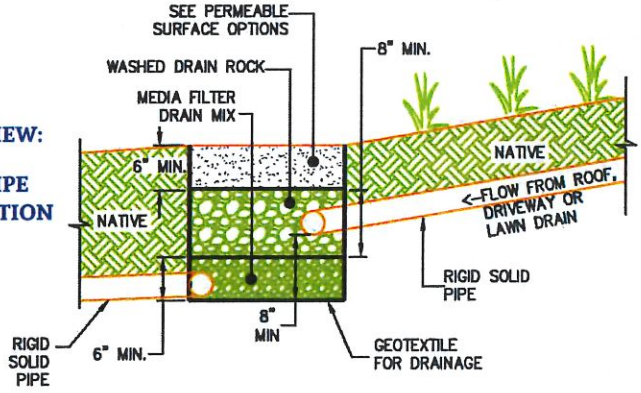
METHOD OF PHOSPHORUS REDUCTION

Treatment via media (MFD mix). Runoff entering the facility passes through the media, where perlite, dolomite, and gypsum provide physical, chemical, and biological treatment for total and dissolved phosphorus.

Above: useful yard space on top of a MFD

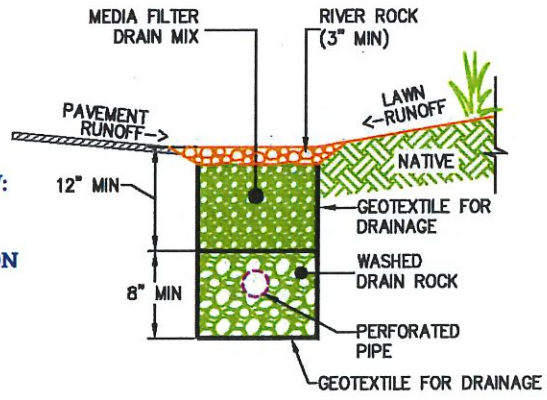
SECTION VIEW:

END-OF-PIPE CONFIGURATION



SECTION VIEW:

SHEET FLOW CONFIGURATION



ADDITIONAL DESIGN FEATURES

Enhance the look of your MFD with one or more of the following site-specific options:

"Patio MFD" where spaced pavers* with gaps create a useable outdoor living space.

"Sidewalk MFD" where pea gravel or spaced pavers* create durable pathways.

* See Design Standards for HIP Permeable Pavement Surfacing. Restrictions and limitations apply to certain properties

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Media Filter Drain projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

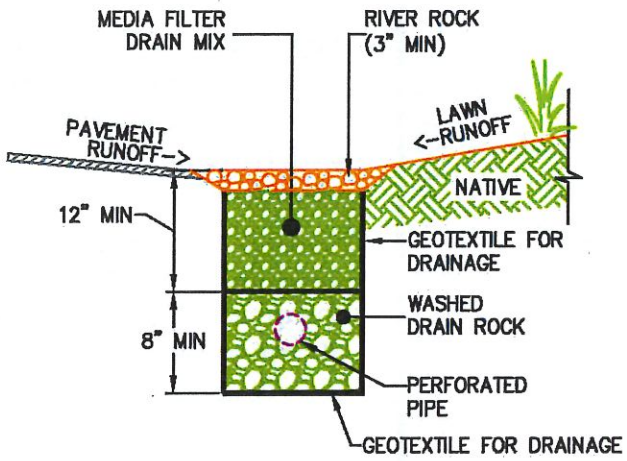
- For MFD trenches accepting sheet flow, trench must be at least 24" wide in all locations
- MFD mix at least 12" deep throughout (sheet flow design)
- For MFD trenches accepting piped flow, the trench must be at least 36" wide in all locations
- MFD mix at least 6" deep throughout (end-of-pipe design)
- Total slope of trench less than 2%
- No single trench longer than 50', use multiple trenches
- Bottom of MFD mix cannot contact groundwater

LOCATION

- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, MFDs cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all MFDs must be at least: 25' from shorelines or creeks (distance may be reduced if soil investigation demonstrates feasibility; check with HIP Coordinator), 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** MFDs cannot be located in public rights-of-way and should be placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

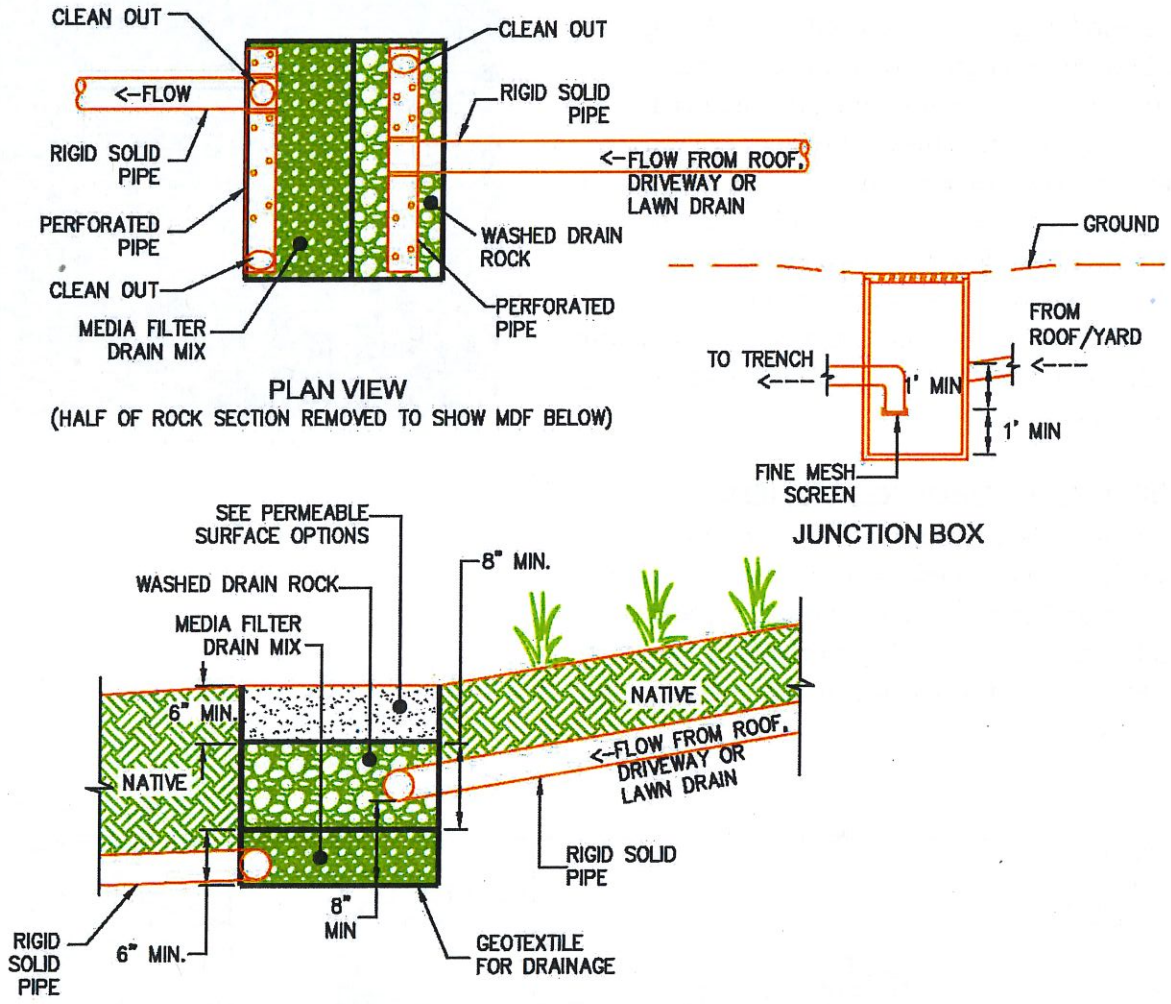
CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Lay fabric in trench and pin to edge
4. Install bottom layer* of material to bed underdrain pipe
5. Install underdrain pipe and stub out
6. Fold fabric over bottom layer
7. Place fabric over remaining trench
8. Install second layer* of material in 6" lifts over fabric
9. Install dispersion inlet (runnel with grade board or perforated pipe)
10. Fold fabric over second layer, cut to fit.
11. Connect underdrain pipe to downstream drainage system
12. Install conveyance to dispersion inlet
13. Connect roof/driveway/yard drains to conveyance
14. Install surfacing (optional)
15. Stabilize disturbed soils
16. Remove erosion controls



SECTION VIEW

MEDIA FILTER DRAIN ; SHEET FLOW CONFIGURATION
HIP BMP "C.1", TYPICAL NTS



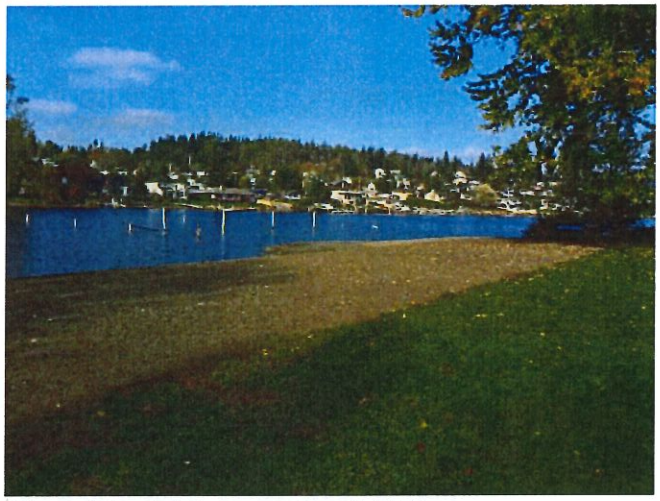
MEDIA FILTER DRAIN END-OF-PIPE CONFIGURATION
HIP BMP "C.2", TYPICAL NTS

Design Standards and Permitting Requirements

Media Filter Drain (MFD) - Clean Beach

DESCRIPTION

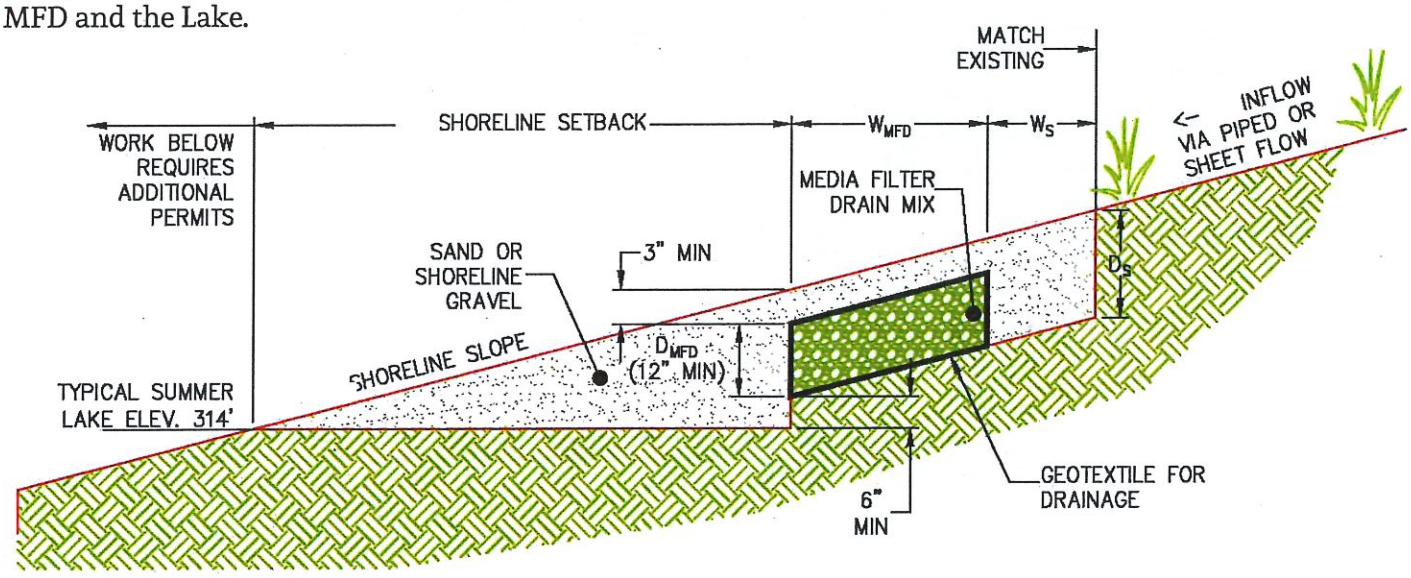
An underground drainage facility, consisting of specially-mixed media (MFD mix), intended to treat runoff from hard surfaces and lawn and landscaped areas. Along the shoreline, MFDs can be coupled with a beach made of treatment sand and native landscaping to enhance the performance of the system. This facility does not require an underdrain or structural overflow because excess water will flow into the sand filter beach. Runoff enters the facility via pipe or sheet flow per to "HIP BMP C.1 and C.2". Projects within Whatcom County must be designed per 30% Clean Beach requirements (see below). Projects within the City of Bellingham can utilize up to 100% clean beach along the shoreline.



Above: Bloedel Donovan Beach MFD

METHOD OF PHOSPHORUS REDUCTION

Treatment via media (MFD mix). Runoff entering the facility passes through the media and sand layers, where perlite, dolomite, and gypsum provide physical, chemical, and biological treatment for total and dissolved phosphorus. Excess runoff is treated by sand between the MFD and the Lake.



Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All Clean Beach projects must meet the following minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- For MFD trenches accepting sheet flow, the trench must be at least 24" wide in all locations
- For MFD trenches accepting piped flow, the trench must be at least 36" wide in all locations
- MFD mix at least 12" deep throughout
- Total slope of trench less than 2%
- No single trench longer than 50', use multiple trenches
- Bottom of MFD mix cannot contact groundwater
- Any non-lawn vegetation along the shoreline must be retained or replaced 3:1 elsewhere on site (see additional requirements if designing a 30% clean beach)
- Permeable surfacing is not permittable in a clean beach design

LOCATION

Conformance with MFD Standards: Clean beach MFD trenches must adhere to the minimum requirements for Critical Areas, Slopes, Separation, and Property Lines described in the HIP Standards for Media Filter Drains. Unless recommended by the HIP Coordinator, Clean Beach MFD trenches must be located at least 25' from the Lake Whatcom ordinary high water mark (OHWM). Placing MFD trenches closer to the shoreline (15' minimum setback) may be possible on some sites if soil investigations demonstrate feasibility.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Place non-woven geotextile (for drainage) onto subgrade
4. Install MFD mix in 6" lifts
5. Pull geotextile edges up and around MFD material, creating a MFD "burrito"
6. Backfill clean sand around and over MFD burrito and match to grade
7. Place drain rock layer and distribution piping*
8. Install conveyance to dispersion inlet*
9. Connect roof/driveway/yard drains to conveyance*
10. Stabilize disturbed soils
11. Remove erosion controls

*Additional steps for end-of-pipe configuration

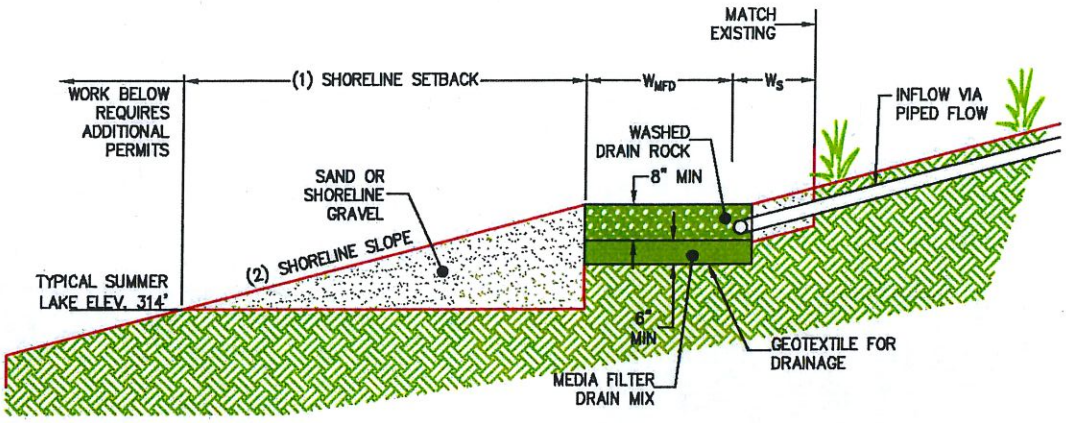
30% CLEAN BEACH OPTION WITH NATIVE LANDSCAPING BUFFER

Shoreline native vegetation provides benefits by reducing phosphorus and nutrients from entering the lake while providing habitat for fish and birds. Shoreline vegetation also provides visual interest and lower maintenance cost compared to lawns.

With the 30% clean beach option, 30% of the property's shoreline is converted to beach and 70% of the shoreline has native landscaping. Projects located within Whatcom County outside of city limits need to adhere to the 30% clean beach requirements listed below. HIP participants within the City of Bellingham may choose to incorporate any amount of native shoreline vegetation as part of their clean beach project design.

30% Clean Beach Requirements:

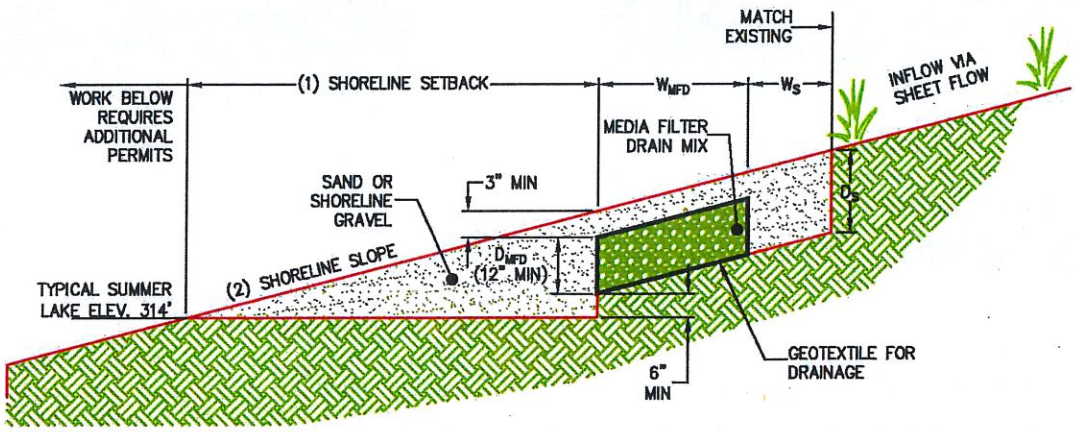
- Refer to the 30% clean beach plan view for conceptual configurations and notes
- See sectional view C.3 detail and notes
- Follow the HIP Native Landscaping BMP design standards included in this manual
- The minimum square footage of native shoreline planting installed must be equal to the total parcel shoreline length x 15'. Planting areas should be contiguous with the shoreline. Planting area shape can vary with a minimum buffer depth of 5' from the shoreline
- Maximum beach width at the shoreline is 30% of total shoreline length; above the shoreline beach width may vary up to the maximum width necessary to capture flow from the MFD



MEDIA FILTER DRAIN - CLEAN BEACH CONFIGURATION — SECTION VIEW
HIP BMP "C.3" TYPICAL END OF PIPE — NTS

(1) 25' RECOMMENDED SHORELINE SETBACK. MAYBE REDUCED TO 15' IF SOIL INVESTIGATION DEMONSTRATES BOTTOM OF MFD IS ABOVE HIGH GROUNDWATER ELEVATION.

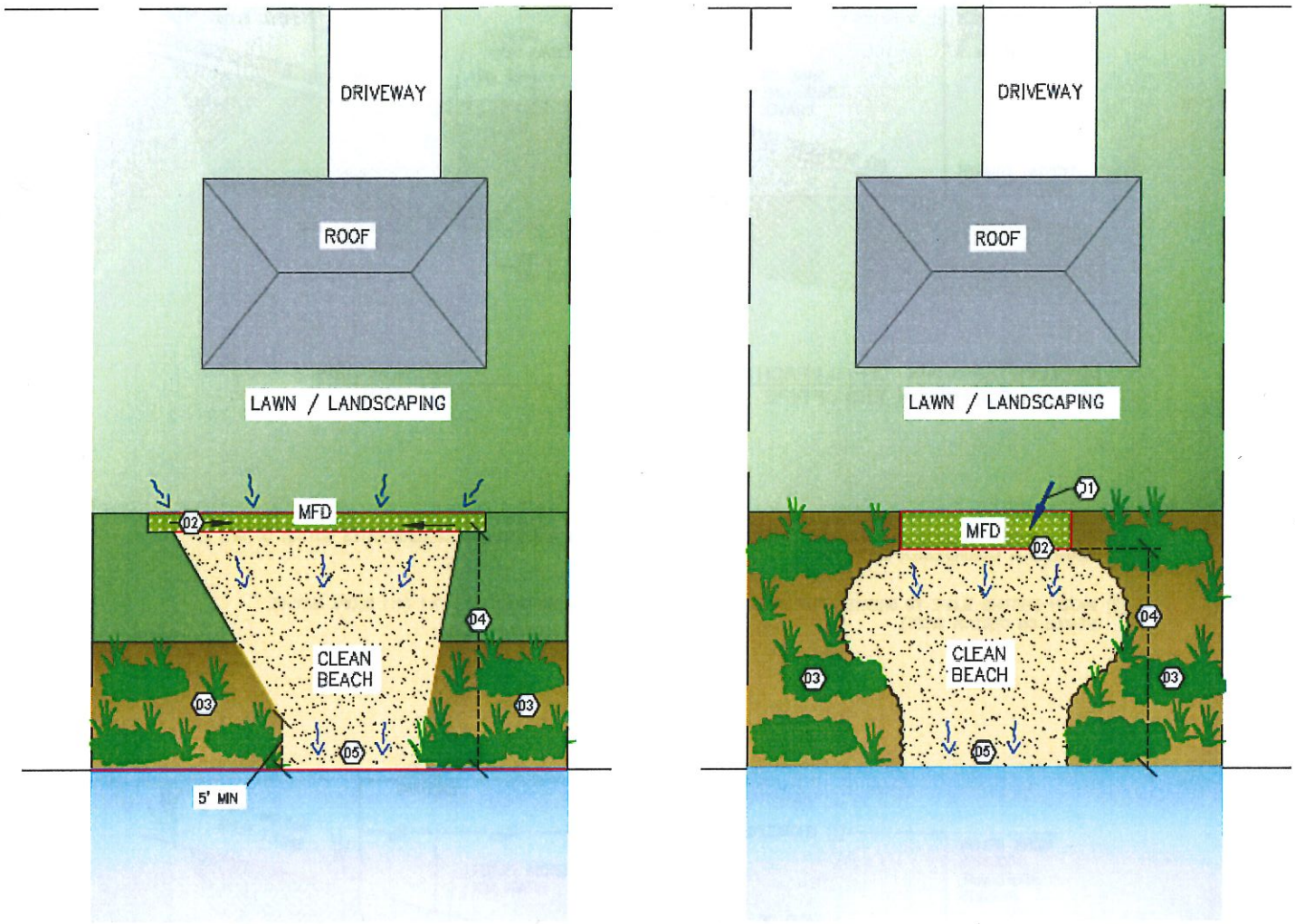
(2) MATCH EXISTING SLOPE TO GREATEST EXTENT FEASIBLE RECOMMENDED MAXIMUM SLOPE IS 7:1 (4:1 SLOPE MAY BE STABLE ON CERTAIN SITES).



MEDIA FILTER DRAIN - CLEAN BEACH CONFIGURATION — SECTION VIEW
HIP BMP "C.3" TYPICAL — NTS

(1) 25' RECOMMENDED SHORELINE SETBACK. MAYBE REDUCED TO 15' IF SOIL INVESTIGATION DEMONSTRATES BOTTOM OF MFD IS ABOVE HIGH GROUNDWATER ELEVATION

(2) MATCH EXISTING SLOPE TO GREATEST EXTENT FEASIBLE. RECOMMENDED MAXIMUM SLOPE IS 7:1. 4:1 SLOPE MAYBE BE STABLE ON CERTAIN SITES



MEDIA FILTER DRAIN
30% CLEAN BEACH

PLAN VIEW
NTS

NOTES

01 INFLOW VIA SHEET OR PIPED FLOW.

02 DIRECT OUTFLOW FROM MFD TOWARDS CLEAN BEACH TO GREATEST EXTENT POSSIBLE. SURFACE GRADING AND SLOPING MDF TRENCH (2% MAX) ALLOWED.

03 SHORELINE NATIVE LANDSCAPING. PROVIDE MINIMUM PLANTED AREA EQUAL TO TOTAL PARCEL SHORELINE LENGTH X 15'. MINIMUM 5' PLANTING BUFFER WIDTH AT SHORELINE.

04 25' STANDARD MFD SETBACK. REDUCED TO 15' WITH SUBSURFACE SOIL INVESTIGATION AND ADEQUATE GROUNDWATER CLEARANCE.

05 PROVIDE MAXIMUM 30% CLEAN BEACH AT SHORELINE FOR WHATCOM COUNTY PROJECTS.

* PLAN VIEW SHOWN IS FOR CONCEPTUAL PURPOSES ONLY. MFD CONFIGURATIONS SHALL MEET ALL MINIMUM REQUIREMENTS IN HIP DESIGNER MANUAL AND MUST BE APPROVED BY PLANNING DEPARTMENT.

Design Standards and Permitting Requirements

Dispersion

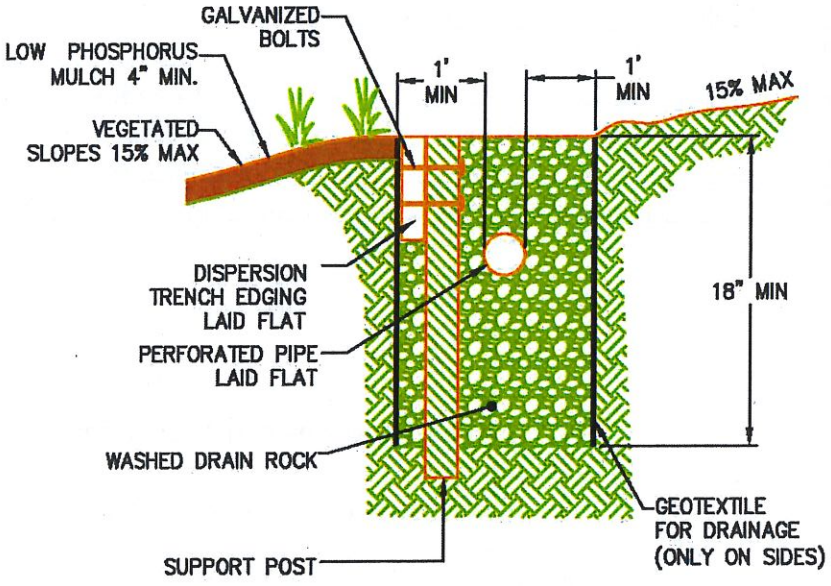
DESCRIPTION

A surface drainage facility, consisting of washed rock and constructed with a flat bottom, intended to convert concentrated flows into sheet flows for dispersion into existing or newly established vegetated areas. This facility does not have underdrain, bypass, or overflow structures.

Above: Dispersion system uses nearby forested area

METHOD OF PHOSPHORUS REDUCTION

Treatment via dispersion into native forested areas. Runoff entering the rock trench is spread evenly throughout the trench and then overflows evenly into the vegetated area. Plants and mulch in the vegetated area capture, neutralize, and recycle phosphorus into healthy plants and soil.



SECTION VIEW

ADDITIONAL DESIGN FEATURES

Enhance your dispersion system with one or more of the following site-specific options:

"Dry Creek Bed" where river rock creates the look of a stream channel in the landscape.

"Dispersion Walkway" where pea gravel creates durable pathways.

"Garden Path" where low-P mulch provides a way to access and enjoy the landscape (only allowed through landscaped areas).

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All dispersion projects must meet these minimum requirements in order to be approved for construction under these HIP Standards:

DESIGN

- At least 24" wide in all locations
- Rock at least 18" deep
- Total slope of trench less than 2%
- Bottom of trench cannot contact groundwater
- No single trench longer than 50', use multiple trenches.
- Vegetated flow path is long enough to absorb all dispersed runoff[1]
- Plant density in flow path meets minimum requirements[2]

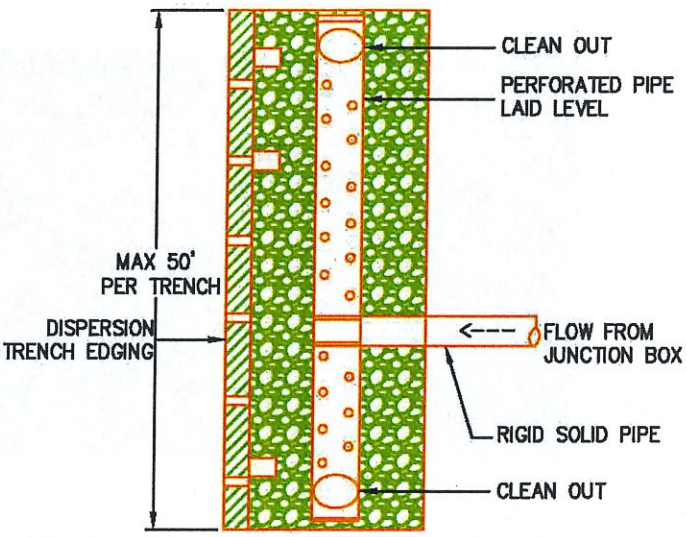
[1] use Dispersion Calculator to determine required flow path
[2] use the Native Landscaping BMP to create a new vegetated flow path

LOCATION

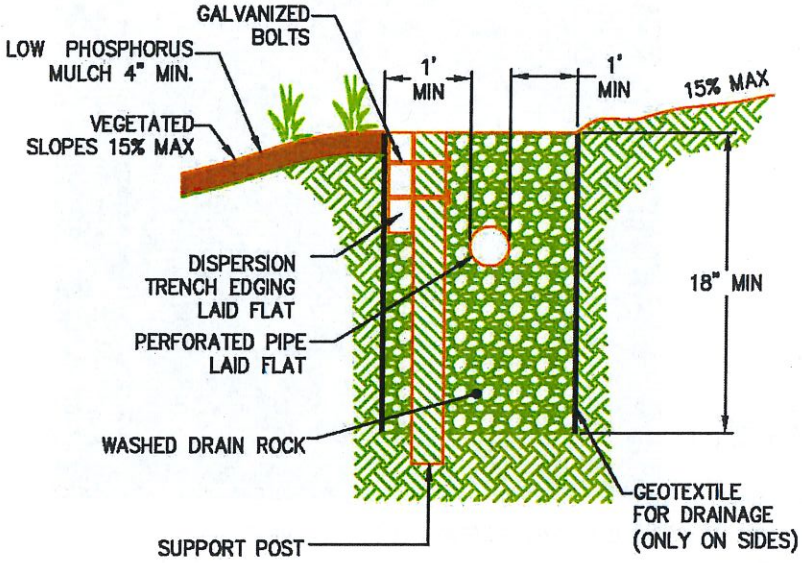
- **Critical Areas:** setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, trenches cannot be placed on slopes >15% and must be at least 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all dispersion facilities must be at least: 25' from shorelines or creeks (distance is greater when critical areas are present), 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the trench at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** trenches cannot be located in public rights-of-way and dispersed water should not cross property lines. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

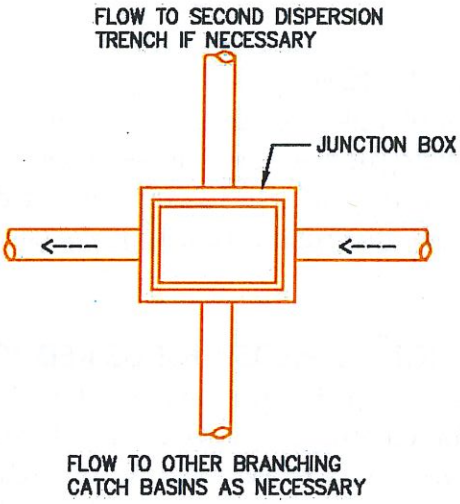
1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install 75% base rock in first lift
5. Install elevated distribution pipe
6. Install drains and conveyance into trench from site surfaces
7. Connect conveyance to distribution pipe
8. Install second lift of rock (25%) to reach final grade
9. Install surfacing (optional)
10. Stabilize disturbed soils
11. Remove erosion controls

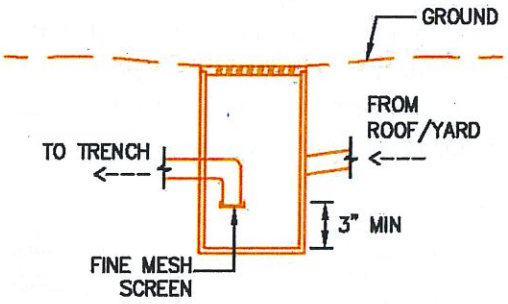


PLAN VIEW

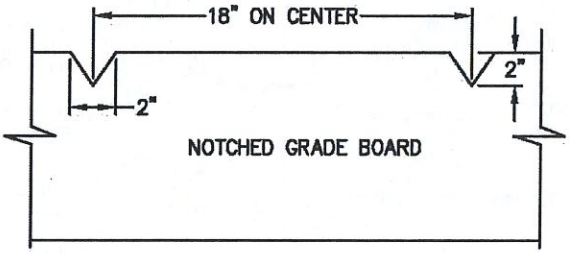


SECTION VIEW





JUNCTION BOX



DISPERSION TRENCH EDGING

DISPERSION TRENCH
HIP BMP "D" TYPICAL

NTS

Design Guidance and Permitting Requirements

Lake Whatcom Rain Garden

DESCRIPTION

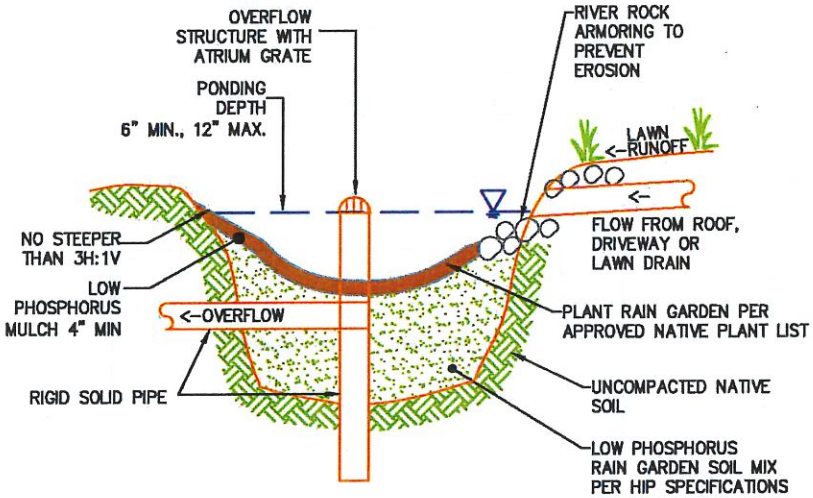
A hybrid underground/surface drainage facility, consisting of special soil mixes and vegetation and constructed with a flat bottom, intended to capture and infiltrate runoff from impervious and pervious surfaces.

METHOD OF PHOSPHORUS REDUCTION

Treatment via infiltration through native soils. Runoff entering the rain garden is detained and allowed to slowly pass through imported and native soil mixes, where phosphorus is bound by, captured within, and recycled into the soil matrix. Plants in the facility attenuate flows through evapotranspiration and reduce nutrient loading by uptake and binding in the vegetative biomass.

Photo source: Stewardship Partners

Photo source: Stewardship Partners



SECTION VIEW

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

MINIMUM REQUIREMENTS AND DESIGN LIMITATIONS

All rain gardens must meet these minimum requirements in order to be approved for construction under these Design Standards:

DESIGN

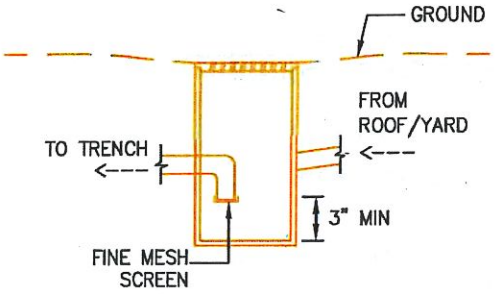
- At least 18" of rain garden soil throughout ponding area
- Total slope of bottom surface less than 2%
- Side slopes 3:1 Horizontal to Vertical or flatter, measured from top of soil mix
- Bottom of soil mix (media) must be more than 1' from groundwater or bedrock
- Low-P mulches from approved list cover all soils with at least 4" deep
- Includes a mix of approved rain garden plants at a minimum density
- Ponding depth cannot exceed 12" or occupy more than half of the side slope area

LOCATION

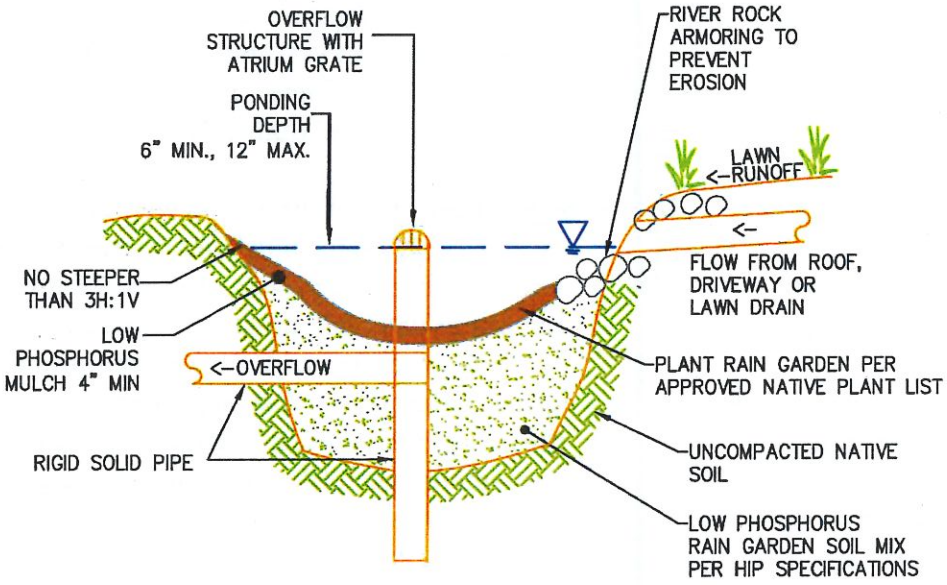
- **Critical Areas:** Setback requirements near critical areas (wetlands, shorelines, or creeks) and their buffers will vary depending on site specifics. Consult with the HIP Coordinator for requirements pertaining to each unique site.
- **Slopes:** unless approved by a licensed geotechnical engineer, rain gardens cannot be placed on slopes >10% and must be at least 10' upgradient from slopes >15% and 50' upgradient from slopes steeper than 35%
- **Separation:** at a minimum, all wetted areas must be at least: 25' from shorelines or creeks 5' from known public and private utilities, 5' from structures with slab-on-grade foundations and 10' from structures with a basement or crawl space. Septic tanks must be protected by placing the rain garden at least 5' from tanks, and 10' upgradient and 30' downgradient from drain fields and drain field reserve areas
- **Property Lines:** rain gardens cannot be located in public rights-of-way and placed at least 10' from neighboring property lines except in some specific cases. Consult with the HIP Coordinator to determine site-specific setback requirements.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install erosion controls
2. Excavate soil and reuse on site or dispose
3. Gently scarify subgrade
4. Install overflow riser and pipe
5. Install 75% of rain garden mix on first lift
6. Connect overflow pipe to downstream drainage system
7. Install drains and conveyance into rain garden from site surfaces
8. Install river rock for energy dissipation at inlet
9. Install second lift of rain garden mix (25%) to final surface grade
10. Place 75% of mulch over all soil surfaces
11. Install plants
12. Place remaining 25% of mulch
13. Stabilize disturbed soils
14. Remove erosion controls



JUNCTION BOX



SECTION VIEW

LAKE WHATCOM RAIN GARDEN
HIP BMP "E" TYPICAL NTS

Construction Criteria for Infiltration Facilities

Initial basin excavation should be conducted to within 1-foot of the final elevation of the basin floor. Excavate infiltration trenches and basins to final grade only after all disturbed areas in the upgradient project drainage area have been permanently stabilized. The final phase of excavation should remove all accumulation of silt in the infiltration facility before putting it in service. After construction is completed, prevent sediment from entering the infiltration facility by first conveying the runoff water through an appropriate pretreatment system such as a pre-settling basin, wet pond, or sand filter.

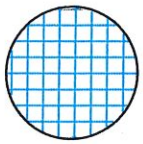
Infiltration facilities should generally not be used as temporary sediment traps during construction. If an infiltration facility is to be used as a sediment trap, it must not be excavated to final grade until after the upgradient drainage area has been stabilized. Any accumulation of silt in the basin must be removed before putting it in service.

Traffic Control Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. The use of draglines and trackhoes should be considered for constructing infiltration basins. The infiltration area should be flagged or marked to keep heavy equipment away.

5 Supplemental & Secondary Best Management Practices

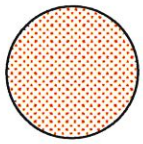
Supplemental Best Management Practices

Supplemental Best Management Practices (BMPs) support the functioning of many primary BMP projects. The need for Supplemental BMPs is based on site-specific requirements.



Conveyance

- Downspout inlet
- Junction box
- French drain
- Pipe connections to existing infrastructure



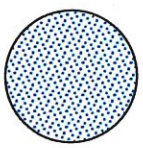
Erosion and Sediment Control

Secondary Best Management Practices

Secondary Best Management Practices (BMPs) may be permitted only in conjunction with one or more HIP-permitted primary BMP projects.

Permeable Pavement Surfacing

Note: This BMP is only eligible for HIP projects as a surface over a proposed infiltration or treatment BMP. Stand-alone permeable pavement projects, or those that propose an expansion of paver area beyond the necessary footprint, may not be permitted under HIP's free permit process.

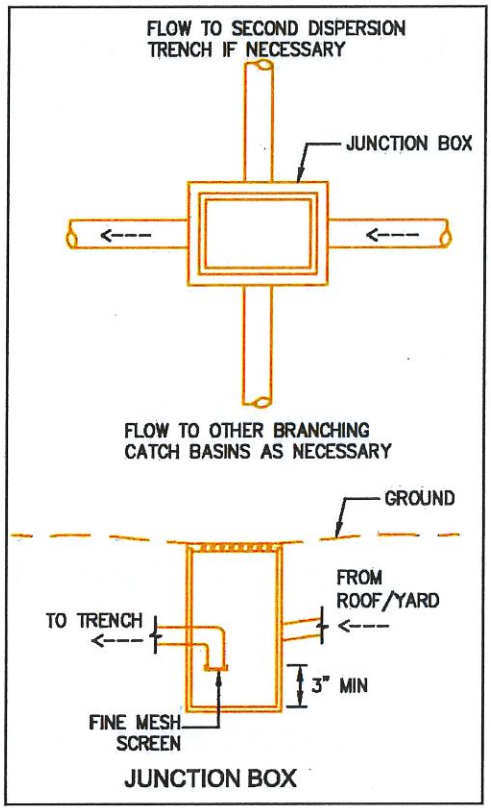


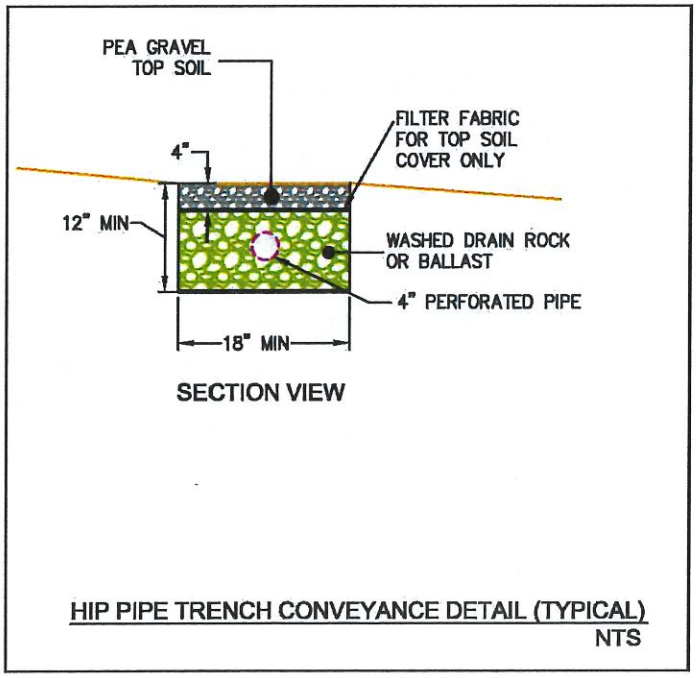
Rainwater Harvesting

Note: This BMP is only eligible for HIP projects as a means to provide irrigation water to new native landscaping, rain garden plantings, or dispersion area vegetation. Stand-alone rainwater harvesting projects, or those that propose utilizing the water for other needs such as lawn or vegetable garden watering, may not be permitted under HIP's free permit process.

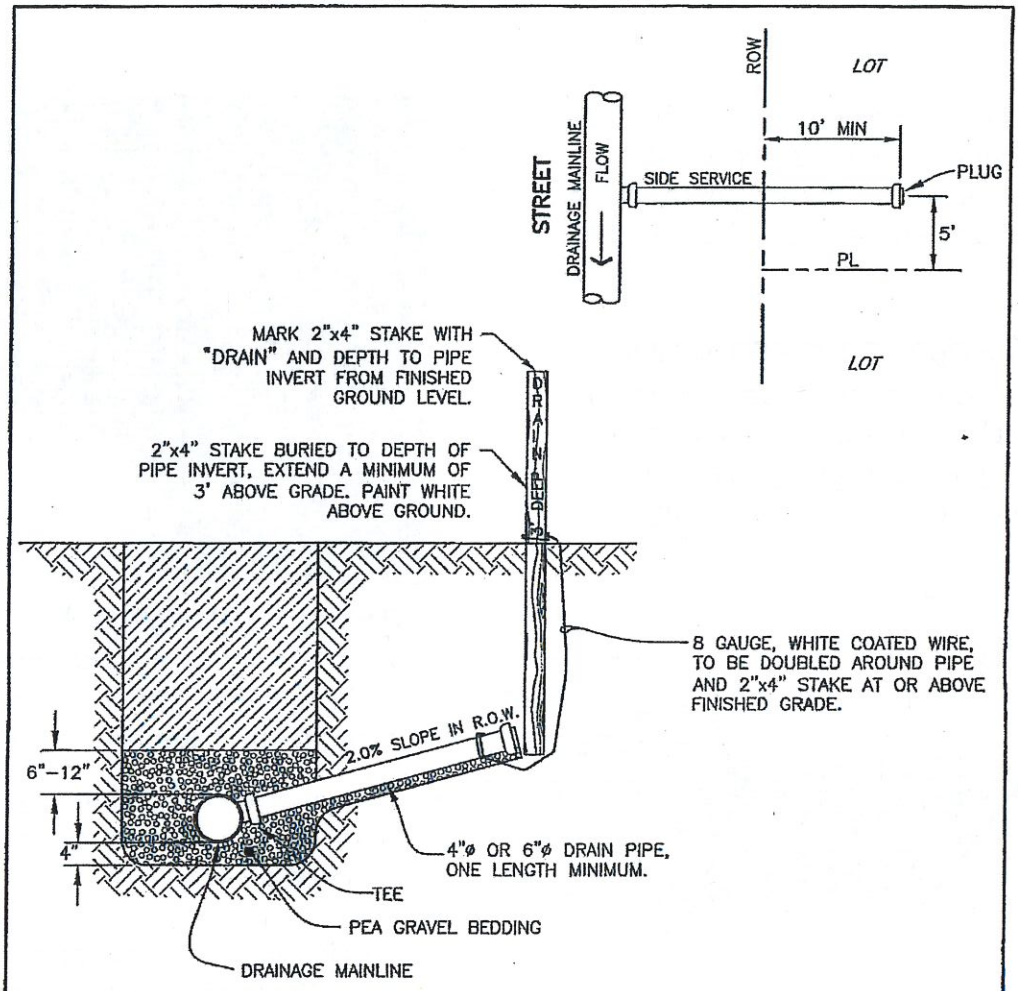
Design Guidance

Conveyance





HIP PIPE TRENCH CONVEYANCE DETAIL (TYPICAL)
NTS



NOTES:

1. UNLESS OTHERWISE INDICATED ON PLAN, SIDE SERVICE SHALL BE LOWER THAN THE LOWEST LOT ELEVATION.
2. WHEN REPLACING EXISTING SIDE SERVICE, CONTRACTOR SHALL VERIFY POSITIVE FALL, OTHER EXISTING CONNECTIONS, AND SAGS OR DEFLECTIONS IN PIPE, AS PER ASTM F 1743 8.6.

NOT TO SCALE

APPROVED		CITY OF BELLINGHAM	DRAWING
City Engineer	Date 4-28-05	STORM DRAIN SIDE SERVICE	DR–530

Design Guidance and Permitting Requirements

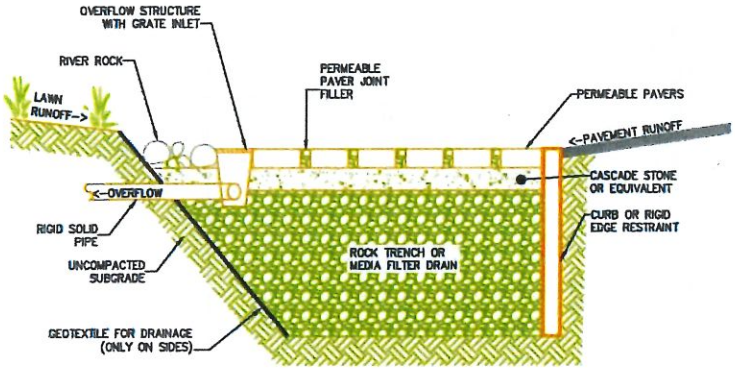
Permeable Pavement

DESCRIPTION

Permeable pavement provides surface stabilization and protection for infiltration trenches and drywells. In some cases, under the right conditions, this component may also be installed above Media Filter Drain (MFD) trenches.

METHOD OF PHOSPHORUS REDUCTION

Permeable pavement does not directly reduce the amount of phosphorus in runoff. This component protects the phosphorus-reducing capacity of the underlying infiltration or treatment facility.



SECTION VIEW

MATERIAL REQUIREMENTS

- All proprietary pavements must be installed and maintained per manufacturer's recommendations based on anticipated use.
- All non-propriety individual pavers must be less than 2 square feet with greater than ½ inch gaps between pavers.
- Special considerations apply near creeks or the Lake Whatcom shoreline. Consult with HIP Coordinator prior to selecting materials

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install primary BMP
2. Install edge restraints (optional)
3. Place #2 stone over BMP surface
4. Place #8 stone ("Cascade Stone") to final depth
5. Install spaced pavers or proprietary permeable pavement material
6. Install clean pea gravel or manufacturer's recommended product in paver gaps. **DO NOT USE SAND.**

MATERIAL EXAMPLES

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

Design Guidance
Rainwater Harvesting

DESCRIPTION

Rainwater harvesting is the process of collecting water from an impervious surface, such as a roof, and routing it to a location where it is beneficially used.

METHOD OF PHOSPHORUS REDUCTION

Rainwater harvesting does not directly reduce the amount of phosphorus in runoff. However, because rainwater is captured in barrels or cisterns, the amount of runoff that carries phosphorus to the Lake during precipitation events is decreased. In addition, harvested rainwater can be connected to other HIP projects, such as native landscaping, rain gardens, and underground pollution filters, where the water is slowed and cleaned prior to reaching Lake Whatcom.

CONSTRUCTION METHOD/ CRITICAL PATH

1. Install primary BMP
2. Choose a location for cistern
3. Choose a material that is compatible with water use
4. Design connectivity to other HIP water quality projects

DESIGN REQUIREMENTS

- All individual tanks hold less than 320 gallons
- Total system storage is less than 5,000 gallons when all tanks are full
- Height to width ratio of tanks are 2:1 or less
- Water from tanks are not used for indoor purposes such as drinking and cooking
- Tanks not meeting these requirements may be permitted through alternative pathways outside of the HIP permitting process
- Overflow/outflow water must be directed to a HIP BMP for tanks to be reimbursable under HI

Note: This design methodology is applicable for HIP projects only. These methods may not be suitable for, and have not been evaluated for, compliance with regulations which require professional engineering.

For more guidance on rainwater harvesting for residential beneficial uses visit cob.org/rainwater.