City of Ontario

Storm Water Management Design Manual

February 2003

Chapter 1.0 - Introduction

1.1 Purpose and Applicability

Stormwater management is important for both flood control and protection of groundwater and surface water quality. Development, with its rooftops and paved surfaces, increases the rate and amount of runoff, and also the level of pollutants that are discharged to groundwater or to the Malheur and Snake Rivers. Pollution reduction is vital to protecting the area's waters for beneficial uses, including fish and wildlife habitat, recreation, and drinking water.

The purpose of this manual is to define standards for the design, construction and maintenance of drainage facilities in Ontario that will prevent flooding from stormwater runoff, and protect groundwater and surface water quality. The manual provides requirements for reducing the impacts of stormwater runoff and pollution from new development and redevelopment.

The standards in this manual apply to new development and redevelopment, public or private. All projects that create over 500 square feet of impervious area are to comply with the requirements of this manual, as are projects of any size that are classified as high risk (as discussed in Section 1.3). Required submittals are outlined in Chapter 2.0, design criteria are defined in Chapter 3.0, and Chapter 4.0 presents information on practices and facilities for stormwater management.

1.2 Authority and Policies

The City of Ontario, as a municipal corporation, has constitutional authority to promulgate stormwater discharge regulations to minimize flooding, protect groundwater resources and prevent surface water pollution. *Refer to ordinance?*

Under regulations mandated by the Clean Water Act of 1987, Ontario may be required to obtain a National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit to control urban stormwater pollution. The permit obligates Ontario to develop, implement, enforce and measure the effectiveness of, a storm water management program designed to reduce the discharge of pollutants and protect water quality.

The waters in the Upstream Snake River are listed as water quality limited due to concerns over dissolved oxygen, mercury, nutrients, sediment and temperature. Stormwater from Ontario discharges to this segment of the Snake River. Reduction of sediment load has been identified as a first step in achieving water quality goals. Additional pollutant removal requirements are under consideration.

1.3 Stormwater Management Criteria

Pollution reduction is required in the City of Ontario for all new development creating over 500 square feet of impervious surface (or redevelopment footprint over 500 square feet). Flow control measures are also required to limit peak flows to the capacity of the conveyance system. Design storms for water quality (pollution reduction) and water quantity (flow control) are defined in Chapter 3.0.

A development may discharge to an existing publicly-owned stormwater system provided the following conditions are met:

- Private on-site flow control facilities are used to the maximum extent practicable
- On-site systems provide required pollution reduction
- The system to which the development is discharging has adequate carrying capacity

Long-term stormwater management requirements are based on the land use and the amount of impervious area resulting from the project. (Impervious area includes rooftops plus asphalt and concrete surfaces such as parking lots, driveways, roads and sidewalks.) Projects involving construction activities that disturb one acre or more have separate stormwater management requirements for the construction phase.

Mitigation measures are encouraged for all projects to reduce stormwater management needs. Mitigation may decrease the volume of stormwater for disposal, reduce peak flows, increase evapotranspiration, reduce pollutants, or facilitate infiltration. Mitigation measures may include limiting the extent of impervious and disturbed areas, stabilizing pervious areas to prevent erosion, and landscaping for flow and pollution control.

Stormwater management criteria, applicability and requirements are summarized in the table below.

Management Category and Criteria	**Stormwater Management Requirements**
New impervious area equal to or greater than 500 square feet, or Redevelopment footprint equal to or greater than 500 square feet	▪ Pollution reduction and flow control measures required ▪ Simplified Approach *(Section 3.3)* may be used (combined flow/pollution control)
Higher risk uses* (see below)	▪ Pollution reduction and flow control measures required ▪ Performance Approach *(Section 3.4)* - separate flow and pollution controls ▪ NPDES permit required for point source discharge from EPA-listed industries *(see Section 2.7)*
Stormwater disposed of by infiltration	▪ Satisfy UIC program requirements *(see Section 2.7)*
Construction activities disturb land area equal to or greater than 1 acre	▪ NPDES permit from Oregon DEQ *(see Section 2.7)* ▪ Erosion and sediment control BMPs

*Higher risk uses are those land use categories that may generate higher pollutant concentrations. These include industrial and commercial land uses such as fuel dispensing facilities; vehicle/equipment service and cleaning; vehicle parking and storage; aboveground storage of liquids (chemicals, oils, solvents); exterior storage of erodible bulk materials (e.g. landscape, sand); material transfer areas/loading docks; and solid waste storage areas.

1.4 Acknowledgements

Several concepts utilized in developing this plan were based on previous work by other cities, particularly Portland and Boise. Their contribution is gratefully acknowledged.
The "Catalog of Stormwater BMPs for Idaho Cities and Counties" has been adopted as a community standard for Ontario, and is incorporated in this manual by reference.

Chapter 2.0 - General Stormwater Requirements

2.1 Introduction

Stormwater management should be an integral part of the development process from the concept stage through design, construction, and occupancy. All developments must submit a storm water management plan that includes a site evaluation, proposed development information, a drainage analysis and a plan for facility operation and maintenance.

2.2 Site Evaluation

Site constraints may limit stormwater management options, which in turn can affect potential land uses and location of improvements. Therefore, evaluation of site suitability should be completed before preparing development concepts or plans. Site conditions that should be evaluated include:

- Size of drainage area
- Possible land uses and related contaminant types
- Site slope and geometry
- Proximity to drinking water supply or surface water
- Past uses as related to soil and groundwater contamination
- Soil types and permeability below drainage facilities
- Subsurface conditions: depth to bedrock, high groundwater

2.3 Proposed Development Information

Development information should include pre-development and post-development site conditions (including change in impervious area), and a determination of the applicable stormwater management criteria.

A scaled site map that provides the following general information is required.

- Vicinity map
- Proposed layout showing buildings, impervious areas, landscaping, utilities, etc.
- Topographic information: existing & proposed site contours, elevations of building(s), grades of impervious surfaces
- Easements (if applicable)
- Landscape plan (if applicable)
- Mitigation measures, as applicable
- Plan of stormwater facilities, with system dimensions

2.4 Drainage Analysis

Two options - the simplified approach and the performance approach - are available for designing stormwater management facilities. These approaches are discussed in Chapter 3.0. The simplified approach utilizes sizing factors for combined pollution reduction and flow control facilities. Facilities designed in accordance with the simplified approach are presumed to comply with the City's pollution reduction and flow control requirements. Detailed hydrologic calculations are not required for these facilities.

Assumptions used in determining the sizing factors for the simplified approach may result in conservative sizing for some developments. Manual users have the option of following the performance approach to submit engineering calculations for alternative facility sizing. The performance approach is also applicable to other types of facilities that are not included in the simplified approach.

If the performance approach is used, submittals should include hydrologic calculations for peak flow rate and runoff volume (pre- and post-development), and the basis for design (including method used, equations, references, graphs, etc.).

2.5 Operation & Maintenance Plan

An Operation and Maintenance (O&M) Plan shall include the following:

- Stormwater system owner(s)
- Party responsible for long-term operation and maintenance of system
- Emergency contacts and response procedures
- Source controls (see Chapter 4.0)
- Schedule for stormwater system inspection and maintenance activities
- Specific maintenance techniques for system components
- Documentation requirements for inspection and maintenance (records of noted conditions and corrective actions to be maintained for at least 5 years)

2.6 Review and Approval Process

A pre-application or predesign conference is recommended for large developments.

Submittals for all developments shall include a site evaluation, proposed development information, drainage calculations (simplified or performance approach) and an operation and maintenance plan, as discussed above.

The City of Ontario will review all submittals for compliance with the requirements of this manual. Approval does not relieve the applicant from responsibility for ensuring facility suitability, performance and safety, nor does it constitute a guarantee of system performance.

2.7 State and Federal Requirements

As noted in Chapter 1.0, certain stormwater discharges require permitting through DEQ. These include:

- Point source stormwater discharges from EPA-listed industries
- Construction activities that disturb one or more acres
- Stormwater disposal by infiltration

Industrial and construction activities are addressed by NPDES storm water regulations. Stormwater disposal by infiltration systems is covered under the Underground Injection Control (UIC) program. Information on these requirements can be accessed at the Oregon DEQ Water Quality Program website at www.deq.state.or.us/wq. (On the Water Quality Program page "Features" menu, select "Permits" for NPDES information, or "UIC" for infiltration disposal system requirements.) Information is also available from the Pendleton office of DEQ (800-452-4011) for NPDES, and from the Portland office (503-229-5495).

Chapter 3.0 - Design Criteria

3.1 Pollution Reduction

Stormwater BMPs shall be designed for removal of total suspended solids (TSS), under post-development conditions, at the rates shown below:

% Parcel Area that is Impervious	% TSS removal required
30 or less	40
35	47
40	53
45	59
50	62
55	66
60	68
65	70
70	72
75	74
80	75
85	77
90	78
95	79
100	80

Removals shall apply to runoff generated from a water quality design storm, defined as 0.26" per hour with a duration of 1 hour.

3.2 Flow Control

Flow controls are intended to maintain post-development peak flows at pre-development levels for most storm events, to keep flows within the capacity of the conveyance system. On-site flow control shall be designed such that the runoff flow rate from a proposed land development shall not exceed the rate of runoff prior to the development, for 5-, 10- and 25-year storms.

Conveyance systems shall be designed to carry the peak flow from the 25-year storm without flooding. Peak volumes for detention and retention facilities shall be based on a 24-hour, 25-year storm event generating 1" total rainfall.

3.3 Simplified Approach

The simplified approach, which utilizes sizing factors for some types of facilities, provides a rapid method to select and design combined pollution reduction and flow control facilities. Facilities designed in accordance with the simplified approach are presumed to comply with the City's pollution reduction and flow control requirements. Detailed hydrologic calculations are not required.

Since each simplified approach facility can handle flow from a limited amount of impervious surface, larger projects must divide impervious surfaces into smaller management areas.

Sizing factors for simplified approach facilities are presented in the table below. Descriptions and general specifications for these BMPs are included in Chapter 4.0. Note that these BMPs can also be used for larger areas than noted, if sized according to the performance approach.

BMP	Simplified Approach Sizing Factor for BMP Area	Max. Impervious Area for Simplified Approach
Bioretention Swale	0.06 x impervious area	15,000 sf
Vegetative Filter Strip	0.13 x impervious area	1,000 sf per strip
Bioretention Basin	0.06 x impervious area	15,000 sf

3.4 Performance Approach

Facilities designed using the performance approach shall provide pollution reduction for the water quality storm and flow control for the water quantity storms, as specified above.

Hydrologic calculations shall provide peak flow rate and runoff volume (for pre- and post-development conditions), and the basis for design (including method used, equations, references, graphs, etc.). The Rational Method may be used for the water quality storm for any size development, but is limited to areas less than 10 acres for water quantity storms. If the Rational Method is used, peak flow rates for water quantity storms shall be based on time of concentration (t_c) and associated intensity for the various storms (t_c no less than 10 minutes). Refer to Intensity-Duration-Frequency curves.

Facilities designed in accordance with the criteria in the "Catalog of Stormwater BMPs for Idaho Cities and Counties" are presumed to provide the pollutant removal efficiencies noted in the Catalog.

Chapter 4.0 - Best Management Practices (BMPs)

4.1 Introduction

Best Management Practices (BMPs) are physical, structural, and/or managerial practices that prevent or reduce water pollution. The two types of BMPs are source control (pollution prevention), and treatment. Most treatment BMPs involve structural measures (e.g. detention ponds and oil/water separators). Source control typically involves non-structural measures, and is generally more cost-effective than treatment for preventing stormwater impacts.

Stormwater management plans should incorporate all practical source control measures before considering treatment facilities.

Source control and treatment BMPs are addressed in detail in the "Catalog of Stormwater BMPs for Idaho Cities and Counties" (hereinafter referred to as the Catalog). The Catalog has been adopted as a community standard for Ontario, and is incorporated in this manual by reference. The Catalog is available on the Idaho DEQ website at www.deq.state.id.us (click on Water Quality, then Catalog of Stormwater BMPs under Stormwater heading).

4.2 Source Control BMPs for Pollution Reduction

Source control practices involve erosion control, spill prevention and other housekeeping practices intended to prevent pollutants from entering the drainage system. Public education, activity schedules, prohibition of practices, maintenance procedures, operating methods, and practices to control runoff, spillage or leaks are possible source controls. Source controls apply to construction, operation and maintenance practices.

Construction projects that disturb one acre or more must have an erosion and sediment control plan approved by DEQ prior to any on-site activities. Best Management Practices applicable to construction can be found in the Catalog. The construction/temporary BMP section of the Catalog covers general site guidelines, housekeeping, slope protection, storm drain and channel protection, sediment collection and runoff diversion. The housekeeping BMPs may also be used as long-term source control measures.

Other source control BMPs include street sweeping, and inspection/cleaning of the stormwater system. The following are recommended frequencies for various maintenance activities:

- Street sweeping: Establish frequency to limit sediment/debris accumulations to 1 cu. ft. per 1000 sq. ft.
- Inspection of stormwater system: Establish frequency based on accumulated sediment, but at least every 5 years for conveyance system; semi-annually and after storm events for other facilities
- Cleaning of stormwater system
  - Conveyance system: when accumulated sediment/trash at 20% of pipe diameter, or if inhibiting facility operation
  - Catch basins: when accumulated sediment/trash blocking 1/3 of pipe diameter
  - Vegetated systems (swales or filter strips): when accumulated sediment exceeds 2" in depth

- Sand filter: when accumulated sediment exceeds ½" in depth
- Oil/water separator: when accumulated sediment exceeds 1' in depth; oil accumulation exceeds 1"

4.3 Structural BMPs for Combined Pollution Reduction/Flow Control

Several BMPs provide both pollution reduction and flow control, and are readily integrated into the site landscaping. These BMPs are used in the simplified approach (sizing criteria are presented in Section 3.3), and can also be sized using the performance approach.

4.3.1 Bioretention Swale

Description: Bioretention swales are long narrow vegetated facilities that provide conveyance as well as treatment and infiltration. Flow through the grass slows the water and facilitates sedimentation and infiltration.

Design Criteria: (Acceptable for sandy loam or soils with loam texture, with infiltration rates 0.5-3.0 in/hr.) Maximum swale slope is 5%; minimum is 1%. All swales will require additional means for disposal. Required setback from property line 2 feet. See Figure 4.1.

4.3.2 Vegetated Filter Strip

Description: Vegetated filter strips are gently sloping areas used to filter, slow and infiltrate stormwater flows that enter the strip as sheet flow. The key to successful vegetated filter strip performance is avoiding concentrated flows. Utilization of site landscape areas as vegetated filters is encouraged.

Design Criteria: (Acceptable for all soil types.) Minimum slope is 1%; maximum is 10%. If slopes exceed 5%, provide check dams (e.g. BMP #22) at 5' intervals. All filter strips will require additional means for disposal. See Figure 4.2.

4.3.3 Bioretention Basin

Description: Bioretention basins are shallow vegetated depressions that provide a temporary ponding area for infiltration and evapotranspiration. Pollutants are removed by settling as the water infiltrates.

Design Criteria: (Acceptable for soils with loam texture, with infiltration rates 0.5-3.0 in/hr.) An overflow to an approved conveyance/disposal facility is required. Required setback from property line is 5 feet. See Figure 4.3.

A dense growth of vegetation is important for proper functioning of all these systems. Fine, close-growing, water-resistant grasses are recommended (suggested species are listed in the Catalog under BMP #38a). Maintenance guidelines are also found in the Catalog.

4.4 Other BMPs

Other BMPs approved by the City may be used separately or in combination for pollution reduction, flow control, and stormwater disposal.

The simplified approach stormwater management facilities address pollution reduction and flow control, but do not necessarily dispose of stormwater adequately in all cases. Disposal facilities may include on-site infiltration facilities, ditches, canals and off-site storm sewers. Infiltration facilities are classified as "injection systems" under the federal Underground Injection Control (UIC) Program. These systems must be either Rule Authorized or permitted by DEQ. Treatment of stormwater prior to disposal in infiltration facilities is required.

The following list summarizes the BMPs that are detailed in the Catalog of Stormwater BMPs for Idaho Cities and Counties. A selection matrix included as part of the Stormwater BMP Selection Suitability Decision Tree may be used to evaluate physical constraints, as well as suitability for flow control and removal of various pollutants.

A. Construction/Temporary

1. General Construction Site Guidelines
   - BMP #1 Timing of Construction
   - BMP #2 Staging Areas
   - BMP #3 Preservation of Existing Vegetation
   - BMP #4 Clearing Limits
   - BMP #5a Stabilization of Construction Entrance and Roads
   - BMP #5b Erosion Prevention on Temporary and Private Roads

2. Housekeeping
   - BMP #6 Dust Control
   - BMP #7 Cover for Materials & Equipment
   - BMP #8 Spill Prevention & Control
   - BMP #9 Vehicle/Equipment Washing & Maintenance
   - BMP #10 Waste Management

3. Slope Protection
   - BMP #11 Mulching
   - BMP #12 Hydromulching
   - BMP #13 Geotextile
   - BMP #14 Matting
   - BMP #15 Pipe Slope Drain
   - BMP #16 Slope Roughening
   - BMP #17 Gradient Terracing
   - BMP #18 Retaining Walls

4. Storm Drain and Channel Protection
   - BMP #19 Gabions
   - BMP #20 Riprap Slope and Outlet Protection
   - BMP #21 Inlet Protection
   - BMP #22 Check Dams
   - BMP #23 Temporary Stream Crossing

5. Sediment Collection and Runoff Diversion
   - BMP #24 Straw Bales/Biofilter Bags
   - BMP #25 Silt Fence
   - BMP #26 Vegetative Buffer Strip

BMP #27 Sedimentation Trap (Basin)
BMP #28 Portable Sediment Tank
BMP #29 Temporary Swale
BMP #30 Earth Dike
BMP #31 Perimeter Dike/Swale
BMP #32 Temporary Berms (Sandbags)
BMP #33 Temporary Storm Drain Diversion

B. Post-Construction/Permanent

1. Slope Protection & Stabilization
   BMP #34 Topsoiling
   BMP #35 Seeding
   BMP #36 Sodding
   BMP #37 Planting

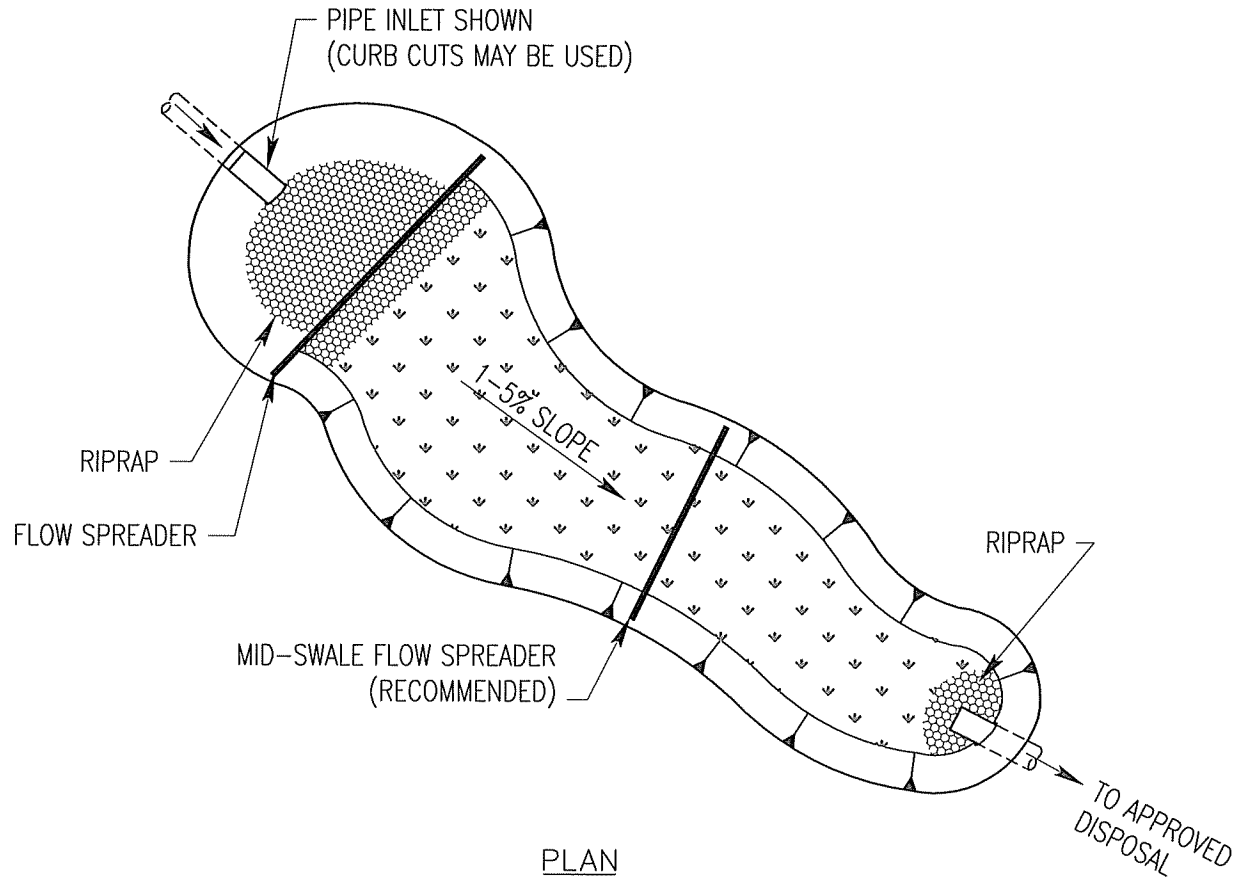
2. Stormwater Filters
   BMP #38a Biofiltration Swale (Vegetated Swale)
   BMP #38b Bioinfiltration Swale (Bioretention Swale)
   BMP #39 Vegetative Filter Strip
   BMP #40 Sand Filter
   BMP #41 Compost Stormwater Filter
   BMP #42 Catchbasin Inserts

3. Infiltration Facilities
   BMP #43 Infiltration Trench
   BMP #44 Bioretention Basin

4. Detention Facilities
   BMP #45 Wet Pond (Conventional Pollutants)
   BMP #46 Wet Pond (Nutrients)
   BMP #47 Wet Extended Detention Pond
   BMP #48 Dry Extended Detention Pond
   BMP #49 Biodetention Basin
   BMP #50 Presettling/Sedimentation Basin
   BMP #51 Wet Vault/Tank

5. Other Structural Controls
   BMP #52 Oil/Water Separator
   BMP #53 Level Spreader

APPENDIX



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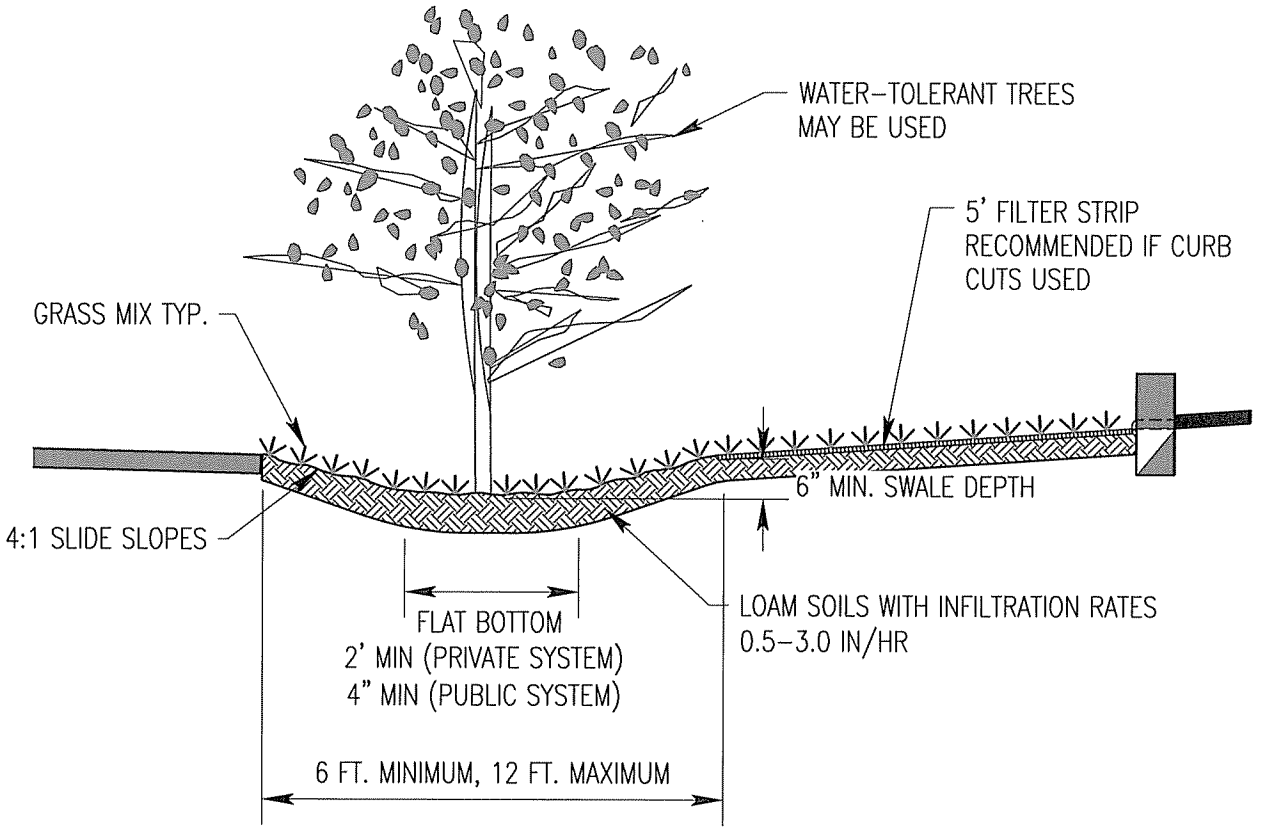

SECTION

FIGURE 4.1
BIORETENTION SWALE

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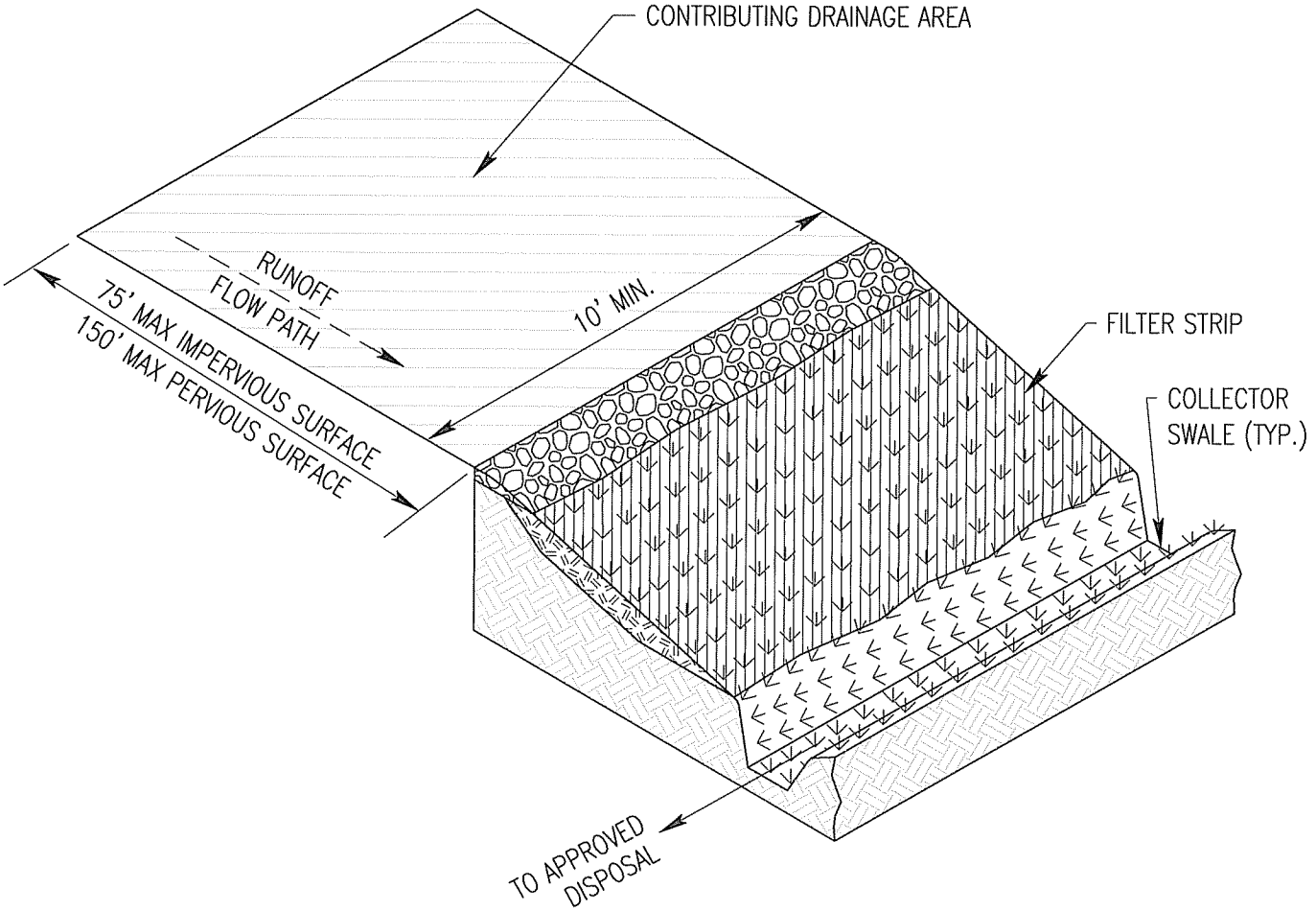

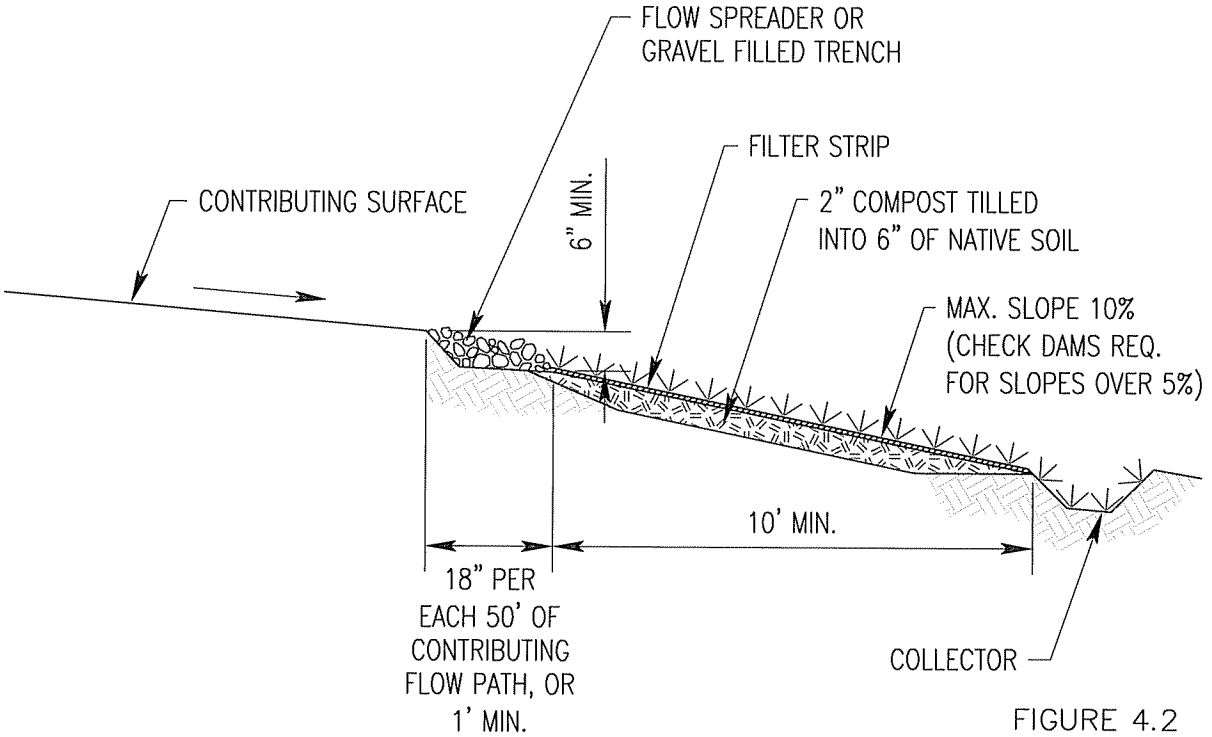

FIGURE 4.2
VEGETATED FILTER STRIP

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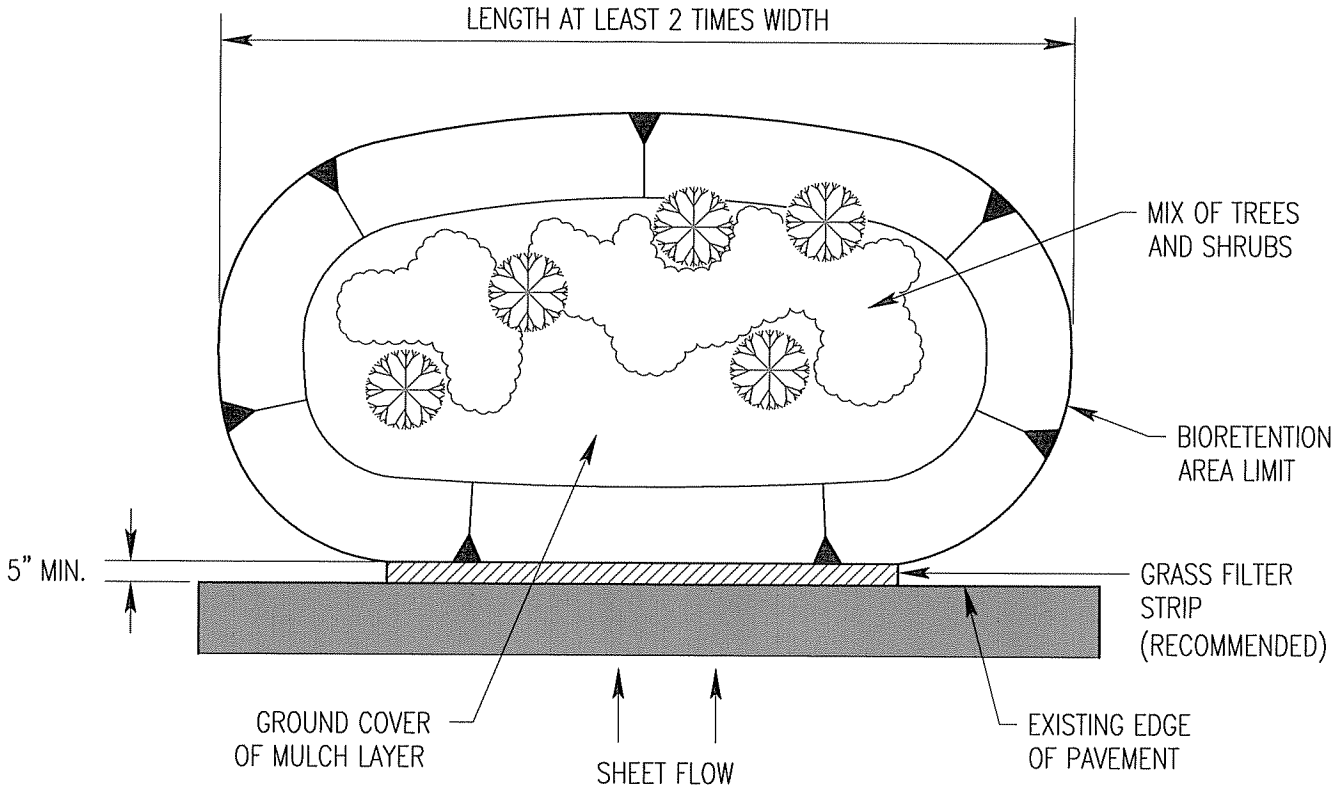

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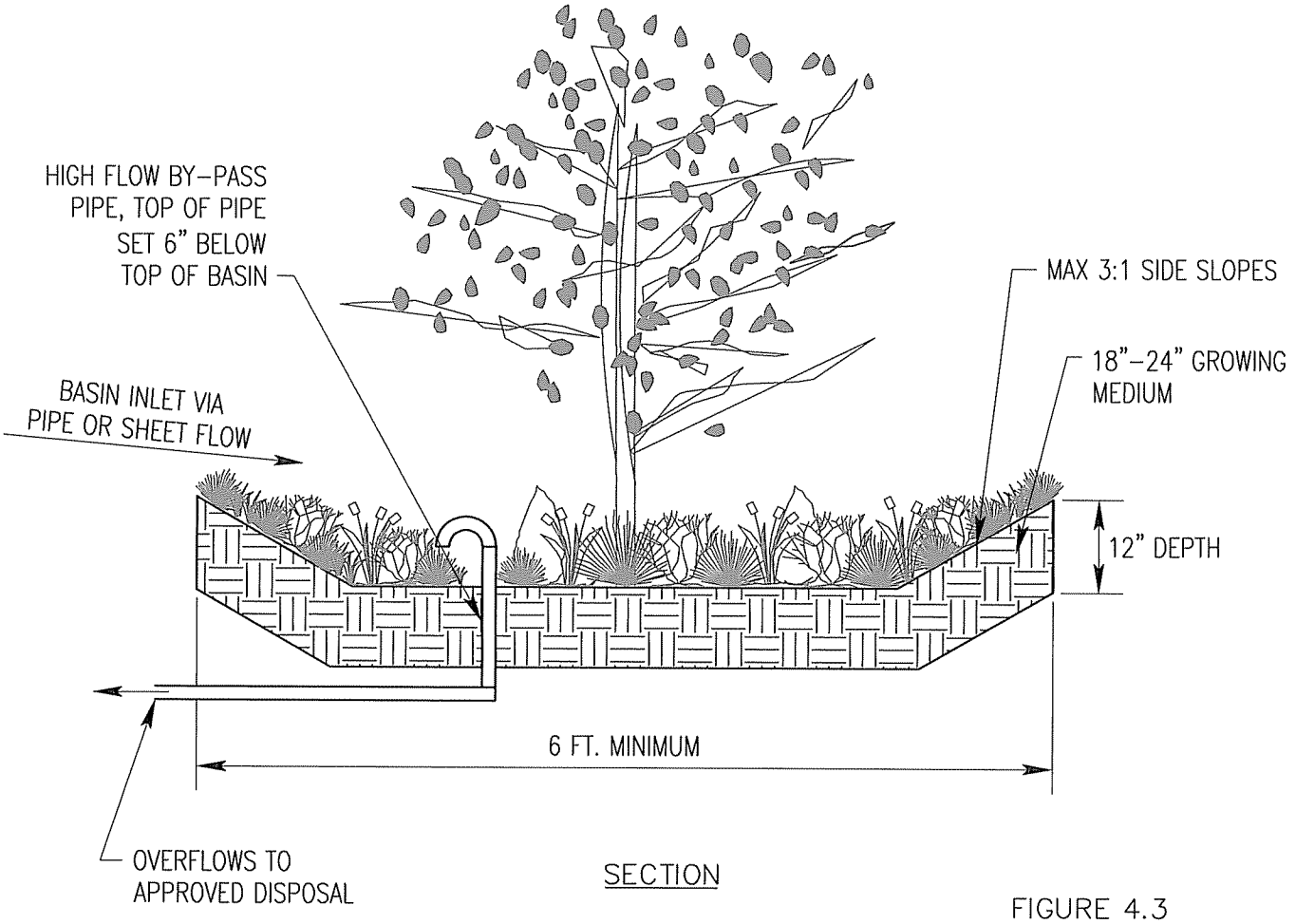

SECTION

FIGURE 4.3
BIORETENTION BASIN

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4) Assumes that 100% of the zoned land is assessed a storm water fee
5) Assumes that only 70% of the commercial zoned land and 10% of the industrial zoned land is developed and assessed a storm water fee at the same rate as if all, developed and undeveloped, zoned land was assessed

In light of the fact that the storm water user rates could significantly increase, it may be appropriate to complete a separate, more detailed storm water fee user rate analysis. A new rate structure could be developed that would provide a gradual increase in storm water fees to accomplish only the most urgent and needed storm water improvements with perhaps other City general fund revenues.