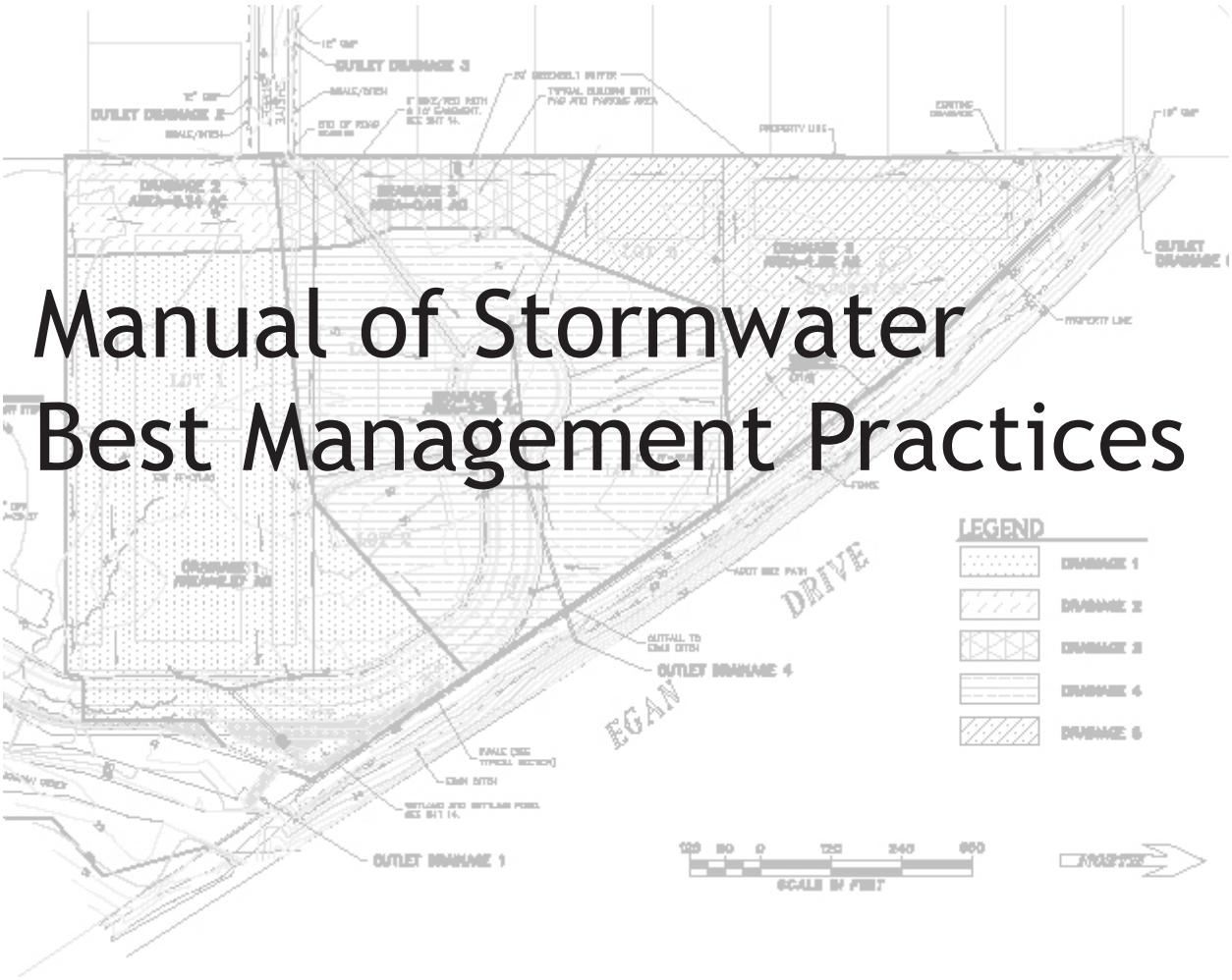

Manual of Stormwater Best Management Practices

A practical guide for land developers, designers, planners and contractors to promote site design and post-construction stormwater management in Juneau, Alaska

Produced by the City and Borough of Juneau
in partnership with the
United States Fish & Wildlife Service
2008

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Chapter I The Importance of Stormwater Management in Juneau

Why are Best Management Practices (BMP's) needed?

Due to challenging topography and physical constraints of the coastal range and the ocean, developable land in Juneau is limited. For this reason, development often occurs in floodplains, wetlands, and close to sensitive streams. However, as less land is available and more development occurs in these areas, the negative effects of stormwater runoff become apparent in stream systems and waterbodies. Currently, Juneau has five state listed impaired anadromous fish streams due to urban stormwater runoff: Lemon Creek, Vanderbilt Creek, Jordan Creek, Duck Creek and Pederson Hill Creek.

These streams are impaired because the water contains high levels of contaminants which may include trace metals, fecal coliform, petroleum products, sediment and debris. Water quality problems can be human health concerns for drinking water and impact fish and wildlife habitat. The pollutants often enter the stream from stormwater runoff from developed sites as well as non-point sources.

Stormwater can also cause problems with flooding and erosion. When rainfall runs over paved or impervious surfaces, the speed and volume of the water is higher than if it runs over grass or forest and infiltrates into the ground. The increased quantity and velocity of the water then causes erosion in stream systems that are not capable of handling this high volume and flow. Eroding banks can cause destabilization of land and structures and high sediment load downstream.

Who cares about BMP's?

Across the country, the Environmental Protection Agency (EPA) enforces standards for treatment of stormwater. Under this system, municipalities retain the responsibility of implementing standards to guide local development practices. In Juneau, the City and Borough of Juneau (CBJ) and environmental agencies such as the the U.S. Army Corps of Engineers (ACOE), Department of Natural Resources (DNR), the Alaska Department of Fish and Game (ADFG), the Alaska Department of Environmental Conservation (ADEC), National Marine Fisheries Services (NMFS) and the U.S. Fish & Wildlife Service (USFWS) review and/or grant permits for development that relates to stormwater discharge and water quality.

When planning a construction project that impacts stormwater, the following permits may be necessary. This list is not a complete list and provides only basic guidelines. All agencies should be consulted prior to beginning site construction.

CBJ:
Building and Grading Permit (includes a drainage plan)
Wetlands Permit - For fill in class C & D wetlands

EPA:
Construction General Permit - this involves writing a Stormwater Pollution Prevention Plan (SWPPP) and permits construction on sites with one acre or more of land disturbance.

ACOE:
Individual Permit/Nationwide Permit - For fill placement in waters of the U.S. or wetlands. In Juneau the ACOE permits class A & B wetlands. CBJ permits class C & D wetlands.

DNR:
Coastal Project Questionnaire (CPQ) - For projects where federal, state or local permits are required.

ADFG:
Fish Habitat Permit - For projects impacting fish habitat.

ADEC:
401 Certification - This is a water quality certification that occurs when a permit is submitted to the ACOE.

How should this guide be used?

In response to regulators and agencies requesting better treatment of stormwater on development projects, the CBJ produced this guide to educate the community on practical site design and BMPs to be implemented in the design and construction phase that will manage stormwater in the post-development phase. For guidance on BMP's to use during construction, the Alaska Storm Water Pollution Prevention Guide produced by the Alaska Department of Transportation and Public Facilities may be helpful.

- Chapter II offers site planning and design considerations to minimize the need for stormwater treatment facilities. By employing proactive stormwater planning, time, land and money can be saved when developing a site.

- Chapter III lists Best Management Practices (BMPs) based on treatment at the source, conveyance treatment, or end of pipe treatment. This chapter is organized into summary fact sheets with sample design standards and details.

- The Appendices provide guidance on plant choices and links to other sources of information on BMP applications.

Chapter II Site Design Strategies to Minimize Stormwater

Simple and cost effective treatments at the source can help to infiltrate, evaporate, detain, and filter water immediately and in smaller quantities, thereby reducing the need for larger land areas to manage stormwater.

From Low Impact Development Technical Guidance Manual for Puget Sound, 2005

Three principles guide site design applications:

1 Use Hydrology to Organize the Site

• Consider the existing hydrology and drainage patterns along with other site needs such as pedestrian and vehicular access and site operations and functionality.

2 Minimize Land Disturbance

• Locate structures and design features with the existing topography. Set structures into hillsides, plan roads along contours, build around streams and wetlands.This will help to maintain existing drainage patterns.
• Minimize the clearing footprint. Reducing the impervious surface area (concrete and ashpalt) on a site will result in less runoff. Existing vegetation (trees and shrubs) and soils will filtrate and evaporate water extremely well in Southeast Alaska.
• Avoid areas sensitive to erosion or areas that will naturally promote drainage, infiltration and filtration such as wetlands and stream banks or edges of water bodies.

3 Decentralize and Reduce Connectivity

• Treat and manage the source of stormwater separately. Direct downspouts of roofs to separate bioretention areas and sheet flow from parking lots to filter strips, bioretention areas or swales at the edges of the parking lot.
• Reduce connectivity to minimize the land area that is needed to manage the water in a larger, separate facility.

Site Design Applications

The following examples of applications are only a few that are applicable to Southeast Alaska conditions and land use constraints. A few of the suggestions for land use options are described in the CBJ Land Use Code and have been implemented in Juneau. The suggested BMP's are explained in Chapter III, Best Management Practice Fact Sheets.

Planned Open Space/Cluster Development

• By increasing the density of development on a site, critical drainage and habitat areas may be preserved as open space, impervious surfaces (concrete, asphalt) are reduced, and the extent of land clearing is minimized. In Southeast Alaska, this site design application is useful in land with wetlands, streamside or lakeside land.

• CBJ Land Use Code 49.15.600, Planned Unit Development, regulates this application. Planned Open Space/Cluster Development is being promoted by the CBJ as a development strategy.

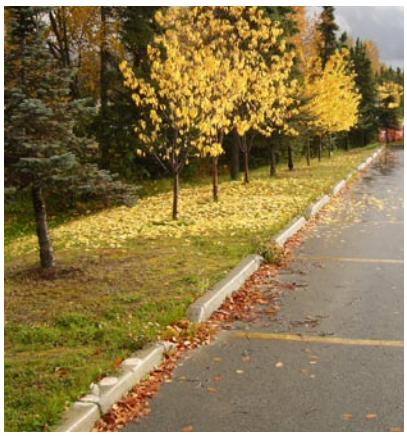
From Low Impact Development Technical Guidance Manual for Puget Sound, 2005

Riparian Buffers

• When water bodies are adjacent to developed sites, filter strips edging the buffer zone are important as treatment for stormwater. Coarse sediment and debris filtration, infiltration, slowing of velocity and some uptake of contaminants will occur in this filter strip prior to encroaching on the sensitive riparian buffer zone.
• Buffers are required along streams and water bodies in the CBJ as regulated in the CBJ Land Use Code 49.70.310.

Buffer on Jordan Creek behind Nugget Mall. Large buffer and filter area allow road runoff to filter prior to entering creek (see inflow to left of bridge)

Parking Lot Retention



- Parking lots present a simple and cost effective opportunity to infiltrate and treat stormwater through the construction of infiltration beds, swales, or bioretention beds. Narrow depressions between parking rows or at the edge of the parking lot collect and store water.
- In Anchorage, this application is common and regulated by the manual, Anchorage Parking Lots: 2002 Best Management Practices Guidance, Municipality of Anchorage. This can be found at http://wms.geonorth.com/library/LibraryReportsDocuments.aspx.

Parking Lots in Anchorage: Top shows curb cuts with flow to filter strip, bottom shows curb cuts with infiltration areas

Downspout/Roof Runoff Infiltration

- Another simple and inexpensive method to infiltrate and treat stormwater is at the discharge point of roof downspouts. Small gardens or infiltration trenches can be built to collect, detain, infiltrate, evaporate, and treat stormwater. The water should be directed 5' away from the building foundation, or the foundation should be protected.
- Landscape plantings in the bioretention area can beautify the development. In residential applications, this is often called a raingarden.
- In Anchorage, this application is common in commercial, urban developments, and residential developments.

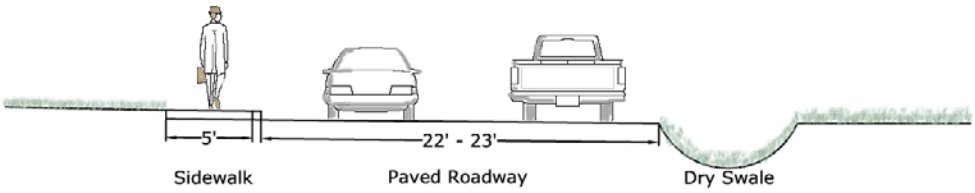
Roof downspout into planted infiltration area

Street Planning

• By minimizing street width, constructing sidewalk on one side of the street and a swale for street drainage on the other side of the street, less clearing of land is required and less asphalt is used. The result is less erosion, less runoff from impervious surfaces, and the decentralization of storm water through the use of a swale.

• An example of narrow streets that function in a neighborhood in Juneau is the Federal Flats area. A, B, C, and D Streets are approximately 22-23' wide with two lanes of traffic. However, one lane is often used for parking and queuing.

•The section below demonstrates roadway sizing based on the Federal Flats area combined with a swale on one side of the road to treat runoff. This model could be used for typical and local access roads.



• CBJ Land Use Code 49.35.240 regulates this application. The Valley Professional Center in the Mendenhall Valley is an example where regulations were modified to allow the construction of one sidewalk and a swale that directed stormwater to a detention basin to minimize runoff to Jordan Creek.

Streetscape in Seattle in construction showing swale/infiltration areas and sidewalk on other side of street, photo provided by Tetra Tech

Chapter III Stormwater BMP Fact Sheets

Recommended Best Managment Practices (BMP's) for Juneau are organized in Chapter III as fact sheets for reference. Each sheet describes one method of stormwater treatment including a general description, information on applicability in Juneau, design criteria, and maintenance requirements. Often, standard drawings and photos help to communicate the purpose and use of the BMP.

The fact sheets are meant as general guidelines for use of the BMP. Each BMP must be designed to function on individual sites and the design standard included in the fact sheet must be modified to meet site needs and site conditions.

There may be other BMP's that function as well or better in Juneau and designers are encouraged to explore alternative treatment methods.

The Alaska Department of Environmental Conservation (ADEC) is developing a state wide stormwater treatment manual with design standards and details on BMP's. Refer to the main website for current information on this manual.

Biofiltration Swales

Grassy to Wet Swale in Anchorage

- *Biofiltration swales are open, gently sloped channels to convey water. They function to slow water velocity and filter sediment and pollutants.*

- *Swales that dry out between rain events should be grassy swales, swales that remain wet most of the time are wet swales and should be planted with wetland vegetation.*

- *Consider using as a pretreatment for constructed wetlands, wetponds or sediment basins.*

- *Dry swales are appropriate along streets, parking lots and perimeters of building sites. Wet swales need adequate spacing from infrastructure.*

Design Criteria

Flow Depth: 1-4"

Velocity: 1 foot/second max

Freeboard height: Min. 6"

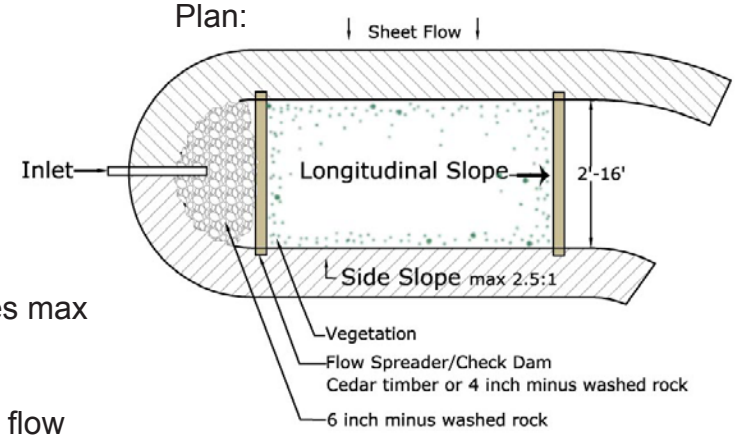
Resident time for water: 9 minutes max

Inlets:
Multiple dispersed inlets or sheet flow best, armored single inlet acceptable

Grassy Swales:
- Longitudinal Slopes min. 1% - max. 3% or with check dams max. 6%
- Water table must be min. 2' below bottom of swale

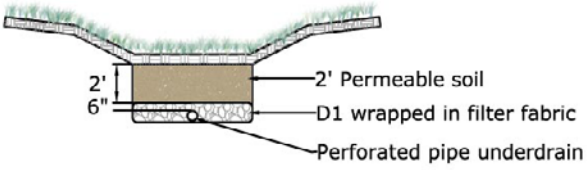
Wet Swales:
- Longitudinal slopes max. 2% (can use steps, gabion walls, check dams to reduce slope)
- No need for underdrain

Plan:



Section with permeable native soils:

Section with impermeable/clay soils:



Biofiltration Swales cont.

Soil

• Soil should allow infiltration but not be highly erosive:
sandy loam, loamy sand, loam soils
sand 35-60%
clay 10%
silt 30-55%
organics 20% (no animal waste)

• Do not use fertilizers or pesticides/insecticides

Vegetation

Grassy Swales:
•Grass must establish prior to to heavy flows

•Seed mixes including Bering Hairgrass, Annual Rye Grass, and Red Fescue work well, see Appendix A for more information

•Seed rate 200 LBS per acre

Wet Swales:
•Wetland plants must establish prior to heavy flows

•Rush, bulrush, sedges, and some grasses work well, see Appendix A for more information

•Use a combination of plugs, perennial and annual seed to establish 100% cover in the first year

Maintenance

• Inspect twice per year for debris and sediment that prevents flow or restricts plant growth

• Check for eroded areas and reseed or replant as needed

• Grassy Swales mow grass twice per year and remove grass clippings

• Do not mow wet swales

Surface Sand Filters

• *Sand Filters are structures that collect and filter stormwater through a bed of sand to improve water quality.*

• *Consider using on small and large sites to remove pollutants and sediment.*

• *They are highly successful at removing hydrocarbons.*

• *They are composed of two chambers: a sedimentation chamber to remove heavy sediment and a sand filtration chamber that filters finer material and pollutants.*

Sand Filter during construction of Home Depot, Juneau

Design Criteria

Min. 1/8" per 1 foot fall for gravity flow of water through structure and sand bed.

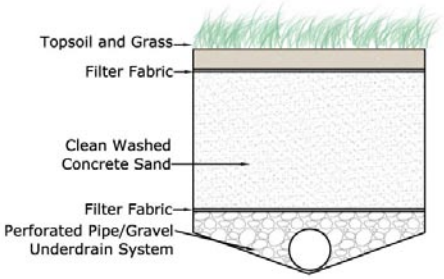
Use a minimum of 18 inches clean concrete sand .02"-.04" or AASHTO M-6. Gravel is 1/2" to 2 inch minus.

Vegetation may be planted on surface of filter for additional treatment, but it may slow infiltration.

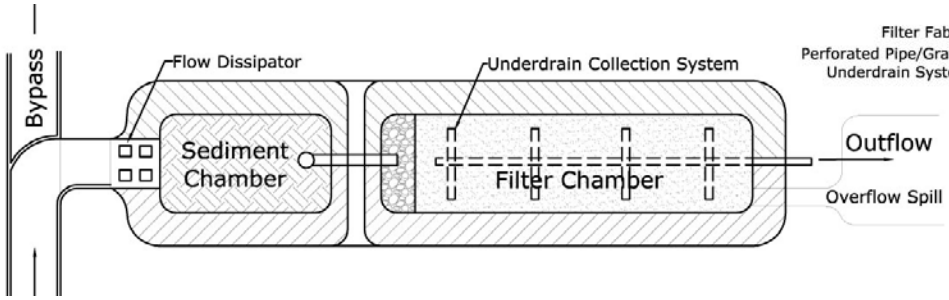
All slopes must be stabilized before runoff enters system.

Where the water table is high, keep the system water tight with impermeable liners.

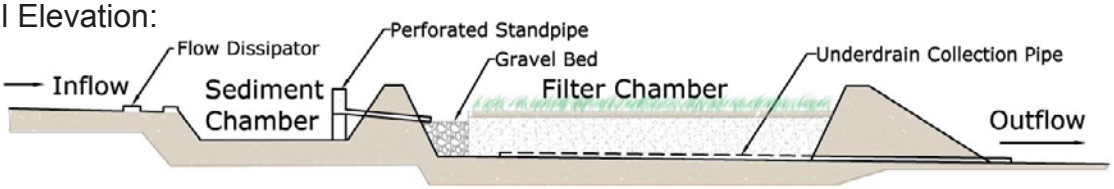
Typical Section:



Plan:



Typical Elevation:



Surface Sand Filters cont.

Maintain a minimum of 2 feet between the bottom of the filter bed and the water table. Provide for storm flows exceeding dike capacity.

Sediment Chamber:

- A flow bypass must be constructed at chamber inlet in case of overflow.
- Full size holds 100% of capture volume and releases it over 24 hours.
- Partial size holds min. 20% of capture volume.
- Minimum depth 3 feet.

Filter Chamber:

- The surface of the filter bed must be completely level.
- Check dams may be used if there is a high gradient slope.
- Separate layers of gravel/sand/topsoil with filter fabric.

Soil

- If sand filter is vegetated, the topsoil should allow infiltration but not be highly erosive:
  sandy loam, loamy sand, loam soils
  sand 45-65%
  clay 10%
  silt 20-30%
  organics 20% (no animal waste)

- Do not use fertilizers or pesticides/insecticides

Vegetation

- Grass must establish on side slopes and filter bed prior to introducing flows.

- Grasses such as Red Fescue, Annual Rye Grass, Bering Hairgrass, Bluejoint Reedgrass and Meadow Barley work well, see Appendix A for more information.

Maintenance

- Maintenance access required

- If water stands on surface of bed for more than 48 hours, remove the top few inches of sand and replace with clean sand and replant.

- Clean out sediment chamber when depth of sediment is 12 inches.

- Annually remove trash and debris from inlet and repair any leaks or structural deterioration.

Filter Strips

• Filter strips are linear, vegetated strips or buffers of land that border impervious surfaces. Water runs off the impervious surface in uniform sheet flow through the filter strip.

• Consider using as a pretreatment method in combination with swales or sand filters.

• They function to slow runoff, reduce erosion and filter sediment.

• Filter strips are appropriate along the edge of parking lots, roads, highways, or any expanse of pavement. Stream buffers may be a type of filter strip.

Filter Strip along parking lot on Glacier Highway, Juneau

Design Criteria

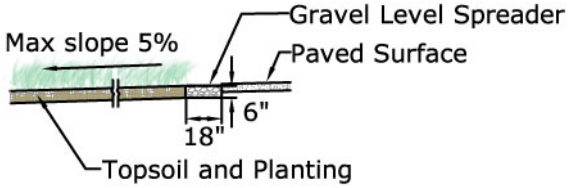
Lateral slope: ≤ 2%
Longitudinal slope: ≤ 5%
Width: 15' minimum
Flow Depth : 1-2"
Water Velocity: ≤ 0.5 ft/sec

When feasible in the design, a level spreader at top of slope shall be installed to minimize erosion and trap sediment.

- Pea gravel or crushed stone 1/8"-3/8"
- Surface of rock shall be flat with no slope
- Depth of gravel 6" and width of rock 18"
- Surface of gravel shall be 1" below the adjacent impervious surface

Do not use curbs between the filter strip and impervious surface and minimize the use of wheel stops to allow for uniform sheet flow.

Typical Section:



Filter Strips cont.

Soil

• Soil should allow infiltration but not be highly erosive:
sandy loam, loamy sand, loam soils
sand 35-60%
clay 10%
silt 30-55%
organics 20% (no animal waste)

• Topsoil shall be 6" deep

Vegetation

• Grasses such as Red Fescue, Annual Rye Grass, Bering Hairgrass, and Bluejoint Reedgrass work well, see Appendix A for recommended species

•Seed rate 200 LBS per acre, apply fertilizer type 20-20-10 at 600 LBS per acre

•A combination of shrubs, groundcovers, and trees can also be used, see Appendix A for recommended species. When planting shrubs, trees or groundcovers, use annual and perennial seed to achieve 100% cover in the first year. Snow plowing may damage woody species along roads and parking lots. Maintain adequate distance from paved surface to trees and shrubs.

Maintenance

• Mow grasses to 6-8" and never less than 3", remove clippings

• Remove dead branches, leaves, or debris from shrubs and trees

Wet Ponds

•Wetponds are permanent pools of water, partially planted with wetland vegetation that temporarily stores stormwater runoff and releases the overflow at a controlled rate.

• Consider using as a secondary treatment method after swales, filter strips or sand filters.

• They function to control peak flows and discharge, settle and remove sediment, infiltration and some uptake of pollutants. Also, it can have value as an aesthetic and recreational attraction.

Inlet and Sediment Forebay in Anchorage

• Wet ponds are appropriate for subdivision developments, commercial/industrial developments and drainage from large areas.

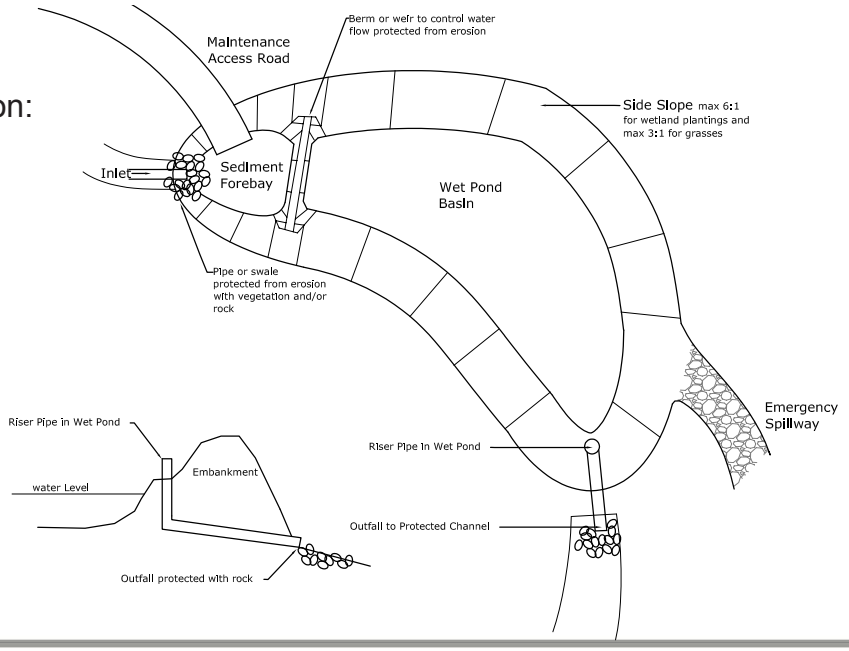
Design Criteria

For wet ponds over 4000 SF, design a sediment forebay at all inlets for pre treatment

- Maximum depth of sediment forebay: 4'
- Total volume of all forebays should be 10-35% of total volume of wet pond

A berm, baffle or weir shall be constructed to separate the sediment forebay and the wet pond basin.

Plan and Riser Pipe Section:



Wet Ponds cont.

Maximum depth of wet pond basin: 8'.

Include an overflow pipe and/or emergency spillway for large storm events in wet pond basin.

Use rounded forms for wet pond, angular forms create dead spots for water flow.

Provide erosion control around all inlets and outlets: rock, plants, or vegetative mats.

Side slopes on the wet pond basin shall be 6:1 maximum for wetland plantings and 3:1 max for grasses.

Provide vehicular access for maintenance of inlet and sediment forebay.

Consideration shall be given for the location and depth of the wet pond. Enclose and protect steep slopes and deep water for safety with plantings and/or fencing.

Soil

- Topsoil shall be 6" deep in vegetated areas
- Soil should allow infiltration but not be highly erosive:
  sandy loam, loamy sand, loam soils
  sand 25-35%
  clay 10-25%
  silt 30-55%
  organics 30-40% (no animal waste)
- In areas inundated by more than 3' of water, topsoil is not necessary,

Vegetation

- Wetland plantings may include sedge species and grasses at the perimeter of the wetpond and emergent species such as Rush, Bulrush, and some species of Sedge. For shrubs, native Dogwoods, Salmonberry and Willows work well. See Appendix A for recommended species.
- Do not plant shrubs or trees within ten feet of the inlet or outlet pipes.
- If the max depth of the wet pond is 3', then the pond must be vegetated with emergent wetland species in 6" topsoil.

Maintenance

- A larger sediment forebay and wet pond results in less maintenance. Dredge sediment from sediment forebay when the capacity has been reduced by 50%.

- Maintain inlet and outlet slopes, add rock or replant to prevent and reduce erosion. Replant vegetation as needed and mow annually if discouraging tree growth.

Infiltration Basins

•Infiltration basins are trenches, depressions, or planters that temporarily store runoff and infiltrate water through a vegetation and soil medium or rock and sand.

• Consider using as a secondary treatment after a filter strip, sediment forebay or swale. They cannot handle large amounts of sediment.

• The primary function is to infiltrate pollutants. It is often used in landscapes as an aesthetic element.

• In residential developments it is often called a raingarden, in commercial developments it can be a planter to infiltrate roof runoff or a trench to infiltrate parking lot runoff.

Top: Roof drainage to planter in Portland
Bottom: Infiltration trench in Anchorage

Design Criteria

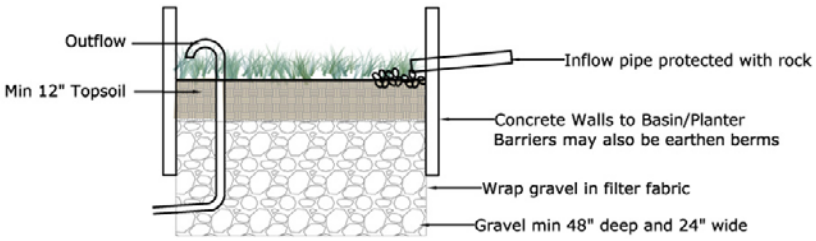
Bottom of infiltration basin shall have a max slope of 6% and shall be min 3' wide
Max side slope is 3:1 for basins with earthen berms

Do not disturb soil in area of infiltration basin during construction to minimize compaction

Water entering basin shall not have high sediment loads that will clog filtration, it is best to pre-treat water with a filter strip, swale or sediment forebay

For better infiltration, extend gravel filter bed at least 12" below frost line where possible.

Infiltration Basin Section:



Infiltration Basins cont.

Outflow can be a pipe or a grate elevated to allow 9-12" water storage

Infiltration time max. 30 hours

Depending on site conditions, infiltration basin may need a perforated drain pipe in gravel filter bed

For water quality improvement benefits, basin shall be vegetated, for flow control and infiltration benefits, basin may be rock

Soil

- Topsoil shall be 12"
- Soil should allow infiltration:
  sandy loam, loamy sand, loam soils
  sand 35-55%
  clay 5-10%
  silt 5-10%
  organics 20-30% (no animal waste)

Vegetation

- Plantings may include grasses, some wetland plants, shrubs and trees. See Appendix A for recommended species.

- May be used as gardens with ornamental plantings

Maintenance

- Prune, weed and remove trash from plantings.

- Remove sediment buildup when 1" collects on soil surface to allow for infiltration, this may require the removal and replacement of the top surface of the topsoil.

- Check inflow and outflow regularly for clogging.

Constructed Wetlands

•Constructed wetlands are shallow ponds with complex topography and emergent vegetation that function to treat runoff through the assimilation of pollutants and sediment filtration.Other functions include flow control and wildlife habitat enhancement.

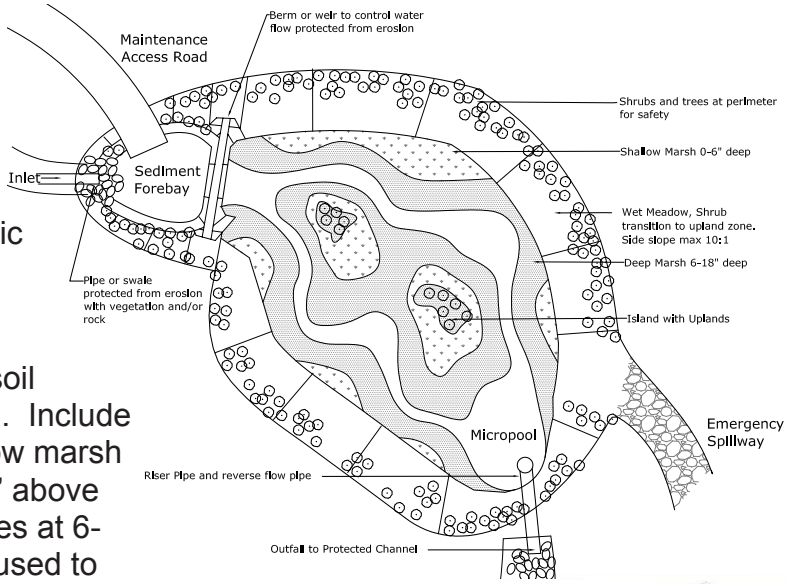
• Constructed stormwater wetlands do not replace natural wetlands and in most cases, existing wetlands should not be used for stormwater treatment.

• They are best used as secondary treatment. Wetponds can have wetland edges and swales can have depressions that are wetlands.

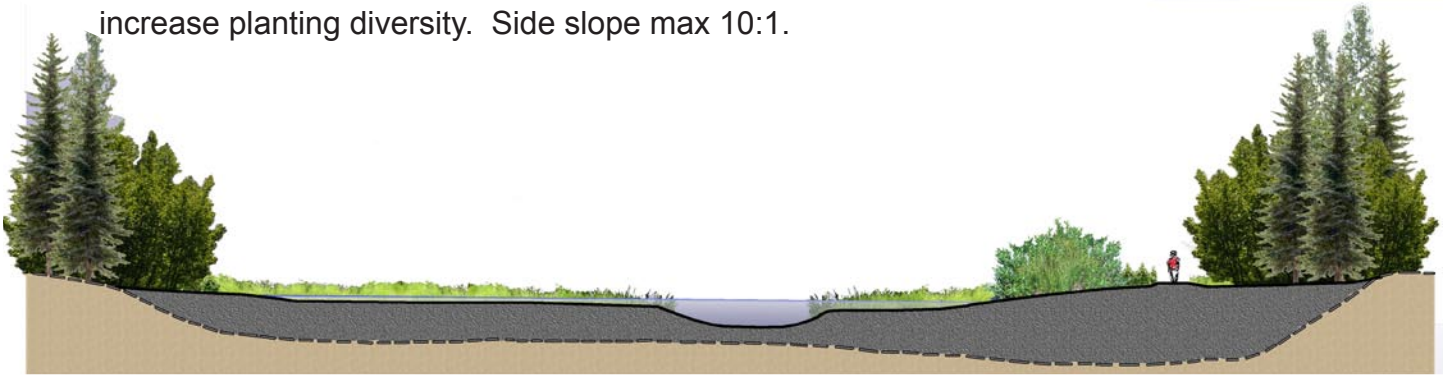
Nancy Street Wetland on Mendenhall Loop Road, Juneau. Constructed from a gravel pit.

Design Criteria

Construct a sediment forebay at inlet 4-6' deep and a micropool at outlet 4-6' deep. Each should include 10% of the total water volume of wetpond. These allow for settling of sediment and organic debris or trash. Inlet shall be protected by rock to prevent erosion.



To increase plant and wildlife diversity soil surface shall be bumpy and not smooth. Include deep marsh areas at 6-18" deep, shallow marsh areas at 0-6" deep, wet meadow at 0-6" above water surface, and transition shrub zones at 6-12". Benches and islands can also be used to increase planting diversity. Side slope max 10:1.



Constructed Wetlands cont.

Flow length to width ratio shall be 3:1 minimum to maximize water and plant contact. Use berms and islands to meander water. Residence time for water 24-36 hours.

Allow for control of outlet through use of a weir or reverse flow pipe. Water draw down will be possible for construction, planting needs and maintenance.

Soil

• If existing soils are highly permeable and do not allow water in wetland in all months of the year, a constructed wetland may not be possible without an impermeable clay liner.

•Topsoil may be organic or mineral. In Juneau, peat and native forest mineral soils have been used effectively. Topsoil shall be 6".

Vegetation

• Use native plants only, invasive species may create problems and negate the function of the wetlands. Plants to be avoided include: Typha latifolia, Cattail; Phragmites spp., Common Reeds; Lythrum salicaria; Purple Loosestrife; Rubus armeniacus and Rubus laciniatus, and Blackberry.

• Revegetation methods include transplanting plugs from nearby wetlands, purchasing native plugs from nurseries in Alaska and the Pacific northwest and collecting or purchasing seed. Plugs should be the primary method in emergent areas, establishing plants with seed in inundated areas is difficult.

•Vegetate 30-50% of the marsh area in the first year. In year two, maintain at least 50% coverage, revegetating as necessary.

•Space plugs 18"-24" apart.

•Recommended plants include willow and dogwood in shrub transition, iris, sedges, grasses in wetland meadow, and sedges, rush, bulrush and marsh marigold in shallow and deep marsh areas. See Appendix A for a detailed species list.

Maintenance

• Allow vehicle access to the sediment forebay to remove accumulated sediment, trash and woody debris. Remove as necessary or every 1-3 years.

• Revegetate as needed to maintain 50% coverage in year two. Remove invasives annually.

• Repair eroded areas.

Oil and Grit Separator

• Underground retention system for water quality treatment from impervious (paved) surfaces. Removes fluid hydrocarbons and coarse sediment from runoff through trapping particles and gravitational settling. It is not effective for organic materials.

• Use as a pretreatment method, prior to other water quality treatment facilities. Best if located close to source to minimize turbidity. When oil emulsifies due to high turbidity in water or presence of detergents, the facility is less effective.

• Regular maintenance required to maintain functionality. Effective when there are high concentrations of oil in water, less effective for low concentrations. High flows can overwhelm the structure and resuspend sediment.

• Appropriate for gas stations, parking lots, and maintenance, industrial, and commercial sites.

Design Criteria

Use a three compartment structure that includes a forebay, oil separation cell and afterbay for oil control at high use and hot spot sites. T or elbow separators may be used at low use sites if additional water quality and water flow treatment facilities are constructed.

Metal parts shall be corrosion resistant. Zinc and galvanized coatings shall be avoided to prevent aquatic toxicity effects.

The separator pool shall be a minimum of 4' deep, water tight and have a shutoff mechanism on the outlet pipe to allow for emergency shut off and maintenance work.

Use for areas less than 2 acres. Wet storage volume shall be a minimum of 400 CF/ acre. Do not discharge rooftop drainage into the oil/water separator. Limit contributing runoff to impervious surfaces with high oil concentrations. Include a flow bypass structure for large storms.

Sediment storage area shall be 2x the estimated annual accumulation.

Maintain straight line access for all trap areas from manhole entrance.

Maintenance

• Access to each chamber is required with a ladder to the bottom of the structure.

• Remove oil and sediment after snowmelt each year (April-May) and prior to the winter season (October) each year or when oil accumulation is greater than 1" or sediment accumulation is greater than 6".

Appendix A-

Recommended Plant List

Grasses

Festuca rubra, Red Fescue - Uplands
Deschampsia cespitosa, Tufted Hairgrass - Moist soils to upland
Calamagrostis canadensis, Blue joint Reedgrass - Wet Meadow to well drained upland
Hordeum brachyantherum, Meadow Barley - Moist soils and wet meadow

Wetland, Non-Woody

Carex sitchensis, Sitka Sedge - Wet meadow to standing water
Carex kellogii, Kellogg's Sedge - Moist to well drained, disturbed sites
Carex mertensii, Merten's Sedge - Moist and wet meadow
Iris setosa, Iris or Wild Flag - Moist to saturated
Scirpus microcarpus, Small Leaf Bulrush - Saturated to standing water
Juncus effusus, Common Rush - Saturated to standing water
Eriophorum angustifolium, Cottongrass - Saturated to standing water
Menyanthes trifoliata, Buckbean - Saturated to standing water
Eleocharis palustris, Spike Rush - Saturated to standing water
Caltha palustris, Marsh Marigold - Standing water
Lysichiton americanum, Skunk Cabbage - Standing water

Trees and Shrubs, Woody

Salix, Willow species - Standing water, moist to upland
Alnus, Alder species - Moist to Upland
Cornus stolonifera, Dogwood - Moist to upland
Rubus spectabilis, Salmonberry - Upland
Populus balsamifera, Cottonwood - Upland near waterbodies
Tsuga heterophylla, Western Hemlock - Moist to upland

Appendix B-

References and Web Links

Alaska Department of Environmental Conservation site for Stormwater Management- a statewide stormwater manual is being developed
http://www.dec.state.ak.us/water/wnpspc/stormwater/stormwater.htm

Municipality of Anchorage site listing all stormwater related manuals
http://wms.geonorth.com/library/LibraryReportsDocuments.aspx#GuideSummer

Fairbanks site for stormwater management - a post-construction BMP manual is being developed
http://www.co.fairbanks.ak.us/pworks/stormwatermanagementprogram/

EPA site for BMP information
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

State of Washington site for stormwater manuals
http://www.ecy.wa.gov/programs/wq/stormwater/tech.html

Puget Sound Low Impact Development Manual
http://www.psp.wa.gov/downloads/LID/LID_manual2005.pdf

Center for Watershed Protection clearinghouse for stormwater management
http://www.stormwatercenter.net/

Alaska Department of Transportation Stormwater Pollution Prevention Plan Guide
http://www.dot.state.ak.us/stwddes/dcsenviron/assets/pdf/swppp/english/eng_ch123.pdf

EPA site for construction BMP's and Stormwater Pollution Prevention Plan Guidance
http://cfpub.epa.gov/npdes/stormwater/swppp.cfm

Works Cited

City of Bellingham. “Stormwater Management Handbook”. November 1997.

City of Knoxville. “Knoxville BMP Manual Stormwater Treatment”. May 2003.

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City of Seattle. “Title 22.800 Stormwater, Grading & Drainage Control Code”. November 2000.

Department of Environmental Conservation. “18 AAC 70 Water Quality Standards”. December 2006.

Halifax Regional Municipality. “Stormwater Management Guidelines”. Prepared by Dillon Consulting Limited. March 2006.

“Low Impact Development Technical Guidance Manual for Puget Sound”. Developed by Puget Sound Action Team and Washington State University Pierce County Extension. January 2005.

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Municipality of Anchorage. “Design Criteria Manual, Chapter 2 Drainage”. January 2007.

“National Management Measures to Control Nonpoint Source Pollution from Urban Areas”. Prepared by the United States Environmental Protection Agency, 2005.

Nebo, Thomas N. and Reese, Andrew. *Municipal Stormwater Management,* Second Edition. New York: Lewis Publishers, 2003.

The Stormwater Manager’s Resource Center. www.stormwatercenter.net. Developed by the Center for Watershed Protection and the United States Environmental Protection Agency.