

APPENDIX 8B

Generic Stormwater Maintenance Manual

An electronic copy of this generic Maintenance Manual can be found on the Kitsap County web page
www.kitsapgov.com

Stormwater Maintenance Manual

Place Project Name Here

Place Project Street Address Here

Prepared by

Engineering Firm

Engineering Firm Address

Engineering Firm Address

Engineering Firm Phone Number With Area Code

Professional Engineer's Seal

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Manual Purpose:

The purpose of this manual and the enclosed inspection sheets is to provide a maintenance plan to ensure the continued proper operation of all stormwater facilities associated with your property. Lack of maintenance could lead to local flooding, water damage and costly repairs or replacements of these or other infrastructure.

Project Description:

The stormwater system that serves this site was designed to accommodate:

- X.X Acres of Impervious Surface (Roof tops, parking areas, roads/driveways)
Consisting of
- X.X Acres of Landscaped Area (Includes lawns, gardens)
- X.X Acres of Natural Vegetation (Retained or replanted)

Stormwater System Description:

The stormwater system consists of the following items that are labeled on the enclosed site drawing with the following symbols: *(Delete and add as necessary)*

- CB: Catch Basin
- OW: Oil/Water Separator *(List type)*
- CS: Control Structure**
- PB: Pre-Settling Basin
- IT: Infiltration Trench
- DT: Dispersion Trench
- Bio: Biofiltration Swale
- NC: Native Vegetation Covenant Area
- IP: Infiltration Pond
- DP: Detention Pond

**List the type of control structure and give orifice/weir sizes and elevations.

Maintenance Intervals: *(Delete and add as necessary)*

- CB: Twice per year (April and September are recommended)
- CS: Twice per year (April and September are recommended)
- PB: Twice per year (April and September are recommended)
- IT: Twice per year (April and September are recommended)
- DT: Twice per year (April and September are recommended)
- Bio: Periodically, especially after heavy storms
- OW: Quarterly and after each oil spill
- Ponds: Twice per year (April and September are recommended)
- Tanks: Twice per year (April and September are recommended)

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Project Construction Information:

Contractor:

Address

Phone:

Date of Construction:

Emergency Operations:

24-hour contact

Name:

Phone:

Detention pond, vault or tank not draining or overflowing in location other than emergency overflow weir/device.

1. Open Control structure manhole with ½ inch Allen wrench
2. Slowly open the cleanout gate (shear gate) to allow water to safely release from the facility until the water lowers below the overflow location.
3. Monitor water level and repeat step 2 as necessary to insure that flooding does not reoccur.
4. At earliest available opportunity contact maintenance vendor to clear blockage.
5. If no blockage found, contact design engineer to determine whether facility is operating properly.

Reseeding or Resodding Bioswales or Ponds:

Pond:

Name	Proportions By Weight	Percent Purity	Percent Germination
<u>Urban Application:</u>			
Kentucky Bluegrass (Adelphi, Baron or Fylking)	30%	85%	80%
Creeping Red Fescue (Pennant)	40%	98%	90%
Perennial Rye (Derby, Pennant)	30%	95%	90%
<u>Rural Application:</u>			
Kentucky Bluegrass (<u>Poa pratensis</u>) (Birka, Majestic or Sydsport)	15%	85%	80%

Bioswale:

Lined with a minimum of 4 inches of Type •A• topsoil according to WSDOT/APWA Standard Specifications

Seed Mixture:

70% Tall Fescue (Alta, Boyager, Orfawn)
20% Perennial Rye
10% White Clover

Application Rate (per 1000 square foot):


5 lbs. Seed
7 lbs. Fertilizer (10-20-20)
50 lbs. Wood Fiber Mulch

Date of Inspection: _____

Inspector: _____

**Maintenance Checklist for
CONTROL STRUCTURES**

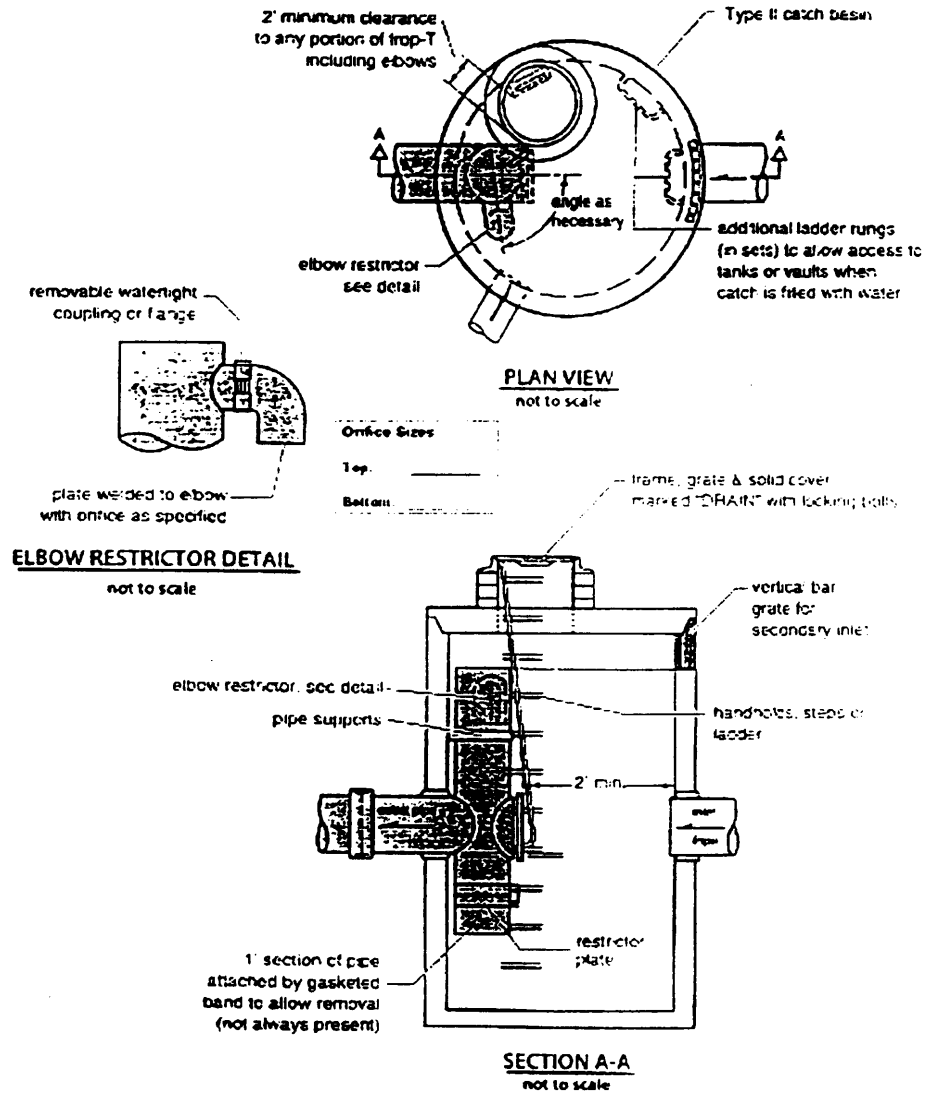
Definition: A facility such as a Flow Restrictor Oil Pollution (FROP) control device or a T Section with a specifically sized orifice(s) to control release rates. Usually located in a Type II Catch Basin/Control Manhole; designated as "CS," on your site plan. There may be a vertical culvert at the outlet ("T") with additional elbow orifice inlets.

Frequency	Drainage Systems Feature		Conditions To Check for	Results Expected After Maintenance Performed
Twice per Year	Ladder Rungs		Ladder is unsafe due to missing rungs, misalignment, rust or cracks	Ladder meets with design standards and allows maintenance persons safe access.
Twice per Year	Trash or Debris (including sediment**)		Distance Between debris build-up and bottom of orifice plate is less than 1.5 ft	All trash and debris removed
Twice per Year	Damage to outlet structure		Structure is not securely attached to manhole wall and outlet pipe	Structure is securely attached to wall and outlet pipe
Twice per Year	Piping Structure		Structure is out of plumb more than 6 inches	Structure is plumb
Twice per Year	Piping Structure		Connections to outlet pipe are not watertight and show signs of rust	Connections to outlet pipe are watertight; structure repaired, or replaced and works as designed; rust removed
Twice per Year	Cleanout gate		Cleanout gate is not watertight or is missing	Gate is watertight and works as designed
Twice per Year	Orifice Plate		Control device is not working; out of place, bent, or missing orifice plate	Control device is in place and orifice plate works as designed

****NOTE:** If using a vendor, ensure that the vendor properly disposes of sediment. If not using a vendor, call the Bremerton Kitsap County Health District Environmental Health Section at (360) 337-5285 for information on how to dispose of sediment.

Date of Inspection: _____
 Inspector: _____

Flow Restrictor (T-Section) (Found in Type 2 Catch Basins)



Date of Inspection: _____
 Inspector: _____

Maintenance Checklist for Fencing

Definition: Six-foot cyclone fence, required if pond slopes are steeper than 4:1 (H:V) or a permanent standing water depth of >18 inches to prohibit entry due to safety considerations


Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Conditions To Check for	Results Expected After Maintenance Performed
Quarterly	Missing or broken parts		Any defect in the fence that permits easy entry into facility	Parts in place to provide adequate security
Quarterly			Parts broken or missing that can be seen by the public that are below the appearance standards of the neighborhood.	Broken or missing parts replaced to conform to the standards of the neighborhood
Quarterly	Erosion		Erosion of more than 4 inches high and 12-18 inches wide permitting an opening under fence	No opening under the fence that exceeds 4 inches in height
Quarterly	Damage or missing parts		Any part of the fence (posts, top rails, fabric) more than 1 foot out of design alignment	Fence aligned and meets standards
Quarterly			Missing or loose tension wire	Tension wire in place and holding fabric
Quarterly			Extension arm missing, broken, or bent out of shape more than 1.5 inches	Extension arm in place with no bends larger than ¼ inch
Quarterly	Paint or Protective Coating		Part or parts that have rusting or scaling condition that has affected structural adequacy	Structurally adequate posts or parts with a uniform protective coating
Quarterly	Opening/holes		Opening in fabric are such that an 8 inch diameter ball could fit through (intent is to prevent small children from entering)	No openings in fence
Quarterly	Warning Signs		Missing, loose, or vandalized	Signs in place and readable
Quarterly	Gates		Missing gate or locking device	Gates and locking devices in place
Quarterly			Broken or missing hinges such that gate cannot be easily opened or closed	Hinges intact and lubed. Gate is working freely
Quarterly			Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment	Gate is aligned and plumb
Quarterly			Missing stretcher bar, stretcher bands, and ties	Stretcher bar, bands, and ties in place

Date of Inspection: _____
 Inspector: _____

Maintenance Checklist for

Access Roads/Easements

Definition: Minimum of 15 feet wide, may be constructed of class "B" road material, AC pavement or heavier fabric/spall sections. Used to access control structure and other facility components.

Frequency	Drainage Systems Feature		Conditions To Check for	Results Expected After Maintenance Performed
Twice per year	Trash & Debris		Trash & debris exceeds 1 cubic foot (one standard office garbage can) per 1,000 sq ft	Trash & debris removed
Twice per year	Blocked Roadway		Any obstructions restricting the access road surface to less than 15 feet	Obstruction removed to allow at least 15 feet access width
Twice per year	Settlement, potholes, soft spots, or ruts in road surface		When any surface defect exceeds 6 inches in depth and 6 sq ft in area. In general, any surface defect which hinders or prevents maintenance access	Road surface uniformly smooth with no evidence of settlement, potholes, soft spots, or ruts
Twice per year	Vegetation		Weeds growing in the road surface that are more than 6 inches tall and less than 6 inches apart within a 400 sq ft area	Road surface free of weeds taller than 2 inches
Twice per year	Erosion		Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep	Shoulder free of erosion and matching the surrounding road

Date of Inspection: _____

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**Maintenance Checklist for
Biofiltration Swales**

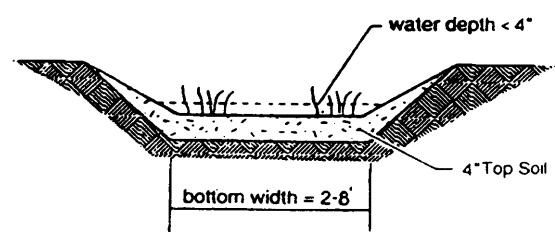
Definition: Swales are broad, vegetated areas that direct and filter runoff. Dense vegetation in swales provides filtration to help improve water quality.

Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Required Actions	Results Expected After Maintenance Performed
Periodically, especially after heavy storms	Trash & Debris		Remove any trash or debris to keep swale attractive and prevent loss of vegetation	Swale free of trash & debris
	Vegetation		Mow grass to a height of 3-5 inches. Remove cuttings promptly, and dispose in a way that will not return pollutants to receiving waters	Grass is mowed at or above design flow height
			Cut vegetation to remain less than 8 inches at end of growing season	Vegetation at least 2 inches above design flow height, but less than 8 inches
			Clean curb cuts when soil and vegetation build up interferes with flow introduction	All vegetation is removed allowing water to flow to the swale unimpeded
	Sediment**		Remove sediment during summer months when greater than 3-4 inches at any spot, cover vegetation, or otherwise interfere with operation.	All sediment is removed, and any bare spots reseeded/repared

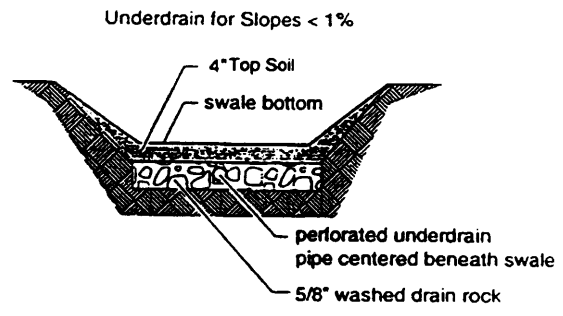
****NOTE:** If using a vendor, ensure that the vendor properly disposes of sediment. If not using a vendor, call the Bremerton Kitsap County Health District Environmental Health Section at (360) 337-5285 for information on how to dispose of sediment.

Date of Inspection: _____
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Typical Bioswale



BIOSWALE SECTION
not to scale




NOTE: Underdrain must infiltrate or drain freely to an acceptable discharge point.

BIOSWALE WITH UNDERDRAIN SECTION
not to scale

Date of Inspection: _____
 Inspector: _____

Maintenance Checklist for Oil/Water Separators

Definition: Separators are designed to remove oil and sediment from water before the water is discharge to the storm drainage or sewer system. It is an underground structure with above ground access for maintenance. It may have baffles (vertical plates) or absorbent pads to retain floating oil. You need to identify which type of oil water separator you have and if it discharges to stormwater or sanitary sewer.

Frequency	Drainage Systems Feature		Conditions requiring Maintenance (cleaning)	Results Expected After Maintenance Performed
Quarterly and after each oil spill	Any o/w separator		Structure is not separating oil from water or is ejecting oil back into stormwater system	Separator repaired or replaced so that oil is being removed from stormwater
Quarterly and after each oil spill	Spill control o/w separator		After each spill	All oil removed
Quarterly and after each oil spill	Spill control o/w separator		When oil accumulation exceeds ½ inch in the first chamber or any visible oil in the second or third chamber.	All oil removed
Quarterly and after each oil spill	API o/w separator		When oil accumulation exceeds ½ inch in the first chamber or any visible oil in the second or third chamber.	All oil removed
Quarterly and after each oil spill	API o/w separator		When the sediment level reaches 6 inches it should be removed.	All sediment remove
Quarterly and after each oil spill	Coalescing plate separator		When oil accumulation exceeds ½ inch in the first chamber or any visible oil in the second or third chamber	All oil removed
Quarterly and after each oil spill	Coalescing plate separator		When the sediment level reaches 6 inches it should be removed.	All sediment removed

Date of Inspection: _____
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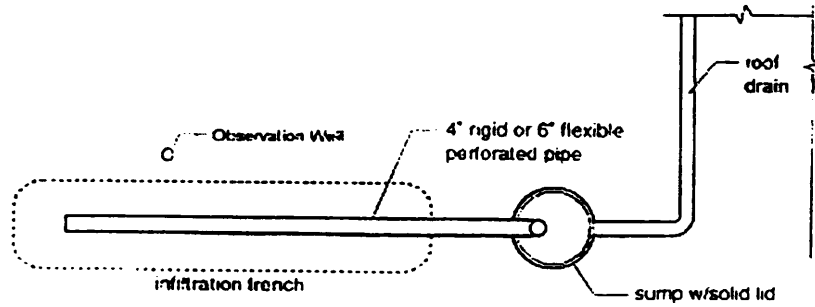
**Maintenance Checklist for
 Infiltration Trenches**

Definition: A rock filled trench that collects stormwater and allows the water to soak into the soil. This infiltration process helps recharge groundwater. Often roof downspouts are piped directly to an infiltration trench.

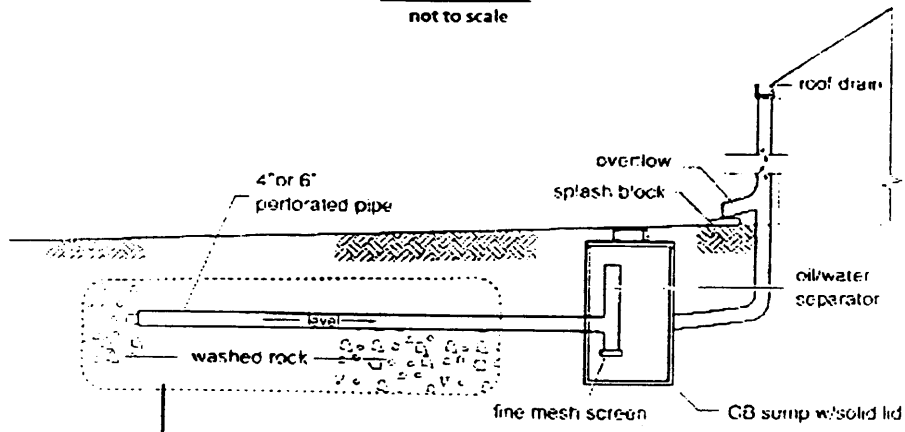
Frequency	<input checked="" type="checkbox"/>	Condition to Check	Results Expected After Maintenance Performed
1. Each large Storm in 1 st yr 2. Monthly (Oct-May) 3. Quarterly (April-Sept)		Check observation well to insure that the trench is not saturated for more than 48 hours after a storm	If trench is not drained within 48 hrs of the end of a storm, contact design engineer to determine if trench needs repair, relocation, or extension.
		Pre Settling Device should also be checked for accumulation of sediment	All sediment removed and pre settling device returned to original condition

Date of Inspection: _____
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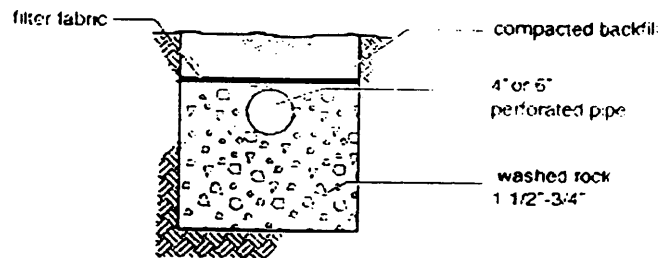
Typical Downspout Infiltration System



PLAN VIEW
not to scale



PROFILE VIEW
not to scale



SECTION A
not to scale

Date of Inspection: _____
 Inspector: _____


Maintenance Checklist for Catch Basins

Definition:

These structures are located beneath many, but not all storm drain grates. They are underground boxes designed to pass water through an outlet pipe while trapping sediment that settles to the bottom.

Type I: An underground concrete water-receiving inlet, rectangular in shape (approximately 3' X 2' X 4' deep) with a slotted iron grate on top to inlet water or a solid rectangular cover. Water may also enter/exit through culverts visible in the sidewalls of basin.

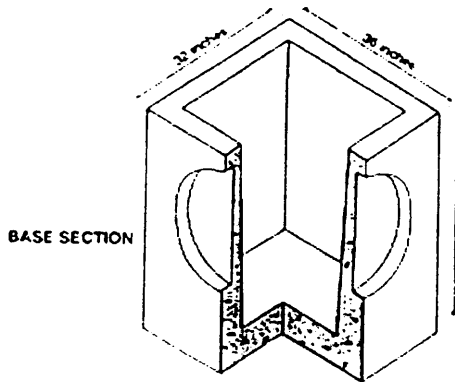
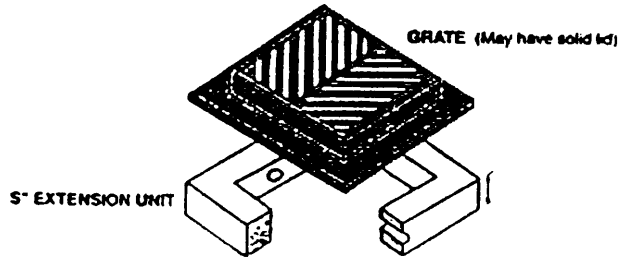
Type II: A round concrete underground basin (4'-8' in diameter; 6' deep or deeper); may contain FROP (Flow Restrictor Oil Pollution control device). These basins are also required when larger diameter culverts are used.

Frequency	Drainage Systems Feature		Conditions requiring Maintenance (cleaning)	Results Expected After Maintenance Performed
Twice per Year	Ladder Rungs (Type II only)		Ladder is unsafe due to missing rungs, misalignment, rust or cracks	Ladder meets with design standards and allows maintenance persons safe access.
Twice per Year	Trash or Debris (including sediment**)		Sediment level is 6 inches or greater	All sediment, trash, and debris removed

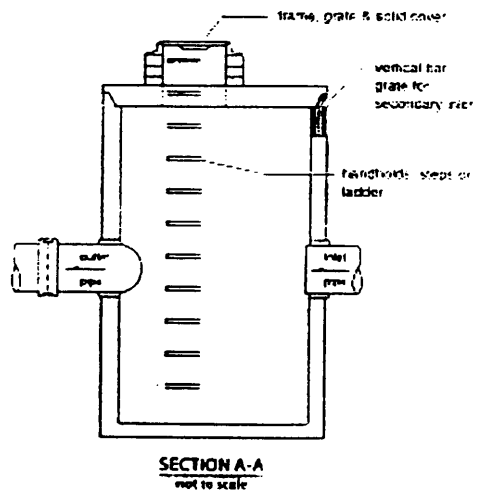
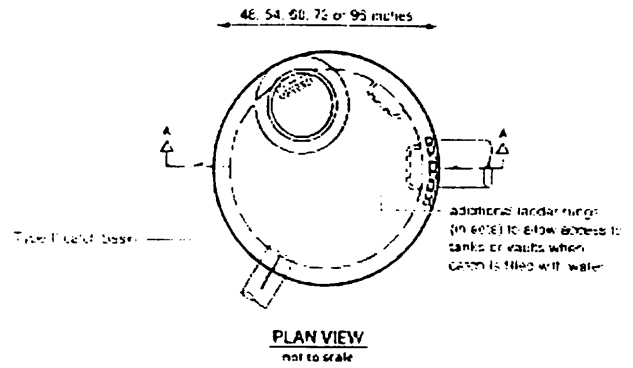
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Date of Inspection: _____
Inspector: _____

Type I Catch Basin



Type II Catch Basin (Round concrete structure)



Date of Inspection: _____

Inspector: _____

Maintenance Checklist for

Ponds

Definition:

Detention Pond: These ponds temporarily store stormwater runoff and release it at a controlled rate to reduce the chance of flooding and downstream impacts.

Retention (Infiltration) Pond: These ponds store stormwater runoff and allow it to infiltrate into the ground or evaporate into the atmosphere.

Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Conditions requiring Maintenance (cleaning)	Results Expected After Maintenance Performed
Twice per year	Trash & Debris		Trash & debris exceeds 1 cubic foot (one standard office garbage can) per 1,000 sq ft	Trash & debris removed
Twice per Year	Poisonous Vegetation		Presence of poisonous vegetation such as: tansy ragwort, poison oak, stinging nettles, devils club	No dangerous vegetation (Coordinate with Bremerton Kitsap County Health District @ (360) 337-5285)
Twice per Year	Pollution		Oil, gasoline, or other contaminants that could: 1) cause damage to plant, animal, or marine life; 2) constitute a fire hazard; or 3) be flushed downstream during rainstorms	No contaminants present other than a surface film. (Coordinate with Kitsap County Storm & Surface Water Management (SSWM) @ (360) 337-7290)
Twice per Year	Unmowed grass/ground cover		Private residential area: mow when grass exceeds 18 inches Other areas: mow to match surrounding ground cover and terrain	When mowing necessary, mow to a height of 4 inches Remove and properly dispose of all harvested vegetation
Twice per Year	Rodent Holes		Any evidence of rodent holes, if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes	Rodents destroyed and dam or berm repaired. (Coordinate with Bremerton Kitsap County Health District @ (360) 337-5285)
Twice per Year	Insects		Insects such as wasps or hornets interfere with maintenance	Insects destroyed or removed from site
Twice per Year	Tree Growth		Tree(s) do not allow maintenance access or activity. (mowing, silt removal, vactoring, etc)	Trees removed or trimmed so they do not hinder maintenance activities
Twice per Year	Erosion		Slopes eroded	Slopes should be stabilized by using appropriate erosion control measure (rock reinforcement, revegetation, compaction, etc)

Date of Inspection: _____
 Inspector: _____

Pond Maintenance Page 2

Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Conditions requiring Maintenance (cleaning)	Conditions That Shall Exist
Twice per Year	Sediment**		Sediment exceeds 10% of design pond depth	Sediment cleaned out, depth and pond shape restored, bottom revegetated as nec.
Twice per year	Pond Dike/Berm		Any portion that has settled 4 inches lower than design ht	Dike/berm restored to design height
Twice per Year	Emergency overflow spill way		Rocks missing or only one layer above soil	Replace rocks
Twice per Year	Emergency overflow spill way		Spill way too small to handle large storms	Consult the design engineer to reevaluate size and configuration
Twice per Year	Trash/Debris Barrier		Trash or debris that is plugging more than 20% of the barrier opening	Barrier clear of obstructions
Twice per Year	Trash/Debris Barrier		Missing bars, deteriorated/rusty bars, or bars bent > ¼ inch	Bars in place at 3 inch intervals

****NOTE:** If using a vendor, ensure that the vendor properly disposes of sediment. If not using a vendor, call the Bremerton Kitsap County Health District Environmental Health Section at (360) 337-5285 for information on how to dispose of sediment.

Date of Inspection: _____
 Inspector: _____

Maintenance Checklist for Tanks/Vaults

Definition:

Detention Tank: Located underground; these tanks temporarily store stormwater runoff and release it at a controlled rate to reduce the chance of flooding and downstream impacts. Tanks are normally composed of large diameter pipe (48" or greater) with Type II catch basins (manholes) at each end.

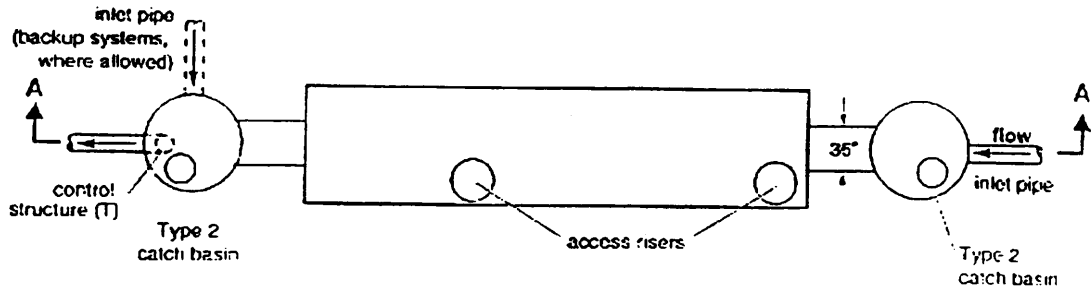
Detention Vault: Perform in same manner as a tank, but are constructed of concrete and are normally rectangular in shape.

Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Conditions requiring Maintenance (cleaning)	Results Expected After Maintenance Performed
Twice per Year	Trash Debris Sediment**		Sediment exceeds 10% of storage depth or if any at any location the depth exceeds 15% of the storage depth	Sediment, trash and debris cleaned out
Twice per year	Vents		½ of the end area of a vent is blocked	Vents free of debris or sediment
Twice per Year	Joints		Gaps exist, cracks in mortar that allows water to escape or enter system	All gaps between tanks (vaults) and pipes are sealed
Twice per Year	Manhole		Cover is missing or only partially in place	Manhole is covered/closed

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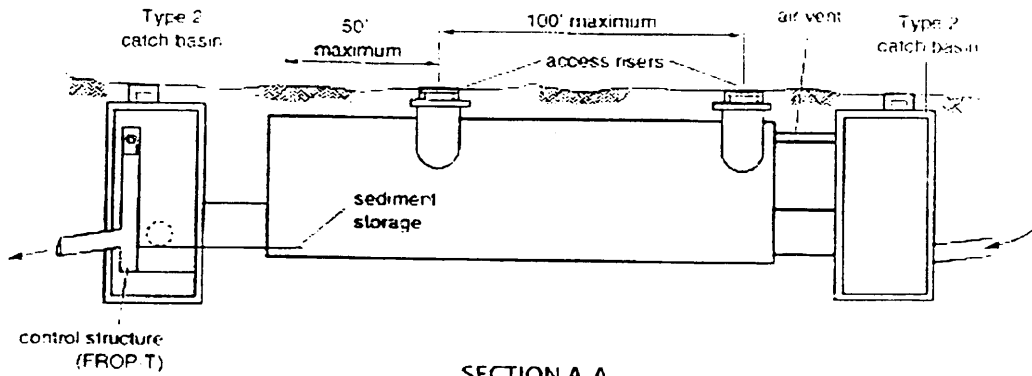
Date of Inspection: _____
Inspector: _____

Typical Detention Tank



PLAN VIEW
not to scale

"Flow through" system shown solid
Designs for "flow backup" system and
parallel tanks shown dashed



SECTION A-A
not to scale

"Flow through" system shown solid.

Date of Inspection: _____
 Inspector: _____

Maintenance Checklist for Dispersion Trenches

Definition:

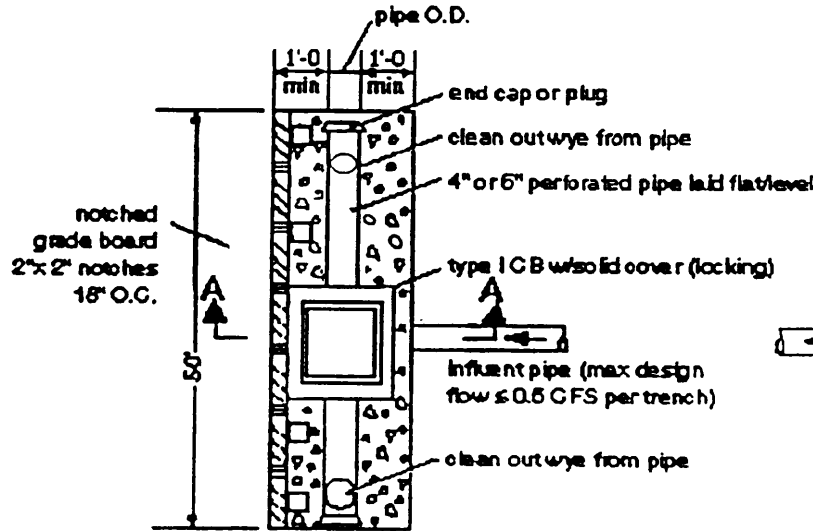
Dispersion Trenches are rock filled devices used to spread water from a collection source over a wide area to encourage gradual infiltration over a large area. Larger trenches may contain catch basins and boards to assist in spreading the water.

Frequency	Drainage Systems Feature	<input checked="" type="checkbox"/>	Conditions requiring Maintenance (cleaning)	Results Expected After Maintenance Performed
Twice per Year	Distribution Catch Basin		Sediment** exceeds 10% of storage depth or if any at any location the depth exceeds 15% of the storage depth	Sediment, trash and debris cleaned out
Twice per year	Distribution Catch Basin		Evidence that water flows out of catch basin instead of pipe/trench	Clean system and contact design engineer to determine whether redesign or rebuild is necessary
Twice per Year	Pipe Perforations		Over ½ of perforations are plugged	Pipe cleaned or replaced
Twice per Year	Erosion		Evidence of channelized discharge (ruts at outlet, etc.)	Trench Redesigned or rebuilt to produce sheet flow

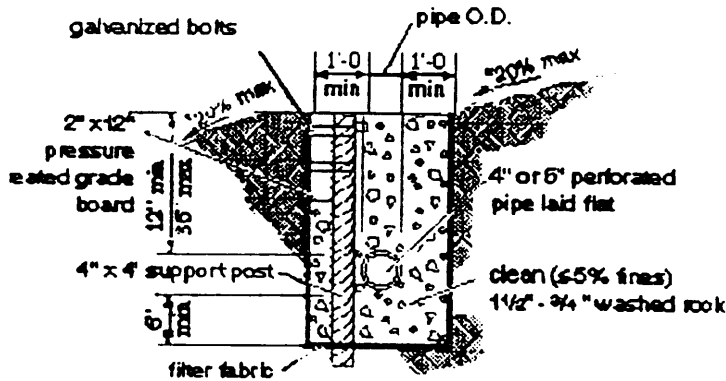
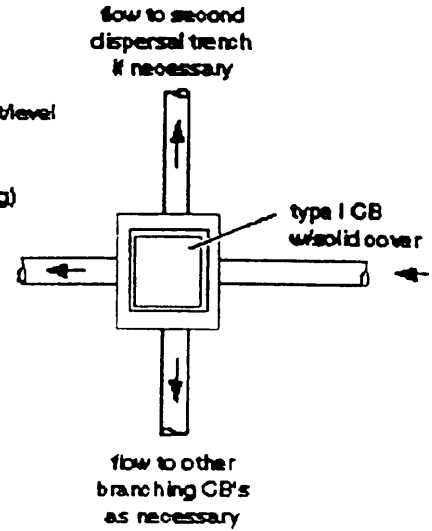
See also Catch Basin Checklist if Trench design contains catch basin

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PLAN



15% max for flow control/water quality treatment in rural areas.

**SECTION A-A
 NOTES**

NOTES:

1. This trench shall be constructed so as to prevent point discharge and/or erosion.
2. Trenches may be placed no closer than 50 feet to one another. (100 feet along flowline)
3. Trench and grade board must be level. Align to follow contours of site.
4. Support post spacing as required by soil conditions to ensure grade board remains level.

Flow Dispersal Trench

