Oregon
Theodore R. Kulongoski, Governor

Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, Oregon 97301-2524
Phone: (503) 373-0050
First Floor/Costal Fax: (503) 378-6033
Second Floor/Director's Office: (503) 378-5518
Web Address: http://www.oregon.gov/LCD

NOTICE OF ADOPTED AMENDMENT

July 25, 2006

TO: Subscribers to Notice of Adopted Plan or Land Use Regulation Amendments

FROM: Mara Ulloa, Plan Amendment Program Specialist

SUBJECT: City of Eugene Plan Amendment
DLCD File Number 001-06

The Department of Land Conservation and Development (DLCD) received the attached notice of adoption. Due to the size of amended material submitted, a complete copy has not been attached. A copy of the adopted plan amendment is available for review at the DLCD office in Salem and the local government office.

Appeal Procedures*

DLCD ACKNOWLEDGMENT or DEADLINE TO APPEAL: August 10, 2006

This amendment was submitted to DLCD for review 45 days prior to adoption. Pursuant to ORS 197.830 (2)(b) only persons who participated in the local government proceedings leading to adoption of the amendment are eligible to appeal this decision to the Land Use Board of Appeals (LUBA).

If you wish to appeal, you must file a notice of intent to appeal with the Land Use Board of Appeals (LUBA) no later than 21 days from the date the decision was mailed to you by the local government. If you have questions, check with the local government to determine the appeal deadline. Copies of the notice of intent to appeal must be served upon the local government and others who received written notice of the final decision from the local government. The notice of intent to appeal must be served and filed in the form and manner prescribed by LUBA, (OAR Chapter 661, Division 10). Please call LUBA at 503-373-1265, if you have questions about appeal procedures.

*NOTE: **THE APPEAL DEADLINE IS BASED UPON THE DATE THE DECISION WAS MAILED BY LOCAL GOVERNMENT. A DECISION MAY HAVE BEEN MAILED TO YOU ON A DIFFERENT DATE THAN IT WAS MAILED TO DLCD. AS A RESULT YOUR APPEAL DEADLINE MAY BE EARLIER THAN THE ABOVE DATE SPECIFIED.**

Cc: Gloria Gardiner, DLCD Urban Planning Specialist
Marguerite Nabeta, DLCD Regional Representative
Amanda Punton, DLCD Natural Resource Specialist
Peggy Keppler, City of Eugene

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2 Notice of Adoption

THIS FORM **MUST BE MAILED** TO DLCD
WITHIN 5 WORKING DAYS AFTER THE FINAL DECISION
PER ORS 197.610, OAR CHAPTER 660 - DIVISION 18

Jurisdiction: **City of Eugene** Local file number: **None**

Date of Adoption: **7/17/2006** Date Mailed: **7/20/2006**

Date original Notice of Proposed Amendment was mailed to DLCD: **3/28/2006**

- [ ] Comprehensive Plan Text Amendment
- [ ] Comprehensive Plan Map Amendment
- [ ] Land Use Regulation Amendment
- [ ] Zoning Map Amendment
- [ ] New Land Use Regulation
- [x] Other: Land Use Decision - Administrative Order

Summarize the adopted amendment. Do not use technical terms. Do not write "See Attached".

The administrative order adopts the Stormwater Management Manual required by Eugene Code (EC) 9.6790. The Stormwater Management Manual sets forth stormwater facility design requirements, operation and maintenance provisions, and source control requirements. The Stormwater Management Manual is consistent with the goals set forth in EC 9.6790 and is intended to protect life and property from flood drainage hazards, reduce impacts of urbanization on the City's water quality, protect headwater areas from erosive affects of increased stormwater runoff, protect the City's stormwater system from oil and grease, and prevent stormwater pollution by eliminating pathways that introduce pollutants into stormwater.

Describe how the adopted amendment differs from the proposed amendment. If it is the same, write "SAME". If you did not give Notice for the Proposed Amendment, write "N/A".

Added section 1.9 to Chapter 1.0, Credits and Incentives for Private Stormwater Facilities, deleted subsections 2.7.1 and 2.7.2 from Chapter 2, Landscape Application and Landscape Design and Management, deleted vegetated swale and street swale from Exhibit 2-1, revised the introduction to the Manufactured Treatment Technology section (Chapter 2), various technical edits and grammatical corrections.

Plan Map Changed from: **N/A** to:

Zone Map Changed from: **N/A** to:

Location: **N/A** Acres Involved:

Specify Density: Previous: **N/A** New:

Applicable Statewide Planning Goals: **1, 2 and 6**

Was and Exception Adopted? ☐ YES ☒ NO

DLCD File No.: 001-06 (15118)

Did the Department of Land Conservation and Development receive a Notice of Proposed Amendment......

Forty-five (45) days prior to first evidentiary hearing?	☒ Yes	☐ No
If no, do the statewide planning goals apply?	☐ Yes	☐ No
If no, did Emergency Circumstances require immediate adoption?	☐ Yes	☐ No

Affected State or Federal Agencies, Local Governments or Special Districts:

City of Eugene

Local Contact: Peggy Keppler Phone: (541) 682-2869 Extension:

Address: 858 Pearl Street, First Floor City: Eugene

Zip Code + 4: 97401-2727 Email Address: peggy.a.keppler@ci.eugene.or.us

ADOPTION SUBMITTAL REQUIREMENTS

This form **must be mailed** to DLCD **within 5 working days after the final decision**
per ORS 197.610, OAR Chapter 660 - Division 18.

1. Send this Form and **TWO (2) Copies** of the Adopted Amendment to:

ATTENTION: PLAN AMENDMENT SPECIALIST
DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT
635 CAPITOL STREET NE, SUITE 150
SALEM, OREGON 97301-2540

2. Submit **TWO (2) copies** the adopted material, if copies are bounded please submit **TWO (2) complete copies** of documents and maps.

3. Please Note: Adopted materials must be sent to DLCD not later than **FIVE (5) working days** following the date of the final decision on the amendment.

4. Submittal of this Notice of Adoption must include the text of the amendment plus adopted findings and supplementary information.

5. The deadline to appeal will not be extended if you submit this notice of adoption within five working days of the final decision. Appeals to LUBA may be filed within **TWENTY-ONE (21) days** of the date, the Notice of Adoption is sent to DLCD.

6. In addition to sending the Notice of Adoption to DLCD, you must notify persons who participated in the local hearing and requested notice of the final decision.

7. **Need More Copies?** You can copy this form on to 8-1/2x11 green paper only; or call the DLCD Office at (503) 373-0050; or Fax your request to:(503) 378-5518; or Email your request to **mara.ulloa@state.or.us** - ATTENTION: PLAN AMENDMENT SPECIALIST.

ADMINISTRATIVE ORDER NO. 58-06-06-F
of the
City Manager of the City of Eugene

ADOPTING THE STORMWATER MANAGEMENT MANUAL.

The City Manager of the City of Eugene finds as follows:

A. Section 2.019 of the Eugene Code, 1971 (EC) authorizes the City Manager to adopt rules for administration and implementation of any provisions of that Code. In addition, EC 9.6790, added to the Code by Ordinance No. 20369 adopted by the City Council on June 12, 2006, requires that the City Manager adopt, in accordance with EC 2.019, a Stormwater Management Manual. The Stormwater Management Manual may contain forms and facility agreements and shall include requirements that are consistent with delineated goals.

B. In accordance with the procedures set forth therein, on May 2, 2006, the City Manager issued Administrative Order No. 58-06-06 proposing the adoption of the Stormwater Management Manual. Notice was posted at the City Manager's office, 777 Pearl Street, at Public Works Engineering, 858 Pearl Street, and at the Eugene Library Reference Center, and was published in the Register Guard, a newspaper of general circulation on May 7, 8, 9, 10 and 11, 2006. The proposed Stormwater Management Manual was made available for review at the City Manager's Office, at Public Works Engineering, and at the Eugene Library Reference Center. Additionally, notice of the proposed adoption of the Stormwater Management Manual was sent to the Department of Land Conservation and Development on March 28, 2006.

C. The notice provided that interested persons could submit written comments thereon for a period of thirty (30) days from the first date of publication, or at the public hearing to be held on June 8, 2006, at 4:00 p.m. at 858 Pearl Street, Lyle Conference Room, Eugene, Oregon. Written comments were received from Rob Handy, Becky Riley, Jerry Finigan, Teresa Damron, Kate Perle, Ellen Hyman, Rachel DeBuse, Tammie Stark, Megan Kemple, Jenya Lemeshow, and Bruce H. Anderson.

D. The following comments were received in response to this notice, or at the June 8, 2006 public hearing, to which I make the following specific findings:

<u>Comment 1</u>: Eugene needs to do more to preserve natural drainage systems in the urban area.

Finding: Concern was expressed during the stormwater development standards ordinance adoption and manual review that, upon development, roadside swales and open waterways would be replaced with engineered (piped) systems for conveying stormwater. Residents stated that, given their multiple benefits, roadside ditches, swales and open waterways should be preserved and utilized rather than replaced by piped systems. The citizens urged Council to take steps to preserve these natural drainage systems.

The type of system used to convey stormwater is not dictated by the recently adopted stormwater development standards Code provisions, existing City Code, existing design standards, or the proposed Stormwater Management Manual, but rather is decided based upon feasibility, cost, and preference. And nothing in the recently adopted Code provisions, existing City Code provisions, existing design standards or the proposed Stormwater Management Manual prohibits the use of natural drainage systems for stormwater. The type of system used to convey stormwater is typically decided based upon feasibility, cost, and preference. No changes have been made as a result of this comment.

Comment 2. Explore "low impact development" standards.

Finding: Staff will continue to research stormwater management technology and incorporate strategies and methodologies that preserve and enhance water quality during updates to the Manual. The Stormwater Management Manual will be reviewed and updated on a regular basis to incorporate improved technology. This comment did not request or require any changes to the Manual.

Comment 3: Rainwater Harvesting. A number of citizens testified at the public hearing on the manual (and also on the ordinance) and submitted written testimony requesting that the city encourage and support rainwater harvesting.

Finding: Rainwater harvesting is one of the approved stormwater facilities listed in the Stormwater Management Manual. Neither the Code provisions nor the Manual require an applicant to use a specific facility or disallows an applicant from using any of the approved facilities. Rainwater harvesting can be a useful tool for irrigation, water conservation, and stormwater mitigation. The Stormwater Management Manual identifies which facilities qualify for pollution reduction, flow control, and destination and then describes how to design, operate and maintain the facilities to meet stormwater mitigation. Rainwater harvesting, through the use of cisterns and storage tanks, may be used for pollution reduction and flow control. The Manual does not regulate uses of the harvested water.

Testimony at the public hearing stated that the Manual is too onerous for residential applications and that it discourages home owners from implementing rainwater harvesting. The Manual is not intended to discourage rainwater harvesting or water conservation. Staff will work with Eugene Water & Electric Board staff and Eugene Building Permit staff to develop a fact sheet/information brochure on residential rainwater harvesting.

To address this concern, a statement has been added to the Manual clarifying that these design standards pertain only to stormwater management regulated by the provisions of the Eugene Code, 1971 added or amended by Ordinance 20369 and development permit applications requesting stormwater SDC credits. Aspects of the installation and use of rainwater harvesting systems may be regulated by State of Oregon structural and plumbing codes, as well as local land use regulations. Permitting requirements, separate from stormwater facilities information in the Stormwater Management Manual, will apply.

<u>Comment 4</u>: Adoption of the stormwater management manual preempts the completion of River Road/Santa Clara Stormwater Basin Plan. Several persons from the River Road and Santa Clara neighborhoods asked that the city refrain from adopting the Manual until after the Basin Plan was completed.

Finding: EC 9.6790, which was added to the Code by Ordinance 20369 adopted by the City Council on June 12, 2006, directs the City Manager to adopt a stormwater facility design manual. The Code provisions adopted by Ordinance 20369 and the River Road/Santa Clara Stormwater Basin Plan are complimentary but independent of each other. Given the in-depth analysis and comparison of options for addressing runoff from new development that was done in the earlier basin planning process, the consistent outcome for all of the other six basins, and the benefits of applying consistent stormwater quality development standards city-wide, additional analysis on that point is not a part of the current work plan. The draft River Road/Santa Clara Basin Plan reflects that implementing on-site stormwater development standards city-wide is the most appropriate strategy for addressing the water quality impacts associated with future development and it is not expected that the River Road/Santa Clara Basin Plan will result in any changes to the stormwater development standards Code provisions.

Delaying adoption of the Stormwater Management Manual pending completion of the River Road/Santa Clara Basin Plan is not warranted given that the City Manager is directed by EC 9.6790 to adopt the Manual and because the River Road/Santa Clara Basin Plan is independent of the stormwater management regulations and design standards. Therefore, no changes have been made as a result of this comment.

<u>Comment 5</u>: Why is it implied that the River Road/Santa Clara Basin has drainage and flood protection strategies?

Finding: Even though the 2002 City of Eugene Stormwater Basin Master Plans did not finalize the River Road/Santa Clara Basin Plan, Volume I of the 2002 Basin Plans (City-Wide Summary) and the 1990 River Road – Santa Clara Drainage Master Plan completed by OTAK does provide the drainage and flood strategies for River Road/Santa Clara. This comment was not directed at any changes to the Manual.

<u>Comment 6</u>: The following specific language changes to suggested: Sec. 1.3 add "and propane dealers" to Bulk Fuel Terminal; define "Urban Transition Area"; Sec. 1.4 add "increased level of pollutants discharged into rivers and streams" to development impacts; include "and increased volumes of pollutants" to "increases in stormwater runoff peak flow rates and volumes resulting from development"; include "and development" to "post-development site"; Sec. 2.2 change "intended to save the project developer and the city time

and expense" to "intended to mimic the natural hydrologic cycle by slowing and infiltrating stormwater, and save"; add "and should be encouraged where conditions allow for favorable outcomes" to "these facilities help infiltrate or retain water on-site"; change "were developed as a simple and quick tool" to "were developed as an effective, simple and quick tool"; Sec. 4.1.1 include "outdoor motorized vehicle sales and storage" to site uses and characteristics that trigger source controls; Sec 4.1.3 add "and other surface runoff" to "signage is required for certain site uses and activities that may pollute stormwater"; change "need to be" to "must be"; Sec. 4.5.1 add "herbicides and creosote treated wood products" to high risk category; Sec. 4.8.2 add "no net increase of runoff shall result from private construction dewatering activities" to construction dewatering.

Finding: Staff reviewed the proposed language changes to the Manual and incorporated two language changes that clarified the intent and purpose of the facilities. The other comments were not included because the comments are not necessary or helpful in administering the Manual.

Comment 7: Can driveways be paved with pervious materials?

Finding: Yes, porous asphalt and concrete materials are available. Inquiry and response only.

Comment 8: Who is accountable for stormwater management facilities that receive stormwater runoff from public right of way?

Finding: City maintenance crews will operate and maintain facilities that are in public rights of way and public easements. Inquiry and response only.

Comment 9: Can't runoff be generated by events other than rain, i.e. 'home' car washing, pressure washing?

Finding: Yes, but the volume of runoff generated by these types of activities does not impact the design of stormwater facilities. These activities are addressed by the city's stormwater education program (to encourage water quality friendly approaches to car washing, for example) and the city's illicit discharge and spill response programs (which include enforcement for illegal discharges to the municipal stormwater system). Inquiry and response only.

Comment 10: Would a drywell be an authorized pretreatment facility for the paved area beneath the cover over fuel dispensing facilities and its surrounding traffic areas?

Finding: No. Inquiry and response only.

Comment 11: There should be a definition that applies to the River Road/Santa Clara area (urban transition area).

Finding: The River Road/Santa Clara area and urban transition areas are already identified in the City Code and land use regulations. As such, no changes were made to the design manual.

<u>Comment 12</u>: **Will all pollution reduction and flow control facilities designed using the SIM form always comply with the requirements, regardless of location and surrounding level of urbanization?**

Finding: Yes, the sizing factors were developed based on the most conservative design parameters, including the lowest infiltration rates, and impervious surface area at full build-out based upon Metro Plan land use designations. Inquiry and response only.

<u>Comment 13</u>: **Will the performance approach for downsizing facilities be allowed when headwater flow controls are not required?**

Finding: Yes. The performance approach is an alternative to the simplified approach to sizing facilities. The performance approach may be used for sizing pollution reduction and/or flow control facilities regardless of location, and requires calculations to verify that a facility design meets the requirements for a particular site. The simplified approach assumes (conservatively) that both pollution reduction and flow control requirements apply. In non-headwaters areas, where flow control requirements do not apply, the manual indicates that the performance approach may be used to downsize facilities, in acknowledgement that by using the simplified approach a facility may be over-designed.

Application of flow control requirements is limited to the headwaters area due to its unique physical characteristics that make it especially vulnerable to erosion and downcutting of streams and drainages with steep slopes, highly erodible soils, and high runoff velocities during rainfall events. Inquiry and response only.

<u>Comment 14</u>: **Can initial feasibility testing for infiltration be waived if existing testing data is on file, regardless of the date?**

Finding: Yes, provided the site is unchanged. Inquiry and response only.

<u>Comment 15</u>: **What provisions for access for operation and maintenance will/should be applied in the River Road/Santa Clara basin?**

Finding: Applicants are required to submit an operation and maintenance plan which describes and visually depicts access to the facility for operations and maintenance purposes. The Eugene Code, 1971 requires that all stormwater facilities constructed pursuant to code requirements be operated and maintained by the owner. Applicants requesting city maintenance of their proposed facilities, must provided access for city equipment before the city will enter into an agreement with the applicant to take on maintenance responsibilities. Inquiry and response only.

__Comment 16__: **Public stormwater facilities shall be designed so permanent long-term irrigation systems are not needed. What about private stormwater management facilities?**

Finding: Methods of irrigation for private facilities is up to the applicant. Plantings are an essential element for many of the various treatment systems. The applicant will be required to maintain the vegetative aspects of the facilities. Failure to properly maintain the facilities will be considered a public nuisance and enforcement policies are established in Chapter 6 of the Eugene code. Inquiry and response only.

__Comment 17__: **Shut off valves are required to protect the city sewer systems or onsite infiltration facilities. What would these facilities be in the River Road/Santa Clara?**

Finding: Shut off valves are required at fuel dispensing facilities and are intended to protect both the wastewater and stormwater systems depending on where a contamination spill may occur. The covered area over the fuel dispensing area drains to the city wastewater system or an approved pretreatment facility. A shut off valve is required to be installed before the domestic wastewater tie-in. This valve remains closed and only opened to allow incidental drainage. The uncovered areas surrounding the fueling pads drain to an approved pollution reduction facility before discharging to an approved destination stormwater facility. A shut off valve is required before the approved discharge point. The valves remain open to facilitate stormwater flows and shall be immediately closed in the event of a spill. The Manual was edited to clarify this intent.

__Comment 18__: **Liquid materials shall be stored and contained in such a manner that if the container(s) is ruptured, the contents will not discharge, flow, or be washed into the a receiving system. Could the "drainage system" include drywells?**

Finding: Yes. Inquiry and response only.

__Comment 19__: **Is pavement for all the *solid waste storage areas, containers, and trash compactors* (specifically the multi-residential) going to add unnecessary impervious surfaces to the River Road/Santa Clara Basin?**

Finding: No. To best serve water quality goals there are cases where pervious pavements are not appropriate. Impervious pavement is used in areas where solid waste, etc., is stored to keep containments that spill or leach from the contained material from infiltrating into the soil. Inquiry and response only.

__Comment 20__: **Can the paved waste storage area required under a structural cover or trash compactor be paved using pervious pavers? Can the paved material transfer areas required under and around loading and unloading areas be paved using pervious pavers? Can wash pads under and around washing activities be pervious pavement?**

Finding: No. See findings for comment 19.

<u>Comment 21</u>: Non-gravity drainage options for paved surfaces under *solid waste storage areas, containers, and trash compactors:* Activity areas that do not have gravity wastewater service can install a pressurized system. Are either of these viable options in the River Road/Santa Clara Basin? Non-gravity drainage options for paved surfaces under *Material transfer areas/loading docks:* Activity areas that cannot achieve gravity wastewater service may be allowed to install a pressurized system. Is this appropriate in the River Road/Santa Clara Basin?

Finding: Yes, both options are viable. Pressurized systems are only necessary when the paved surface is lower than the wastewater tie-in. Inquiry and response only.

<u>Comment 22</u>: Soil management in section 4.8.2 of the *Manual* should specify minimum weight standard for temporary plastic sheeting covering stockpiles.

Finding: Protecting stockpiles of contaminated soils from coming into contact with stormwater with plastic film or sheeting is a temporary requirement. Contaminated soils must be decontaminated or removed to an approved disposal site. While the contaminated soils remain, the general outcome of this requirement of this section is that applicants apply a plastic material that prevents stormwater from coming into contact with the stockpiled materials. Materials that fail to meet this requirement will be in violation of the Code and the applicant will be instructed to replace the materials with another at their own cost. No changes were made as a result of this comment.

<u>Comment 23</u>: In regards to 4.8.2 (3) Post-Construction Surface Drainage Systems, with increased density in the River Road/Santa Clara Basin, how will a system of virtually 100% private on site infiltration systems impact the management of stormwater flows and pollutants into the East Santa Clara Waterway?

Finding: As related to *Stormwater and Groundwater Management for Development on Land with Suspected or Known Contamination*, post construction surface drainage systems have four methods of approved disposal. Both of the infiltration alternatives and the disposal into a receiving stream require the applicant to obtain authorization from the city and the Oregon Department of Environmental Quality. The Army Corps of Engineers must also authorize disposal into a receiving stream. Development applications that come into the city for review that show 100% on-site infiltration will have minimal impact on the East Santa Clara waterway. Retaining the flows on site will reduce the peak flows in the stream and pollutants will be collected and treated at the site. Inquiry and response only.

I. Staff has recommended that the Stormwater Management Manual be adopted as amended in response to the comments received. I concur with that recommendation and find that adoption of the Stormwater Management Manual as attached hereto as Exhibit B is necessary in order to meet the requirements of Section 9.6790 of the Eugene Code, 1971.

Now, therefore, based on the above findings, the findings in Administrative Order 58-06-06, the legislative findings attached hereto as Exhibit A, which are adopted in support of this Administrative Order, I hereby order that:

1. The Stormwater Management Manual, a copy of which is attached hereto as Exhibit B, is hereby adopted

2. The Stormwater Management Manual Appendix A is included for informational purposes only, and is not adopted by this Administrative Order.

Dated and effective this 17th day of July, 2006.

Dennis M. Taylor
City Manager

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EXHIBIT A

FINDINGS IN SUPPORT OF THE ADOPTION OF ADMINISTRATIVE ORDER NO. 58-06-06-F

Introduction

The City of Eugene has added provisions to Chapter 9 of the Eugene Code (EC), the City of Eugene's adopted land use code, in order to protect life and property from flood and drainage hazards, reduce the impacts that urbanization is having on the City's water quality, protect waterways in the headwater areas from erosive affects of increases in stormwater runoff, protect the City's stormwater system from oil and grease from stormwater runoff, and prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater (hereinafter referred to as "the Stormwater Regulations"). The Stormwater Regulations will require that developers comply with standards that are based, in part, on facilities and methodologies set forth in the Stormwater Management Manual. The Stormwater Regulations provide that the Stormwater Management Manual will be adopted by the City in the manner set forth in EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures.

This administrative order that adopts the Stormwater Management Manual is a not a land use regulation. However, the administrative order, that implements the City's adopted land use code, is potentially a land use decision. The City recognizes that state law does not require a local government to show compliance with the Statewide Planning Goals when making an administrative land use decision. However, because the administrative order implements an acknowledged land use regulation (the City's adopted land use code), the findings set forth below are intended to demonstrate that the standards are consistent with the Statewide Planning Goals.

Findings of Consistency with the Statewide Planning Goals

(1) The administrative order is consistent with applicable statewide planning goals adopted by the Land Conservation and Development Commission.

<u>*Goal 1 - Citizen Involvement*</u>*. To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.*

The City has acknowledged provisions for citizen involvement that insure the opportunity for citizens to be involved in all phases of the planning process and set out requirements for such involvement. The action taken did not amend the citizen involvement program.

Throughout the Stormwater Management Manual drafting process, the City provided numerous opportunities for citizen involvement. The City initiated the public involvement in 1999 when it convened a fourteen-member Stormwater Department Advisory Committee (DAC) to provide feedback to Eugene Public Works on the results of the Stormwater Basin Planning efforts. The 1999

DAC met from February 1999 through June 2000. The result of this long-term planning effort was called the proposed "stormwater management strategy," and included a capital project list, waterway protection measures and stormwater development standards. The 1999 DAC approved, with some modification, city staff's proposed stormwater management strategy. This stormwater management strategy served as the starting point for the Water Quality Implementation DAC Subcommittee (the 2005 DAC).

City staff conducted broader public outreach from October 2000 through May 2001 on the proposed stormwater management strategy (*i.e.,* capital projects list and proposed stormwater development standards) to receive further community feedback. This outreach included presentations to 10 neighborhood groups, as well as the Neighborhood Leaders Council, Long Tom Watershed Council, League of Women Voters, American Society of Landscape Architects and Oregon Landscape Contractors.

The 2005 DAC was initiated in August 2005. The membership of the 2005 DAC included representatives of special interests (Chamber of Commerce, Lane County Home Builders' Association, Citizens for Public Accountability); technical expertise in architecture, engineering, site design, land use and the environment; and a neighborhood representative. The Committee met six times between August and November 2005 to review and provide input on the draft Stormwater Development Standards ordinance (August 8, August 25, October 3, October 25, October 31 and November 10).

On June 8, 2006, a public hearing was held. Department of Land Conservation and Development notice, notice to interested parties and newspaper publication was provided for that hearing.

The process for adopting this administrative order complies with Goal 1 because it complies with, and surpasses, the requirements of the State's citizen involvement provisions.

<u>*Goal 2 - Land Use Planning*</u>. *To establish a land use planning process and policy framework as a basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.*

The record shows that there is an adequate factual base for the adoption of this administrative order.

Goal 2 requires that plans be coordinated with the plans of affected governmental units and that opportunities be provided for review and comment by affected governmental units. The Goal 2 coordination requirement is met when the City engages in an exchange, or invites such an exchange, between the City and any affected governmental unit and when the City uses the information obtained in the exchange to balance the needs of the citizens. This administrative order does not affect any other governmental units.

There are no Goal 2 exceptions required for this administrative order. Therefore, the administrative order is consistent with Goal 2.

Goal 3 - Agricultural Lands. To preserve and maintain agricultural lands.

The administrative order applies to property located within the urban growth boundary and does not affect any land designated for agricultural use. Therefore, Goal 3 does not apply.

Goal 4 - Forest Lands. To conserve forest lands by maintaining the forest land base and to protect the state's forest economy

The administrative order applies to property located within the urban growth boundary and does not affect any land designated for forest use. Therefore, Goal 4 does not apply.

Goal 5 - Natural Resources, Scenic and Historic Areas, and Open Spaces. To protect natural resources and conserve scenic and historic areas and open spaces.

The administrative order does not create or amend the City's list of Goal 5 resources, does not amend a code provision adopted in order to protect a significant Goal 5 resource or to address specific requirements of Goal 5, does not allow new uses that could be conflicting uses with a significant Goal 5 resource site and does not amend the acknowledged urban growth boundary. Therefore, Goal 5 does not apply.

Goal 6 - Air, Water and Land Resources Quality. To maintain and improve the quality of the air, water and land resources of the state.

Goal 6 addresses waste and process discharges from development, and is aimed at protecting air, water and land from impacts of those discharges. This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as groundwater pollution.

The proposed administrative order will implement the City's Stormwater Development Standards is one component of the larger Stormwater Program initiated by the Oregon Department of Environmental Quality (DEQ)'s approval of the City's National Pollutant Discharge Elimination System (NPDES) permit. The City's NPDES Stormwater permit, first issued by DEQ in 1994, and subsequently re-issued in March 2004, includes measures which in total fulfill the applicable federal Clean Water Act requirements for large municipalities over 100,000 in population.

The proposed administrative order will provide the stormwater facility design specifics, operation and maintenance requirements and specific source control requirements that will work in tandem with the City's Stormwater Development Standards. The Stormwater Development Standards will regulate the location, design, construction, and maintenance of stormwater facilities that capture and treat stormwater runoff from new development and significant re-development to reduce impacts that urbanization has on water quality; protect waterways in headwater areas from the erosive effects of increased stormwater runoff peak flow rates and volumes resulting from development; restrict the discharge of oil and grease from land uses that produce high concentrations of these pollutants; and prevent stormwater pollution by eliminating pathways that may introduce pollutants. This administrative order is consistent with the City's existing measure to provide for clean air, water and land resources; therefore, these amendments are consistent with Goal 6.

Goal 7 - Areas Subject to Natural Disasters and Hazards. To protect people and property from natural hazards.

The administrative order does not affect the City's restrictions on development in areas subject to natural hazards. Further, the administrative order does not allow for new development that could result in a natural hazard. Therefore, Goal 7 does not apply.

Goal 8 - Recreational Needs. To satisfy the recreational needs of the citizens of the state and visitors and, where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

The administrative order does not affect the City's provisions for recreation areas, facilities or recreational opportunities. Therefore, Goal 8 does not apply.

Goal 9 - Economic Development. To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.

The administrative order does not impact the supply of industrial or commercial lands. Therefore, the administrative order is consistent with Goal 9. The administrative order does not render any property unusable for commercial or industrial uses. In fact, the Stormwater Development Standards, the standards that the proposed administrative order will implement, are drafted to ensure that neither the administrative order nor the code provisions that the administrative order is implementing have such an effect on a property. Those provisions are:

1. The pollution reduction and flow control regulations do not apply to: (1) land use applications that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development; (2) development permit applications that will result in less than 1,000 square feet of new or replaced impervious surface within a 12-month period; (3) development permit applications to construct or alter one- or two-family dwellings; or, (4) development permit applications to replace more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system on the development site.

2. An applicant can seek an adjustment to the requirement that the selected pollution reduction facilities treat all of the stormwater runoff that will result from the water quality design storm if the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious

surface and is isolated from the pollution reduction facility; (2) the area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

3. An applicant can seek an adjustment to the requirement that all pollution reduction facilities must be selected, sited and constructed in accordance with the Stormwater Management Manual and that all facilities must be designed using one of the three methodologies outlined in the Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

4. An applicant can seek an adjustment to the requirement that the applicant demonstrate that peak rates of flow delivered to an existing open waterway at a point above 500 feet will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the subject development if the proposed flow control facility will control flow rates as much as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility; (2) the area generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

5. An applicant can seek an adjustment to the requirement that all flow control facilities must be selected from and sited, designed and constructed according to the Stormwater Management Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

6. An applicant can seek an adjustment to the requirement that all oil control facilities be sited,

designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Manual.

7. An applicant can seek an adjustment to the requirement that all source controls be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Manual.

Considering the above-listed provisions in the Stormwater Development Standards, the application of this administrative order to a property zoned and designated for commercial or industrial use does not result in a diminution in the area's supply of commercial or industrial land. Therefore, this administrative order is consistent with Goal 9.

<u>*Goal 10 - Housing*</u>. *To provide for the housing needs of citizens of the state.*

The administrative order does not impact the supply of residential lands. Therefore, the administrative order is consistent with Goal 10. The administrative order does not render any property unusable for residential uses. In fact, the Stormwater Development Standards, the standards that the proposed administrative order will implement, are drafted to ensure that neither the administrative order nor the code provisions that the administrative order is implementing have such an effect on a property. Those provisions are:

1. The pollution reduction and flow control regulations do not apply to: (1) land use applications that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development; (2) development permit applications that will result in less than 1,000 square feet of new or replaced impervious surface within a 12-month period; (3) development permit applications to construct or alter one- or two-family dwellings; or, (4) development permit applications to replace more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system on the development site.

2. An applicant can seek an adjustment to the requirement that the selected pollution reduction facilities treat all of the stormwater runoff that will result from the water quality design storm if the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the pollution reduction facility; (2) the area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

3. An applicant can seek an adjustment to the requirement that all pollution reduction facilities must be selected, sited and constructed in accordance with the Stormwater Management Manual and that all facilities must be designed using one of the three methodologies outlined in the Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

4. An applicant can seek an adjustment to the requirement that the applicant demonstrate that peak rates of flow delivered to an existing open waterway at a point above 500 feet will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the subject development if the proposed flow control facility will control flow rates as much as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility; (2) the area generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

5. An applicant can seek an adjustment to the requirement that all flow control facilities must be selected from and sited, designed and constructed according to the Stormwater Management Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

6. An applicant can seek an adjustment to the requirement that all oil control facilities be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Manual.

7. An applicant can seek an adjustment to the requirement that all source controls be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Manual.

Considering the above-listed provisions in the Stormwater Development Standards, the application of this administrative order to a property zoned and designated for residential use does not result in a diminution in the area's supply of residential land. Therefore, this administrative order is consistent with Goal 10.

<u>*Goal 11- Public Facilities and Services*</u>. *To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.*

The Eugene-Springfield metropolitan area has an acknowledged Public Facilities and Services Plan (PFSP). The PFSP describes the public stormwater facilities necessary to support the land uses designated in the Eugene-Springfield Metropolitan Area General Plan (Metro Plan) within the urban growth boundary. This administrative order is consistent with the adopted Eugene-Springfield Metro Area PFSP. Further, this administrative order does not affect the City's provision of any public facilities and services, including stormwater facilities and services. Therefore, Goal 11 does not apply.

<u>*Goal 12- Transportation*</u>. *To provide and encourage a safe, convenient and economic transportation system.*

Goal 12 is implemented through the Transportation Planning Rule (TPR). The Eugene-Springfield Metropolitan Area Transportation Plan (TransPlan) provides the regional policy framework through which the TPR is enacted at the local level.

The Transportation Planning Rule (OAR 660-012-0060) states that land use changes that significantly affect a transportation facility shall require mitigation measures to address the anticipated impacts. The rule states that:

(1) Amendments to functional plans, acknowledged comprehensive plans, and land use regulations which significantly affect a transportation facility shall assure that allowed land uses are consistent with the identified function, capacity, and performance standards (e.g. level of service, volume to capacity ratio, etc.) of the facility. This shall be accomplished by either:
- *(a) Limiting allowed land uses to be consistent with the planned function, capacity, and performance standards of the transportation facility;*
- *(b) Amending the TSP to provide transportation facilities to support the proposed land uses consistent with the requirements of this division.*
- *(c) Altering land use designations, densities, or design requirements to reduce demand for automobile travel and meet travel needs through other modes; or*
- *(d) Amending the TSP to modify the planned function, capacity and performance standards, as needed, to accept greater motor vehicle congestion to promote mixed use, pedestrian-friendly development where multi modal travel choices are provided.*

(2) A plan or land use regulation amendment significantly affects a transportation facility if it:

(a) Changes the functional classification of an existing or planned transportation facility;
(b) Changes standards implementing a functional classification system;
(c) Allows types or levels of land uses that would result in levels of travel or access that are inconsistent with the functional classification of a transportation facility; or
(d) Would reduce the performance standards of the facility below the minimum acceptable level identified in the TSP.

Adoption of this administrative order will not change the functional classification of an existing or planned transportation facility. Nor will it change standards implementing a functional classification system. Further, it will not allow types or levels of land uses which would result in levels of travel or access which are inconsistent with the functional classification of a transportation facility or reduce the performance standards of any facility. Therefore, Goal 12 is not implicated by this administrative order.

Goal 13 - Energy Conservation. To conserve energy.

The administrative order does not impact energy conservation. Therefore, Goal 13 does not apply.

Goal 14 - Urbanization. To provide for an orderly and efficient transition from rural to urban land use.

The administrative order does not affect the City's provisions regarding the transition of land from rural to urban uses. Therefore, Goal 14 does not apply.

Goal 15 - Willamette River Greenway. To protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

The Willamette River Greenway area within the Eugene Urban Growth Boundary is governed by existing local provisions that have been acknowledged as complying with Goal 15. Those provisions are unchanged by this administrative order. Therefore, Goal 15 does not apply.

Goals 16 - 19. Estuarine Resources, Coastal Shorelands, Beaches and Dunes, and Ocean Resources.

These Statewide Planning Goals do not apply to the actions taken.

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CERTIFICATE OF MAILING

I certify that on July 20, 2006, I served a true and correct copy of Form 2, Notice of Adoption, and two copies of the Adopted Amendment, on the Plan Amendment Specialist for the Department of Land Conservation and Development, by causing the same to be deposited in the United States Mail at Eugene, Oregon, enclosed in a sealed envelope with postage prepaid, and addressed as follows:

Attention: Plan Amendment Specialist
Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, OR 97301-2540

Kathryn P. Brotherton

Kathryn P. Brotherton, OSB #98153

City Attorney
Civil Department

City of Eugene
360 East 10th Avenue, Suite 300
Eugene, Oregon 97401
(541) 682-5080

July 20, 2006

Attention: Plan Amendment Specialist
Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, OR 97301-2540

Re: *Notice of Adoption*

Enclosed please find Form 2, Notice of Adoption, two copies of Administrative Order No. 58-06-06-F, the adopted Stormwater Management Manual, and a Certificate of Mailing.

HARRANG LONG GARY RUDNICK P.C. –
CITY ATTORNEYS

Kathryn P. Brotherton

Kathryn P. Brotherton

KPB:abm
Enclosures

cc: Peggy Keppler

STORMWATER MANAGEMENT MANUAL

July 2006

WATER QUALITY

NATURAL RESOURCE

FLOOD CONTROL

EUGENE

STORMWATER MANAGEMENT MANUAL
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2.9 Facility Design Criteria (Continued)

Stormwater Management Design Criteria For:

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4.0 Source Controls

LIST OF EXHIBITS

Chapter 1.0
GENERAL POLICIES

Summary of Chapter 1.0

This chapter outlines the City of Eugene's stormwater management requirements and identifies who is required to conform to these requirements. It includes:

1.1 PURPOSE OF MANUAL

Stormwater management is a key element in maintaining and enhancing the City's livability. There is a direct link between stormwater and the City's surface and ground waters. As the City is developed, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge. Parking lots, roadways, and rooftops increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water.

The purpose of this manual is to provide stormwater management principles and techniques that help preserve or mimic the natural hydrologic cycle and achieve water quality goals. This *Stormwater Management Manual* provides developers and design professionals with specific requirements for reducing the impacts of stormwater runoff quantity and pollution resulting from new development.

This manual is for development subject to the stormwater development standards adopted by City ordinance (See **Appendix A**). This manual also provides standards for determining qualification for stormwater SDC and user fee credits.

1.2 SUMMARY OF MANUAL CONTENTS

Chapter 1.0: General Policies, outlines the purpose and use of this manual and defines terms. It outlines pollution reduction, flow control, and destination design standards, explains the rules for connecting to existing systems, and differentiates public and private stormwater management systems. This chapter also identifies special circumstances on a proposed development site that may make it impractical to implement on-site pollution reduction or flow control to the standards specified in this manual.

Chapter 2.0: Stormwater Management Facility Design, provides methods for selecting and designing stormwater management facilities that accomplish pollution reduction, flow control, and/or destination goals. The "simplified," "presumptive," and "performance" approaches are presented.

Chapter 3.0: Operations & Maintenance, presents operations and maintenance (O&M) submittal requirements and provides templates for stormwater management facility O&M plans.

Chapter 4.0: Source Controls, addresses site activities and characteristics with the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 3.0.

Appendix A: Eugene City Code Section 9.6790-9.6796 includes the section of City Code that addresses stormwater management policies and standards and that officially recognizes the City's *Stormwater Management Manual.*

Appendix B: Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies includes the City's testing protocol for acceptance of stormwater pollution reduction facilities.

Appendix C: Santa Barbara Urban Hydrograph Method describes the Santa Barbara Urban Hydrograph method of computing stormwater runoff hydrographs. It includes the City's 24-hour rainfall depths, formulas for computing time of concentration, and runoff curve numbers.

Appendix D: Simplified Approach Sizing Calculations, provides a sample of the method used to calculate the simplified approach sizing factors.

Appendix E: Water Quality Design Storm Development , outlines the rational behind the development of Eugene's pollution reduction storm rate and volume, and associated goal of treating 80% of the average annual rainfall.

Appendix F: Flood Control Design Storm Tables, outlines the rainfall intensity, duration and frequency curves, storm recurrence intervals, and storm events for planning and designing stormwater flood control facilities.

Appendix G: Facility Planting & Soil Recommendations, presents plant species recommendations for each vegetated stormwater management facility type, as well as recommended soil specifications.

Appendix H: Supplemental Drawings, includes color drawings of many stormwater management facilities. It also includes example planting plans and supplemental plan-view and cross-sectional drawings.

Appendix I: Stormwater Facility Photos, provides a number of stormwater management facility photos.

Appendix J: Headwater Streams Map, presents headwater streams identified for flow controls.

Appendix K: Infiltration Limited Areas Map, presents areas which may be infiltration limited due to generalized site conditions such as soil type and groundwater depth.

References & Resources

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1.3 DEFINITIONS

Note: Definitions are intended to be consistent with Eugene Code Chapter 9, Land Use; Chapter 6, Environment and Health; and Chapter 7, Public Improvements.

Above-Ground Storage of Liquid Materials **(Section 4.3)**: Places where exterior storage (either permanent or temporary) of liquid chemicals, food products, waste oils, solvents, or petroleum products in above-ground containers, in quantities of 50 gallons or more exist.

***Aboveground Storage Tank (AST)*:** A stationary container, vessel, or other permanent holding device designated for the storage and/or distribution of a liquid product.

Applicant: Any person, company, or agency that applies for a permit through the City of Eugene.

***Approved Receiving System (Destination)*:** Any system approved by PW to receive stormwater runoff or other discharges. Receiving systems include, but are not limited to, groundwater; on-site, off-site, or public stormwater; wastewater; and waters of the state.

***Batch Discharge*:** The controlled discharge of a discrete, contained volume of water or wastewater. Batch discharges into the public wastewater system must conform to the requirements of Eugene Code sections 6.501-6.596: Industrial Pretreatment Program.

***Bulk Fuel Terminal*:** Any area with its primary function dedicated to the storage and distribution of fuel to distributors (such as gas stations).

***Bulk Materials*:** Non-containerized materials.

***Bulk Material Transportation Route*:** Any path routinely used to transport materials regulated in Section 4.5 onto, off of, or within a site. Bulk material transportation routes shall be constructed with impervious surfaces and shall provide spill containment.

Capacity: The capacity of a stormwater drainage system is the flow volume or rate that a facility (e.g., pipe, pond, vault, swale, ditch, drywell, etc.) is designed to safely contain, receive, convey, reduce pollutants from or infiltrate stormwater that meets a specific performance standard. There are different performance standards for pollution reduction, detention, conveyance, and destination, depending on location. Example: Public stormwater pipes are required to convey the 10-year storm without surcharge, and the 25-year storm without damage to property or endangering human life or public health. Public infiltration sumps are required to infiltrate the 10-year storm with a safety factor of two.

Catch Basin: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, catch basins have grated lids, allowing stormwater from the surface to pass through for collection. Catch basins also include a sump bottom and submerged outlet pipe (down-turned 90 degree elbow, hood, or baffle board) to trap coarse sediment and oils.

Constructed Treatment Wetlands: A facility that exhibits wetland characteristics but was constructed for the express purpose to perform a utility need, such as a sedimentation pond, and is not eligible for mitigation credit or subject to the jurisdictional requirements of federal and state wetland law. See **Chapter 2.0** for information regarding the design of constructed treatment wetlands.

Contained Planter Box: A structural facility filled with topsoil and planted with vegetation. When placed over impervious surfaces such as sidewalks or rooftops, contained planter boxes intercept rainfall that would otherwise contribute to stormwater runoff. See **Chapter 2.0** for information regarding the design of contained planter boxes.

Containerized: The storage of any product, by-product, or waste that is completely held or included on all sides, within a discrete volume or area.

Containment: The temporary storage of potentially contaminated stormwater or process wastewater when a City wastewater system is not available for appropriate disposal.

Control Structure: A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices. See **Chapter 2.0** for information regarding the design of control structures.

Conveyance: The transport of stormwater from one point to another.

Covered Vehicle Parking Areas **(Section 4.9)**: Covered vehicle parking structures used to cover parked vehicles other than single-level covers, such as canopies, overhangs, and carports. Single- and two-family residential covered vehicle parking areas are exempt.

Destination: The ultimate discharge point for the stormwater runoff from a particular site, also known as stormwater disposal. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

Detention Facility: A facility designed to receive and hold stormwater and release it at a slower rate, usually over a number of hours. The full volume of stormwater that enters the facility is eventually released.

Detention Tank, Vault, or Oversized Pipe: A structural subsurface facility used to provide flow control for a particular drainage basin. See **Chapter 2.0** for information regarding the design of detention tanks, vaults, and oversized pipes.

Development: Any human-induced change to improved or unimproved real estate, whether public or private, for which a permit is required, including but not limited to construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration such as dredging, grading, paving, parking or storage facilities, excavation, filling, or clearing.

Development Permit: A permit authorized or required by the Oregon Structural Specialty Code and Oregon One and Two Family Dwelling Code, including but not limited to permits for:

1. New buildings.
2. Additional square footage added to a building.
3. Building demolition.
4. Foundations.
5. Change of occupancy.
6. Grading/Fill.
7. Site improvements.

Development Footprint: The new or redeveloped area covered by buildings or other roof structures and other impervious surface areas, such as roads, parking lots, and sidewalks.

Disposal: See definition of *Destination.*

Drainage Basin: A specific area that contributes stormwater runoff to a particular point of interest, such as a stormwater management facility, stream, wetland, or pipe.

Drainage way: An open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water. It may be permanently or temporarily inundated.

Driveway: The area that provides vehicular access to a site. A driveway begins at the property line and extends into the site. In parking areas, the driveway does not include vehicular parking, maneuvering, or circulation areas.

Dry Detention Pond: A surface vegetated basin used to provide flow control for a particular drainage basin. Stormwater temporarily fills the dry detention pond during large storm events and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of dry detention ponds.

Drywell: A structural subsurface facility with perforated sides or bottom, used to infiltrate stormwater into the ground. See **Chapter 2.0** for information regarding the design and use of drywells.

Eco-Roof: A lightweight low-maintenance vegetated roof system used in place of a conventional roof. Eco-roofs provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of eco-roofs.

Equipment and/or Vehicle Washing Facilities (**Section 4.7**): Designated equipment and/or vehicle washing or steam cleaning areas. This includes smaller activity areas such as wheel washing stations.

Extended Wet Detention Pond: A surface vegetated basin with a permanent pool of water and additional storage volume, used to provide pollution reduction and flow control for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. During large storm events, stormwater temporarily fills the additional storage volume and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of extended wet detention ponds.

Exterior Materials Storage Area: Any exterior materials storage location that is not completely enclosed by a roof and sidewalls.

Exterior Storage of Bulk Materials (**Section 4.5**): Outdoor areas used to stockpile erodible materials.

Flood Control: The practice of managing stormwater drainage and flood protection. Drainage and flood protection strategies are outlined in the adopted City of Eugene Stormwater Basin Master Plans.

Flow Control: The practice of limiting the peak flow rates and volumes. Flow control is intended to protect downstream properties, infrastructure, and resources from the increased stormwater runoff peak flow rates and volumes resulting from development.

Flow Control Facility: Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development water quantity leaving the development site.

Flow-Through Planter Box: A structural facility filled with topsoil and gravel and planted with vegetation. The planter is completely sealed, and a perforated collection pipe is placed under the soil and gravel, along with an overflow provision, and directed to an acceptable destination point. The stormwater planter receives runoff from impervious surfaces, where it is filtered and retained for a period of time. See **Chapter 2.0** for information regarding the design of flow-through planter boxes.

Fuel Dispensing Facilities (**Section 4.2**): Areas where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers (including fuel islands, above ground fuel tanks, fuel pumps, and the surrounding pad). This definition applies to large-sized gas stations as well as single-pump fueling operations.

Grassy Swale: A long, narrow, trapezoidal or semicircular-shaped channel, planted with a dense grass mix. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. See **Chapter 2.0** for information regarding the design of grassy swales.

Hazardous Material: Any material or combination of materials that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or that may pose a present or potential hazard to human health, safety, or welfare, or to animal or aquatic life or the environment when improperly used, stored, transported or disposed of, or otherwise managed. For purposes of chemical regulation by this manual, moderate to high toxicity and confirmed human carcinogenicity are the criteria used to identify hazardous substances. (Note: This manual does not use the Resource Conservation and Recovery Act (RCRA) definition of hazardous. For the purpose of this manual, hazardous material is intended to include hazardous, toxic, and other harmful substances.)

Hazardous Material Containment Zone (HMC Zone): An area where a specific individual activity involving use of a hazardous material takes place, and where chemical quantities at that location are expected to exceed defined thresholds. HMCs may include (but are not limited to) storage and/or process areas, transportation routes, work areas, and loading/unloading facilities.

Headwaters Area: The area within Eugene city limits that is above 500 feet.

Headwater Streams: Streams that: (1) are identified on the Headwater Streams Map (**Appendix J** of the Stormwater Management Manual) as having all or a portion of their length located on slopes greater than 10%; (2) are identified on the Sensitive Areas Map as having all or a portion of their length located in areas with highly erodible soils; (3) are at least 500 feet or longer; and, (4) drain at least 10 acres.

High-Risk Site: A site with characteristics and/or activities that have the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 2.0. High-risk site characteristics and activities are listed in **Section 4.1.1**.

Impervious Surface/Area: Any surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from conditions pre-existing to development. Types of impervious surface include, but are not limited to, rooftops, asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

Infiltration: The percolation of water into the ground.

Infiltration Planter Box: A structural facility filled with topsoil and gravel and planted with vegetation. The planter has on open bottom, allowing water to infiltrate into the ground. Stormwater runoff from impervious surfaces is directed into the planter box, where it is filtered and infiltrated into the surrounding soil. See **Chapter 2.0** for information regarding the design of infiltration planter boxes.

Inlet: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, inlets have grated lids, allowing stormwater from the surface to pass through for collection. The term "inlet" can also be used in reference to the point at which stormwater from impervious surfaces or conveyance piping enters a stormwater management facility.

LD-50: The lethal dose of a substance that is expected to kill approximately 50 percent of experimental animals through oral ingestion. (Refer to product Material Safety Data Sheet.)

Local Dispensing Location: An area within 15 feet of an aboveground storage tank (AST) and used to dispense fuel directly from the AST, typically through a flexible hose.

Manufactured Stormwater Treatment Technology: A proprietary structural facility or device used to remove pollutants from stormwater. Refer to **Chapter 2.0** and **Appendix B** for approval criteria related to manufactured stormwater treatment technologies.

Material Transfer Areas/Loading Docks (**Section 4.6**): Areas designed to accommodate a truck/trailer being backed up to or into them, and used specifically to receive or distribute materials to and/or from trucks/trailers. Includes loading/unloading facilities with docks, and large bay doors without docks.

Maximum Extent Practicable (MEP): See definition of *Practicable.*
Multi-Level Parking Structure: Any parking facility with greater than one continuous level of parking.

Off-site stormwater facility: Any stormwater management facility located outside the property boundaries of a specific development, but designed to reduce pollutants from and/or control stormwater flows from that development.

On-site stormwater facility: Any stormwater management facility necessary to control stormwater within an individual development project and located within the project property boundaries.

Operations and Maintenance (O&M): The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives. See **Chapter 3.0** regarding operations and maintenance requirements for stormwater management facilities.

Outfall: A location where collected and concentrated water is discharged. Outfalls include discharge from stormwater management facilities, drainage pipe systems, and constructed open channels. See **Chapter 2.0** for information regarding the design of outfalls.

Parking Area: Any area which can be used by motor vehicles, recreational vehicles, trailers, and boats for parking, including driveways and access aisles providing access to the parking stalls.

Permeable Pavement: See definition of *Pervious Pavement.*

Pervious Pavement: The numerous types of pavement systems that allow stormwater to percolate through them and into subsurface drainage systems or the ground. See **Chapter 2.0** for design requirements related to pervious pavement. Also referred to as porous or permeable pavement.

Pollutant: An elemental or physical product that can be mobilized by water or air and creates a negative impact on the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

Pollutants of Concern: Watershed-specific parameters identified by the Oregon Department of Environmental Quality (DEQ) as having a negative impact on the receiving water body. Pollutants of concern can include suspended solids, heavy metals, nutrients, bacteria and viruses, organics, floatable debris, and increased temperature.

Pollution Reduction Facility: Any structure or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.
Porous Pavement: See definition of *Pervious Pavement.*

Post-Developed Condition: As related to new development: A site's ground cover after development.

Practicable: Available and capable of being done as determined by the City, after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

Pre-Developed Condition: As related to new development: A site's ground cover prior to the proposed development.

Privately Engineered Public Improvement (PEPI): A public facility that is designed, constructed and financed by a private developer, entity, or its agent.

Public facility: A street, right-of-way, sewer, drainage, stormwater management, or other facility that is either currently owned by the City or will be conveyed to the City for maintenance responsibility after construction. A stormwater management facility that receives direct stormwater runoff from a public right-of-way shall become a public (City-maintained) facility unless the right-of-way is not part of the City's road maintenance system.

Public works project: Any development conducted or financed by a local, state, or federal governmental body and includes local improvements and public improvements.

Rainwater Harvesting: The practice of collecting and using stormwater for purposes such as irrigation and toilet flushing. See **Chapter 2.0** for information regarding rainwater harvesting.

Recycled Land **(Section 4.8)**: Land that currently has or previously has had pollutants detected in the soil or groundwater at concentrations that exceed risk-based cleanup levels or state/federal cleanup standards for the particular pollutant(s) of concern.

Redevelopment: Any development that requires demolition or complete removal of existing structures or impervious surfaces at a site and replacement with new impervious surfaces. Maintenance activities such as top-layer grinding and re-paving are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment. Utility trenches in streets are not considered redevelopment unless more than 50% of the street width is removed and re-paved.

Retention Facility: A facility designed to receive and hold stormwater runoff. Rather than storing and releasing the entire runoff volume, retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation. In this way, the full volume of stormwater that enters the facility is not released off-site.

Roadway: Any paved surface used to carry vehicular traffic (cars/trucks, forklifts, farm machinery, or any other large machinery).

Roof Garden: A heavyweight roof system of waterproofing material with a thick soil and vegetation cover. Roof gardens provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of roof gardens.

Runoff: Stormwater flows across the ground surface during and after a rainfall event.

Sand Filter: A structural facility with a layer of sand, used to filter pollutants from stormwater. See **Chapter 2.0** for information regarding the design of sand filters.

Santa Barbara Urban Hydrograph (SBUH): A hydrologic method used to calculate runoff hydrographs. See **Appendix C** for information regarding the use of the Santa Barbara Urban Hydrograph method.

Soakage Trench: A long linear excavation backfilled with sand and gravel, used to filter pollutants from and infiltrate stormwater into the ground. See **Chapter 2.0** for information regarding the design of soakage trenches.

Solid Waste Storage Areas, Containers, and Trash Compactors **(Section 4.4)**: Outdoor areas with one or more facilities that store solid waste (both food and non-food waste). Single- and two-family residential solid waste storage areas, containers, and trash compactors are exempt.

Stormwater: Water runoff that originates as precipitation on a particular site, basin, or watershed.

Stormwater Facility Landscaping: The vegetation (plantings), topsoil, drain rock, and other surface elements associated with stormwater management facility design.

Stormwater Management: The overall culmination of techniques used to reduce pollutants from, detain and/or retain, and provide a destination for stormwater to best preserve or mimic the natural hydrologic cycle on a development site. Public health and safety, aesthetics, maintainability, capacity of existing infrastructure and sustainability are important characteristics of a site's stormwater management plan.

Stormwater Management Facility: Any structure or configuration of the ground that is used, or by its location, becomes a place where stormwater flows or is accumulated, including but not limited to, pipes, sewers, curbs, gutters, manholes, catch basins, ponds, open drainage ways, runoff control facilities, wetlands, and their accessories.

Stormwater Re-use: See definition of *Rainwater Harvesting*.

Street Swale: A vegetated or grassy swale located next to a public or private street for the purpose of managing stormwater. See **Chapter 2.0** for information regarding the design of street swales.

Sump: As used in this manual: A large public drywell (see definition) used to infiltrate stormwater from public streets. Sumps are generally 48 inches in diameter and 30 feet deep. The term "sump" can also be used to reference to any volume of a facility below the point of outlet, in which water can accumulate. See **Chapter 2.0** for information regarding the use and design of sumps.

Surface Conveyance: The transport of stormwater on the ground surface from one point to another.

Surface Infiltration Facility: A facility designed to receive and infiltrate stormwater runoff at the ground surface to meet stormwater destination requirements.

Surface Retention Facility: A facility designed to receive and hold stormwater runoff at the ground surface. Rather than storing and releasing the entire runoff volume, surface retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation.

Tenant Improvements: Structural upgrades made to the interior or exterior of buildings. Tenant improvements may trigger **Chapter 4.0** Source Controls if they take place on sites with specified high-risk activities.

Time of Concentration (T_c): The amount of time it takes stormwater runoff to travel from the most distant point (measured by travel time) on a particular site or drainage basin to a particular point of interest. See **Appendix C** for calculations related to time of concentration.

Total Suspended Solids (TSS): Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter.

Underground Injection Control (UIC): A federal program under the Safe Drinking Water Act, delegated to the Oregon Department of Environmental Quality (DEQ), which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. See **Section 1.4.4** for information regarding the UIC program.

Vegetated Facilities: As used in this manual: Stormwater management facilities that rely on plantings to enhance their performance. Plantings can enhance many facility functions, including infiltration, pollutant removal, water cooling, flow calming, and prevention of erosion.

Vegetated Filter Strip: A gently sloping, densely vegetated area used to filter, slow, and infiltrate stormwater. See **Chapter 2.0** for information regarding the design of vegetated filter strips.

Vegetated Infiltration Basin: A vegetated surface facility that temporarily holds and infiltrates stormwater into the ground. See **Chapter 2.0** for information regarding the design of vegetated infiltration basins.

Vegetated Swale: A long, narrow, trapezoidal or semicircular channel, planted with a variety of trees, shrubs, and grasses. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. Check dams are used to create small ponded areas to facilitate infiltration. See **Chapter 2.0** for information regarding the design of vegetated swales.

Water Body: Water bodies include rivers, streams, sloughs, drainages including intermittent streams and seeps, ponds, lakes, aquifers, wetlands, and coastal waters.

Watercourse: A channel in which a flow of water occurs, either continuously or intermittently, with some degree of regularity. Watercourses may be either natural of artificial.

Water Quality: A term used to describe the chemical, physical, and biological characteristics of stormwater. Pollution reduction and flow control are two components of water quality management in stormwater runoff.

Water Quality Design Storm: A theoretical storm for estimating the amount of stormwater runoff to be treated. Facilities designed to store and treat a volume of stormwater shall be sized in accordance with Section 1.5.2 of this *Stormwater Management Manual.*

Wet Pond: A surface vegetated basin with a permanent pool of water, used to provide pollution reduction for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. See **Chapter 2.0** for information regarding the design of wet ponds.

Wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, and similar areas except those constructed as water quality or quantity control facilities. Specific wetland designations shall be made by the Corps of Engineers and the Division of State Lands.

1.4 STORMWATER DESTINATION

1.4.1 The Purpose of Stormwater Destination

Stormwater destination refers to the ultimate discharge point for stormwater generated by large, intense rainfall events from a particular development site. While many of the stormwater management facilities from Chapter 2.0 are designed to provide pollution reduction, flow control, or both, most of them do not infiltrate stormwater from large, intense rainfall events sufficiently enough to be considered the only stormwater destination for the site. In addition to water quality measures, destination measures from Chapter 2.0 are required and must be approved by PW (for off-site flow or infiltration within the public right-of-way and for infiltration on private property). It should be noted that the destination method might have an impact on the pollution reduction and flow control requirements for a site. Therefore, it is advantageous to determine the method of destination first.

Destinations can be grouped into two general categories: on-site infiltration and off-site flow. On-site infiltration methods include surface infiltration techniques, soakage trenches, drywells, and infiltration sumps. Off-site flow methods include discharge to drainage ways (including roadside ditches and natural drainages and streams), rivers, and off-site stormwater facilities. The appropriate destination point is site-specific and depends on a number of factors, including soil type, slopes, and availability of public and private infrastructure.

1.4.2 Destination Design Methodology

The City of Eugene has developed a flood control strategy for each of the drainage basins within the Urban Growth Boundary and published its findings in the adopted Stormwater Basin Master Plans. To evaluate the capacity of storm drainage facilities for the desired level of protection the Flood Control Design Storm information is provided in **Appendix F.**

1.4.3 Destination Standards

<u>ON-SITE INFILTRATION</u>

Where complete on-site infiltration is used for the destination of stormwater, the following standards shall apply:

> **Surface Infiltration Facilities:** Surface infiltration facilities must demonstrate the ability to store and infiltrate the Flood Control Design Storm. See **Section 2.2.2** for detailed surface infiltration facility sizing and design procedures, including safety factors.

Drywell, Infiltration Sump, and Soakage Trench Systems: The peak flow rate from the Flood Control Design Storm must be calculated using the Rational Method (Q=C*I*A), and a safety factor of 2 shall be applied. The intensity shall correspond to the calculated time of concentration (5-minute minimum, see the City of Eugene's *Public Improvements Design Standards Manual* for rainfall intensity charts, for 5-minute time of concentration intensity = 3.1 "/hr).

Sites proposing to use subsurface infiltration systems must either be located outside infiltration limited areas as identified on the City's Infiltration Limited Areas Map (See **Appendix K**) or the design professional must prove the viability of on-site infiltration using the drywell testing procedure outlined in Chapter 2.0.

OFF-SITE DISCHARGE TO SURFACE FLOW

Where stormwater is discharged to an off-site surface flow conveyance facility, such as a ditch, drainage way, stream, or river, the following standards shall apply:

Beginning at the point of discharge from the site, the surface conveyance facility must have the capacity to convey flows from the Flood Control Design Storm from all contributing upstream drainage areas. The Flood Control Design Storm peak flow rate shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Eugene's *Public Improvements Design Standards Manual* for rainfall intensity charts and list of approved hydrologic modeling methods.

OFF-SITE DISCHARGE TO PIPED FLOW

Where stormwater is discharged to an off-site piped conveyance facility the following standards shall apply:

<u>For development with an increase in net impervious area</u>: Beginning at the point of discharge from the site, the piped conveyance facility must have the capacity to convey flows from the Flood Control Design Storm from all contributing upstream drainage areas without surcharge. If no other stormwater options are available, the existing piped conveyance facility may surcharge, but the hydraulic grade line must remain 6" below gutter elevation where water could surcharge into the street, catch basins, manholes, curb inlets. The Flood Control Design Storm flow rates shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Eugene's *Public Improvements Design Standards*

Manual for rainfall intensity charts and list of approved hydrologic modeling methods.

For development with no net increase in impervious area: Existing downstream pipe conveyance facilities may be allowed to surcharge under certain circumstances. See the City of Eugene's *Public Improvements Design Standards Manual* for allowable surcharge criteria.

100-YEAR ESCAPE ROUTE

All projects must demonstrate where stormwater from the 100-year storm event will go, and that public safety concerns and property damage will be avoided. This may include storage in parking lot, street, or landscaping areas.

Also see the City of Eugene's *Public Improvements Design Standards Manual* for more information regarding the conveyance and destination of stormwater.

1.4.4 Underground Injection Control Structures (UICs)

This section provides general information only. Complete regulations and requirements are available on the Oregon Department of Environmental Quality (DEQ) website: **http://www.deq.state.or.us/wq/groundwa/uichome.htm**

The federal Underground Injection Control (UIC) Program (under the Safe Drinking Water Act) regulates the injection of water below the ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. DEQ administers the UIC Program in Oregon.

DEQ defines a UIC as any system, structure, or activity that discharges fluid below the ground or subsurface. UICs can pollute groundwater and surface water if not properly designed, sited, and operated. Stormwater systems such as sumps, drywells, and soakage trenches are examples of UICs subject to DEQ regulation.

Owners or operators of new and existing UICs are required to register and provide inventory data to DEQ. This information helps DEQ determine if the UIC is eligible for "rule authorization." Rule authorization allows the owner or operator to operate the UIC without a permit from DEQ. UICs that do not qualify for rule authorization must either be closed, modified to meet requirements for rule authorization, or the owner must submit a water pollution control facility permit application to DEQ and obtain a permit.

CRITERIA FOR RULE AUTHORIZATION

UICs must be registered and approved by DEQ before construction. DEQ has set minimum criteria for rule authorization (OAR 340-044-0018), identified below:

- No other waste is mixed with stormwater.
- Site development, design, construction, and management practices have minimized stormwater runoff.
- No other method of stormwater disposal, including construction or use of surface discharging storm drains or surface infiltration designs, is appropriate.
- No domestic drinking water wells are present within 500 feet.
- No public drinking water supply wells are present within 500 feet or a two-year time of travel.
- No soil or groundwater contamination is present.
- The UIC is not deeper than 100 feet and does not discharge within 10 feet of the highest seasonal groundwater level.
- A confinement barrier or filtration medium is present, or best management practices (BMPs) are used to prevent or treat stormwater contamination. Stormwater management efforts should focus on maximizing source controls, use of vegetated pollution controls, and infiltration through surface infiltration or shallow subsurface facilities.
- Design and operation prevents accidental or illicit spills and allows for temporary blocking.

Compliance with these criteria must be demonstrated during the registration process. Compliance can generally be more readily accomplished if stormwater management efforts focus on maximizing source controls, using surface vegetated pollution control options such as swales and planters, and disposing of stormwater through surface infiltration or shallow subsurface facilities.

RULE AUTHORIZATION PROCESS

The City of Eugene is managing the rule authorization process for public facilities (UICs that drain public right-of-ways). To allow adequate time to complete the UIC process, registration and inventory information for proposed public UICs should be submitted to the City of Eugene as soon as possible after it has been determined that new or existing public right-of-way will be constructed or improved. Contact PW at 541-682-5291 to get the public UIC process started.

Registration and inventory information for UICs proposed to serve private property should be submitted directly to Ms. Barbara Priest, Oregon DEQ, (503) 229-5945.

Registration and inventory data should be submitted at least 60 days in advance of potential start of work. In some cases, DEQ and the City will need additional information from the applicant in order to make a determination on the potential for use of a UIC.

The registration, rule authorization and permit process is explained in more detail on DEQ's permit webpage: **http://www.deq.state.or.us/pubs/permithandbook/wquic.htm** For technical questions, call the DEQ UIC Program at 503-229-5945. For copies of UIC registration applications or forms, call 1-800-452-4011.

1.5 POLLUTION REDUCTION

1.5.1 The Purpose of Pollution Reduction

Urbanization is recognized as having a serious impact on Eugene's waters. As land is developed, impervious area and surface runoff increase. This runoff collects and transports pollutants to downstream receiving waters. Pollutants of concern include:

- Suspended solids (sediment)
- Heavy metals (dissolved and particulate, such as lead, copper, zinc, and cadmium)
- Nutrients (such as nitrogen and phosphorus)
- Bacteria and viruses
- Organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers)
- Floatable debris
- Increased thermal load (temperature)

In response to the water quality impacts of urbanization, Congress passed the Clean Water Act amendments of 1987, mandating the U.S. Environmental Protection Agency (EPA) to issue regulations to control urban stormwater pollution. The regulations, published in 1990, require larger cities such as Eugene to obtain a National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit for their municipal separate storm sewer discharges. Compliance with the NPDES permit requires the City to establish a comprehensive stormwater management program. Eugene's citywide management program includes design standards for source control devices as well as best management practices designed to improve stormwater quality. This *Stormwater Management Manual* is part of Eugene's NPDES stormwater management program to improve the quality of Eugene's waters.

1.5.2 Pollution Reduction Design Methodologies

Pollution reduction facilities shall be designed using the Water Quality Design Storm (see definition of Water Quality Design Storm). Pollution reduction facilities are sized using two different methods. Vegetated filters, oil/water separators, and some proprietary treatment systems are sized to treat a rate of flow draining through them. Other pollution reduction facilities are sized to treat a volume of runoff.

Flow rate-based pollution reduction facilities (such as swales and filters) designed to treat runoff generated by a rainfall intensity of 0.13 inches per hour for off-line flow-through type facilities and 0.22 inches per hour for on-line flow-through type facilities, and flow volume-based facilities (such as wet ponds) designed to treat runoff generated by 1.4 inches of rainfall over 24 hours (with NRCS Type 1A rainfall distribution) will treat approximately 80 percent of the average annual rainfall. Facilities that must be sized by routing a hydrograph through the facility (rate-based facilities with a storage volume component) may utilize a continuous simulation program or single-storm hydrograph-based analysis method, such as SBUH (with 1.4 inches of rainfall over 24 hours and NRCS Type 1A rainfall distribution) to demonstrate capture and treatment 80% of the average annual rainfall volume. See **Appendix E** for more detailed information regarding the formulation of Eugene's pollution reduction standards and Water Quality Design Storm.

One of the three design methodologies from **Chapter 2.0** must be used to design pollution reduction facilities to meet these requirements. The above rainfall intensities are to be used in the Rational Method (Q=CIA) equation to calculate pollution reduction runoff rates for flow rate based facilities. The above 24-hour storm is to be used in the Soil Conservation Service (SCS, now Natural Resources conservation Service) methodology to design volume based facilities. These Water Quality Design Storms are used to size rate-based pollution reduction facilities unless the **Simplified Approach** from Chapter 2.0 is used.

Exhibit 1-1: Pollution Reduction Facility Removal Capabilities

The facility can likely remove the parameter
The facility can potentially remove the parameter, depending on design
The facility cannot likely remove the parameter

Pollution Control Facility Type	Bacteria	Temperature	Nutrients	Pesticides (DDT, Dieldrin, Aldrin)	PCB	PCB FW	PCB NT	PCB	2,3,7,8 TCDD (Dioxin)	PAH	Trace Metals (Pb, As, Fe, Mn)
Eco-roof											
Roof garden											
Pervious pavement											
Tree credit											
Contained planter box											
Infiltration planter box											
Flow-through planter box											
Vegetated swale											
Grassy swale											
Street swale/planter											
Vegetated filter strip											
Vegetated infiltration basin											
Wet pond											
Extended wet detention pond											
Constructed treatment wetland											
Sand filter											
Manufactured filtration device											
Rainwater harvesting											

Note: This table is for guidance only. Actual pollutant removal capabilities are based on specific facility design and site parameters.

OIL CONTROL FOR HIGH-RISK VEHICLE AND EQUIPMENT TRAFFIC AREAS

Oil controls can include either (1) spill control manholes (**Exhibit 2-25**) or (2) the incorporation of Lynch-type catch basins within the parking lot or at the outlet to swales or other pollution reduction facilities. The discharge of stormwater with a visible sheen off-site or into on-site UICs is prohibited.

1.6 FLOW CONTROL

1.6.1 The Purpose of Flow Control

Prior to development, rainfall appears as stream flow, evaporates into the atmosphere, or infiltrates into the ground where it recharges groundwater aquifers or surface water bodies. Urbanization results in the loss of forest, agricultural land, and open space and increases the amount of impervious area. As a result, development can have the following hydrologic impacts:

- Increased stormwater flow rates
- Increased stormwater runoff volumes
- Decreased groundwater recharge and base flows into streams
- Seasonal flow volume shifts

Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increases in stormwater runoff peak flow rates and volumes resulting from development.

The City's policy is to ensure that runoff leaving the post-development site:
- does not exceed the capacity of the receiving conveyance facility or water body.
- does not increase the potential for stream bank and stream channel erosion.
- does not create or increase any upstream or downstream flooding problems.

The basic design concept for flow control (detention and retention) is simple: water from developed areas is managed with a variety of flow control techniques and released to downstream conveyance systems at a slower rate (detention) and lower volume (retention). Managing flows in this way attempts to mimic the site's natural rainfall runoff response prior to development (See **Exhibit 1-2**).

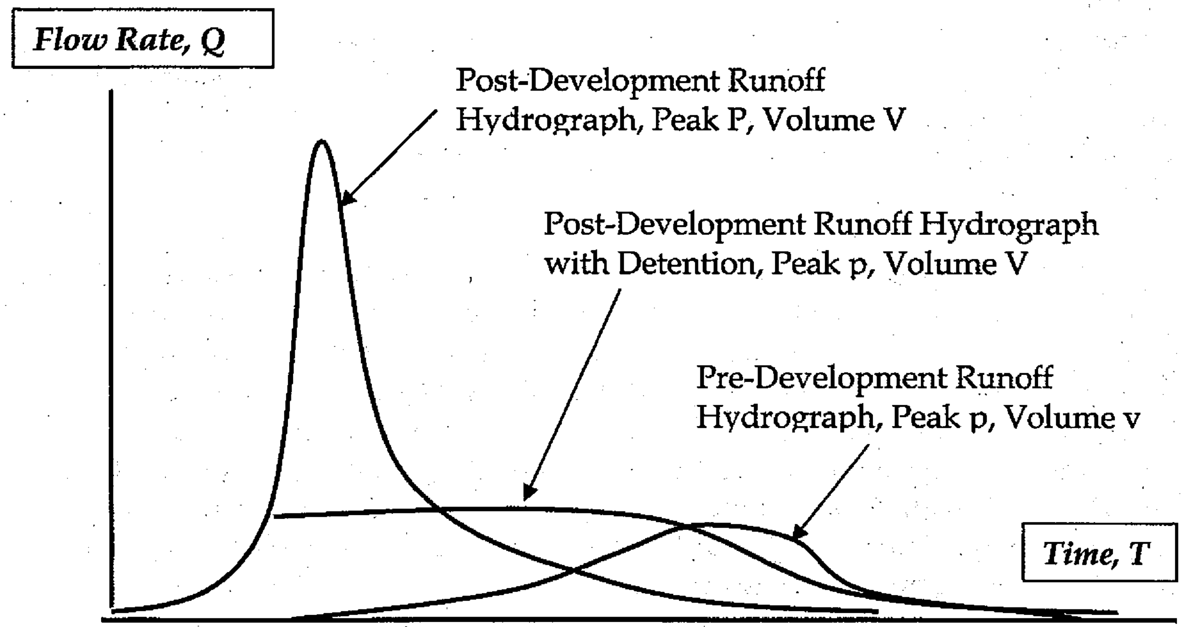
Detention facilities temporarily store stormwater runoff in a pond, tank, vault, or pipe. The water is slowly released from the facility, typically over a number of hours.

Retention facilities also store stormwater runoff. Rather than storing and releasing the entire runoff volume, however, the facility permanently retains a portion of the water on-site, where it infiltrates and recharges the groundwater aquifer, and in the case of surface retention facilities, evaporates or is absorbed and used by surrounding vegetation. In this way, retention facilities reduce the total volume of water released downstream. Surface treatments (such as eco-roofs or pervious pavements) that cover or replace traditional impervious surfaces and vegetated facilities such as swales, filters, ponds, and planter boxes are all examples of retention facilities.

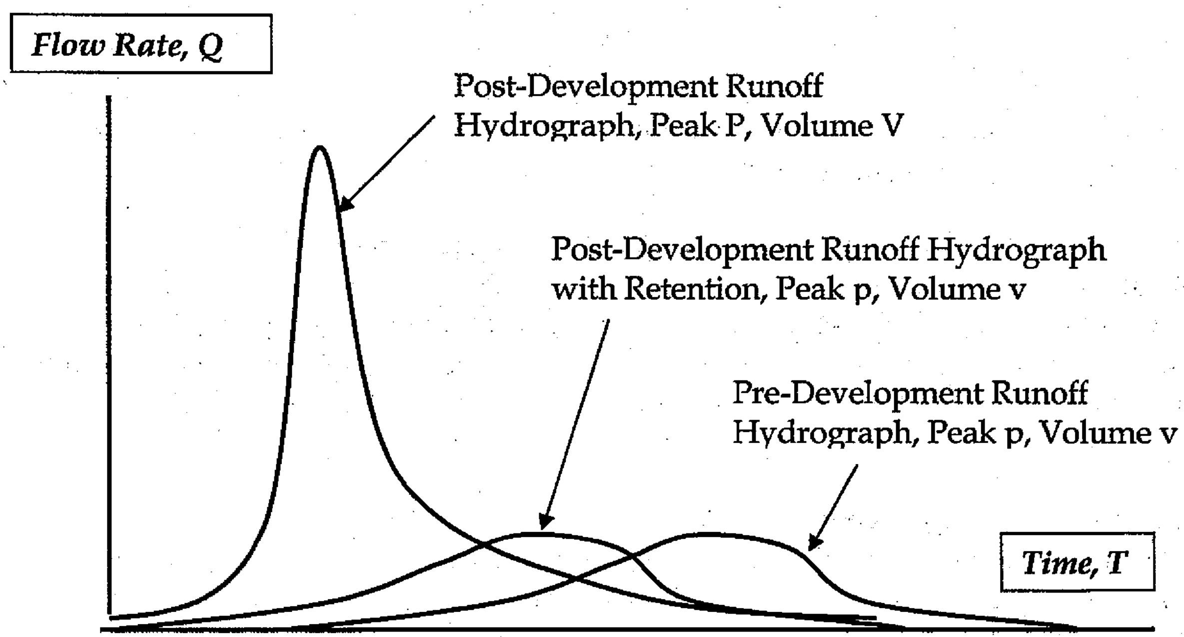
In the past, flow control plans often relied solely on detention facilities. Facilities that control only peak flow rates, however, allow the duration of high flows to increase, causing the potential for increased erosion downstream. For example, after development with detention, the magnitude of the 2-year peak flow rate may not increase, but the amount of time that the flow rate occurs will increase. Retention systems, on the other hand, are particularly effective at lowering the overall runoff volume, reducing the amount of time that the peak flow rate occurs. In addition, by infiltrating stormwater, retention systems recharge groundwater that serves as the base flow for streams during the dry season. Therefore, stream systems that require erosion protection, including salmonid habitat streams, warrant the use of retention systems. Where retention systems cannot be used, detention systems that control the duration of the geomorphically significant flow (i.e., flow capable of moving sediment) shall be used. Such detention systems employ lower release rates and are therefore larger in volume.

Time of concentration, or the time it takes rainfall to accumulate and run off a site, is another important factor in determining downstream hydrologic impacts created by development. Flow rates from individual sites may be controlled, but when they are combined quickly in fast-flowing conveyance pipes, the downstream effect will still be increased in-stream flow rates and volumes. Breaking flow patterns up into surface retention systems helps increase a site's time of concentration and lessons downstream impacts.

Exhibit 1-2: Illustration of the effect of detention and retention facilities on post-developed hydrographs (large storm events)



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Detention Facility in Place.



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Retention Facilities in Place.

1.6.2 Flow Control Strategies

Background:
Many tributary streams in Eugene show evidence of excessive stream bank and channel erosion. Any development that discharges stormwater runoff off-site that eventually flows into a headwater stream or drains into a pipe that discharges into a headwater stream shall be designed to control and minimize increases in flows to reduce the potential for further aggravation of in-stream erosion problems.

The added controls are based on the geomorphically significant flow, which is the flow that initiates sediment movement in the channels. The erosion-causing flow varies from channel to channel. Unless more specific data are available, the City assumes that the erosion-causing flow is equivalent to the Water Quality Design Storm, and the requirements of this manual are based on that assumption. **Specifically, the more restrictive control requirement is to limit the post-development peak flow rate from the Water Quality Design Storm to the pre-development peak flow rate from the Water Quality Design Storm. The facilities shall also control the post-development flows from the Flood Control Design Storm peak flows to the pre-development levels.**

General Requirement:
Flow controls are required in the Headwaters Area of Eugene. For new development in this area, on-site infiltration or on-site retention (such as pervious pavement, planters, swales, and other surface vegetated facilities) is preferred to control stormwater volumes and flow rates. Regardless of the method used, flow control shall be sufficient to maintain peak flow rates at their pre-development levels for storms larger than the Water Quality Design Storm and smaller than the Flood Control Design Storm. (See definition of pre-developed condition in **Section 1.3**)

Circumstances when more restrictive flow control is required:
Development projects proposing to discharge stormwater off-site must evaluate the capacity of the off-site receiving system (i.e. storm sewer, ditch, drainageway, etc.) against the standards presented in **Section 1.4**. Additional flow control may be required on-site if off-site receiving systems do not have sufficient capacity to accept the additional flows.

Circumstances when flow control is required:

- Development in the headwaters area that drains directly to a headwaters stream or drains into a pipe that discharges into a headwaters stream. (See **Appendix J Headwaters Streams Map)**

IMPORTANT NOTES:

- Pollution reduction requirements still apply if a development site is exempt from flow control requirements.
- Development must still properly dispose of stormwater using approved methods in accordance with **Section 1.4** of this manual.

SUMMARY OF THE CITY'S FLOW CONTROL REQUIREMENTS:

1) **Flow Control requirements apply to a development in the headwaters area that drains directly to a headwaters stream or drains into a pipe that discharges into a headwaters stream. (See Appendix J; Headwaters Streams Map).**
2) On-site infiltration is required to the maximum extent practicable.
3) Where complete on-site infiltration is not practicable, on-site retention (flow volume control) facilities should be used.
4) Piping systems that provide conveyance from a site to an ultimate discharge point must have adequate capacity per City's standard, or additional flow control on-site may be required.

1.7 OPEN DRAINAGE

A drainage way is an open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water. It may be permanently or temporarily inundated. Open drainage provides many important functions to both our stormwater conveyance system and the environment. Drainage ways provide both flow management (regulation of stream flow, retention and detention of water, flood control, contribution to seasonal base flows, and groundwater recharge) and water quality protection (filtration of pollutants and reduction of stormwater temperatures). Open drainage ways may either be privately or publicly maintained, but maintenance operations should not hinder the functionality of the public use of the facility.

1.7.1 Interlot Drainage

Interlot drainage refers to overland drainage without a defined channel (sheet drainage) and some French drain systems. This may include minor open channels and enclosed storm drain pipe systems, upon private properties that serves only to collect and remove stormwater runoff generated within the boundaries of private properties. All maintenance of interlot drainage systems is the responsibility of the property owner or abutting property owners.

If water from an interlot system exits a private property onto an adjacent private property, the maintenance system is the joint responsibility of the private property owners involved.

1.7.2 Disturbances or Development within Drainage ways

Disturbances or development within drainage ways may be allowed when all of the following conditions exist:

1) The disturbance or development will not impede or reduce flows within the drainage way.
2) The disturbance or development will not increase erosion downstream.
3) The disturbance or development will not cause detrimental impacts to stream side habitat values; the migration, rearing, feeding, or spawning of fish; or to habitat needs of other aquatic species in either the immediate stream reach or in downstream water bodies.
4) Where the development involves a constructed crossing of the drainage way for vehicular or pedestrian access.
5) The constructed pipe system is sized to convey all of the runoff from upstream watershed when the upstream watershed is completely developed.

Alterations to natural drainage ways require either a grading/fill permit from the Building Permit Services or privately engineered public improvement construction permit from Public Works Engineering.

1.7.3 Maintenance Guidelines

Cleaning operations may be done only as needed to maintain the conveyance capacity of the drainage way.

Cleaning operations should be done during the drier months when equipment can gain access to the channel banks without damage. Upon completion of the work, the banks shall not be left rutted or torn up or in a condition which would encourage rain water erosion. After cleaning operations, the banks along the channel shall be repaired of all damage caused by the maintenance activities in order to prevent accelerated erosion of the banks.

When and where necessary, City Maintenance staff will perform cleaning operations to maintain the conveyance capacity of major channels that are located within public drainage easements that have sufficient access available for equipment to perform the necessary cleaning. City Maintenance staff may perform emergency cleaning on any blockage which is causing water to back up into the City stormwater system or is creating a hazard to the public.

Unless a drainage way is publicly owned or covered by a recorded maintenance agreement that states otherwise; private property owners are responsible for vegetation management and debris removal. No mowing shall be performed on the banks of channels.

1.7.4 Easement Guidelines

Drainage easements are to assure that the current flow rate and pattern of the drainage way continues to be adequately conveyed through the development site. Current flow volumes and/or drainage way capacities will be determined by reviewing existing data, which may include available hydrologic records, drainage basin hydrology, historical data, high water marks, soil inundation records, photographs of past flooding, and other similar information. The City of Eugene developed the 2002 Eugene Stormwater Basin Master Plans as a resource for designing stormwater management.

Public drainage easements may be accepted by the City when all of the following criteria are met:

1) The storm drainage conveys water from public rights of way or is part of an identified public drainage system.

2) Capacity of the drainage facility is approved by the City as to meeting expected future development needs.
3) Existing systems are inspected by City staff prior to acceptance and all deficiencies discovered during the inspection are removed.
4) Maintenance access is provided.

1.8 OTHER REGULATORY STORMWATER PROGRAMS

Conformance with this manual's requirements does not relieve the applicant of other applicable local, state, or federal regulatory or permit requirements. This chapter is intended to complement any additional regulation, and is not expected to conflict with, exclude, or replace those regulations. In case of a conflict, the most stringent local, state, or federal regulations apply. Some of the more common additional regulations that may apply are summarized below.

1.8.1 Illicit Discharge Program

The City expects spill response supplies, such as absorbent material and protective clothing, to be available at all potential spill areas. Employees should be familiar with the site's operations and maintenance plan and/or proper spill cleanup procedures.

1.8.2 Industrial Pretreatment Program

Some facilities may be required to obtain a State of Oregon NPDES stormwater permit before discharging to the City's storm sewer system or to waters of the state. Applicants may also be required to obtain an industrial wastewater permit for discharges to the wastewater system. Facilities subject to these requirements are generally commercial or industrial facilities. Typical discharges include process wastewater, cooling water, or other discharges generated by some of the sources in this chapter that drain to the City stormwater or wastewater systems. (Contact PW staff at 541-682-5291 for a list of current wastewater discharge limits.)

An evaluation will be done during the building permit review process to determine if an industrial discharge permit is required. If a permit is required, the industrial permit application process will be independent of the building permit review/issuance process. However, building permit applications may have to be revised to accommodate industrial permitting compliance requirements (*i.e.* sampling points, pretreatment facilities, *etc.*).

1.8.3 Oregon DEQ Underground Injection Control (UIC) Program

The Oregon Department of Environmental Quality (DEQ) identifies drywells, sumps, and piped soakage trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. Because the UIC Program states that these types of wells may have a direct impact on groundwater, registration or permitting with DEQ is required. See **Section 1.4.4** for additional information.

1.8.4 Other Local, State, and Federal Programs

The requirements presented in this chapter do not exclude or replace the requirements of other applicable codes or regulations, such as the hazardous substances storage requirements of articles 79 and 80 of the Oregon State Fire Code; the spill prevention control and containment (SPCC) regulations of 40 CFR 112 (EPA); the Resource Conservation and Recovery Act (RCRA); or any other applicable local, state, or federal regulations or permit requirements.

Additional City of Eugene and Oregon Department of Environmental Quality (DEQ) permit requirements may apply. Contact PW staff at 541-682-5291 for additional information about stormwater or wastewater discharges to City-owned wastewater or stormwater systems.

1.9 Credits and Incentives for Private Stormwater Facilities

Stormwater quantity credits for SDCs and user fees are based on a public system benefit from development reducing the quantity of stormwater entering the public system through on-site retention methods. Developments utilizing private means for reducing the quantity of water discharged from a development site to the public system can reduce the demand for additional capacity in downstream public water conveyance facilities. Establishing stormwater quantity SDC and user fee credits provides a general recognition of reduced demand.

Stormwater quality credits for SDCs and user fees are based on a public system benefit from development treating stormwater quality through privately constructed and maintained facilities and effective impervious area reduction techniques. Developments utilizing private means for water quality treatment can reduce the demand for downstream public facilities for water quality treatment. Establishing stormwater quality SDC and user fee credits provides a general recognition of reduced demand and provides a modest incentive for meeting and exceeding minimum water quality treatment requirements.

Implementation of stormwater quality SDC and user fee credits are related to adoption of stormwater development standards which require water quality treatment at sites of new development. Adopted standards provide a basis for evaluation of the degree of impact reduction of a development. These credits recognize impact reduction and provide incentives for pollution reduction across three types of development sites: 1) those not subject to the standards for stormwater pollution reduction but which treat all or a portion (minimum 20%) of the impervious area of the development site; 2) sites where a portion of the site impervious area is subject to the standards for stormwater pollution reduction but treat runoff from 20% or more impervious area than the minimum required; and, 3) sites where all of the site impervious area is subject to the standards for stormwater pollution reduction which reduce a minimum of 20% of the total impervious area of the development.

See the adopted Eugene SDC methodologies document, Appendix D, Section 6.0 for additional criteria for SDC credits.

See the adopted Eugene Stormwater Service Charges methodology document for additional criteria for user fee credits.

Chapter 2.0
STORMWATER MANAGEMENT FACILITY DESIGN

Summary of Chapter 2.0

This chapter provides procedures for selecting and designing facilities that provide stormwater pollution reduction, flow control, and/or destination benefits. It includes:

To Use This Chapter:
1) Use the ordinance in **Appendix A** and **Chapter 1.0** to determine the pollution reduction, flow control, and destination requirements for the project.
2) Select stormwater management facilities from **Section 2.9: Facility Selection and Design** to meet pollution reduction, flow control, and/or destination requirements for the project.
3) Size facilities using the **simplified approach, presumptive approach,** or **performance approach** presented in this chapter. For simplified approach facilities, use **Form SIM** for sizing. For presumptive or performance approach facilities, use specific sizing criteria presented with each facility type and hydrologic analysis methods listed in **Section 2.3**. Integrate the facilities into the project's overall site plan.
4) Prepare drawings and specifications for each stormwater management facility in accordance with the design criteria in **Section 2.9: Facility Selection and Design.**
5) Consult **Chapter 3.0** for the operations and maintenance guidelines for each stormwater management facility.

2.1 INTRODUCTION

Facilities presented in this chapter receive credit toward compliance with pollution reduction, flow control, destination, or in some cases a combination of the three. Three methodologies are included in this chapter for the sizing and design of stormwater management facilities: the simplified, presumptive, and performance approach. Each design approach has limitations on applicability. See **Exhibit 2-1** for a list of the facility types, their applicable design methodologies, and stormwater management credits given.

Exhibit 2-1: Stormwater Management Facility Application Table

Stormwater Management Facility Type	Credit Given with Associated Design Approach		
	Pollution Reduction	Flow Control	Destination
Eco-roof & roof garden	Simplified	Simplified	NA
Pervious pavement	Simplified	Simplified	Performance
Contained planter	Simplified	Simplified	NA
Tree credit	Simplified	Simplified	NA
Infiltration planter	Simplified[1]	Simplified	Presumptive[3]
Flow-through planter	Simplified[1]	Simplified	NA
Swales < 15,000 sq-ft impervious area	Simplified[1]	Simplified	Presumptive[3]
Swales > 15,000 sq-ft impervious area	Presumptive	NA	Presumptive[3]
Vegetated filter strip	Simplified[1]	Simplified	Presumptive[3]
Vegetated infil. basin	Simplified[1]	Simplified	Presumptive[3]
Sand filter	Simplified[1]	Simplified	Presumptive[3]
Wet pond	Presumptive	NA	NA
Extended wet det. pond	Presumptive	Presumptive	NA
Dry detention pond	Presumptive[4]	Presumptive	NA
Treatment wetland	Presumptive	Presumptive	NA
Manufactured treatment technology	Performance	NA	NA
Structural det. facility	NA	Presumptive	NA
Spill control manhole	Presumptive[2]	NA	NA
Rainwater harvesting	Performance	Performance	NA
Soakage trench	NA	Presumptive	Presumptive
Infiltration sump	NA	Presumptive	Presumptive
Drywell	NA	Presumptive	Presumptive

Exhibit 2-1 Notes:

[1]The performance approach may be used to downsize these simplified approach facilities when flow control is not required.

[2]Spill control manholes receive credit for oil removal only; additional pollution reduction facilities will be required to meet basic water quality management.

[3]The **Surface Infiltration Facility** design criteria must be used to receive destination credit.

[4]Vegetated or grassy swales must be integrated into the bottom of dry detention ponds to receive pollution reduction credit.

2.2 DESIGN METHODOLOGIES

2.2.1 Simplified Approach

The simplified approach is a relatively easy process for selecting and designing combined pollution reduction and flow control facilities, intended to save the project developer and the City time and expense. Combination facilities can be more practical to build than separate pollution reduction and flow control facilities. Simplified approaches facilitate the surface retention of stormwater, which provides a number of benefits, including pollution reduction, groundwater recharge and protection, peak flow reduction, and volume reduction. Rather than detaining stormwater and releasing it off-site at increased post-developed volumes, these facilities help infiltrate or retain water on-site. In areas with surface drainage ways and streams, on-site retention lessens the "flashy" high- and low-flow impacts created by development in watershed basins. Stream erosion and temperature impacts are also decreased. Overall, these facilities help mimic the natural hydrologic cycle by slowing and infiltrating stormwater.

Simplified Approach Sizing

Facilities designed in accordance with the simplified approach are presumed to comply with the City's pollution reduction and flow control requirements. As sized with **Form SIM** sizing factors, the simplified approach facilities do not sufficiently dispose of large storm events. Additional facilities, designed using the presumptive or performance approach, are required that meet the destination requirements.

Sizing factors for the simplified approaches (shown on **Form SIM** below) were developed as an effective, simple, and quick tool to use for site planning and to accelerate permit review and approval. Generalized assumptions were used that may result in conservative sizing for some development sites. Manual users have the option to use the sizing factors as given on Form SIM, or follow the performance approach and submit an alternative facility size, along with supporting engineering calculations for City review for compliance with the performance criteria. The performance approach may be used to downsize facilities in circumstances when flow control is not required.

Appendix D: *Simplified Approach Sizing Calculations* provides information about how facility sizing factors were developed, and guidance on how the same methodology can be used to develop alternative facility sizes. An approved hydrologic analysis method (**Section 2.3**), such as a Santa Barbara Urban Hydrograph (SBUH) based approach or continuous simulation model, must be used to generate flow rates and volumes for design analysis. When facilities are downsized to meet pollution reduction requirements only, flows above the pollution reduction design flow must be routed around the facility with an approved diversion structure (**Section 2.5**).

The first four simplified approaches on Form SIM (pervious pavements, eco-roofs and roof gardens, contained planter boxes, and tree credits) are impervious area reduction or mitigation techniques to reduce the overall square-footage of impervious area that requires stormwater management. These facilities intercept rainfall, and are not generally designed to receive stormwater runoff. The second group of simplified approaches on Form SIM (infiltration and flow-through planter boxes, vegetated and grassy swales, vegetated filter strips and infiltration basins, and sand filters) is designed to receive stormwater runoff from impervious surfaces.

Simplified Approach Applications

Applicants using the simplified approach shall submit **Form SIM** as part of their permit application, along with construction drawings and details. **Page 2 of Form SIM** can be used to claim stormwater management credit for planting new trees and retaining existing tree canopy on-site.

A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be included. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects that utilize simplified approach facilities must also fulfill Stormwater Destination requirements.

Form SIM: Simplified Approach for Stormwater Management

The city has produced this form to assist with a quick and simple approach to manage stormwater on-site.
Facilities sized with this form are presumed to comply with pollution reduction and flow control requirements.

New or Replaced Impervious Site Area [ ] Box 1

(do not include roof areas that will be infiltrated on-site with drywells or soakage trenches)

INSTRUCTIONS

1. Enter square footage of new or redeveloped impervious site area in Box 1 at the top of this form.
2. Select impervious area reduction techniques from rows 1-4 to reduce the site's resulting stormwater management requirement. Tree credit can be calculated using the tree credit worksheet on the next page. Sum square footage of rows 1-4 and enter Total Impervious Area Reduction in Box 2.
3. Subtract Box 2 from Box 1 and enter number in Box 3. This is development area that is required to provide treatment facilities for its stormwater runoff.
4. Select desired stormwater management facilities from rows 5-11. In Column 1, enter the square footage of impervious area that each facility will manage.
5. Multiply each impervious area from Column 1 by the corresponding sizing factor in Column 2, and enter the result in Column 3. This is the facility surface area needed to manage runoff from the impervious area.
6. Total Column 1 (Rows 5-11) and enter the resulting "Impervious Area Managed" in Box 4.
7. Subtract Box 4 from Box 3 and enter the result in Box 5. When this number reaches 0, poluution reduction and flow control requirements have been met. Submit this form with the application for permit.
8. If Box 5 is greater than 0 square feet, add square footage or facilities to Column 1 and recalculate, or use additional facilities from Chapter 2.0 of the Stormwater Management Manual to manage stormwater from these remaining surfaces.

Impervious Area Reduction Technique	Column 1: Impervious Area Managed = Facility Surface Area	
1) Pervious Pavement(s)	______	sf
2) Eco-Roof / Roof Garden	______	sf
3) Contained Planter	______	sf
4) Tree Credit (See Next Page)	______	sf

Total Impervious Area Reduction (Sum 1 thru 4) [ ] Box 2

New Impervious Management Area (Box 1 - Box 2) [ ] Box 3

Stormwater Management Facility	Column 1: Impervious Area Managed			Column 2: Sizing Factor		Column 3: Facility Surface Area	Unit
5) Infiltration Planter	______	sf	x	0.07	=	[ ]	sf
6) Flow-Through Planter	______	sf	x	0.07	=	[ ]	sf
7) Vegetated Swale	______	sf	x	0.09	=	[ ]	sf
8) Grassy Swale	______	sf	x	0.1	=	[ ]	sf
9) Vegetated Filter Strip	______	sf	x	0.2	=	[ ]	sf
10) Vegetated Infil. Basin	______	sf	x	0.11	=	[ ]	sf
11) Sand Filter	______	sf	x	0.06	=	[ ]	sf

Total Impervious Area Managed (Sum 5 thru 11) [ ] Box 4

See Chapter 2.0: drywell and soakage trench sizing and design requirements.

Box 3 - Box 4 [ ] **Box 5**

Development Site (Information):

Tax Map/Lot	
Street Address	
Total Sq. ftg.	
Soil Type	
Perc Rate	

Form SIM (Page 2): Tree Credit Worksheet

See **Tree Credits** section for more information regarding the use of trees to meet stormwater management requirements.

New Evergreen Trees

To receive stormwater management credit, new evergreen trees must be planted within 25 feet of ground-level impervious surfaces. New trees cannot be credited against rooftop surfaces. Minimum tree height (at the time of planting) to receive credit is 6 feet.

Enter number of new evergreen trees that meet qualification requirements in Box A — **Box A**

Multiply Box A by 200 and enter result in Box B — **Box B**

New Deciduous Trees

To receive stormwater management credit, new deciduous trees must be planted within 25 feet of ground-level impervious surfaces. New trees cannot be credited against rooftop surfaces. Minimum tree caliper (at the time of planting) to receive credit is 2 inches.

Enter number of new deciduous trees that meet qualification requirements in Box C — **Box C**

Multiply Box C by 100 and enter result in Box D — **Box D**

Existing Tree Canopy

To receive stormwater management credit, existing tree canopy must be preserved during and after construction. Existing tree canopy must be within 25 feet of ground-level impervious surfaces. Existing trees cannot be credited against rooftop surfaces. Minimum tree caliper to receive credit is 4 inches. No credit will be given to existing tree canopy located within environmental zones.

Enter square-footage of existing tree canopy that meets qualification requirements in Box E — **Box E**

Multiply Box E by 0.5 and enter the result in Box F — **Box F**

Total Tree Credit

Add boxes B, D, and F and enter the result in Box G — **Box G**

For sites with less than 1,000 square-feet of new or redeveloped impervious area:
The amount in Box G is to be entered as "Tree Credit" on Form SIM. ** Stop Here **

For sites with more than 1,000 square-feet of new or redeveloped impervious area:
Multiply Box 1 of Form SIM by 0.1 and enter the result in Box H — **Box H**

Enter the lesser of Box G and H in Box I. — **Box I**
This is the amount to be entered as "Tree Credit" on Form SIM. **Stop Here**

2.2.2 Presumptive Approach

Facilities that utilize this design approach are classified as "presumptive," *i.e.*, facilities that are *presumed* to be in compliance with the City's pollution reduction, flow control, and/or destination requirements if the presented sizing and design requirements are followed.

There are a few key differences between the presumptive and simplified approach sizing methodologies. Stormwater management goals that require the presumptive approach to be used for a particular facility type do not lend themselves well to simplified sizing. More detailed hydrologic calculations must be performed to adequately design the facility to achieve the desired goal. Another difference is that the presumptive approach presents sizing methodologies that meet the requirements of one particular goal (pollution reduction, flow control, or destination), rather than multiple goals. See **Exhibit 2-1** for the table that specifies the design approaches that are applicable to each management goal, for each facility type.

Presumptive Approach Application

In addition to detailed construction drawings and details shown on permit drawings, all applicants using the presumptive approach for stormwater management are required to submit a detailed stormwater report. This report shall include a general description of the stormwater facility and how it is intended to function. It shall include detailed hydraulic calculations, as summarized in **Exhibit 2-2**. A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be provided. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects using facilities designed under the presumptive approach must also fulfill Stormwater Destination requirements.

Exhibit 2-2:
Checklist of Calculations to be Included in Stormwater Report

<u>Stormwater Facility Type</u>
A= Grassy Swale, and Subsurface Infiltration Facilities
B= Wet Pond
C= Extended Wet Detention Pond, and Surface Infiltration Facilities
D= Dry Detention Pond
E= Constructed Treatment Wetland
F= Detention Tank, Vault, or Pipe
G= Manufactured Treatment Technology or Spill Control Manhole

Parameter or Calculated Value to be Included in the Stormwater Report	A	B	C	D	E	F	G
Site Variables:							
Site soil type (A, B, C, or D)	x	x	x	x	x	x	x
Contributing area (acres)	x	x	x	x	x	x	x
Pre-developed curve number CN			x	x	x	x	
Pre-developed time of concentration T of C (minutes)			x	x	x	x	
Post-developed curve number CN	x	x	x	x	x	x	x
Post-developed time of concentration T of C (minutes)	x	x	x	x	x	x	x
Distance from ground surface to max. height of seasonal groundwater (feet)	x	x	x	x	x	x	x
Hydrographs:							
Pre-developed hydrographs for the water quality and flood control storms, including peak rates & total volumes			x	x	x	x	
Post-developed hydrographs for the water quality and flood control storms, including peak rates & total volumes (only if routed through the facility)			x	x	x	x	
Post-developed hydrographs for the water quality and flood control storms after being routed through the facility, including peak rates & total volumes			x	x	x	x	
Facility Geometry:							
Table showing area and volume of the facility every 6" in elevation		x	x	x	x	x	
Side slopes (h: v or %)	x	x	x	x	x		
Longitudinal slope (h: v or %)	x				x		
Bottom width and length (feet)	x	x	x	x	x		
Overall width and length (feet)	x	x	x	x	x		
Hydraulic Controls:							
Orifice or weir descriptions, sizes, and elevations, including by-pass facilities			x	x	x	x	
Elevation, size, and type of overflow spillway or pipe	x	x	x	x	x	x	x
Calculated Values:							
Pollution reduction flow rate	x						x
Pollution reduction permanent pool volume and elevation		x	x		x		
Forebay volume and elevation		x	x	x	x		
Hydraulic residence time for the pollution control storm	x				x		
Storm routing data showing the peak water surface elevation in the facility for the 2 water quality & flood control storms (only if routed through the facility)	x	x					x

Detailed storm routing data for the water quality and flood control storms, showing inflow rate, outflow rate, and water surface elevation in the facility every 10 minutes throughout the storm.			x	x	x	x	

PRESUMPTIVE SURFACE INFILTRATION DESTINATION DESIGN APPROACH

Where soil conditions allow for percolation near the ground surface, surface infiltration facilities can be used to dispose of stormwater from large storm events to meet destination standards. The infiltration of stormwater near the ground surface helps increase the separation to groundwater, providing a greater filtration layer and decreasing the risk of groundwater contamination. It also serves to mimic the predevelopment hydrologic cycle, decreasing downstream impacts and recharging groundwater and increasing evapotranspiration.

Examples of surface infiltration facilities that can be designed under this approach include vegetated, grassy, and street swales, infiltration planters, and vegetated infiltration basins. While the design procedure in this section accounts for complete on-site infiltration of stormwater, facilities sized per the simplified approach are not sized adequately to meet destination standards and must include an overflow to an acceptable destination point. Surface infiltration facilities are not classified as underground injection controls (UICs) by DEQ, and therefore do not need to be registered.

Surface Infiltration Facility Design Approach to Meet Destination Standards

1) Determine the preliminary facility size by calculating the runoff volume generated by the 5-year storm (3.6 inches of rainfall over 24 hours, NRCS Type 1A rainfall distribution-from Table C-1). The SBUH method can be used to determine this volume, or the volume can be approximated by the following formula:

   Runoff Volume (cubic feet) = 0.3 feet * Impervious Area (square-feet)

   The facility will need to be capable of containing this volume of runoff through a combination of above ground storage and below ground storage within voids in a subsurface rock trench.

2) Surface infiltration facilities require infiltration tests during the design phase of the project. For public facilities, double-ring infiltrometer tests shall be conducted, in accordance with ASTM D3385-94 and City review for compliance with testing methods. For private facilities, the falling head infiltration test procedure specified in **Section 2.4.2** shall be used. The minimum acceptable infiltration rate for surface infiltration facilities to meet destination standards is 0.5 inches per hour. A clogging factor of 4 is then applied to the resulting infiltration rate to be used in the design of the facility.

3) The design infiltration rate (measured infiltration rate divided by 4) is then used to check the facility drawdown time. When full, the facility drawdown time shall not exceed 30 hours.

4) The wet seasonal high water table must be determined, and a minimum 4-foot clearance to bottom of facility must be maintained.

5) The 100-year base flood elevation shall be determined and must show that structures will not be flooded and that property damage and safety risks will be avoided.

6) Minimum setbacks from surface infiltration facilities to structures are shown in **Exhibit 2-4.**

7) All areas to be used as surface infiltration facilities shall be back-filled with a suitable sandy loam planting and filtration medium. Minimum depth shall correspond to each facility type's specification. The borrow source of this medium, which may be the same or a different location from the facility area itself, must be tested as follows:

   If the borrow area is undisturbed soil one test is required per 200 square-feet of borrow area. The test consists of "grab" samples at 1-foot depth intervals to the bottom of the borrow area. All samples at the testing location are then mixed, and the resulting sample is laboratory tested to meet the following criteria:

   USDA minimum textural analysis requirements: A textural analysis is required from the site-stockpiled topsoil. If topsoil is imported, a textural analysis shall be performed for each location where the topsoil was excavated.

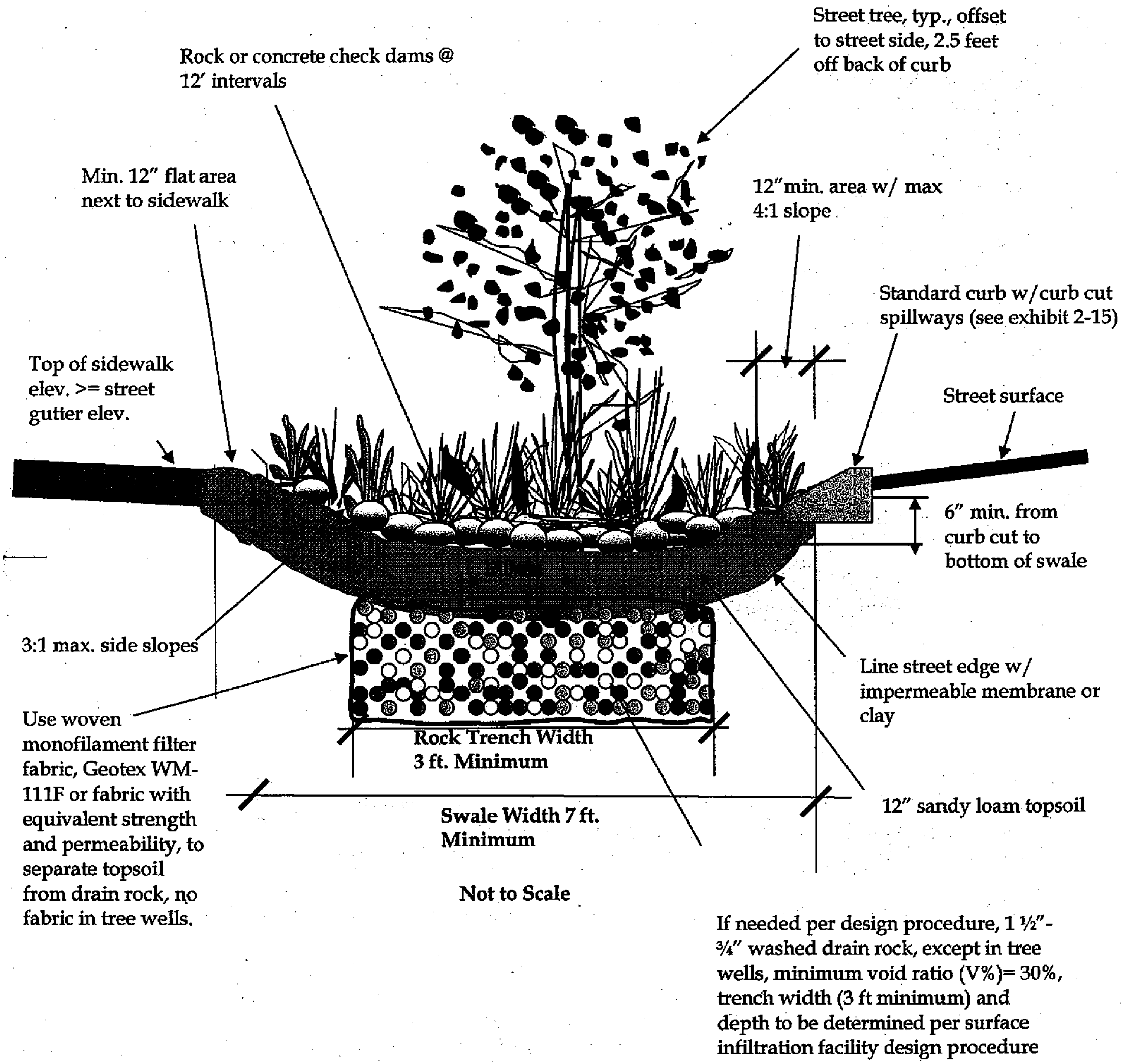
   Requirements:
   Sand 35 – 60%
   Silt 30 – 55% (Loam)
   Clay 10 – 25%

   The soil shall be a uniform mix, free of stones, stumps, roots, or other similar objects larger than two inches.

8) Surface infiltration facility areas shall be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular construction traffic, except that specifically used to construct the facility, shall be allowed within 10 feet of surface infiltration facility areas.

9) For surface infiltration facilities, post-construction field infiltration testing will be required. Methods consistent with those used during design of the facilities shall be used. The resulting infiltration rate must show that the facility drawdown time will not exceed 30 hours.

Exhibit 2-3: Example Cross-Section of Vegetated Street Swale, Modified To Receive Credit for Destination



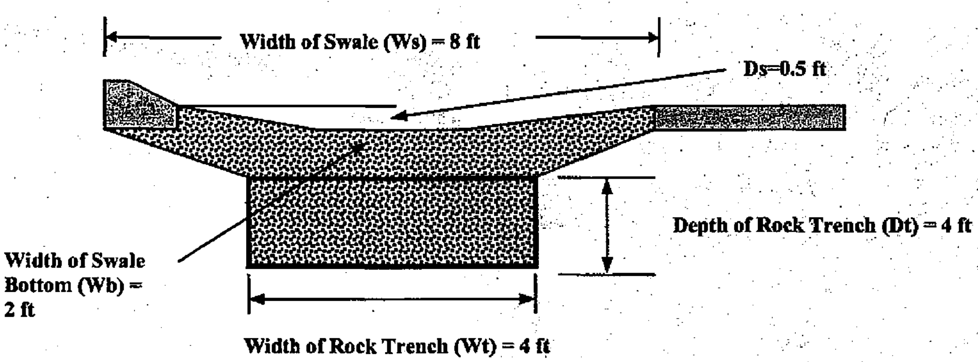
SURFACE INFILTRATION FACILITY SIZING EXAMPLE

Facility Type: Vegetated Street Swale

Objective: Find swale dimensions needed to meet destination standards.

Givens: Design Storm (P) = 5 year, 24 hour storm = 3.6 total inches = **0.3 feet**
Maximum Drawdown Time (Td) = **30 hours**
Infiltration Rate Safety Factor = **4**

Site Characteristics:
Impervious Area (Ai) = 200′ x 28′ = **5,600 square feet**
Measured Infiltration Rate (Im), using Double-Ring Infiltrometer Test = 12″/hr = **1′/hr**
Swale width (Ws) = **8 feet**
Swale bottom width (Wb) = **2 feet**
Swale depth (Ds) = **0.5 feet**
Rock trench width (Wt) = **4 feet**
Rock trench depth (Dt) = **4 feet**
Void Ratio of Rock Trench (VR) dimensionless = **0.30**



Calculations:
Runoff Volume (Vr) cubic feet = P * Ai = 0.3 * Ai = 0.3 * 5,600 = **1,680 cubic feet**
Design Infiltration Rate (Id) feet per hour = Im / 4 = **0.25 ft/hr**
Swale Storage Volume (Vs) = L * [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]

Check #1: Runoff Volume (Vr) must be less than or equal to Swale Storage Volume (Vs)

Vr <= Vs

(0.3 * Ai) <= L * [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]

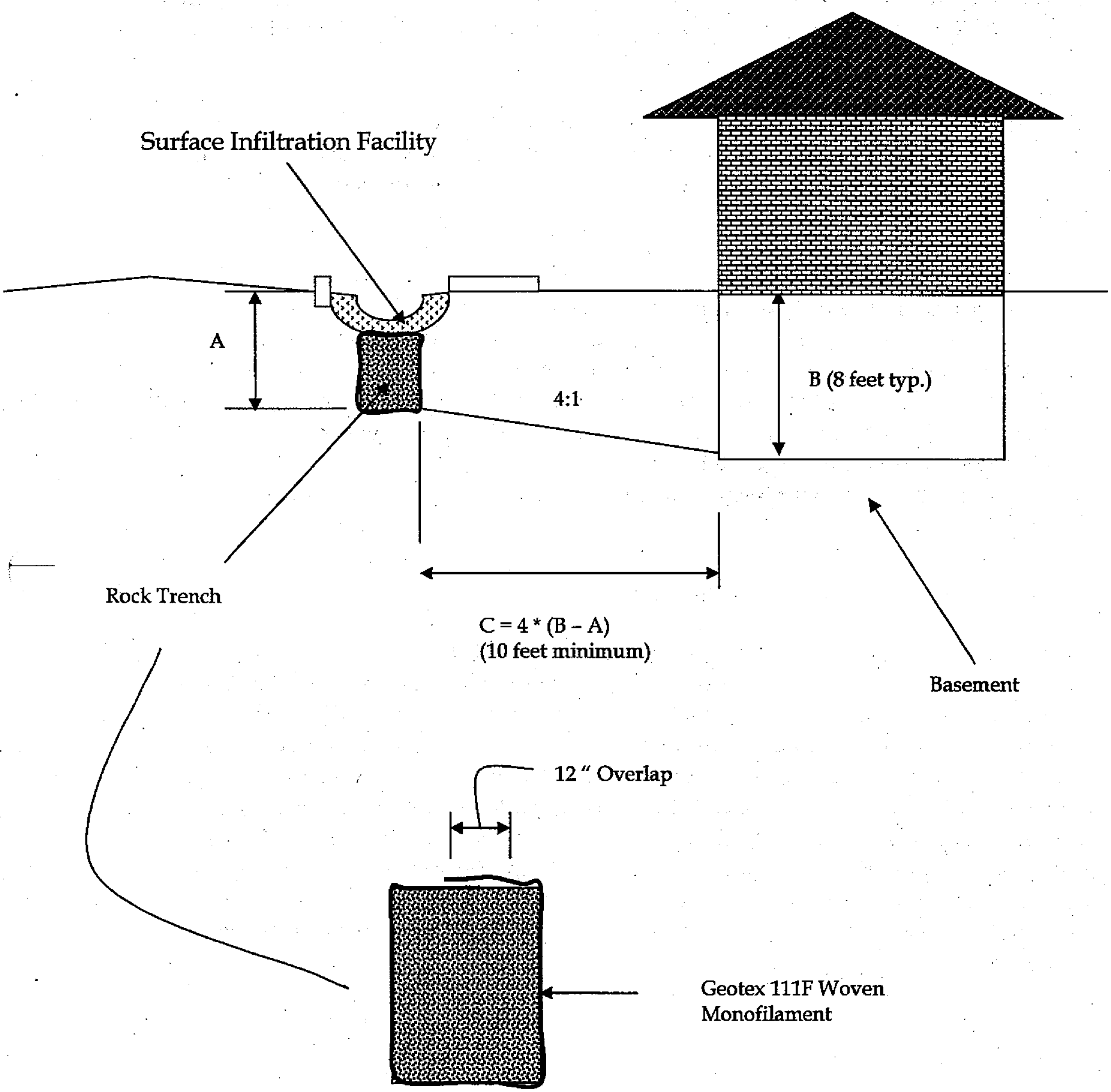
To find L: L = (0.3 * Ai) / [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]
L = (0.3 * 5,600) / [(0.5 * 0.5 * (8 + 2)) + (0.30 * 4 * 4)] = <u>230 feet</u>

Check #2: Swale drawdown time must not exceed maximum allowable (Td) = 30 hours

(0.3 * Ai) / (Id * Wt * L) <= 30 hours

(0.3 * 5,600) / (0.25 * 4 * 230) = <u>7.3 hours</u> < 30 hours, therefore OK

Exhibit 2-4: Surface Infiltration Facility Setback Detail



2.2.3 Performance Approach

The list of accepted stormwater management facilities is continually changing as new products are developed and more is learned about the performance of facilities already in use. Design professionals may propose facilities other than those included in this manual by using the performance approach.

The performance approach requires detailed engineering design and calculations, as well as documented evidence of the proposed design's performance. The City will accept the proposed design for meeting pollution reduction requirements if the design professional demonstrates that it:

- Will perform at the required efficiency and capture and treat 80 percent of the average annual rainfall. See **Appendix B**: Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies, which is actually a function of influent concentration. Also see Appendix B for required testing protocol, related definitions, and additional requirements. Documented performance is required and shall include published data, with supporting cited research, demonstrating removal of target pollutants at required levels.
- Can be maintained to perform at the maintenance level set forth in **Chapter 3** of this Manual.

Performance Approach Application

In addition to detailed construction drawings and details to be shown on permit drawings, all applicants using the performance approach for stormwater management are required to submit a detailed stormwater report. This report shall include a description of the stormwater facility, how it is intended to function, and documented evidence of the proposed design's performance. It shall include detailed hydraulic calculations as summarized in **Exhibit 2-2** and must demonstrate the performance criteria listed above. A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be included. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects using facilities designed under the performance approach must also fulfill Stormwater Destination requirements.

2.3 HYDROLOGIC ANALYSIS

With the exception of pollution reduction and flow control facilities designed using the simplified approach, stormwater management facilities should be designed using hydrologic analysis methods described below. If one of the hydrologic analysis methods discussed below is not used, City staff must pre-approve the alternative method before the plans and calculations are submitted. Regardless of how the hydrologic calculations are performed, all hydrologic submittals shall include data necessary to facilitate the City's review. This data is summarized in **Exhibit 2-2**.

2.3.1 Pollution Reduction

Flow Rate-Based Facilities: With the exception of facilities sized using the simplified approach, City staff will use the Rational Method with rainfall intensities presented in **Section 1.5.2** to verify flow rates used to size rate-based pollution reduction facilities. The design professional may, in addition to the Rational Method, use SBUH, NRCS TR-55, HEC-1, or SWMM to demonstrate treatment of 80% of the average annual rainfall.

Flow Volume-Based Facilities: Volume-based pollution reduction facilities included in this manual (wet ponds and extended wet detention ponds) are required to use the pre-determined volume of 1.4 inches over 24 hours with a Vb/Vr ratio of 2 to be in presumptive compliance.

Combination Rate/Volume Facilities: With the exception of facilities sized using the simplified approach, City staff will use a software program based on the Santa Barbara Urban Hydrograph (SBUH) method, or a continuous simulation model with Eugene rainfall data, to verify the sizing of flow rate-based pollution reduction facilities that also rely on a storage volume component. An example of this includes the downsizing of simplified approach facilities (such as infiltration basins) to achieve pollution reduction only. When using SBUH, a 1.4 inch, 24-hour storm with NRCS type 1A rainfall distribution shall be used. The design professional may also use NRCS TR-55, HEC-1, or SWMM.

2.3.2 Flow Control

With the exception of facilities sized using the simplified approach, City staff will use a software program based on the Santa Barbara Urban Hydrograph (SBUH) to check design calculations for flow control facilities. The design professional may, in addition to the SBUH, use the Rational Method, NRCS TR-55, HEC-1, or SWMM to demonstrate compliance with flow control standards.

2.3.3 Destination

The Rational Method must be used to design the infiltration flow rate for infiltration sumps, drywells, and soakage trenches. If surface infiltration facilities, such as vegetated, grassy, or street swales, vegetated infiltration basins, and infiltration planters are proposed to meet destination requirements, the **Surface Infiltration Facility** sizing methodology must be used to meet presumptive compliance. The surface infiltration facility sizing methodology relies on the determination of the 5-year storm runoff volume, which can be calculated using the simple approximation formula provided, SBUH, NRCS TR-55, HEC-1, or SWMM.

2.3.4 Conveyance

Reference the City of Eugene's *Public Improvement Design Standards Manual* for acceptable hydrologic analysis methods for the stormwater conveyance. The Rational Method will be used to verify design calculations for pipe or surface conveyance facility sizing. HEC-1 or SWMM may be used for projects greater than 40 acres in size.

2.3.5 Hydrologic Analysis Method Resources

The **Santa Barbara Urban Hydrograph (SBUH) Method (See Appendix C)** may be applied to small, medium, and large projects. It is a recommended method for completing the analysis necessary for designing flow control facilities when not using the simplified approach.

The **SCS TR-55 Method** may be applied to small, medium, and large projects. This is also one of the recommended methods for completing hydrologic analysis necessary for designing flow control facilities when not using the simplified approach. (Refer to SCS Publication 210-VI-TR-55, Second Edition, June 1986.)

The **HEC-1 Method** may be used on medium and large projects. (Refer to the HEC User's Manual.)

The **SWMM Method** may be used on medium and large projects. (Refer to the SWMM User's Manual.)

2.4 INFILTRATION TESTING

To size stormwater management facilities, it is often necessary to know the infiltration rate of the soil at the actual facility location. The following general criteria apply to all proposed infiltration facilities:

1) For all infiltration facilities, a minimum infiltration rate of 0.5 inches per hour is required. Infiltration rates shall be determined by performing either infiltration testing in compliance with this section or Chapter 2 of the Eugene Public Improvement Design Standards Manual.
2) Testing can be classified into three categories, (1) initial feasibility testing, (2) design testing, and (3) post-construction testing. (see **Exhibit 2-5**)
3) Testing shall be conducted or observed by a qualified professional. This professional shall either be a registered professional engineer in the State of Oregon, or a soils scientist or geologist licensed in the State of Oregon.
4) All field-testing must be done in the proposed area of the facility.
5) Testing data shall be documented, including a description of the infiltration testing method.

2.4.1 Initial Feasibility Testing

Initial feasibility testing is conducted to determine whether full-scale testing is necessary, and is meant to screen unsuitable sites and reduce testing costs. It involves either one field test per facility (regardless of type or size) or previous testing data, such as the following:

- Septic percolation testing on-site, within 200 feet of the proposed facility location and on the same contour; or
- Previous written geotechnical reporting on the site location as prepared by a qualified geotechnical expert; or
- NRCS Lane County Soil Mapping showing unfeasible conditions such as a hydrologic group "D" soil in a low-lying area.

If the results of initial feasibility testing as determined by a qualified professional (registered professional engineer, landscape architect, or geologist) show that an infiltration rate of greater than 0.5 inches per hour is probable, then the design and post-construction testing shall be in accordance with **Exhibit 2-5**. PW will waive design-testing if existing testing data is on file with the City for the site. In the case of infiltration testing, an encased soil boring may be substituted for a test pit, if desired.

Exhibit 2-5: Infiltration Testing Summary Table

Type of Facility	Initial Feasibility Testing (Section 2.4.1)	Design Testing (Section 2.4.2)	Post-Construction Testing (Section 2.4.3)
Drywell System	Required	One test pit and one falling head test per drywell.	(see **drywell** section for procedure)
Soakage Trench	Required	One test pit and one falling head test per soakage trench.	Not applicable.
Infiltration Sump System	Required	Testing of an existing sump in the vicinity, or construction and testing of one sump.	All infiltration sumps must be field-tested after construction. (see **infiltration sump** section for procedure)
Surface Infiltration Facility	Required	One double-ring infiltrometer test (for public facilities) or one falling head test (for private facilities) per facility area	All surface infiltration facilities must be field tested after construction.

2.4.2 Design Testing

The following **test pit** procedure shall be followed:

1) Excavate a test pit or dig a standard soil boring to a minimum depth of 4 feet below the proposed facility bottom elevation. Also conduct Standard Penetration Testing (SPT) every 2 feet to a depth of 4 feet below the facility bottom.
2) Determine depth to highest seasonal groundwater table (if within 4 feet of proposed bottom) upon initial digging or drilling.
3) Determine USDA or Unified Soil Classification System textures at the proposed bottom and 4 feet below the bottom of the facility.
4) Determine depth to bedrock (if within 4 feet of proposed bottom).
5) The soil description should include all soil horizons.
6) The location of the test pit or boring shall correspond to the facility location; test pit/soil boring stakes are to be left in the field for inspection purposes and shall be clearly labeled as such.

The following **falling head infiltration test** procedure shall be followed:

1) Install casing (solid 5-inch diameter, 30-inch length) to 24 inches below proposed facility bottom (see **Exhibit 2-6**).
2) Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester's discretion, a 2-inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with clean water to a depth of 24 inches and allow to pre soak for 24 hours.
3) 24 hours later, refill casing with another 24 inches of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a total of four observations. Upon the tester's discretion, the final field rate may either be the average of the four observations or the value of the last observation. The final rate shall be reported in inches per hour.
4) Testing may be done through a boring or open excavation.
5) The location of the test shall correspond to the facility location.
6) Upon completion of the testing, the casings shall be immediately pulled, and the test pit shall be back-filled.

Where required, the **double-ring infiltrometer test** procedure must follow ASTM D3385-94, standard test method for infiltration rate of soils in field using double-ring infiltrometer.

Note: For soils types known as Cascade silt loams (soils with a fragipan that causes a perched water table in winter months), testing must be done between June 1 and October 1.

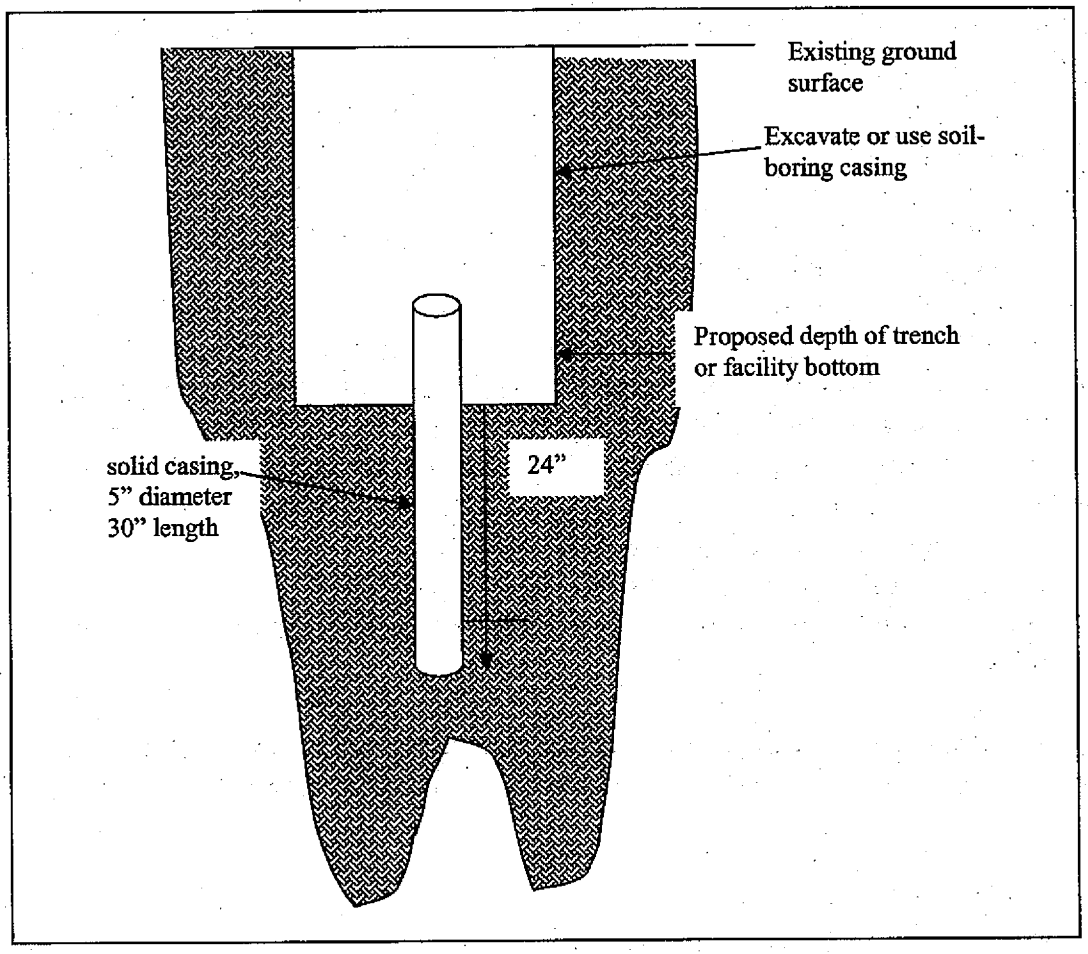
2.4.3 Post-Construction Testing

See surface infiltration facility, sump, and drywell design sections for post-construction infiltration testing procedures.

2.4.4 Laboratory Testing

Grain-size sieve analysis and hydrometer tests where appropriate may be used to determine USDA soils classification and textural analysis. Visual field inspection by a qualified professional may also be used, provided it is documented. The use of laboratory testing to establish infiltration rates is prohibited.

Exhibit 2-6: Falling Head Test



2.5 CONTROL STRUCTURES FOR DETENTION SYSTEMS

This section presents the methods and equations for the design of flow restricting control structures, for use with extended wet detention ponds, dry detention ponds, and structural detention facilities. It includes details and equations for the design of orifices, and equations for rectangular sharp crested weirs and v-notch weirs.

Detention control structures shall be either weir structures or orifice structures. Weir structures may be enclosed in a catch basin, manhole, or vault, or may be installed in the open, provided they are accessible for maintenance and are not exposed to damage. Riser type restrictor devices also provide some incidental oil/water separation and spill control. Weir structures provide some oil/water separation when fitted with a baffle plate located upstream of the weir.

2.5.1 Design Methodologies

The following criteria apply to control structure design.

- The control structure shall be designed to pass the 100-year storm event as overflow without causing flooding of the contributing drainage area.

Orifices

- Orifices may be constructed on a "tee" riser section (see **Exhibit 2-7**) or on a baffle (see **Exhibit 2-8**).

- The minimum allowable diameter for an orifice used to control flows in a public facility is 2 inches. Private facilities may utilize a 1-inch diameter orifice if additional clogging prevention measures are implemented. The orifice diameter shall always be greater than the thickness of the orifice plate.

- Multiple orifices may be necessary to meet the flood control design storm performance for a detention system. However, extremely low flow rates may result in small orifices (< 2 inches) that are prone to clogging. In these cases, retention facilities that do not rely on orifice structures shall be used to the maximum extent practicable to meet flow control requirements. Large projects may also result in high flow rates that necessitate excessively large orifice sizes that are impractical to construct. In such cases, several orifices may be located at the same elevation to reduce the size of each individual orifice.

Orifice Sizing Equation:

$$Q = CA\sqrt{2gh}$$

where:

Q = Orifice discharge rate, cfs
C = Coefficient of discharge, feet (suggested value = 0.60 for plate orifices)
A = Area of orifice, square feet
h = hydraulic head, feet
$g = 32.2\ \text{ft/sec}^2$

The diameter of plate orifices is typically calculated from the given flow. The orifice equation is often useful when expressed as an equivalent orifice diameter in inches.

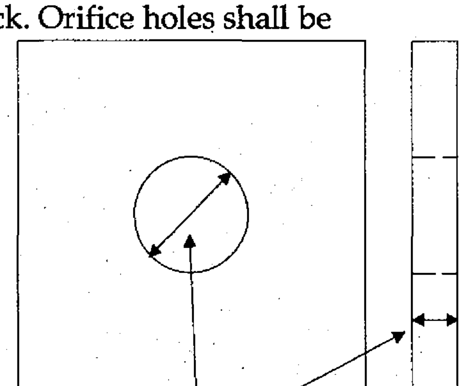
$$d = \sqrt{\frac{36.88\,Q}{\sqrt{h}}}$$

where:

Q = flow, cfs
d = orifice diameter, inches
h = hydraulic head, feet

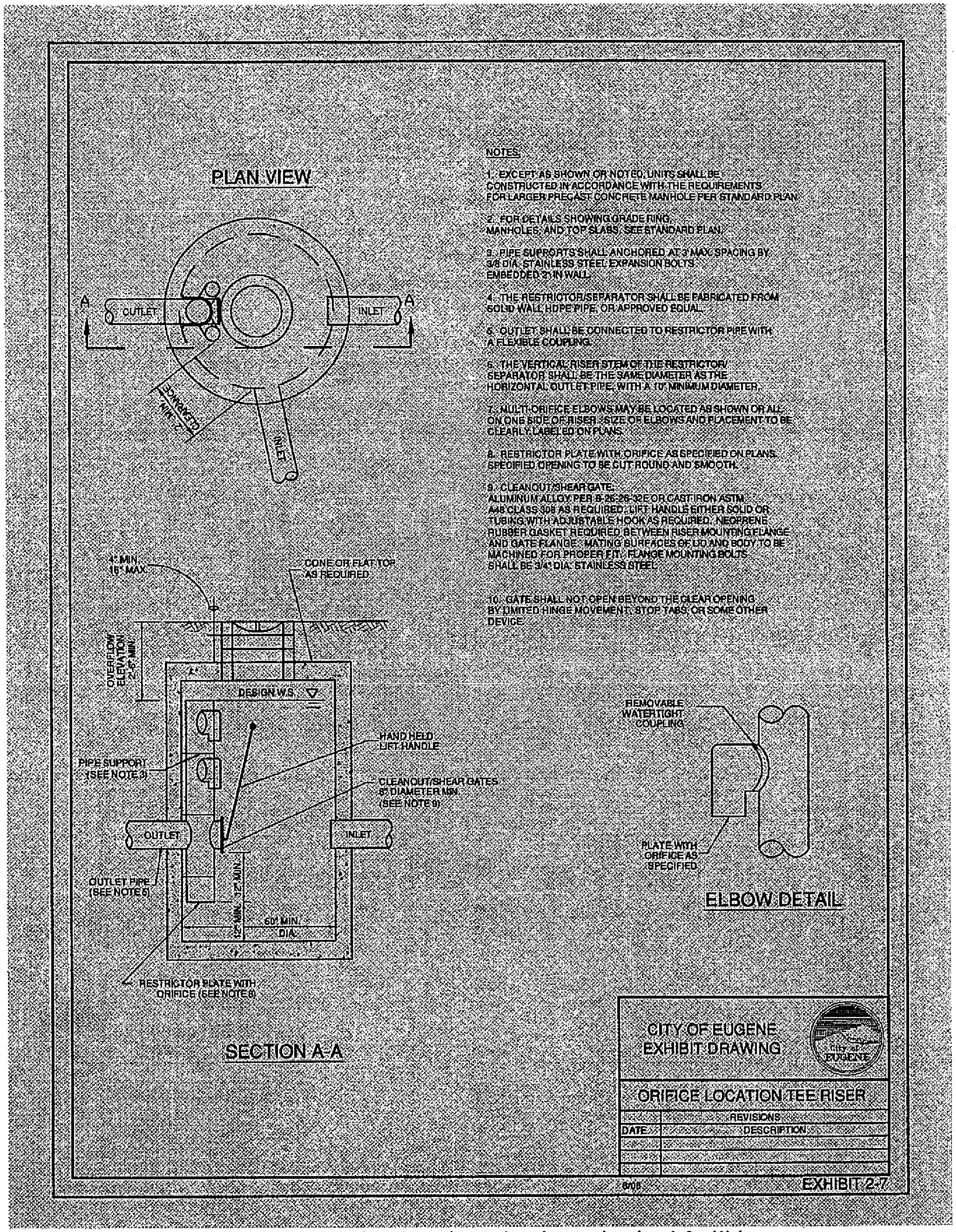
- Orifices shall be protected within a manhole structure, or by a minimum 18-inch-thick layer of 1½" to 3" evenly graded, washed rock. Orifice holes shall be externally protected by stainless steel or galvanized wire screen (hardware cloth) with a mesh of 3/4" or less. Chicken wire shall not be used for this application.

- Orifice diameter shall be greater than or equal to the thickness of the orifice plate (see diagram).



Orifice diameter cannot be less than orifice plate thickness

- If less than 3", the orifice shall not be made of concrete. A thin material (e.g., stainless steel, HDPE or PVC) shall be used to make the orifice plate; the plate shall be attached to the concrete or structure.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

NOTES

1. EXCEPT AS SHOWN OR NOTED, UNIT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS FOR LARGE PRE CAST CONCRETE MANHOLES.

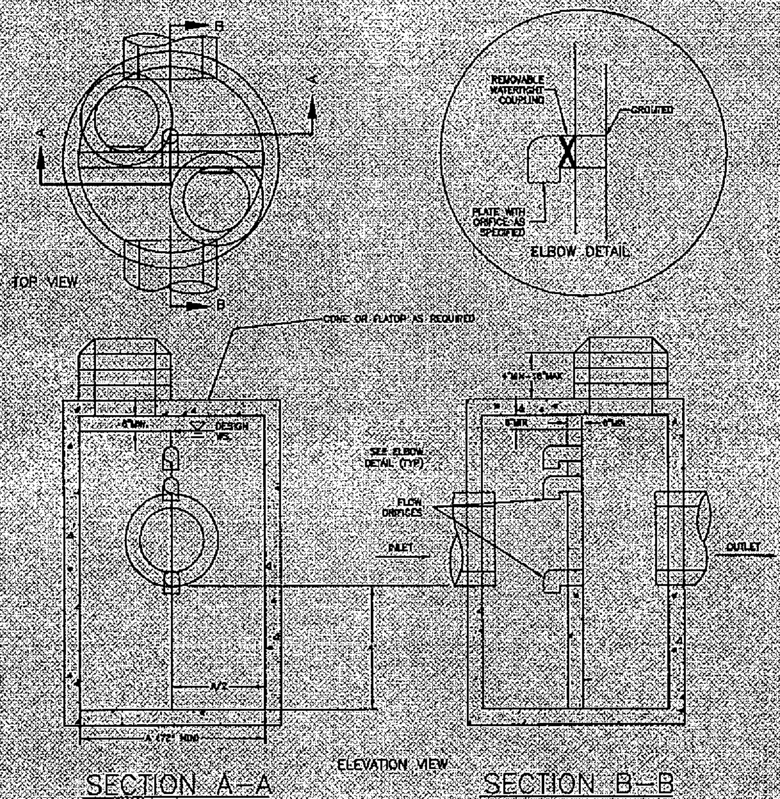
2. SEE PROJECT PLANS FOR SIZE AND LOCATION OF ORIFICES.

3. PIPE SIZES, SLOPES AND ALL ELEVATIONS AS SHOWN IN THE PLANS.

4. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.

5. PRE CAST BAFFLE WALL SHALL BE KEYED AND GROUTED IN PLACE.

6. ORIFICE PLATES TO BE 1/4" THICK MIN. HDPE OR APPROVED EQUAL AND ATTACHED WITH 1/2" STAINLESS STEEL BOLTS.



CITY OF EUGENE
EXHIBIT DRAWING

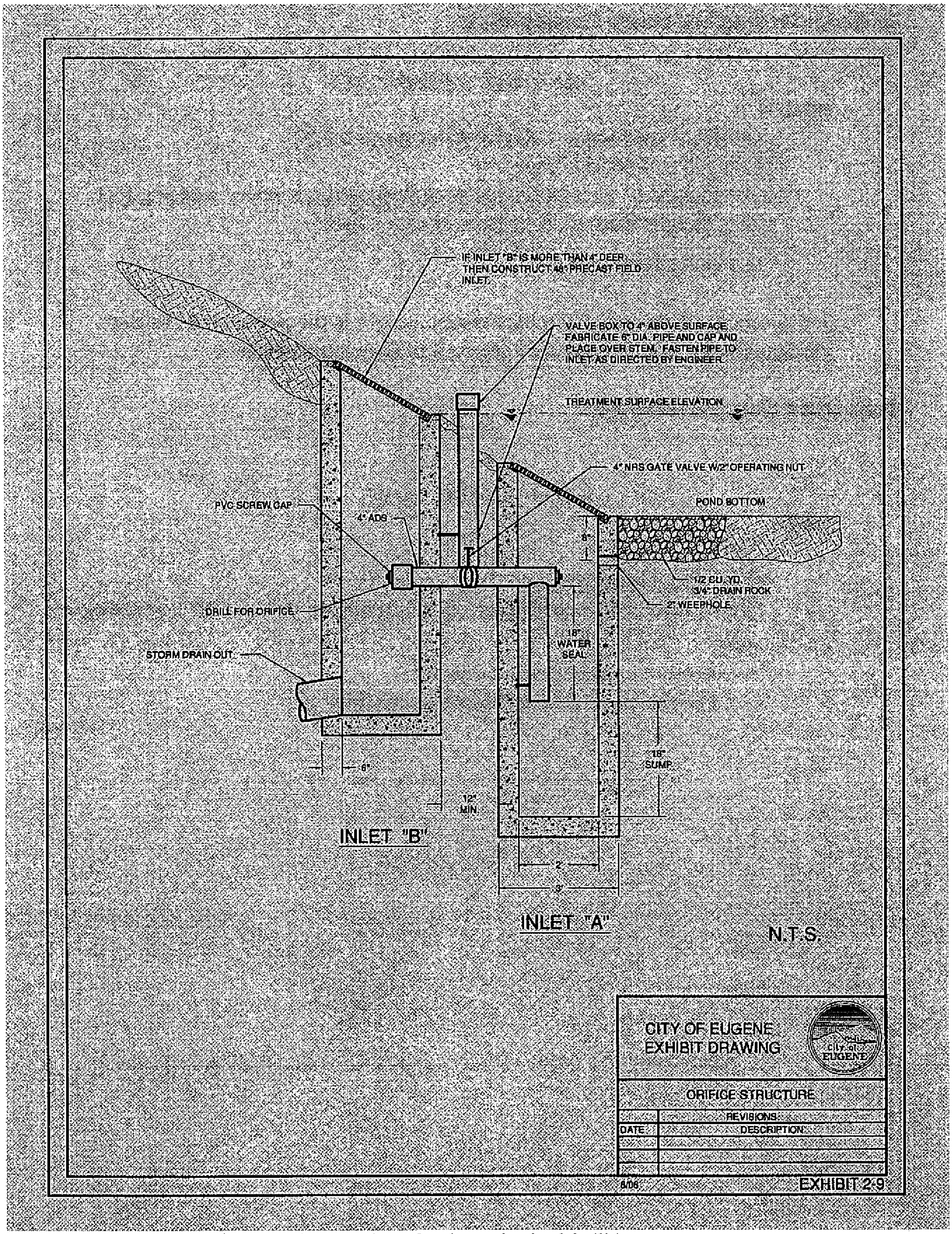
ORIFICE LOCATION BAFFLE RISER

REVISIONS	
DATE	DESCRIPTION

6/06

EXHIBIT 2-8

Note: See Eugene Standard Construction Drawings, for city-maintained facilities.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Rectangular Notched Sharp Crested Weir

$$Q = C(L - 0.2H) * H^{1.5}$$

where:

Q= Weir discharge, cubic feet per second (cfs)
C = 3.27 + 0.40*H/P, feet
P = Height of weir bottom above downstream water surface, feet
H = Height from weir bottom to crest, feet
L = Length of weir, feet*

* For weirs notched out of circular risers, length is the portion of the riser circumference not to exceed 50 percent of the circumference.

V-Notched Sharp Crested Weir

$$Q = C_d (\text{Tan} \frac{\theta}{2}) H^{\frac{5}{2}}$$

where:

Q = Weir discharge, cfs
C_d = Contraction coefficient, feet (suggested value = 2.5 for 90 degree weir)
θ = Internal angle of notch, degrees
H = Height from weir bottom to crest, feet

2.6 ACCESS FOR OPERATIONS AND MAINTENANCE

Adequate access for operations and maintenance must be provided to all stormwater management facilities and their components. Public facilities shall have access routes at least 10 feet wide, not to exceed 10 percent in slope, and shall be located adjacent to public rights-of-way wherever feasible. Access routes greater than 100 feet in length shall provide a vehicle turn-around (see *Public Improvement Design Standards Manual*) for the maintenance vehicles. Where structural surfaces are needed to support maintenance vehicles, access routes shall be constructed of gravel or other permeable paving surface where possible. Public facility vehicular access routes shall be designed for H-20 loading.

2.7 LANDSCAPING

2.7.1 Landscaping Applications

The design must include elements that ensure landscape plant survival and overall stormwater facility functional success. Construction specifications and/or drawings need to include the following elements:

- Irrigation system to be used for the establishment period and permanent long-term. Note that public stormwater management facilities shall be designed so permanent long-term irrigation systems are not needed.

- Landscape plan showing the location of landscape elements, including size and species of all proposed plantings, and existing plants and trees to be preserved.

- Plant list/table, including scientific name, size at time of planting, quantity, type of container, evergreen or deciduous, appropriate planting season, native or non-native to region, and other information in accordance with the facility-specific planting section and landscape industry standards.

- Topsoil stockpile location, including source of topsoil, if imported. Include erosion protection per the City's *Erosion Prevention Code and its corresponding Administrative Order(s)*. Soil analysis for all topsoil to be used within the facility area.

2.7.2 Landscaping Design and Management

Vegetation is a key element in the performance of many stormwater management facilities. Facility-specific planting practices are shown in **Section 2.9**. These practices are based on experience and/or standard landscape industry methods for design and construction, and are required to be covered by a 2-year warranty period.

At the end of the first year and again at the end of the 2-year warranty period, all plants that do not survive must be replaced. Establishment procedures, such as control of invasive weeds, animal and vandal damage, mulching, re-staking, watering, and mesh or tube protection replacement, shall be implemented to the extent needed to ensure plant survival.

Designers may elect to use an Alternative Revegetation approach, which allows smaller materials to be planted in larger quantities. If this approach is chosen, the following practices shall apply:

1) A 5-year warranty period from the time of plant installation shall be provided.
2) Plants must be installed during the dormant season, typically defined as December through March.
3) A survival rate of 75 percent (no replacements) must be achieved for all bare root plants measured in the third and fifth year after installation. If the survival rate falls below this threshold, a number of additional plants, sufficient to meet the 75% survival rate must be installed. The number of additional plants required will be based on the mortality rate of the initial planting.
4) Density of plantings shall be at least one tree and one shrub per 50 square feet of facility area. These plants are bare root (seedlings) and range in size from 10 inches to 24 inches tall.
5) Bareroot seedlings must be dormant in order to harvest from farm sites for planting.
6) All plants must be native from local seed sources and found on the Eugene Plant List. A minimum of four different species of trees and shrubs must be used. At least half of the trees must be evergreen. Ground covers must be native grasses ad wildflowers from local seed sources. See **Appendix G** for a list of native plant suppliers.
7) During the period between harvest and installation, the plants must be kept in a temperature-controlled facility. Temperature must be kept between 33 and 36 degrees Fahrenheit, and plant roots must be kept moist at all times. Plants must be planted within 24 hours of removal from the temperature-controlled facility.

Stormwater facilities located in the public street right-of-way are not required to use evergreen trees to meet landscaping requirements.

Where the plant material schedules of this manual and Eugene Code differ, the designer shall use the larger quantity and sizes. (In calculating quantities, fractions should be rounded to the higher number.)

In some cases landscaping required by Eugene Code may be counted toward meeting the facility-specific landscape requirements for stormwater management if the plantings are located within the facility area. Similarly, in some cases plantings that meet the schedules in this chapter may also meet Eugene Code landscape requirements.

It is critical that selected plant materials are appropriate for soil, hydrologic, and other facility and site conditions. For City-maintained facilities located outside of the public right-of-way, all plants within the facility area shall be appropriate native species from the **recommended plant lists in Appendix G** (no nuisance or prohibited plants).

The design for plantings shall minimize the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis. Plantings shall be designed to minimize the need for mowing, pruning, and irrigation.

Grass or wildflower seed shall be applied at the rates specified by the suppliers. If plant establishment cannot be achieved with seeding by the time of substantial completion of the stormwater facility portion of the project, the contractor shall plant the area with wildflower sod, plugs, container plants, or some other means to complete the specified plantings and protect against erosion before water is allowed to enter the facility.

2.8 OUTFALL DESIGN

Outfalls should be located above the downstream mean low water level, unless a pipe velocity of 3′ per second can be maintained with the pipe outfall located below the water surface level. **Exhibit 2-10** shows a typical outfall layout. Publicly accessible outfalls greater than 15 inches in diameter shall include grated protection in accordance with **Exhibit 2-14**. All outfalls shall be provided with a rock splash pad or other approved erosion control/energy dissipation measures. Rock protection at outfalls from small diameter pipes shall be as follows:

RIP-RAP PAD DIMENSIONS FOR SMALL OUTFALLS

2″ Pipe: 12″ wide x 24″ long x 2″ deep, Average Stone Size = 1″
4″ Pipe: 24″ wide x 36″ long x 4″ deep, Average Stone Size = 2″
6″ Pipe: 36″ wide x 48″ long x 6″ deep, Average Stone Size = 4″

Rock protection at outfalls from pipes greater than 6 inches shall be designed in accordance with **Exhibit 2-11,** unless otherwise approved by the City. **Exhibit 2-12** shows riprap class selection.

Engineered energy dissipaters, including stilling basins, drop pools, hydraulic jump basins, baffled aprons, and bucket aprons, are required for outfalls with velocity at design flow greater than 20 feet per second (fps). These shall be designed by a professional engineer using published references such as *Hydraulic Design of Energy Dissipaters for Culverts and Channels* (U.S. Department of Transportation, Federal Highway Administration) and other references. The construction plan submittal shall identify the design reference.

Drainage ways and rivers may have steep slopes or banks and may have unstable landforms (i.e. slump). Geotechnical investigation and analysis to determine the stability of the stream or river bank shall be provided with the stormwater study.

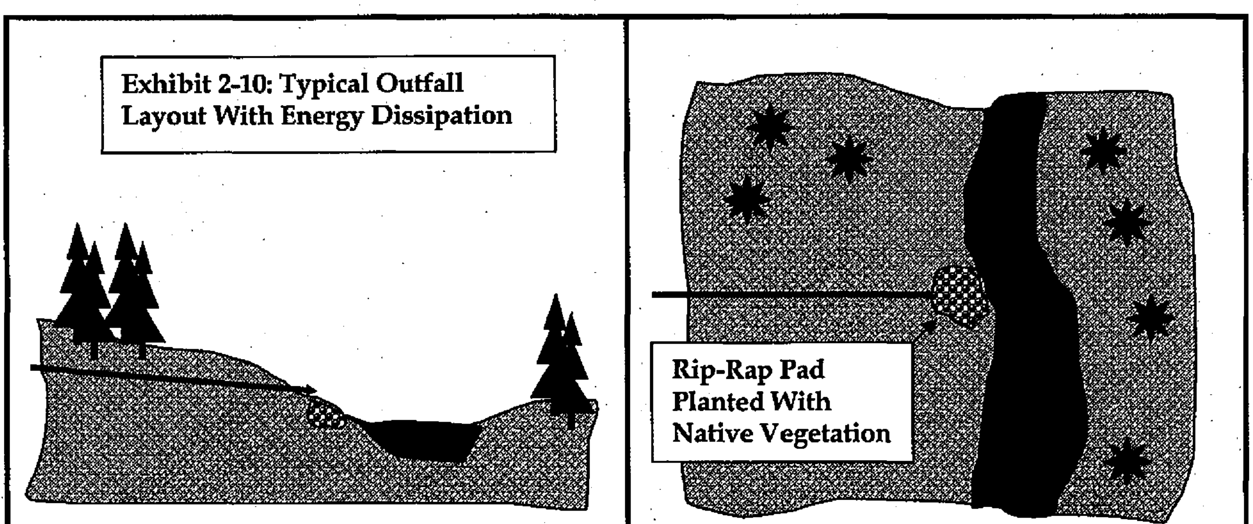


Exhibit 2-10: Typical Outfall Layout With Energy Dissipation

Exhibit 2-11
ROCK PROTECTION AT OUTFALLS FOR PIPES GREATER THAN 6 INCHES IN DIAMETER

Discharge Velocity at Design Flow (fps)			REQUIRED PROTECTION Minimum Dimensions				
			Type	Depth*	Width	Length**	Height
0	To	5	Riprap*	2 x (max stone size)	Diameter + 6 ft.	As calculated	Crown + 1 ft.
6	To	10	Riprap*	2 x (max stone size)	Diameter + 6 ft. or 3x dia. which-ever is greater	As calculated	Crown + 1 ft.
11	To	20	Gabion or Riprap*	2 x (max stone size)	Diameter + 6 ft. or 4x dia. which-ever is greater	As calculated	Crown +1 ft.
Over 20			Engineered Energy Dissipater Required				

* Riprap size shall be determined using the following formulae*** and the City's *Standard Construction Specifications*

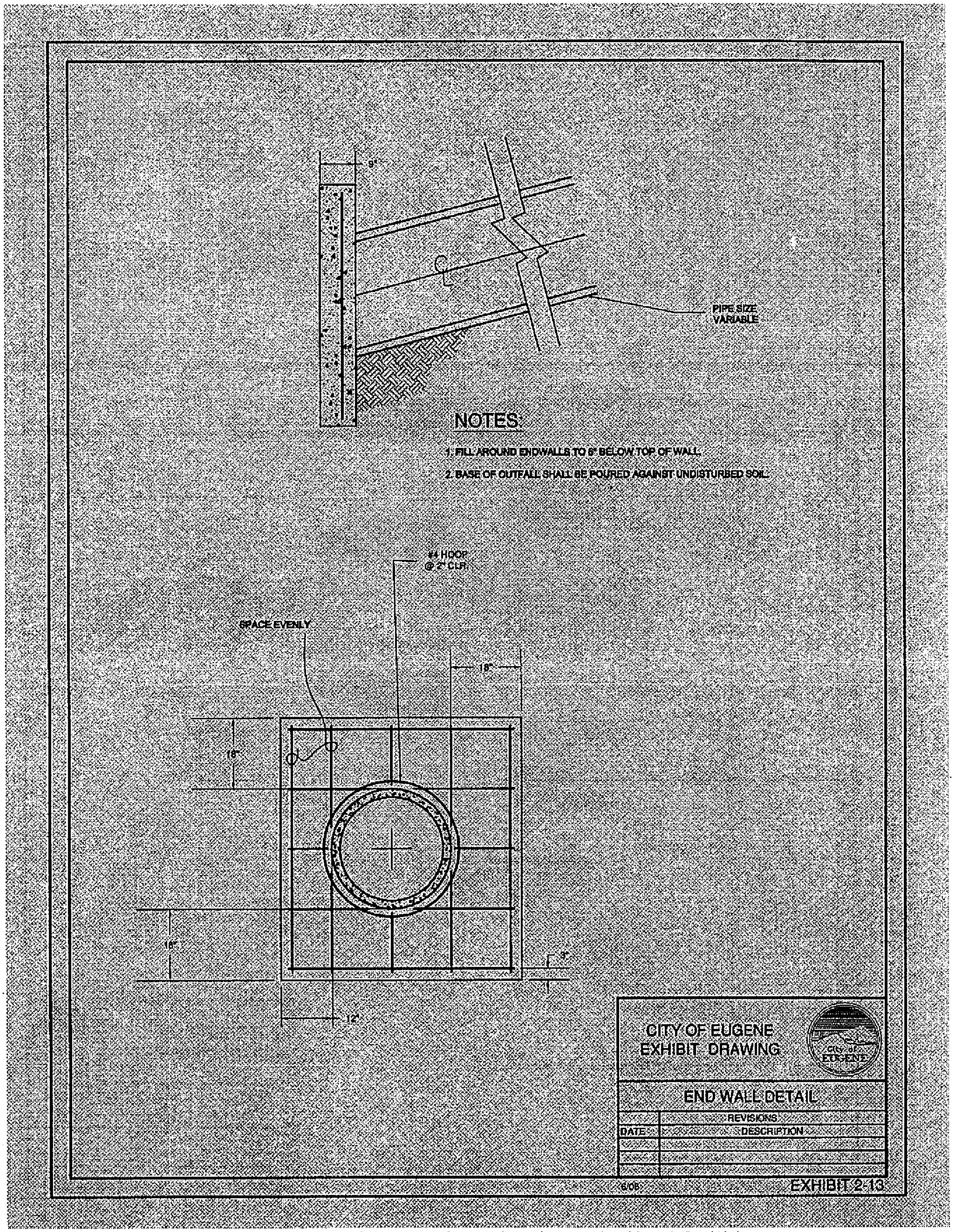
V = Average velocity (ft/s)　　*Riprap size ds=0.25*Do*Fo (6″ minimum)
Do = Pipe diameter (ft)　　Depth=2*ds (1 foot minimum)
ds = Riprap diameter (ft)　　**Apron length Lsp= Do(8+17*Log Fo)
Lsp = Apron length (ft)
depth = Thickness (ft)
Fo = $V/(g*Do)^{0.5}$　　$g = 32.2$ ft/s^2

***US Army Corps of Engineers design formulas from *Erosion and Riprap Requirements at Culvert and Storm Outlets*, January 1970

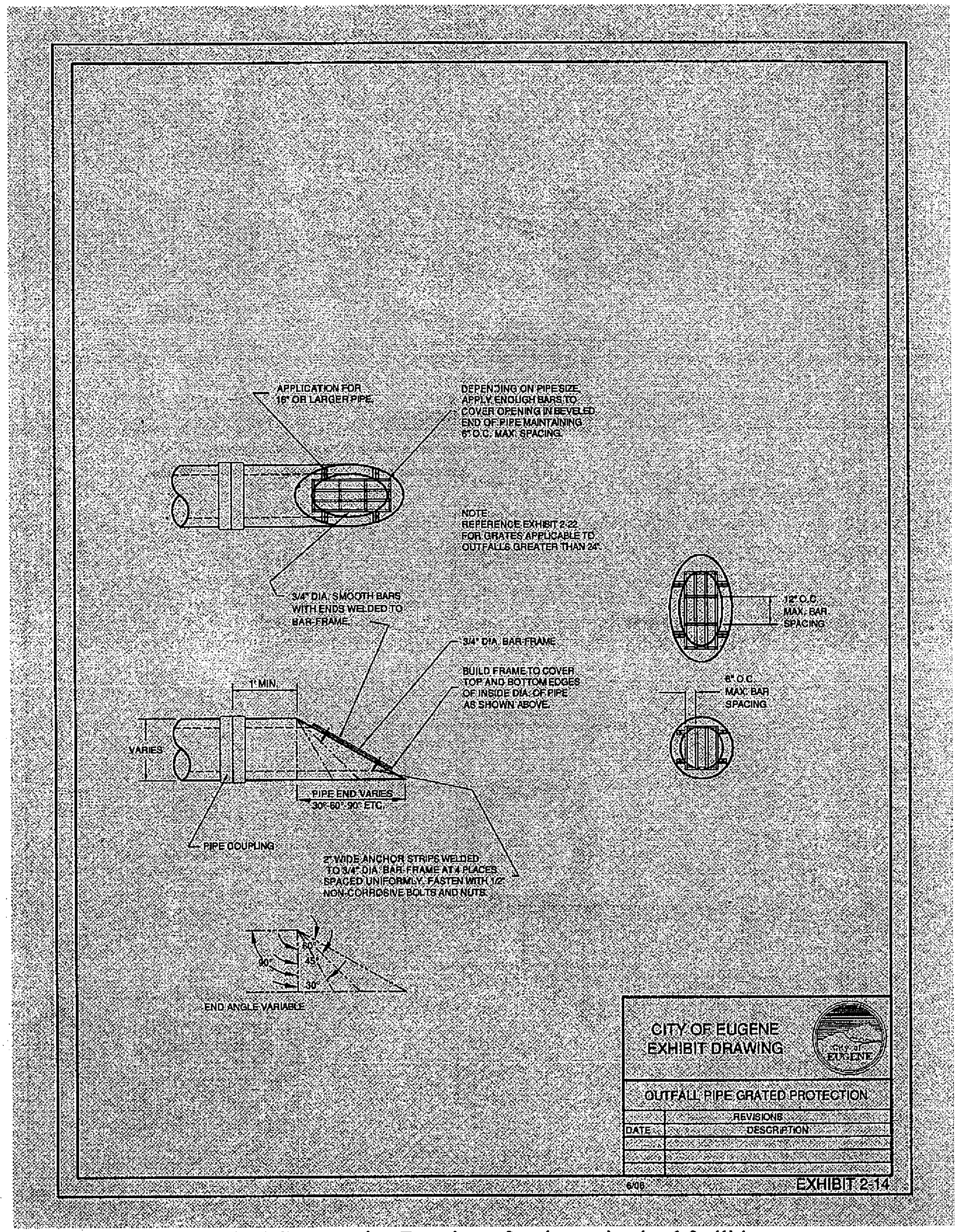
Exhibit 2-12: RIPRAP CLASS SELECTION

Weight (lbs)	Spherical Size (inches)	% by Weight	Average Stone Size (inches)
Class 50			6.3
30 – 50	8.5 – 10	20	
15 – 30	6.7 – 8.5	30	
2 – 15	3.5 – 6.7	40	
0 – 2	0 – 3.5	10	
Class 100			7.6
60 – 100	10.6 – 12.8	20	
25 – 60	8.0 – 10.6	30	
2 – 25	3.5 – 8.0	40	
0 – 2	0 – 3.5	10	
Class 250			11.3
200 – 250	15.0 – 18.0	20	
100 – 200	12.0 – 15.0	30	
10 – 100	6.0 – 12.0	40	
0 – 10	0 – 6.0	10	
Class 700			15.2
500 – 700	21.5 – 24.0	20	
200 – 500	15.9 – 21.5	30	
20 – 200	7.4 – 15.9	40	
0 – 20	0 – 7.4	10	
Class 2000			21.7
1400 – 2000	30.4 – 34.0	20	
700 – 1400	24.0 – 30.4	30	
40 – 700	9.3 – 24.0	40	
0 – 40	0 – 9.3	10	

Reference: Erosion and Riprap Requirements at Culverts and Storm-Drain Outlets
U.S. Army Engineers, Jan 1970

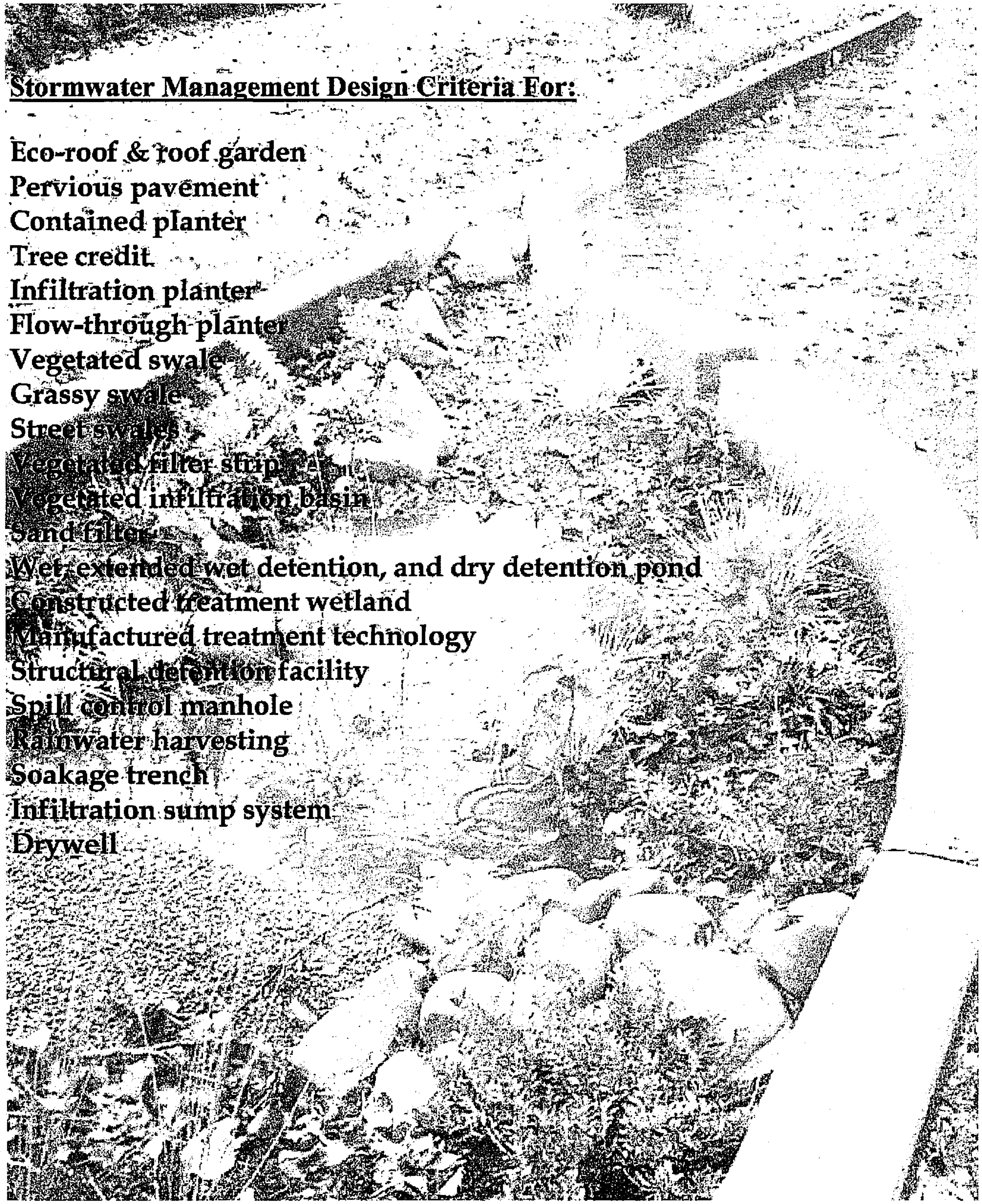


Note: See Eugene Standard Construction Drawings, for city-maintained facilities.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

2.9 FACILITY SELECTION AND DESIGN



Stormwater Management Design Criteria For:

Eco-roof & roof garden
Pervious pavement
Contained planter
Tree credit
Infiltration planter
Flow-through planter
Vegetated swale
Grassy swale
Street swales
Vegetated filter strip
Vegetated infiltration basin
Sand filter
Wet, extended wet detention, and dry detention pond
Constructed treatment wetland
Manufactured treatment technology
Structural detention facility
Spill control manhole
Rainwater harvesting
Soakage trench
Infiltration sump system
Drywell

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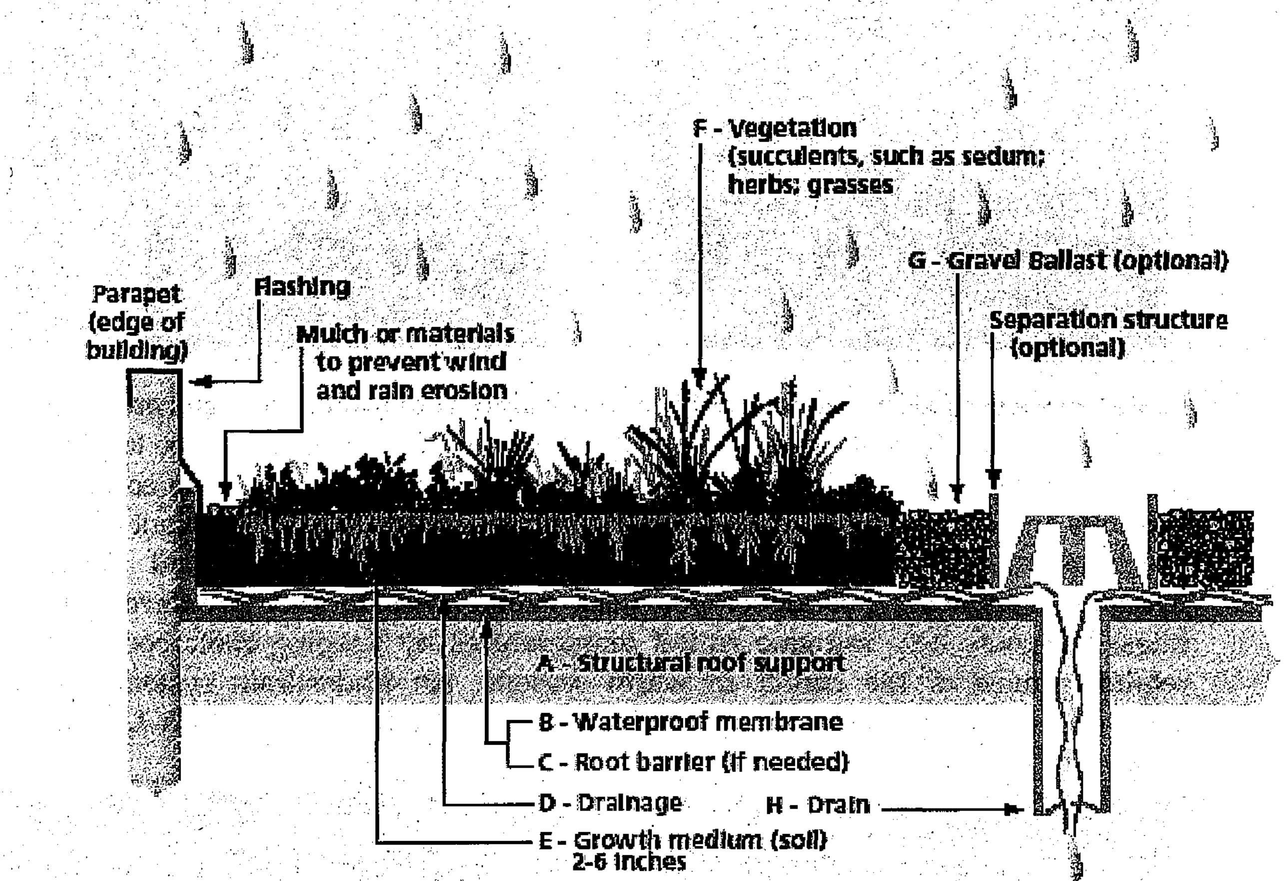
Eco-Roof & Roof Garden



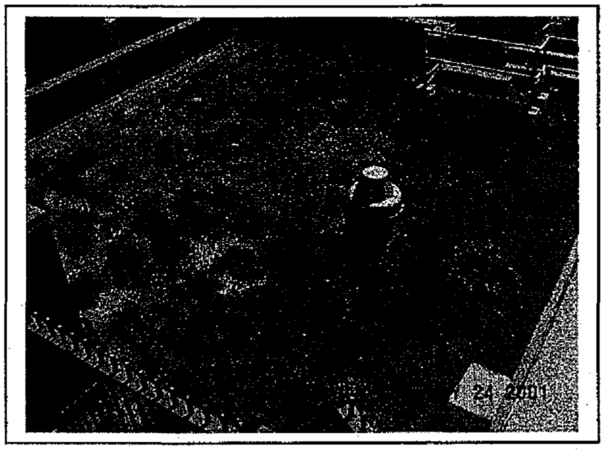
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Impervious Area Reduction....................	SIM
√ Pollution Reduction..................................	SIM
√ Flow Control...	SIM
Destination..	NA

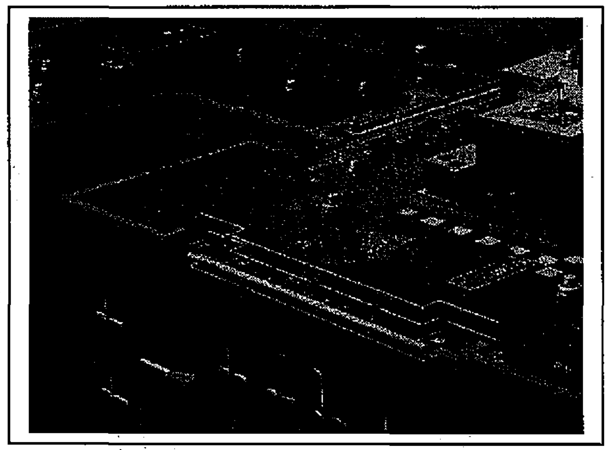
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

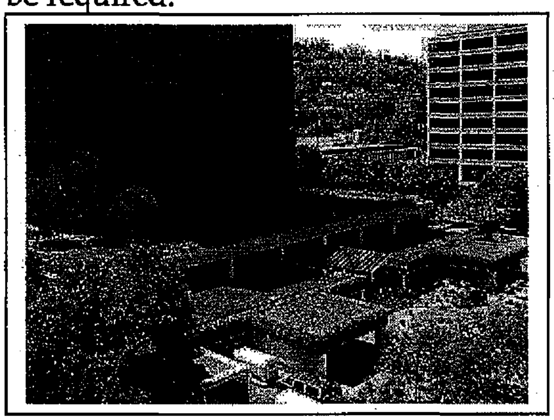
Notes: 1) This facility is an impervious surface reduction technique. Its applicability is limited to rooftops or decks above building structures.

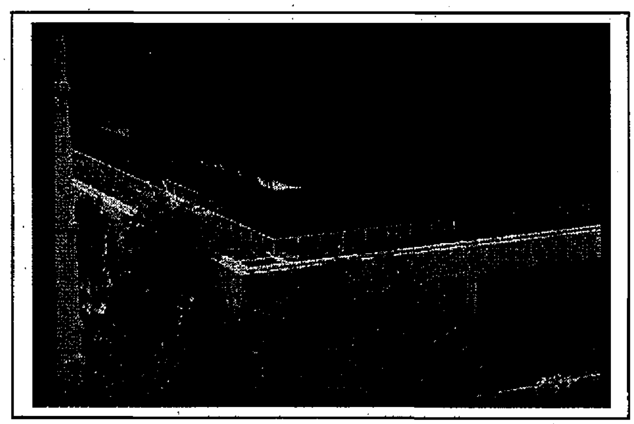
Eco-Roof & Roof Garden





Eco-Roof Description: An eco-roof is a lightweight roof system of waterproofing material with a thin soil/vegetation protective cover. The eco-roof can be used in place of a traditional roof as a way to limit impervious site area. The eco-roof captures and depending on the season, evapotranspirates 10 to 100 percent of the precipitation. Eco-roofs attempt to mimic pre-developed ground cover hydrology, reducing post-developed peak runoff rates to near pre-developed rates. Eco-roofs help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in warm seasons. An underdrain system and overflow to an approved conveyance/ destination method per **Section 1.4** will be required.





Roof Garden Description: A roof garden is a heavy weight roof system of waterproofing material with a thick soil/vegetation protective cover. The roof garden can be used in place of a traditional roof to limit impervious site area. The roof garden captures and then evapotranspirates 50 to 100% of precipitation, depending on the season. Roof gardens attempt to mimic pre-developed hydrology, therefore reducing post-developed peak runoff rates to near pre-developed rates. They help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in warm seasons. Roof gardens should not be used on slopes greater than 10%. A drain system and overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Eco-Roof & Roof Garden

Design Requirements:

General Specifications: Good quality waterproofing material must be used on the roof surface. Soil of adequate fertility and drainage capacity at depths of 2-6 inches, and weight of 10 to 30 pounds per square foot, shall be applied. The building structure must be shown to be adequate to hold the additional weight. Vegetation shall be self-sustaining plants, without the need for fertilizers or pesticides. Soil coverage to prevent erosion shall be established immediately upon installation by using mulch, vegetation mats, or other approved protection method. Ninety-percent plant coverage shall be achieved within 2 years. Temporary irrigation to establish plants is recommended. A permanent irrigation system using potable water may be used, but an alternative means of irrigation, such as air conditioning condensate or other non-potable sources is recommended. Alternative sources should be analyzed to determine if the source has chemicals that might harm or kill the vegetation. Maximum roof slope shall be 25%, unless the applicant can provide documentation for runoff control on steeper slopes.

A. **Structural Roof Support:** The structural roof support must be sufficient to hold the additional weight of the eco-roof. For retrofit projects, check with an architect, structural engineer, or roof consultant to determine the condition of the existing building structure and what might be needed to support an eco-roof. This might include additional decking, roof trusses, joists, columns, and/or foundations. Generally, the building structure must be adequate to hold an additional 10 to 25 pounds per square-foot (psf) saturated weight, depending on the vegetation and growth medium that will be used. (This is in addition to snow load requirements.) An existing rock ballast roof may be structurally sufficient to hold a 10-12 psf eco-roof. (Ballast typically weighs 10-12 psf.)

   For New Construction the project architects and structural engineers shall address the structural requirements of the eco-roof during the design process. Greater flexibility and options are available for new buildings than for re-roofing. The procedures for the remaining components (B through H) are the same for both re-roofing and new construction.

B. **Waterproof Membrane (Impermeable Material):** Waterproof membranes are made of various materials, such as modified asphalts (bitumens), synthetic rubber (EPDM), hypolan (CPSE), and reinforced PVC. Some of the materials come in sheets or rolls and some are in liquid form. They have different strengths and functional characteristics. Some of these products require root inhibitors (refer to C) and other materials to protect the membrane.

Numerous companies manufacture waterproofing materials appropriate for eco-roofs.

Protection Boards or Materials: These materials protect the waterproof membrane from damage during construction and over the life of the system, usually made of soft fibrous materials.

C. **Root Barrier (If needed):** Root barriers are made of dense materials that inhibit root penetration. The need for a root barrier depends on the waterproof membrane selected. Modified asphalts usually require a root barrier, while synthetic rubber (EPDM) and reinforced PVC generally do not. Check with the manufacturer to determine if a root barrier is required for a particular product. Note: membranes impregnated with pesticides are not allowed. Manufacturers must provide City with evidence that membranes impregnated with copper will not leach out at concentrations of concern.

D. **Drainage Layer (If needed):** There are numerous ways to provide drainage. Products range from manufactured perforated plastic sheets to a thin layer of gravel. Some eco-roof designs do not require any drainage layer other than the growth medium itself, depending on roof slope and size (for example, pitched roofs and small flat roofs).

E. **Growth Medium (Soil):** The growth medium is generally 2 to 6-inches thick and well drained. It weighs from 10 to 25 pounds per square-foot when saturated. A simple mix of one-fourth topsoil, one-fourth compost, and one-half pumice perlite may be sufficient for many applications. Some companies have their own growth medium specifications. Other components could include digested fiber, expanded clay or shale, or coir.

F. **Vegetation:** Eco-roof and roof garden vegetation should have the following attributes:
- Drought-tolerant, requiring little or no irrigation after establishment
- A growth pattern that allows the plant to thoroughly cover the soil. At least 90% of the overall surface shall be covered.
- Self-sustaining, without the need for fertilizers, pesticides, or herbicides
- Able to withstand heat, cold, and high winds
- Very low-maintenance, needing little or no mowing or trimming
- Perennial or self-sowing
- Fire resistant

A mix of sedum/ succulent plant communities is recommended because they possess many of these attributes. Herbs, forbs, grasses, and other low groundcovers can also be used to provide additional benefits and aesthetics;

however, these plants may need more watering and maintenance to survive and keep their appearance.

***Link to Eco-Roof Landscaping Plan Example**
***Link to Eco-Roof and Roof Garden Recommended Plants**

Installation: Four methods (or combinations of them) are generally used to install the vegetation: vegetation mats, plugs/ potted plants, sprigs, and seeds.

1. **Vegetation mats** are sod-like, pre-germinated mats that achieve immediate full plant coverage. They provide immediate erosion control, do not need mulch, and minimize weed intrusion. They also need minimal maintenance during the establishment period and little ongoing watering and weeding.
2. **Plugs or potted plants** may provide more design flexibility than mats. However, they take longer to achieve full coverage, are more prone to erosion, need more watering during establishment, require mulching and more weeding.
3. **Sprigs** are hand-broadcast. They require more weeding, erosion control, and watering than mats.
4. **Seeds** can be either hand-broadcast or hydraseeded. Like sprigs, they require more weeding, erosion control, and watering than mats.

G. **Gravel Ballast (If needed):** Gravel ballast is sometimes placed along the perimeter of the roof and at air vents or other vertical elements. The need for ballast depends on operational and structural design issues. It is sometimes used to provide maintenance access, especially to vertical elements requiring periodic maintenance. In many cases, very little, if any, ballast is needed. In some situations a header or separation board may be placed between the gravel ballast and adjacent elements (such as soil or drains). If a root barrier is used, it must extend under the gravel ballast and growth medium, and up the side of the vertical elements.

H. **Drain:** As with a conventional roof, an eco-roof must safely drain runoff from the roof to an approved stormwater destination. See **Section 1.4** for stormwater destinations.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from roof lines
2) Profile view of facility, including typical cross-sections with dimensions

3) Growing medium specification, including weight
4) Filter fabric specification
5) Drainage layer specification
6) Waterproof membrane specification, including root barriers
7) Planting and irrigation plan
8) Final stormwater destination

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Roof Structure	Call for inspection
Waterproof membrane	Call for inspection
Drainage layer/ plumbing & pipes	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

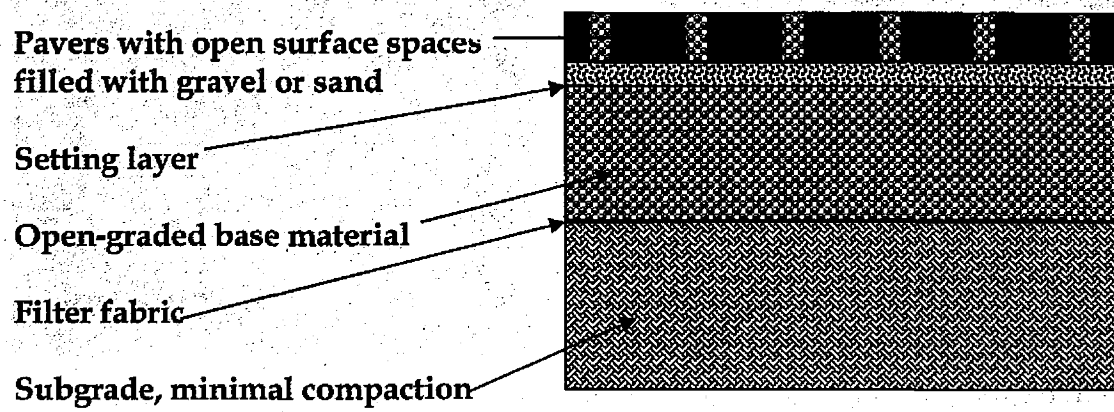
*** Link to eco-roof and roof garden O&M form**

Additional photos and drawings:

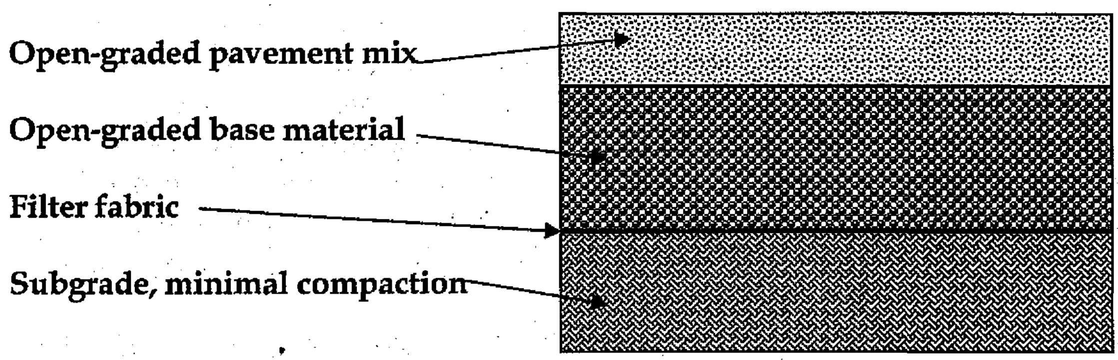
*** Link to eco-roof and roof garden photos**
*** Link to eco-roof and roof garden drawings**

Pervious Pavement

Pervious Concrete Block or "Paver" Systems



Pervious (Open Graded) Concrete and Asphalt Mixes



Stormwater Management Goals Achieved — **Acceptable Sizing Methodologies**

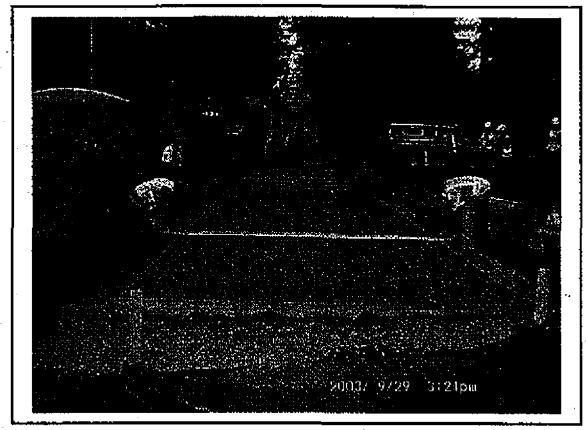
- √ Impervious Area Reduction
- √ Pollution Reduction................................ SIM
- √ Flow Control.. SIM
- √ Destination.. PERF

  This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility is an impervious surface reduction technique. It is applicable for use in parking lots, driveways, and in some cases streets.

Pervious Pavement



Description: There are many types of pervious pavement on the market today. Numerous products and design approaches are available, including special asphalt paving; manufactured products of concrete, plastic, and gravel; paving stones; and brick. It may be used for walkways, patios, plazas, driveways, parking lots, and some portions of streets, subject to compliance with building codes. To receive credit, the material must be installed and maintained to manufacturer's specifications. Pervious pavement accepts only precipitation, not stormwater runoff. These materials may not be allowed in certain areas (see **Chapter 4.0** for restrictions). A professional engineer, registered in the state of Oregon must design pervious pavement systems that will be supporting vehicular traffic. For EPA's "Porous Pavement Phase I Design and Operational Criteria" (EPA-600/2-80-135), go to: **http://www.epa.gov/ednnmrl/repository/abstrac2/abstra2.htm**. For Portland's Bureau of Environmental Service's report on pervious pavement demonstration projects, vendors, and other resources, go to: **http://www.cleanrivers-pdx.org/pdf/alternative_paving.pdf**.

Design Considerations: When designing pervious pavement systems, the infiltration rate of the native soil is a key element in determining the depth of base rock for the storage of stormwater, or for determining whether an underdrain system is appropriate. Traffic loading and design speed are important considerations in determining which type of pervious pavement is applicable. Pedestrian ADA accessibility, aesthetics, and maintainability are also important considerations, depending on pavement use.

Construction Considerations: Installation procedures can be detrimental to the success of pervious pavement projects, particularly pervious asphalt and concrete pavement mixes. The subgrade and base rock cannot be overly compacted with the inclusion of fine particulates or the void ratio critical to providing storage for large storm events will be lost. Weather conditions at the time of installation can affect the final product, as in the case of high or low temperatures with pervious asphalt and excessive rainfall with pervious concrete. Pavement infiltration rates shall be verified prior to final acceptance.

Design Requirements:

Soil Suitability: Pervious pavement systems are appropriate for all soil types, but will require underdrain systems to an approved stormwater destination (per **Section 1.4**) for soils that do not infiltrate well (less than 0.5 inches per hour, generally NRCS soil type D). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the base rock and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.), unless an underdrain system is used.

Dimensions and Slopes: Minimum/ maximum dimensions and other specifications are product-specific and shall comply with manufacturer's recommendations. Slopes shall be less than 10% in all cases.

Setbacks: Not applicable.

Sizing: Pervious pavement systems are not considered to be impervious surfaces, and therefore do not trigger pollution reduction and flow control requirements. A high-flow overflow or underdrain system must be provided to an approved destination point per **Section 1.4**.

Limitations: Pervious pavements shall not be used on sites with a likelihood of high oil and grease concentrations. These site uses include vehicle wrecking or impound yards, fast food establishments, automotive repair and sales, and parking lots that receive a high number of average daily trips (> 1,000).

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions, grades, grade breaks, and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Pervious pavement materials and installation procedure specifications
4) Subgrade and base course specifications
5) Filter fabric specification (if applicable)
6) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Pervious Pavement

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Subgrade	
Filter fabric (if applicable)	
Underdrain piping (if applicable)	Call for inspection
Base rock	
Pervious pavement installation	Call for inspection

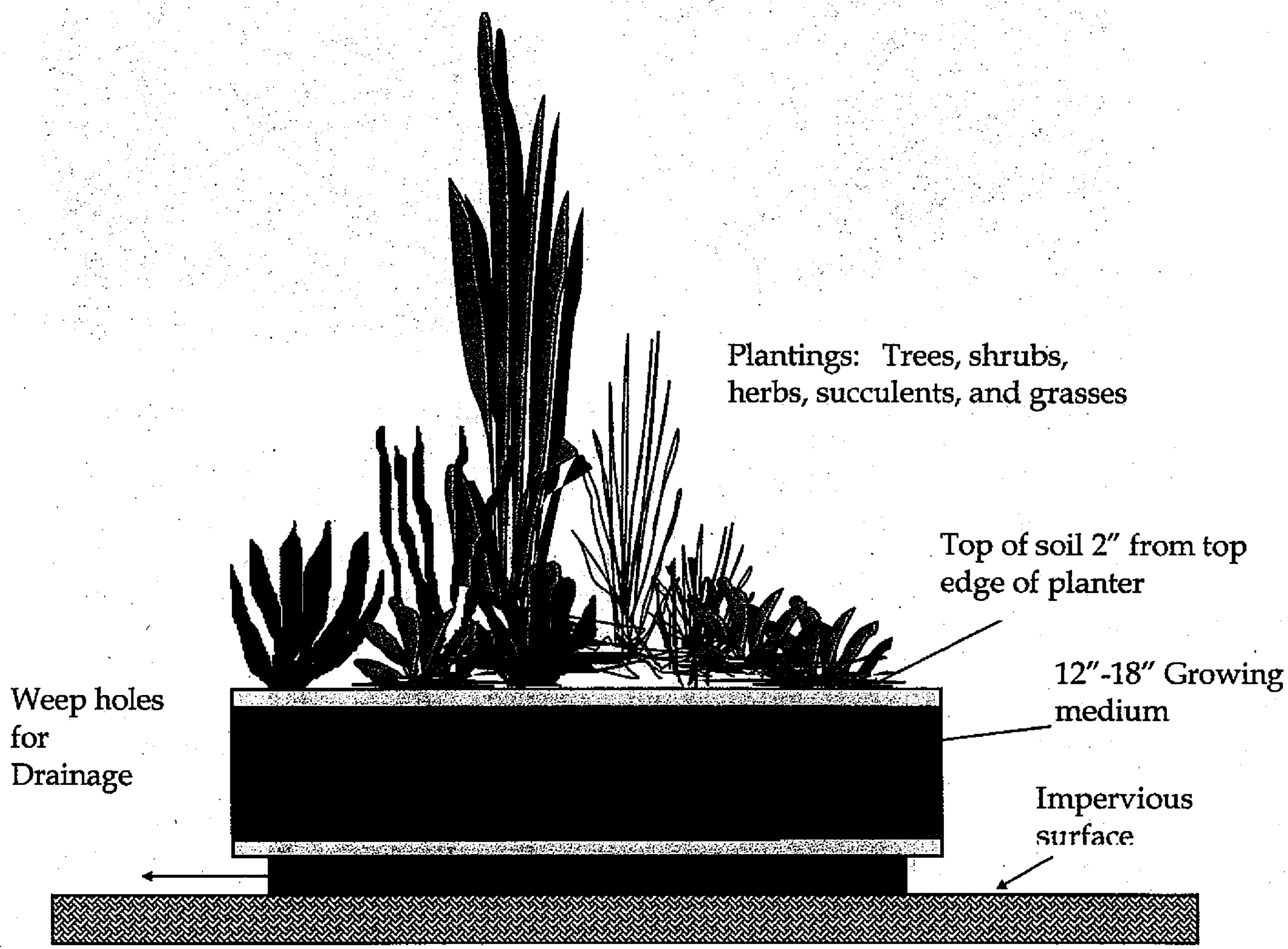
Operations and Maintenance requirements: See **Chapter 3.0.**

* **Link to pervious pavement O&M form**

Additional photos and drawings:

* **Link to pervious pavement photos**
* **Link to pervious pavement drawings**
    * **Link to pervious Asphalt drawing**
    * **Link to pervious concrete drawing**
    * **Link to brick drawing**
    * **Link to cobble drawing**
    * **Link to crushed aggregate drawing**
    * **Link to natural stone drawing**
    * **Link to turf block drawing**
    * **Link to unit pavers on sand drawing**

Contained Planter



Section Not to Scale

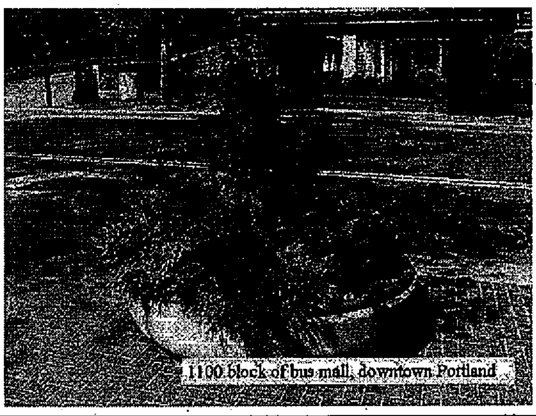
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Impervious Area Reduction	SIM
√ Pollution Reduction	SIM
√ Flow Control	SIM
Destination	NA

This facility is not classified as an Underground Injection Control structure (UIC).

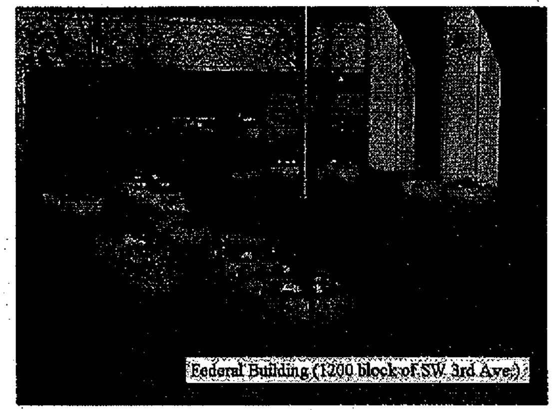
SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility is an impervious surface reduction technique. It may be placed over sidewalk, parking lot, flat roof, and plaza areas to reduce the effective impervious area.

Contained Planter



1100 block of bus mall, downtown Portland



Federal Building (1200 block of SW 3rd Ave.)

Description: Contained planters are used for planting trees, shrubs, and ground cover for placement over impervious surface. The planter may be a prefabricated pot of various dimensions or may be constructed in place and have an infinite variety of shapes and sizes. Contained planters accept precipitation only, not stormwater runoff. Planters are placed on impervious surfaces, such as sidewalks, plazas and rooftops. Drainage is allowed through the bottom of the planter onto the impervious surface.

Design Considerations: Plants shall be relatively self-sustaining, with little need for fertilizers or pesticides. Irrigation is optional, although plant viability must be maintained. Planters tend to dry out more quickly due to reflective heat, insulation to protect roots may be necessary. Trees are encouraged and may receive added stormwater management credit on the tree credit section of Form SIM.

Design Requirements:

Soil Suitability: Contained planters are appropriate for all soil types, as they are placed over impervious surface. Topsoil shall be used within the top 12 to 18 inches of the facility.

Setbacks: Not applicable.

Planter Walls: Planter walls shall be made of stone, concrete, brick, clay, plastic, wood, or other stable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Contained planters are given stormwater management credit for the square-footage of impervious surface that they cover, at a 1 to 1 ratio.

Contained Planter

Landscaping: Contained planters shall be planted to cover at least 50% of the planter surface.

***Link to Planter Recommended Plants**

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and location
2) Planter wall material specification
3) Growing medium specification
4) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Structural planter components	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to contained planter O&M form**

Additional photos and drawings:

*** Link to contained planter photos**
*** Link to contained planter drawings**

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Tree Credits

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Impervious Area Reduction....................	SIM
√ Pollution Reduction..............................	SIM
√ Flow Control...	SIM
Destination...	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility intercepts rainfall and provides shade for impervious surfaces. Trees may only receive credit against the construction of ground-level impervious surfaces.

Tree Credits

Description: Trees intercept precipitation and provide several stormwater management benefits:

- Flow control: Trees hold water on the leaves and branches and allow it to evaporate, retaining flow and dissipating the energy of runoff. These functions are most measurable for storms of less than 0.5 inches over 24 hours. While deciduous trees are not as effective during winter months, evergreen trees are effective year round for these smaller storms and portions of larger storms. Generally, large trees with small leaves are the most efficient rainfall interceptors. Trees also facilitate stormwater infiltration and groundwater recharge.

- Pollution reduction/ stormwater cooling: Trees can provide shade over large areas of impervious surface. This provides two direct benefits. First, the hard surface is protected from direct solar exposure, which reduces heat gain. The less heat gain there is in pavement, the less heat is absorbed by stormwater as it flows over the surface. Second, by shading pavement, the trees help reduce or minimize air temperature increases caused by the hot pavement. Cooler air may help prevent stream temperature increases associated with air temperatures.

New trees planted within 25 feet of ground-level impervious surfaces are eligible for stormwater management credit. 100 square feet of credit is given for new deciduous trees, and 200 square feet of credit is given for new evergreen trees (See minimum sizes below). Stormwater management credits also apply to existing trees kept on a site if the trees' canopies are within 25 feet of ground-level impervious surfaces. The credit is the square-footage equal to one-half of the existing tree canopy. No more than 10% can be mitigated through the use of trees.

Tree Credits

Trees used for stormwater management credit shall be clearly labeled on permit drawings.

NEW EVERGREEN AND DECIDUOUS TREES:

Trees shall be maintained and protected on the site after construction and for the life of the development (50-100 years or until any approved redevelopment occurs in the future). During the life of the development, trees approved for stormwater credit shall not be removed without approval from the City. Trees that are removed or die shall be replaced within 6 months with like species. Trees shall be pruned in conformance with the Eugene Code 6.350, 7.280; Administrative Rules R 6.350, 7.280; Oregon Safety and Health Administration regulations, and the American National Standards Institute (A.N.S.I) Z133.1.300.

The trees selected shall be suitable species for the site conditions and the design intent. Trees should be relatively self-sustaining and long-lived. Native conifers are highly encouraged, as many of these trees naturally grow in harsh/rocky conditions. Temporary irrigation shall be provided for native plantings. Long-term irrigation is not required. New deciduous trees must be at least 2 caliper inches and new evergreen trees must be at least 6 feet tall to receive simplified approach credit. Trees planted to meet stormwater facility planting requirements cannot also receive simplified approach credit.

By City ordinance, the Urban Forester is authorized to set standards for tree sizes planted on public rights-of-way. A permit or authorization is required from Urban Forestry to plant, prune, or remove right-of-way trees. Right-of-way trees shall be at least 1.5 caliper inches for residential and 2 caliper inches for collector and arterial streets or trees abutting commercially-zoned properties. For parks and other public areas, the tree standard is 1.5-2 caliper inches. Tree planting shall also be in compliance with land use and street tree requirements.

Tree Credits

Approved Trees

The following tree and arborescent shrub* species are approved outright for use as simplified approach tree credits. Other species may be given credit, as approved.

Acer macrophyllum	Juniperus occidentalis*	Quercus garryana
Alnus rubra	Libocendrus decurrens	Rhamnus purshiana
Arbutus menziesii	Pinus contorta	Sequoia sempervirens
Castanopsis chrysophylla*	Pinus monticola	Thuja plicata
Chamacyparis lawsoniana	Pinus ponderosa	Tsuga heterophylla
Cornus nuttallii	Pseudotsuga menziesii	Umbellularia californica
Fraxinus latifolia	Quercus chrysolepis*	

EXISTING TREES:

Mature evergreen and deciduous trees can have significant benefits in addition to stormwater management. They already provide habitat for urban wildlife, energy and cost conservation, aesthetics, visual screens, heritage value, windbreaks, and recreation.

The stormwater credit applies to existing trees of 4-inch caliper or larger. Credit is based on one-half of the square footage of the tree canopy, measured within the drip-line.

Protection during construction shall be in the conformance with the City's tree preservation standards. The applicant will have to provide documentation required by the City to ensure the tree will remain healthy after construction and during the life of the project. During the life of the development, trees approved for stormwater credit shall not be removed without approval from the City. Stormwater management functions of any removed trees shall be replaced on the site with other trees or stormwater management approaches. Trees that die shall be replaced within 6 months. Trees shall be pruned in conformance with the Eugene Code 6.350, 7.280; Administrative Rules R 6.350, 7.280; Oregon Safety and Health Administration regulations, and the American National Standards Institute (A.N.S.I) Z133.1.300.

Tree Credits

Checklist of minimal information to be shown on the permit drawings:

1) Trees to be given stormwater management credit shall be clearly labeled as such, with the size and species included.
2) Approximate setbacks from property lines and structures shall be shown.
3) Temporary irrigation measures shall be shown, if applicable.
4) Form SIM must be submitted, clearly showing that less than 10% of the impervious area is being mitigated with tree credits.

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to new tree O&M form**

Additional photos:

*** Link to tree photos**

Tree Credits

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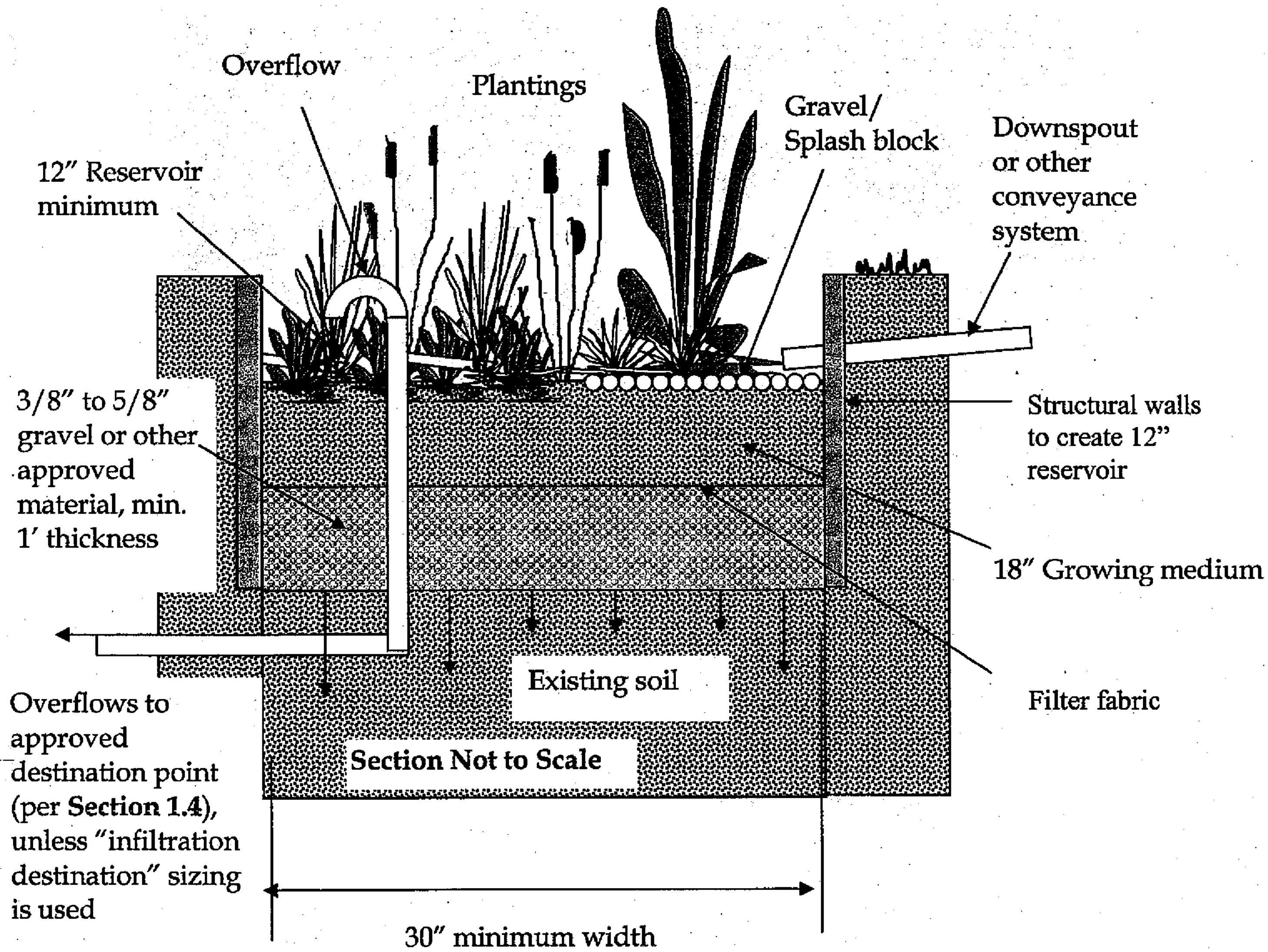
Infiltration Planter



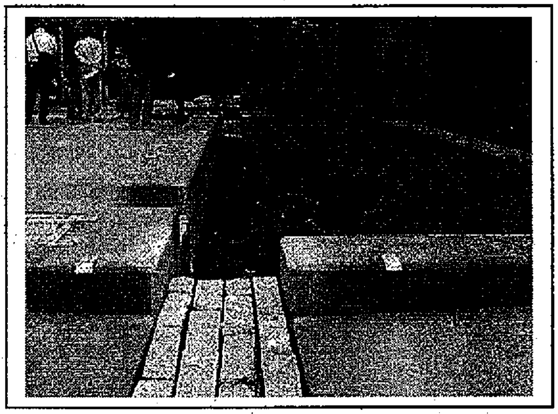
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	SIM, PERF[1]
√ Flow Control	SIM
√ Destination	PRES[2]

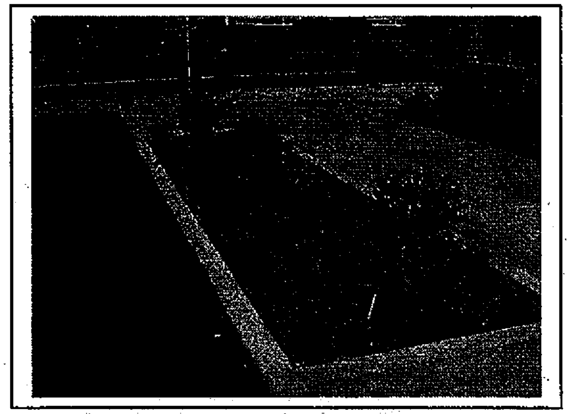
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution control. **2)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.
Infiltration planters may be designed to manage runoff from rooftops, and if submerged into the ground, parking lots and streets in many cases.

Infiltration Planter





Description: Infiltration planters are structural landscaped reservoirs used to collect, filter, and infiltrate stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground. In addition to providing pollution reduction, flow rates and volumes can also be managed with infiltration planters. Planters can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required, unless the facility is sized per **Surface Infiltration Facility** guidelines presented in this chapter.

Design Considerations: When designing infiltration planters, the infiltration rate of the native soil is a key element in determining size and viability.

Construction Considerations: Infiltration planter areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of planter areas. Infiltration rates shall be verified prior to construction.

<u>**Design Requirements:**</u>

Soil Suitability: Infiltration planters are appropriate for soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the facility and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.) Topsoil shall be used within the top 18 inches of the facility.

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum planter width is 30 inches. Planters shall be constructed without slope.

Infiltration Planter

Setbacks: Required setback from property lines is 5 feet, and 10 feet from structures.

Planter Walls: Planter walls shall be made of stone, concrete, brick, wood, or other durable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Individual infiltration planters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.07 may be used to receive credit for pollution and flow control. A high-flow overflow must be provided, or to receive credit for stormwater destination, the **Surface Infiltration Facility** design criteria from this chapter must be used. In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor. Planters shall be designed to pond water for less than 12 hours after each storm event.

Landscaping: Plantings shall be designed at the following quantities per **100** square feet of facility area. Facility area is equivalent to the area of the planter calculated from Form SIM.

4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Note: Tree planting is not required in planters, but is encouraged where practical. Tree planting is also encouraged near planters.

***Link to Flow-Through Planter Landscaping Plan Example**
***Link to Planter Recommended Plants**

Infiltration Planter

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Planter wall material and waterproofing membrane specification
4) Growing medium specification
5) Drain rock specification
6) Filter fabric specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
8) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Planter grading/ excavation	
Structural components/ liner	
Piping	Call for inspection
Drain rock	
Filter fabric	
Growing medium	
Plantings	Call for inspection

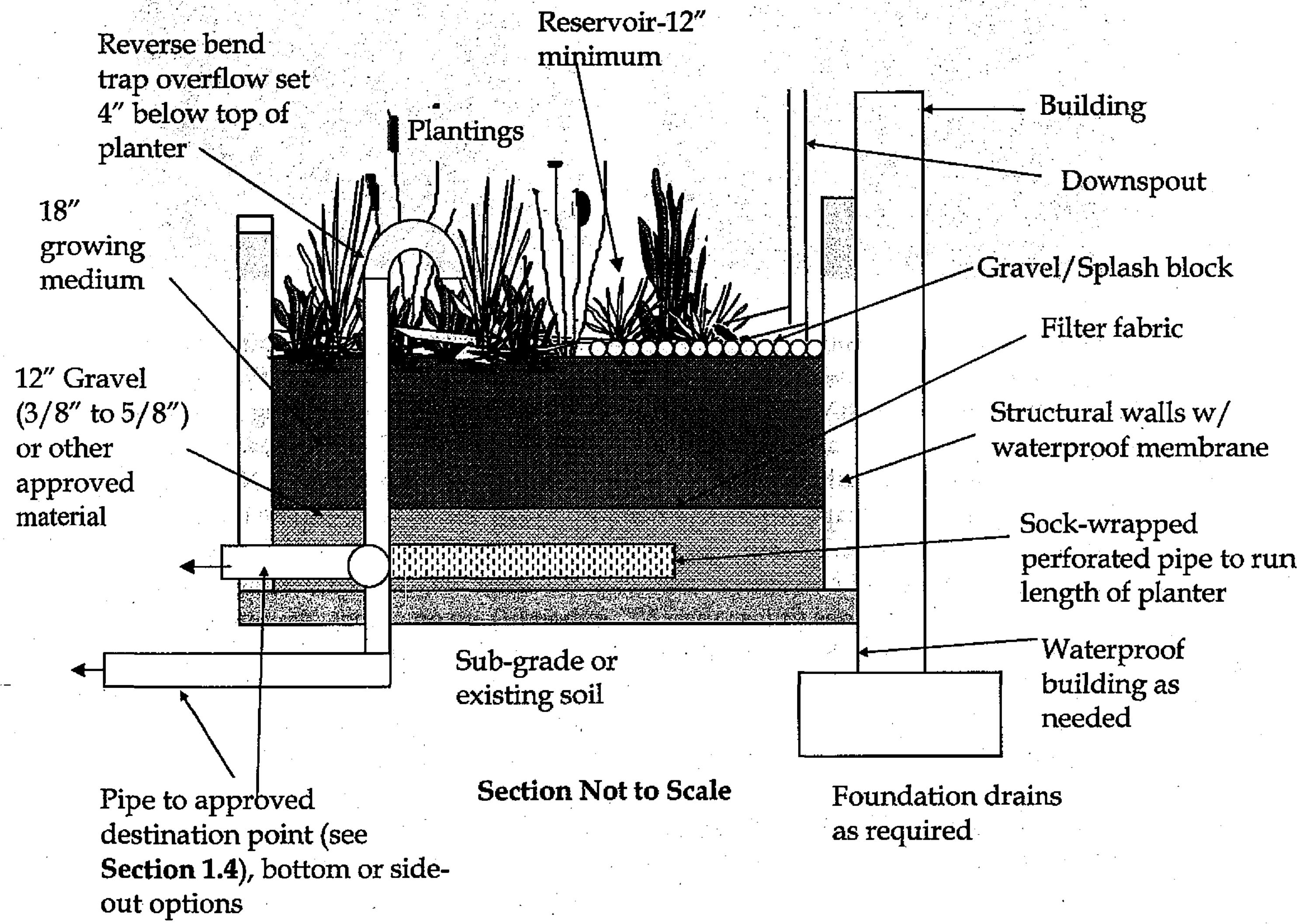
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to infiltration planter O&M form**

Additional photos and drawings:

*** Link to infiltration planter photos**
*** Link to infiltration planter drawings**

Flow-Through Planter



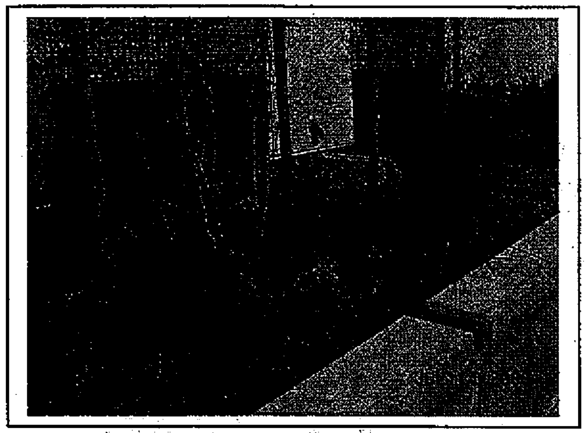
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	SIM, PERF[1]
√ Flow Control	SIM
Destination	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Flow-through planters may be designed to manage runoff from rooftops, and if submerged into the ground, parking lots and streets in some cases.

Flow-Through Planter

Description: Flow-through planters are structural landscaped reservoirs used to collect and filter stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil. In addition to providing pollution reduction, flow rates and volumes can also be managed with flow-through planters. Planters should be integrated into the overall site design. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. Because they include a waterproof lining, flow-through planters are extremely versatile and can be used next to foundation walls, adjacent to property lines (if less than 30" in height), or on slopes. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Design Considerations: When designing flow-through planters, the structural walls can often times be incorporated with building foundation plans.

Construction Considerations: Special attention needs to be paid to the planter waterproofing if constructed adjacent to building structures.

Design Requirements:

Soil Suitability: Flow-through planters are appropriate for all soil types. Topsoil shall be used within the top 18 inches of the facility.

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum planter width is 18 inches. Planter slopes shall be less than 0.5%.

Setbacks: Not applicable.

Planter Walls: Planter walls shall be made of stone, concrete, brick, or wood. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Flow-Through Planter

Sizing: Individual flow-through planters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.06 may be used to receive credit for pollution reduction and flow control. A high-flow overflow must be provided to an approved destination point per **Section 1.4**. In cases when pollution reduction is the only stormwater management goal, the performance approach may be used to downsize the simplified approach sizing factor. Planters shall be designed to pond water for less than 12 hours after each storm event.

Landscaping: Plantings shall be designed at the following minimum quantities per **100** square feet of facility area. Facility area is equivalent to the area of the planter calculated from Form SIM.

4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Note: Tree planting is not required in planters, but is encouraged where practical. Tree planting is also encouraged near planters.

***Link to Flow-Through Planter Landscaping Plan Example**
***Link to Planter Recommended Plants**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions
2) Profile view of facility, including typical cross-sections with dimensions
3) Planter wall material and waterproofing membrane specification
4) Growing medium specification
5) Drain rock specification
6) Filter fabric specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
8) Stormwater destination
9) Landscaping plan

Flow-Through Planter

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Planter grading/ excavation	
Structural components/ liner	
Piping	Call for inspection
Drain rock	
Filter fabric	
Growing medium	
Plantings	Call for inspection

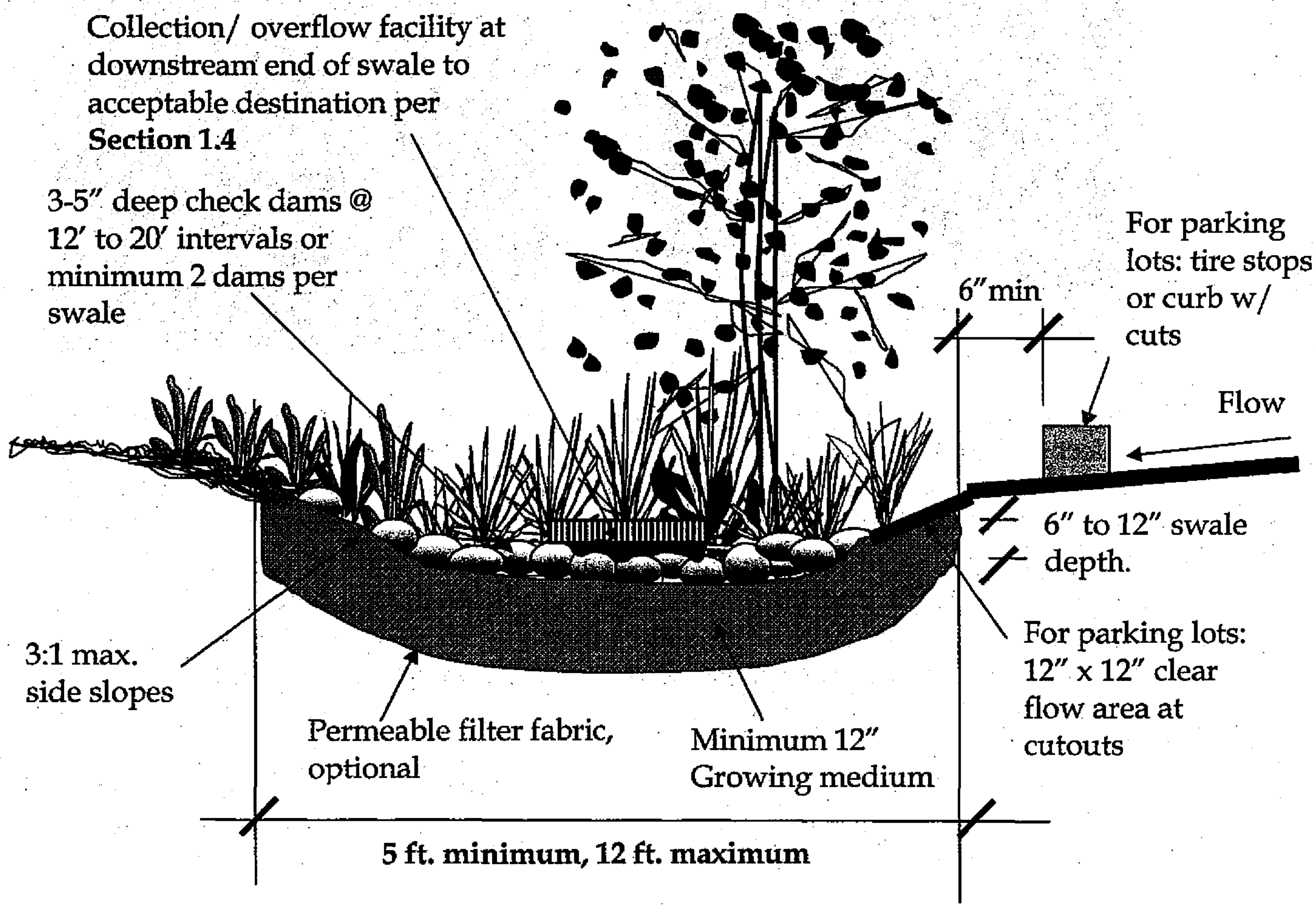
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to flow-through planter O&M form**

Additional photos and drawings:

*** Link to flow-through planter photos**
*** Link to flow-through planter drawings**

Vegetated Swale



Section Not to Scale

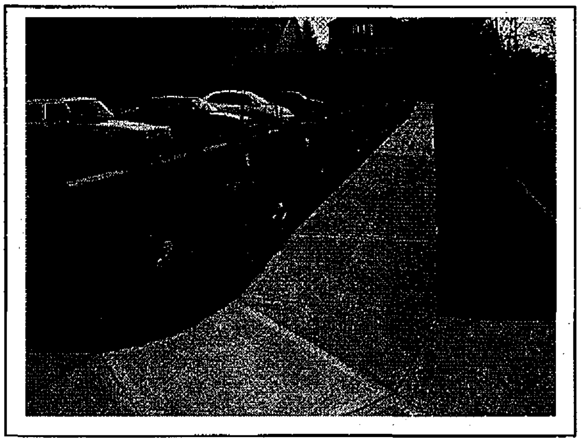
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction................................	SIM, PERF[1], PRES[2]
√ Flow Control..	SIM
√ Destination...	PRES[3]

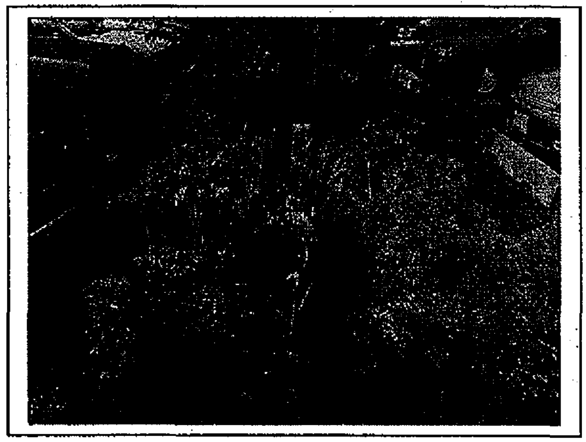
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Vegetated swales can be used to manage runoff from parking lots, rooftops, and private streets. For public street runoff, the street swale criteria must be used. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Vegetated Swale





Description: Vegetated swales are long narrow landscaped depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows from one bay to the next through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed with vegetated swales, as check dams are provided every 12 to 20 feet to slow and pool water. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale.

Design Considerations: When designing vegetated swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility.

Construction Considerations: Vegetated swale areas should be clearly marked before site work begins to avoid soil disturbance and compaction during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

Design Requirements:

Soil Suitability: Vegetated swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix F** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 3 horizontal to 1 vertical. Minimum flat bottom width is 2 feet for private swales, and 4 feet for public swales. Maximum longitudinal slope is 6% (temporary erosion control measures will be required on slopes greater than 2%, to stabilize soils until sufficient vegetative growth is established).

Vegetated Swale

Setbacks: Required setback from top of bank of swale is 10 feet from structures unless lined with impermeable fabric or approved by City.

Sizing: Vegetated swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.09 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4.** In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

   - Maximum design velocity of 0.9 feet per second.
   - Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
   - Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent .
   - Designed using a Manning "n" value of 0.35.
   - 3:1 (or flatter) side slopes in the treatment area.

   A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

   Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) Maximum bottom width shall be 8 feet.

3) Vegetation shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

4) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

5) Access routes to the swale for maintenance purposes must be shown on the plans. Public swales will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete, or soil by integrating them into the grading of the swale. Check dams shall be 12 inches in length, by the width of the swale, by 3 to 6 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the swale, including bottom and side slopes, as calculated from Form SIM. Minimum plant material quantities per 100 square feet of facility area are as follows:

1 - Evergreen or deciduous tree (planted around the perimeter of the swale):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants: 1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Vegetated Swale

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to vegetated swale O&M form**

Additional photos and drawings:

*** Link to vegetated swale photos**
*** Link to vegetated swale drawings**

Vegetated Swale

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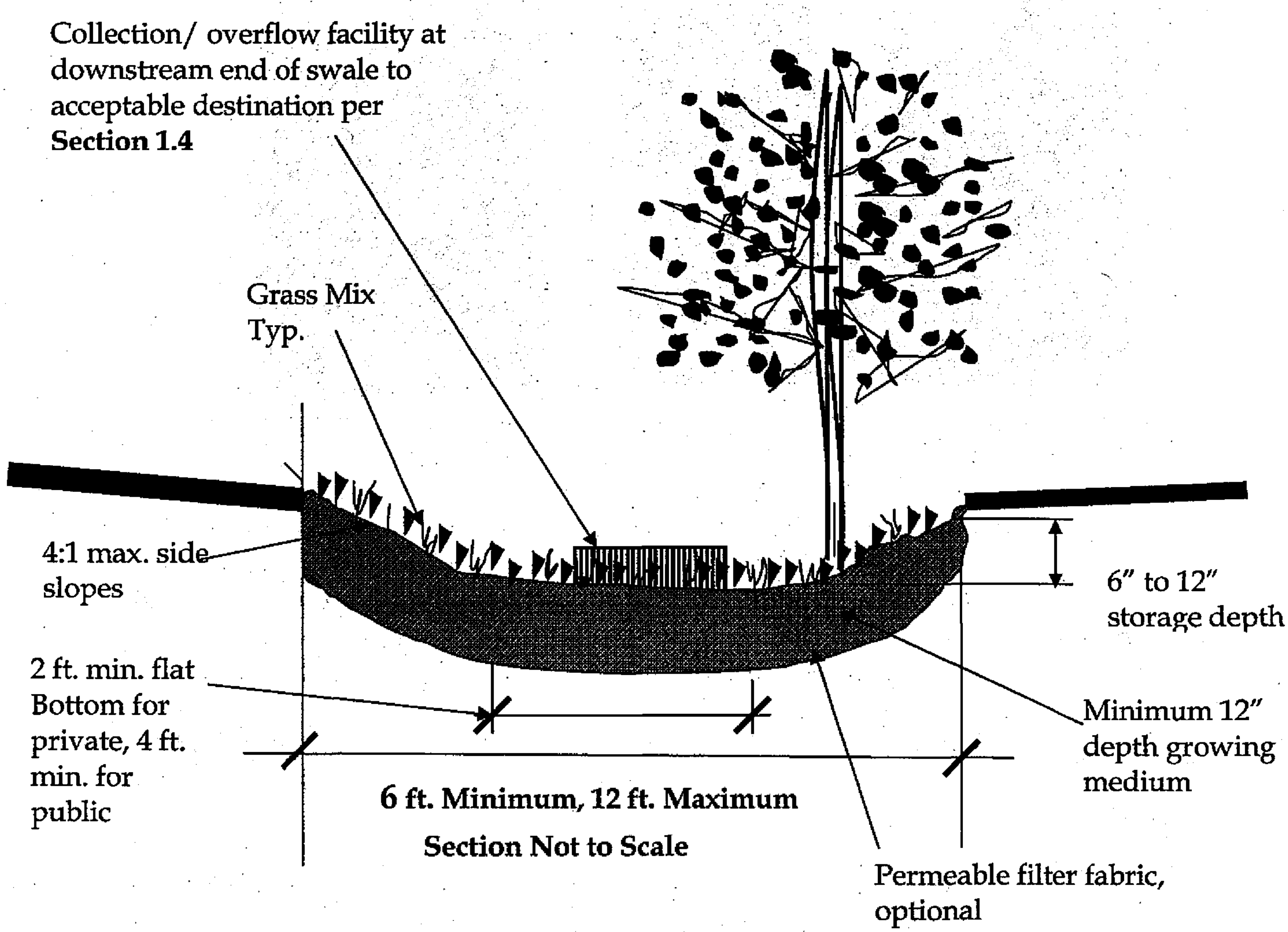
Grassy Swale



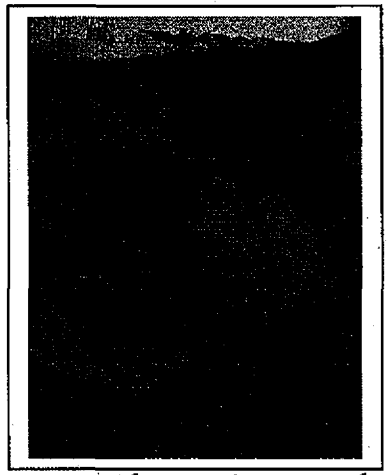
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction................................	SIM, PERF[1], PRES[2]
√ Flow Control..	SIM
√ Destination..	PRES[3]

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Grassy swales can be used to manage runoff from parking lots, rooftops, and private streets. For public street runoff, the street swale criteria must be used. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Grassy Swale



Description: Grassy swales are long narrow grassy depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed for small projects (<15,000 square feet of impervious surface) with grassy swales. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale.

Design Considerations: When designing grassy swales, slopes and depth should be kept as mild as possible to avoid safety risks and prevent erosion within the facility.

Construction Considerations: Grassy swale areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

Design Requirements:

Soil Suitability: Grassy swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 4 horizontal to 1 vertical. Minimum flat bottom width is 2 feet for private swales, and 4 feet for public swales. Minimum length is 100 feet. Maximum longitudinal slope is 5%, while minimum slope is 0.5%. Maximum surrounding ground slopes shall be 10%.

Grassy Swale

Setbacks: Required setback from is 10 feet from building foundations unless lined with impermeable fabric.

Sizing: Grassy swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.1 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4**. In cases when pollution reduction is the only stormwater management goal, or there is more than 15,000 square feet of impervious area to manage, the Presumptive Approach must be used size the swale for pollution reduction, and additional facilities will be required to meet flow control requirements, where applicable.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

   - Maximum design depth of 0.33 feet.
   - Maximum design velocity of 0.9 feet per second.
   - Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
   - Minimum longitudinal slope of 0.5 percent, maximum slope of 5 percent. For slopes greater than 2 percent, check dams shall be used (one 3 to 5-inch high dam every 12 feet).
   - Designed using a Manning "n" value of 0.25.
   - 4:1 (or flatter) side slopes in the treatment area.

   A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

   Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) The swale shall incorporate a flow-spreading device at the inlet. The flow spreader shall provide a uniform flow distribution across the swale

bottom. In swales with a bottom width greater than 6 feet, a flow spreader shall be installed at least every 50 feet.

3) To minimize flow channelization, the swale bottom shall be smooth, with uniform longitudinal slope, and with a minimum bottom width of 2 feet for private facilities and 4 feet for public facilities. Maximum bottom width shall be 8 feet.

4) Grasses or sod shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

5) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

6) Access routes to the swale for maintenance purposes must be shown on the plans. Public swales will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope.

Landscaping: Plantings shall be designed at the following quantities per **200** square feet of facility area. Facility area is equivalent to the area of the swale calculated from Form SIM. (Note: Facilities smaller than 200 square feet shall have a minimum of one tree per facility.):

1 Evergreen or Deciduous tree:

Evergreen trees:	Minimum height: 6 feet.
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.

Grass: Seed or sod is required to completely cover the grassy swale bottom and side slopes. (Shrubs are optional)

For the swale flow path, approved native grass mixes are preferable and may be substituted for standard swale seed mix. Seed shall be applied at the rates specified by the supplier. The applicant shall have plants established at the time of facility completion (at least 3 months after seeding). No runoff shall be allowed to flow in the swale until grass is established. Trees and shrubs may be allowed in the flow path within swales if the swale exceeds the minimum length and widths specified.

Native wildflowers, grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

***Link to Grassy Swale Recommended Seed Mixes**

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings/ seeding/ sod	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to grassy swale O&M form**

Additional photos and drawings:

*** Link to grassy swale photos**
*** Link to grassy swale drawings**

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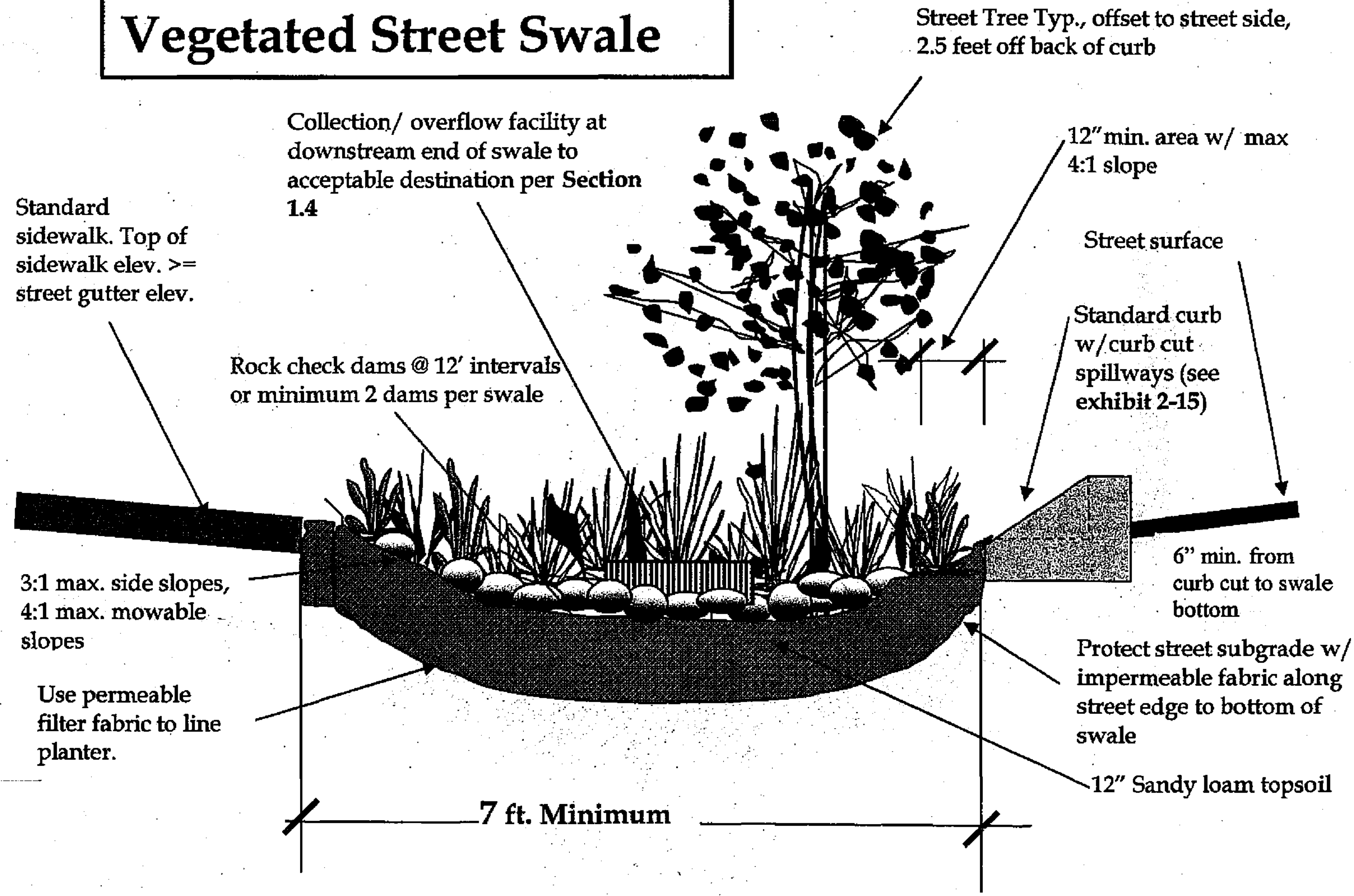
Street Swales

Vegetated Street Swale



Section Not to Scale

Stormwater Management Goals Achieved Acceptable Sizing Methodologies

√ Pollution Reduction.................................. SIM, PERF[1], PRES[2]
√ Flow Control... SIM
√ Destination.. PRES[3]

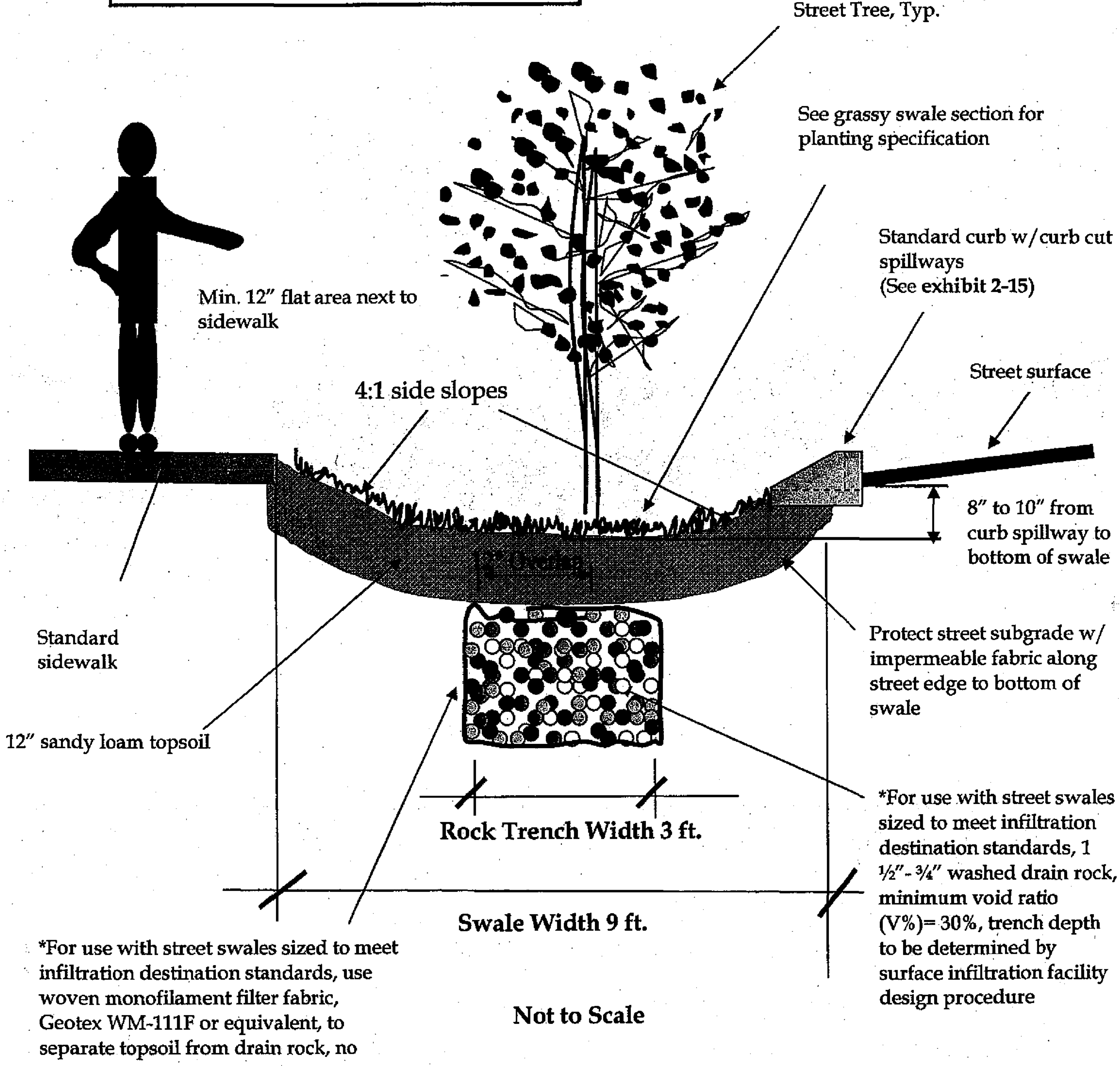
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Street swales can be used to manage runoff from parking lots, rooftops, and private streets. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

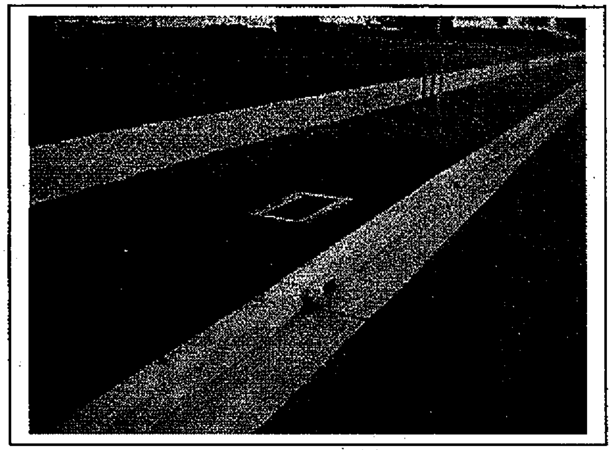
Street Swales

Grassy Street Swale



***Note:** Overflow to an approved destination point is required, unless swale is sized in accordance with **Surface Infiltration Facility** design procedure.

Street Swales

Description: Street construction poses particular challenges related to stormwater management design. Lack of available space is often the most difficult hurdle in locating stormwater pollution reduction and flow control facilities in or near allocated rights-of-way. Specific street swale designs that incorporate pollution reduction, flow control, and volume control into the cross-section of the street have been developed. For more information and ideas about stormwater friendly street designs, Metro has developed three handbooks: "Creating Livable Streets," "Green Streets," and "Trees for Green Streets." These handbooks can be purchased from Metro at: **www.metro-region.org.**

Street swales are long narrow landscaped depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows from one bay to the next through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed with street swales, as check dams are provided every 12 to 20 feet to slow and pool water. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale, unless the swale is designed per the surface infiltration facility criteria presented in this chapter.

Design Considerations: When designing street swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility. All applicable City requirements for other street elements (curbs, sidewalks, trees, etc.) must be met.

Construction Considerations: Street swale areas should be clearly marked before site work begins to avoid soil disturbance and compaction during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

Street Swales

Design Requirements:

Soil Suitability: Street swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 3 horizontal to 1 vertical for vegetated swales, and 4 horizontal to 1 vertical for grassy swales (to accommodate for mowing). Minimum flat bottom width is 2 feet. Maximum longitudinal slope is 6% (temporary erosion control measures will be required on slopes greater than 2%, to stabilize soils until sufficient vegetative growth is established).

Setbacks: Required setback from building foundations is 10 feet unless lined with impermeable fabric.

Sizing: To meet pollution reduction and flow control requirements, the square-footage of street swales is to be determined using vegetated or grassy swale sizing criteria (shown on **Form SIM**), depending on which surface treatment is being used. The minimum width for street swales is 7 feet for vegetated, and 9 feet for grassy. Street swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.09 for vegetated swales and 0.10 for grassy swales may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4**.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

- Maximum design velocity of 0.9 feet per second.
- Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
- Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent. For slopes greater than 2 percent, check dams shall be used (one dam every 12 feet).
- Designed using a Manning "n" value of 0.25 for grassy swales and 0.35 for vegetated swales.

A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) The swale shall incorporate a flow-spreading device at the inlet. The flow spreader shall provide a uniform flow distribution across the swale bottom. In swales with a bottom width greater than 6 feet, a flow spreader shall be installed at least every 50 feet.

3) Minimize flow channelization, with uniform longitudinal slopes, and with a minimum bottom width of 2 feet for private facilities and 4 feet for public facilities. Maximum bottom width shall be 8 feet.

4) Vegetation shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

5) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete, or soil by integrated them into the grading of the swale. Check dams shall be 12 inches in length, by the width of the swale, by 3 to 5 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the swale, including bottom and side slopes, as calculated from Form SIM. Turf grass may be used to cover the entire swale surface area. If plantings are chosen to landscape the swale, the minimum plant material quantities per 100 square feet of facility area shall be as follows:

4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Street Swales

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually.

Recommended street trees in or near street swales:

With overhead power lines	**Without overhead power lines**
Acer campestre 'Evelyn'	Betula jacquemontii
Carpinus caroliniana	Celtis occidentalis
Cercis Canadensis	Fraxinus pennsylvanica 'Johnson'
Gleditsia triacanthos 'Impcole'	Gleditsia triacanthos 'Skycole'
Koelreuteria paniculata	Nyssa sylvatica
	Quercus shumardii

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All curb cut details and stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Street Swales

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Curbs / curb cuts	Call for inspection
Piping (if applicable)	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to vegetated and grassy swale O&M form**

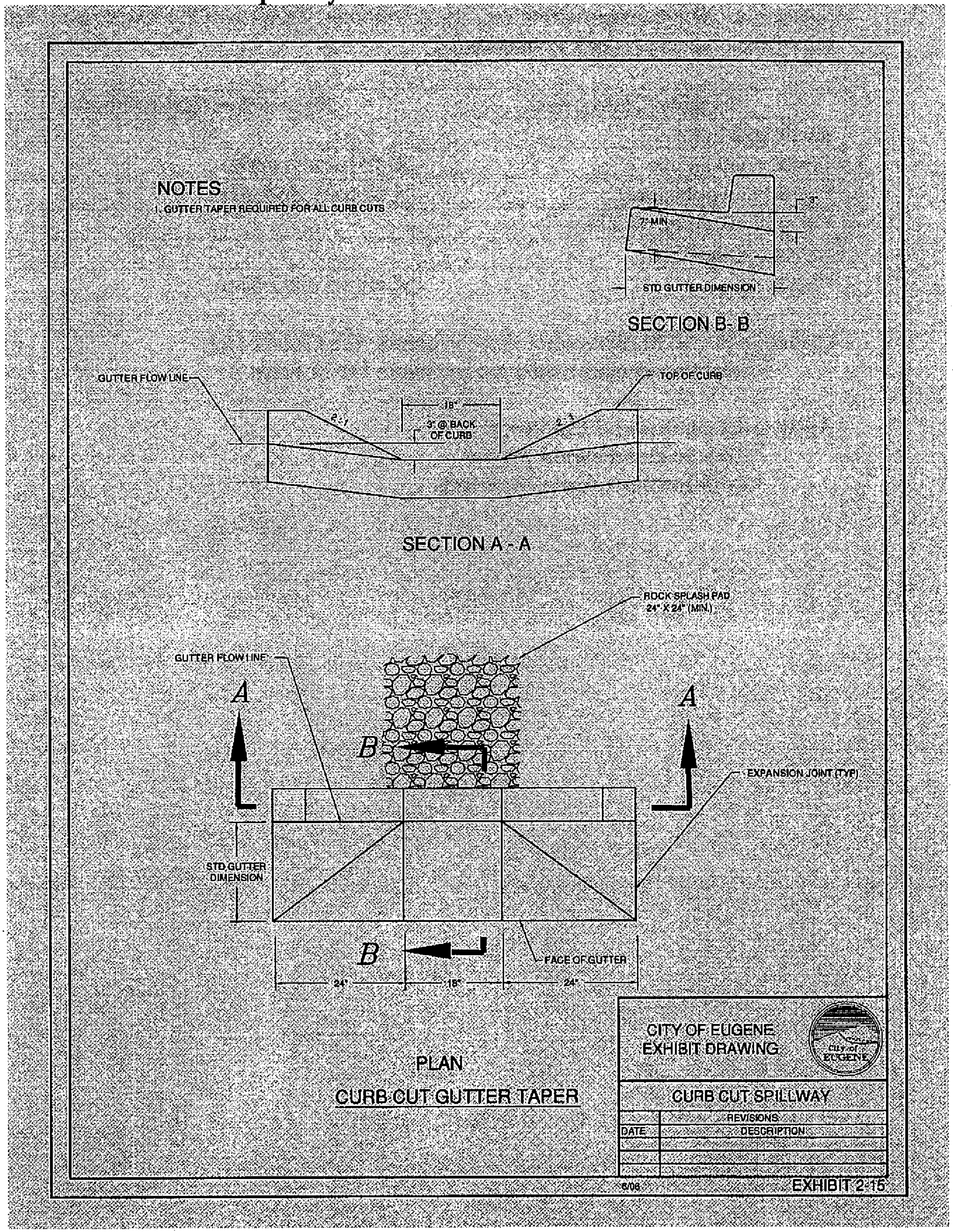
Additional photos and drawings:

*** Link to street swale photos**

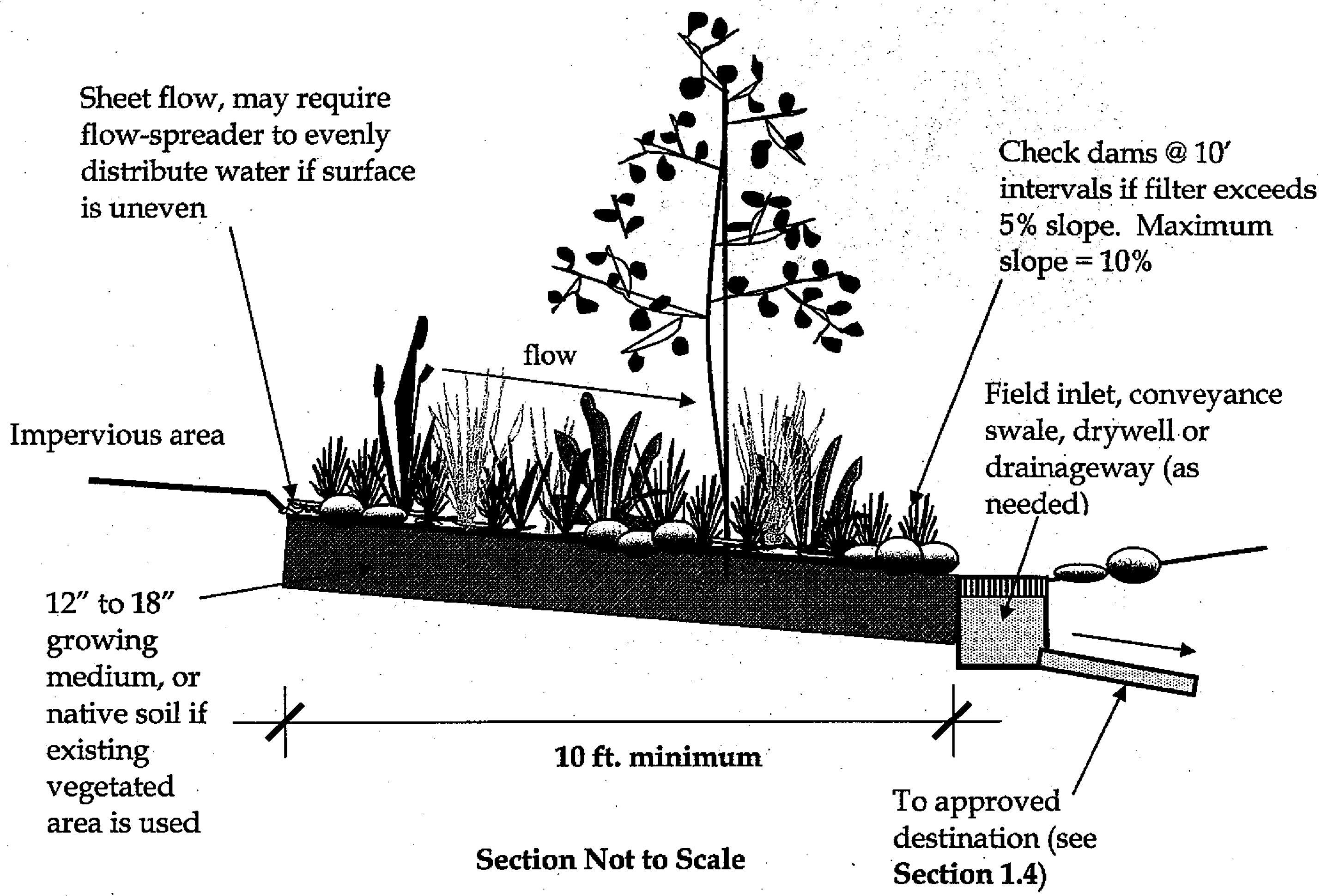
*** Link to street swale drawings**

Street Swales

Exhibit 2-15: Curb Cut Spillway



Vegetated Filter Strip



Section Not to Scale

<u>**Stormwater Management Goals Achieved**</u>   <u>**Acceptable Sizing Methodologies**</u>

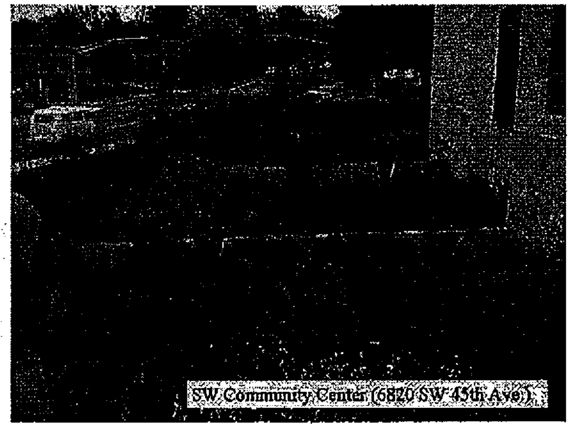
√ Pollution Reduction............................SIM, PERF[1]
√ Flow Control.......................................SIM
√ Destination[2]......................................SIM[2]

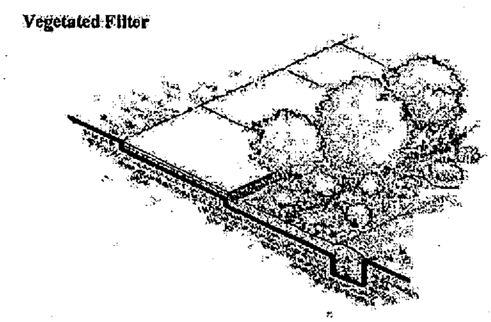
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Vegetated filters can be used to manage stormwater from rooftops, pathways, parking lots, and potentially streets (with flow spreaders or if the runoff is left as unconcentrated sheet flow). **2)** Where soils infiltrate sufficiently, stormwater destination credit may be given for projects with less than 500 square feet of impervious surfaces to manage.

Vegetated Filter Strip


SW Community Center (6820 SW 45th Ave)



Description: Vegetated filter strips, or vegetated filters, are gently sloping areas used to filter, slow, and infiltrate stormwater flows. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a flow spreader. Flow control is achieved using the relatively large surface area and for slopes greater than 5%, a generous proportion of check dams or terraces. Pollutants are removed through filtration and sedimentation. Filters can be planted with a variety of trees, shrubs, and ground covers, including grasses. Sod may be used for single-family residential sites, where a simple downspout disconnection into lawn or landscaping is used. There are an infinite number of ways to fit this concept into site designs and designers are encouraged to use the site landscape areas for this purpose. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the filter.

Design Considerations: When designing vegetated filters, slopes should be kept as flat as possible to prevent erosion. Spreading the flow evenly across the filter is also important in ensuring that the facility functions correctly and avoids flow channeling.

Construction Considerations: Vegetated filter areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of filter areas. Flow spreaders must be constructed perfectly level to distribute flows evenly across the filter, and for public facilities must be surveyed after construction.

Design Requirements:

Soil Suitability: Vegetated filters are appropriate for all soil types. Unless existing vegetated areas are used for the filter, topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Vegetated Filter Strip

Dimensions and Slopes: Maximum allowable vegetated filter slopes are 10%. Terraces may be used to decrease ground slopes. Minimum slopes are 0.5%.

Setbacks: Required setback is 10 feet from structures unless lined with impermeable fabric.

Sizing: Unless used for very long, narrow projects such as pathways and trails, vegetated filters cannot be used to manage flow from more than 2,000 square-feet of impervious area. Filters shall be a minimum of 10 feet wide x 10 feet long. A Simplified Approach sizing factor of 0.2 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the filter to an approved destination point, per **Section 1.4.** In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete. Check dams shall be 12 inches in length, by the width of the filter, by 3 to 5 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. Sod may be used for single-family residential sites, where a simple downspout disconnection into lawn or landscaping is used. For other projects, minimum plant material quantities per **100** square feet of facility area are as follows. The "facility area" is equivalent to the area of the filter, as calculated from Form SIM.

1 - Evergreen or deciduous tree (planted around the perimeter of the swale):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Vegetated Filter Strip

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification (if applicable)
4) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
5) Landscaping plan
6) Flow spreader details and specifications
7) Check dam or terrace details and specifications

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Filter grading (if applicable)	
Flow spreaders/Terraces (if applicable)	
Piping (if applicable)	Call for inspection
Growing medium (if applicable)	
Plantings	Call for inspection

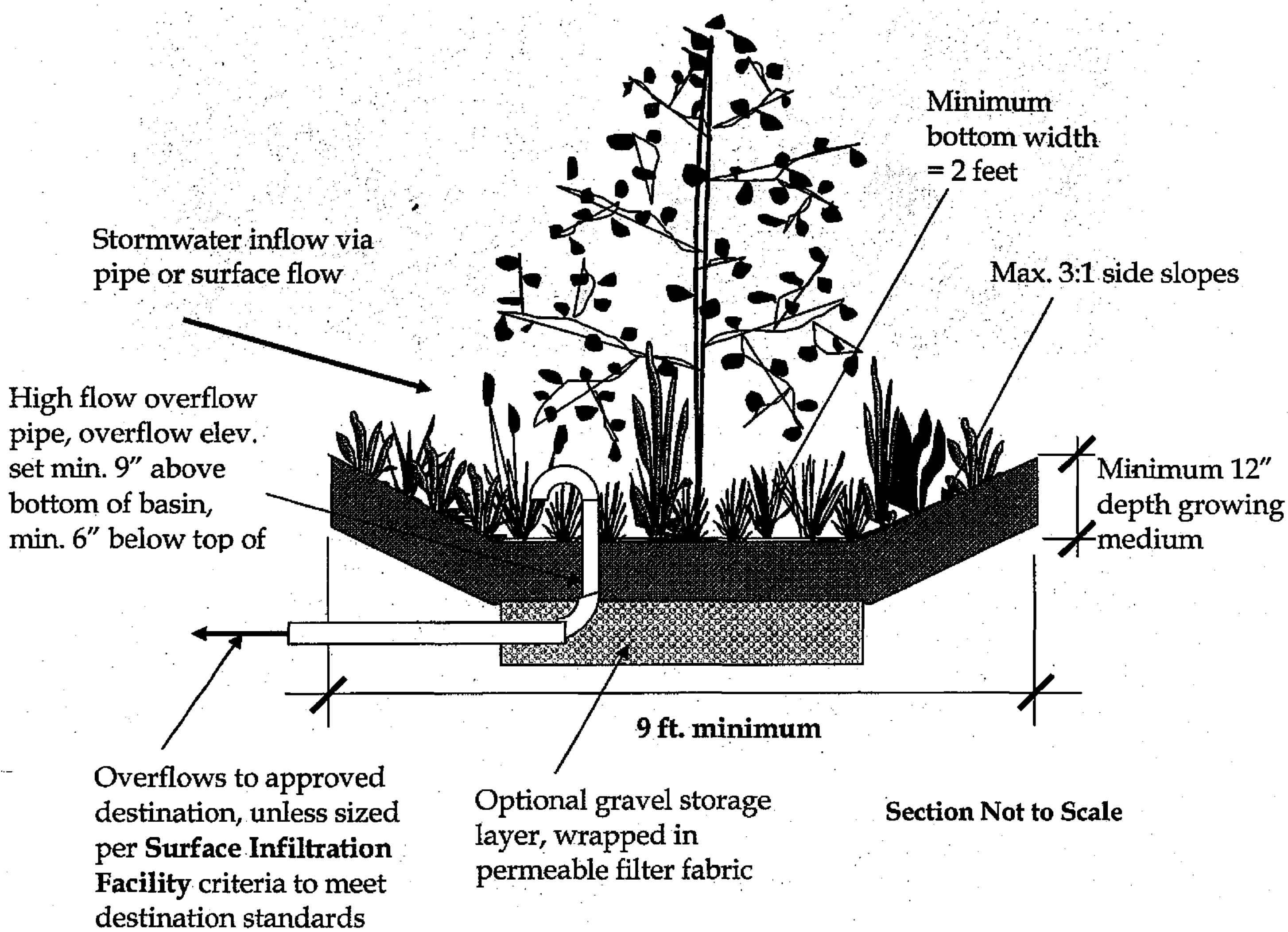
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to vegetated filter O&M form**

Additional photos and drawings:

*** Link to vegetated filter photos**
*** Link to vegetated filter drawings**

Vegetated Infiltration Basin



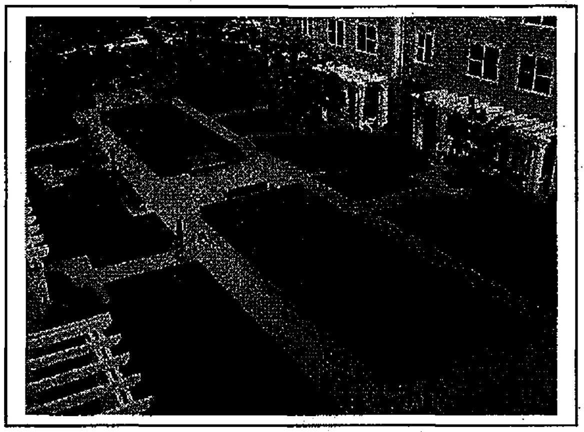
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction...............................	SIM, PERF[1]
√ Flow Control.......................................	SIM
√ Destination..	PRES[2]

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution control. **2)** The **Surface Infiltration Facility** sizing methodology from this chapter may be used to achieve stormwater destination. Vegetated infiltration basins can be used to manage stormwater from all impervious surface types, and must be located on private property.

Vegetated Infiltration Basin



Description: Vegetated infiltration basins are shallow landscaped depressions used to collect and hold stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground. In addition to providing pollution reduction, flow rates and volumes can also be managed with vegetated infiltration basins. They should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. As shown in the example photos, the design can be formal or informal in character and planting scheme. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required, unless the basin is designed per "infiltration swale" guidelines presented in the chapter.

Design Considerations: When designing vegetated infiltration basins, the infiltration rate of the native soil is a key element in determining size and viability. Slopes and depth should be kept as mild as possible to avoid safety risks.

Construction Considerations: Infiltration basin areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of infiltration basin areas.

Design Requirements:

Soil Suitability: Vegetated infiltration basins are appropriate for soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the facility and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Vegetated Infiltration Basin

Dimensions: Facility storage depth may vary from 9 to 18 inches. Maximum side slopes are 3 horizontal to 1 vertical. Minimum bottom width is 2 feet.

Setbacks: Required setback is 10 feet from building foundations. Infiltration basins shall meet the following setback requirements from downstream slopes: minimum of 100 feet from slopes of 10%; add 5 feet of setback for each additional percent of slope up to 30%; 200-foot setback for slopes of 30%; infiltration trenches shall not be used where slopes exceed 30%.

Sizing: Vegetated infiltration basins sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.11 may be used to receive credit for pollution reduction and flow control. A high-flow overflow must be provided, or to receive credit for complete stormwater infiltration, the "infiltration swale" design criteria from this chapter must be used. In this case, pre and post-construction infiltration tests are required to demonstrate infiltration performance. In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor. Drawdown time (time for the basin to empty water from the water quality design storm) shall not exceed 24 hours.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the basin, including bottom and side slopes, plus a 10-foot buffer around the basin. Minimum plant material quantities per 300 square feet of facility area are as follows:

1 - Evergreen or deciduous tree (planted around the perimeter of the basin):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants: 1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

For vegetated infiltration basins, the following additional design criteria shall apply:

1) Two staff gauges shall be installed at opposite ends of the bottom of the basin, to enable maintenance staff to measure the depth of accumulated silts.

2) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional geotechnical engineer, shall inspect the soil after the system is excavated to confirm that soils remain in suitable condition for infiltration.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Basin grading	
Piping	Call for inspection
Filter fabric	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

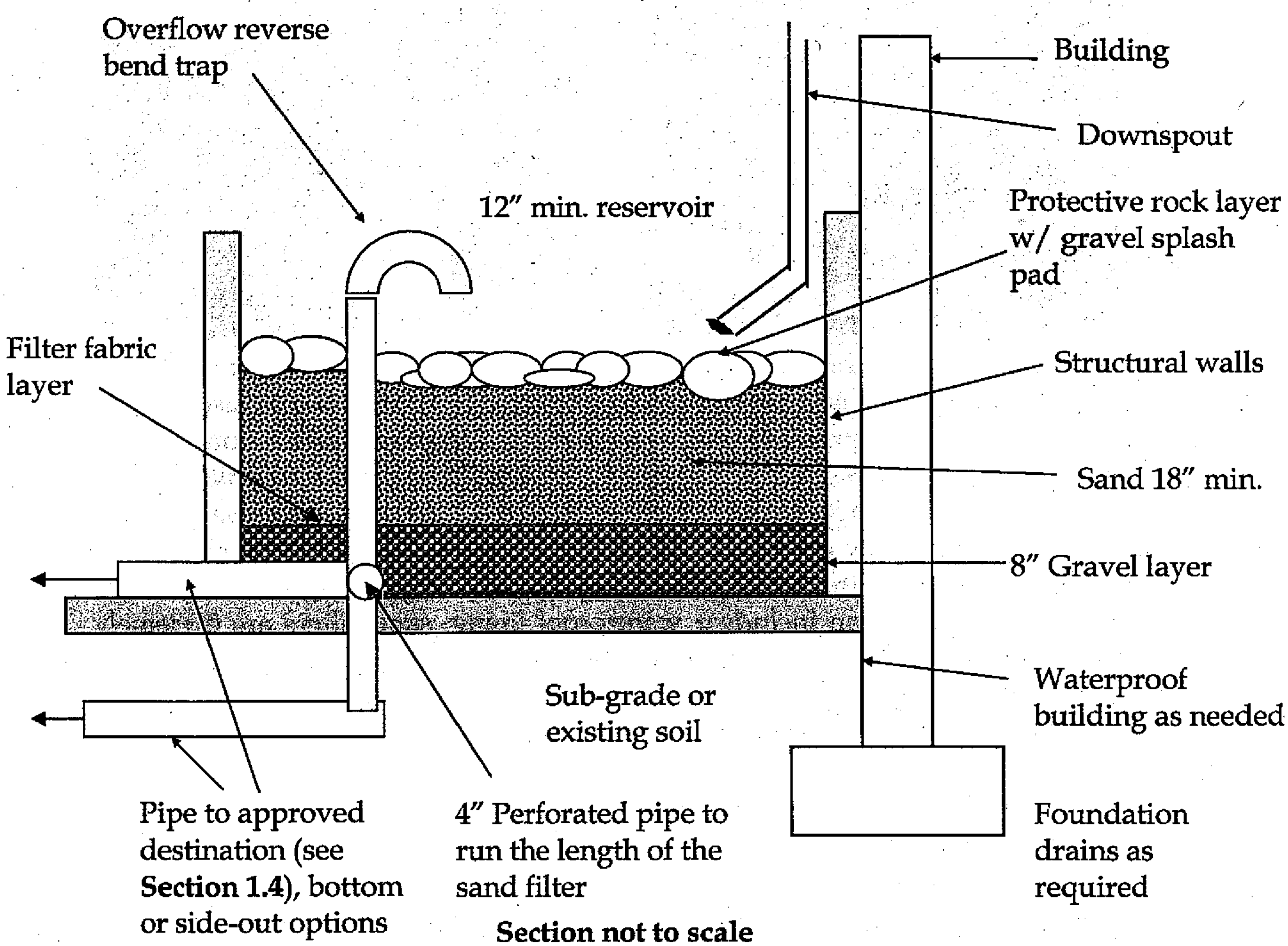
*** Link to vegetated infiltration basin O&M form**

Additional photos and drawings:

*** Link to vegetated infiltration basin photos**

*** Link to vegetated infiltration basin drawings**

Sand Filter



Section not to scale

Stormwater Management Goals Achieved — **Acceptable Sizing Methodologies**

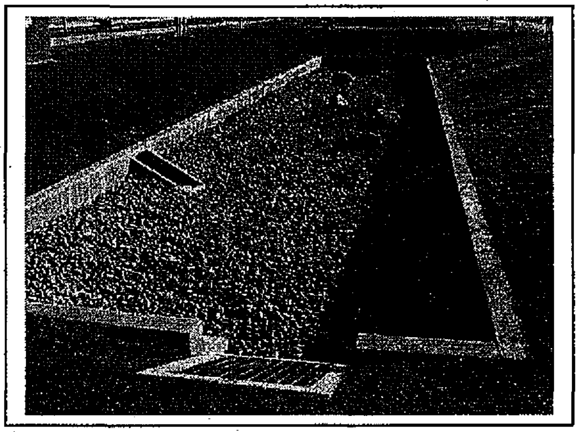
√ Pollution Reduction............................... SIM, PERF[1]
√ Flow Control.. SIM
√ Destination.. PRES[2]

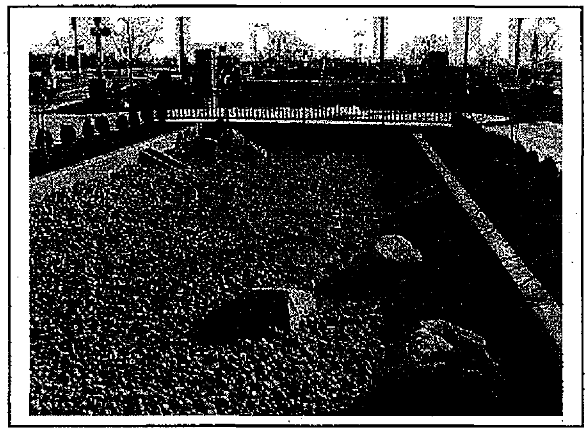
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Sand filters can be used to manage stormwater from any impervious surface, and must be located on private property. **2)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Sand Filter





Description: There are two sand filter options. One is designed with an impervious bottom or is placed on an impervious surface. It can be used for all soil types. The other option, for native soils with a minimum infiltration rate of 2 inches per hour (NRCS soil types A and B), allows filtered water to infiltrate into the ground. For both options, pollutant reduction is achieved as the water filters through the sand; flow control is obtained by slowing the discharge rate as the water filters through the sand. Filters may be constructed in-ground or above grade. Because they can include a waterproof lining, sand filters are extremely versatile and can be used next to foundation walls, adjacent to property lines (if less than 30" in height), or on slopes. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Design Considerations: When designing sand filters, the structural walls can often times be incorporated with building foundation plans.

Construction Considerations: Special attention needs to be paid to the filter waterproofing if constructed adjacent to building structures.

Design Requirements:

Soil Suitability: Lined sand filters are appropriate for all soil types. Filters designed to infiltrate into native soils are appropriate in soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C).

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum sand filter width is 18 inches. Filter slopes shall be less than 0.5%.

Setbacks: Required setback from property lines is 5 feet, unless the sand filter height is less than 30 inches. Required setback from building structures is 10 feet, unless the sand filter is properly lined.

Sand Filter

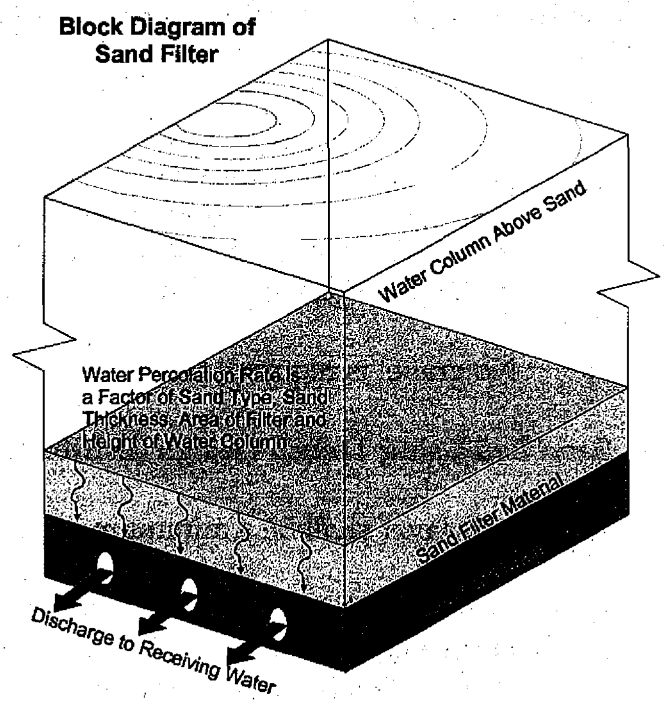
Structural Walls: Sand filter walls shall be made of stone, concrete, brick, or wood. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Sand filters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.06 may be used to receive credit for pollution reduction and flow control. For projects with more than 15,000 square-feet of impervious surface, additional facilities may be required to meet flow control requirements. A high-flow overflow must be provided to an approved destination point per **Section 1.4**. In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used to downsize the Simplified Approach sizing factor. Sand filters shall be designed to pond water for less than 4 hours after each storm event.

Vegetation: Plantings are optional in sand filters. For aesthetic purposes, potted plants may be submerged in the sand filter.

For public sand filters, the following additional criteria shall apply:

The sand filter consists of an inlet structure, sand bed, underdrain piping, and basin liner. Criteria for these components are provided below.



Inlet Structure

1) The inlet structure shall spread the flow of incoming water uniformly across the surface of the filter medium during all anticipated flow conditions. This flow shall be spread in a manner that prevents roiling or otherwise disturbing the filter medium.

Sand Bed/ Filter Medium

1) The length-to-width ratio shall be 2:1 or greater.

2) The sand bed configuration may be either of the two configurations shown in **Exhibit 2-16**. All depths shown are final depths. The effects of consolidation and/or compaction must be taken into account when placing medium materials. The surface of the filter medium shall be level.

3) Sand used as filter medium shall be certified by a testing laboratory as meeting or exceeding the specifications presented below:

The filter bed medium shall consist of clean medium to fine sand with no organic material, or other deleterious materials and meeting the following gradation:

Sieve Size	Percent Passing
3/8"	100
#4	95-100
#8	80-100
#16	45-85
#30	15-60
#50	3-15
#100	< 4

Sand Bed with Gravel Filter (Exhibit 2-16:A)

1) The top layer shall be a minimum of 18 inches of approved sand.

2) The sand shall be placed over an acceptable geofabric material covering a layer of ½- to 2-inch washed drain rock. The finished depth of this drain rock shall be sufficient to provide a minimum of 2 inches of cover over the underdrain piping system.

3) No gravel is required below the underdrain piping system.

Sand Bed Using Trench Design (Exhibit 2-16:B)

1) The top layer shall be a minimum of 12 inches of approved sand.

2) The sand shall be placed over an acceptable geotextile fabric material covering a layer of ½ to 2-inch washed drain rock. The finished depth of this drain rock shall be sufficient to provide a minimum of 2 inches of cover over the underdrain piping system.

3) The piping and gravel shall be underlain with geotextile fabric.

Sand Filter

Underdrain Piping

1) The underdrain piping system shall consist of appropriately sized (minimum 4-inch diameter) collector manifold with perforated lateral branch lines. The pipe used in this conveyance system shall be schedule 40 polyvinyl chloride (PVC) material or an approved equal. Lateral spacing shall not exceed 10 feet.

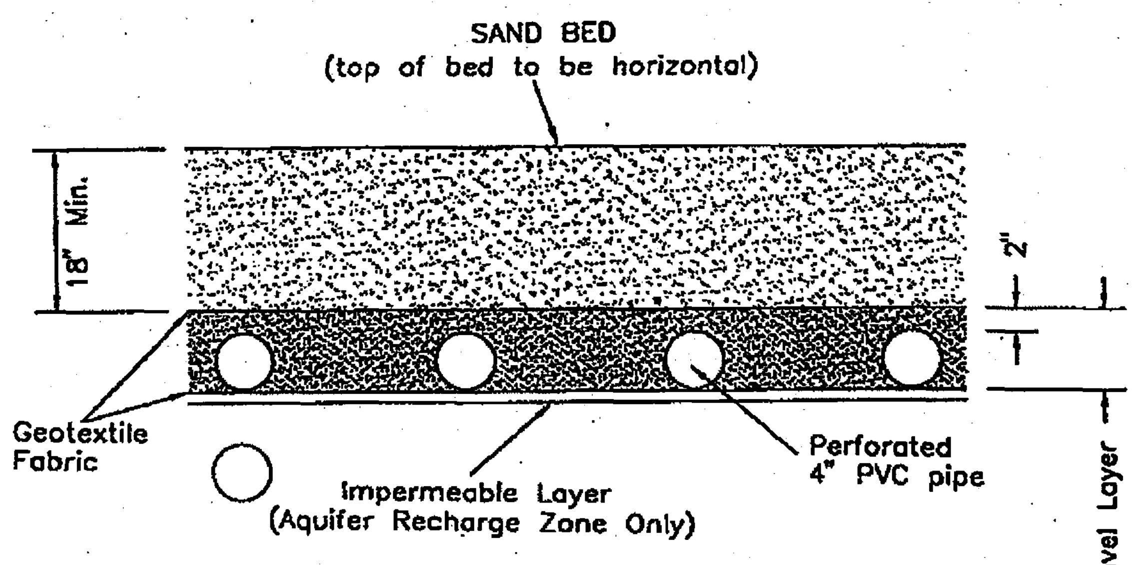
2) The underdrain laterals shall be placed with positive gravity drainage to the collector manifold.

3) The collector manifold shall have a minimum 1 percent grade toward the discharge point.

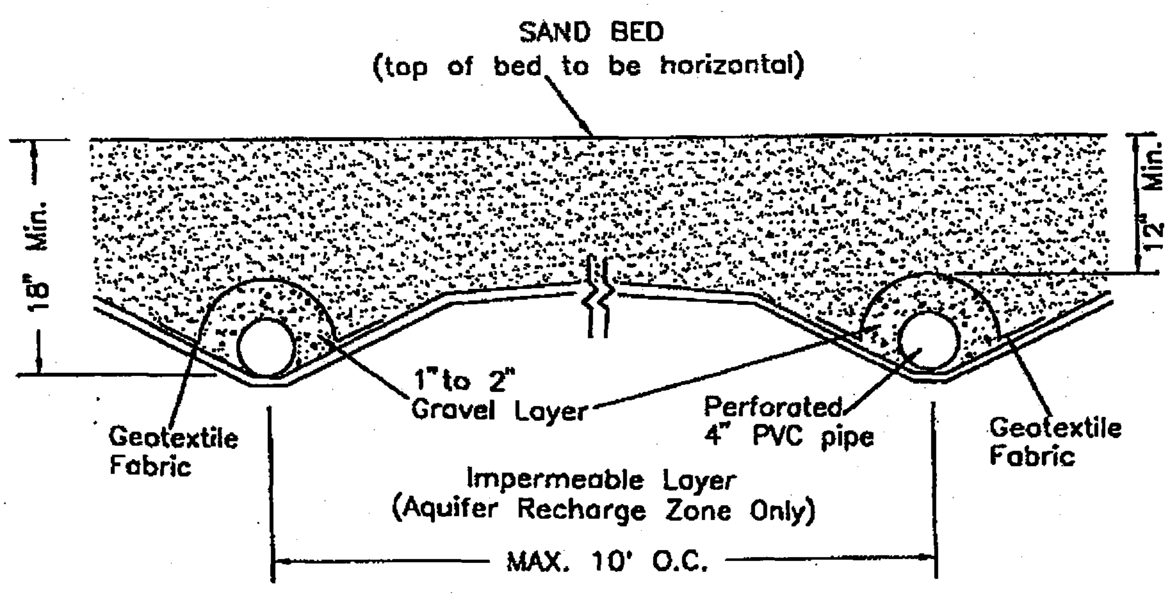
4) All laterals and collector manifolds shall have cleanouts installed, accessible from the surface without removing or disturbing filter media.

Sand Filter

Exhibit 2-16



A. SAND BED PROFILE (with gravel filter)



B. SAND BED PROFILE (trench design)

Sand Filter

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Structural wall material specification
4) Sand specification
5) Filter fabric specification
6) Rock surface layer specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Sand filter grading	
Structural walls	Call for inspection
Piping	Call for inspection
Sand	
Filter fabric	
Rock layer	
Plantings (if applicable)	

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to sand filter O&M form**

Additional photos and drawings:

*** Link to sand filter photos**

Sand Filter

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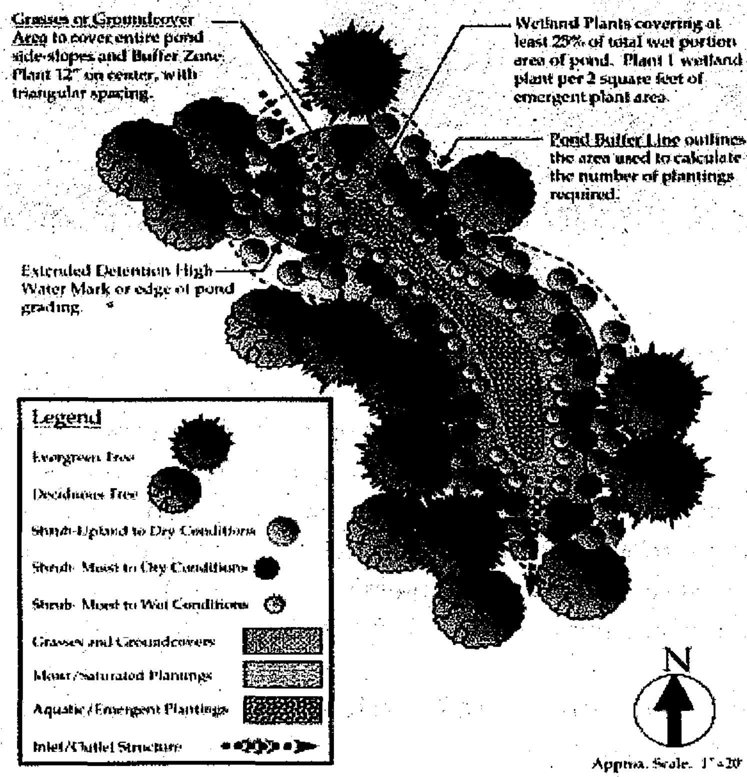
Wet, Extended Wet, & Dry Detention Pond

Wet and Extended Wet Ponds

The plan below illustrates a typical planting plan for an approximately 3,500 square foot wet or extended wet pond. This plan is diagrammatic use only. The actual project site condition may require designers to consider numerous other pond configurations and planting layouts.



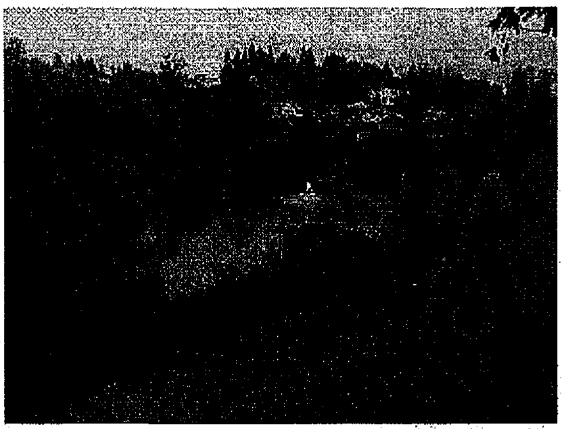
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction...............................	PRES[1]
√ Flow Control..	PRES[2]
Destination..	NA

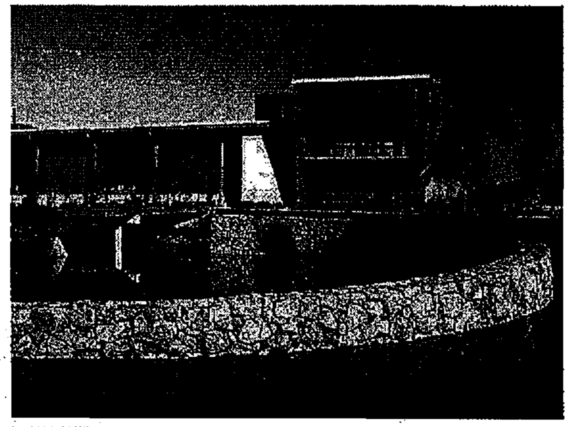
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Wet and extended wet detention ponds receive credit for pollution reduction. For dry detention ponds to receive credit for pollution reduction, the bottom flow path of the pond must be designed as a vegetated or grassy swale, with sizing and design in accordance with criteria presented in this chapter. **2)** Only extended wet detention and dry detention ponds receive credit for flow control. All ponds must overflow to an acceptable stormwater destination per **Section 1.4.** Wet and extended wet detention ponds can be used to provide pollution reduction for any impervious surfaces, and must be located outside of public rights-of-way.

Wet, Extended Wet, & Dry Detention Pond





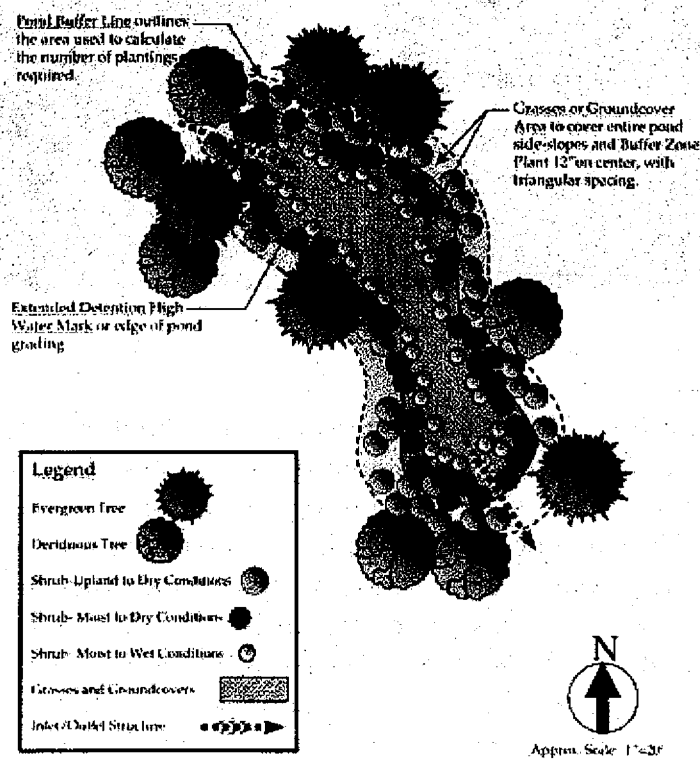
Wet Pond Description: Wet ponds are constructed with a permanent pool of water (called pool storage or dead storage). Stormwater runoff enters the pond at one end and displaces water from the permanent pool. Pollutants are removed from stormwater through gravitational settling and biologic processes. When the sizing criteria presented in this section is used, pollution reduction requirements are presumed to be met. Additional facilities will be required to meet flow control requirements, as applicable. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Extended Wet Detention Pond Description: Extended wet detention ponds are constructed with a permanent pool of water (called pool storage or dead storage) and additional storage above, which fills during storm events and releases water slowly over a number of hours. The permanent pool is sized to provide pollution reduction, and the additional storage above (extended detention area) is sized to meet flow control requirements. Pollutants are removed from stormwater through gravitational settling and biologic processes. When the sizing criteria presented in this section is used, pollution reduction requirements are presumed to be met. The extended detention portion of this facility must be designed using acceptable hydrologic modeling techniques (see **Section 2.3**) to meet applicable flow control requirements (see **Section 1.6.2**). An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

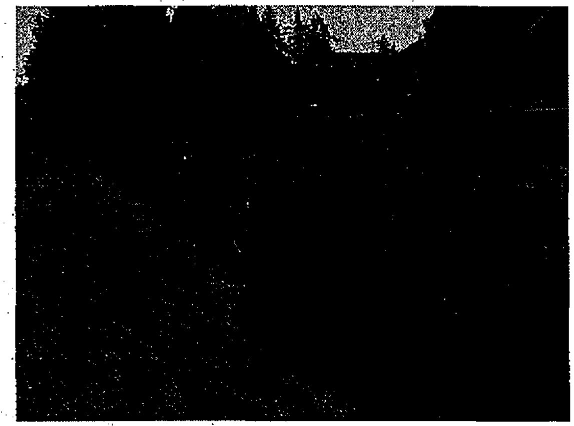
Dry Detention Pond Description: Dry detention ponds are vegetated basins designed to fill during storm events and slowly release the water over a number of hours. Dry detention ponds must be designed using acceptable hydrologic modeling techniques (see **Section 2.3**) to meet applicable flow control requirements (see **Section 1.6.2**. Additional facilities are required to meet pollution reduction requirements, unless the bottom flow path of the pond is designed as a vegetated or grassy swale, per swale sizing and design criteria. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Dry Detention Ponds

The plan below illustrates a typical planting plan for an approximately 3,500 square foot dry detention pond. This plan is diagrammatic use only. The actual project site condition may require designers to consider numerous other pond configurations and planting layouts.



Wet, Extended Wet, & Dry Detention Pond



Design Considerations: Slopes and depth should be kept as mild as possible to avoid safety risks. Wet and extended wet detention ponds should be designed for large drainage areas (5 to 150 acres) to help avoid problems associated with long periods of stagnant water. The City encourages applicants to design ponds to function as multi-purpose facilities (e.g., parks, open space, recreation facilities, or parking lots), provided that any alternative uses are compatible with the primary stormwater functions and maintenance standards. Instream ponds are not encouraged. If used, they require special approvals from the National Marine Fisheries Service, Oregon Department of Fish and Wildlife, Oregon Division of State Lands, and City of Eugene, in addition to water rights from the Oregon Division of Water Rights.

Construction Considerations: As pond grading generally requires the topsoil to be removed to form the basin shape of the pond, the resulting top layers of soil must to be amended, or topsoil must be brought back in to ready the soil for planting.

Location and Ownership:
- All open ponds to be city-maintained shall be located in a separate open space tract with public drainage easements dedicated to the City.
- Open ponds serving more than one tax lot, or designed to function as multi-use/recreational facilities, shall be located in a separate tract (e.g., Tract A), defined easement, or designated open space.

Setbacks: Ponds shall be constructed to maintain the following setback distances from structures and other facilities. (All distances are measured from the edge of the maximum water surface elevation. The setback limit applies to ponds near the top of slope, not the bottom.)
- Minimum distance from the edge of the pond water surface to property lines and structures: 20 feet, unless an easement with adjacent property owner is provided.

- Distance from the toe of the pond berm embankment to the nearest property line: one-half of the berm height (minimum distance of 5 feet).
- Minimum distance from the edge of the pond water surface to septic tank, distribution box, or septic tank drain field: 50 feet.
- Surrounding slopes shall not exceed 10%. Minimum distance from the edge of the pond water surface to the top of a slope greater than 15 percent: 200 feet, unless a geotechnical report is submitted and approved by the City (**Exhibit 2-17**).
- Minimum distance from the edge of the pond water surface to a well: 100 feet (**Exhibit 2-17**).

Geometry/ Design Requirements:

- Slopes within the pond shall not exceed 3 horizontal to 1 vertical.
- The distance between all inlets and the outlet shall be maximized to facilitate sedimentation. The minimum length-to-width ratio is 3:1, at the maximum water surface elevation. This ratio is critical to prevent "short-circuiting," where water passes directly through the facility without being detained for any length of time. If area constraints make this ratio unworkable, baffles, islands, or peninsulas may be installed, with City approval, to increase the flow path and prevent short-circuiting.
- The maximum water depth of the pond shall not exceed 4 feet. The 0 to 2-foot depth shall be distributed evenly around the perimeter of the pond.
- Minimum freeboard shall be 1 foot above the highest potential water surface elevation (one foot above the emergency overflow structure or spillway elevation).
- Wet and extended wet detention ponds are applicable in NRCS Type C and D soils (A and B soils with impermeable liner). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.
- Dry detention ponds are applicable in NRCS type B, C, and D soils (the pond should most likely be designed as an infiltration basin in type A soils). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.
- Unless designed with a pollution reduction swale in the bottom flow path, dry detention ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area, and shall provide at least 0.5 feet of dead storage for sediment accumulation.
- Wet and extended wet detention ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area, and shall provide at least 0.5 feet of dead storage for sediment accumulation.
- Public ponds shall be designed with an upstream sedimentation manhole with downturned elbow or tee riser outflow pipe (See **Exhibit 2-18**) to trap oils and reduce the likelihood of a visible sheen on the pond surface.

- Access routes to the pond for maintenance purposes must be shown on the plans. Public ponds will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope. A minimum 30 foot inside turning radius shall be provided.
- Where possible, a dewatering outlet with shut-off valve shall be provided to aid in the maintenance of the permanent pool.
- For wet and extended wet detention ponds, a water budget shall be submitted for review. The water budget must demonstrate that the baseflow to the pond is sufficient such that water stagnation/alga matting will not become a problem.

Outlet/ Overflow:

- If a riser pipe outlet is used, it shall be protected by a trash rack and anti-vortex plate. If an orifice plate is used, it shall be protected with a trash rack with at least 10 square feet of open surface area. In both cases, the rack must be hinged or easily removable to allow for cleaning. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.
- All ponds shall have an emergency overflow spillway or structure designed to convey the 100- year, 24-hour design storm for post-development site conditions, assuming the pond is full to the overflow spillway or structure crest. The overflow shall be designed to convey these extreme event peak flows around the berm structure for discharge into the downstream conveyance system. The overflow shall be designed and sited to protect the structural integrity of the berm. This will assure that catastrophic failure of the berm is avoided, property damage is avoided, and water quality of downstream receiving water bodies is protected (see **Exhibit 2-19**).
- The subgrade of the spillway shall be set at or above the 100-year overflow elevation of the control structure. The spillway shall be located to direct overflows safely into the downstream conveyance system and shall be located in existing soil wherever feasible. The emergency overflow spillway shall be armored with riprap or other flow-resistant material that will protect the embankment and minimize erosion. Riprap shall be designed in conformance with **Section 2.8** and shall extend to the toe of each face of the berm embankment. The emergency overflow spillway weir section shall be designed for the maximum design storm event for post-development conditions, using the following formula:

$$L = \frac{Q_{100}}{3.21H^{1.5}} - 2.4\,H$$

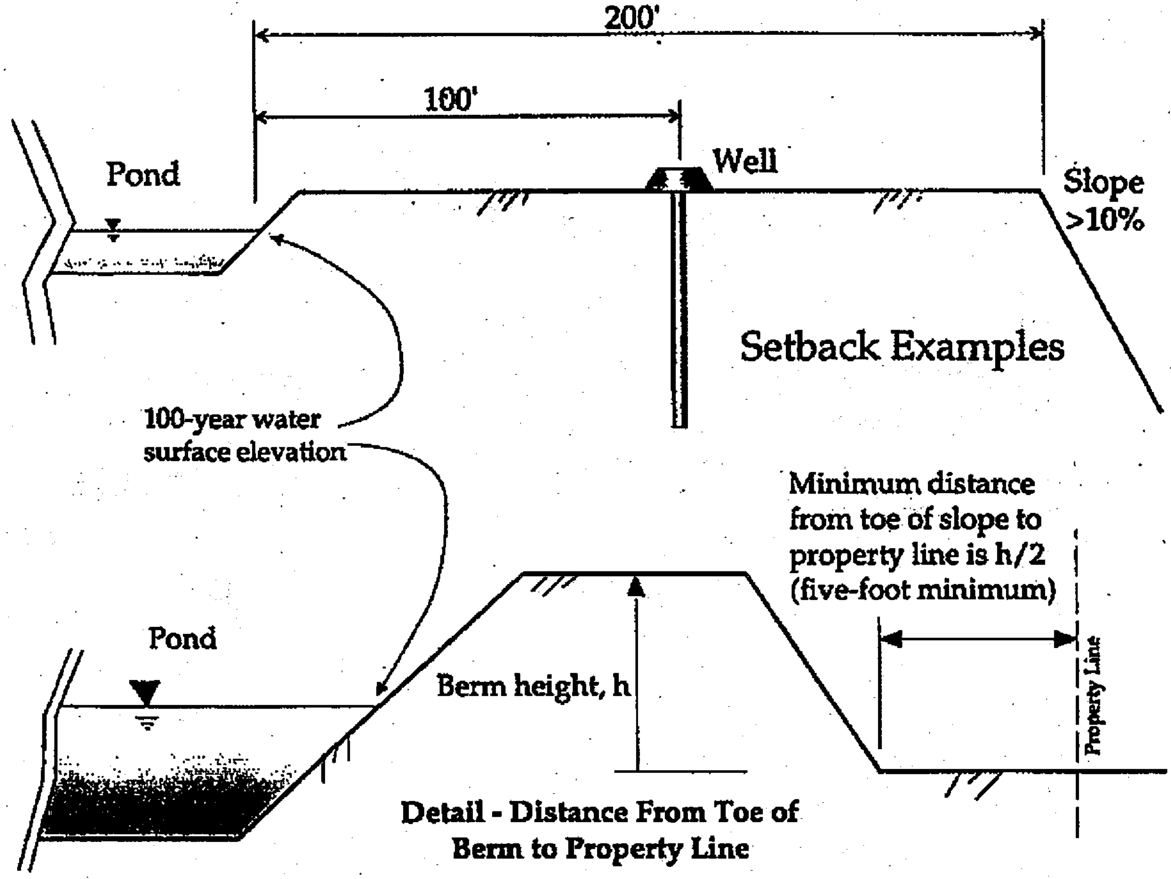
where:

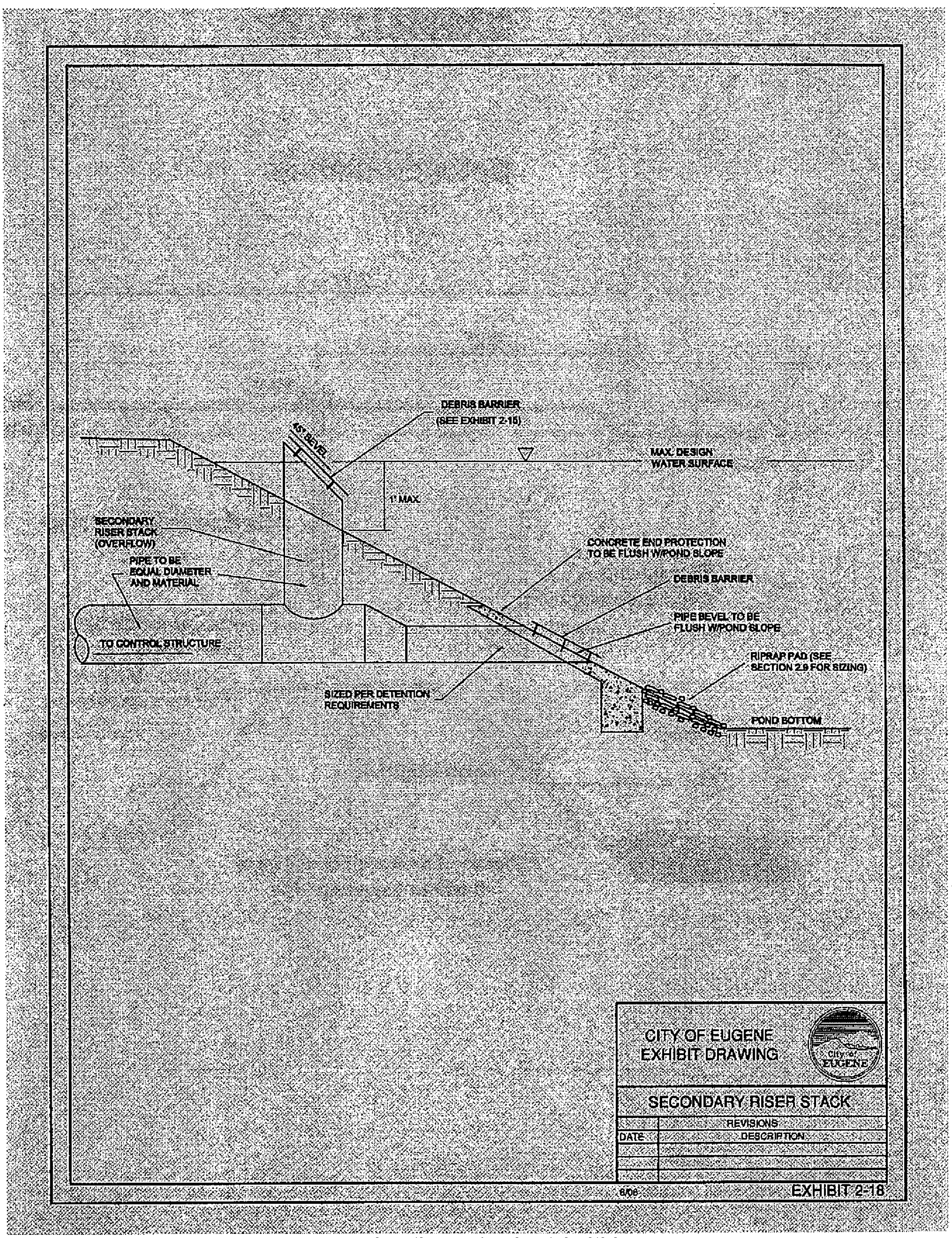
L	= Length of bottom of weir, feet
Q_{100}	= 100-year post-development flow rate, cfs
H	= Height of emergency overflow water surface, feet

Wet, Extended Wet, & Dry Detention Pond

EXHIBIT 2-17

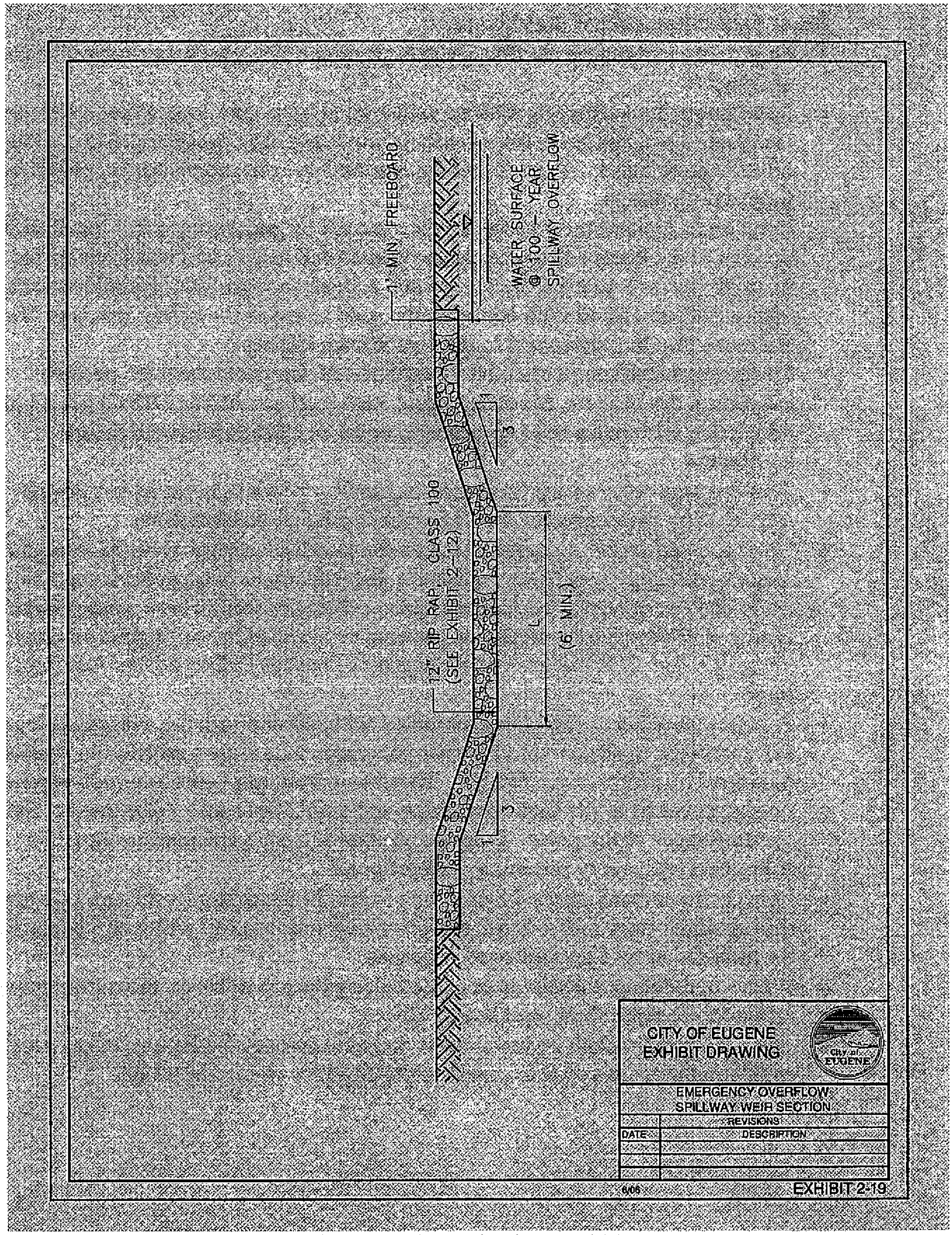
Setback Details





Note: See Eugene Standard Drawings, for City-maintained facilities.

Wet, Extended Wet, & Dry Detention Pond

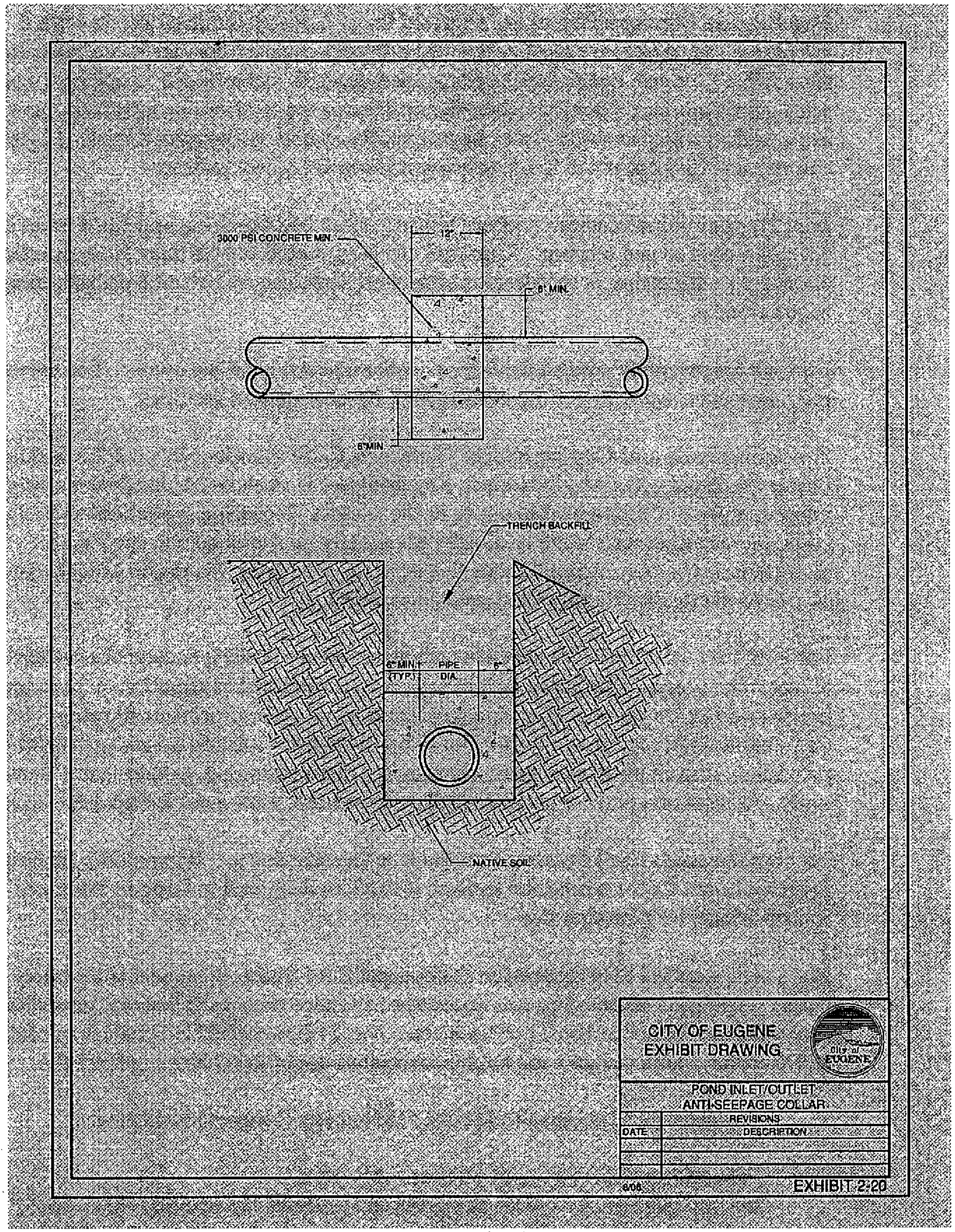


Note: See Eugene Standard Drawings, for City-maintained facilities.

Wet, Extended Wet, & Dry Detention Pond

Berm Embankment/Soil Stabilization:

- Pond berm embankments shall be designed by a civil engineer licensed in the State of Oregon.
- Pond berm embankments shall be constructed on native consolidated soil (or compacted and stable fill soil) that is free of loose surface soil materials, roots, and other organic debris. Topsoil will be required over the consolidated soil to support required plantings.
- Pond berm embankments shall be constructed by excavating a key equal to 50 percent of the berm embankment cross-sectional height and width measured through the center of the berm. (Note: A key in a berm is an excavated trench below the berm filled with soil material used to make the berm. It acts to "key" the berm into the native soil to prevent it from sliding.)
- The berm embankment shall be constructed of compacted soil (95 percent maximum dry density, Modified Proctor Method per ASTM D1557) placed in 6- to 8-inch lifts with hand-held equipment, or 10- to 12-inch lifts with heavy equipment.
- Anti-seepage collars shall be placed on outflow pipes in berm embankments impounding water greater than 8 feet in depth (see **Exhibit 2-20).**
- During construction, exposed earth on the pond side slopes shall be sodden or seeded with appropriate seed mixture. Establishment of protective vegetative cover shall be ensured with appropriate surface-protection best management practices (BMPs) and reseeded as necessary. See the City of Eugene's *Erosion Prevention and Construction Site Management Practices Ordinance and Administrative Rules.*
- Pond embankments shall be constructed with a maximum (i.e. steepest) slope of 3H: 1V on the upstream and downstream face. Side slopes **within** the pond shall be sloped no steeper than 3H: 1V. The use of retaining walls in ponds requires pre-approval from the City. Retaining walls shall not exceed one-third of the circumference of the pond. Detailed structural design calculations must be submitted with every retaining wall proposal.
- Pond berm embankments 6 feet or less in height including freeboard, measured through the center of the berm, shall have a minimum top width of 6 feet, or as recommended by a geotechnical engineer.
- Where maintenance access is provided along the top of berm, the minimum width of the top of berm shall be at least 15 feet.
- Two staff gauges shall be installed at opposite ends of the bottom of the pond, to enable maintenance staff to measure the depth of accumulated silts.



Note: See Eugene Standard Drawings, for City-maintained facilities.

Wet, Extended Wet, & Dry Detention Pond

Fencing and Signage: Fences are required for all City-maintained ponds with a permanent or temporary pool greater than 18 inches deep, interior side slopes steeper than 3H: 1V, or any walls/bulkheads greater than 24 inches high. Generally, a pond with gently sloping sides (less than 3:1) and including a 10-foot-wide safety bench around the facility at the point of slope transition does not require a fence. Applicants can request City approval to use fencing if there are safety concerns.

For City-maintained facilities where fencing is not required, the applicant must have City approval to use fencing. Approval will be granted only if there is no practical alternative. If fencing is required or approved, the design shall address screening requirements.

Fencing for privately owned facilities is at the discretion of the owner. The owner may, however, want to use the criteria for City-maintained facilities.

For both private and City-maintained facilities, Eugene code may prohibit fencing or require screening in some locations. The designer is responsible for determining which sections of Eugene code apply to the project. If fencing is prohibited by Eugene code, the designer may have to modify the facility or site design to provide an alternate means of securing the site (for example, reducing the depth of water or side slopes of the facility to minimize safety concerns).

For both private and City-maintained facilities where fencing is used, fences shall be at least 6 feet high. The 6-foot height may not be required in situations where fences are not needed to prevent climbing (e.g., on steep slopes to prevent slipping). For City-maintained facilities, a minimum of one vehicular locking access gate shall be provided. It shall be 10 feet wide, consisting of two swinging sections each 5 feet wide. At least one pedestrian gate shall be provided, with a minimum 4-foot width.

Fencing materials shall be complementary to the site design. If chain link fencing is proposed for a City-maintained facility, it shall be designed to Oregon Standard Specifications for Construction.

Wet and Extended Wet Detention Permanent Pool Sizing: The permanent pool (or "dead") storage volume, V_{pond}, is equivalent to twice the runoff volume generated by the pollution reduction storm of 1.4 inches over 24 hours (NRCS Type 1A rainfall distribution). This volume can be approximated using the following formula:

Volume = 2 * 1.4 inches * (1 foot/12 inches) * Impervious Surface

Volume = permanent pool volume, cubic feet
Impervious Surface = area of impervious surfaces to manage, square feet

EXAMPLE

A 20-acre site is to be developed. After development, the site will be 60 percent impervious. What is the required volume for a wet pond to meet pollution reduction requirements?

For the post-development condition, the total area is 20 acres and the impervious area has increased to 60 percent, or 12 acres:

Permanent Pool Volume = 2 * 1.4/12 * (43560 * 12) = 121,968 cubic feet

Flow Control for Extended Wet Detention and Dry Detention Ponds: To restrict flow rates exiting the pond to those required by **Section 1.6.2**, a control structure designed in accordance with **Section 2.5** must be used. For extended wet detention ponds, this control structure must be located above the permanent pool elevation. The outlet orifice shall be designed to minimize clogging (see **Section 2.5: Control Structures**).

Landscaping: Shrubs and wetland plantings shall be designed to minimize solar exposure of open water areas. Trees or other appropriate vegetation shall be located around the east, south, and west sides of a facility to maximize shading. Reducing solar exposure has two benefits: it helps reduce heat gain in water before discharging to a receiving water, and it helps maintain a healthy and aesthetic pond condition, reducing algae blooms and the potential for anaerobic conditions to develop.

Facility area is equivalent to the area of the pond, including bottom and side slopes, plus a 10-foot buffer around the pond. Minimum plant material quantities per 250 square feet of the facility area are as follows:

1 - Evergreen or deciduous tree:	
Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wetland plants:	1 per 2 square feet of a pond emergent plant zone. The emergent plant zone shall be at least 25 percent of the total pond water surface area.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

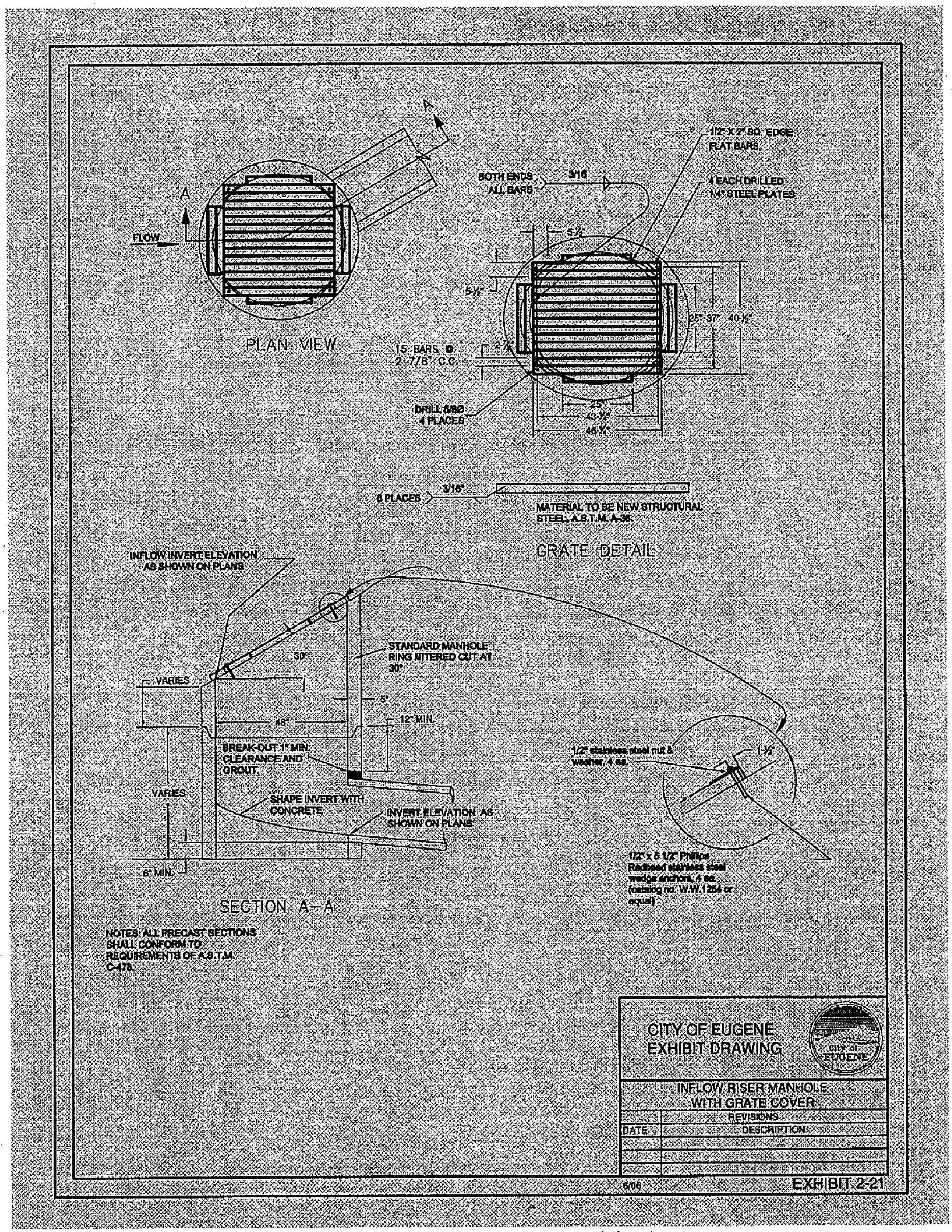
Facility Component	Inspection Requirement
Pond grading	
Piping	Call for inspection
Control (orifice) structure for extended wet detention and dry detention ponds	Call for inspection
Filter fabric or lining (if applicable)	
Growing medium	
Plantings	

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to wet, extended wet detention, & dry detention pond O&M form**

Additional photos and drawings:

*** Link to wet and extended wet detention pond photos**
*** Link to wet and extended wet detention pond drawings**
*** Link to dry detention pond photos**
*** Link to dry detention pond drawings**



Note: See Eugene Standard Drawings for City-maintained facilities.

Wet, Extended Wet, & Dry Detention Pond

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Constructed Treatment Wetland

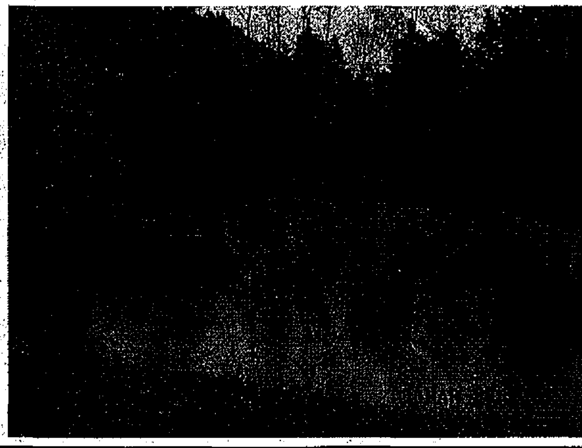
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction..............................	PRES
√ Flow Control..	PRES
Destination..	NA

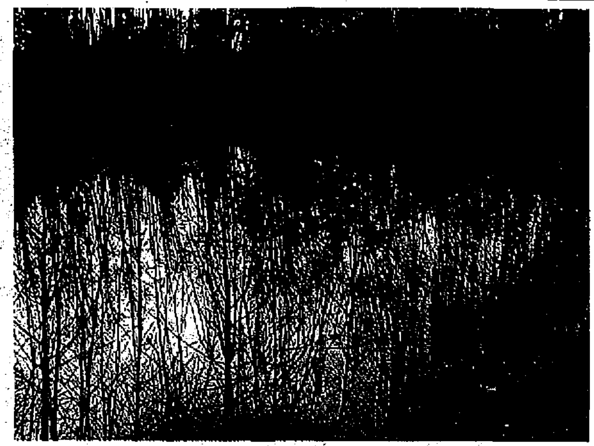
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Wetlands can be used to manage stormwater from any type of impervious surface.

Constructed Treatment Wetland





Description: A wetland is an area inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, and similar areas **except those constructed as pollution reduction or flow control facilities.** The Corps of Engineers and Division of State Lands make specific wetland designations. Constructed treatment wetlands are wetlands designed and constructed for the specific purpose of providing stormwater management. Unlike natural wetlands, constructed treatment wetlands are not regulated by the Corps of Engineers and the Division of State Lands.

Wetlands remove pollutants through several processes, including sedimentation, filtration, and biological uptake. When enough volume is provided, constructed treatment wetlands can also provide a significant level of flow control.

Design Criteria: To receive pollution reduction credit, the wet portion or permanent pool of the wetland shall be equal to that required for wet ponds, or the residence time of the stormwater volume (calculated as the pollution reduction design storm volume divided by the average facility outflow rate) shall be no less than 36 hours. A design team with experience in hydrology, wetland plants, and engineering will be needed to develop a successful wetland pollution reduction facility. A water budget analysis shall be performed with the design of the facility.

Sizing: Drainage area to be served shall be no less than 10 acres. To meet pollution reduction requirements, dead storage within the wetland must equal or exceed wet pond dead storage criteria. To meet flow control requirements, a detailed hydraulic analysis must be performed by a Professional Engineer, showing compliance with flow control standards presented in **Section 1.6.2.**

Constructed Treatment Wetland

Geometry: The configuration of a constructed wetland shall be tailored to each site, rather than limited to one design. Major elements of a wetland can include channels or trenches, shallow marshes, and deeper ponded areas. These elements shall be combined to take advantage of the site topography. Maximum slopes within the wetland area shall be 20%, and maximum slopes of surrounding land shall not exceed 10%. All wetland design shall address habitat, planting, and aesthetic issues.

1) The volume of water to be treated shall be allocated over the treatment area of the facility as follows:

Component	Percent of Design Volume (approx.)	Percent of Facility Surface Area (approx.)
Forebay	10	5
Micropool	10	5
Deep water (> 18")	50	40
Deep wetland (6"-18")	20	25
Shallow wetland (<6")	10	25

Definitions:

Forebay: A relatively deep zone placed where influent water discharges to a stormwater wetland. It traps coarse sediments, reduces incoming velocity, and helps distribute runoff evenly over the wetland.

Micropool: A deep (4 to 6 feet) pool placed at the outlet of a stormwater wetland forebay.

Deep-water: The area within a stormwater wetland that has a water depth greater than 18 inches.

Deep wetland: The area within a stormwater wetland that has a water depth between 6 and 18 inches.

Shallow wetland: The area within a stormwater wetland that has a water depth less than 6 inches.

2) The minimum length-to-width ratio shall be 3:1, unless otherwise approved by the City. If area constraints make this ratio unworkable, baffles, islands, or peninsulas may be installed, with City approval, to increase the flow path and prevent short-circuiting.

3) Where wetland vegetation is to be planted, side slopes shall be no steeper than 5:1. Wetland plant selection shall be consistent with anticipated hydrology.

4) Access routes to the wetland for maintenance purposes must be shown on the plans. Public wetlands will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope. A minimum 30 foot turning radius shall be provided.

Flow:

1) Flow velocity through the wetland shall average less than 0.01 feet per second for the water quality design storm event (1.4 inches in 24 hours). If natural slope does not allow for this velocity, berms shall be used to create ponded benches.

2) Flow through the wetland shall be distributed as uniformly as possible across the marsh and ponded section.

Forebay:

1) The forebay area shall be established along the wetland inflow points to capture sediment. The forebay shall have a water depth of about 3 feet and have at least 10 percent and up to 25 percent of the total treatment wetland volume.

An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Soil Suitability: Constructed treatment wetlands are appropriate for NRCS type C and D soils. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Setbacks: Required setback from the top of the bank to property lines is 5 feet, and 10 feet from building foundations. Infiltration basins shall meet the following setback requirements from downstream slopes: minimum of 100 feet from slopes of 10%; add 5 feet of setback for each additional percent of slope up to 30%; 200-foot setback for slopes of 30%; infiltration trenches shall not be used where slopes exceed 30%.

Landscaping: Shrubs and wetland plantings shall be designed to minimize solar exposure of open water areas. Trees or other appropriate vegetation shall be located around the east, south, and west sides of a facility to maximize shading. Reducing solar exposure has two benefits: it helps reduce heat gain in water before discharging to a receiving water, and it helps maintain a healthy and aesthetic pond condition, reducing algae blooms and the potential for anaerobic conditions to develop.

Facility area is equivalent to the area of the wetland, including bottom and side slopes, plus a 10-foot buffer around the wetland. Minimum plant material quantities per **200** square feet of the facility area are as follows:

1 - Evergreen or deciduous tree:

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.
Wetland plants:	1 per 2 square feet of a pond emergent plant zone. The emergent plant zone shall be at least 25 percent of the total pond water surface area.

Wildflowers, native grasses, and ground covers used for city-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for city-maintained facilities; any exceptions will require City approval.

***Link to Recommended Plants**

1) Two staff gauges shall be installed at opposite ends of the bottom of the wetland, to enable maintenance staff to measure the depth of accumulated silts.

2) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional geotechnical engineer, shall inspect the soil after the system is excavated to confirm that soils remain in suitable condition for planting.

Constructed Treatment Wetland

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2**.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Wetland grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to constructed treatment wetland O&M form**

Additional photos:

*** Link to constructed treatment wetland photos**

Manufactured Treatment Technology

Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction	PERF
Flow Control	NA
Destination	NA

These facilities may or may not be classified as Underground Injection Control structures (UICs), depending on specific manufacturer design.

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) For a list of currently accepted stormwater treatment technologies, call PW at 541-682--5291. Manufactured stormwater treatment technologies can be used to provide pollution reduction for any impervious surface. They can be located on private property, and some are approved for use in public right-of-ways.

For a manufactured stormwater treatment technology to be approved for general use within the City of Eugene, the manufactured stormwater treatment technology must be approved by the Portland Bureau of Environmental Services to meet the 70% removal of TSS standard.[1] Alternatively a manufactured stormwater treatment technology that meets the Portland Bureau of Environmental Services requirement for pretreatment, 50% removal of TSS, maybe used in conjunction with low-profile elbows placed in all catchbasins, curb inlets, area drains, or other flow input devices, that drain the area required for treatment. At the discretion of the City Engineer an alternative manufactured treatment technology maybe approved for use that has not met testing requirements.

Manufacturers wishing to submit technologies for approval will follow the Portland Bureau of Environmental Services "Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies" located in **Appendix B**.

[1] See **Appendix B** for a more detailed definition of "70% removal of TSS", which is actually a function of influent TSS concentration.

In addition, to be approved for use as a publicly owned or city-maintained facility, the manufacturer must also submit detailed information about the facility's design criteria, construction techniques, operation and maintenance procedures, reliability, and cost to City of Eugene PW. This information will be reviewed by PW, which will decide whether or not the facility can be used for public projects.

Manufactured Treatment Technology

Manufactured stormwater treatment technologies on BES's approved list must be designed and constructed in accordance with the manufacturer's recommendations. Eugene may also place special design conditions on the acceptance of the technology, such as sizing requirements that go beyond the manufacturer's recommendations, which must also be followed to obtain plan approval.

In addition to design calculations shown in the Report requirements of **Exhibit 2-2**, the following must be submitted with each manufactured stormwater treatment technology project:

1) Pollution reduction capacity of the facility
2) Flow-through conveyance capacity (i.e., how much flow can be passed through the facility without stirring up and releasing trapped pollutants)

An operations and maintenance manual must also be submitted for City review. See **Chapter 3.0** for O&M plan guidance.

Manufactured stormwater treatment technologies on BES's approved list for general use may not be capable of meeting specific TMDL requirements for certain watersheds. In that case, the treatment technology will not be accepted as a stand-alone pollution reduction facility. Rather, a pollution reduction facility that is presumed by DEQ to meet the TMDL requirement must be used.

Checklist of minimal information to be shown on the permit drawings:

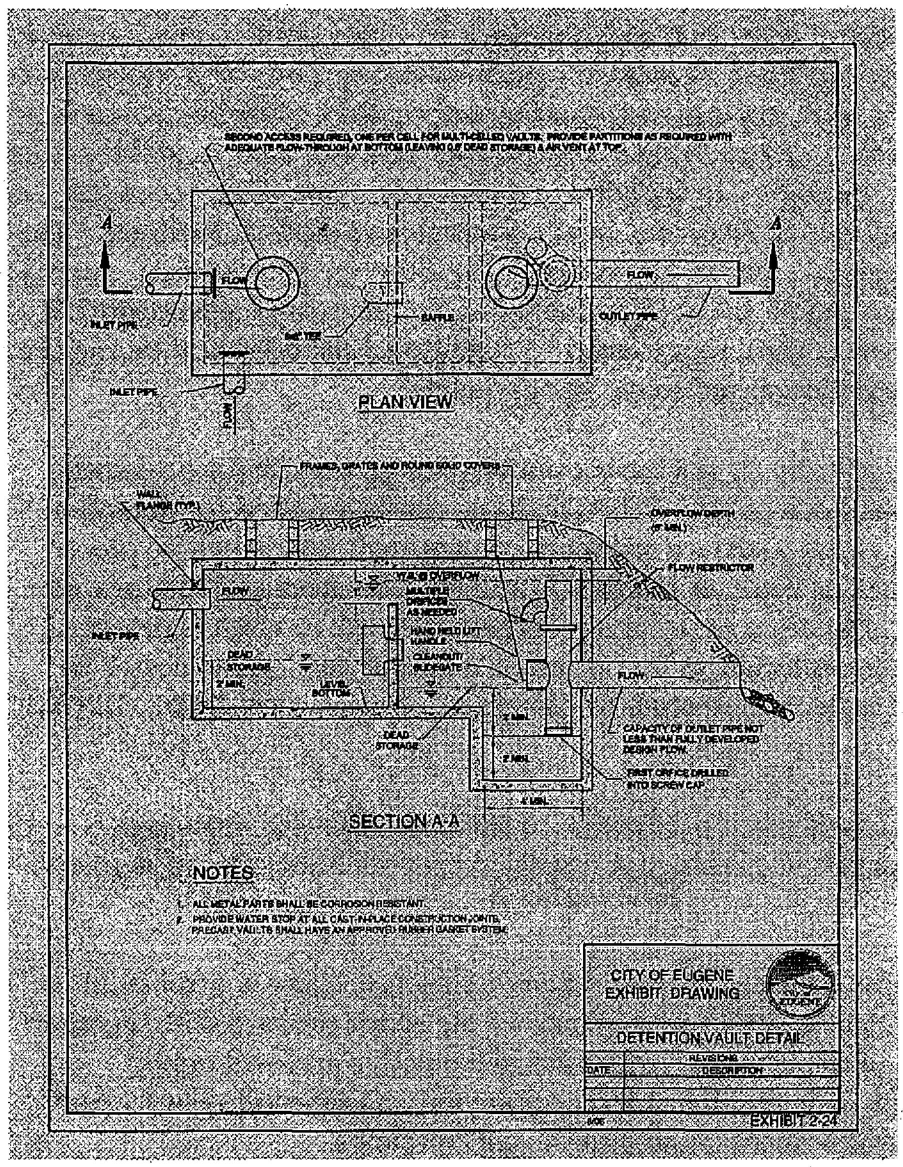
1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Vault excavation	
Piping	Call for inspection
Vault installation	Cal for inspection

Operations and Maintenance requirements: An operations and maintenance plan will be required, including information from the manufacturer, as per **Chapter 3.0.**

Structural Detention Facility



Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
Pollution Reduction............................	NA
√ Flow Control..	PRES
Destination..	NA

This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) See Report requirements, **Exhibit 2-2,** for hydrologic and hydraulic calculations that must be submitted with structural detention design. Structural detention facilities may be used to provide flow control for any impervious surface type, and may be located on private property or within the public right-of-way.

Structural Detention Facility

Description: Structural detention facilities such as tanks, vaults, and oversized pipes provide underground storage of stormwater as part of a runoff flow control system. As with any underground structure, they must be designed not only for their function as runoff flow control facilities, but also to withstand an environment of periodic inundation, potentially corrosive chemical or electrochemical soil conditions, and heavy ground and surface loadings. They must also be accessible for maintenance. Facilities in this section must be designed using acceptable hydrologic modeling techniques (See **Section 2.3**) to meet applicable flow control requirements. Additional facilities will be required to meet applicable pollution reduction requirements.

Tanks and vaults typically do not have a built-in design feature for containing sediment, as do multi-cell ponds. When tanks or vaults are used for detention storage, therefore, either a surface sediment containment pond shall be placed upstream of the tank or vault, or the tank/vault shall be oversized to allow for the temporary accumulation of sediment. Where the tank or vault is designed to provide sediment containment, a minimum of ½ foot of dead storage shall be provided, and the tank or vault shall be designed and constructed with 0% (flat) bottom slope.

Tanks and vaults can be used in conjunction with other detention storage facilities, such as ponds or parking lot ponds, to provide initial or supplemental storage.

Because of minimum orifice size specifications, structural flow control facilities (such as detention tanks, vaults, and oversized pipes) for projects with less than 15,000 square feet of impervious surface are not effective and will not be permitted. Projects with less than 15,000 square feet of impervious surface are required to use surface retention facilities to control flows.

Design Requirements:
The following criteria apply to detention tank, vault, and oversized pipe design.

- All areas of a tank or vault shall be within 50 feet of a minimum 36-inch diameter access entry cover. All access openings shall have round, solid locking lids.
- Publicly owned detention tanks, vaults, and pipes are permitted within public rights-of-way. If developments are served with publicly operated and maintained tanks and vaults that are not located within the right-of-way, the tanks/vaults shall be located in separate open space tracts with public sewer easements that are dedicated to the City of Eugene. All privately owned and maintained facilities shall be located to allow easy maintenance and access. (**See Chapter 3.0**: Operation and Maintenance)

Structural Detention Facility

- All tanks and vaults shall be designed as flow-through systems, unless separate sediment containment is provided.
- Minimum size for a public detention pipe shall be 36 inches. If the collection system piping is designed also to provide storage, the resulting maximum water surface elevation shall maintain a minimum 1-foot of freeboard in any catch basin below the catch basin grate. Pipe capacity shall be verified using an accepted methodology approved by the City (see Eugene's Public Improvements Design Standards Manual). The minimum internal height of a vault or tank shall be 3 feet, and the minimum width shall be 3 feet. The maximum depth of the vault or tank invert shall be 20 feet. Pipe material and surface treatment shall conform to the standards for detention tanks and vaults (see **Exhibits 2-22 and 2-24).**
- Detention tanks and vaults shall have a minimum of ½ foot of dead storage, unless upstream sedimentation is provided (see **Exhibits 2-22 and 2-24**).

Flow Control:

- To restrict flow rates exiting the pond to those required by **Section 1.6.2**, a control structure per **Section 2.5** must be used.

Materials and Structural Stability:

- For publicly owned or city-maintained facilities, pipe materials and joints shall conform to the City of Eugene's *Public Improvements Design Standards Manual*. For privately owned and maintained facilities, the pipe material shall conform to the Unified Plumbing Code.
- All tanks, vaults, and pipes shall meet structural requirements for overburden support and traffic loadings, if appropriate. H-20 live loads shall be accommodated for tanks and vaults under roadways and parking areas. End caps shall be designed for structural stability at maximum hydrostatic loading conditions.
- Detention vaults shall be constructed of structural reinforced concrete (3000 psi, ASTM 405). All construction joints shall be provided with water stops.
- In soils where groundwater may induce flotation and buoyancy, measures shall be taken to counteract these forces. Ballasting with concrete or earth backfill, providing concrete anchors or other counteractive measures shall be required. Calculations shall be required to demonstrate stability.
- Tanks and vaults shall be placed on stable, consolidated native soil with suitable bedding. Tanks and vaults shall not be allowed in fill slopes, unless a geotechnical analysis is performed for stability and construction practices.

Structural Detention Facility

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

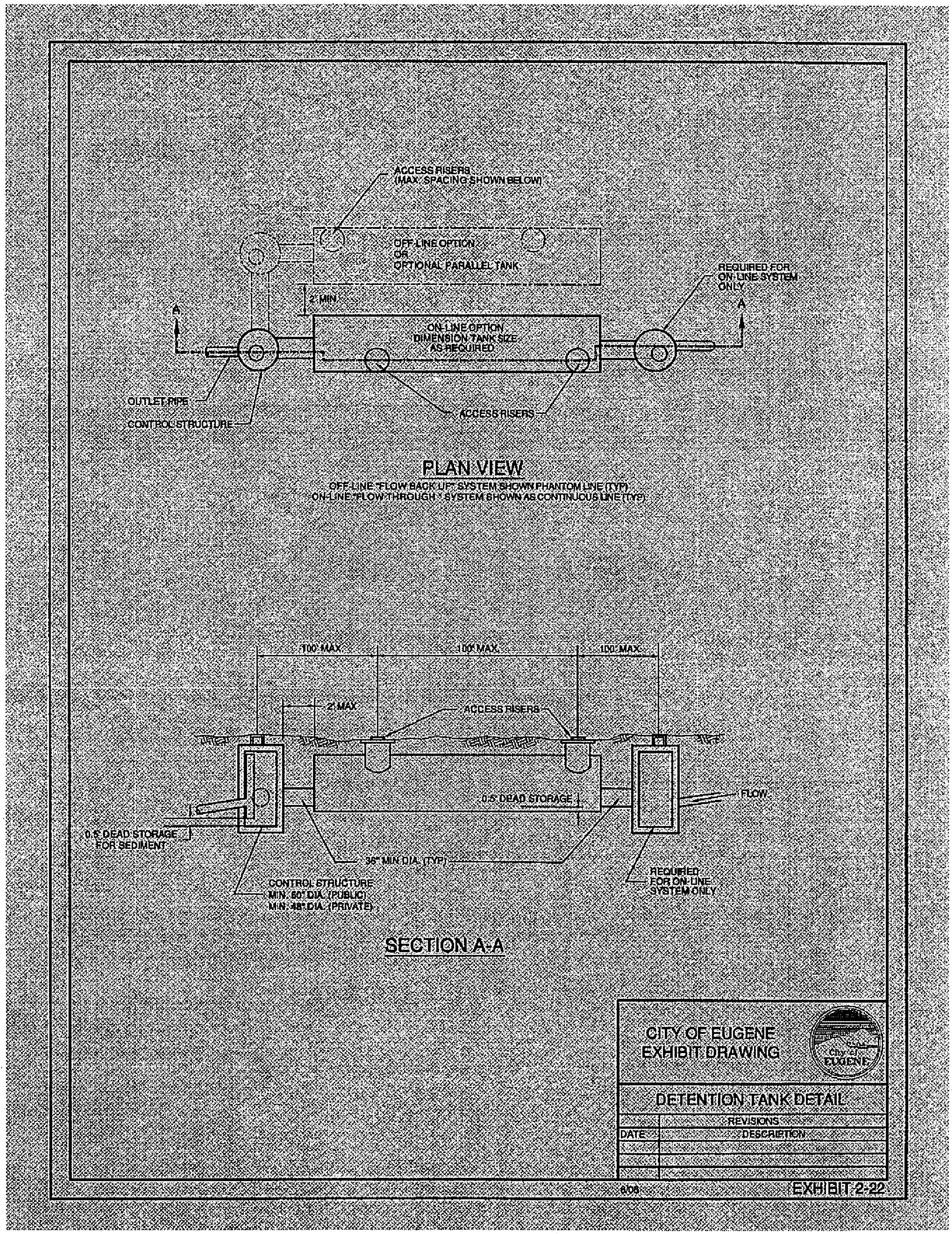
Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Vault excavation	
Piping	Call for inspection
Vault installation	Call for inspection
Control structure (orifice structure)	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

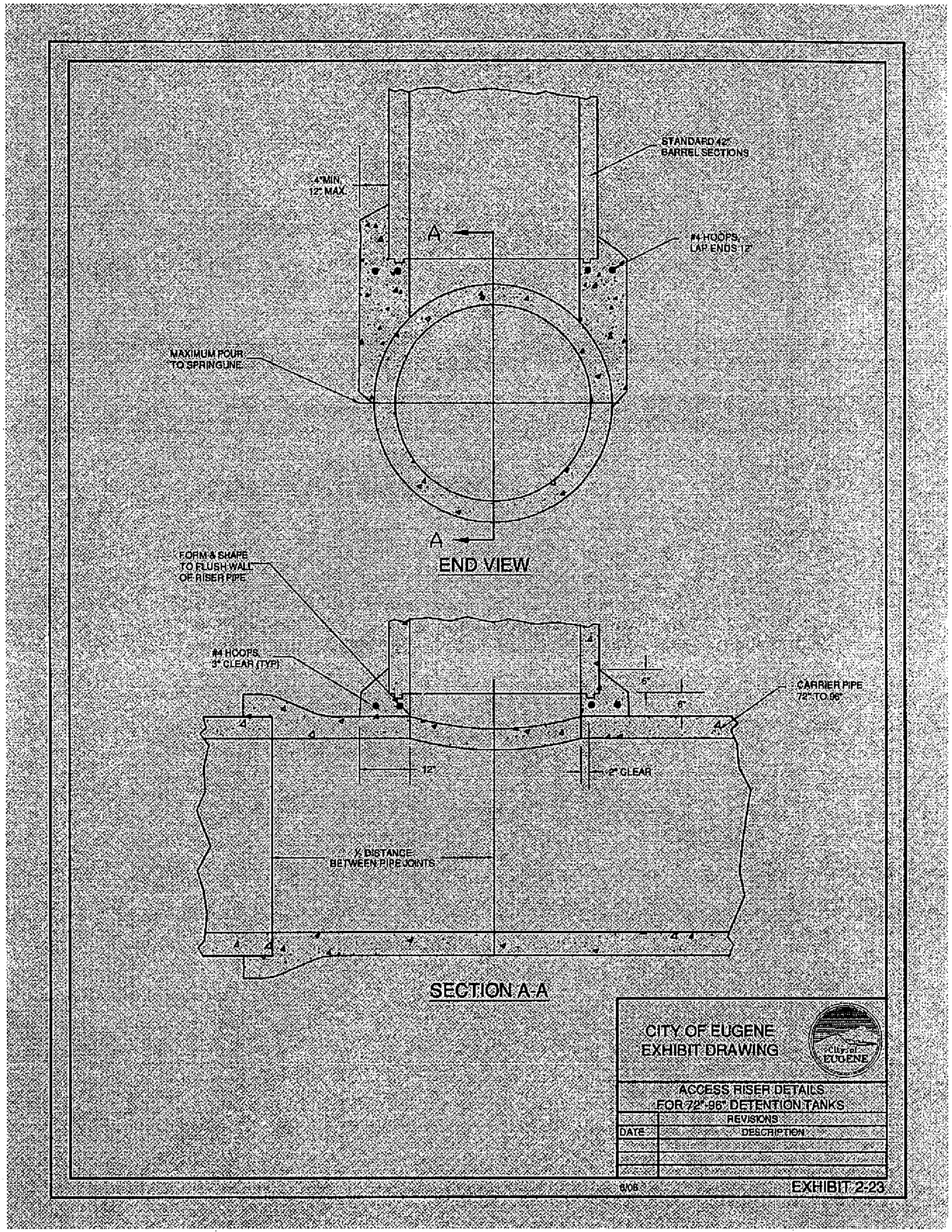
*** Link to tank, vault, and oversized pipe O&M form**

Structural Detention Facility



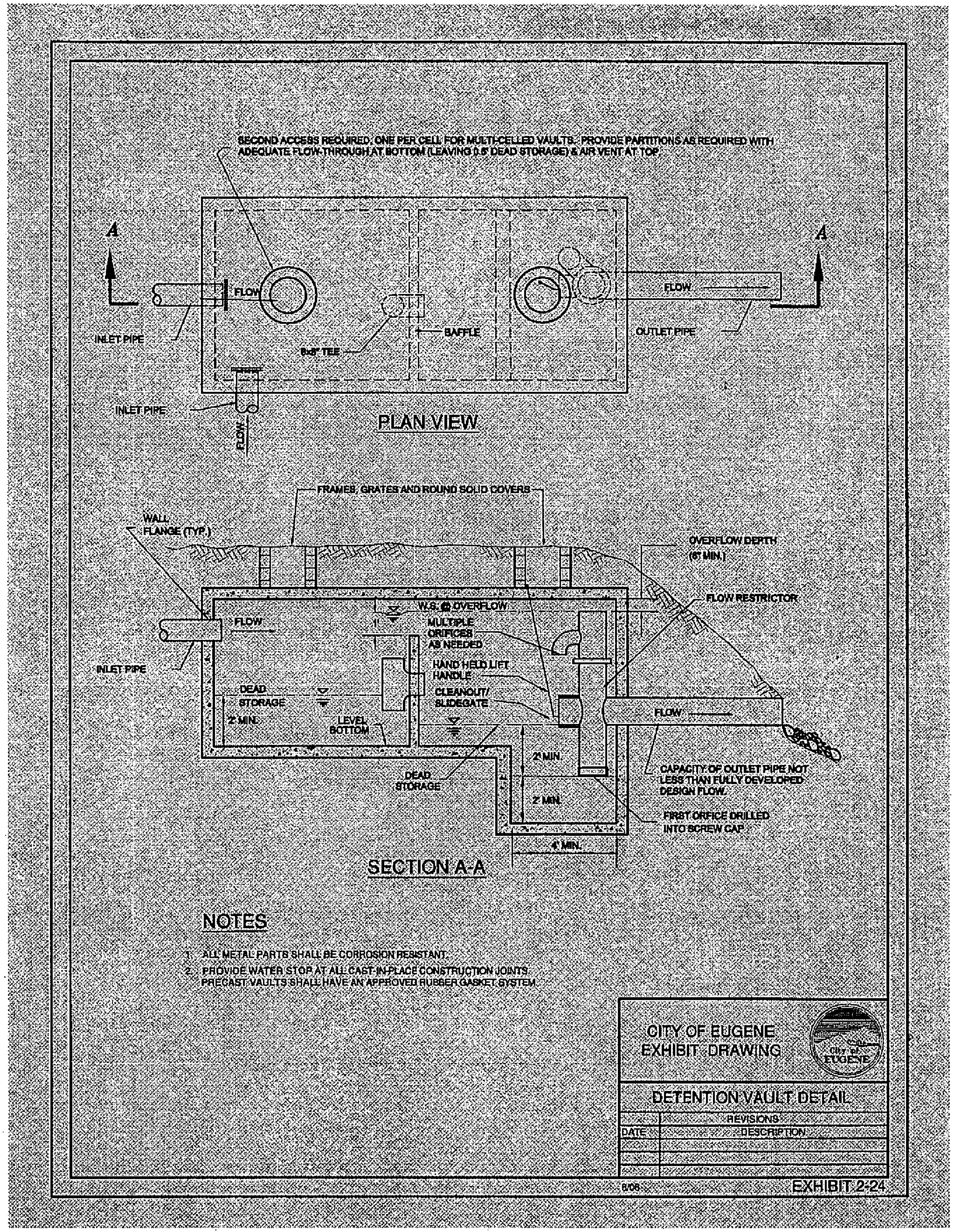
Note: See Eugene Standard Drawings, for city-maintained facilities.

Structural Detention Facility



Note: See Eugene Standard Drawings, for city-maintained facilities.

Structural Detention Facility



Note: See Eugene Standard Drawings, for city-maintained facilities

Structural Detention Facility

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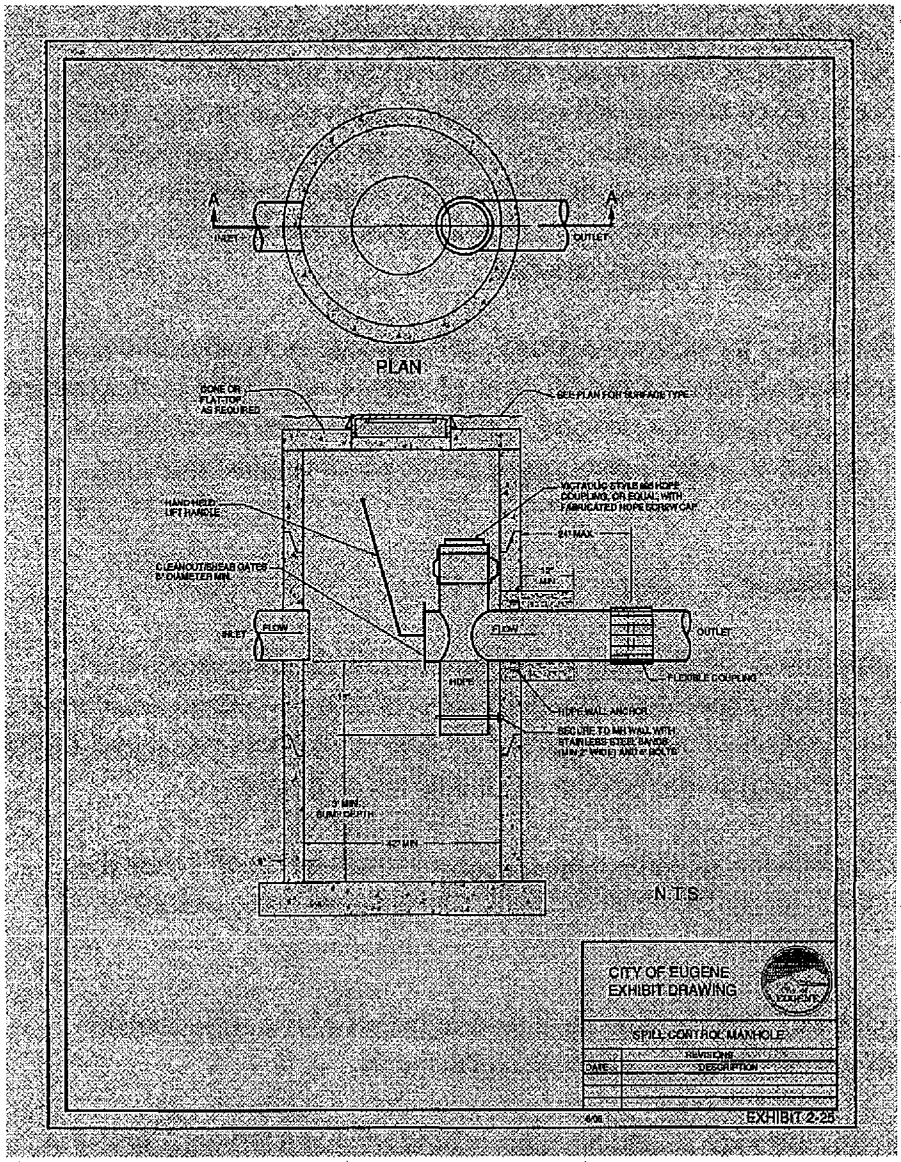
Spill Control Manhole



Note: See Eugene Standard Construction Drawing for City-maintained facilities.

Stormwater Management Goals Achieved | **Acceptable Sizing Methodologies**

√ Pollution Reduction[1] (Oil Only)................PRES[1]
Flow Control....................................... NA
Destination... NA
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Spill control manholes receive credit for oil removal only. They may be used to remove oil from parking lots and other vehicular access areas.

Spill Control Manhole

Description: Spill control manholes rely on passive mechanisms that take advantage of oil being lighter than water. Oil rises to the surface and can be periodically removed. They consist of a simple underground manhole with a "T" outlet designed to trap small spills. Spill control manholes will not be given credit for basic pollution reduction requirements. They must be used in conjunction with other pollution reduction systems from this chapter to meet oil control and pollution reduction requirements.

Other Options: There may be other acceptable oil controls not listed above. Applicants may propose an alternative oil control option under the performance approach. However, proposal of a new oil control will require an additional review process for approval, which may delay issuance of related building permits.

Design and Sizing Criteria:

- Spill control manholes shall be used in conjunction with an appropriately sized pollution reduction facility. The spill control sump volume shall be 60 cubic feet *or* 20 cubic feet of sump capacity for each cubic feet per second (cfs) of peak pollution reduction design flow, whichever is greater.

- To maintain efficiencies and reduce size, all roof drainage shall enter the stormwater system downstream of the spill control manhole, unless sized accordingly.

- Any pumping devices shall be installed downstream of the spill control manhole to prevent oil emulsification in stormwater.

- Engineered calculations are required, using the Rational Method (Q=C*I*A).

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and location.
2) Profile view of facility, including typical cross-section details with dimensions. These details shall match manufacturer specifications and details.
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Spill Control Manhole

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Manhole excavation	
Piping	Call for inspection
Manhole installation	Cal for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to Spill Control Manhole O&M form**

Spill Control Manhole

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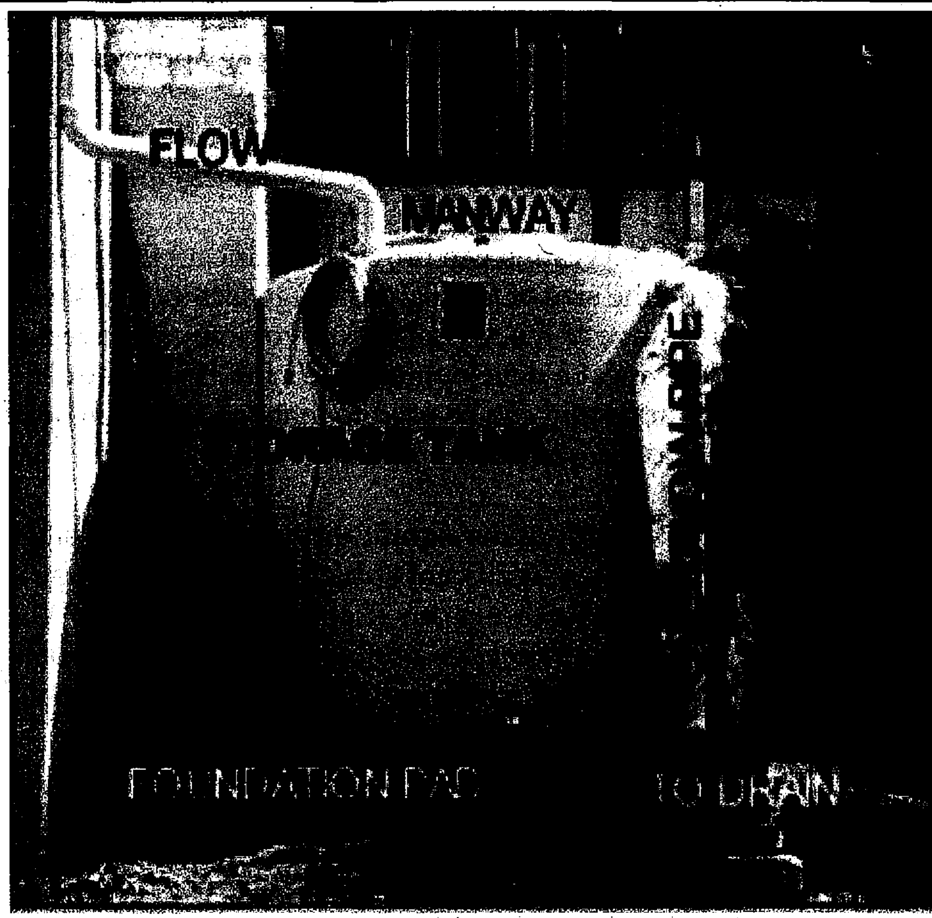
Rainwater Harvesting



Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction................................	PERF[1]
√ Flow Control..	PERF[1]
Destination..	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The required water storage volume is a function of drainage area, rate of water usage, and stormwater management goal. Rainwater harvesting systems may be used to manage stormwater from rooftops and depending on the water use, other impervious surfaces, and must be located on private property.

Rainwater Harvesting

Description: Stormwater may be collected and reused for non-potable water uses within a house or building, or for landscape irrigation purposes. Uses can include reusing water in toilets and at hose bibs. Plumbing approval must be obtained with any such system.

Rainwater harvesting can provide several stormwater management benefits:

- Flow control: Rainwater harvesting can provide significant flow-reduction benefits. Depending on the size of the water storage facility and the rate of use, a significant percentage of the annual runoff volume can be reused. Where it isn't feasible to meet a development site's full flow control obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall flow control requirement.

- Pollution reduction: As a result of the significant reduction in off-site flow volume that can be achieved, a significant reduction in the discharge of pollutants associated with stormwater can also be accomplished. Where it isn't feasible to meet a development site's full pollution reduction obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall pollution reduction requirement.

Checklist of minimal information to be shown on the permit drawings, or included with the permit submittal package:

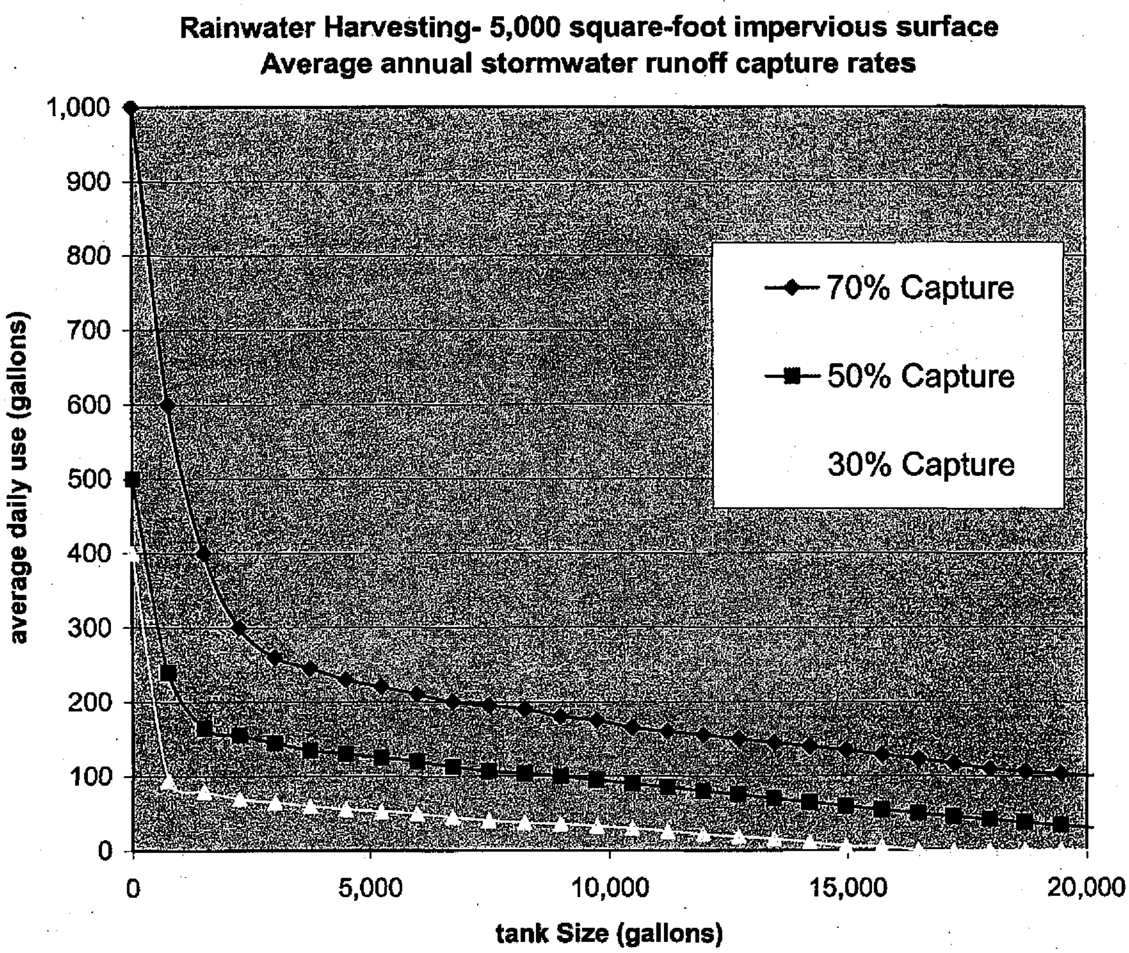
1) Water storage facility details and specifications
2) Pump and associated electrical details and specifications
3) Piping size, material, and placement details and specifications
4) Average daily water use documentation
5) Hydraulic calculations demonstrating compliance with stormwater management requirements (pollution and flow control)
6) Approximate setbacks from property lines and structures shall be shown
7) Overflow connection to approved stormwater destination per **Section 1.4**

Operations and Maintenance requirements: See **Chapter 3.0**.

The following chart represents an analysis done on a 5,000 square-foot project site with 100% impervious surface. 8.5 months of 5-minute rainfall intensity data from the Fernwood rain gage in Portland was used in the analysis, which shows the relationship between water storage volume and average daily water use rate for average annual runoff capture goals of 30%, 50%, and 70%.

For example, if the stormwater management goal is 50% reduction of the annual release volume, the pink line is used to show that if a 2,000-gallon tank were used, the average daily use would need to be approximately 160 gallons per day. A larger tank would necessitate a smaller average daily use rate to achieve the same stormwater management goal of 50% annual volume reduction.

Exhibit 2-26:



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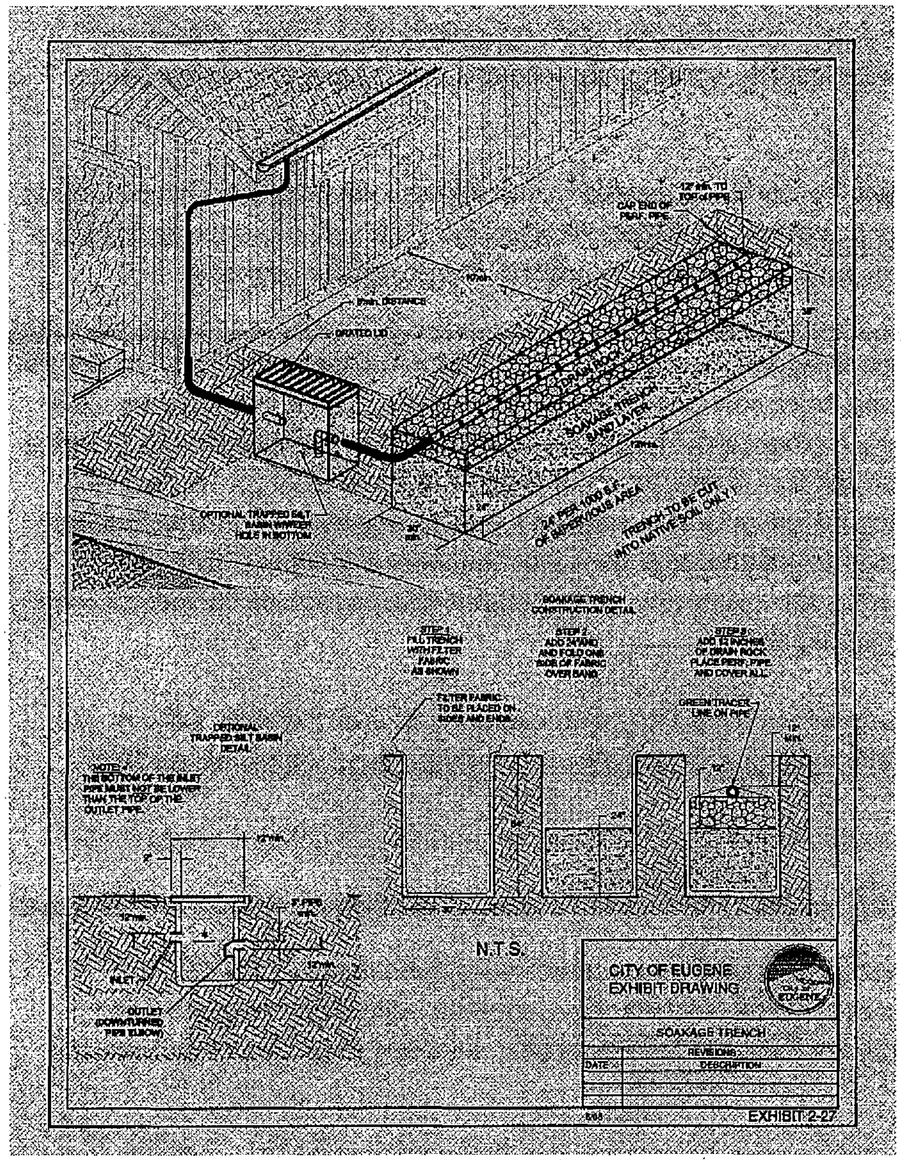
Soakage Trench



Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
Pollution Reduction..	NA[1]
√ Flow Control..	PRES
√ Destination..	PRES

This facility is classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Soakage trenches can be used to manage stormwater runoff, and with a sufficient layer of sand or soil for filtration, may be used to meet pollution reduction requirements.

Soakage Trench

A soakage or "infiltration" trench is a shallow trench in permeable soil that is backfilled with sand and coarse stone and lined with filter fabric. The trench surface may be covered with grating, stone, sand, or a grassed cover with a surface inlet.

Soakage trenches can be used to provide a stormwater destination by collecting and recharging stormwater runoff into the ground. The use of soakage trenches is highly dependent on soil type and height of the groundwater table.

Note: DEQ has identified soakage trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be classified as exempt, authorized by rule, or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, pollution reduction is required before disposing stormwater into them, with the exception of soakage trenches that serve rooftops only. All soakage trenches, with the exception of those that drain residential rooftops only, must be registered with DEQ.

More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**

For technical questions call DEQ- UIC Program at 503-229-5945. For copies of applications or forms, call 1-800-452-4011.

Soakage trenches are recognized as a stormwater destination, and with a sufficient layer of sand or soil for filtration, may be used to meet pollution reduction requirements. **Exhibit 2-28** provides detailed drawing of a standard soakage trench.

Soakage Trench Design and Sizing Method

Soil conditions are critical to the success of soakage trenches. Because of this, the use of soakage trenches must be pre-approved by the City. Supporting geotechnical evidence and a documented infiltration test may be required to demonstrate that soakage trenches will work in the project area. Soakage trenches shall be sized in accordance with **Exhibit 2-28**, once City approval has been given for on-site infiltration.

Soakage Trench

General Requirements:

Maximum area to be served:	15,000 square-feet per trench
Soils requirements: (NRCS classification)	A or B; C soils may be used if drawdown times are met
Maximum ground slopes	20 percent
Soil test requirement	ASTM D 3385-88 or City approval

1) If designed as the only stormwater destination, the soakage trench shall infiltrate the entire flood control design storm without overflow.

2) Soakage trenches shall not be accepted in soils with a tested infiltration rate of less than 0.5 inches per hour.

3) There shall be no less than 4 feet of undisturbed depth of infiltration medium between the bottom of the facility and any impervious layer (hardpan, solid rock, etc.) or seasonal high groundwater levels.

4) Drawdown time when full shall not exceed 10 hours.

5) Soakage trenches shall meet the following setback requirements for downstream slopes: minimum of 100 feet from slopes of 20%; add 5 feet of setback for each additional percent of slope up to 30%; infiltration trenches shall not be used within 200 feet of where slopes exceed 30%.

6) The bottom of the soakage trench shall be flat, or clay check-dams may be used to prevent water from collecting near the downstream end.

7) Drain medium shall have filter fabric between the medium and native soils or backfill.

8) Soakage trench areas shall be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular construction traffic, except that specifically used to construct the facility, shall be allowed within 10 feet of soakage trench areas.

9) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional engineer, shall inspect the soil after the system is excavated, before trenches are filled with drain medium, to confirm that soils remain in suitable condition to perform at anticipated infiltration rates.

10) Soakage trenches should be located down slope of structures, and are required to be setback at least 10 feet from structures, 5 feet from property lines, and 5 feet from public utility lines.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Drain rock specification
4) Sand specification
5) Filter fabric specification
6) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection Requirements and Schedule:

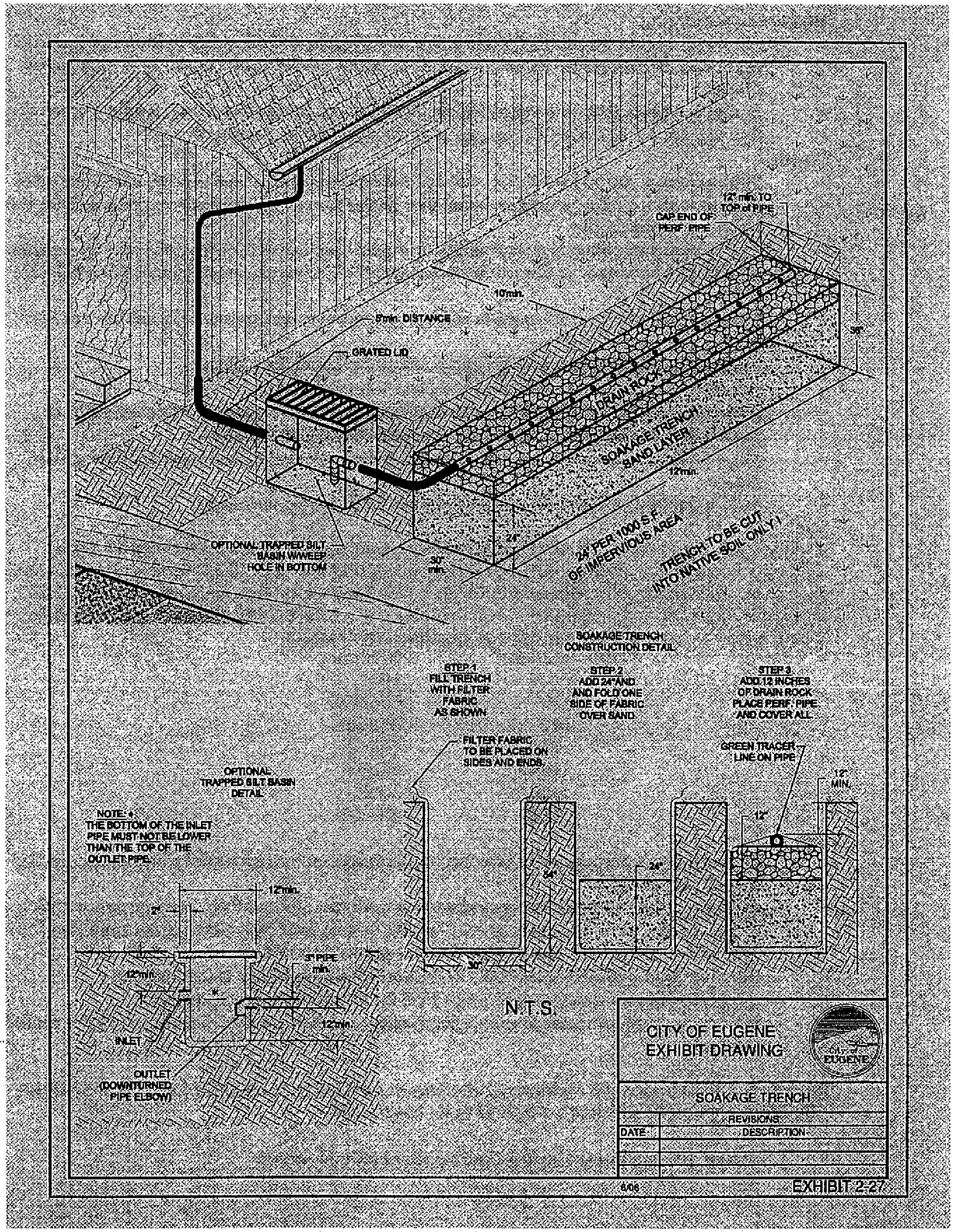
The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Trench grading	
Piping	Call for inspection
Filter fabric	
Sand layer	
Drain rock	

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to soakage trench O&M form**

Soakage Trench



Note: See Eugene Standard Drawings, for city-maintained facilities.

Soakage Trench

Soakage Trench Sizing

- Hydraulic calculations shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's *Public Improvement Design Standards Manual.*
- Soakage trenches shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for a soakage trench design shall be 5 minutes.

Trench

- Soakage trench and perforated pipe must be installed level and parallel to contour of finish grade.
- Soakage trench shall be located no closer than 10 feet to any building structure and not closer than 5 feet from property line.
- Unless a separate pollution reduction facility is used upstream of the trench, the sand filter portion of soakage trench must be filled with a minimum of 24" medium sand meeting OAR 340-71-295 (3)(e).
- Minimum 12" of ¾" – 2 ½" round or crushed rock to cover sand separated by one layer of filter fabric.
- The pipe shall be laid on top of this gravel and covered with filter fabric.
- At least 12" minimum of backfill shall be placed over the trench.
- All trenches shall be constructed on native soil and shall not be subject to vehicular traffic or construction work that will compact the soil, thus reducing permeability.
- Slope shall not exceed 20% without a stamped and signed geotechnical report addressing slope stability.
- Trench shall not be constructed under current or future impervious surface.

Sand

Medium sand meeting OAR 340-71-295 (3)(e) will be required. Sieve analysis of the medium sand is required to be made by a qualified party and a report provided to City of Portland plumbing inspector at the time of inspection. Analysis to comply with ASTM C136, Standard Methods for Sieve Analysis of Fine and Coarse Aggregate and in conjunction and accordance with ASTM C-117, Standard Test Method for Materials Finer than No.200 Sieve in Mineral Aggregates by Washing.

Sieve #	% Passing
3/8	100%
#4	95-100%
#8	80-100%
#16	45-85%
#30	15-60%
#50	3-15%
#100	4% or less

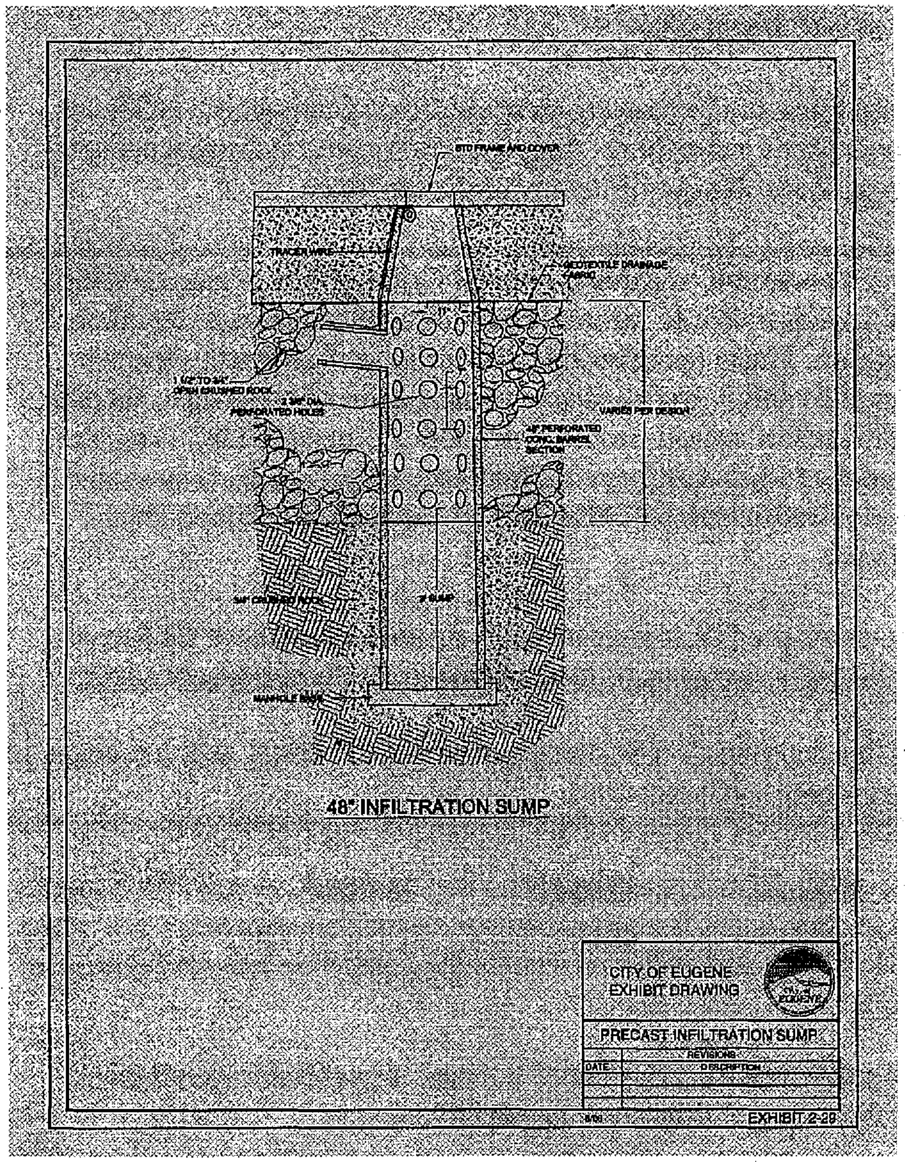
Pipe

- The solid pipe from building or other source to connection with perforated pipe must be installed at a ¼" per foot slope.
- All piping within 10 feet of building must be sch. 40 ABS, sch. 40 PVC, cast iron, sch. 40 ABS, 3" sch. 40 PVC or 3" cast iron pipe may be used for rain drain piping serving not more than 1500 sf of roof or surface area. Use 4" pipe if area is greater than 1500 sf.
- Pipe must have a minimum cover of 12" measured from top of pipe to finished grade.
- The pipe within the trench shall either be PVC D2729 or HDPE Leach field pipe.
- The silt trap shall be installed between the dwelling and the sand filter, a minimum of 5' from the dwelling.

Filter Fabric must be one of the following types/brands: LINQ 125EX; LINQ TYPAR3201; TNS E040; TNS R035; TNS R040; TNS R042; AMOCO 4535; Marafi 140NL.

- At least 12" minimum of backfill shall be placed over this trench.

Infiltration Sump System



Note: See Eugene Standard Drawings, for city-maintained facilities.

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
Pollution Reduction..............................	NA
√ Flow Control..	PRES
√ Destination..	PRES

This facility is classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Infiltration sump systems are used to manage stormwater from street surfaces.

Infiltration Sump System

INFILTRATION SUMP SYSTEMS

Infiltration sump systems can be used to provide street drainage by collecting and recharging stormwater runoff into the ground. The use of sumps is highly dependent on soil type and height of the groundwater table.

Note: The Oregon Department of Environmental Quality (DEQ) has identified sumps as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be either authorized by rule or authorized by permit by DEQ. In the case of public infiltration sumps, Eugene administers the rule authorization process with DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, site controls and pollution reduction facilities are required prior to disposing stormwater into them.

More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**

For technical questions call DEQ- UIC Program at 503-229-5945, and for copies of applications or forms call 1-800-452-4011.

Sumps are recognized as a destination method for managing stormwater runoff, but are not intended to be used to meet pollution reduction requirements. Sump systems are excluded from use within the following specific areas and land-use types within the City:

- Neighborhood collectors in commercially zoned areas (Refer to *Arterial & Collector Street Plan, City of Eugene, November 1999*)
- Within 500 feet of municipal or domestic drinking water wells, or a two-year time of travel zone, whichever is greater
- In areas with permanent or seasonally-shallow groundwater (< 10 feet below the ground surface)

A "sump system" (see **Exhibit 2-28**) is the total of all sump components at a single location (e.g., an intersection) and consists of inlets, piping, a sedimentation manhole, and one or more sumps. If one sump lacks adequate capacity to handle the design flow, a second sump may be placed in series with the first to provide additional capacity.

Infiltration Sump System

Sedimentation manholes with oil traps receive runoff from inlets before stormwater enters the sumps. The sedimentation manholes settle out most of the large particulate material that can clog sumps' drainage holes, decreasing maintenance needs and increasing long-term effectiveness.

Detailed drawings of a standard sump and standard sedimentation manhole can be found as **Exhibits 2-29** and **2-30** of this manual.

When constructed according to the standard design procedures, the sump system achieves both flow control and destination benefits. A sedimentation manhole reduces pollution through removal of sediment, oils, and grease. Additional pollution reduction facilities, such as street swales, planters or filters, must be used in non-residential streets, or streets with over 1,000 average daily trips.

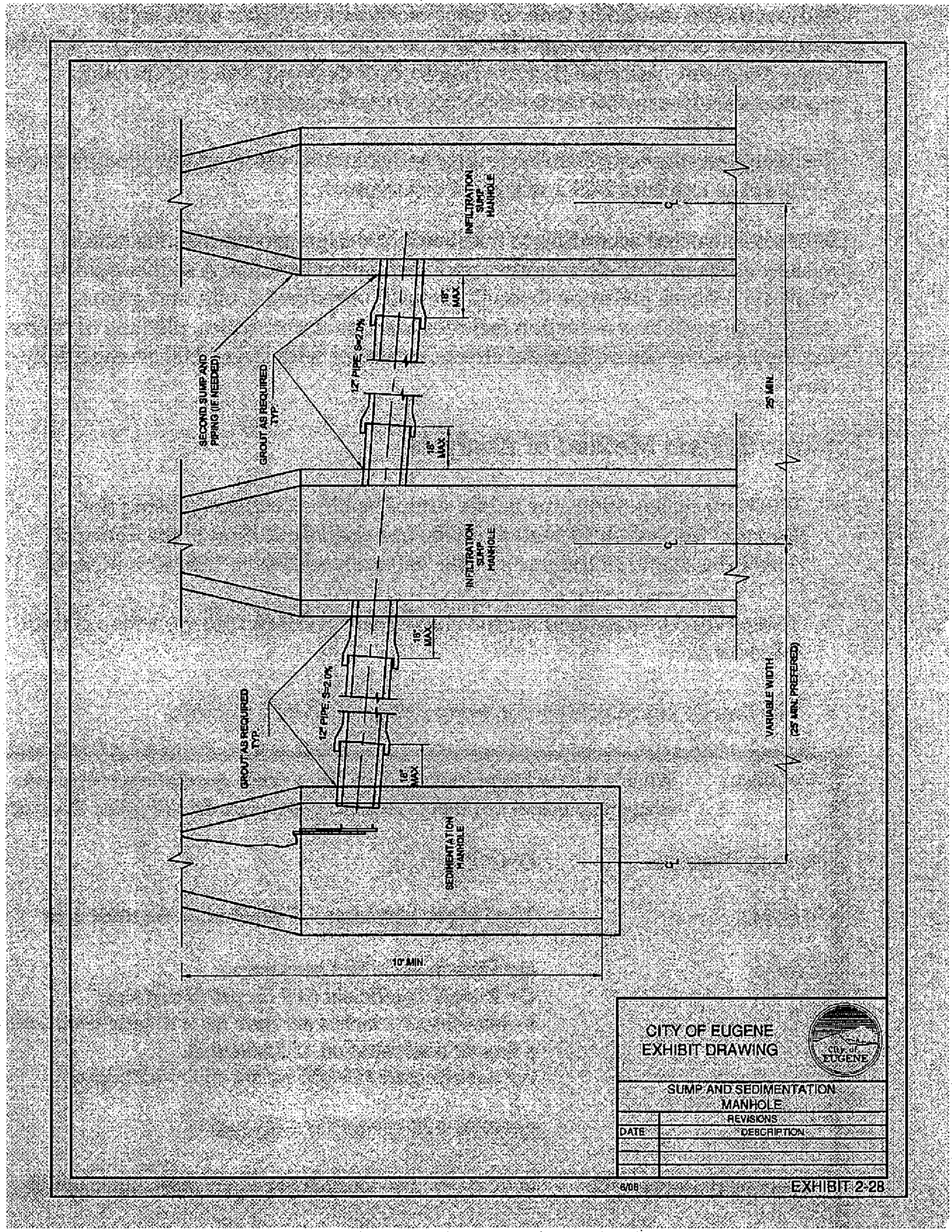
Sump System Method of Analysis

- Hydraulic calculations for public sumps shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's *Public Improvement Design Standards Manual.*
- Sumps shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for sump design shall be 5 minutes.

Example: What is the design percolation rate that a sump system must achieve to adequately dispose of runoff from 10,000 square-feet of paved street area?

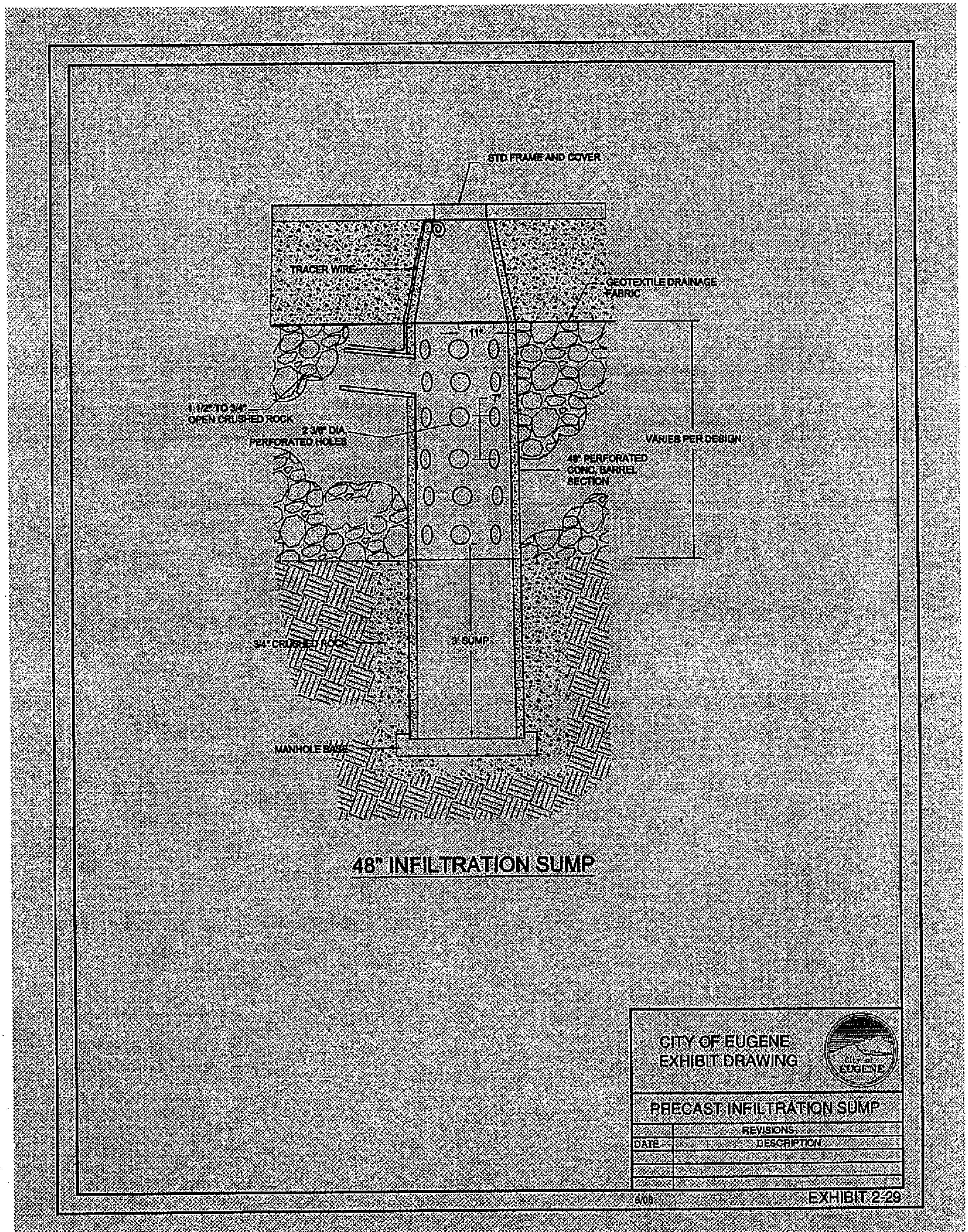
Rational Formula:	Q=C*I*A
Assume:	Time of concentration = 5 minutes for the street area
Where:	Q= Flow in cubic feet per second C= Runoff Coefficient (0.9 for paved surfaces) I= Intensity (3.1 inches per hour for a 10-year storm event and a time of concentration of 5 minutes) A= Area in acres (10,000 square-feet = 0.23 acres)
	Q= (0.9) * (3.1) * (0.23) = 0.64 cfs
Apply safety factor of 2:	Q= 2 * 0.64 cfs = **1.28 cfs or 574.5 gallons per minute**

Infiltration Sump System



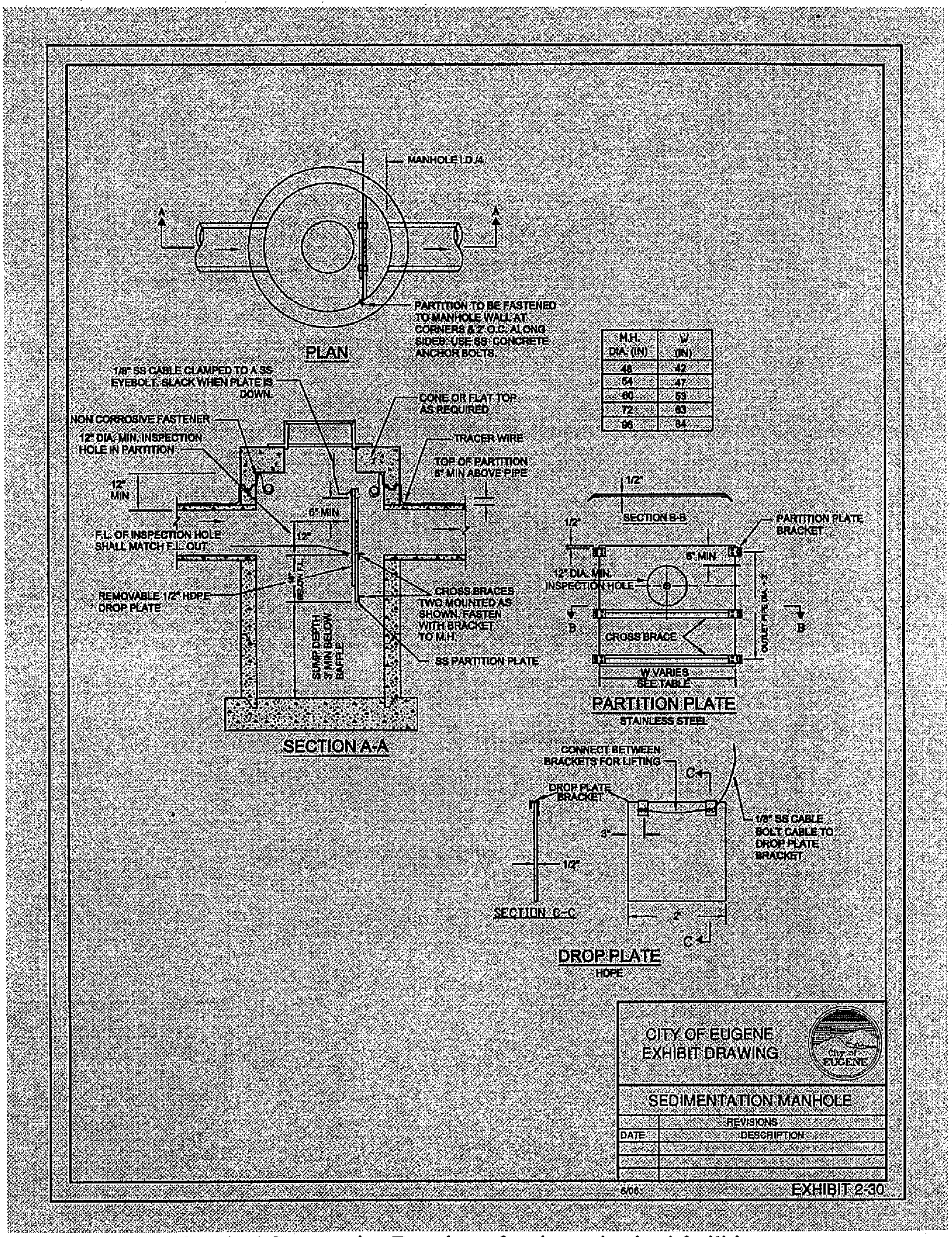
Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System

Sump System Design Requirements

- Sump systems shall be designed to handle **twice** the flow from the calculated design storm.

- A maximum of two sumps shall be used in series, unless approved by PW.

- The minimum distance between sumps shall be 25 feet.

- The desired distance between the sump and sedimentation manhole is 25 feet. This figure is a guideline and depends on site conditions.

- Sumps shall not be located within 200 feet from the tops of slopes more than 10 feet high and steeper than 2h: 1v.

- The diameter of pipe between the sump and sedimentation manhole shall be 12 inches.

- For Public Sump Systems, see Eugene's *Public Improvement Design Standards Manual* for acceptable pipe material types between the sump and sedimentation manhole.

- Sumps shall not be located in areas with a constant or seasonally high groundwater table, or shallow bedrock. The bottom of the sump shall be at least 10 feet above the seasonal high water table, and at least 3 feet above bedrock.

SUMP TESTING

Soil conditions are critical to the success of sump systems. The use of sumps will not be approved without supporting geotechnical evidence and a documented sump test to demonstrate they will work in that particular area. The geotechnical evidence shall include test sump data to provide information about local underground soil conditions and the potential infiltration capacity of the surrounding soil. Before being accepted by the City, all public sumps shall be tested after construction to ensure they meet or exceed the design capacity. The following sump testing procedure shall be used and must be shown on the construction plans of all public works sump projects:

Infiltration Sump System

SUMP NOTES
Design flows reflect a factor of safety of 2.
All sumps shall be tested by the contractor as directed and approved by the city inspector.
Sump testing shall take place after sump construction is complete and before the construction of the sedimentation manhole. Should a sump test fail to verify adequate capacity, an additional sump, constructed in series with the first sump (a maximum of two sumps per system) shall be required, as approved by PW. Should a test of two sumps in series fail to verify adequate capacity, an alternative public stormwater destination shall be required, as approved by PW.
Notify City inspector, at (541) 682-5560, at least 48 hours before beginning sump testing. A PW representative must be present during all sump capacity tests.
Contractor shall contact the EWEB, to arrange for sump test water supply. Contractor shall be responsible for obtaining necessary permits, authorization, and any fees.
Provide water flow from fire hydrants to sump being tested using 8-inch nominal diameter pipe. Deliver clean potable water to sump. Introduction of sediment is not acceptable and may result in failure of sump capacity test and reconstruction of sump.
Fill sump with water at an initial rate of 300 gallons per minute (gpm) and record water elevation below sump manhole lid, every five minutes. When water surface reaches a constant elevation, increase flow rate to sump to 600 gpm. Record water surface elevations every five minutes. Continue to increase flow rate 300 gpm each time water surface elevation stabilizes, until maximum capacity is reached.
Immediately upon completion of the sump test, provide City inspector with recorded test data. Contractor shall sign the results and submit to the City inspector.
The closest fire hydrant for sump testing is located at the intersection of ____________ & ____________. Contact EWEB to apply for a hydrant use permit.

Infiltration Sump System

Checklist of minimal information to be shown on the permit drawings:

1) Sump and sedimentation manhole location with setbacks to curb, right-of-way lines, and other existing and proposed utilities.
2) Rim and bottom elevation.
3) The sump and sedimentation manhole shall reference the City standard plan numbers.
4) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Operations and Maintenance requirements: Turbid runoff from construction sites shall not be allowed to enter the system at any time. One year after construction is completed and prior to Final Acceptance, the contractor shall verify the design capacity of the sump using the above sump testing procedures. For Public Sump Systems, the sedimentation manhole shall be cleaned prior to City acceptance of ownership and maintenance.

Infiltration Sump System

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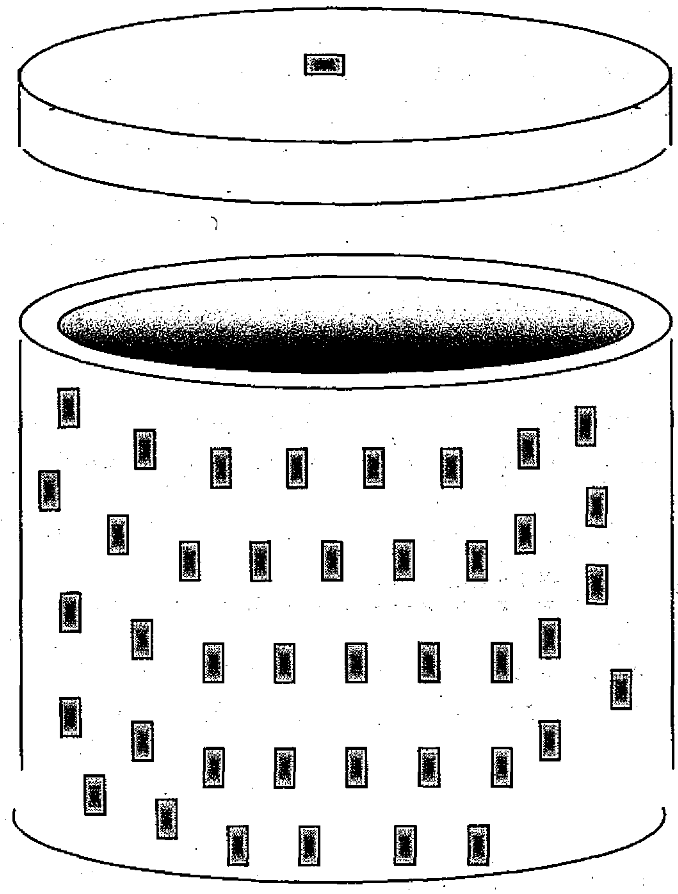
Drywell



Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
Pollution Reduction....................................	NA
√ Flow Control....................................	PRES
√ Destination....................................	PRES

This facility is classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Drywells can be used to manage stormwater runoff.

Drywell

Description: Drywells can be used as a stormwater destination by collecting and recharging stormwater runoff into the ground. The use of drywells is highly dependent on soil type and height of the groundwater table.

> **Note:** DEQ identifies drywells as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be classified as exempt, authorized by rule, or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, pollution reduction is required before disposing stormwater into them, with the exception of drywells that serve rooftops only. All drywells, with the exception of those that drain residential rooftops only, must be registered with DEQ prior to City permit issuance.
>
> More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**
>
> For technical questions call the DEQ UIC Program at 503-229-5945. For copies of applications or forms call 1-800-452-4011.

Drywells are recognized as a stormwater destination, but they are not intended to be used to meet pollution reduction requirements. Unless a drywell used exclusively for roof runoff, pollution reduction facilities must be used to receive runoff before it enters the drywell.

Drywell systems are prohibited where permanent or seasonally shallow groundwater will exist within 10 feet of the bottom of the drywell.

Drywell Design and Sizing Method

Soil conditions are critical to the success of drywells. Because of this, the use of drywells must be pre-approved by the City. Supporting geotechnical evidence and a documented drywell test may be required to demonstrate that drywells will work in the project area. Drywells shall not be located in areas with a constant or seasonally high groundwater table.

> **Note:** Developers should refer to OAR 340, Division 44, "Construction and Use of Waste Disposal Wells or Other Underground Injection Activities" for additional design and regulatory requirements.

Drywell

Drywell Sizing:

- Hydraulic calculations shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's Public Improvement Design Standards Manual.
- Drywells shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for a Drywell design shall be 5 minutes.

General Requirements:

Soils requirements: (NRCS classification)	A or B; C soils may be used if drawdown times are met
Maximum ground slopes	20 percent
Soil test requirement	ASTM D 3385-88 or City approval

1) If designed as the only stormwater destination, the drywell shall infiltrate the entire flood control design storm without overflow.

2) Drywells shall not be accepted in soils with a tested infiltration rate of less than 0.5 inches per hour.

3) There shall be no less than 4 feet of undisturbed depth of infiltration medium between the bottom of the facility and any impervious layer (hardpan, solid rock, etc.) or seasonal high groundwater levels.

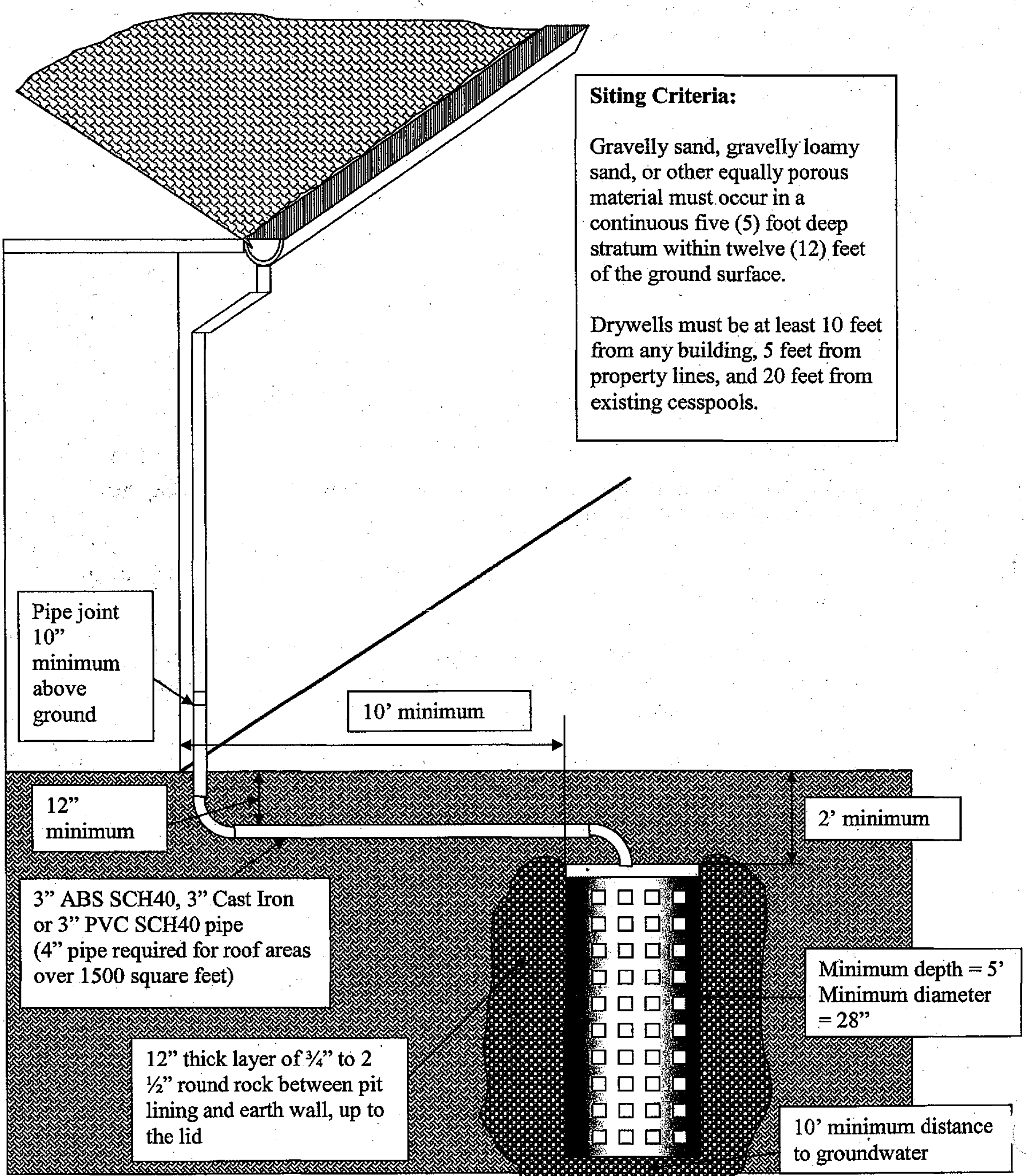
4) Drawdown time when full shall not exceed 10 hours.

5) Drywells shall meet the following setback requirements for downstream slopes: minimum of 100 feet from slopes of 20%; add 5 feet of setback for each additional percent of slope up to 30%; drywells shall not be used within 200 feet of where slopes exceed 30%.

6) Drywells should be located down slope of structures, and are required to be setback at least 10 feet from structures, 5 feet from property lines, and 5 feet from public utility lines.

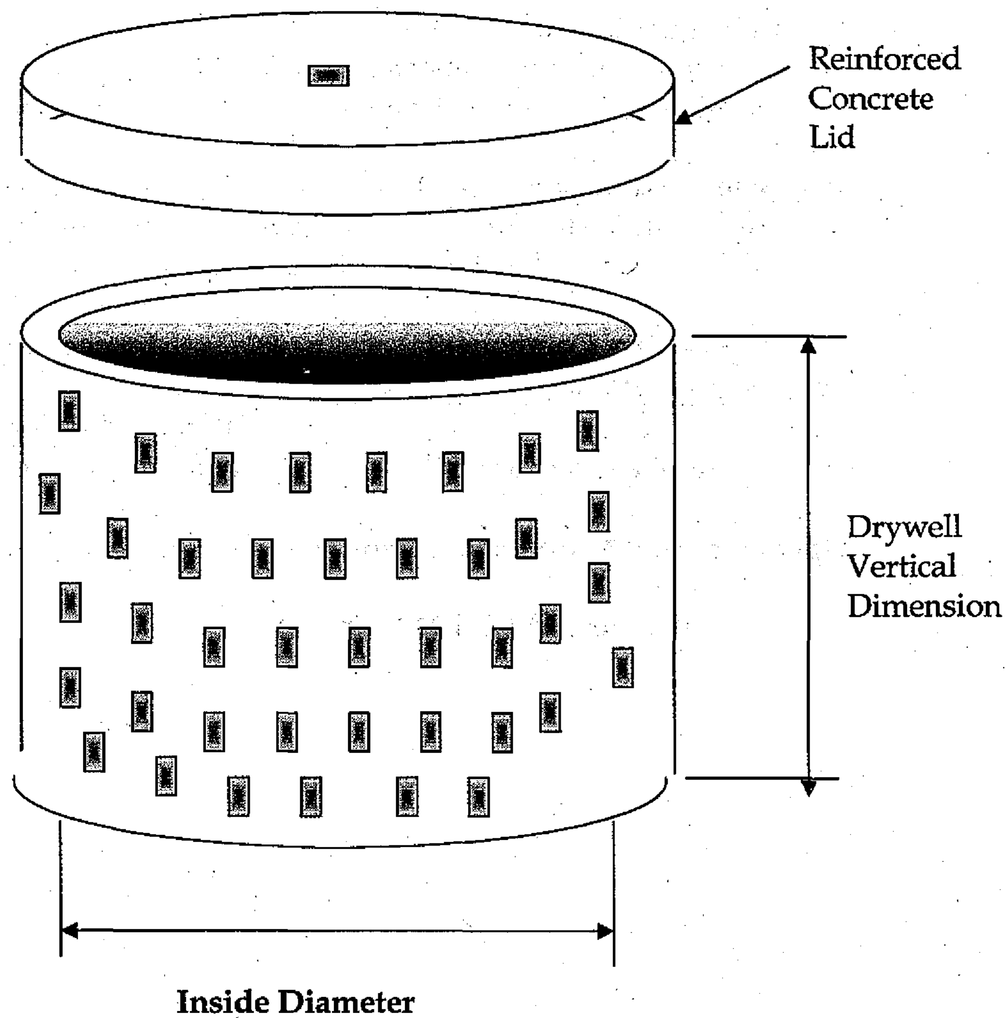
Drywell

Exhibit 2-31: Reinforced Concrete Drywell Typical Configuration



Drywell

Exhibit 2-32: Typical Drywell:



Drywell

Checklist of minimal information to be shown on the permit drawings:

1) Facility location with setbacks from property lines and structures.
2) Depth and diameter of drywell.
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Drywell excavation	
Piping	Call for inspection
Drywell installation & backfill	Cal for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to drywell O&M form**

Chapter 3.0
OPERATIONS & MAINTENANCE

Summary of Chapter 3.0

This chapter presents operation and maintenance (O&M) requirements for the stormwater management facilities in this manual. It includes:

To Use This Chapter:
1) After using **Chapters 1.0** and **2.0** to complete a stormwater management design for the project, fill out **Form O&M.**
2) Form O&M includes a blank section to insert a **site plan**, or attach a separate site plan sheet showing the location of the stormwater management facilities on the site, sources of stormwater runoff, and ultimate stormwater destination.
3) For **private** facilities: Record a copy of **Form O&M** and the **site plan** with the applicable county Department of Assessment and Taxation.
4) Submit a recorded copy of these sheets, along with the **facility-specific O&M plan** for each stormwater management facility used on-site, with the permit application. The O&M activities listed on the facility-specific O&M forms, which will be on file with PW, may later be revised with PW approval.
5) For **public** facilities: Submit a copy of an O&M plan with the public works permit application. County recording of this plan is not necessary.

Note: Enforcement rules regarding the inspection, operations, and maintenance of stormwater management facilities can be found in the *PW Enforcement Administrative Rules,* not included in this manual. Contact PW at 541-682-4800 for a copy of this document.

3.1 INTRODUCTION O & M

This chapter provides a **facility-specific O&M plan** that identifies the O&M requirements for each type of facility included in this manual. If a stormwater facility that is not included in this manual is used (such as a manufactured stormwater treatment technology) an O&M plan prepared by the proprietor, and facility-specific O&M activities that comply with the requirements of this chapter must still be submitted.

- The operations and maintenance (O& M) strategies in this chapter apply to all stormwater management facilities and related facility components identified in **Chapter 2.0**.

3.2 O&M APPLICATION SUBMITTALS

3.2.1 Privately Maintained Facilities

Form O&M: Operations & Maintenance Plan. The completed form must identify the owner's name, address, and phone number, the site address, financial method used to cover future operation and maintenance, and parties responsible for inspecting and maintaining the facility. It also provides a space to insert a site plan to identify the location of the facility on the site, sources of runoff entering the facility, and ultimate stormwater destination. This form must be included with every private stormwater management facility permit application, and must be recorded with the applicable county before permit issuance.

Facility-specific O&M plans (see page 3-14 through 3-41) The plans identify the specific O&M activities that are required for each type of stormwater management facility. The appropriate plans must be attached to **Form O&M** and submitted as part of the stormwater management facility permit application. The facility-specific O&M plans do not have to be recorded with the county. This allows the future stormwater management facility owner to submit O&M activity revisions, to the City, without the need to re-record the O&M plan with the county.

The facility-specific O&M activities for private facilities may be modified any time after permit issuance. Modifying the O & M activities is optional, and is intended to give the owner an opportunity to adjust maintenance needs according to site-specific history and conditions. Proposed modifications to the O&M plan must be submitted to the City for review and approval.

City Code requires an **Inspection and Maintenance Log** to be kept by facility owners. In general, the log should note all inspection dates, the facility components that were inspected, and any maintenance or repairs made. The facility-specific O&M plans can serve as a checklist for what should be included in the log (e.g. the facility elements that need to be inspected, frequency of inspection, conditions that indicate maintenance is needed, etc.). See page 3-13 for an **inspection and maintenance log sample.**

3.2.2 City-Maintained Facilities

A stormwater management facility that receives stormwater runoff from a public right-of-way shall become a public (City-maintained) facility. Facilities that will become City-maintained shall be constructed in compliance with City Code and the City's Public Improvement Design Standards Manual and shall be constructed under an "Engineering and Construction Agreement". See Section IV of the City's Public

Improvement Design Standards Manual (www.ci.eugene.or.us/pw/engineering/pidsm) for further information.

For facilities built under a privately engineered public improvement (PEPI) permit, a preliminary O&M plan shall be submitted as part of the applicant's public works permit application package. **Form O&M** and **facility-specific O&M plans** may be used to serve as the O&M plan. In addition, the applicant shall demonstrate on the construction plans that the City can achieve the specified O&M activities. Construction of maintenance access roads shall be part of the construction plans and the dedication of public access easements must be affirmed before the construction permit is issued.

Contractors building facilities under a PEPI permit are responsible for maintaining all site stormwater management features, including their associated vegetative components, during a 2-year maintenance warranty period. The contractor shall demonstrate vegetation cover planted, after the initial planting, has one full growth establishment season during the maintenance warranty period or the maintenance warranty period will be extended for one year.

At the end of this period a modified O&M plan for all site features, based on experience with the site over the 2 years, shall be filed with the City. Final facility sign-off will not be given until the modified O&M plan has been submitted.

Contractors working directly for the City shall follow the specifications in their contracts.

3.3 O&M PLAN ENFORCEMENT

Stormwater management facilities, constructed to comply with the requirements of this manual, must be properly operated and maintained for the life of the facility. The facility owner is responsible for all aspects of facility maintenance unless specified otherwise in an Operations and Maintenance Agreement (O&M Agreement) that is approved by the City, signed by all affected parties, and recorded against all affected properties.

City staff has the right and responsibility to inspect private facilities to assure they are being properly operated and maintained. It is the intent of the City to use education and technical assistance to ensure the proper O&M of private facilities. Administrative rules and procedures regarding City inspection and enforcement activities for assurance of proper O&M are not included in this manual

FORM O&M: OPERATIONS & MAINTENANCE PLAN

INSTRUCTIONS

The following are instructions to prepare and file Form O&M: Operations & Maintenance Plan for a stormwater management facility.

Failure to properly operate or maintain the water quality or quantity control facility according to the operation and maintenance plan may result in a civil penalty.

A copy of the operation and maintenance plan shall be filed with the Eugene Public Works. Completed O&M Plans shall be submitted to:

Public Works Parks & Open Spaces

1820 Roosevelt

Eugene, OR 974

The operation and maintenance plan shall be recorded and filed with the Lane County Department of Assessment and Taxation. Form O&M with a site plan must be recorded. Additional plans of the facility and facility-specific O&M activities will be retained at Public Works Engineering, 858 Pearl Street, Eugene, OR 97401.

Before recording the O&M plan, the applicant shall sign the form, and the signature shall be notarized. When completed accurately, this form meets the recording requirements in Lane County. The notarized O&M plan may be submitted in person or mailed, along with payment of the applicable fees, to the County Recorder's Office, Lane County Assessment and Taxation, Deeds and Records, 125 E. 8th Avenue, Eugene, OR 97401 http://www.co.lane.or.us/AT_PropRec/default.htm.

FORM O&M: OPERATIONS & MAINTENANCE PLAN

INSTRUCTIONS (PAGE 2)

1: Fill out Form O&M

Project building application number: City staff will insert this number.

Owner: Print the name of the property owner.

Phone no.: Print the area code and 7-digit phone number of the property owner.

Mailing address: Print the property owner's mailing address, including zip code. After the plan is recorded with the county recorder's office, a copy of the recorded O&M Plan will be mailed to this address. The City will also use this address if further correspondence is required.

Site address: Print the address of the property where the stormwater management facility is located.

Site legal description: Print the property's legal description. Property legal descriptions may be obtained from the county assessor's office.

Signature: Sign the O&M plan form under "filer" in the presence of a notary.

Site plan: Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), the sources of runoff entering the stormwater facility, where stormwater will be discharged to after leaving the facility, and the maintenance access location. The site plan can be inserted on Form O&M or included as a separate sheet.

Description of the financial method used to cover future operations and maintenance:
Check the appropriate box.

Party (ies) responsible for maintenance:
Provide the name, address, and phone number (both daytime and after-hours numbers) for the person or company who shall be responsible for maintaining or directly supervising the maintenance of the stormwater facilities described in the O&M Plan.

Maintenance practices and schedule for the stormwater management facility:
Provide the date the O&M Plan was prepared, the date the plan was revised (if applicable), and the month and year of the stormwater management facility installation. Provide the name, firm (if applicable), and address of the person who prepared the O&M Plan.

Spill response plan for the stormwater management facility:
Provide a spill response plan for the cleanup and disposal of spilled or discharged hazardous or environmentally damaging substances. Provide the name, firm (if applicable), and address of the person who will be responsible for responding in the event of a spill or discharge of hazardous or environmentally damaging substances.

FORM O&M: OPERATIONS & MAINTENANCE PLAN
REQUIRED IN ACCORDANCE WITH CITY CODE

Project Building Application No.	*For official county use only*
Owner's Name Phone No. (area code required) (_____) _____ - _________	
Mailing Address (RETURN ADDRESS FOR RECORDER)	
Site Address	
Site Legal Description	

BY SIGNING BELOW, filer accepts and agrees to the terms and conditions contained in this operations & maintenance plan and in any document executed by filer and recorded with it.

____

Filer

NOTARIZATION: GIVEN under my hand and official seal

this _______ day of _________________, _________.

Notary Public in and for the State of Oregon:

My Appointment Expires on:

O&M PLAN REQUIRED INFORMATION:

1) Site Plan. Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), sources of runoff entering the facility, and where stormwater will be discharged to after leaving the facility. **The stormwater management facility located on this site plan is a required condition of building permit approval for the identified property. The owner of the identified property is required to operate and maintain this facility in accordance with the O&M plan on file with the City. The requirement to operate and maintain this facility in accordance with the on-file O&M plan is binding on all current and future owners of the property. The O&M plan may be modified under written consent of new owners with written approval by and re-filing with the City. The O&M plan for this facility is available at the Public Works Department, located at 1820 Roosevelt, Eugene, Oregon, between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call (541) 882-4800 for assistance.**	**Site Plan (insert here or include separate sheet):**

2) Description of the financial method used to cover future operations and maintenance. ***Check One:***

☐ Homeowner Association ☐ Property Owner Account ☐ Other (*describe*)_______________________________

3) Party (ies) responsible for maintenance (only if other than owner).

Daytime Phone No. (area code required)(_____) _____ - _____	Emergency/After-Hours Contact Phone No. (_____) _____ -
Maintenance Contact & Address	

4) Maintenance practices and schedule for the stormwater facility is included in the facility-specific O&M plan filed with the Public Works Department, City of Eugene. The operation and maintenance practices are based on the publication date of the City of Eugene's Stormwater Management Manual.

Preparation Date ____ / ____ / ______	Revision Date ____ / ____ / ______	Estimated Date of Installation *(month/year)* ___ / ___
Prepared By_______________________________		

FORM O&M: OPERATIONS & MAINTENANCE PLAN (Example)

REQUIRED IN ACCORDANCE WITH CITY CODE

Project Building Application No.	*For official county use only*
Owner's Name John Doe **Phone No.** (area code required) (541) 555 - 5555	
Mailing Address (RETURN ADDRESS FOR RECORDER) **XXX NW XXX Street, XXXXX, OR XXXXX**	
Site Address **XXX NW XXX Street, XXXXX, OR XXXXX**	
Site Legal Description **Section XX, Township XX, Range XX, Tax Lot XX**	

BY SIGNING BELOW, filer accepts and agrees to the terms and conditions contained in this operations & maintenance plan and in any document executed by filer and recorded with it.

John Doe

Filer

NOTARIZATION: GIVEN under my hand and official seal

this ________ day of ____________________ , __________.

Notary Public in and for the State of Oregon:

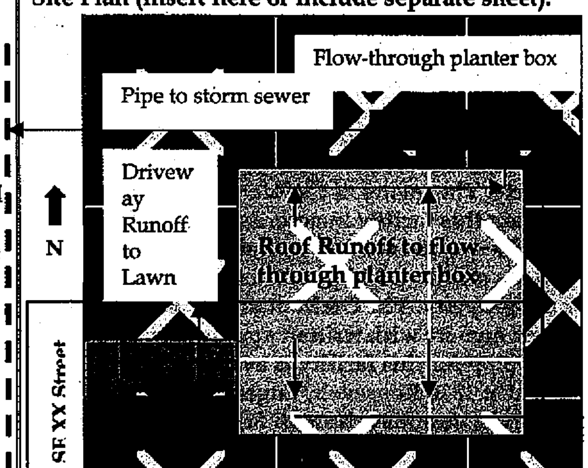
My Appointment Expires on:

O&M PLAN REQUIRED INFORMATION:

1) Site Plan. Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), sources of runoff entering the facility, and where stormwater will be discharged to after leaving the facility.

The stormwater management facility located on this site plan is a required condition of building permit approval for the identified property. The owner of the identified property is required to operate and maintain this facility in accordance with the O&M plan on file with the City. The requirement to operate and maintain this facility in accordance with the on-file O&M plan is binding on all current and future owners of the property. The O&M plan may be modified under written consent of new owners with written approval by and re-filing with the City. The O&M plan for this facility is available at Public Works Department, located at 1820 Roosevelt, Eugene, Oregon, between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call 541-682-4800 for assistance.

Site Plan (insert here or include separate sheet):



2) Description of the financial method used to cover future operations and maintenance. ***Check One:***

❑ Homeowner Association   X Property Owner Account   ❑ Other *(describe)*____________________

3) Party (ies) responsible for maintenance (only if other than owner). Owner Responsible

Daytime Phone No. (area code required) **(541) xxx–xxxx**	Emergency/After-Hours Contact Phone No. **(541) xxx-xxxx**
Maintenance Contact & Address **Garden Guy Landscaping XXX NE XX Street XXXXXX, OR 97XXX**	

4) Maintenance practices and schedule for the stormwater facility is included in the facility-specific O&M plan filed with the Public Works Department, City of Eugene. The operation and maintenance practices are based on the publication date of the City of Eugene's Stormwater Management Manual.

Preparation Date **XX/ XX /200X**	Revision Date ______ / ____ / _______	Estimated Date of Installation *(month/year)* **XX /XXXX**

Prepared By **John Doe**

STORMWATER MANAGEMENT FACILITY
CITY OF EUGENE, OREGON
OPERATION & MAINTENANCE AGREEMENT (SAMPLE)

Sediment and other pollutants that degrade water quality will accumulate in urban stormwater facilities. The operation and maintenance of stormwater management facilities including the implementation of pollution reduction facilities is essential to the protection of the city's water quality. Removal of accumulated pollutants and sediment is important for proper operation. All property owners are expected to conduct business in a manner that promotes resource protection. This agreement contains specific provisions with respect to city maintenance of private stormwater management facilities and use of pollution reduction facilities.

Property Address:

Legal description:

Whereas, ____________________, herein referred to as Owner, has constructed improvements, including but not limited to buildings, pavement, and stormwater management facilities on the property described above. In order to further the goals of the City of Eugene to ensure the protection and enhancement of water quality, the City of Eugene and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

Recitals

1. **Owner owns the above described property within the City of Eugene, Lane County, Oregon.**
2. **Owner owns and operates stormwater management facilities approved and permitted as required by land use permit _________.**
3. **Owner has requested the city to provide the functional maintenance of the facility.**
4. **City approved construction plans dedicating the drainage system conveying runoff from the residential properties to the stormwater facility as a public drainage system are on file.**
5. **Access routes have been located within a dedicated public easement on private or commonly held property, within the public right-of-way or on city owned property.**
6. **Sufficient easement area, right-of-way width or property have been provided to accommodate the construction and maintenance of all existing and proposed utilities and public infrastructure.**

Owner shall:

1. **Implement the stormwater management program included herein as Attachment "A". (Stormwater disposal and pollution reduction construction details, and source control protection, etc.)**
2. **Implement the stormwater maintenance plan included herein as Attachment "B". (Owner responsibilities such as vegetation control, debris pickup, etc.)**
3. **Inspect the facilities monthly and after significant storm events to determine if maintenance activity is warranted.**
4. **Maintain maintenance and inspection records (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by appointment at ________________________. The log book shall catalog any action taken, who took the action, when it was taken, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected as specified in the attached instructions or more often if necessary. The Owner and Users are encouraged to photocopy the individual checklists in Attachment "A" and use them to complete its inspections. These completed checklists would then, in combination, comprise the logbook.**
5. **Submit an annual report to the City of Eugene regarding implementation programs referenced in (1) and (2) above. The report must be submitted on or before June 30 of each calendar year after execution of this agreement. At a minimum, the following items shall be included in the report:**
   - A. **Name, address, and telephone number of the businesses, persons, or firms responsible for maintenance plan implementation, and the persons completing the report.**
   - B. **Time period covered by the report.**
   - C. **A chronological summary of activities conducted to implement the program and plan referenced in (1) and (2) above. A photocopy of the applicable sections of the logbook with any additional explanations needed, shall suffice. For any activities conducted by paid parties, include a copy of the invoice for services.**
   - D. **Any outline planned activities for the upcoming year.**
6. **Allow the City of Eugene staff to inspect stormwater management facilities at the above referenced site.**

City of Eugene shall:

1. Execute the following periodic major maintenance on the subdivision's pollution reduction facilities: sediment removal from facilities, resetting orifice sizes and elevations, and adding baffles.
2. Maintain all stormwater management facility elements within the public rights of way and dedicated easements, such as catch basins, weirs, oil-water separators, and pipes.
3. Provide technical assistance to the Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and as the City of Eugene's time and resources permit.
4. Review the annual report and conduct a minimum of one (1) site visit per year to discuss performance and problems with the stormwater management facilities.
5. Review the agreement with the Owner and modify it as necessary at least once every three (3) years.

Remedies:

1. If the City of Eugene determines that maintenance that maintenance or repair work is required to be done to the stormwater management facilities located in the subdivision, the City of Eugene shall give the Owner notice of the specific maintenance and/or repair required. The City of Eugene shall set a reasonable time in which such work is to be completed the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the City of Eugene, written notice will be sent to the Owner stating the City of Eugene's intention to perform such maintenance and bill the Owner for all incurred expenses.
2. If, at any time, the City of Eugene determines that the existing facility creates any imminent threat to public health, safety, or welfare, the City of Eugene may take immediate measures to remedy said threat. No notice to the persons listed in Remedies (1), above shall be required under such circumstances. All other Owner responsibilities shall remain in effect.
3. The Owner shall grant unrestricted authority to the City of Eugene for access to any and all stormwater management facilities for the purpose of performing maintenance or repair as may become necessary under Remedies (1) and/or (2).
4. The Owner shall assume responsibility for the cost of maintenance and repairs to the stormwater management facilities, except for those maintenance actions explicitly assumed by the City of Eugene in the preceding section. Such responsibility shall include reimbursement to the City of Eugene within 90 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the City of Eugene will be borne by the parties responsible for said reimbursements.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the City of Eugene. It shall run with the land and be binding on all parties having or acquiring any right, title, or interest or any part thereof, of real property in the subdivision. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof or interest therein, and to the benefit of all citizens of the City of Eugene.

Agreed to and signed by:

Owner(s) ____ Date __________________

On this day and year, the above Owner(s) ____________________, personally appeared before me and provided photo identification, and who executed the foregoing instrument and acknowledge that they signed the same as their free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this ______ day of _________________, 20______

Notary Public in and for the State of

Oregon, residing in ______________________

My commission expires ______________________

Dated in Eugene, Oregon, this ________ day of ______________, 20_______

MANAGER, CITY OF EUGENE

On this day and year, personally appearing before me, ________________________ and ______________________, who executed the foregoing instrument and acknowledge the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute said instrument.

Given under my hand and official seal this ______ day of _________________, 20______

Notary Public in and for the State of

Oregon, residing in ______________________

My commission expires ______________________

Dated in Eugene, Oregon, this ________ day of ______________, 20_______

STORMWATER MANAGEMENT FACILITY
INSPECTION & MAINTENANCE LOG (SAMPLE)

Property Address:

Inspection Date:

Inspection Time:

Inspected By:

Approximate Date/Time of Last Rainfall:

Type of Stormwater Management Facility:

Location of Facility on Site (In relation to buildings or other permanent structures):

Water levels and observations (Oil sheen, smell, turbidity, etc.):

Sediment accumulation & record of sediment removal:

Condition of vegetation (Height, survival rates, invasive species present, etc.) & record of replacement and management (mowing, weeding, etc.):

Condition of physical properties such as inlets, outlets, piping, fences, irrigation facilities, and side slopes. Record damaged items and replacement activities:

Presence of insects or vectors. Record control activities:

Identify safety hazards present. Record resolution activities:

FACILITY-SPECIFIC OPERATIONS AND MAINTENANCE PLANS

FACILITY PAGE

Eco-Roofs and Roof Gardens

Operations & Maintenance Plan

Eco-roofs and Roof Gardens are vegetated roof systems that retain and filter stormwater and provide aesthetic and energy conservation benefits. All facility components, including soil substrate or growth medium, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure shall be inspected for proper operations, integrity of the waterproofing, and structural stability throughout the life of the eco-roof or roof garden. All elements shall be inspected once a month from April through September. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Soil Substrate/ Growing Medium shall be inspected for evidence of erosion from wind or water.

- If erosion channels are evident, they shall be stabilized with additional soil substrate/growth medium and covered with additional plants.

Eco-Roof System Structural Components shall be operated and maintained in accordance with manufacturer's requirements. Drain Inlets shall be kept unrestricted.

- Inlet pipe shall be cleared when soil substrate, vegetation, debris or other materials clog the drain inlet. Sources of sediment and debris shall be identified and corrected.
- Determine if drain inlet pipe is in good condition and correct as needed.

Debris and Litter shall be removed to prevent clogging of inlet drains and interference with plant growth.

Vegetation shall be maintained to provide 90% plant cover.

- During the Establishment Period, plants shall be replaced once per month as needed. During the long-term period, dead plants shall generally be replaced once per year in the fall months.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Nuisance and prohibited vegetation from the Eugene Plant List shall be removed when discovered.
- Dead vegetation shall be removed and replaced with new plants.
- Weeding shall be manual with no herbicides or pesticides used. Weeds shall be removed regularly and not allowed to accumulate.
- Fertilization is not necessary and fertilizers shall not be applied.
- During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss.
- Mowing of grasses shall occur as needed. Clippings shall be removed.

Irrigation can be accomplished either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, manufacturers' instructions for operations and maintenance shall be followed.

- During the Establishment Period (1-3 years), water sufficient to assure plant establishment and not to exceed ¼ inch of water once every 3 days shall be applied.
- During the long-term period (3+ years), water sufficient to maintain plant cover and not to exceed ¼ inch of water once every 14 days shall be applied.

Spill Prevention measures from mechanical systems located on roofs shall be exercised when handling substances that can contaminate stormwater.

- Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining eco-roofs shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access and Safety to the eco-roof shall be safe and efficient.

- Egress and ingress routes shall be maintained to design standards. Walkways shall be clear of obstructions and maintained to design standards.

Aesthetics of the eco-roof shall be maintained as an asset to the property owner and community.

- Evidence of damage or vandalism shall be repaired and accumulation of trash or debris shall be removed upon discovery.

Insects shall not be harbored at the eco-roof.

- Standing water creating an environment for development of insect larvae shall be eliminated by manual means. Chemical sprays shall not be used.

Contained Planters

Operations & Maintenance Plan

Contained planters are designed to intercept rainfall that would normally fall on impervious surfaces. In this respect contained planters convert impervious surfaces to pervious ones, decreasing the amount of stormwater runoff from a site. Water should drain through the planter within 3-4 hours after a storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation and 2 times per year thereafter. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Filter Media consisting of sand or topsoil shall allow stormwater to percolate uniformly through the planter.

- The planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.

Planter shall contain filter media and vegetation.

- Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.

Planter Reservoir receives and detains storm water prior to infiltration. If water does not drain from reservoir within 3-4 hours of storm event, sources of clogging shall be identified and corrected. Topsoil may need to be amended with sand or replaced all together.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished at least annually.
- Planter vegetation shall be irrigated to ensure survival.
- Vegetation, large shrubs or trees that limit access or interfere with planter operation shall be pruned or removed.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance and prohibited vegetation from the Eugene Plant List shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species (measured in a 10 x 10 foot plot) shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe, e.g., 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Training and/or written guidance information for operating and maintaining planters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored at the stormwater planter. Pest control measures shall be taken when insects/rodents are found to be present.

- Standing water creating an environment for development of insect larvae shall be eliminated.
- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the stormwater planter shall be filled and compacted.

Pervious Pavement
Operations & Maintenance Plan

Pervious pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil or being collected in underlying drain pipes and being discharged off-site. There are many types of pervious pavement including plastic rings planted with grass, stone or concrete blocks with pore spaces backfilled with gravel or sand, porous asphalt, and porous concrete. Pervious pavement accepts only precipitation, not stormwater runoff. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Surface: In most pervious pavement design, the pavement itself acts as pretreatment to the stone reservoir below. The surface shall be kept clean and free of leaves, debris, and sediment. The surface shall not be overlaid with an impermeable paving surface

- Regular sweeping shall be implemented for porous asphalt or concrete systems.

Overflows or Emergency Spillways are used in the event that the facility's infiltration capacity is exceeded. Overflow devices shall be inspected for obstructions or debris, which shall be removed upon discovery Overflow or emergency spillways shall be capable of transporting high flows of stormwater to an approved stormwater receiving system.

- Sources of erosion damage shall be identified and controlled when native soil is exposed near the overflow structure.

Vegetation (where applicable) shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Vegetation, such as trees and shrubs, should not be located in or around the pervious pavement because roots from trees can penetrate the pavement, and leaves from deciduous trees and shrubs can increase the risk of clogging the surface.

- Vegetation and large shrubs/trees that limit access or interfere with porous pavement operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Poisonous, nuisance, dead or odor producing vegetation shall be removed immediately.
- Grass shall be mowed to less than four inches and grass clippings shall be bagged and removed.
- Irrigation shall be provided as needed.

Source Control measures prevent pollutants from mixing with stormwater. Typical non-structural control measures include raking and removing leaves, street sweeping, vacuum sweeping, limited and controlled application of pesticides and fertilizers, and other good house keeping practices.

Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater. A spill prevention plan shall be implemented at all non-residential sites and in areas where there is likelihood of spills from hazardous materials. However, virtually all sites, including residential and commercial, present potential danger from spills. All homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, solvents, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining pervious pavement shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the pervious pavement shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.
Obstacles preventing maintenance personnel and/or equipment access to the porous pavement shall be removed. Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present.

- Standing water creating an environment for development of insect larvae shall be eliminated.
- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    i) Installation of predacious bird or bat nesting boxes.
    ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.

If used at this site, the following will be applicable:

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. It may also discourage behaviors that adversely affect stormwater protection measures. For example, if debris is a problem, a sign reminding people not to litter may partially solve the problem. Broken or defaced signs shall be replaced/repaired.

Vegetated, Grassy, and Street Swales
Operations & Maintenance Plan

Swales are planted or grassed open channels that trap pollutants by filtering and slowing flows, allowing particles to settle out. The swale should drain within 48 hours of a storm event. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Swale Inlet (such as curb cuts or pipes) shall maintain a calm flow of water entering the swale.

- Source of erosion shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4" thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Rock splash pads shall be replenished to prevent erosion.

Side Slopes shall be maintained to prevent erosion that introduces sediment into the swale.

- Slopes shall be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are forming.

Swale Media shall allow stormwater to percolate uniformly through the landscape swale. If the swale does not drain within 48 hours, it shall be tilled and replanted according to design specifications.

- Annual or semi-annual tilling shall be implemented if compaction or clogging continues.
- Debris in quantities that inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Swale Outlet shall maintain sheet flow of water exiting swale unless a collection drain is used. Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.

- Outlets such as drains and overland flow paths shall be cleared when 50% of the conveyance capacity is plugged.
- Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Mulch shall be replenished as needed to ensure survival of vegetation.

- Vegetation, large shrubs or trees that interfere with landscape swale operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Grassy swales shall be mowed to keep grass 4" to 9" in height. Clippings shall be removed to remove pollutants absorbed in grasses.
- Nuisance and prohibited vegetation from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation and woody material shall be removed to maintain less than 10% of area coverage or when swale function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining swales shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the swale shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the swale shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated, Grassy, and Street Swales Operations & Maintenance Plan
Insects & Rodents shall not be harbored in the swale. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the swale shall be filled.
If used at this site, the following will be applicable:
Check Dams shall control and distribute flow. • Causes for altered water flow shall be identified, and obstructions cleared upon discovery. • Causes for channelization shall be identified and repaired.

Vegetated Filter Strips

Operations & Maintenance Plan

Vegetated filter strips are gently sloped vegetated areas that stormwater runoff is directed to flow and filter through. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a flow spreader. Flow control is achieved using the relatively large surface area and check dams. Pollutants are removed through infiltration and sedimentation. The vegetative filter should drain within 48 hours of storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Flow Spreader shall allow runoff to enter the vegetative filter as predominantly sheet flow.
- Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment build-up near or exceeding 2" in depth shall be removed.

Filter Inlet shall assure unrestricted stormwater flow to the vegetative filter.
- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged.
- Rock splash pads shall be replenished to prevent erosion.

Filter Media shall allow stormwater to percolate uniformly through the vegetative filter.
- If the vegetative filter does not drain within 48 hours, it shall be regraded and replanted according to design specifications. Established trees shall not be removed or harmed in this process.
- Debris in quantities more than 2" deep or sufficient to inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Check Dams shall direct and control flow.
- Causes for altered water flow and channelization shall be identified, and obstructions cleared upon discovery.
- Cracks, rot, and structural damage shall be repaired.

Filter Outlet shall allow water to exit the vegetative filter as sheet flow, unless a collection drainpipe is used.
- Sources of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are deeper than 2 inches.
- Outlet shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance and prohibited vegetation from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater.
Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining vegetated filters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the vegetative filter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards.
Obstacles preventing maintenance personnel and/or equipment access to the facility shall be removed.
Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated Filter Strips

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the vegetated filter. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the vegetated filter shall be filled.

Infiltration and Flow-Through Planters

Operations & Maintenance Plan

Planters are designed to allow runoff to filter through layers of topsoil (thus capturing pollutants) and then either infiltrate into the native soils (infiltration planter) or be collected in a pipe to be discharged off-site (flow-through planter). The planter is sized to accept runoff and temporarily store the water in a reservoir on top of the soil. The flow-through planter is designed with an impervious bottom or is placed on an impervious surface. Water should drain through the planter within 3-4 hours after a storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Downspout from rooftop or sheet flow from paving allows unimpeded stormwater flow to the planter.

- Debris shall be removed routinely (e.g., no less than every 6 months) and upon discovery.
- Damaged pipe shall be repaired upon discovery.

Splash Blocks prevent splashing against adjacent structures and convey water without disrupting media.

- Any deficiencies in structure such as cracking, rotting, and failure shall be repaired.

Planter Reservoir receives and detains storm water prior to infiltration. Water should drain from reservoir within 3-4 hours of storm event.

- Sources of clogging shall be identified and corrected.
- Topsoil may need to be amended with sand or replaced all together.

Filter Media consisting of sand, gravel, and topsoil shall allow stormwater to percolate uniformly through the planter. The planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.

- Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- Sediment accumulation shall be hand removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.

Planter shall contain filter media and vegetation.

- Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.

Overflow Pipe safely conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow pipe shall be cleared of sediment and debris when 50% of the conveyance capacity is plugged.
- Damaged pipe shall be repaired or replaced upon discovery.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished at least annually.
- Vegetation, large shrubs or trees that limit access or interfere with planter operation shall be pruned or removed.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe, e.g., 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining stormwater planters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Infiltration and Flow-Through Planters

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the stormwater planter.
Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    i) Installation of predacious bird or bat nesting boxes.
    ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the stormwater planter shall be filled and compacted.

Vegetated Infiltration Basins

Operations & Maintenance Plan

A **vegetated Infiltration Basin** is a vegetated depression created by excavation, berms, or small dams to provide for short-term ponding of surface water until it percolates into the soil. The basin shall infiltrate stormwater within 24 hours. All facility components and vegetation shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Basin Inlet shall assure unrestricted stormwater flow to the vegetated basin.

- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Inlet shall be cleared when conveyance capacity is plugged.
- Rock splash pads shall be replenished to prevent erosion.

Embankment, Dikes, Berms & Side Slopes retain water in the infiltration basin.

- Structural deficiencies shall be corrected upon discovery:
- Slopes shall be stabilized using appropriate erosion control measures when soil is exposed/ flow channels are forming.
- Sources of erosion damage shall be identified and controlled.

Overflow or Emergency Spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow shall be cleared when 25% of the conveyance capacity is plugged.
- Sources of erosion damage shall be identified and controlled when soil is exposed.
- Rocks or other armament shall be replaced when only one layer of rock exists.

Filter Media shall allow stormwater to percolate uniformly through the infiltration basin. If water remains 36-48 hours after storm, sources of possible clogging shall be identified and corrected.

- Basin shall be raked and, if necessary, soil shall be excavated, and cleaned or replaced.

Sediment/ Debris Management shall prevent loss of infiltration basin volume caused by sedimentation. Gauges located at the opposite ends of the basin shall be maintained to monitor sedimentation.

- Sediment and debris exceeding 4" in depth shall be removed every 2-5 years or sooner if performance is affected.
- Restricted sources of sediment and debris, such as discarded lawn clippings, shall be identified and prevented.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished as needed to ensure healthy plant growth.
- Vegetation, large shrubs or trees that limit access or interfere with basin operation shall be pruned or removed.
- Grass shall be mowed to 4"-9" high and grass clippings shall be removed no less than 2 times per year.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to control erosion.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining vegetated infiltration basins shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the infiltration basin shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the infiltration basin shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated Infiltration Basins Operations & Maintenance Plan
Insects & Rodents shall not be harbored in the infiltration basin. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the infiltration basin shall be filled.
If used at this site, the following will be applicable:
Fences shall be maintained to preserve their functionality and appearance. • Collapsed fences shall be restored to an upright position. • Jagged edges and damaged fences shall be repaired or replaced.

Sand Filters
Operations & Maintenance Plan

Sand filters consist of a layer of sand in a structural box used to trap pollutants. The water filters through the sand and then flows into the surrounding soils or an underdrain system that conveys the filtered stormwater to a discharge point. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Filter Inlet shall allow water to uniformly enter the sand filter as calm flow, in a manner that prevents erosion.

- Inlet shall be cleared of sediment and debris when 40% of the conveyance capacity is plugged.
- Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- Rock splash pads shall be replenished to prevent erosion.

Reservoir receives and detains stormwater prior to infiltration. If water does not drain within 2-3 hours of storm event, sources of clogging shall be identified and correction action taken.

- Debris in quantities more than 1 cu ft or sufficient to inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.
- Structural deficiencies in the sand filter box including rot, cracks, and failure shall be repaired upon discovery.

Filter Media shall allow to stormwater to percolate uniformly through the sand filter. If water remains 36-48 hours after storm, sources of possible clogging shall be identified and corrected.

- Sand filter shall be raked and if necessary, the sand/gravel shall be excavated, and cleaned or replaced.
- Sources of restricted sediment or debris (such as discarded lawn clippings) shall be identified and prevented.
- Debris in quantities sufficient to inhibit operation shall be removed no less than quarterly, or upon discovery.
- Holes that are not consistent with the design structure and allow water to flow directly through the sand filter to the ground shall be filled.

Underdrain Piping (where applicable) shall provide drainage from the sand filter, and **Cleanouts** (where applicable) located on laterals and manifolds shall be free of obstruction, and accessible from the surface.

- Underdrain piping shall be cleared of sediment and debris when conveyance capacity is plugged. Cleanouts may have been constructed for this purpose.
- Obstructions shall be removed from cleanouts without disturbing the filter media.

Overflow or Emergency Spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow spillway shall be cleared of sediment and debris when 50% of the conveyance capacity is plugged.
- Source of erosion damage shall be identified and controlled when erosion channels are forming.
- Rocks or other armament shall be replaced when sand is exposed and eroding from wind or rain.

Vegetation

- Vegetation, large shrubs or trees that limit access or interfere with sand filter operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining sand filters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the sand filter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the facility shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Sand Filters **Operations & Maintenance Plan**
Insects & Rodents shall not be harbored in the sand filter. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the infiltration basin shall be filled.

Soakage Trenches

Operations & Maintenance Plan

Soakage Trenches consist of drain rock and sand, and receive stormwater from roof downspouts and/or area drains. There are various components within the system – piping, silt basin and the trench itself. The **Conveyance Piping** consists of an inlet pipe (downspout or area drain), an outlet pipe located between the silt basin and the soakage trench, and a perforated pipe, located on top of the aggregate bed of the soakage trench. The **Silt Basin** is a structure receiving runoff from an inlet pipe and conveying it to the soakage trench. The silt basin serves as the pre-treatment system for the soakage trench, removing sediments and other debris that can impact its proper functioning. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first two years from the date of installation, then two times per year afterwards, or within 48 hours after each major storm. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Soakage trench infiltration: If water is noticed on top of the trench within 48 hours of a major storm, the soakage trench may be clogged.

- Check for debris/sediment accumulation, rake and remove and evaluate upland causes (erosion, surface or roof debris, etc
- Assess the condition of the aggregate and the filter fabric in the trench. If there is sediment in the aggregate, excavate and replace.
- If there is a tear in the filter fabric, repair or replace.

Conveyance Piping: If water ponds over the trench for more than 48 hours after a major storm and no other cause if identified, it may be necessary to remove the filter fabric to determine if the perforated pipe is clogged with sediment or debris.

- Any debris or algae growth located on top of the soakage trench should be removed and disposed of properly.
- If the piping has settled more than 1-inch, add fill material. If there are cracks or releases, replace or repair the pipe. If there are signs of erosion around the pipe, this may be an indication of water seeping due to a crack or break.

Silt Basin: If water remains in the soakage trench for 36-48 hours after storm, check for sediment accumulation in the silt basin

- If less than 50% capacity remains in the basin or 6" of sediment has accumulated, remove and dispose the sediment.

Spill Prevention: Virtually all sites, including residential and commercial, present dangers from spills. All homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect groundwater if spilled. It is important to exercise caution when handling substances that can contaminate stormwater.

- Activities that pose the chance of hazardous material spills shall not take place near soakage trenches.

A **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the soakage trench to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.

Training and/or written guidance information for operating and maintaining soakage trenches shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the soakage trench is required for efficient maintenance. Egress and ingress routes will be maintained to design standards at inspections.

Soakage Trenches

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the soakage trench. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    - i) Installation of predacious bird or bat nesting boxes.
    - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the soakage trench shall be filled.

Wet, Extended Wet Detention, and Dry Detention Ponds

Operations & Maintenance Plan

Wet Ponds are constructed ponds with a permanent pool of water. Pollutants are removed from stormwater through gravitational settling and biologic processes. **Extended Wet Ponds** are constructed ponds with a permanent pool of water and open storage space above for short-term detention of large storm events. Pollutants are removed from stormwater through gravitational settling and biologic processes. **Dry Detention Ponds** are constructed ponds with temporary storage for the detention of large storm events. The stormwater is stored and released slowly over a matter of hours. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Pond Inlet shall assure unrestricted stormwater flow to the wet pond.

- Inlet pipe shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Determine if pipe is in good condition:
  - If more than 1 inch of settlement, add fill material and compact soils.
  - If alignment is faulty, correct alignment.
  - If cracks or openings exist indicated by evidence of erosion at leaks, repair or replace pipe as needed.

Forebay traps coarse sediments, reduces incoming velocity, and distributes runoff evenly over the wet pond. A minimum 1-foot freeboard shall be maintained.

- Sediment buildup exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected.

Embankment, Dikes, Berms & Side Slopes retain water in the wet pond.

- Slopes shall be stabilized using appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Structural deficiencies shall be corrected upon discovery:
  - If cracks exist, repair or replace structure.
  - If erosion channels deeper than 2 inches exist, stabilize surface. Sources of erosion damage shall be identified and controlled.

Control Devices (e.g., weirs, baffles, etc.) shall direct and reduce flow velocity. Structural deficiencies shall be corrected upon discovery:

- If cracks exist, repair or replace structure.

Overflow Structure conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow structure shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Sources of erosion damage shall be identified and controlled when native soil is exposed at the top of overflow structure or erosion channels are forming.
- Rocks or other armoring shall be replaced when only one layer of rock exists above native soil.

Sediment & Debris Management shall prevent loss of wet pond volume caused by sedimentation.

- Wet ponds shall be dredged when 1 foot of sediment accumulates in the pond.
- Gauges located at the opposite ends of the wet pond shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year.
- Sources of restricted sediment or debris, such as discarded lawn clippings, shall be identified and prevented.
- Debris in quantities sufficient to inhibit operation shall be removed routinely, e.g. no less than quarterly, or upon discovery.

Wet, Extended Wet Detention, and Dry Detention Ponds Operations & Maintenance Plan
Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas. • Mulch shall be replenished at least annually. • Vegetation, large shrubs or trees that limit access or interfere with wet pond operation shall be pruned or removed. • Grass (where applicable) shall be mowed to 4"-9" high and grass clippings shall be removed. • Fallen leaves and debris from deciduous plant foliage shall be raked and removed. • Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced. • Dead vegetation shall be removed to maintain less than 10% of area coverage or when wet pond function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed. • Vegetation producing foul odors shall be eliminated.
Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater Releases of pollutants shall be corrected as soon as identified.
Training and/or written guidance information for operating and maintaining ponds shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the wet pond shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable. • Obstacles preventing maintenance personnel and/or equipment access to the wet pond shall be removed. • Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.
Insects & Rodents shall not be harbored in the pond. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the pond shall be filled.
If used at this site, the following will be applicable:
Signage shall clearly convey information. • Broken or defaced signs shall be replaced or repaired.
Fences shall be maintained to preserve their functionality and appearance. • Collapsed fences shall be restored to an upright position. • Jagged edges and damaged fences and shall be repaired or replaced.

Constructed Treatment Wetlands

Operations & Maintenance Plan

Constructed Treatment Wetlands remove pollutants through several processes: sedimentation, filtration, and biological processes. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Wetland Inlet shall assure unrestricted stormwater flow to the wetland.

- Inlet pipe shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Determine if pipe is in good condition:
  - If more than 1 inch of settlement, add fill material and compact soils.
  - If alignment is faulty, correct alignment.
  - If cracks or openings exist indicated by evidence of erosion at leaks, repair or replace pipe as needed.

Forebay traps coarse sediments, reduces incoming velocity, and distributes runoff evenly over the wetland. A minimum 1-foot freeboard shall be maintained.

- Sediment buildup exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected.

Embankment, Dikes, Berms & Side Slopes retain water in the wetland.

- Slopes shall be stabilized using appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Structural deficiencies shall be corrected upon discovery:
  - If cracks exist, repair or replace structure.
  - If erosion channels deeper than 2 inches exist, stabilize surface. Sources of erosion damage shall be identified and controlled.

Control Devices (e.g., weirs, baffles, etc.) shall direct and reduce flow velocity.

- Structural deficiencies shall be corrected upon discovery:
- If cracks exist, repair or replace structure.

Overflow Structure conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow structure shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Sources of erosion damage shall be identified and controlled when native soil is exposed at the top of overflow structure or erosion channels are forming.
- Rocks or other armament shall be replaced when only one layer of rock exists above native soil.

Sediment & Debris Management shall prevent loss of wetland volume caused by sedimentation.

- Wetlands shall be dredged when 1 foot of sediment accumulates.
- Gauges located at the opposite ends of the wetland shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year.
- Sources of restricted sediment or debris, such as discarded lawn clippings, shall be identified and prevented.
- Debris in quantities sufficient to inhibit operation shall be removed routinely, e.g. no less than quarterly, or upon discovery.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas.

- Mulch shall be replenished when needed.
- Vegetation, large shrubs or trees that limit access or interfere with wetland operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when wetland function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
- Vegetation producing foul odors shall be eliminated.

Constructed Treatment Wetlands Operations & Maintenance Plan
Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater Releases of pollutants shall be corrected as soon as identified.
Training and/or written guidance information for operating and maintaining treatment wetlands shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the wetland shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable. • Obstacles preventing maintenance personnel and/or equipment access to the wetland shall be removed. • Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.
Insects & Rodents shall not be harbored in the constructed treatment wetland. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the constructed treatment wetland shall be filled.
If used at this site, the following will be applicable:
Signage shall clearly convey information. • Broken or defaced signs shall be replaced or repaired.
Fences shall be maintained to preserve their functionality and appearance. • Collapsed fences shall be restored to an upright position. • Jagged edges and damaged fences and shall be repaired or replaced.

Underground Detention Tanks, Vaults, and Pipes

Operations & Maintenance Plan

Underground detention tanks, vaults, and pipes are designed to fill with stormwater during large storm events, slowly releasing it over a number of hours. There are numerous components to each system. **Drain Inlet Pipes** convey stormwater into the detention facility. The **detention Chamber** is the structure in which stormwater accumulates during a storm event. **Orifice Structure/ Outlet Drain Pipe** restricts the flow out of the detention chamber, allowing it to fill up and slowly drain out. The orifice structure is located at the downstream end of the detention chamber. Underground facilities shall be inspected quarterly and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Drain Inlet Pipes shall be inspected for clogging or leaks where it enters the vault or basin during every inspection and cleanout.

- Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Detention Chamber shall be inspected for cracks or damage during each inspection.

- The detention chamber shall be cleaned out yearly or after an inch of sediment has accumulated. If there is a valve on the outlet pipe it shall be closed otherwise the outlet shall be plugged prior to cleanout. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning.
- Water and sediment in the detention chamber shall be removed, tested, and disposed of in accordance with regulations.
- Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.

Orifice Structure/ Outlet Drain Pipe shall be inspected for clogging during unit inspections/cleanouts.

- Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Vegetation such as trees should not be located in or around the detention facility because roots from trees can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging the intake pipe.

- Large shrubs or trees that are likely to interfere with detention facility operation shall be identified at each inspection then removed.

Source Control measures typically include structural and non-structural controls. Non-structural controls can include street sweeping and other good house keeping practices. It is often easier to prevent pollutants from entering stormwater than to remove them.

- Source control measures shall be inspected and maintained (where applicable).

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important for everyone to exercise caution when handling substances that can contaminate stormwater.
Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.

Training and/or written guidance information for operating and maintaining detention facilities shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the detention facility is required for efficient maintenance.
Egress and ingress routes shall be open and maintained to design standards.

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signs may also discourage behavior that adversely impacts the stormwater protection measures and encourages behavior that enhances or preserves stormwater quality. If debris is a problem, a sign reminding people not to litter may partially solve the problem.
Signage (where applicable) will be maintained and repaired as needed during or shortly after inspections.

Insects & Rodents shall not be harbored in the detention facility. Pest control measures shall be taken when insects/rodents are found to be present

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    - i) Installation of predacious bird or bat nesting boxes.
    - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the detention facility shall be filled.

Drywells

Operations & Maintenance Plan

Drywells are designed to infiltrate stormwater into the ground. Stormwater is piped to drywells from roof downspouts or pollution control facilities such as swales or planters. The pollution control facility is designed to settle out sediments and separate oils and greases from the water before releasing it through a pipe to the drywell. This prolongs the life of the drywell and helps to prevent the contamination of soils and groundwater. The drywell is a concrete or plastic manhole section with many small holes in the sides to allow stormwater to infiltrate into the surrounding soil. The drywell system shall be inspected and cleaned quarterly and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Stormwater Drain Pipe shall be inspected for clogging or leaks where it enters the drywell.

- Debris/sediment that is found to clog the pipe shall be removed and disposed of in accordance with applicable federal and state requirements.

Drywell shall be inspected during each cleanout. Ponding around the catch basins or sedimentation manhole or drywell lids may indicate that the drywell is failing due to siltation, or the clogging of the sediment pores surrounding the drywell. Clogged drywells must be replaced.

Vegetation such as trees should not be located in or around the drywell because roots from trees can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging the intake pipe.

- Large shrubs or trees that are likely to interfere with operation will be identified at each inspection and removed.

Source Control measures typically include structural and non-structural controls. Non-structural controls can include parking lot or street sweeping and other good house keeping practices. It is often easier to prevent pollutants from entering stormwater than to remove them.

- Source control measures shall be inspected and maintained (where applicable).

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, solvents, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater.
Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.

A **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the drywell to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.

Training and/or written guidance information for operating and maintaining drywell systems shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the drywell is required for efficient maintenance. Egress and ingress routes shall be open and maintained to design standards.

Drywells **Operations & Maintenance Plan**
Insects & Rodents shall not be harbored in the drywell. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the drywell shall be filled.
Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signs may also discourage behavior that adversely impacts the stormwater protection measures and encourages behavior that enhances or preserves stormwater quality. If debris is a problem, a sign reminding people not to litter may partially solve the problem. Signage (where applicable) shall be maintained and repaired as needed during or shortly after inspections.

Spill Control Manholes

Operations & Maintenance Plan

Spill Control Manholes operate using the principal that oil and water are immiscible (do not mix) and have different densities. Oil, being less dense than water, floats to the surface. The spill control manhole shall be inspected and cleaned quarterly. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

- **Stormwater Drain Inlet Pipe** shall be inspected for clogging or leaks where it enters the manhole during every inspection and cleanout. Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Manhole Chamber shall be inspected for cracks or damage during each inspection.

- The manhole shall be cleaned out quarterly. Cleanout shall be done in a manner to minimize the amount of trapped oil entering the outlet pipe. If there is a valve on the outlet pipe it shall be closed otherwise the outlet will be plugged prior to cleanout.
- Water and oil shall be removed, tested, and disposed of in accordance with regulations. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning
- Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.

Absorbent Pillows and Pads (where applicable) absorb oil from the separation chamber.

- Replacement shall occur at least twice a year, in the spring and fall, or as necessary to retain oil-absorbing function.

Stormwater Drain Outlet Pipe shall be inspected for clogging or leaks where it exits the manhole. Particular attention shall be paid to ensure that the joint where the tee joins the outlet pipe is watertight.

- Debris/sediment that is found to clog the outlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Vegetation such as trees should not be located in or around the spill control manhole because roots can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging.

- Large shrubs or trees that are likely to interfere with manhole operation shall be identified at each inspection and removed.

Source Control measures typically include structural and non-structural controls. Non-structural controls can include street sweeping and other good house keeping practices.

- Source control measures shall be inspected and maintained.

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.

Training and/or written guidance information for operating and maintaining spill control manholes shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the spill control manhole is required for efficient maintenance. Egress and ingress routes shall be open and maintained to design standards.

Spill Control Manholes

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the spill control manhole. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    - i) Installation of predacious bird or bat nesting boxes.
    - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the manhole shall be filled.

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signage (where applicable) shall be maintained and repaired as needed during or shortly after inspections.

New Evergreen and Deciduous Trees

Operations & Maintenance Plan

Trees intercept rainfall and therefore provide a level of pollution reduction and flow control. They also provide shade, helping to cool stormwater runoff. Trees used to meet stormwater management requirements shall be kept on a site and maintained properly to ensure continued stormwater benefits. Trees shall be inspected 2 times a year and within 48 hours of a major wind or storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Leaves and Debris from the tree shall be regularly raked and disposed of.

- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Poisonous and nuisance vegetation around the tree shall be removed when discovered.
- Dead vegetation shall be pruned from the tree on a regular basis.

Irrigation shall be implemented during the establishment period to ensure tree survival. Hand watering is preferred, but a drip-irrigation system may be used.

Protection of the tree trunk and roots shall ensure tree survival. Care should be taken when digging near tree roots.

Replacement of dead trees shall be with a comparable species if it dies or must be removed for any another reason. The replacement tree shall be a minimum of 6' tall.

Insects & Rodents shall not be harbored in or around the trees. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the trees shall be filled.

Chapter 4.0
SOURCE CONTROLS

Summary of Chapter 4.0

This chapter presents storm source controls required for site uses and characteristics that generate, or have the potential to generate, specific pollutants of concern.

To Use This Chapter:
1) Determine which characteristics and/or site uses listed in **Section 4.1.1** are included in the project.
2) Follow the design methodologies to design source controls for the project.
3) The site use may require a Discharge Authorization Request **(DAR) Form** to be submitted with the permit application.

4.1 INTRODUCTION

Some site characteristics and uses may generate specific pollutants of concern or levels that are not addressed solely through implementation of the pollution reduction measures identified in Chapter 2.0. The site characteristics and uses in this chapter have been identified as potential sources for chronic loadings or acute releases of pollutants such as oil and grease, toxic hydrocarbons, heavy metals, toxic compounds, solvents, abnormal pH levels, nutrients, organics, bacteria, chemicals, and suspended solids. This chapter presents source controls for managing these pollutants at their source.

Stormwater discharge benchmarks for pollutants exist in NPDES Industrial Stormwater General Permits issued by the State of Oregon for facilities with industrial activities that are exposed to rainfall and stormwater runoff. The state also has water quality standards listed in Oregon Administrative Rules (OAR) 340 Division 041 for discharges to surface waters.

Eugene Code 6.340-6.380 lists prohibited discharges to the City's storm sewer system. The City has used these standards and benchmarks in the development of the listed source controls so stormwater discharges can better meet these criteria.

Section 4.1.1 lists the site uses and characteristics subject to the design methodologies of this chapter, and will therefore be subject to City review. Sections 4.2 through 4.9 then provide detailed information about the required source controls.

The implementation of this chapter is in addition to the applicable pollution reduction, flow control, and destination requirements.

All structural source controls require a **Discharge Authorization Request (DAR) form**, located at the end of this chapter, to be submitted as part of the development permit application packet. For more details on structural controls, please refer to the **DAR form**. Applicants may propose alternatives to the source controls identified in this chapter. To request an alternative source control the applicant must complete the Special Requests section of the **DAR form**. Proposal of an alternative source control or alternative design element will require an additional review process and may delay issuance of related building or public works permits.

4.1.1 Site Uses and Characteristics That Trigger Source Controls

Projects with the following site uses and characteristics are subject to the design methodologies of this chapter:

- Fuel Dispensing Facilities and Surrounding Traffic Areas (**Section 4.2**)
- Above-Ground Storage of Liquid Materials (**Section 4.3**)
- Solid Waste Storage Areas, Containers, and Trash Compactors (**Section 4.4**)
- Exterior Storage of Bulk Materials (**Section 4.5**)
- Material Transfer Areas/Loading Docks (**Section 4.6**)
- Equipment and/or Vehicle Washing Facilities (**Section 4.7**)
- Stormwater and Groundwater Management For Development On Land With Suspected or Known Contamination (**Section 4.8**)
- Covered Vehicle Parking Areas (**Section 4.9**)

Detailed descriptions of these site uses and characteristics can be found in each applicable section. Definitions of terms used in Sections 4.2 through 4.9 are provided in **Section 1.3**.

Applicants are required to address all of the site characteristics and uses listed in Sections 4.2 through 4.9. For example, if a development includes both a fuel dispensing area and a vehicle washing facility, the source controls in both Sections 4.2 and 4.7 will apply.

4.1.2 Source Control Goals and Objectives

The specific source control standards are based on the following goals and objectives:

1) Prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.

2) Protect soil, groundwater and surface water by capturing acute releases and reducing chronic contamination of the environment.

3) Direct wastewater discharges and areas with the potential for relatively consistent wastewater discharges (such as vehicle washing facilities) to the wastewater system.

4) Direct areas that have the potential for acute releases or accidental spills, and are not expected to regularly receive flow or require water use (such as covered fuel islands or covered containment areas), to an approved method of containment or destination.

6) Safely contain spills on-site, avoiding preventable discharges to wastewater facilities, surface water bodies, or underground injection control structures (UICs).

7) Emphasize structural controls over operational procedures. Structural controls are not operator dependent and are considered to provide more permanent and reliable source control. Any proposals for operation-based source controls need to describe the long-term viability of the maintenance program.

4.1.3 Signage

Informational signage is required for certain site uses and activities that may pollute stormwater. Signage addresses good housekeeping rules and provides emergency response measures in case of an accidental spill.

All signage shall conform to the standards described in the following box. Additional signage for specific activities are noted in applicable sections.

Signs shall be located and plainly visible from all activity areas. More than one sign may be needed to accommodate larger activity areas. Signs shall be water-resistant and shall include the following information:

- Safety precautions for self protection and spill containment.
- Immediate spill response procedures—for example: "Turn the valve located at..." or "Use absorbent materials"
- Emergency contact(s) and telephone number(s)—for example: "Call 911" and "City of Eugene Spill Response Number 541-682-4800"

Any applicable spill response supplies must be clearly marked and located where the signage is posted and near the high-risk activity area. More than one spill response kit may be necessary to accommodate larger activity areas.

Spill sign samples recommend PMS 185 red and black on white

4.1.4 Request for Alternative Design Method of Source Control

Applicants must notify the City's Public Works Department of their request in writing, specifying the reason for the request and supporting it with technical and factual data. The Discharge Authorization Request **(DAR) Form**, located at the end of this chapter, should be used when requesting an alternative design to the source control design methodologies.

Staff will check the DAR Form and supporting information submittal for completeness prior to review and decision. The applicant should expect to be contacted within five (5) working days if additional documentation is needed.

If the request cannot be satisfied with this process, the adjustment review process, as described in **Appendix A**, will be implemented.

4.2 FUEL DISPENSING FACILITIES AND SURROUNDING TRAFFIC AREAS

4.2.1 Design

1) COVER

The fuel dispensing area shall be covered with a permanent canopy, roof, or awning so precipitation cannot come in contact with the fueling activity area. Rainfall shall be directed from the cover to an approved stormwater destination.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area it is to cover.

- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area it is to cover.

2) PAVEMENT

A paved fueling pad shall be placed under and around the fueling activity area with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the activity area, including placement and number of the vehicles or pieces of equipment to be fueled by each pump. Fuel pumps shall be located a minimum of seven feet from the edge of the fueling pad.

3) DRAINAGE

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains. This will prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to an approved City wastewater system, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated fueling pad to a stormwater destination that meet all stormwater management practices of this manual and other applicable code requirements.

4) SIGNAGE

Signage shall be provided at the fuel dispensing area and shall be plainly visible from all fueling activity areas. Detailed information about signage is located in **Section 4.1.4**, and examples have been provided.

5) SPILL CONTROL MANHOLE

A spill control manhole shall be installed on the discharge line of the fueling pad (before the domestic waste line tie-in). The tee section shall extend 18 inches below the outlet elevation, with an additional 3 feet of dead storage volume below the tee to provide storage for oil and grease. The manhole shall be located on private property. For more information about spill control manholes, see **Exhibit 2-25**.

6) SHUT-OFF VALVES

A. **Shut off valves** are required to protect the City sewer systems or onsite infiltration facilities of spill risks from chemicals and other constituents that provide a danger for wide spread contamination, system damages or risk to the public health. Manual shut off valves shall not be permitted unless a "Special Request" for an adjustment is approved by the City.

Shut off valves will be required under the following situations:

- Site or activity areas are corrosives or oxidizers are used or stored (for example, concentrated acids are corrosives having a pH of less than or equal to 2.0 and bases such as sodium or ammonium hydroxide having a pH of greater than or equal to 12.5, common oxidizers are hydrogen peroxide and bleach); or
- Substances which are water soluble or float on water. These substances can spread rapidly into downstream conveyance and destination systems causing wide spread impacts, and difficult clean up situations (for example, oil and grease); or
- Substances such as solvents and petroleum products that are known to infiltrate through soils and contaminate groundwater.

B. **Traffic pathways that surround the fueling pad, also designated as high-use/high-risk areas, will require a shut-off valve on the storm drainage system.** Valves installed on storm drainage systems shall be installed downstream of all private pollution reduction facilities to accommodate spill containment. These valves should be left open to facilitate stormwater flows during normal conditions, and immediately closed in the event of a spill.

C. **Fueling pads will require a shut-off valve downstream of the spill control manhole.** Valves installed on wastewater systems shall be installed before the domestic waste line tie-in. These valves must be kept closed, and only opened to allow incidental drainage activities that do not pose to be a threat or risk to the destination system. Immediately close the valve when drainage activities are completed.

Shut-off valves shall be located on private property and downstream of the exposed area's collection system. All valves shall be installed and maintained as per manufacturers recommendations. For more information about shut-off valves and associated valve boxes, contact Building & Permit Services at 541-682-5086.

7) ADDITIONAL REQUIREMENTS

A) **Installation, alterations, or removal of above-ground fuel tanks larger than 55 gallons, and any related equipment,** are subject to additional permitting requirements by the Eugene Fire Marshall's Office. For technical questions and permitting, call the Fire Marshall's Office Permit Center at 541-682-5411, or visit them at Permit & Information Center, 99 W. 10th Avenue, Eugene, OR 97401.

B) **Bulk fuel terminals, also known as tank farms,** will require the following:

- Secondary containment equal to 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.
- A separate containment area for all valves, pumps and coupling areas with sub-bermed areas either in front of or inside the main containment areas. These sub-bermed areas are required to have rain shields and be directed to a City wastewater system for disposal. If no City wastewater facility is available, drainage shall be directed to a temporary holding facility for proper disposal and may require a DEQ permit from the Underground Injection Control (UIC) program.
- An impervious floor within all containment areas. Floors must be sealed to prevent spills from contaminating the groundwater.
- Truck loading and off-loading areas. These areas shall follow cover, pavement, drainage, spill control, and shut-off valve requirements identified for fuel dispensing facilities.
- Shut-off valves installed for the drainage of the tank yard, shall be installed downstream of the drainage system of the primary containment area, and kept closed. Valves installed for the drainage of the truck pad and sub-bermed containment areas shall be installed on the wastewater line downstream of the spill control manhole.
- A batch discharge authorization before draining a containment area. This authorization will determine appropriate disposal methods, identify pretreatment requirements (if applicable), and authorize the discharge. Pretreatment may be required for oil and grease removal, and testing may be required to establish the specific characteristics of the discharge.

Underground fuel tanks less than 4,000 gallons in size are subject to additional permitting requirements by Oregon's Department of Environmental Quality (DEQ) and tanks larger than 4,000 gallons are referred to the Federal Environmental Protection Agency (EPA). For technical questions and permitting, call DEQ's NW Region main office at 1-800-844-8467 and ask for the Underground Storage Tank Permitting Department.

4.3 ABOVE-GROUND STORAGE OF LIQUID MATERIALS

4.3.1 Design

1) CONTAINMENT

Liquid materials shall be stored and contained in such a manner that if the container(s) is ruptured, the contents will not discharge, flow, or be washed into a receiving system. A containment device and/or structure for accidental spills shall have enough capacity to capture a minimum of 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.

Containers, such as double-walled containers, with internal protection are exempt from these spill containment requirements.

2) COVER

Storage containers (other than tanks) shall be completely covered so rainfall cannot come in contact with them. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.
- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

3) PAVEMENT

A paved storage area is required. The storage area shall be paved with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the area intended for storage.

The applicant shall clearly identify any alternative method by submitting a **DAR Form,** located at the end of this chapter.

4) DRAINAGE

All paved storage areas shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater run-on to a storage area.

Covered storage areas: Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities <u>are not required</u> for the contained area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to an approved City wastewater facility or authorized pretreatment facility.

Uncovered storage areas with containment: Water will accumulate in uncovered storage areas during and after rain. Any *contaminated* water cannot simply be drained from the area. It must be collected, inspected, and tested at the expense of the property owner before proper disposal can be determined. Some type of monitoring may also be needed to determine the characteristics and level of contamination of the stormwater.

All discharges to the wastewater system shall be considered batch discharges and shall require approval and pretreatment prior to discharge. Pretreatment requirements shall be set as part of the discharge approval process, based on the types and quantities of material to be discharged. A discharge evaluation shall be performed before connection to a wastewater facility. Testing may be required to establish characteristics of the wastewater or contaminated stormwater and to verify that local discharge limits are not exceeded. For batch discharge applications, call PW's staff at 541-682-5291.

5) SIGNAGE

Signage shall be provided at the liquid storage area and shall be plainly visible from all surrounding activity areas. Detailed information and examples are located in **Section 4.1.4.**

6) ADDITIONAL REQUIREMENTS

A) **Covered storage areas:** If the applicant elects to install drainage facilities to an approved City wastewater facility, **a shut-off valve** may be required for the covered storage area. PW will make this determination based on the type of material stored and the proposed system receiving the discharge.

Uncovered storage areas: A shut-off valve shall be installed in the storage area so excess stormwater can be drained out of the activity area and directed either to the storm drainage facilities (*if clean*) or into the City wastewater system or authorized pretreatment facility (*if contaminated*). Except when excess stormwater is being discharged, the valve shall always be kept closed so any spills within the activity area can be effectively contained.

B) **Storage of hazardous materials** located in designated groundwater resource protection areas may be subject to additional requirements.

Tank farms **shall follow the criteria established for Bulk Fuel Terminals, under** Section 4.2.

C) **Storage of reactive, ignitable, or flammable liquids** shall comply with the Uniform Fire Code as adopted by the State of Oregon. Source controls presented in this section are intended to complement, not conflict with, current fire code requirements. None of these requirements shall exclude or supersede any other requirements in this manual, other City permit requirements, or state and federal laws pertaining to water quality. Contact the Eugene Fire Marshall (541-682-5411) and/or PW staff (541-682-5291) for further information and requirements.

4.4 SOLID WASTE STORAGE AREAS, CONTAINERS, AND TRASH COMPACTORS

4.4.1 Design

For approval of solid waste storage and handling activity areas in the City of Eugene, the following design requirements will apply. See below for a clarification of each requirement.

ACTIVITY/ USE	REQUIREMENTS			
	(1) Cover	(2) Pavement	(3) Isolated	(4) Wastewater Drain
Multi-residential (with shared trash areas)	X	X	X	X*
Commercial	X	X	X	X
Industrial	X	X	X	X
Compactors (regardless of use)	X	X	X	X
Can and bottle return stations	X	X	X	X

* Multi-residential ONLY. In the event gravity service to the wastewater lines cannot be obtained, a "Special Request" can be made to direct the drainage from the hydraulically isolated activity area to the development's stormwater pollution reduction facility. For more information, refer to **Additional Requirements** below.

1) COVER

A permanent canopy, roof, or awning must be provided to cover the solid waste storage activity area and shall be constructed to cover the activity area so rainfall cannot come in contact with the waste materials being stored. The cover shall be sized relative to the perimeter of the hydraulically isolated activity area it is to cover. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

2) PAVEMENT

A paved waste storage area is required when a structural cover or trash compactor is used. The area shall be paved with asphalt or concrete and meet all applicable building code requirements. Sizing of the paved area shall adequately cover the activity area intended for refuse storage, or the trash compactor(s) and associated equipment.

3) ISOLATION

Hydraulic isolation must be provided for the solid waste storage activity areas and shall be designed to prevent uncontaminated stormwater runoff from entering the area and carrying pollutants away. Runoff occurring outside the hydraulically isolated area shall be directed to a stormwater destination that meets all applicable code requirements. This can be achieved by reverse grading at the perimeter of an activity area, perimeter curbing or berming, or by the use of area drains to collect and divert runoff.

4) DRAINAGE

Drainage must be provided for the hydraulically isolated solid waste storage area and directed to the city's wastewater facility or authorized pretreatment facility. A wastewater drain is required for those areas that may be subject to refuse or suspected pollutants that pose a risk if the structural integrity of the trash receptacle is damaged or if its contents are exposed to rainfall.

Non-gravity Option
Activity areas that do not have gravity wastewater service can install a pressurized system. These types of installations will require the following to be provided at the time of building permit application:

1) Verification or evidence that gravity service cannot be obtained; and,
2) Details of an electronic sump pump system equipped with a float switch; and,
3) A completed DAR form.

Pressurized system installations are considered "permanent equipment" and deemed the property owner's liability in the event of system failure or if the property becomes vacated.

Building & Permit Services will review all sump pump or sewage ejector installations for compliance with Uniform Plumbing Code and Oregon State Plumbing Specialty Code. The PW staff will review for compliance with this chapter of the Stormwater Management Manual.

5) ADDITIONAL REQUIREMENTS

Multi-residential developments with shared trash areas may be allowed an alternative to the wastewater drain for the hydraulically isolated solid waste storage area. This activity area can drain to the site's privately owned and operated stormwater pollution reduction facility if gravity service to the wastewater pipe of the development cannot be obtained. In order to be considered for the alternative, information showing that gravity service cannot be obtained and a completed **DAR form** that has both the General Information and Special Request sections completed must be submitted. All requirements previously outlined for multi-residential uses will apply.

4.5 EXTERIOR STORAGE OF BULK MATERIALS

4.5.1 Bulk Materials Categories

The materials are separated into three categories based on risk assessments for each material stored: high-risk, low-risk, and exempt.

High-Risk Materials	Low-Risk Materials	Exempt Materials
• Recycling materials with potential effluent • Corrosive materials (*i.e.* lead-acid batteries) • Storage and processing of food items • Chalk/gypsum products • Feedstock/grain • Material by-products with potential effluent • Asphalt • Fertilizer • Pesticides • Lime/lye/soda ash • Animal/human wastes	• Recycling materials without potential effluent • Scrap or salvage goods • Metal • Sawdust/bark chips • Sand/dirt/soil (including contaminated soil piles) • Material by-products without potential effluent • Unwashed gravel/rock • Compost	• Washed gravel/rock • Finished lumber • Rubber and plastic products (hoses, gaskets, pipe, *etc.*) • Clean concrete products (blocks, pipe, *etc.*) • Glass products (new, non-recycled) • Inert products

4.5.2 Design

1) COVER

Low-risk materials must be covered with a temporary plastic film or sheeting at a minimum.

High-risk materials are required to be permanently covered with a canopy or roof to prevent stormwater contact and minimize the quantity of rainfall entering the storage area. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

2) PAVEMENT

Low-risk material storage areas are not required to be paved.

High-risk material storage areas shall be paved beneath the structural cover.

3) DRAINAGE

Low-risk material storage areas are allowed in areas served by standard stormwater management systems. However, all erodible materials being stored must be protected from rainfall.

If materials are erodible, a structural containment barrier shall be placed on at least three sides of every stockpile to act as a barrier to prevent uncontaminated stormwater from running onto the storage area and carrying pollutants away. If the area under the stockpile is paved, the barrier can be constructed of asphalt berms, concrete curbing, or retaining walls. If the area under the stockpile is unpaved, sunken retaining walls or ecology blocks can be used. The applicant shall clearly identify the method of containment on the building plans, and on the **DAR form**, located at the end of this chapter.

For **high-risk** material storage areas, the paved area beneath the structural cover shall be hydraulically isolated through grading, structural containment berms or walls, or perimeter drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities <u>are not required</u> for the containment area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to the City's wastewater facility or authorized pretreatment facility.

4) ADDITIONAL REQUIREMENTS

A) **Storage of pesticides and fertilizers** may need to comply with specific regulations outlined by the Oregon Department of Environmental Quality (DEQ). For answers to technical questions, call DEQ's NW Region main office at 1-800-844-8467.

B) **A sampling manhole** or other suitable stormwater monitoring access point may be required to monitor stormwater runoff from the storage area. This may apply to certain types of storage activities and materials or if an alternative source control is proposed. This requirement complies with Eugene Code, which requires appropriate stormwater destination. PW staff will review for applicability of this requirement.

C) **Signage** shall be provided at the storage area if hazardous materials or other materials of concern are stored. Signage shall be located so it is plainly visible from all storage activity areas. More than one sign may be needed to accommodate large storage areas. Detailed information and examples are provided in Section 4.1.3.

D) If the applicant elects to install drainage facilities to the City's wastewater facility, **a shut-off valve** may be required for the structurally covered storage area. Eugene will make this determination based on the type of material stored and the proposed system receiving the discharge.

4.6 MATERIAL TRANSFER AREAS/LOADING DOCKS

4.6.1 Material Transfer Areas

Two standard types of material transfer areas associated with buildings are:

1) loading/unloading facilities with docks, and 2) large bay doors without docks. The requirements apply to all material transfer areas, including loading/unloading docks, bay doors, and any other building access point(s) with the following characteristics:

- The area is designed (size, width, *etc.*) to accommodate a truck or trailer being backed up to or into it; <u>and,</u>
- The area is expected to be used specifically to receive or distribute materials to and from trucks or trailers.

4.6.2 Design

1) PAVEMENT

A paved material transfer area shall be placed underneath and around the loading and unloading activity area with asphalt or concrete that meets all applicable building code requirements. This will reduce the potential for soil contamination with potential impacts on groundwater and will help control any acute or chronic release of materials present in these areas.

2) ISOLATION

<u>Loading Docks</u>

The first three feet of the paved area, measured from the building or dock face, shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away.

<u>Bay Doors and Other Interior Transfer Areas</u>

Bay doors and other interior transfer areas shall be designed so that stormwater runoff does not enter the building. This can be accomplished by grading or drains.

3) DRAINAGE

Loading Docks

Drainage from the hydraulically isolated area shall be directed to the City's wastewater facility or authorized pretreatment facility. Surrounding runoff and drainage from the access ramp shall be directed away from the hydraulically isolated area to a stormwater destination that meets all applicable requirements of this manual.

The requirement for the drainage from the hydraulically isolated area of the loading dock to be directed to the City's wastewater facility, or authorized pretreatment facility may be waived if PW determines there is no gravity wastewater service available and an appropriately sized, underground temporary storage structure (such as a catch basin with no outlet or dead-end sump) is provided. A completed DAR form will be required.

Non-Gravity Option

Activity areas that cannot achieve gravity wastewater service may be allowed to install a pressurized system. These types of installations will require the following to be provided at the time of building permit application:

1) Proof that gravity wastewater service cannot be obtained; and,
2) Details of an electronic sump pump system equipped with a float switch; and,
3) A completed **DAR form.**

Pressurized system installations are considered "permanent equipment" and deemed the property owner's liability in the event of system failure or if the property becomes vacated.

The Building & Permit Services will review all sump pump or sewage ejector installations for compliance with Uniform Plumbing Code and Oregon State Plumbing Specialty Code. The City will review for compliance with this chapter of the Stormwater Management Manual.

Bay Doors and Other Interior Transfer Areas

Because interior material transfer areas are not expected to accumulate precipitation, installation of floor drains is not required or recommended. It is preferable to handle these areas with a dry-mop or absorbent material. If interior floor drains are installed, they shall be plumbed to the City's wastewater facility or authorized pretreatment facility.

4) SIGNAGE

Signage shall be provided at the material transfer area and shall be plainly visible from all surrounding activity areas. Detailed information and examples are located in **Section 4.1.4.**

5) ADDITIONAL REQUIREMENTS

A) **Bay doors and other interior transfer areas** shall provide a 10-foot "no obstruction zone" beyond the entrance within the building. This will allow the transfer of materials to occur with the truck or trailer end placed at least 5 feet inside the building, with an additional staging area of 5 feet beyond that. The "no obstruction" zone shall be clearly identified on the building plan at the time of the building permit application, and identified at the facility by painting the no obstruction zone with a bright or fluorescent floor paint.

B) **<u>Shut-off valves will be required under the following situations</u>:**

1) Site activity areas are exposed to corrosives or oxidizers that can harm conveyance system components (such as battery acid).
2) Substances that do not settle or remain in one location, but are capable of being dissolved in or float on top of water (such as oil and grease). These substances can spread rapidly into downstream systems, causing widespread impacts and difficult clean-up situations.
3) Substances that are known to infiltrate through soils and contaminate groundwater.

Valves located in material transfer areas are typically left open to facilitate drainage during normal conditions, and immediately closed in the event of a spill.

Prior to transfer activities of harmful substances, the valves should be closed and only re-opened after the transfer is complete. The shut-off valves must be located on private property and downstream of the exposed area's collection system.

All valves shall be installed and maintained in accordance with manufacturer specifications. For more information about shut-off valves and associated valve boxes, contact the Building & Permit Services at 541-682-5086.

4.7 EQUIPMENT AND/OR VEHICLE WASHING FACILITIES

4.7.1 Design

1) COVER

The washing area shall be covered with a permanent canopy or roof so precipitation cannot come in contact with the washing activity area. Precipitation shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.
- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.

2) PAVEMENT

A paved wash pad shall be placed under and around the washing activity area with asphalt or concrete that meets all applicable building code requirements. Sizing of the paved area shall adequately cover the activity area, including the placement of the vehicle or piece of equipment to be cleaned.

3) DRAINAGE

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to the City's wastewater facility, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated washing pad to a stormwater destination that meets all applicable requirements of this manual.

4) OIL CONTROLS

All vehicle and equipment washing activities will be reviewed for needed oil controls to comply with the City's wastewater discharge limits. The following design criteria are established for oil/water separators discharging to a wastewater facility:

A) <u>Washing Areas Protected with a Cover or Located Inside a Structure</u>
   1) Baffled oil/water separators and spill control (SC-Type) separators shall not be allowed for use with equipment and/or vehicle washing applications. *Note: Activities and processes of a washing facility change over time and the introduction of heat and surfactants may occur.*

2) Coalescing plate separators shall be designed to achieve 100 ppm non-polar oil and grease in the effluent from the peak flow generated by the washing activity. Testing information must be submitted by the manufacturer of the unit that supports the 100 ppm effluent standard at the calculated flow rate.
    a. Standard flow from a 5/8" hose is estimated to be 10 gpm.
    b. For specially designed washing units, check the vendor specifications for maximum flow rates.
3) Any pumping devices shall be installed downstream of the separator to prevent oil emulsification.
4) Separator details must be shown on the building plans submitted for permit, and shall match manufacturer specifications and details, including the unit flow rate, effluent water quality, and maximum process flow rate.

B) <u>On-site Wash Recycling Systems</u>
Wash recycling systems may be used for oil control as long as they can meet effluent discharge limits for the City's wastewater system. A detail of the wash recycling system and vendor specifications identifying effluent efficiencies shall be submitted as part of the building plans at the time of building permit application.

4.8 STORMWATER AND GROUNDWATER MANAGEMENT FOR DEVELOPMENT ON LAND WITH SUSPECTED OR KNOWN CONTAMINATION

4.8.1 Review and Permit Process

In addition to local, state and federal regulations requiring special handling and management of site soils, groundwater, and surface drainage may be necessary. As a result of these regulations, sites with suspected or known contamination will require a more detailed review process and may delay issuance of related building permits.

To research contaminant information, parties should refer to DEQ's Facility Profiler database, which can be found at: http://deq12.deq.state.or.us

If records indicate that a No Further Action (NFA) or Record of Decision (ROD) exist for your site, you must contact DEQ prior to pre and post construction activities to ensure conditions of record are not violated. For technical questions related to site contamination and clean-up, contact the Land Quality Division of DEQ.

All regulatory Divisions or Departments of DEQ, as referenced in this section, can be reached by calling DEQ's Northwest Region Office at 1-800-844-8467.

Note: Even if DEQ does not have a site included in it's tracking database, this does not mean that contamination may not be present. At a minimum, if commercial or industrial history exists, a Phase I site assessment should be performed prior to design.

Contaminants have the potential to become entrained and transported through exposure to construction activities and post-construction design elements of a development. The requirements in this section apply to excavation and stockpiling of contaminated soils, and disposal or re-use facilities related to groundwater, foundation or footing drains, interior floor drains in basements or sub-grade structures, construction dewatering, and surface stormwater treatment and conveyance systems.

4.8.2 Design

Contaminants, media, and site conditions are unique to each parcel of land, therefore sites at risk for contamination shall be reviewed on a case-by-case basis.

1) SOIL MANAGEMENT

Stockpiles of contaminated soils shall be covered with temporary plastic film or sheeting to prevent stormwater from coming into contact with them.

Stockpile perimeters shall have a containment barrier on all four sides of every stockpile to prevent stormwater run-on and material run-off. Barriers can consist of concrete curbing, silt fencing, or other berming material, depending on the activity, size, and resources available.

Areas under stockpiles of contaminated soils are not required to be paved. However, an impervious layer shall be placed beneath the stockpile to protect uncontaminated areas from potential leachate.

2) CONSTRUCTION DEWATERING

All construction dewatering discharges resulting from groundwater or precipitation (rainfall) shall be evaluated for contamination before disposal methods can be approved.

If on-site infiltration is the proposed method for disposal, authorizations must be obtained from the City and the Land Quality Division of DEQ.

Infiltration systems for private construction dewatering must be located and maintained on private property, outside the public rights-of-way.

If on-site sub-surface injection is the proposed method for disposal, authorizations must be obtained from the City and the Water Quality Division of DEQ.

Private sub-surface injection systems (a.k.a. Underground Injection Controls) must be located and maintained on private property, outside the public rights-of-way.

If a receiving stream is the proposed method for disposal, authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If an off-site City sewer system is the proposed method for disposal, authorization must be obtained from the City. Authorizations will be permitted through a discharge authorization letter. All groundwater discharge applications will go through an evaluation process before a discharge to the City sewer system will be permitted. Evaluations for discharges from sites with suspected contamination shall be based on the following:

a) Discharges to a storm sewer system will be required to meet instream water quality standards, as stated in OAR 340-41, Table 20. Table 20 can be found on the internet at **www.deq.state.or.us/wq/wqrules/340Div41Tbl20.pdf**

b) Discharges to a sump system will be required to meet safe drinking water standards, as stated in the National Safe Drinking Water Act. The safe drinking water standards can be found on the internet at: **www.epa.gov/safewater/mcl.html#mcls**

c) Discharges to a wastewater system will only be allowed if extensive pretreatment is required and the discharge is approved through the City's Wastewater

Discharge Permit process. All groundwater and surface water discharges to a wastewater system will be required to meet discharge limits of the Wastewater Discharge Permit, and will be subject to discharge volume charges. Discharges will be charged at wastewater volume rates, as stated in City Code.

d) Lab analysis reports will be required, as defined at the end of this section.

e) A temporary sampling point is required if multiple discharges are proposed. The temporary sampling point shall be agreed upon between the City staff member processing the Wastewater Discharge Permit and the applicant.

Source control requirements will be identified as part of the review process of the laboratory analysis reports and the building permit application. Source Controls, sampling points and destination shall be identified on the erosion control plan of the building permit application.

For technical assistance on obtaining a batch discharge authorization for construction dewatering activities, contact PW staff at 541-682-5291.

3) POST-CONSTRUCTION SURFACE DRAINAGE SYSTEMS

If on-site infiltration is the proposed method for disposal, authorizations must be obtained from the City and the Land Quality Division of DEQ.

Private infiltration systems must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If on-site subsurface injection is the proposed method for disposal, authorizations must be obtained from the City and the Water Quality Division of DEQ.

Private Underground Injection Controls must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If a receiving stream is the proposed method for disposal, authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If an off-site City stormwater or wastewater system is the proposed method for disposal, authorization must be obtained from the City. The determination of where you can dispose of the surface drainage shall be based on the following:

a) Surface drainage systems, that are not exposed to contaminated soils or subsurface discharges that are not expected to contain contaminants, can connect to the off-site City stormwater system..

b) Surface drainage systems, that are exposed to contaminated soils or subsurface discharges that are expected to contain contaminants, must go through the same evaluation criteria as stated under 4.8.2 2) Construction Dewatering (a-e) with the following replacement for e):
   e) A permanent monitoring point is required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

4) POST-CONSTRUCTION WATER RECLAIM OR RE-USE SYSTEMS

Water reclamation or re-use systems provide innovative ways to use natural resources and save money. However, using groundwater as a resource from sites at risk for contamination may require additional source controls and environmental compliance regulations depending on the nature of the contaminants and the extent of the remediation that has been completed

Authorizations for re-use systems will need to be obtained from the City, the Oregon Water Resource Department, and DEQ.

If surface drainage systems are the proposed resource, discharges are not expected to contain contaminants and do not pose to be a threat to City infrastructure. Review will verify that there is no interaction between groundwater and the surface.

<u>Non-potable uses</u> for plumbing fixtures and industrial equipment, *i.e.* cooling towers or boilers, will require the following:

a) A discharge meter shall be installed on the outlet of the re-use system for sewer billing purposes.

b) Industrial equipment bleed-offs or drain valves shall have discharges routed to the wastewater line of the facility.

c) Overflows from the re-use system, prior to use, are not considered wastewater and shall have discharges routed to the storm destination system of the facility.

<u>Irrigation systems</u> may encourage transportation of contaminants and should obtain authorization from the Land Quality Division of DEQ prior to installation.

If sub-surface drainage systems are the proposed resource, discharges may contain contaminants and shall be evaluated for contamination before disposal methods can be approved.

Non- potable uses for plumbing fixtures and industrial equipment, *i.e.* cooling towers or boilers, will require the following:

a) A discharge meter shall be installed on the outlet of the re-use system for sewer billing purposes.

b) Industrial equipment bleed-offs or drain valves shall have discharges routed to the wastewater line of the facility. Discharges will be required to meet local discharge limits, as stated in City Code.

c) Overflows from the re-use system, prior to use, may contain contaminants so the requirements stated under **Post-Construction Subsurface Drainage Systems** will apply.

d) A permanent monitoring point may be required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

Irrigation systems may encourage transportation of contaminants and should obtain authorization from the Land Quality Division of DEQ prior to installation.

If groundwater is proposed for commercial or industrial uses of a development, i.e. non-potable uses or irrigation, authorization or a permit should be obtained through the Oregon Water Resource Department (WRD) prior to use.

Minimum requirements that warrant a permit for industrial and commercial groundwater wells include, but are not limited to, irrigation of areas greater than ½ an acre, and use of more than 5,000 gpd of water. Unique groundwater reuse systems, anything other than a standard supply well installation, shall be reviewed on a case-by-case basis to determine permitting requirements (if applicable).

For assistance in obtaining authorization for the use of groundwater, contact Lane County Water Master at 541-682-3620. For more information on water rights and groundwater regulations the Oregon Water Resource Department website can be found on the Internet at: **www.wrd.state.or.us**

5) POST CONSTRUCTION SUB-SURFACE DRAINAGE SYSTEMS

Structures proposed below grade, in an area at risk for contamination, can greatly impact and add unexpected costs to the surface drainage systems, water reclaim or re-use systems and subsurface drainage systems of a project.

All surface, sub-surface and re-use systems shall be evaluated for contamination risks before disposal and re-use methods can be approved.

If on-site infiltration is the proposed method for disposal, authorizations will need to be obtained from the City and the Land Quality Division of DEQ.

Private infiltration systems will need to be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits will need to be obtained.

If on-site subsurface injection is the proposed method for disposal, authorizations must be obtained from the City and DEQ.

Private subsurface injection systems (or Underground Injection Controls) must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If a receiving stream is the proposed method for disposal [destination], authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If crossings of public rights-of-way are necessary to obtain access to an approved discharge point of a receiving stream, authorizations and permits must be obtained.

If an off-site City stormwater and wastewater system is the proposed method for disposal, authorization must be obtained from the City. Evaluations for discharges from sites with suspected contamination shall be based on the same criteria as stated under Construction Dewatering, Section 4.8.2 (2), items a) through d), with the following replacement for e):

e) A permanent monitoring point may be required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

6) LABORATORY ANALYSIS REPORTS

Laboratory analysis reports are required to identify the characteristics and levels of contamination in the soils and groundwater of a site.

An additional review process will be applied to these reports to determine regulatory authority and requirements. Testing and analysis are highly recommended prior to building permit applications. DEQ permitting and/or review may be required if contaminants are found, and levels of contamination appear to exceed the City's local discharge regulations. This may delay issuance of related building permits.

Lab analysis reports shall include the following information:

a) Analysis reports shall identify the elevation of the seasonal water table and identify the depth of any perched water aquifers.

b) Analysis reports shall identify the method of laboratory testing, the detection level and analytical method for detection, and the depth of any found contaminants in the soils.

c) Minimum test parameters for base line contaminants shall include: metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc), TPH (total petroleum hydrocarbons), and BTEX (benzene, toluene, ethylbenzene and xylene).

d) Test parameters may be required to include other contaminants as identified through historical data, research and environmental assessments.

e) If post-construction subsurface drainage or dewatering systems are proposed to discharge to a City separated storm sewer system, test parameters will be required to include the instream water quality standards as identified under OAR 340-41, Table 20. Table 20 can be found on the internet at: **www.deq.state.or.us/wq/wqrules/340Div41Tbl20.pdf**

f) If post-construction subsurface drainage or dewatering systems are proposed to discharge to a City sump system, test parameters will be required to include the safe drinking water standards as identified in the National Safe Drinking Water Act. These standards can be found on the internet at: **www.epa.gov/safewater/mcl.html#mcls**

7) PERMANENT MONITORING POINTS

To ensure compliance with local discharge regulations, a suitable monitoring point may be required to monitor groundwater discharges to an off-site City sewer system. Monitoring requirements will be identified as part of the review process of the laboratory analysis reports and the building permit application. If monitoring is necessary, a permanent structure (such as a sampling manhole or flow through vault) shall be installed on the discharge line of the subsurface drainage system.

Structure type and location will need to be approved by the assigned City Source Control plans examiner, complying with Eugene Code. For technical assistance on suitable monitoring points, contact PW staff at 541-682-5291.

8) ADDITIONAL REQUIREMENTS

All structural controls of this section require a Discharge Authorization Request (DAR) form, located at the end of this chapter. Typical controls needing a DAR form would be containment areas, shut-off valves, oil/water separators, etc. If you request an alternative or adjustment to any of the source controls identified in this section. These types of requests will require an additional review process and may delay issuance of related building or public works permits.

4.9 COVERED VEHICLE PARKING AREAS

4.9.1 Design

1) DRAINAGE

Top Floor Drainage of a Multi-Level Parking Structure

Stormwater runoff from the top floor shall be directed to a stormwater destination that meets all water quality requirements of this manual and any other applicable code requirements.

Lower Floor Drainage of a Multi-Level Parking Structure

Significant amounts of precipitation are not expected to accumulate in covered vehicle parking areas, and drainage facilities are not required for the lower floors. If the applicant elects to install drainage facilities, the drainage from the lower floors shall be directed to an approved City wastewater facility.

Adjacent, Uncovered Portions of the Site

The surrounding uncovered portions of the site shall be designed so stormwater does not enter the covered parking areas. This can be accomplished through grading or drains.

DISCHARGE AUTHORIZATION REQUEST

for

Source Control(s)

Discharge Authorizations are required for source controls in areas that have site characteristics and facility uses that have activities at risk for source point pollutant releases that are regulated or prohibited by local, state and federal regulations.

NOTE: A separate Authorization shall be filled out for each activity area, and Special Requests are available on the second page of this form.

GENERAL INFORMATION (***to be completed for all Discharge Authorization Requests***)

Applicant's Name: ______________________ Date: __________

Facility Name: __________ Owner/Operator Name: __________

Facility Address: ______________________

Business Mailing Address: ______________________

Phone No.: __________ Type of business/facility: __________

Building Permit No. (*if applicable*): ______________________

SOURCE CONTROL INFORMATION

Installation of Source Control(s) are a result of:

- ☐ Tenant Improvements to an existing facility and/or building.
- ☐ New Development of a site or property that was unimproved.
- ☐ Re-Development of a site or property that had prior uses.
- ☐ Code Compliance in response to local, state or federal notification.
- ☐ Other: ______________________

Proposed Source Control(s) (***check all that apply***):

- ☐ Oil/Water Separator
- ☐ Dock Leveler Pit with Retrofit
- ☐ Wall Valve for Containment Area
- ☐ Collection Device/ Structure
- ☐ Other:
- ☐ Containment Area
- ☐ Sedimentation Manhole with Retrofit
- ☐ Discharge Line Shut-Off Valve
- ☐ Cooling Towers
- ☐ Other: __________

[NOTE: Additional City approved "Standard Maintenance" appendices will be required for each Source Control listed above, or provide a vendor's Maintenance document (if available). Contact PW at 541-682-5291 for applicable appendices.]

Describe the site activity (ies) the source control(s) apply to:

____

____

____

(DISCHARGE AUTHORIZATION REQUEST FORM CONT.)

Attach a site plan with the location of the Source Control. Be sure to identify the location in reference to a permanent structure, for assistance in field verification. *(A hand-drawn sketch, not to scale, is acceptable as long as it is legible.)*

SPECIAL REQUEST (***check only if applicable***)

- ☐ Request to *remove* or *abandon* existing source control(s).
- ☐ Request to propose *alternative* source control(s).
- ☐ Request to *ADJUST* source control requirement(s).
- ☐ Request for review of *ADJUSTMENT* qualifications.

Please provide a brief explanation (*Use additional pages if necessary.*): ____________________

____

____

____

TO BE COMPLETED BY CITY:

☐ Approved ☐ Denied

Date: ________ Signature: ____________________ Dept.: __________

Comments: ____

____

____

ORDINANCE NO. 20369

AN ORDINANCE CONCERNING STORMWATER PROVISIONS; AMENDING SECTIONS 9.0500, 9.6420, 9.8030, 9.8055, 9.8090, 9.8100, 9.8215, 9.8220, 9.8320, 9.8325, 9.8440, 9.8445, 9.8515, AND 9.8520 OF THE EUGENE CODE, 1971; REPEALING SECTION 9.6510 OF THAT CODE; AND ADDING SECTIONS 9.6790, 9.6791, 9.6792, 9.6793, 9.6794, 9.6795, 9.6796, AND 9.6797 TO THAT CODE.

THE CITY OF EUGENE DOES ORDAIN AS FOLLOWS:

Section 1. Section 9.0500 of the Eugene Code, 1971 is amended by adding the following definitions in alphabetical order to the existing definitions, to provide:

9.0500 **Definitions**. As used in this land use code, unless the context requires otherwise, the following words and phrases mean:

Destination. The ultimate discharge point for the stormwater runoff from a particular site. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

Equivalent on-site area. An area of existing impervious surface that: (1) does not have facilities or structures to treat stormwater runoff; (2) is of equal or greater square footage to the area of proposed new impervious surface on the same site; and, (3) is of equal use.

Flood control design storm. A theoretical storm for evaluating the capacity of the storm drainage system and designing improvements for the required level of protection, in accordance with the Stormwater Management Manual.

Flow control facility. Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development water quantity leaving the development site.

Headwaters Area. The area within Eugene city limits that is above 500 feet.

Headwater streams. Streams that: (1) are identified on the Headwater Streams Map (an Appendix to the Stormwater Management Manual) as having all or a portion of their length located on slopes greater than 10%; (2) are identified on the Sensitive Areas Map as having all or a portion of their length located in areas with highly erodible soils; (3) are at least 500 feet or longer; and, (4) drain at least 10 acres.

Impervious surface/area. Any surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from conditions pre-existing to development. Types of impervious surface include, but are not limited to, rooftops, asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

Oil control facility. Any structure or drainage device that is designed, constructed, and maintained to remove oil and grease from storm runoff.

Pollution reduction facility. Any structure or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

Property suspected or known to contain contaminants in the soil or groundwater. Any real property where the presence of any hazardous substance or petroleum product indicates an existing release, past release, or threatened release of a hazardous substance or petroleum product into the ground, ground water, or surface water of the property.

Source control. Any structure, device, or design that is used to eliminate or reduce pollution from a source.

Stormwater Management Manual. The City of Eugene Stormwater Management Manual adopted by the city in the manner set forth in EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures.

Stormwater Management Facility. Any structure or configuration of the ground that is used or, by its location, becomes a place where stormwater flows or is accumulated, including but not limited to, pipes, sewers, curbs, gutters, manholes, catch basins, ponds, open drainage ways, runoff control facilities, wetlands, and their accessories.

Water Quality Design Storm. A theoretical storm for estimating the amount of stormwater runoff to be treated. Facilities designed to store and treat a volume of stormwater shall be sized in accordance with the Stormwater Management Manual.

Section 2. Subsection (2) of Section 9.6420 of the Eugene Code, 1971, is amended as follows.

9.6420 Parking Area Standards.

(2) **Drainage.** All parking areas, except those in conjunction with a single family or two family dwelling, shall be graded so as not to drain storm water over the public sidewalk or onto any abutting property. Drainage improvements shall be provided as required by the stormwater provisions of EC 9.6790 to 9.6797.

Section 3. Section 9.6510 of the Eugene Code, 1971, is repealed.

Section 4. Sections 9.6790, 9.6791, 9.6792, 9.6793, 9.6794, 9.6795, 9.6796, and 9.6797 are added to the Eugene Code, 1971, to provide:

9.6790 Stormwater Management Manual. In order to implement Section 9.6791 through 9.6797 of this code, the City Manager shall adopt in accordance with EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures, a Stormwater Management Manual. The Stormwater Management Manual may contain forms, maps and facility agreements and shall include requirements that are consistent with the following goals:

(1) Reduce runoff pollution from development by reducing impervious surfaces and capturing and treating approximately 80% of the average annual rainfall.

(2) Control and minimize flows from development in the Headwater Areas using a variety of techniques to release water to downstream conveyance systems at a slower rate and lower volume, thereby reducing the potential for further aggravation of instream erosion problems.

(3) Emphasize stormwater management facilities that incorporate vegetation as a key element, and include design and construction requirements that ensure landscape plant survival and overall stormwater facility functional success.

(4) Operate and maintain stormwater management facilities in accordance with facility-specific O & M Plans.

(5) Reduce pollutants of concern that are generated by identified site uses and site characteristics that are not addressed solely through the pollution reduction measures by implementing additional specific source control methods including reducing or eliminating pathways that may introduce pollutants into stormwater, capturing acute releases, directing wastewater discharges and areas with the potential for relatively consistent wastewater discharges to the wastewater system, containing spills on site, and avoiding preventable discharges to wastewater facilities, surface waters or ground waters.

9.6791 Stormwater Destination.

(1) **Purpose.** The purpose of EC 9.6791 is to protect life and property from flood and drainage hazards by maintaining the capacity of the city's stormwater conveyance system through the establishment of destination regulations for stormwater runoff from development.

(2) **Applicability.** Destination standards apply to all development.

(3) **Standards.** Stormwater drainage facilities shall be designed and constructed

according to adopted plans and policies, and in accordance with standards in EC Chapters 6 and 7, and the stormwater destination provisions and the facility design requirements set forth in the Stormwater Management Manual. An applicant proposing a new development must submit documentation to the city showing the stormwater destination into which the proposed development will be disposed. The documentation must establish that the new development will be disposed of into existing stormwater drainage facilities that, considering all developments that have received tentative or final plan approval as of the date the developer submits a complete application, have the capacity to handle the stormwater runoff that will be generated by the proposed new development for the flood control design storm, or, if the applicant cannot establish that existing stormwater drainage facilities have such capacity, the applicant must construct storm drainage facilities to accommodate the stormwater draining from the proposed development.

(4) **Underground Injection Control Systems.** Stormwater runoff disposed of in underground systems is also regulated through the federal Underground Injection Control (UIC) program under Part C of the Safe Drinking Water Act (42 U.S.C. § 300, Chapter 6A, Subchapter XII) and Oregon Administrative Rule Chapter 340, Section 044.

9.6792 **<u>Stormwater Pollution Reduction</u>.**

(1) **Purpose.** The purpose of EC 9.6792 is to reduce the impacts that urbanization is having on the city's water quality by providing standards for the capture and treatment of stormwater runoff from development.

(2) **Applicability and Exemptions.**

(a) Except as exempt under EC 9.6792(2)(c), the standards in EC 9.6792(3) apply to all land use applications submitted after July 14, 2006 requesting approval of one or more of the following:

1. A cluster subdivision - tentative plan (EC 9.8055);
2. A conditional use (EC 9.8090 or 9.8100);
3. A partition - tentative plan (EC 9.8215 or 9.8220);
4. A planned unit development - tentative plan (EC 9.8320 or 9.8325);
5. Site review (EC 9.8440 or 9.8445);
6. A subdivision tentative plan (EC 9.8515 or 9.8520).

(b) Except as exempt under EC 9.6792(2)(c), the standards in EC 9.6792(3) apply to all applications for development permits submitted after July 14, 2006.

(c) The standards in EC 9.6792(3) do not apply to:

1. A land use application that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development.
2. A development permit application for any of the following:
    a. Development of a lot or parcel included in a land use application that was determined by the city to comply with the standards in EC 9.6792(3). For such a development permit, the approved land use plan shall control.
    b. Development of a lot or parcel that was not included in a

land use application that was determined by the city to comply with the standards in EC 9.6792(3) and:

(1) Will result in less than 1,000 square feet of new or replaced impervious surface within a 12 month period; or

(2) Is to construct or alter a one or two family dwelling; or

(3) The replacement of more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site.

(3) **Standards.**

(a) Applications shall include pollution reduction facilities selected from the Stormwater Management Manual as follows:

1. For land use applications listed in EC 9.6792(2)(a) for undeveloped land, the selected pollution reduction facilities shall treat all the stormwater runoff from the development site that will result from the water quality design storm;
2. For land use applications listed in EC 9.6792(2)(a) that change or add development to an already developed site, the selected pollution reduction facilities shall treat the stormwater runoff from all added and replaced impervious surface that will result from the water quality design storm;
3. For development permit applications, the selected pollution reduction facilities shall treat all stormwater runoff from all new or replaced impervious surface, or an equivalent on-site area, that will result from the water quality design storm;

(b) All pollution reduction facilities shall be sited, designed and constructed according to the pollution reduction provisions and the facility design requirements set forth in the Stormwater Management Manual. Pollution reduction facilities must be designed using one of the three methodologies outlined in the Stormwater Management Manual.

(c) The standards in EC 9.6792(3) may be adjusted pursuant to EC 9.8030(24).

9.6793 **<u>Stormwater Flow Control (Headwaters).</u>**

(1) **Purpose.** The purpose of EC 9.6793 is to protect waterways in the headwaters area from the erosive affects of increases in stormwater runoff peak flow rates and volumes resulting from development.

(2) **Applicability and Exemptions.**

(a) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all land use applications for development sites in the headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006 requesting approval of one or more of the following:

1. A cluster subdivision - tentative plan (EC 9.8055);

2. A conditional use (EC 9.8090 or 9.8100);
3. A partition - tentative plan (EC 9.8215 or 9.8220);
4. A planned unit development - tentative plan (EC 9.8320 or 9.8325);
5. Site review (EC 9.8440 or 9.8445);
6. A subdivision tentative plan (EC 9.8515 or 9.8520).

(b) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all applications for development permits for development sites in a headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006.

(c) The standards in EC 9.6793(3) do not apply to:

1. A land use application that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development.
2. A development permit application for any of the following:
   a. Development of a lot or parcel included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3). For such a development permit, the approved land use plan shall control.
   b. Development of a lot or parcel that was not included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3) and:
      (1) Will result in less than 1,000 square feet of new or replaced impervious surface within a 12 month period; or
      (2) Is to construct or alter a one or two family dwelling; or
      (3) Is for the replacement of more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site.
3. Development sites within a drainage basin for which the city has constructed or approved a project to restore the receiving waterway, and the entire downstream system has been designed to accommodate full build-out conditions within the drainage basin.

(3) Standards.

(a) Applications shall demonstrate, using methodology in the Stormwater Management Manual, that peak rates of flow delivered to an existing open waterway at a point above 500 feet in elevation will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the development that is the subject of the application;

(b) For purposes of designing the system as required by the standards in this section, the amount of impervious surface per lot is assumed to be the maximum lot coverage allowed for the use in the zone in which it is located, unless the applicant demonstrates otherwise.

(c) All facilities to control the rate of stormwater runoff shall be sited, designed and constructed according to the flow control provisions and the facility design requirements set forth in the Stormwater Management Manual. Flow control facilities must be designed using one of the methodologies outlined in the Stormwater Management Manual.

(d) The standards in EC 9.6793(3) may be adjusted pursuant to EC 9.8030(24).

9.6794 Stormwater Oil Control.

(1) **Purpose.** The purpose of EC 9.6794 is to protect the city's stormwater system from oil and grease from stormwater runoff of impervious surface areas on properties that produce high concentrations of these pollutants.

(2) **Applicability.** Oil control standards set forth in EC 9.6794(3) apply to:

(a) All new commercial and industrial development with parking lots that store wrecked or impounded vehicles; or

(b) Any development that would result in an expected daily traffic count greater than one hundred vehicles per 1,000 square feet of gross building area, based on the most recent version of The Institute of Transportation Engineers' Trip Generation Manual; or

(c) Any development that would result in 100 or more off-street parking spaces; or

(d) Any commercial or industrial development that receives an adjustment approving the installation of 125 percent or more of the minimum off-street parking spaces required by EC 9.6410(3), Minimum Number of Required Off-Street Parking Spaces and that adjustment will result in, at least, a total of 10 parking spaces.

(3) **Standards.** Unless adjusted pursuant to EC 9.8030(24), all oil control facilities shall be sited, designed and constructed according to the oil control provisions and the facility design requirements set forth in the Stormwater Management Manual.

9.6795 Stormwater Source Controls.

(1) **Purpose.** The purpose of EC 9.6795 is to prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.

(2) **Applicability and Exemptions.** Except as exempted below and except when the source control would duplicate source controls required by a state or federal permit obtained by the applicant, source control standards set forth in EC 9.6795(3), apply to all land use applications, development permits and tenant improvements that result in any of the defined site uses or characteristics listed in EC 9.6795(2)(a)–(h).

(a) Fuel dispensing facilities and surrounding traffic areas where vehicles, equipment, or tanks are refueled on the premises. A fuel dispensing facility is the area where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers. Exempt from this subsection are:

1. Propane tanks.
2. Fuel dispensing areas generally used to service oversized equipment, for example cranes, that cannot maneuver under a roof or canopy.

3. Existing fueling areas where scope of work is limited to a new canopy installation over an existing fuel pad that is not being upgraded, an underground tank replacement for compliance with state regulations, or the replacement of a fuel pump on an existing fuel pad that is not being upgraded.

(b) Exterior storage of liquid materials, for example chemicals, food products, waste oils, solvents, process wastewaters, or petroleum products in aboveground containers, in quantities of 50 gallons or more, including permanent and temporary storage areas. Exempt from this subsection are underground storage tanks or installations requiring a Water Pollution Control Facility (WPCF) permit and containers with internal protections (such as double-walled containers).

(c) All facilities that store solid waste. A solid waste storage area is a place where solid waste containers, including compactors, dumpsters, and garbage cans, are collectively stored. Solid waste storage areas include, areas used to collect and store refuse or recyclable materials collection areas. Exempt from this subsection are solid waste storage areas for one and two family dwelling and areas used for the temporary storage of wood pallets or cardboard.

(d) Developments that stockpile or store high-risk or low-risk bulk materials in outdoor containers, as the terms "high risk" and "low risk" are in the Stormwater Management Manual. Exempt from this subsection are:

1. Materials which have no measurable solubility or mobility in water and no hazardous, toxic or flammable properties.
2. Materials which exist in a gaseous form at ambient temperature.
3. Materials, except for pesticides and fertilizers, that are contained in a manner that prevents contact with stormwater.

(e) Developments proposing the installation of new material transfer areas as defined in the Stormwater Management Manual, or structural alterations to existing material transfer areas, such as access ramp re-grading and leveler installations. Exempt from this subsection are areas used only for mid-sized to small-sized passenger vehicles and restricted by lease agreements or other regulatory requirements to storing, transporting or using materials that are classified as domestic use, for example, primary educational facilities (elementary, middle or high schools), buildings used for temporary storage and churches.

(f) All development with a designated equipment or vehicle washing or steam cleaning area, including smaller activity areas such as wheel-washing stations. Exempt from this subsection are:

1. Washing activity areas generally used to service oversized equipment than cannot maneuver under a roof or canopy, for example cranes and sail boats.
2. Evaporation unit installed as part of a wash recycling system are exempt from the wastewater connection requirement.
3. One and two family dwelling sites.

Development that is intended for the storage of 10 or more fleet vehicles shall include a designated vehicle washing area.

(g) All development projects that disturb property suspected or known to contain contaminants in the soil or groundwater.

(h) All development with new covered vehicle parking areas, or existing parking structures that are being developed. Exempt from this subsection are single-level canopies, overhangs and carports.

(3) **Standards.** Unless adjusted pursuant to EC 9.8030(24), all source controls shall be designed and constructed according to the source control provisions set forth in the Stormwater Management Manual.

(4) **Enforcement.** Failure to construct, operate and maintain source controls when a land use application, development permit or tenant improvement has resulted in a defined site use or characteristic listed in EC 9.6795(1)(a)-(h) is subject to enforcement in accordance with EC Chapter 6.

9.6796 **Dedication of Stormwater Easements.**

(1) **Purpose.** The purpose of EC 9.6796 is to ensure that city maintained stormwater management facilities designed and constructed in accordance with EC 9.6791-9.6795 and the Stormwater Management Manual can be accessed by the city for routine and/or emergency maintenance to protect life and property from flood and drainage hazards, ensure that water quality is protected, and to ensure that waterways in the headwaters area are protected from the erosive effects of runoff.

(2) **Applicability.** Stormwater easement standards set forth in EC 9.6791 apply to all land use applications and development permits that result in the construction of a city maintained stormwater management facility.

(3) **Standards.** The applicant must dedicate public easements approved by the city over city maintained stormwater management facilities provided the city makes findings to demonstrate consistency with constitutional requirements. The conveyance of ownership or dedication of easements may be required in any of the following circumstances:

(a) Except for areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any open drainage way, headwater, stream, creek, wetland, spring, or pond, including those not maintained by the city which drain onto or from city-owned property or into city maintained facilities.

(b) For areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any water course or channel.

(c) Where necessary to extend public drainage facilities and services to adjoining undeveloped property.

(d) To provide necessary drainage from the public right-of-way.

(e) Where the City has accepted functional maintenance responsibility for pollution reduction and/or flow control facilities in accordance with EC 9.6797(4)(b).

9.6797 **Stormwater Operation and Maintenance.**

(1) **Purpose.** The purpose of EC 9.6797 is to ensure that stormwater management facilities designed and constructed in accordance with EC 9.6791-9.6796 and the Stormwater Management Manual are operated and maintained in a manner that protects life and property from flood and drainage hazards, protects water quality, and protects the waterways in the headwaters area from the erosive effects of runoff.

(2) **Applicability.** Operation and maintenance standards apply to all facilities designed and constructed in accordance with EC 9.6792 through EC 9.6795 and the Stormwater Management Manual.

(3) **Standards.**

(a) Unless the city accepts the responsibility to operate and maintain a stormwater facility, all stormwater management facilities shall be privately operated and maintained.

(b) All stormwater facilities shall be operated and maintained in accordance with EC Chapters 6 and 7, and the Stormwater Management Manual.

(c) Privately maintained facilities. Applications proposing private operation and maintenance of all or part of the stormwater facility shall include an Operations and Maintenance Plan in accordance with the forms adopted as a part of the Stormwater Management Manual.

(d) Publicly maintained facilities. Applications proposing city operation and maintenance of all or part of the stormwater facility shall include an Operations and Maintenance Agreement in accordance with the facility agreements adopted as a part of the Stormwater Management Manual.

(4) **City Maintenance.**

(a) If the conditions of EC 9.6797(4)(b) are satisfied, the city will accept functional maintenance responsibility of the following facilities:

1. A facility designed and constructed to provide treatment solely for runoff from the public right-of-way;
2. A facility designed and constructed to provide treatment solely for runoff from 4 or more one and two family residential properties that are not under common ownership;
3. A facility designed and constructed to provide treatment solely for runoff that is a combination of one and two family residential properties not under common ownership and the public right-of-way.

(b) The city will accept functional maintenance responsibility of a facility listed in EC 9.6797(4)(a) if all of the following conditions are met:

1. The city has approved the dedication of the easement or public way to the city the property on which the facility is located or the city has approved plans allowing the facility to be placed within the public right-of-way; and
2. The city has approved plans dedicating the drainage system conveying runoff from the residential properties to the stormwater facility as a public drainage system; and
3. The stormwater facility access routes have been located within a dedicated public easement on private or commonly held property, within the public right-of-way or on city owned property; and
4. Sufficient easement area, right-of-way width or property have been provided to accommodate the construction and maintenance of all existing and proposed utilities and public infrastructure; and
5. The facility is designed and constructed in accordance with the city's Stormwater Management Manual; and
6. Access to the proposed facility allows maintenance to be performed using city owned maintenance equipment; and
7. As-construct plans of the drainage system shall be submitted designating all facilities that are proposed for public maintenance within 30 days of the city accepting maintenance responsibilities; and

8. The facility is designed and constructed in compliance with the city's Public Improvement Design Standards Manual.

(c) Notwithstanding EC 9.6797(4)(a) and (b), the city will not accept operation and maintenance responsibility of eco-roofs, roof gardens, pervious pavement, contained planters, tree credits, rainwater harvesting or private drywells.

(5) Private Operation and Maintenance. All privately operated and maintained stormwater management facilities shall be operated and maintained in accordance with EC Chapter 6.

__Section 5__. Subsection (24) is added to Section 9.8030 of the Eugene Code, 1971, to provide:

9.8030 __**Adjustment Review - Approval Criteria.**__ The planning director shall approve, conditionally approve, or deny an adjustment review application. Approval or conditional approval shall be based on compliance with the following applicable criteria.

(24) Stormwater Pollution Reduction, Flow Control, Oil Control and Source Control Standards Adjustment.

(a) The requirement in EC 9.6792(3)(a)1 and EC 9.6792(3)(a)3 that selected pollution reduction facilities shall treat all the stormwater runoff that will result from the water quality design storm may be adjusted upon a finding that the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies:

1. The area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the pollution reduction facility;
2. The area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility;
3. Constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage to other natural resources; or
4. The area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

(b) The requirement in EC 9.6792(3)(b) that all pollution reduction facilities be selected from and sited, designed, and constructed according to the pollution reduction provisions and the facility design requirements set forth in the Stormwater Management Manual and that pollution reduction facilities must be designed using one of the methodologies outlined in the Stormwater Management Manual may be adjusted upon finding that all of the following requirements are met:

1. The proposed alternative design will achieve equal, or superior, results for function (reducing pollution), maintainability and safety, and the proposed siting does not adversely affect structures or other properties.
2. The applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer.

The description of the proposed design submitted for review must include all of the following information for each component of the proposed alternative design:

a. Size, technical description, capacity, capital cost, design life, construction process and costs, consequences of improper construction, operation and maintenance requirements and costs;

b. Data on the effectiveness of proposed alternative technologies, if available, including data from laboratory testing and pilot/full-scale operations, and information regarding the operations of any full-scale installations;

c. Any other available information about the proposed design, including peer review articles, scientific or engineering journals, and approvals from other jurisdictions.

3. The applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design once constructed, and a schedule for its maintenance.

4. The applicant has submitted a signed statement that the applicant will replace the alternative pollution reduction facility if the facility does not function as proposed.

(c) The requirement in EC 9.6793(3)(a) and EC 9.6793(3)(b) may be adjusted upon a finding that the flow control facility will control flow rates as much as possible and one of the following applies:

1. The area at issue generating runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility;

2. The area at issue generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the flow control facility;

3. Constructing facilities to control the flow of runoff from the area at issue would require removal of trees or damage to other natural resources;

4. The area at issue generating runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

(d) The requirements in EC 9.6793(3)(d) that all flow control facilities be selected from and sited, designed, and constructed according to the flow control provisions and the facility design requirements set forth in the Stormwater Management Manual may be adjusted upon finding that all of the following requirements are met:

1. The proposed alternative design will achieve equal, or superior, results for function (maintaining flow or restricting flow or both), maintainability and safety, and the proposed siting does not adversely affect structures or other properties;

2. The applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer. The description of the proposed design submitted for review must include all of the following information for each component of the proposed alternative design:

a. Size, technical description, capacity, capital cost, design life, construction process and costs, consequences of improper construction, operation and maintenance requirements and costs;

b. Data on the effectiveness of proposed alternative design, if available, including data from laboratory testing and pilot/full-scale operations, and information regarding the operations of any full-scale installations;

c. Any other available information about the proposed design, including peer review articles, scientific or engineering journals, and approvals from other jurisdictions.

3. The applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design once constructed, and a schedule for its maintenance;

4. The applicant has submitted a signed statement that the applicant will replace the alternative flow control facility if the facility does not function as proposed.

(e) The requirement in EC 9.6795(3) that oil control facilities be sited, designed and constructed according to the oil control provisions and the facility design requirements set forth in the Stormwater Management Manual may be adjusted if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Stormwater Management Manual.

(f) The requirement in EC 9.6796(3) that source controls be sited, designed and constructed according to source control provisions set forth in the Stormwater Management Manual may be adjusted if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Stormwater Management Manual. Applicants seeking an adjustment to EC 9.6796(3) must submit a completed authorization request form adopted as part of the Stormwater Management Manual.

<u>**Section 6**</u>. Subsection (1) of Section 9.8055 of the Eugene Code, 1971 is amended as follows:

9.8055 <u>**Cluster Subdivision- Approval Criteria - General**</u>. The planning director shall approve, approve with conditions, or deny a proposed cluster subdivision. Approval or approval with conditions shall be based on the following:

(1) The proposed subdivision complies with:

(a) EC 9.8515 <u>Subdivision, Tentative Plan Approval Criteria- General</u> except for the standards related to EC 9.2760 <u>Residential Zone Lot Standards</u>;

(b) EC 9.2750 <u>Residential Zone Development Standards</u>;

(c) EC 9.2000 through 9.3915 regarding lot dimensions, solar standards, and density requirements for the subject zone;

(d) EC 9.6500 through EC 9.6505 Public Improvement Standards;

(e) EC 9.6800 through EC 9.6875 Streets, Alleys, and Other Public Ways Standards; and

(f) EC 9.6791 through 9.6797 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

The residential lot and development standards may be relaxed based on compliance with the remainder of the cluster subdivision criteria. An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 7. Subsection (8) of Section 9.8090 of the Eugene Code, 1971, is amended as follows:

9.8090 **Conditional Use Permit Approval Criteria - General.** A conditional use permit shall be granted only if the proposal conforms to all of the following criteria:

(8) The proposal complies with all applicable standards, including but not limited to:

(a) EC 9.2000 through 9.3915 regarding lot dimensions, solar standards, and density requirements for the subject zone;

(b) EC 9.6500 through EC 9.6505 Public Improvement Standards;

(c) EC 9.6791 through 9.6797 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance; and

(d) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and other Public Ways;

(e) Where the proposal is to establish non-residential uses subject to residential density requirements on development sites in the residential zone category, it shall achieve the minimum and maximum density requirements in accordance with Table 9.2750 Residential Zone Development Standards, unless specifically exempted elsewhere in this code or granted a modification through an approved conditional use permit. For purposes of calculating "net density," the acreage of land considered shall include the entire development site and exclude public property, such as public streets, parks, and other public facilities. In considering whether to grant a modification to the density requirements, the hearings official shall evaluate the following factors:

1. The availability of the development site for residential use on August 1, 2001. The term "availability" in this section shall include consideration of whether the site was already developed with non-residential uses or had other site constraints impacting its suitability for residential use.
2. The necessity of the development site to be developed with residential uses to be able to achieve the minimum residential density for the area designated on the Metro Plan Land Use Diagram for either medium- or high-density residential use.
3. Adopted plan policies indicate the suitability and appropriateness of the site for non-residential use.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard. Additional criteria may also be required based on the applicability of other sections of this land use code.

Section 8. Subsection (4) of Section 9.8100 of the Eugene Code, 1971 is amended as follows:

9.8100 **Conditional Use Permit Approval Criteria- Needed Housing.** The hearings official shall approve, conditionally approve, or deny the conditional use permit application. Unless the applicant elects to use the general criteria contained in EC 9.8090 Conditional Use Permit Approval Criteria - General, where the applicant proposes needed housing, as defined by the State statutes, the hearings official shall approve or approve with conditions a conditional use based on compliance with the following criteria:

(4) The proposal complies with all applicable standards, including, but not limited to:
- (a) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (b) EC 9.6710(6) Geological and Geotechnical Analysis.
- (c) EC 9.6730 Pedestrian Circulation On-Site.
- (d) EC 9.6735 Public Access Required.
- (e) EC 9.6750 Special Setback Standards.
- (f) EC 9.6775 Underground Utilities.
- (g) EC 9.6780 Vision Clearance Area.
- (h) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
- (i) An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 9. Subsection (1) of Section 9.8215 of the Eugene Code, 1971 is amended as follows:

9.8215 **Partition, Tentative Plan Approval Criteria- General.** The planning director shall approve, approve with conditions, or deny a partition, with findings and conclusions. Approval, or approval with conditions, shall be based on compliance with the following criteria:

(1) The proposed partition complies with all of the following:
- (a) Lot standards of EC 9.2000 through 9.3915 regarding applicable parcel dimensions and density requirements.
- (b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.
- (c) EC 9.6500 through EC 9.6505 Public Improvement Standards.
- (d) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (e) EC 9.6710 Geological and Geotechnical Analysis.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.
- (j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control,

easements, and operation and maintenance.

(k) All other applicable development standards for features explicitly included in the application.

(l) The applicable adopted plan policies beginning at EC 9.9500.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 10. Subsection (2) of Section 9.8220 of the Eugene Code, 1971 is amended as follows:

9.8220 **Partition, Tentative Plan Approval Criteria- Needed Housing.** The planning director shall approve, conditionally approve, or deny the partition application. Unless the applicant elects to use the general criteria contained in EC 9.8215 Partition, Tentative Plan Approval Criteria- General, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a partition based on compliance with the following criteria:

(2) The proposed partition complies with all of the following:

(a) Lot standards of EC 9.2000 through 9.3915 regarding applicable parcel dimensions and density requirements.

(b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.

(c) EC 9.6500 through EC 9.6505 Public Improvement Standards.

(d) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.

(e) EC 9.6710(6) Geological and Geotechnical Analysis.

(f) EC 9.6735 Public Access Required.

(g) EC 9.6750 Special Setback Standards.

(h) EC 9.6775 Underground Utilities.

(i) EC 9.6780 Vision Clearance Area.

(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

(k) EC 9.6880 through EC 9.6885 Tree Preservation and Removal Standards.

(l) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 11. Subsection (11) of Section 9.8320 of the Eugene Code, 1971 is amended as follows:

9.8320 **Tentative Planned Unit Development Approval Criteria- General**. The hearings official shall approve, approve with conditions, or deny a tentative PUD application with findings and conclusions. Decisions approving an application, or approving with conditions shall be based on compliance with the following criteria:

(11) The PUD complies with all of the following:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through EC 9.6505 Public Improvement Standards.
- (c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (d) EC 9.6710 Geological and Geotechnical Analysis.
- (e) EC 9.6730 Pedestrian Circulation On-Site.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.
- (j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
- (k) All other applicable development standards for features explicitly included in the application except where the applicant has shown that a proposed noncompliance is consistent with the purposes set out in EC 9.8300 Purpose of Planned Unit Development.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 12. Subsection (7) of Section 9.8325 of the Eugene Code, 1971 is amended as follows:

9.8325 **Tentative Planned Unit Development Approval Criteria - Needed Housing**. The hearings official shall approve, conditionally approve, or deny the PUD application with findings and conclusions. Unless the applicant elects to use the general criteria contained in EC 9.8320 Tentative Planned Unit Development Approval Criteria - General, where the applicant proposes needed housing, as defined by the State statutes, the hearings official shall approve or approve with conditions a PUD based on compliance with the following criteria:

(7) The PUD complies with all of the following:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through 9.6505 Public Improvement Standards.
- (c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (d) EC 9.6710(6) Geological and Geotechnical Analysis.
- (e) EC 9.6730 Pedestrian Circulation On-Site.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.

(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 13. Subsection (5) of Section 9.8440 of the Eugene Code, 1971 is amended as follows:

9.8440 **Site Review Approval Criteria-General**. The planning director shall approve, conditionally approve, or deny the site review application. Approval or conditional approval shall be based on compliance with the following criteria:

(5) The proposal complies with all of the following standards:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through 9.6505 Public Improvement Standards.
- (c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (d) EC 9.6710 Geological and Geotechnical Analysis.
- (e) EC 9.6730 Pedestrian Circulation On-Site.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.
- (j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
- (k) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 14. Subsection (4) of Section 9.8445 of the Eugene Code, 1971 is amended as follows:

9.8445 **Site Review Approval Criteria- Needed Housing**. The planning director shall approve, conditionally approve, or deny the site review application. Unless the applicant elects to use the general criteria contained in EC 9.8440 Site Review Approval Criteria - General, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a site review based on compliance with the following criteria:

(4) The proposal complies with all of the following standards:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through 9.6505 Public Improvement Standards.

(c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
(d) EC 9.6710 (6) Geological and Geotechnical Analysis.
(e) EC 9.6730 Pedestrian Circulation On-Site.
(f) EC 9.6735 Public Access Required.
(g) EC 9.6750 Special Setback Standards.
(h) EC 9.6775 Underground Utilities.
(i) EC 9.6780 Vision Clearance Area.
(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
(k) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 15. Subsections (1) and (10) of Section 9.8515 of the Eugene Code, 1971 are amended as follows:

9.8515 **Subdivision, Tentative Plan Approval Criteria - General.** The planning director shall approve, approve with conditions, or deny a proposed subdivision. Approval, or approval with conditions shall be based on compliance with the following criteria:

(1) The proposed subdivision complies with the following:
(a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone;
(b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways; and
(c) EC 9.6500 through EC 9.6505 Public Improvement Standards.

(10) The proposed subdivision complies with all of the following:
(a) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
(b) EC 9.6710 Geological and Geotechnical Analysis.
(c) EC 9.6730 Pedestrian Circulation On-Site.
(d) EC 9.6735 Public Access Required.
(e) EC 9.6750 Special Setback Standards.
(f) EC 9.6775 Underground Utilities.
(g) EC 9.6780 Vision Clearance Area.
(h) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
(i) The proposed subdivision complies with other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 16. Subsection (3) of Section 9. 8520 of the Eugene Code, 1971 is amended as follows:

9.8520 **Subdivision, Tentative Plan Approval Criteria- Needed Housing.** The planning director shall approve, conditionally approve, or deny the subdivision application. Unless the applicant elects to use the general criteria contained in EC 9.8515 Subdivision, Tentative Plan Approval Criteria- General, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a subdivision based on compliance with the following criteria:

(3) The proposed subdivision complies with all of the following:

(a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.

(b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.

(c) EC 9.6500 through EC 9.6505 Public Improvement Standards.

(d) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.

(e) EC 9.6710(6) Geological and Geotechnical Analysis.

(f) EC 9.6730 Pedestrian Circulation On-Site.

(g) EC 9.6735 Public Access Required.

(h) EC 9.6750 Special Setback Standards.

(i) EC 9.6775 Underground Utilities.

(j) EC 9.6780 Vision Clearance Area.

(k) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 17. The City Recorder, at the request of, or with the concurrence of the City Attorney, is authorized to administratively correct any reference errors contained herein or in other provisions of the Eugene Code, 1971, to the provisions added, amended, or repealed herein.

Section 18. The findings set forth in Exhibit A attached hereto are adopted in support of this Ordinance.

Passed by the City Council this	**Approved by the Mayor this**
12th day of June, 2006.	**14th day of June, 2006.**
City Recorder	**Mayor**

Appendix B

CITY OF PORTLAND, OREGON
BUREAU OF ENVIRONMENTAL SERVICES

VENDOR SUBMISSION GUIDANCE

FOR

EVALUATING STORMWATER TREATMENT TECHNOLOGIES

February 2001

INDEX

VENDOR SUBMISSION GUIDANCE FOR EVALUATING STORMWATER TREATMENT TECHNOLOGIES

February 20, 2001

I. Introduction

The City of Portland's Bureau of Environmental Services recently completed a Stormwater Manual update in September of 2000, and expects to complete the next revision by September of 2002. This manual provides storm water treatment requirements and guidance. BES specifies design criteria, such as storm events and facility performance goals. Facilities need to be designed to satisfy those criteria as stand-alone systems or as parts of treatment train approaches. The Stormwater Manual can be found online at www.cleanrivers-pdx.org.

Chapter 5.0 deals with storm water quality and includes a section on manufactured storm water treatment technologies. The facilities currently included in the manual are CSR Hydro Conduit™ Stormceptor®, Vortechnics™ Stormwater Treatment System™, H.I.L. Technology Inc.™ Downstream Defender™, CDS Technologies™, and Stormwater Management™ Stormfilter™. Storm water technologies and the knowledge base around them is rapidly evolving, and as such these facilities were included with a limited foundation of consistent test data to back their claims of performance to Portland's design standards.

This guidance is designed to gather the information needed to address these needs, and to provide a process for designating approval levels of manufactured treatment technologies. It is understood that vendors' initial submittals may not be fully compliant with the assessment protocol (see Technology Assessment Protocol section, Page 3), just as the data submitted by the vendors of the manufactured technologies currently included in the Stormwater Manual is not. However, to be included in the September 2002 revision of BES's Stormwater Manual, new or previously approved vendors must submit test data that meets the requirements set forth in this protocol by July 1, 2002. Results must indicate that the facility performs to Portland's design standards (see Performance Criteria section below, and Data Evaluation section, Page 11).

This guidance will also define "TSS (Total Suspended Solids) removal", and provide the equations necessary to calculate it. Portland's method for evaluating test results, which includes provisions for influent concentration, is also included (See Data Evaluation section, Page 11).

II. Performance Criteria

DESIGN STORM

Treatment facilities shall be sized to treat runoff from the water quality design storm, defined as 0.83 inches of rainfall in a 24-hour period (SCS Type 1A rainfall distribution), which is also one-third of Portland's 2-year event of 2.5 inches over 24 hours. Approved hydrology methods, as outlined in chapter 6.0 of BES's Stormwater Manual, shall be used to identify runoff volumes and peak flow rates for design purposes. By treating this storm event, roughly 95% of storm events in Portland are effectively treated.

REQUIRED TREATMENT PERFORMANCE GOALS

Basic Water Quality Performance Goal

The basic treatment performance goal for the entire city is 70% TSS (Total Suspended Solids) removal from post-developed runoff from the design storm (See Treatment Efficiency section, Page 6 and 7). TSS is defined as "matter suspended in storm water excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter (larger than coarse sand, also see Distribution of Sediment Sizes Table, Page 6). Influent concentration of TSS is known to greatly impact the ability of a facility to remove 70% TSS, so it is important to specify limits to be used in performance tests. BES will use the "Line of Comparative Performance©" method, developed by Dr. Gary Minton of Resource Planning Associates (See Charts 1 through 3 in the Data Evaluation section, Pages 11 and 12) to determine whether or not a facility meets this requirement. These lines were generated from test data on the TSS removal efficiencies of grassy swales and sand filters and modified to account for Portland's 70% TSS removal standard. The premise behind using these lines of performance is that grassy swales and sand filters have been widely accepted as adequate-performing treatment facilities. These, as well as other treatment BMPs, remove a higher percentage of TSS with higher TSS influent concentrations. It is not fair or practical to require 70% TSS removal from clean storm water. This method of evaluation, however, accounts for this dilemma. Manufactured technologies will not be expected to outperform grassy swales and sand filters, but data points must be comparable, with a certain percentage falling above the "Line of Comparative Performance©" for the facility to be accepted as a "Presumptive Approach" in the Stormwater Manual. As a low-level baseline, a facility must also achieve an effluent goal of no more than 20 mg/l TSS for low influent concentrations (≤ 70 mg/l).

TMDL Enhanced Performance Goal

Certain watersheds within the City of Portland have established TMDLs (Total Maximum Daily Loads). The TMDLs apply specific pollution control requirements to designated pollutants of concern. To ensure that new development does not contribute pollutants of concern to a TMDL watershed, pollution reduction facilities are required to demonstrate specific removal rates for those specific pollutants. For example, the Tualatin Basin Watershed currently has Phosphorus as a listed pollutant of concern. The City's policy in the Tualatin Basin, therefore, is to construct storm water facilities that are capable of removing 65% of the post-developed Phosphorus from the storm water.

To be considered for use as a stand-alone facility in a TMDL watershed, a manufactured technology must demonstrate removal efficiencies for specific pollutants of concern, as well as TSS. Contact BES for a current list of TMDL watersheds with corresponding pollutant parameters.

Oil and Grease Performance Goal

Certain site uses within the City of Portland, such as high-use or high-risk parking lots, require additional treatment for oil and grease. The Stormwater Manual currently only recognizes oil/water separators for the pretreatment of oil and grease. To be considered for use as an oil/water separator, a manufactured technology must demonstrate adequate performance. Adequate performance needs to include: the removal of oil droplets from 50 to 60 microns in size, and the ability to achieve effluent efficiencies of 10 ppm or mg/L for influent concentrations exceeding 50 ppm or mg/L. The Stormwater Manual's Chapter 9.0, Section 9.8, identifies conditions under which a high-use or high-risk assessment is made.

Pretreatment Performance Goal

A facility may be approved for pretreatment use only. In this case, the facility would be constructed in conjunction with another water quality facility as a "treatment train" to accomplish the basic or enhanced performance goal. To be approved as a pretreatment facility only, data pertaining to the assessment protocol should be submitted. However, the level of performance will not need to meet basic water quality performance goals. The facility will need to demonstrate the ability to remove large debris and the larger range of TSS particle sizes (see Distribution of Sediment Sizes Chart on page 6), as approved by BES.

REQUIRED PERFORMANCE

Manufactured technologies claiming effectiveness for the listed pollutants must demonstrate (based on data provided per the Technology Assessment Protocol described below) that the above treatment performance goals will be generally achieved. Facilities shall be designed to perform without maintenance for one full year. In addition, factors other than treatment performance are important and will be evaluated to determine appropriate use of the emerging technology. Technologies may be approved as "Presumptive Approaches", which are then presumed to comply with the City's basic water quality performance goal, or as pre-treatment facilities, only accepted in combination with other facilities. Facilities demonstrating compliance with enhanced or oil and grease performance goals may be added to applicable Stormwater Manual sections in future revisions. Facilities that don't demonstrate adequate maintainability (See Section E, page 8) will not be included in the Stormwater Manual and will not be accepted for use within the City.

III. Technology Assessment Protocol

This testing protocol is based on protocols developed by other jurisdictions in the northwest. The Washington Chapter of the American Public Works Association (APWA), the Washington Department of Ecology, the City of Olympia, and the City of Sacramento/ Sacramento County have all developed very similar protocols, and were all instrumental in the development of this one. In this document, BES has tailored various sections of these protocols to fit Portland's design standards. BES reserves the right to change or update this document at any time. As design standards change, compliance with this protocol does not "grandfather" any manufactured facilities into the Stormwater Manual. BES reserves the right to request additional information at any time, and may remove technologies from accepted status after gaining further experience with them, or as new data becomes available. If a vendor wishes to use a different protocol, it is highly recommended to submit protocol details to BES for review prior to initiating tests.

REQUIRED NUMBER AND TYPES OF STUDIES

For BES to adequately evaluate the performance of a facility, a sufficient number of data points, or tests, must be submitted by the manufacturer. The submission of at least 30 tests will be deemed adequate for review. A "test" is defined as a controlled study that meets the requirements set forth in this protocol and results in a single data point which can be plotted on an Influent TSS (mg/L) vs. Removal Efficiency (%) curve (see Chart 3, Page 12). Removal efficiency shall be calculated using methods specified on page 7 of this report. At least half of the tests must come from field installations; either field performance studies with real storms or field performance studies with artificial storms.

Testing by "Independent Entities"

Testing of technologies may be conducted by qualified "independent entities" such as consultants, universities, local, state, or federal agencies. Testing may also be sponsored by the manufacturers themselves, but actual sampling, testing, and laboratory reporting must come from a qualified laboratory.

A. FIELD PERFORMANCE STUDIES WITH REAL STORMS

For inclusion in the Stormwater Manual as a stand-alone "Presumptive Approach", at least 15 data points must be obtained from actual field installations. These can come from field studies with real or artificial storms. At least two different land-uses must be represented, including medium density residential, retail commercial, non-retail commercial, or industrial. Testing within transportation corridors, including public or private streets within these land-uses, is encouraged. The purpose of this is to obtain a range of influent concentrations representative of typical storm water runoff. While it is acknowledged to be more difficult and expensive than laboratory testing, field testing will ensure that situations existing in "real-life" will be mimicked to the maximum extent practicable.

The following storm characteristic requirements must be met for field tests with real storm events, and must be documented and submitted to BES for acceptance.

NUMBER AND CHARACTERISTICS OF SAMPLED STORMS

Minimum Number of Sampled Storms

For inclusion in the Stormwater Manual as a stand-alone "Presumptive Approach", 5 storm events from three different sites must be submitted for a total of 15 storms. Real or artificial storm events can be used. At least two different land-uses must be represented, from either medium density residential, retail commercial, non-retail commercial, or industrial. Testing within transportation corridors, including public or private streets within these land-uses, is encouraged. The purpose of this is to obtain a range of influent concentrations representative of typical storm water runoff. For possible acceptance as a pretreatment device, at least 5 storm events must be submitted. To represent seasonal differences if only real storms are used, the tests shall occur throughout the calendar year. No more than 70% of the real storms may be sampled during the dry season (May through September) or during the wet season (October through April).

Minimum Storm Depth

The minimum total storm depth shall be 0.12 inches. As a guideline, at least 50% of the sampled storms should exceed 0.42 inches, and at least 10% of the sampled storms should exceed 0.83 inches.

Minimum Facility Flow Rate

Obtain data for a range of flows, from 10 to 100% of the design flow for off-line facilities, and from 10 to 125% for facilities designed to be flow-through, on-line facilities. Exceeding the design flow will demonstrate the facility's ability to retain previously trapped pollutants during high-flow periods. This requirement will most likely be accomplished through field testing with artificial storms.

Start/ End of Storm Event: A storm event is preceded and followed by at least six hours of dry weather.

Minimum Runoff Duration: 6 Hours.

Minimum Average Rainfall Intensity

Minimum average rainfall intensity shall be 0.02 inches/ hour. As a guideline, at least 50% of the storms should exceed 0.03 inches/ hour, and at least 10% should exceed 0.05 inches/ hour.

Maximum Average Rainfall Intensity: Maximum average rainfall intensity shall be 0.1 inches/ hour.

SAMPLING SPECIFICATIONS

Type of Samples

Flow-weighted composite samples (Event Mean Concentration or EMC), except pollutants or technologies for which grab sampling is mandated by sampling protocols. Document all sample types for BES review.

Sampling Procedure

To the maximum extent practicable, sample the entire runoff period. As a guideline, sample at least 75% of the total volume of each storm. The final composite sample shall comprise at least 10 influent and 10 effluent sub-samples collected throughout the storm. Plot sampling times on a copy of the runoff hydrograph.

Sampling Locations

If Method #1, 2, or 3 (Page 7) is used to calculate Removal Efficiency: Collect influent samples and measurements of flow rates and volumes at a point upstream of the treatment system, before any flow bypasses. Collect effluent samples and measurements of flow rates and volumes at a point downstream of the treatment system after bypassed and treated flows are rejoined.

If Method #4 (Page 7) is used to calculate Removal Efficiency: Ensure that the unit has been thoroughly cleaned and all sediment removed prior to start of test. Collect influent samples and measurements of flow rates and volumes at a point upstream of the treatment system. Immediately after test, block incoming flows and remove collected pollution for analysis.

Document all sampling locations for BES review.

Parameters of Interest

Parameters of interest include: total suspended solids (TSS), total dissolved solids, BOD, temperature, pH, hardness, total recoverable and dissolved metals including zinc, copper, lead, and cadmium, total and ortho-phosphate, total nitrogen, total petroleum hydrocarbons (NWTPH-Dx and –Gx, silica gel), visible sheen, bacteria (E. coli), nitrate-N, and ammonia-N. The vendor may submit any additional parameters that are deemed to be relevant to facility performance.

The vendor should tailor its sampling procedure to support the treatment goal. To be included in the Stormwater Manual as a general "Presumptive Approach", TSS needs to be sampled. To be considered as an oil/ water separator, Total petroleum hydrocarbons (NWTPH-Dx and –Gx, silica gel) and visible sheen needs to be tested. To be considered for use in TMDL watersheds, other pollutants of concern must be addressed. Because pollution removal parameter requirements tend to change over time, it is in the vendor's best interest to evaluate as many pollutants as possible. Testing methods and procedures are not included in this document for all pollutants of interest, and therefore must be submitted to BES with any testing data.

Sample Handling and Reporting

The methods of sample preservation and analysis are to be documented and submitted with test results. A qualified laboratory shall analyze samples. Results shall be analyzed and reported by entities independent of the vendor. The report shall discuss any discarded samples, QA/QC, duplicates, and ignored data. Analyzation techniques should not employ very minute samples, such as the "10 ml technique".

ACCUMULATED SEDIMENT TESTING

At the end of the test period, remove, weigh, and analyze accumulated sediment. Evaluate the sediment for the following: total dry weight, moisture content, particle size distribution, organic content, TPH, total phosphorus, and total zinc, copper, cadmium, and lead. Analyze particle size distribution using both wet and dry sieve test procedures following ASTM methods. Analyzing particle size distribution is very important in determining a facility's ability to remove the full range of sediment sizes (see table on page 6). Quantify or otherwise document gross solids (debris, litter, and other particles exceeding 1 mm in diameter) and oil accumulations.

GROSS SOLIDS TESTING

At the end of the test period, remove, weigh, and describe accumulated gross solids. Compare gross solids collected in the facility with gross solids bypassed downstream, measured through collection in mesh bags with one-millimeter openings.

RAINFALL MONITORING

Rainfall shall be measured at a representative site. Document site location and distance from facility.

GEOGRAPHIC SETTING

Sites in the Pacific Northwest (SCS Type 1A Rainfall Distribution) are preferred, but not required, as long as rainfall and runoff measurements are within tolerances specified on page 4.

B. FIELD PERFORMANCE STUDIES WITH ARTIFICIAL STORMS

Field performance studies with artificial storms may be submitted by vendors. The procedures described above for "real" storms must be followed, and additional data on the methods used to calculate and field-distribute the artificial storms must be documented and submitted. An artificial hydrograph or series of constant flow rates must be formulated and followed during the field test. It is highly recommended that the vendor submit this artificial hydrograph to BES for review prior to field testing.

C. LABORATORY PERFORMANCE STUDIES

BES recognizes that laboratory testing provides useful information under controlled conditions. Vendors may submit laboratory performance studies for consideration. Up to one-half (15) of the performance studies may be performed in the laboratory.

Removal rates for tests using potable water, spiked with pollutants, have generally been shown to be higher than tests using "real" storm water. Real storm water is therefore preferred when laboratory testing is employed, and should be used for at least half of the tests. When real storm water is used, one performance study shall be comprised of at least 10 influent and 10 effluent samples collected throughout the testing period (treatment efficiency calculation method #1, Page 7), or 10 influent samples collected throughout the testing period and one final captured load mass (treatment efficiency calculation method #4, Page 7). Documentation of the method of acquisition of test water must be submitted to BES for approval.

Spiked test water may be used for up to seven studies. When spiked test water is used, one study shall consist of either; 1) a test performed on water loaded with the full range of particle sizes, or 2) a series of tests on each separate particle size. Treatment efficiency calculation method #4 on page 7 shall be used in either case. TSS added to laboratory water shall conform to the particle size distribution shown in the table below. Documentation of the composition of test water must be submitted to BES for approval.

TABLE: DISTRIBUTION OF SEDIMENT SIZES (STANDARD SIEVE)

PARTICLE DIAMETER	% LESS THAN (WEIGHT)
< 1,000 micron	100%
< 707 micron (coarse sand)	95 to 100%
< 595 micron	90 to 95%
< 420 micron (medium sand)	85 to 90%
< 297 micron	80 to 85%
< 177 micron (fine sand)	75 to 80%
< 88 micron (very fine sand)	50 to 75%
< 44 micron (coarse silt)	25 to 50%
< 16 micron (medium silt)	0 to 25%
<8 micron (fine silt)	0%

D. TREATMENT EFFICIENCY

There are many different methods used to calculate treatment efficiency, four of which are shown below. Method #1 and #4 calculate efficiencies for individual storms, while method #2 and #3 calculate average efficiencies over a number of storms. While any of these described methods are acceptable for use, methods 1 and 4 require fewer storm events to be sampled and are therefore easier to perform. Describe which treatment efficiency methods below were used and include calculations. All are expressed as percentages. Any samples analyzed below detection limits may either be included at the detection limit, or be excluded (with a notation to that effect).

Method #1: Removal in each storm calculated as:

100(flow-weighted influent concentration – flow-weighted effluent concentration) / flow-weighted influent concentration

Where: All concentrations are averages of the 10 flow-weighted sub-samples.

Method #2: Aggregate removal of the storms sampled as:

100(A-B) / A

Where: A = (influent concentration Storm 1)(flow of Storm 1) + (influent concentration of Storm 2)(flow of Storm 2) +...(influent concentration of Storm N)(flow of Storm N)

B = (effluent concentration of Storm 1)(flow of Storm 1) + (effluent concentration of Storm 2)(flow of Storm 2) +...(effluent concentration of Storm N)(flow of Storm N)

Where concentrations are flow-weighted, and flow = average storm flow or total storm volume (vendor's choice).

Method #3: Efficiency based on geometric mean:

100(A-B) / A

Where: A = Geometric mean of all products of flow-weighted influent concentration times average storm flow or total storm volume.

B = Geometric mean of all products of flow-weighted effluent concentration times average storm flow or total storm volume.

Method #4: Removal in each storm calculated as:

Efficiency = 100(Captured load mass) / (Influent load mass over entire storm)

Where: Captured load mass = Mass of accumulated TSS in the treatment facility during testing period

Influent load mass over entire storm = Flow-weighted influent concentration times total storm volume through facility, or for laboratory tests with spiked water, total mass of added TSS. Note: TSS gradation must comply with table on page 6.

E. FACTORS OTHER THAN TREATMENT PERFORMANCE

BES staff must make reasoned decisions about storm water treatment technologies. To do so, all relevant factors need to be evaluated, while recognizing the critical importance of the technology's verified treatment performance for a target group of pollutants. Given the limited experience with emerging technologies, this is an arena where "best professional judgement" based on the weight of evidence is appropriate. To be accepted as a publicly owned and maintained facility, the vendor must present the following data to BES's *Standards and Practices Committee*, and receive their official consent. To be accepted for use as private facilities, the vendor must submit the following data to the BES address on page 10.

Applications

1) How does the facility work? How does it remove pollutants?
2) For which applications (e.g. land uses, pollutants) does the vendor recommend this technology? Why?
3) How many systems are installed in the United States? Provide at least three references with names and telephone numbers. Provide specific model numbers.
4) Provide information on at least three units owned and maintained by public municipalities and information on the oldest units installed to date. Provide specific model numbers.

Site Characteristics

5) Do any of these site characteristics or safety considerations favor or limit the technology's use: steep slopes, high groundwater, baseflows, soils, proximity to wells, septic systems and buildings, facility depth limits for access and safety, risk of hazardous materials spills, and driving head requirements? How?

Design Criteria

6) Pollutant removal at design flow and for representative storm water characteristics (e.g. TSS particle size distribution)
7) Storm water constituent limitations, pollutants and other constituents, including fouling factors
8) Design hydraulics (treatment and hydraulic design flows, by-pass flow, hydraulic grade line, scour velocities, etc.)
9) Design residence time, vertical/ horizontal velocities, etc.
10) Specific flow rate for media
11) Head loss curves for media
12) Minimum contact time and minimum thickness for media
13) Design life of system or components of the system before major overhaul is projected; describe fully
14) Media specifications to ensure that adequate quality of each medium is supplied to the user at all times. A list of all the physical/ chemical and impurity specifications should be provided
15) Structural, water tightness, buoyancy, and constructability
16) Design sizing and cost information for units designed to perform without maintenance for one full-year, and over-designed to last three years before the first cleaning.
17) Pretreatment requirements if any
18) Materials used to construct facility

Construction

19) What role does the vendor take in design and construction? Will a vendor representative be available to the contractor in the field? A letter from the vendor is required with every facility accepted to be publicly owned and maintained. This letter must confirm that the facility is being designed per manufacturer specifications to meet City of Portland requirements.
20) List the steps taken to install the technology. How long does it take?
21) How are factors such as structural integrity, water tightness, and buoyancy addressed?
22) What types of problems can occur in designing and installing the technology?

23) How are potential problems diagnosed and corrected, and by whom?
24) If problems go uncorrected, how does this affect the technology's effectiveness? What will cause complete facility failure?
25) How available is the technology (e.g. where do the major components come from and how much lead-time is needed?)

Costs

26) Provide materials (capital) and installation costs for complete system(s), indicating total costs and costs per cfs treated (not per cfs hydraulic capacity)
27) What is estimated useful facility life before replacement is needed?

Operation and Maintenance: For a typical installation with typical storm water, discuss each of the following:

28) How are inspections performed and how often?
29) How do you tell or forecast when maintenance will be needed, i.e., what is the "trigger" for determining when maintenance is needed and why?
30) How is maintenance performed? Specify equipment, materials, and man-hours necessary
31) Are all maintenance areas accessible by people and equipment? Are special equipment or methods needed for access? Any confined space entry areas?
32) What is the estimated maintenance frequency and on what information/ tests do you base this estimate?
33) What role does the vendor take in maintenance/ How much does the vendor charge for maintenance service?
34) Can the technology be damaged due to delayed maintenance, and if so, how is it restored?
35) How many years have you been in business? If vendor goes out of business or product model changes, how/ where will facility owner find needed parts, materials, and service?
36) Provide information on how other public jurisdictions clean and maintain their units.
37) Is there a standardized Operations and Maintenance plan available? If so, please provide a copy.

Reliability

38) Assuming the technology is designed and installed correctly, what factors can cause it not to perform as designed?
39) Can the technology add, transform, or release accumulated pollutants?
40) Does the filter medium decompose or is it subject to slime/ bacteria growth/
41) Is the technology sensitive to heavy or fine sediment loadings- is pretreatment required?
42) How is under-performance diagnosed and treated?
43) What is the warranty?
44) What initial/ ongoing user support is provided? Does the vendor charge for support?

Other Factors

45) Does the technology provide benefits or present challenges in other potentially relevant areas, such as groundwater recharge, thermal effects on surface waters, habitat creation, aesthetics, vectors, safety, community acceptance, and recreational use?

IV. REPORTING

Vendors seeking BES approval of manufactured storm water treatment facilities must submit the specified test data in report format, and must include answers to the "Factors Other than Treatment Performance" section above. While treatment performance is the most obvious factor in determining facility acceptance, others such as maintainability and reliability are equally important.

All relevant data should be included in the report, including but not limited to: test site locations with maps, dates and times of sampling, topography maps outlining drainage basins, system plans showing all relevant storm water piping and water quality facilities, expected flow calculations for various storm events, beginning and end times of all storm events and samplings, rainfall data from specified rain gage, measured flows through the system at various times (submit calculated hydrographs), and history of the facility (when constructed, when last maintenance/ cleaning occurred, etc.). All data pertaining to characteristics of storms and sampling procedures must be submitted to show conformance with previous specifications.

All reports should be submitted to ATTN: Steve Fancher, PE
Bureau of Environmental Services, C.O.P.
1120 SW 5th Ave. Room 1100
Portland, OR 97204-1972

BES will evaluate the data and report findings to the vendor within 60 days of the submittal.

V. DATA EVALUATION

BES will evaluate the data submitted by the vendors, and group each technology into one or more of the following classifications:

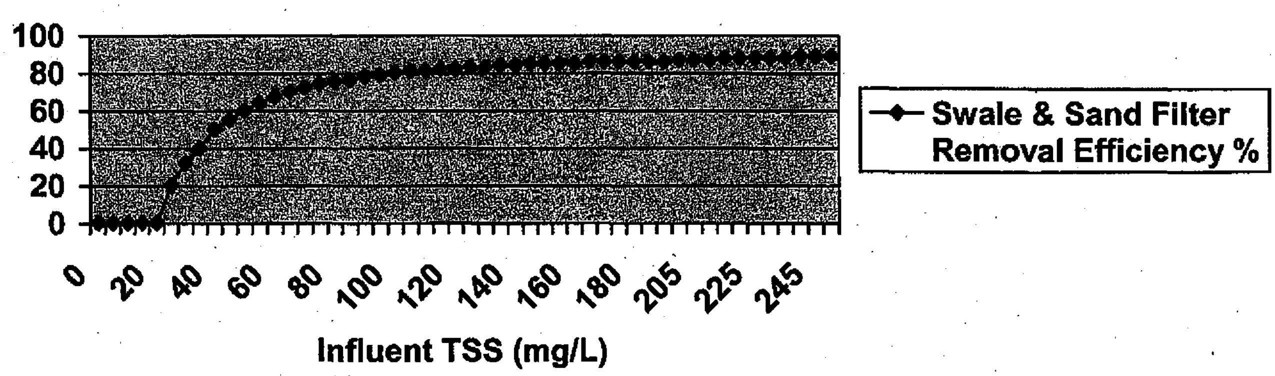
- Presumptive Approach (TSS)
- Pretreatment Only
- Oil/ Water Separation
- Specific Pollutants of Concern (TMDL pollutants)
- Acceptable as Public Facility
- Private Facility Only
- Not Approved for Any Application
- Insufficient Information, Provide Additional Data

LINES OF COMPARABLE PERFORMANCE

As mentioned earlier, BES will use the "Line of Comparative Performance©" method to evaluate a treatment technology's ability to remove TSS. The following table describes the data points that form the approximate grassy swale/ sand filter comparison line:

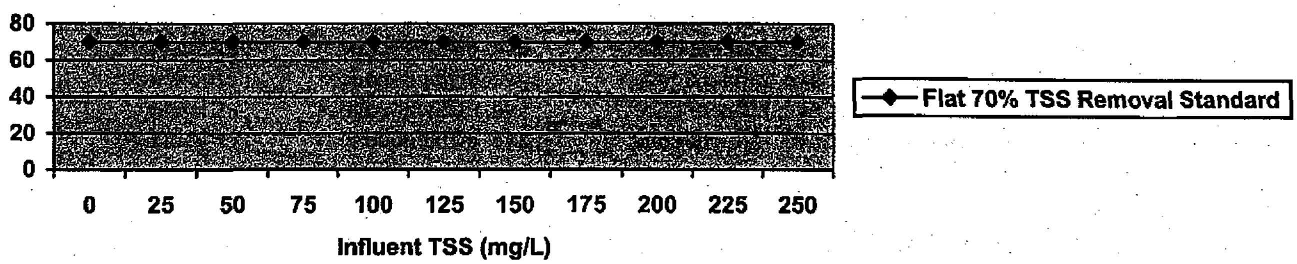
INFLUENT TSS (mg/L)	REMOVAL EFFICIENCY
20	0 %
25	20 %
50	60 %
75	74 %
100	80 %
125	83 %
150	85 %
175	87 %
200	88 %
250	89 %

Chart 1: Grassy Swale/ Sand Filter Line of Performance



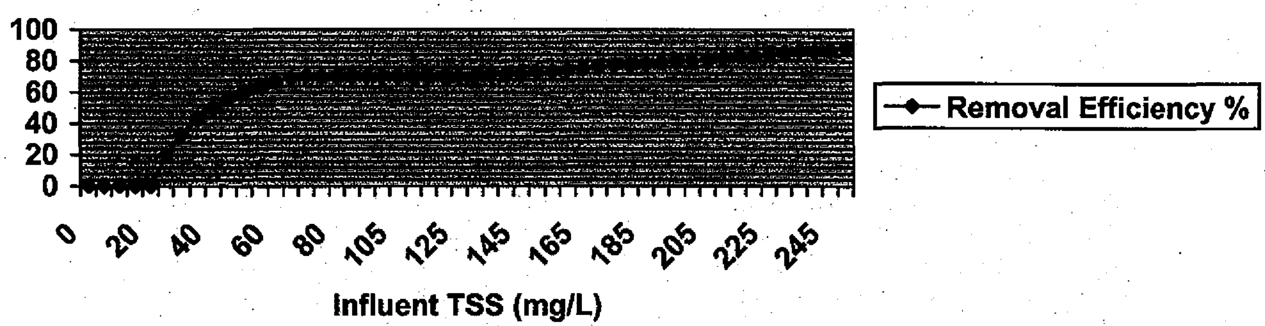
The following chart represents a flat "70% TSS Removal" standard:

Chart 2: Flat 70% TSS Removal Line



The following performance line is consistent with the City of Portland's 70% TSS removal standard and takes into account influent TSS concentrations:

Chart 3: Portland's Modified Performance Standard Line



According to Section 403 Report to Congress, U.S. EPA, 1995, "Typical" storm water contains about 100 mg/L TSS. This line specifies 70% TSS removal for a range 30% below and 30% above 100 mg/L. For every point with less than 70 mg/L influent TSS, it is assumed that the effluent will be the minimum allowed 20 mg/L. For influent concentrations greater than 130 mg/L, the points rise linearly to 88% removal at 250 mg/L, which is a point shared with the swale/ sand filter comparison line.

To meet the City of Portland's basic water quality standard, at least 50% of a technology's data points should fall above this line of performance, as approved by BES. Efficiency calculation methods on page 6 and 7 shall be used to plot points on the chart. Facilities will be required to remove more than 70% for high (<130 mg/L) influent concentrations, while being allowed to remove less than 70% for low (<70 mg/L) influent concentrations. This will result in facilities being evaluated as they actually perform in the field, with those that average 70% TSS removal during the design storm of 0.83 inches over 24 hours receiving acceptable performance evaluations.

SAMPLE DATA COLLECTION SHEET

FIELD SITE #1

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

FIELD SITE #2

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

FIELD SITE #3

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

LABORATORY STUDIES WITH "REAL" STORM WATER

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 6= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 7= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 8= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

LABORATORY STUDIES WITH SPIKED WATER

TEST 1: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 2: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 3: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 4: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 5: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 6: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 7: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____

VI. REFERENCES

Washington Department of Ecology, "Draft 4: Vendor Submission Guidance for Evaluating Emerging Stormwater Treatment Technologies", October 2000

Puget Sound Watershed, "Final Draft: Protocol for the Acceptance of Unapproved Stormwater Treatment Technologies for Use in the Puget Sound Watershed", APWA Task Committee, November 1999

The County of Sacramento and Cities of Citrus Heights, Folsom, Galt, and Sacramento, "Investigation of Structural Control Measures for New Development", November 1999

Boyd, Gail, URS Corporation, personal communication

Technical Update #1

Subject: **Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies: Clarification Regarding "TSS" versus "SSC" Testing Methods**

Date: **July 5, 2001**

The recently released USGS policy regarding the collection and use of total suspended solids data in determining the suspended sediment load in storm water runoff was recently brought to our attention. We have been reviewing the USGS "Comparability of Suspended-Sediment Concentration and Total Suspended Solids Data" document dated August of 2000, and would like to clarify our sampling specifications, as listed in the above mentioned "Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies".

By using "Total Suspended Solids" or "TSS" terminology, we may have implied that the *Total Suspended Solids Analytical Method*, as described by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation should be used to analyze test samples. According to the USGS study (Water-Resources Investigations Report 00-4191 by John R. Gray, G. Douglas Glysson, Lisa M. Turcios, and Gregory E. Schwarz) this method, which uses predetermined sub-sample volumes from an original water sample obtained while the sample is being mixed, is fundamentally unreliable for the analysis of natural-water samples. Methods used in the withdrawal of an aliquot of the original sample are inconsistent and often non-representative of the sample.

The *Suspended-Sediment Concentration Analytical Method*, however, measures all sediment and the mass of the entire water-sediment mixture. ASTM Standard Test Method D 3977-97 lists three methods that result in a determination of SSC values in water and wastewater samples: Test Method A- Evaporation, Test Method B- Filtration, and Test Method C- Wet-sieving filtration. The percentage of sand-size and finer material can be determined as part of the SSC method, but not as part of the TSS method. Overall, the SSC method "produces relatively reliable results for samples of natural water, regardless of the amount or percentage of sand-size material in the samples".

We would like to see the *Suspended-Sediment Concentration Analytical Method* used, as described in ASTM D 3977-97 for analysis of suspended sediment load in storm water runoff.

Appendix C
SANTA BARBARA URBAN HYDROGRAPH METHOD

INTRODUCTION

The Santa Barbara Urban Hydrograph (SBUH) method was developed by the Santa Barbara County Flood Control and Water Conservation District to determine a runoff hydrograph for an urbanized area. It is a simpler method than some other approaches, as it computes a hydrograph directly without going through intermediate steps (i.e., a unit hydrograph) to determine the runoff hydrograph.

The SBUH method is a popular method for calculating runoff, since it can be done with a spreadsheet or by hand relatively easily. The SBUH method is the method approved by the City of Eugene for determining runoff when doing flow control calculations.

ELEMENTS OF THE SBUH METHOD

The SBUH method depends on several variables:

- Pervious (A_p) and impervious (A_{imp}) land areas
- Time of concentration (T_c) calculations
- Runoff curve numbers (CN) applicable to the site
- Design storm

These elements shall all be presented as part of the submittal process for review by staff. In addition, maps showing the pre-development and post-development conditions shall be presented to help in the review.

Land Area

The total area, including the pervious and impervious areas within a drainage basin, shall be quantified in order to evaluate critical contributing areas and the resulting site runoff. Each area within a basin shall be analyzed separately and their hydrographs combined to determine the total basin hydrograph. Areas shall be selected to represent homogenous land use/development units.

Time of Concentration

Time of concentration, T_c, is the time for a theoretical drop of water to travel from the furthest point in the drainage basin to the facility being designed. (In this case, T_c is derived by calculating the overland flow time of concentration and the channelized flow time of concentration.) T_c depends on several factors, including ground slope, ground roughness, and distance of flow. The following formula for determining T_c is:

Formulas

$T_c = T_{t1} + T_{c2} + T_{c3} + \ldots + T_{cn}$

$T_t = L/60V$ (Conversion of velocity to travel time)

$T_t = \frac{0.42\,(nL)^{0.8}}{1.58(s)^{0.4}}$ (Manning's kinematic solution for sheet flow less than 300 feet)

(Shallow concentrated flow for slopes less than 0.005 ft/ft.):

$V = 16.1345(s)^{0.5}$ (Unpaved surfaces)

$V = 20.3282(s)^{0.5}$ (Paved surfaces)

Where,

T_t = travel time, minutes
T_c = total time of concentration, minutes (minimum T_c = 5 minutes)
L = flow length, feet
V = average velocity of flow, feet per second
n = Manning's roughness coefficient for various surfaces
s = slope of the hydraulic grade line (land or watercourse slope), feet per foot

When calculating T_c, the following limitations apply:

- Overland sheet flow (flow across flat areas that does not form into channels or rivulets) shall not extend for more than 300 feet.

- For flow paths through closed conveyance facilities such as pipes and culverts, standard hydraulic formulas shall be used for establishing velocity and travel time.
- Flow paths through lakes or wetlands may be assumed to be zero (i.e. $T_c = 0$).

Runoff Curve Numbers

Runoff curve numbers were developed by the Natural Resources Conservation Service (NRCS) after studying the runoff characteristics of various types of land. Curve numbers (CN) were developed to reduce diverse characteristics such as soil type, land usage, and vegetation into a single variable for doing runoff calculations. The runoff curve numbers approved for water quantity/quality calculations are included as Table C-2 of this appendix.

The curve numbers presented in Table C-2 are for *wet* antecedent moisture conditions. Wet conditions assume previous rainstorms have reduced the capacity of soil to absorb water. Given the frequency of rainstorms in this area, wet conditions are most likely, and give conservative hydrographic values.

Design Storm

The SBUH method also requires a design storm to perform the runoff calculations. For flow control calculations, use NRCS Type 1A 24-hour storm distribution. This storm is shown in Figure C-1 and Table C-4. The depth of rainfall for the 2 through 100-year storm events is shown below in Table C-1.

Table C-1
24-HOUR RAINFALL DEPTHS

Recurrence Interval, Years	2	5	10	25	100
Flood Control, Destination: 24-Hour Depths, Inches	3.12	3.6	4.46	5.18	6.48

Pollution Reduction: 24-Hour Depths, 1.4 Inches

Table C-2
RUNOFF CURVE NUMBERS

Runoff curve numbers for urban areas*

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover <50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

Runoff curve numbers for other agricultural lands*

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing					
<50% ground cover or heavily grazed with no mulch	Poor	68	79	86	89
50 to 75% ground cover and not heavily grazed	Fair	49	69	79	84
>75% ground cover and lightly or only occasionally grazed	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay	-	30	58	71	78
Brush--weed-grass mixture with brush as the major element					
<50% ground cover	Poor	48	67	77	83
50 to 75% ground cover	Fair	35	56	70	77
>75% ground cover	Good	30	48	65	73
Woods-grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79

Runoff curve numbers for other agricultural lands*

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Woods					
Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.	Poor	45	66	77	83
Woods are grazed but not burned, and some forest litter covers the soil.	Fair	36	60	73	79
Woods are protected from grazing, and litter and brush adequately cover the soil.	Good	30	55	70	77

Runoff curve numbers for Simplified Approaches**

Cover description		Curve numbers for hydrologic soil group			
Simplified Approaches	Hydrologic condition	A	B	C	D
Eco-roof	Good	n/a	61	n/a	n/a
Roof Garden	Good	n/a	48	n/a	n/a
Contained Planter Box	Good	n/a	48	n/a	n/a
Infiltration & Flow-Through Planter Box	Good	n/a	48	n/a	n/a
Pervious Pavement	-	76	85	89	n/a
Trees					
New and/or Existing Evergreen	-	36	60	73	79
New and/or Existing Deciduous	-	36	60	73	79

n/a - Does not apply, as design criteria for the relevant mitigation measures do not include the use of this soil type.
*Soil Conservation Service, *Urban Hydrology for Small Watersheds*, Technical Release 55, pp. 2.5-2.8, June 1986.
**CNs of various cover types were assigned to the Proposed Simplified Approaches with similar cover types as follows:

Eco-roof – assumed grass in good condition with soil type B.
Roof Garden – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Contained Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Infiltration & Flow-Through Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Pervious Pavement – assumed gravel.
Trees – assumed woods with fair hydrologic conditions.

Note: To determine hydrologic soil type, consult local USDA Soil Conservation Service Soil Survey.

TABLE C-3
NRCS HYDROLOGIC SOIL GROUP DESCRIPTIONS

NRCS Hydrologic Soil Group	Description
Group A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.
Group B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
Group C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.
Group D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a fragipan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Figure C-1 - NRCS 24-Hour Type 1A Hyetograph

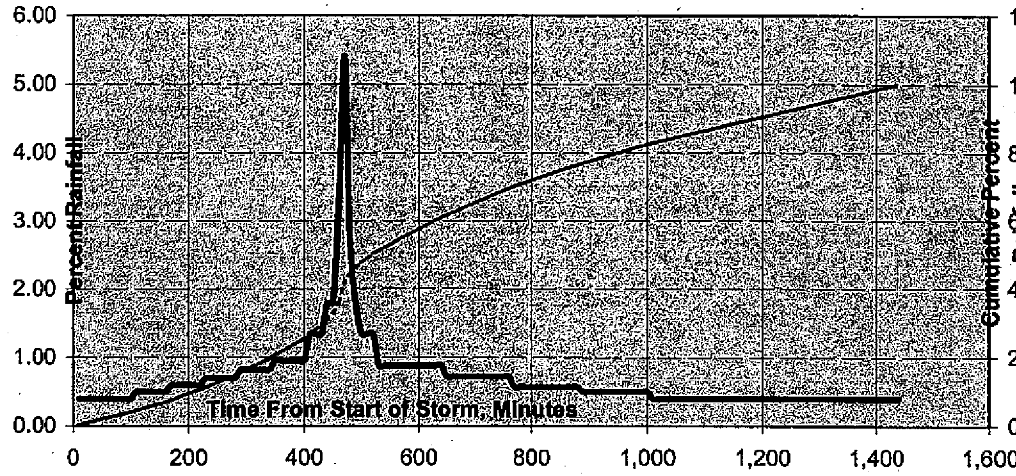


Table C-3 - NRCS Type 1A Hyetographic Distrubution - For Use In Water Quality/Quantity Design

Time From Start of Storm Minutes		% Rainfall	Cumulative % Rainfall
0 -	10	0.40	0.40
10 -	20	0.40	0.80
20 -	30	0.40	1.20
30 -	40	0.40	1.60
40 -	50	0.40	2.00
50 -	60	0.40	2.40
60 -	70	0.40	2.80
70 -	80	0.40	3.20
80 -	90	0.40	3.60
90 -	100	0.40	4.00
100 -	110	0.50	4.50
110 -	120	0.50	5.00
120 -	130	0.50	5.50
130 -	140	0.50	6.00
140 -	150	0.50	6.50
150 -	160	0.50	7.00
160 -	170	0.60	7.60
170 -	180	0.60	8.20
180 -	190	0.60	8.80
190 -	200	0.60	9.40
200 -	210	0.60	10.00
210 -	220	0.60	10.60
220 -	230	0.70	11.30
230 -	240	0.70	12.00
240 -	250	0.70	12.70
250 -	260	0.70	13.40
260 -	270	0.70	14.10
270 -	280	0.70	14.80
280 -	290	0.82	15.62
290 -	300	0.82	16.44
300 -	310	0.82	17.26
310 -	320	0.82	18.08
320 -	330	0.82	18.90
330 -	340	0.82	19.72
340 -	350	0.95	20.67
350 -	360	0.95	21.62
360 -	370	0.95	22.57
370 -	380	0.95	23.52
380 -	390	0.95	24.47
390 -	400	0.95	25.42
400 -	410	1.34	26.76
410 -	420	1.34	28.10
420 -	430	1.34	29.44
430 -	440	1.80	31.24
440 -	450	1.80	33.04
450 -	460	3.40	36.44
460 -	470	5.40	41.84
470 -	480	2.70	44.54
480 -	490	1.80	46.34
490 -	500	1.34	47.68
500 -	510	1.34	49.02
510 -	520	1.34	50.36
520 -	530	0.88	51.24
530 -	540	0.88	52.12
540 -	550	0.88	53.00
550 -	560	0.88	53.88
560 -	570	0.88	54.76
570 -	580	0.88	55.64
580 -	590	0.88	56.52
590 -	600	0.88	57.40
600 -	610	0.88	58.28
610 -	620	0.88	59.16
620 -	630	0.88	60.04
630 -	640	0.88	60.92
640 -	650	0.72	61.64
650 -	660	0.72	62.36
660 -	670	0.72	63.08
670 -	680	0.72	63.80
680 -	690	0.72	64.52
690 -	700	0.72	65.24
700 -	710	0.72	65.96
710 -	720	0.72	66.68
720 -	730	0.72	67.40
730 -	740	0.72	68.12
740 -	750	0.72	68.84
750 -	760	0.72	69.56
760 -	770	0.57	70.13
770 -	780	0.57	70.70
780 -	790	0.57	71.27
790 -	800	0.57	71.84
800 -	810	0.57	72.41
810 -	820	0.57	72.98
820 -	830	0.57	73.55
830 -	840	0.57	74.12
840 -	850	0.57	74.69
850 -	860	0.57	75.26
860 -	870	0.57	75.83
870 -	880	0.57	76.40
880 -	890	0.50	76.90
890 -	900	0.50	77.40
900 -	910	0.50	77.90
910 -	920	0.50	78.40
920 -	930	0.50	78.90
930 -	940	0.50	79.40
940 -	950	0.50	79.90
950 -	960	0.50	80.40
960 -	970	0.50	80.90
970 -	980	0.50	81.40
980 -	990	0.50	81.90
990 -	1000	0.50	82.40
1000 -	1010	0.40	82.80
1010 -	1020	0.40	83.20
1020 -	1030	0.40	83.60
1030 -	1040	0.40	84.00
1040 -	1050	0.40	84.40
1050 -	1060	0.40	84.80
1060 -	1070	0.40	85.20
1070 -	1080	0.40	85.60
1080 -	1090	0.40	86.00
1090 -	1100	0.40	86.40
1100 -	1110	0.40	86.80
1110 -	1120	0.40	87.20
1120 -	1130	0.40	87.60
1130 -	1140	0.40	88.00
1140 -	1150	0.40	88.40
1150 -	1160	0.40	88.80
1160 -	1170	0.40	89.20
1170 -	1180	0.40	89.60
1180 -	1190	0.40	90.00
1190 -	1200	0.40	90.40
1200 -	1210	0.40	90.80
1210 -	1220	0.40	91.20
1220 -	1230	0.40	91.60
1230 -	1240	0.40	92.00
1240 -	1250	0.40	92.40
1250 -	1260	0.40	92.80
1260 -	1270	0.40	93.20
1270 -	1280	0.40	93.60
1280 -	1290	0.40	94.00
1290 -	1300	0.40	94.40
1300 -	1310	0.40	94.80
1310 -	1320	0.40	95.20
1320 -	1330	0.40	95.60
1330 -	1340	0.40	96.00
1340 -	1350	0.40	96.40
1350 -	1360	0.40	96.80
1360 -	1370	0.40	97.20
1370 -	1380	0.40	97.60
1380 -	1390	0.40	98.00
1390 -	1400	0.40	98.40
1400 -	1410	0.40	98.80
1410 -	1420	0.40	99.20
1420 -	1430	0.40	99.60
1430 -	1440	0.40	100.00

Appendix D
SIMPLIFIED APPROACH SIZING CALCULATIONS

The spreadsheet columns are described below:

Column (1)	Time in Minutes
Column (2)	Inflow for Storm Event (25-Year Detention Storm 3.9"/24 hours) and Contributing Impervious Area (1 acre)
Column (3)	Inflow (cf) = Inflow (cfs) x 60 x 10
Column (4)	Inflow (in) = Inflow (cf) x 12 / 43,560
Column (5)	Cumulative Inflow (in) = inflow (in) + Cumulative inflow (in) of previous step
Column (6)	Max Outflow (cfs) = Facility Area (sf) x Infiltration Rate (ft/s) **Note: Infiltration rate is assumed to be 2.5"/hr in this case. Also, for simplicity head is not taken into account.**
Column (7)	Cumulative Outflow (cf) = outflow (cfs) x 10 x 60 + cumulative outflow (cf) of previous step
Column (8)	Inflow – Outflow (cfs) = Column 2 inflow (cfs) – Column 6 outflow (cfs)
Column (9)	Incremental inflow – outflow (cf) = inflow – outflow (cfs) x 10 x 60
Column (10)	Cumulative inflow – outflow (cf) = If incremental inflow – outflow (cf) + cumulative inflow – outflow (cf) of previous step is less than 0, 0; else = incremental inflow – outflow (cf) + cumulative inflow – outflow (cf) of previous time step
Column (11)	Cumulative depth (in) = cumulative inflow – outflow (cf) x 12 / Facility Area (sf) **Note that cumulative depth does not exceed 6 inches in this case, which would result in an overflow condition. When modeling for detention purposes, overflow is allowed, but only at pre-developed peak rates. When modeling for pollution reduction, the entire post-developed runoff rate from the pollution reduction storm must be infiltrated without overflow.** **Resulting swale square-footage is 3,940, which when divided by the 43,560 square-foot impervious surface equals the 0.09 sizing factor.**

Spreadsheet Illustrating Vegetated Swale Sizing: 43,560 sq-ft imp. 25 yr storm Swale Square Footage= **3940**

B Soil Infiltration Rate=2.5"/hr= .21 ft/hr= 0.00006 ft/s

(1) Time (min)	(2) Inflow (cfs)	(3) Inflow Volume (cf)	(4) Inflow Volume (in)	(5) Cumulative Inflow (in)	(6) Max Outflow (cfs)	(7) Cumulative Outflow Vol. (cf)	(8) Inflow - Outflow (cfs)	(9) Incremental Inflow - Outflow (cf)	(10) Cumulative Inflow - Outflow (cf)	(11) Cumulative Depth (in)
0	0	0	0.00	0.00	0.2364	0	-0.2364	-141.84	0	0
10	0	0	0.00	0.00	0.2364	141.84	-0.2364	-141.84	0	0
20	0	0	0.00	0.00	0.2364	283.68	-0.2364	-141.84	0	0
30	0	0	0.00	0.00	0.2364	425.52	-0.2364	-141.84	0	0
40	0.01	6	0.00	0.00	0.2364	567.36	-0.2264	-135.84	0	0
50	0.02	12	0.00	0.00	0.2364	709.2	-0.2164	-129.84	0	0
60	0.03	18	0.00	0.01	0.2364	851.04	-0.2064	-123.84	0	0
70	0.03	18	0.00	0.01	0.2364	992.88	-0.2064	-123.84	0	0
80	0.04	24	0.01	0.02	0.2364	1134.72	-0.1964	-117.84	0	0
90	0.05	30	0.01	0.03	0.2364	1276.56	-0.1864	-111.84	0	0
100	0.05	30	0.01	0.04	0.2364	1418.4	-0.1864	-111.84	0	0
110	0.06	36	0.01	0.05	0.2364	1560.24	-0.1764	-105.84	0	0
120	0.08	48	0.01	0.06	0.2364	1702.08	-0.1564	-93.84	0	0
130	0.08	48	0.01	0.07	0.2364	1843.92	-0.1564	-93.84	0	0
140	0.08	48	0.01	0.09	0.2364	1985.76	-0.1564	-93.84	0	0

150	0.09	54	0.01	0.10	0.2364	2127.6	-0.1464	-87.84	0	
160	0.09	54	0.01	0.12	0.2364	2269.44	-0.1464	-87.84	0	
170	0.1	60	0.02	0.13	0.2364	2411.28	-0.1364	-81.84	0	
180	0.11	66	0.02	0.15	0.2364	2553.12	-0.1264	-75.84	0	0
190	0.12	72	0.02	0.17	0.2364	2694.96	-0.1164	-69.84	0	0
200	0.12	72	0.02	0.19	0.2364	2836.8	-0.1164	-69.84	0	0
210	0.12	72	0.02	0.21	0.2364	2978.64	-0.1164	-69.84	0	0
220	0.12	72	0.02	0.23	0.2364	3120.48	-0.1164	-69.84	0	0
230	0.13	78	0.02	0.25	0.2364	3262.32	-0.1064	-63.84	0	0
240	0.15	90	0.02	0.28	0.2364	3404.16	-0.0864	-51.84	0	0
250	0.15	90	0.02	0.30	0.2364	3546	-0.0864	-51.84	0	0
260	0.15	90	0.02	0.33	0.2364	3687.84	-0.0864	-51.84	0	0
270	0.15	90	0.02	0.35	0.2364	3829.68	-0.0864	-51.84	0	0
280	0.15	90	0.02	0.38	0.2364	3971.52	-0.0864	-51.84	0	0
290	0.17	102	0.03	0.40	0.2364	4113.36	-0.0664	-39.84	0	0
300	0.18	108	0.03	0.43	0.2364	4255.2	-0.0564	-33.84	0	0
310	0.18	108	0.03	0.46	0.2364	4397.04	-0.0564	-33.84	0	0
320	0.18	108	0.03	0.49	0.2364	4538.88	-0.0564	-33.84	0	0
330	0.18	108	0.03	0.52	0.2364	4680.72	-0.0564	-33.84	0	0
340	0.18	108	0.03	0.55	0.2364	4822.56	-0.0564	-33.84	0	0
350	0.2	120	0.03	0.59	0.2364	4964.4	-0.0364	-21.84	0	0
360	0.21	126	0.03	0.62	0.2364	5106.24	-0.0264	-15.84	0	0
370	0.21	126	0.03	0.66	0.2364	5248.08	-0.0264	-15.84	0	0
380	0.22	132	0.04	0.69	0.2364	5389.92	-0.0164	-9.84	0	0
390	0.22	132	0.04	0.73	0.2364	5531.76	-0.0164	-9.84	0	0
400	0.22	132	0.04	0.77	0.2364	5673.6	-0.0164	-9.84	0	0
410	0.26	156	0.04	0.81	0.2364	5815.44	0.0236	14.16	14.16	0.04830213
420	0.31	186	0.05	0.86	0.2364	5957.28	0.0736	44.16	58.32	0.19893928
430	0.31	186	0.05	0.91	0.2364	6099.12	0.0736	44.16	102.48	0.34957644
440	0.36	216	0.06	0.97	0.2364	6240.96	0.1236	74.16	176.64	0.60254862
450	0.42	252	0.07	1.04	0.2364	6382.8	0.1836	110.16	286.8	0.97832284
460	0.6	360	0.10	1.14	0.2364	6524.64	0.3636	218.16	504.96	1.72250314
470	1.02	612	0.17	1.31	0.2364	6666.48	0.7836	470.16	975.12	3.32629766
480	0.94	564	0.16	1.46	0.2364	6808.32	0.7036	422.16	1397.28	4.76635
490	0.52	312	0.09	1.55	0.2364	6950.16	0.2836	170.16	1567.44	5.3468
500	0.37	222	0.06	1.61	0.2364	7092	0.1336	80.16	1647.6	5.6202
510	0.31	186	0.05	1.66	0.2364	7233.84	0.0736	44.16	1691.76	5.770876
520	0.31	186	0.05	1.71	0.2364	7375.68	0.0736	44.16	1735.92	5.92151390
530	0.26	156	0.04	1.76	0.2364	7517.52	0.0236	14.16	1750.08	5.96981604
540	0.21	126	0.03	1.79	0.2364	7659.36	-0.0264	-15.84	1734.24	5.91578314
550	0.21	126	0.03	1.82	0.2364	7801.2	-0.0264	-15.84	1718.4	5.86175025
560	0.21	126	0.03	1.86	0.2364	7943.04	-0.0264	-15.84	1702.56	5.80771736
570	0.21	126	0.03	1.89	0.2364	8084.88	-0.0264	-15.84	1686.72	5.75368446
580	0.21	126	0.03	1.93	0.2364	8226.72	-0.0264	-15.84	1670.88	5.69965157
590	0.21	126	0.03	1.96	0.2364	8368.56	-0.0264	-15.84	1655.04	5.64561868
600	0.21	126	0.03	2.00	0.2364	8510.4	-0.0264	-15.84	1639.2	5.59158578
610	0.21	126	0.03	2.03	0.2364	8652.24	-0.0264	-15.84	1623.36	5.53755289
620	0.21	126	0.03	2.07	0.2364	8794.08	-0.0264	-15.84	1607.52	5.48352
630	0.21	126	0.03	2.10	0.2364	8935.92	-0.0264	-15.84	1591.68	5.42948710
640	0.21	126	0.03	2.14	0.2364	9077.76	-0.0264	-15.84	1575.84	5.37545421
650	0.19	114	0.03	2.17	0.2364	9219.6	-0.0464	-27.84	1548	5.28048731
660	0.17	102	0.03	2.20	0.2364	9361.44	-0.0664	-39.84	1508.16	5.14458639
670	0.17	102	0.03	2.22	0.2364	9503.28	-0.0664	-39.84	1468.32	5.00868548
680	0.17	102	0.03	2.25	0.2364	9645.12	-0.0664	-39.84	1428.48	4.87278456
690	0.17	102	0.03	2.28	0.2364	9786.96	-0.0664	-39.84	1388.64	4.73688365
700	0.17	102	0.03	2.31	0.2364	9928.8	-0.0664	-39.84	1348.8	4.60098274
710	0.17	102	0.03	2.34	0.2364	10070.64	-0.0664	-39.84	1308.96	4.46508182
720	0.17	102	0.03	2.37	0.2364	10212.48	-0.0664	-39.84	1269.12	4.32918091
730	0.17	102	0.03	2.39	0.2364	10354.32	-0.0664	-39.84	1229.28	4.19328
740	0.17	102	0.03	2.42	0.2364	10496.16	-0.0664	-39.84	1189.44	4.05737908
750	0.17	102	0.03	2.45	0.2364	10638	-0.0664	-39.84	1149.6	3.92147817
760	0.17	102	0.03	2.48	0.2364	10779.84	-0.0664	-39.84	1109.76	3.78557725
770	0.15	90	0.02	2.50	0.2364	10921.68	-0.0864	-51.84	1057.92	3.60874233
780	0.13	78	0.02	2.52	0.2364	11063.52	-0.1064	-63.84	994.08	3.39097340
790	0.13	78	0.02	2.55	0.2364	11205.36	-0.1064	-63.84	930.24	3.17320446
800	0.13	78	0.02	2.57	0.2364	11347.2	-0.1064	-63.84	866.4	2.95543553
810	0.13	78	0.02	2.59	0.2364	11489.04	-0.1064	-63.84	802.56	2.73766659
820	0.13	78	0.02	2.61	0.2364	11630.88	-0.1064	-63.84	738.72	2.5198
830	0.13	78	0.02	2.63	0.2364	11772.72	-0.1064	-63.84	674.88	2.3021
840	0.13	78	0.02	2.65	0.2364	11914.56	-0.1064	-63.84	611.04	2.0843

850	0.13	78	0.02	2.67	0.2364	12056.4	-0.1064	-63.84	547.2	1.86659086
860	0.13	78	0.02	2.70	0.2364	12198.24	-0.1064	-63.84	483.36	1.64882192
870	0.13	78	0.02	2.72	0.2364	12340.08	-0.1064	-63.84	419.52	1.43105299
880	0.13	78	0.02	2.74	0.2364	12481.92	-0.1064	-63.84	355.68	1.21328406
890	0.13	78	0.02	2.76	0.2364	12623.76	-0.1064	-63.84	291.84	0.99551512
900	0.12	72	0.02	2.78	0.2364	12765.6	-0.1164	-69.84	222	0.75727918
910	0.12	72	0.02	2.80	0.2364	12907.44	-0.1164	-69.84	152.16	0.51904324
920	0.12	72	0.02	2.82	0.2364	13049.28	-0.1164	-69.84	82.32	0.28080731
930	0.12	72	0.02	2.84	0.2364	13191.12	-0.1164	-69.84	12.48	0.04257137
940	0.12	72	0.02	2.86	0.2364	13332.96	-0.1164	-69.84	0	0
950	0.12	72	0.02	2.88	0.2364	13474.8	-0.1164	-69.84	0	0
960	0.12	72	0.02	2.90	0.2364	13616.64	-0.1164	-69.84	0	0
970	0.12	72	0.02	2.92	0.2364	13758.48	-0.1164	-69.84	0	0
980	0.12	72	0.02	2.94	0.2364	13900.32	-0.1164	-69.84	0	0
990	0.12	72	0.02	2.96	0.2364	14042.16	-0.1164	-69.84	0	0
1000	0.12	72	0.02	2.98	0.2364	14184	-0.1164	-69.84	0	0
1010	0.11	66	0.02	3.00	0.2364	14325.84	-0.1264	-75.84	0	0
1020	0.09	54	0.01	3.01	0.2364	14467.68	-0.1464	-87.84	0	0
1030	0.09	54	0.01	3.03	0.2364	14609.52	-0.1464	-87.84	0	0
1040	0.09	54	0.01	3.04	0.2364	14751.36	-0.1464	-87.84	0	0
1050	0.09	54	0.01	3.06	0.2364	14893.2	-0.1464	-87.84	0	0
1060	0.09	54	0.01	3.07	0.2364	15035.04	-0.1464	-87.84	0	0
1070	0.09	54	0.01	3.09	0.2364	15176.88	-0.1464	-87.84	0	0
1080	0.09	54	0.01	3.10	0.2364	15318.72	-0.1464	-87.84	0	0
1090	0.09	54	0.01	3.12	0.2364	15460.56	-0.1464	-87.84	0	0
1100	0.09	54	0.01	3.13	0.2364	15602.4	-0.1464	-87.84	0	0
1110	0.09	54	0.01	3.15	0.2364	15744.24	-0.1464	-87.84	0	0
1120	0.09	54	0.01	3.16	0.2364	15886.08	-0.1464	-87.84	0	0
1130	0.09	54	0.01	3.18	0.2364	16027.92	-0.1464	-87.84	0	0
1140	0.09	54	0.01	3.19	0.2364	16169.76	-0.1464	-87.84	0	0
1150	0.09	54	0.01	3.20	0.2364	16311.6	-0.1464	-87.84	0	0
1160	0.09	54	0.01	3.22	0.2364	16453.44	-0.1464	-87.84	0	0
1170	0.09	54	0.01	3.23	0.2364	16595.28	-0.1464	-87.84	0	0
1180	0.09	54	0.01	3.25	0.2364	16737.12	-0.1464	-87.84	0	0
1190	0.09	54	0.01	3.26	0.2364	16878.96	-0.1464	-87.84	0	0
1200	0.09	54	0.01	3.28	0.2364	17020.8	-0.1464	-87.84	0	0
1210	0.09	54	0.01	3.29	0.2364	17162.64	-0.1464	-87.84	0	0
1220	0.09	54	0.01	3.31	0.2364	17304.48	-0.1464	-87.84	0	0
1230	0.09	54	0.01	3.32	0.2364	17446.32	-0.1464	-87.84	0	0
1240	0.09	54	0.01	3.34	0.2364	17588.16	-0.1464	-87.84	0	0
1250	0.09	54	0.01	3.35	0.2364	17730	-0.1464	-87.84	0	0
1260	0.09	54	0.01	3.37	0.2364	17871.84	-0.1464	-87.84	0	0
1270	0.09	54	0.01	3.38	0.2364	18013.68	-0.1464	-87.84	0	0
1280	0.09	54	0.01	3.40	0.2364	18155.52	-0.1464	-87.84	0	0
1290	0.09	54	0.01	3.41	0.2364	18297.36	-0.1464	-87.84	0	0
1300	0.09	54	0.01	3.43	0.2364	18439.2	-0.1464	-87.84	0	0
1310	0.09	54	0.01	3.44	0.2364	18581.04	-0.1464	-87.84	0	0
1320	0.09	54	0.01	3.46	0.2364	18722.88	-0.1464	-87.84	0	0
1330	0.09	54	0.01	3.47	0.2364	18864.72	-0.1464	-87.84	0	0
1340	0.09	54	0.01	3.49	0.2364	19006.56	-0.1464	-87.84	0	0
1350	0.09	54	0.01	3.50	0.2364	19148.4	-0.1464	-87.84	0	0
1360	0.09	54	0.01	3.52	0.2364	19290.24	-0.1464	-87.84	0	0
1370	0.09	54	0.01	3.53	0.2364	19432.08	-0.1464	-87.84	0	0
1380	0.09	54	0.01	3.55	0.2364	19573.92	-0.1464	-87.84	0	0
1390	0.09	54	0.01	3.56	0.2364	19715.76	-0.1464	-87.84	0	0
1400	0.09	54	0.01	3.58	0.2364	19857.6	-0.1464	-87.84	0	0
1410	0.09	54	0.01	3.59	0.2364	19999.44	-0.1464	-87.84	0	0
1420	0.09	54	0.01	3.61	0.2364	20141.28	-0.1464	-87.84	0	0
1430	0.09	54	0.01	3.62	0.2364	20283.12	-0.1464	-87.84	0	0
1440	0.09	54	0.01	3.64	0.2364	20424.96	-0.1464	-87.84	0	0
1450	0.05	30	0.01	3.64	0.2364	20566.8	-0.1864	-111.84	0	0
1460	0	0	0.00	3.64	0.2364	20566.8	-0.2364	-141.84	0	0

APPENDIX E

WATER QUALITY DESIGN STORM DEVELOPMENT

REVISED DRAFT

CITY OF EUGENE
DEVELOPMENT STANDARDS MEMORANDUM #4
WATER QUALITY DESIGN STORM SELECTION

INTRODUCTION

In Development Standards Memorandum #2, the following four approaches for implementing stormwater quality requirements were considered:

1. Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified amount of rainfall, or "water quality design storm"
2. Stormwater quality facilities are required to meet a specified performance threshold (e.g., 80% removal of TSS)
3. Specific stormwater quality facilities are required for specific land uses
4. In-lieu-of fees are allowed

Based on the advantages and disadvantages described for each of the four approaches, we decided to further evaluate Approach #1 – Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified water quality design storm.

Structural stormwater quality facilities (i.e., not site planning) can generally be divided into two groups based on different design requirements: detention facilities and flow-through facilities. Detention type facilities include dry ponds, wet ponds, and stormwater marshes. These facilities are designed to allow for the settling of particulates and other pollutants in stormwater by storing the stormwater runoff for a certain period. Therefore, the total rainfall (depth in inches) of the water quality design storm needs to be specified to determine the appropriate size of a detention type facility.

Flow-through facilities include vegetated swales and/or structural facilities with filter media such as sand or compost. These facilities remove particulates and other pollutants by mechanical means (e.g., baffles) or by passing the stormwater through a filtration media (e.g., vegetation, sand or compost). Since flow-through type facilities operate with little or no detention, these types of facilities are designed to treat a maximum flow rate rather than a total runoff volume. Therefore, the rainfall intensity (inches/hour) of the water quality design storm needs to be specified to determine the appropriate size of a flow-through based facility.

The purpose of this memorandum is to describe the methods used to select the water quality design storm parameters for detention type and flow-through type stormwater quality facilities. This memo contains the following information:

- Description of measured rainfall data sources
- Description of the rainfall analysis procedures
- A discussion of the conceptual design procedure for the preliminary capital projects
- Summary of the results of the water quality design storm analysis

- Comparison to other jurisdictions
- Recommendation for further evaluation

LONG-TERM RAINFALL DATA SOURCES

The parameters of the water quality design storm (i.e., total rainfall and rainfall intensity) are based on a statistical analysis of local long-term rainfall data. Hourly rainfall measurements are needed to determine the total rainfall volume for designing detention type facilities. For Eugene, long-term hourly precipitation data are available from a rain gage operated by the National Weather Service (NWS) at the Eugene Airport. Hourly precipitation data is available for this gauge location from 1948 to the present.

Shorter increment rainfall measurements (i.e., 5 to 15 minutes) are more appropriate for determining the rainfall intensity for designing flow-through type facilities. The City has operated several rain gauges within Eugene for the past six years that measure rainfall at 15-minute increments. The rainfall data collected at City gauge I1 (located in west Eugene on the Bertlesen Slough) and City gauge M2 (located in Amazon Park) were used in this analysis.

RAINFALL ANALYSIS PROCEDURES

The statistical analyses of the long-term hourly rainfall measurements collected by the NWS at the Eugene Airport were completed using the Synoptic Rainfall Data Analysis Program (SYNOP). SYNOP provides a summary and statistical analysis of storm event parameters (e.g., rainfall depths, storm intensity, storm duration) and of annual and monthly rainfall totals. The two key input variables in SYNOP are the inter-event time and minimum storm depth. The inter-event time represents the minimum length of dry period, in hours, beyond which additional rainfall measurements are considered to be separate storm events. It is used to separate a long-term continuous rainfall record into discrete, independent storm events. The minimum storm depth is applied to eliminate small storm events from the long-term record that are unlikely to produce measurable stormwater runoff. Storm events with a depth of 0.01 inches or less were eliminated from the long-term record as they are unlikely to produce measurable stormwater runoff. Additional analyses of the results from SYNOP were completed using Microsoft Excel.

CONCEPTUAL DESIGN OF PRELIMINARY CAPITAL PROJECTS

In order to develop conceptual designs for the preliminary capital projects identified during the basin planning process, a preliminary water quality design storm was needed. A SYNOP analysis was completed on the long-term hourly precipitation data from the NWS gage at the Eugene airport using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. The results of the SYNOP and spreadsheet analyses are presented in Figure 1.

The plot in Figure 1 presents the average annual percentage of storm events (y axis) that are equal to or less than a specific design storm rainfall depth (x axis). For example, approximately 80% of the storm events have a rainfall depth of 1.4 inches or less. Therefore, if a detention type stormwater quality facility were designed to capture and treat the stormwater runoff from a site resulting from a 1.4 inch storm event, approximately 80% of the annual stormwater runoff from the site would be treated. This storm depth, 1.4 inches, was selected as the preliminary water quality design storm for completing the conceptual designs for the detention type stormwater quality capital projects.

WATER QUALITY DESIGN STORM ANALYSIS

Based on recent Department Advisory Committee meetings, it seems apparent that development standards for stormwater quality are recommended for portions of Eugene. Therefore, we completed a more detailed analysis of the NWS and City rainfall records to develop the specific parameters of the water quality design storm for implementing development standards. The total rainfall and rainfall distribution is required to design detention type stormwater quality facilities. The rainfall intensity is required to design flow-through type facilities (both off-line and on-line). The procedures used to obtain these water quality design storm parameters are described below.

Detention Type Water Quality Facilities

Long-term hourly precipitation data at the Eugene airport were analyzed to select the water quality design storm parameters for designing detention type stormwater quality facilities. The SYNOP analysis was conducted using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. Based on the results presented in Figure 1, a design storm rainfall depth of 1.4 inches is required to capture approximately 80% of the average annual runoff from a site. A design storm rainfall depth of 0.95 inches is required to capture approximately 70% of the average annual runoff from a site. A design storm rainfall depth of 2.4 inches is required to capture 90% of the average annual runoff from a site.

The rainfall distribution describes the temporal distribution for the total rainfall. The U.S. Soil Conservation Service (SCS) developed a rainfall distribution for western Oregon and Washington referred to as SCS Type 1A. The duration of the SCS Type 1A storm event is typically specified as 24 hours. Based on our SYNOP analysis, the average storm durations for a 6-hr, 12-hr, and 24-hr inter-event time were 16 hours, 26 hours, and 46 hours, respectively. Therefore, a 24-hour rainfall distribution appears to be appropriate.

Flow-through Type Water Quality Facilities

Flow-through type facilities can be installed as off-line or on-line structures. With off-line facilities, an inlet control structure (e.g., flow control manhole) is installed to limit the maximum allowable flow rate that can be treated by the stormwater quality facility. Stormwater flows that exceed the maximum allowable flow rate are bypassed around the facility. The off-line configuration minimizes the possibility that particulates and other pollutants previously trapped by the facility will be resuspended and transported downstream during higher flows.

For on-line facilities, the high flows are not bypassed around the stormwater quality facility. A typical example of this type of facility is a vegetated swale. Most vegetated swales are designed to treat the peak flow rate resulting from the water quality design storm but also convey the peak flow rate resulting from the flood control design storm. During high flows, the treatment effectiveness of an on-line facility is eliminated or greatly reduced. Furthermore, there is a risk that a portion of the particulates and other pollutants that were previously trapped by the on-line facility could be resuspended and transported downstream. Due to these concerns, for an equivalent drainage area, an on-line facility typically must be significantly larger than an off-line facility to provide an equivalent degree of water quality treatment. Therefore, two rainfall intensities need to be specified for designing these facilities: one for the design of on-line facilities and one for the design of off-line facilities.

QA/QC for the 15-Minute Rainfall Data Collected at City Gauges I1 and M2

The 15-minute rainfall data collected at City gauges I1 and M2 were used to determine the rainfall intensity for designing flow-through type facilities. The rainfall data were available from I1 and M2 from January 1995 to December 1999. A comparison of the rainfall data from the two gauges indicated that significant differences exist in the two data sets for some periods of record. Therefore, the 15-minute rainfall data collected at I1 and M2 were studied and analyzed for quality assurance and control purposes. The daily precipitation data collected from the NWS Rain Gauge at the Eugene Airport were also used in the data QA/QC process. The steps involved in data QA/QC are summarized below.

First we calculated daily precipitation at I1 and M2 from 1995 to 1999 by summing all the 15-minute rainfall data collected on each individual day. The daily precipitation at I1 and M2 were then compared with the daily precipitation data collected from the National Weather Service Rain Gauge at the Eugene Airport. One rainfall data file was developed from the two city data sets (i.e., the I1 and M2 rain gages) based on the following criteria:

- If the daily precipitation data for specific dates at one city gauge were significantly different from the daily rainfall data from the NWS gauge and the other city gauge, the data collected at this city gauge were excluded for those dates;
- If the daily precipitation data collected at the two city gauges were similar for a storm event but were quite different from the data collected from NWS, the city gauge that had the closer daily rainfall values to the NWS data were included in the combined data set;
- For certain days in a month that the daily rainfall data were different at all three rain gauges, data from the city gauge that was excluded the least frequently in that month was included in the combined data set.

The following periods of precipitation data were excluded altogether from the records due to the malfunctioning of both the I1 and M2 rain gages:

1. March 6, 1995 through March 31, 1995
2. September 1, 1999 through December 31, 1999.

The QA/QC results can be found in the spreadsheet files titled 1995.xls, 1996.xls, 1997.xls, 1998.xls and 1999.xls. The shaded areas in the spreadsheet represent the periods of record that were excluded. A new set of 15-minute rainfall data was developed by combining the 15-minute rainfall data collected at I1 and M2 from 1995 to 1999 as described above. A spreadsheet analysis was then performed on the combined data set to develop a frequency distribution of rainfall intensities for on-line and off-line flow-through water quality facilities. Descriptions of the spreadsheet analysis for both off-line and on-line flow-through facilities are provided in the following sections.

Off-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was completed to summarize the occurrence of rainfall intensities for off-line facilities. The results are presented in Figure 2. The results are based on the assumption that all stormwater runoff would be treated if the measured rainfall intensity was equal to or less than the design storm intensity. If the measured rainfall intensity exceeded the design storm intensity, then the percentage of the storm that could be treated was set equal to the ratio of the design storm intensity to the actual storm intensity. For example, if the facility is designed to treat storm events with a maximum intensity of 0.2 in/hr, then all the runoff from storm events with intensities less than or equal to 0.2 in/hr can be treated. However, if the rainfall intensity is 0.3 in/hr, then only 2/3 (or 66%) of the runoff generated this storm event would get treated.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.13 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.08 in/hr, and 90% would be treated using a rainfall intensity of 0.19 in/hr.

On-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was also completed to summarize the occurrence of rainfall intensities for on-line facilities. The results are presented in Figure 2. The results for on-line facilities are based on a different set of assumptions than for off-line facilities. Similar to off-line facilities, if the measured rainfall intensity was less than or equal to the design storm intensity, then all of the stormwater runoff would be treated. However, if the measured rainfall intensity exceeded the design storm intensity, the results are based on the assumption that all of the stormwater runoff from that event would not receive treatment.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.22 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.17 in/hr, and 90% would be treated using a rainfall intensity of 0.34 in/hr.

COMPARISON WITH OTHER JURISDICTIONS

Several other regional jurisdictions have recently adopted development standards for water quality. The following table presents the water quality requirements for Portland, Gresham, and the Unified Sewerage Agency with proposed requirements in Eugene.

Jurisdiction	Average Annual Rainfall (in)	Water Quality Design Storm			
		Detention Type Facilities		Flow-through Type Facilities	
		Total Rainfall (in)	Storm Duration	Off-Line Facilities	On-Line Facilities
Portland	34	0.83	24-hr duration	Not Specified	Not Specified
Gresham	34	1.2	12-hr duration	0.11 in/hr	0.20 in/hr
USA	40	0.36	4-hr duration	Not Specified	Not Specified
Eugene	45	1.4	24-hr duration	0.13 in/hr	0.22 in/hr

RECOMMENDATION

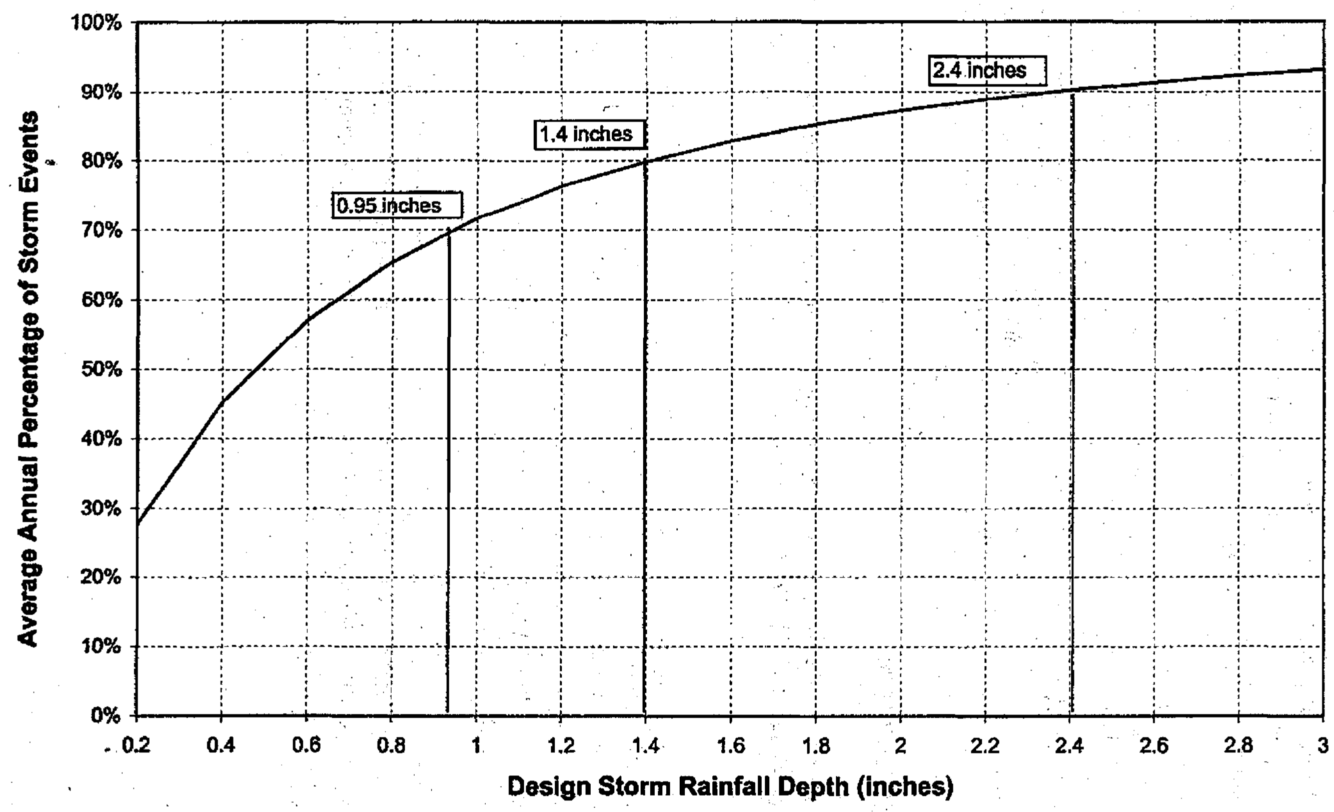
Based on the above analysis, we recommend that preliminary capital project designs and example site designs (for the DAC) incorporate the use of the following design storm specifications:

- For detention type facilities: required storage volume is equal to the stormwater runoff resulting from a 1.4 inch, 24-hour duration design storm
- For off-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.13 in/hr
- For on-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.22 in/hr

For the development of design tools (Task 400B1) and development of the BMP manual (Task 400B3), we recommend further analysis of the proposed design storms. Specifically, we recommend designing some example facilities to meet these requirements and running the long-term rainfall record through the facilities to ensure 80% capture of runoff.

Figure 1

Occurrence of Storm Events Based on an Analysis of the 50-year NWS Rainfall Record from the Eugene Airport (inter-event time = 6 hrs, minimum storm volume = 0.01 in)



I:\945042na\task300\precip\wqdesign\volume.xls 7/5/02

Figure 2

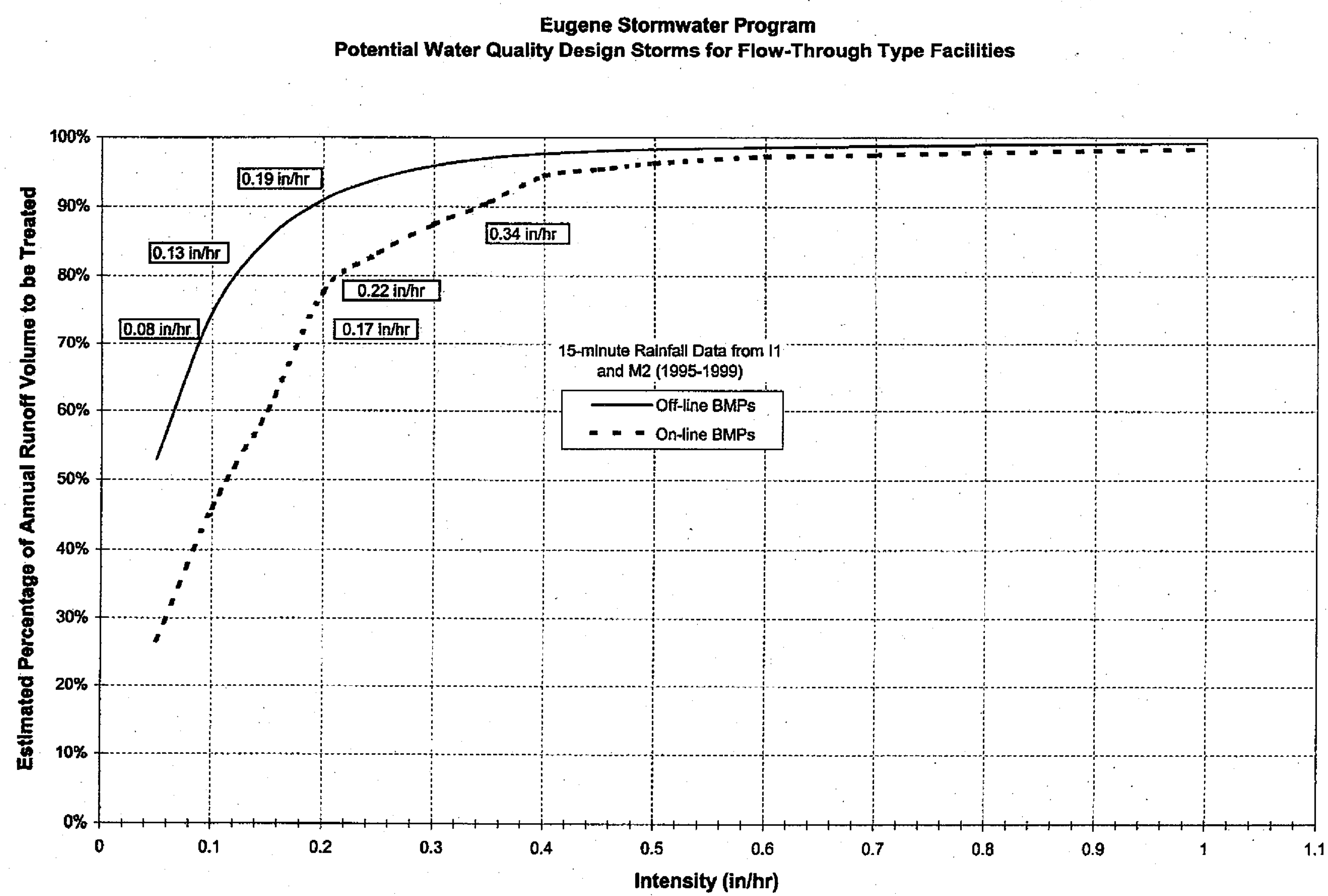


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FIGURE 1

APPENDIX F

FLOOD CONTROL DESIGN STORMS

Storm Recurrence Intervals
(Tables 3-1, 3-2, and 3-3, Section 3, 2002 Basin Plans)

OTAK Rainfall Intensity Curves

Table 3-1
Storm Recurrence Intervals for Planning and Design of Drainage Improvements

			Type of Drainage Improvement				
					Culverts and Bridges - Type of Roadway		Design Storm Recurrence Interval in Years
Drainage Area (acres)			Open Channel	Closed Pipe	Major Collectors and Neighborhood Collectors	Major Arterials and Minor Arterials	
<40	40 TO 640	>640	(a)	(b)	(c)	(d)	(e)
X				X			5/10 (h)
X			X		X	X	10 (f)
	X			X			10 (f)
	X		X		X		10 (f)
	X					X	25
		X	X	X(g)	X		25
		X				X	50
All improvements on waterways with FEMA 100-year floodplains							100

(a) Includes roadside ditches and drainage swales
(b) Storm sewer systems or a closed conduit whose length exceeds that of a normal culverted crossing of a single roadway
(c) Includes local or residential streets, local collectors, and any other roadways up to a major arterial
(d) Major arterial or better within the City's right-of-way maintenance
(e) Assuming ultimately planned development conditions (i.e., impervious cover) within the City's Urban Growth Boundary (UGB) and existing development conditions outside of the City's UGB
(f) The 5-year recurrence interval can be used in unusual situations involving sufficient topographical conditions that result in an exceptionally high cost differential between the 10-year and 5-year improvement design (e.g., 40%)
(g) Closed pipe systems should not be used on waterways draining more than 640 acres (i.e., 1 square mile)
(h) The 5-year storm may be used when the Rational Method is applied to calculate the design flow rate. The 10-year storm should be used for closed pipes with <40 acre drainage areas when using the City's SWMM modeling results or when extending the City's SWMM model using consistent methods and assumptions as used for the City's SWMM modeling work.

Table 3-2
Selected Design Events for Each Basin

Design Event	Amazon Creek	Willow Creek	Bethel Danebo	Laurel Hill	Willakenzie	Willamette River
10-Year	11/25/77	11/23/60	11/23/60	11/25/77	11/25/77	8/16/68 2/5/96
25-Year Summer	8/16/68	**	8/16/68	8/16/72	8/21/79	*
25-Year Winter	2/5/96	2/5/96	10/31/94	10/31/94	10/31/94	*
50-Year	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	*
100-Year	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	*

*For the Willamette basin, only the 10-year storm was needed for the evaluation because only selected portions of the basin were modeled.
**For the Willow Creek basin, an August storm was not evaluated as the short, high-intensity events were not as critical in this basin as the long duration, high-volume events.

Table 3-3
Design Events Characteristics

Design Event	Rainfall Volume (inches)	Maximum Intensity (in/hour)	Approximate Duration (hours)
11/23/60	7.36	0.67	114
8/16/68	1.36	1.14	10
8/16/72	1.38	0.92	5
11/25/77	2.09	0.66	7
8/21/79	1.82	1.11	3
10/31/94	4.05	0.70	32
2/5/96	7.24	0.66	51
50-Year SCS Type 1A	5.76	0.95	24
100-Year SCS Type 1A	6.48	1.06	24

The above information is based on NWS rain gage data.

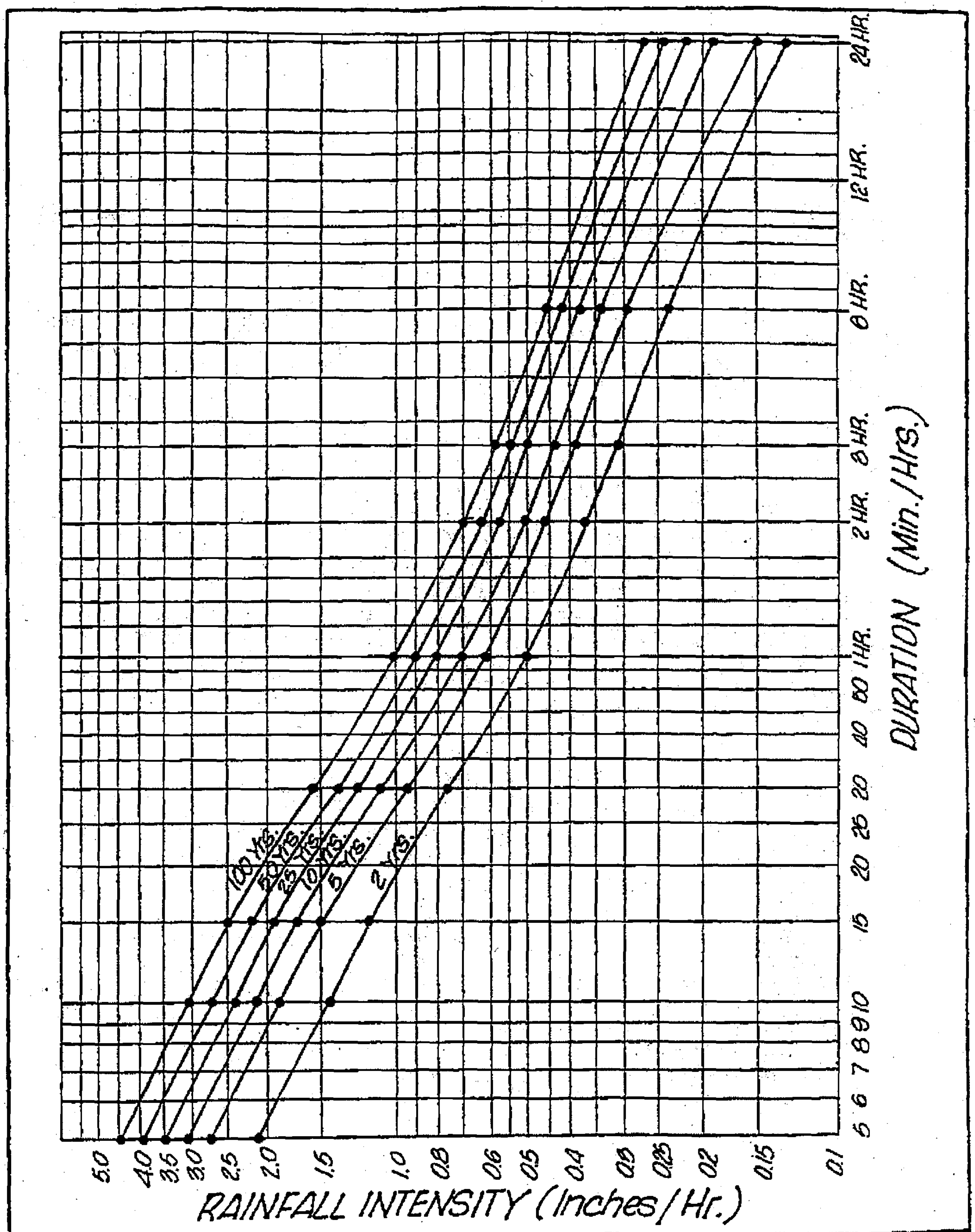


FIGURE 4.1
Rainfall Intensity, Duration and Frequency Curves for Eugene, Oregon

otak incorporated
INC. ARCHITECTS, P.C.

Appendix G
FACILITY PLANTING & SOIL RECOMMENDATIONS

G.1 RECOMMENDED PLANT LISTS

Eco-Roof Recommended Plants:

Note: For Roof Garden plants, the City of Eugene recommends using drought tolerant, self-sustaining native trees, shrubs and ecoroof plants.

Sedums and Succulents

Delosperma cooperi,	Ice plant
Delosperma nubegenum,	Ice plant
Sedum acre	Stonecrop
**Sedum album*	White Stonecrop
**Sedum telephium* varieties including 'Autumn Joy' and 'Variegatum'	Stonecrop
Sedum divergens	Stonecrop
Sedum hispanicum	Stonecrop
Sedum kamtschaticum	Stonecrop
**Sedum oreganum*	Oregon Stonecrop
Sedum sexangular	Stonecrop
**Sedum spathilifolium*	Stonecrop
**Sedum spurium* varieties	Stonecrop
**Sempervivum tectorum,*	Hens and Chicks

Herbaceous

Achillea millefolium,	Common Yarrow
Achillea ageratifolia,	Greek Yarrow
Achillea tomentosum,	Wooly Yarrow
Allium acuminatum	Hooker's Onion
Allium amplectens	Slim Leaf Onion
Arenaria montana,	Sandwort
Artemesia 'Silver mound',	Artemesia
Aurinia saxatilis,	Alyssum saxatile
Brodiaea congesta	Harvest Brodiaea
**Cerastium,*	Snow-in-Summer
Clarkia amoena	Summer's Darling
Clarkia purpurea	Four Spot Godetia
Dianthus alwoodii,	Pink
Dianthus deltoides,	Maiden Pink
Dichelostemma congestum	Ookow

Erigeron discoideus,	Fleabane
Festuca glauca,	Blue Fescue
Fragaria vesca,	Woodland Strawberry
Gazania linearis var. 'CO gold',	Gazania
**Gilia capitata,*	Globe gilia
Koeleria macrantha	Junegrass*
Lobularia maritima,	Sweet alyssum
Nierembergia repens,	Cup Flower
**Polypodium glycrrhiza,*	Licorice Fern
**Polystichum munitum,*	Sword Fern
Potentilla nepalensis,	Nepal Cinquefoil
Potentilla nuemaniana,	Cinquefoil
Thymus serphyllum,	Mother of Thyme
Thymus vulgaris,	Common Thyme
Veronica liwanensis,	Speedwell

* Indicates that Portland's Bureau of Environmental Services has observed these plants generally survive in ecoroof areas that do not receive summer irrigation. Most of these locations have moderate to deep shade. To date these plants appear very stressed by the end of summer, but they have comeback each year. It is likely that many of the other plants listed above could survive in such conditions without irrigation.

Contained Planter Box, Infiltration Planter Box, and Flow-Through Planter Box Recommended Plants:

Note: Generally, plants requiring **moist-wet** conditions are preferred for flow-through facilities; plants requiring **moist to dry** conditions are preferred for infiltration facilities.

Shrubs

Ceanothus velutinus,	Snowbrush- moist-dry
Cornus sericea,	Redtwig Dogwood- moist-wet
Gaultheria shallon,	Salal- moist-dry
Mahonia (or Berberis) aquifolium,	Tall Oregon Grape-moist-dry
Mahonia nervosa,	Dull Oregon Grape– moist-dry
Physocarpus capitatus,	Pacific Ninebark- moist-wet
Ribes sanguineum,	Red-flowering Current- moist-dry
Rosa gymnocarpa,	Baldhip Rose– moist-dry
Rosa nutkana,	Nootka Rose– moist-dry
Rosa pisocarpa,	Swamp Rose– moist-dry
Rubus parviflorus,	Thimbleberry– moist-dry
Symphoricarpos alba,	Common Snowberry- moist-dry
Viburnum edule,	Highbush Cranberry; Squashberry- moist

Large Shrubs/ Small Trees

Acer circinatum,	Vine Maple– moist-wet
Amelanchier alnifolia,	Western Saskatoon Serviceberry-dry
Crataegus douglasii (or *C. suksdorfii*),	Douglas' Black Hawthorn– moist-wet
Malus fusca,	Pacific Crab Apple– moist-wet
Oemleria cerasiformis,	Indian Plum– moist-dry
Philadelphus lewisii,	Mock Orange– moist-dry
Prunus emarginata (or *P. virginiana*),	Bitter Cherry- moist
Rhamnus purshiana,	Cascara– dry-wet
Salix hookeriana,	Piper's Willow– moist-wet
Salix scouleriana,	Scoulers Willow- moist-wet
Salix sessilifolia,	Soft leafed Willow– moist-wet
Salix sitchensis,	Sitka Willow– moist-wet
Spiraea douglasii,	Douglas Spiraea– moist-wet

Grass and Grass-Like Plants

Agrostis exarata	Spike Bentgrass - wet -dry
Allium amplectens	Slim Leaf Onion- moist-dry
Allium acuminatum	Hooker's Onion- moist-dry
Beckmannia syzigachne,	American Slough Grass– moist-wet
Brodiaea congesta	Harvest Brodiaea- moist-dry
Bromus carinatus,	California Brome Grass- moist-dry

Bromus sitchensis,	Alaska Brome– moist-dry
Bromus vulgaris,	Columbia Brome Grass– moist-dry
Camassia quamash,	Common Camas- moist-dry
Carex densa	Dense Sedge– moist-wet
Carex deweyanna,	Dewey Sedge– moist-wet
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge– moist-wet
Carex tumulicola	Foothill Sedge- moist-dry
Dichelostemma congestum	Ookow- moist-dry
Deschampsia cespitosa,	Tufted Hairgrass- moist-dry
Deschampsia elongata	Slender Hairgrass- moist-dry
Eleocharis acicularis,	Needle Spike-Rush- moist-wet
Eleocharis ovata,	Ovate Spike-Rush- moist-wet
Eleocharis palustris,	Creeping Spike-Rush- moist-wet
Elymus glaucus,	Blue Wildrye– moist-dry
Elymus trachycaulus	Slender Wheatgrass- - moist-dry
Festuca occidentalis,	Western Fescue Grass– moist-dry
Festuca rubra var. commutata,	Western Red Fescue– moist-dry
Festuca roemeri var. *roemeri*	Roemer's Fescue - dry
Glycera occidentalis,	Western Mannagrass– moist-wet
Iris tenax,	Oregon Iris– moist-dry
Juncus acuminatus	Tapertip Rush– moist-wet
Juncus effusus var. pacificus	Common Rush– moist-wet
Juncus effufus var. gracilis	Common Rush– moist-wet
Juncus ensifolius,	Dagger-leaf Rush- moist-wet
Juncus patens,	Grooved Rush, Spreading Rush, - moist-wet
Juncus tenuis,	Slender Rush– moist-wet
Juncus unilateralis	One-sided Rush- moist-wet
Koeleria macrantha	Junegrass- moist-dry
Scirpus acutus,	Hardstem Bulrush- moist-wet
Scirpus microcarpus,	Small Fruited Bulrush- moist-wet
Sedum oreganum,	Oregon Sedum- dry
Sisyrinchium idahoense (or *S.angustifolium; S. bellum*),	Blue-eyed Grass– moist
Sisyrinchium douglasii,	Purple-Eyed Grass-moist

Ferns: Moist Shade

Athyrium felix-femina,	Lady Fern
Blechnum spicant,	Deer Fern
Polypodium glycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern
Pteridium aquilinum,	Bracken Fern

Vegetated Swale and Vegetated Filter Strip Recommended Plants:

Planting zones
Swale bottom to 1.5 ft. up the side slope = wet to moist
Side slopes from 1.5 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Grasses and Groundcovers - Wet to Moist

Agrostis exarata	Spike Bentgrass
Carex obnupta,	Slough Sedge
Eleocharis ovata,	Ovate Spike-Rush- moist-wet
Eleocharis acicularis,	Needle Spike-Rush- moist-wet
Eleocharis palustris,	Creeping Spike-Rush- moist-wet
Downingia elegans	Calico Flower
Glyceria occidentalis,	Manna Grass
Hordeum brachyantherum,	Meadow Barley
Juncus acuminatus	Tapertip Rush- moist-wet
Juncus effusus var. pacificus	Common Rush
Juncus effufus var. gracilis	Common Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus oxymeris,	Pointed Rush
Juncus tenuis,	Slender Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus unilateralis	One-sided Rush- moist-wet
Plagiobothrys figuratus	Popcorn Flower
Scirpus microcarpus,	Small flowered (or fruited) Bulrush

Ferns: Moist shade

Blechnum spicant,	Deer Fern
Polypodium gycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern

Moist to dry

Arctostaphyllos uva-ursi,	Kinnick-innick Aster
Aster suspicatus,	Douglas' Aster
Aster hallii	Hall's Aster
Bromus carinatus,	California Brome Grass
Bromus sitchensis,	Alaska Brome
Bromus vulgaris,	Columbia Brome Grass
Clarkia amoena	Summer's Darling
Clarkia purpurea	Four Spot Godetia
Collomia grandiflora	Large Leaf Collomia
Danthonia californica	California Oatgrass

Epilobium densiflora	Dense Spike Primrose
Eriophyllum lanatum	Oregon Sunshine
Festuca roemeri var. *roemeri*	Roemer's Fescue
Grindelia integrifolia	Gumweed
Iris tenax	Oregon Iris
Koeleria macrantha	Junegrass
Lupinus micranthus,	Small Flowered Lupine
Lupinus polyphyllus	Large Leaf Lupine
Lupinus rivularis	Riverbank Lupine
Madia elegans	Showy Tarweed
Potentilla gracilis var. gracilis	Graceful Cinquefoil
Prunella vulgaris var. *vulgaris*	Heal All
Ranunculus occidentalis	Western buttercup
Sisyrinchium idahoense,	Blue-eyed Grass
Camassia quamash,	Common Camas
Festuca occidentalis,	Western Fescue Grass
Deschampsia caespitosa,	Tufted Hairgrass
Elymus glaucus,	Blue Wildrye
Fragaria vesca or *F. virginiana,*	Woodland strawberry or Wild strawberry
Sisyrinchium idahoense,	Blue-eyed Grass

Shrubs- varying zones

Cornus sericea,	Redtwig Dogwood- moist-wet
Gaultheria shallon,	Salal- dry
Mahonia aquifolium,	Tall Oregon Grape- moist -dry
Mahonia nervosa,	Dull Oregon Grape- moist-dry
Physocarpus capitatus,	Pacific Ninebark- moist-wet
Ribes sanguineum,	Red-flowering Current-dry
Rosa gymnocarpa,	Baldhip Rose- moist -dry
Rosa nutkana,	Nootka Rose- moist-dry
Rosa pisocarpa,	Swamp Rose- moist-dry
Spiraea douglasii	Douglas Spiraea – moist-dry
Symphoricarpos alba,	Common Snowberry- moist-dry
Viburnum edule,	Highbush Cranberry; Squashberry- moist -dry

Large Shrub/Small Tree- varying zones

Acer circinatum,	Vine Maple- moist-wet
Amelanchier alnifolia,	Western Saskatoon Serviceberry- dry
Ceanothus cuneatus	Buckbrush- dry
Ceanothus integerrimus	Deerbrush- dry
Ceanothus sanguineus,	Oregon Redstem Ceanothus- dry
Corylus cornuta,	Western Beaked Hazelnut- moist-dry
Crataegus douglasii,	Douglas' Black Hawthorn- moist

Holodiscus discolor,	Oceanspray- moist-dry
Malus fusca,	Pacific Crab Apple- moist-wet
Oemleria cerasiformis,	Indian Plum; Osoberry- moist-wet
Philadelphis lewesii,	Mock Orange- moist-dry
Prunus emarginata or *P. Virginiana*	Bitter or Choke Cherry- moist
Rhamnus purshiana,	Cascara- dry-wet
Rosa nutkana,	Nootka Rose- moist-dry
Rubus parviflorus,	Thimbleberry- moist-dry
Salix fluviatalis,	Columbia Willow- moist-wet
Salix hookeriana,	Piper's Willow- moist-wet
Salix lucida (or S. *lasiandra*),	Pacific Willow- moist-wet
Salix scouleriana,	Scoulers Willow-moist-wet
Salix sessilifolia,	Soft leafed Willow- moist-wet
Salix sitchensis,	Sitka Willow- moist-wet
Sambucus cerulea,	Blue Elderberry- moist- dry
Sambucus racemosa,	Red Elderberry- moist- dry

Conifer and Evergreen Trees- varying zones

Abies grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense cedar – moist-dry
Pinus monticola,	Western White Pine- moist-dry
Pinus ponderaosa,	Ponderosa Pine- dry
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Thuja plicata,	Western Red Cedar- moist-wet

Deciduous Trees- varying zones

Acer macrophyllum,	Big leaf Maple- moist-dry
Alnus rhombifolia	White Alder – moist-wet
Alnus rubra,	Red Alder - moist-wet
Amelanchier alnifolia,	Serviceberry - dry
Cornus nuttallii,	Western Flowering Dogwood– moist-dry
Fraxinus latifolia,	Oregon Ash - moist-wet
Populus balsamifera,	Black Cottonwood – moist-wet
Quercus garryana,	Oregon White Oak – dry
Quercus kelloggii	California Black Oak - dry

Grassy Swale Recommended Seed Mixes:

See **Exhibit G-1** for grass seed recommendations and specifications.

Vegetated Infiltration Basin and Dry Detention Pond Recommended Plants:

Planting zones
Basin bottom to 1.5 ft. up the side slope = moist
Side slopes from 1.5 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Note: These plants are recommended based on experience and/or literature review. For soils with slow infiltration rates (< 2 inches per hour) moist to wet plants are preferable; for soils with higher infiltration rates moist to dry plants are preferable.

Grasses and groundcovers: See **Exhibit G-1** for grass seed recommendations and specifications.

Moist	
Agrostis exarata	Spike Bentgrass
Beckmannia syzigachne,	American Slough Grass
Carex densa	Dense Sedge- moist-wet
Carex deweyanna,	Dewey Sedge- moist-wet
Carex hendersonii,	Henderson Sedge
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge- moist-wet
Carex tumulicola	Foothill Sedge- moist-dry
Eleocharis acicularis,	Needle Spike-rush
Eleocharis ovata,	Ovate Spike-rush
Eleocharis palustris,	Creeping Spike-rush
Juncus effusus,	Common/Soft Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus tenuis,	Slender Rush
Scirpus acutus,	Hardstem Bulrush
Scirpus americanus,	Three-square or American Bulrush
Scirpus microcarpus,	Small Fruited Bulrush

Moist to Dry	
Aster hallii	Hall's Aster
Aster suspicatus,	Douglas' Aster
Bromus carinatus,	California Brome Grass

Bromus sitchensis,	Alaska Brome
Bromus vulgaris,	Columbia Brome Grass
Camassia quamash,	Common Camas
Festuca occidentalis,	Western Fescue Grass
Deschampsia caespitosa,	Tufted Hairgrass
Elymus glaucus,	Blue Wildrye
Fragaria vesca or F. virginiana,	Woodland strawberry or Wild strawberry
Hordeum brachyantherum,	Meadow Barley
Iris tenax,	Oregon Iris
Lupinus micranthus,	Small Flowered Lupine
Lupinus rivularis	Riverbank Lupine
Sisyrinchium idahoense,	Blue-eyed Grass

Ferns: Moist shade

Blechnum spicant,	Deer Fern
Polypodium gycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern
Athyrium felix-femina,	Lady Fern

Shrubs: moist

Cornus sericea,	Red-stemmed or Red-osier Dogwood
Salix hookeriana,	Hookers Willow
Salix lucida var. 'lasiandra',	Pacific Willow
Salix sitchensis,	Sitka Willow
Salix scouleriana,	Scouler's Willow
Salix fluviatalis,	Columbia Willow
Sambucus racemosa,	Red Elderberry
Physocarpis capitatus,	Pacific Ninebark
Spiraea douglasii,	Douglas Spirea
Crataegus douglasii,	Black Hawthorn
Rhamnus purshiana,	Cascara
Rubus spectabilis,	Salmonberry
Rosa pisocarpa,	Swamp Rose

Shrubs: (moist-dry)

Acer circinatum,	Vine maple
Ceanothus cuneatus	Buckbrush- dry
Ceanothus integerrimus	Deerbrush- dry
Ceanothus sanguineous,	Oregon Redstem Ceanothus
Ceanothus velutinus,	Snowbrush
Corylus cornuta,	Western Beaked Hazelnut
Gautheria shallon,	Salal
Holodiscus discolor,	Oceanspray

Mahonia aquifolium,	Tall Oregon Grape
Mahonia nervosa,	Dull Oregon Grape
Philadelphus lewisii,	Mock Orange
Ribes sanguineum,	Red Flowering Currant
Rosa gymnocarpa,	Baldhip Rose
Rosa nutkana,	Nootka Rose
Rubus parviflorus,	Thimbleberry
Spiraea douglasii,	Douglas' Spiraea
Symphoricarpus albus,	Snowberry
Viburnum edule,	Highbush Cranberry

Trees

Conifer and Evergreen Trees- varying zones

Abies Grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense Cedar
Castanopsis chrysopylla,	Chinquapin- dry
Pinus monticola,	Western White Pine- moist-dry
Pinus Ponderaosa,	Ponderosa Pine- dry
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Thuja plicata,	Western Red Cedar- moist-wet (prefers shade)

Deciduous Trees- varying zones

Acer macrophyllum,	Big leaf Maple – moist-dry
Alnus rhombifolia	White Alder- moist-wet
Alnus rubra,	Red Alder - moist-wet
Amelanchier alnifolia,	Serviceberry - dry
Cornus nuttalii,	Western Flowering Dogwood – moist-dry
Fraxinus latifolia,	Oregon Ash - moist-wet
Malus fusca,	Pacific crabapple - moist-wet
Oemleria cerasiformis,	Indian Plum - moist-dry
Populus balsamifera,	Black Cottonwood – moist-wet
Quercus garryana,	Oregon White Oak – moist-dry
Quercus kelloggii	California Black Oak - dry

Wet and Extended Wet Pond Recommended Plants:

Planting zones
Shallow water to 1 ft. up the side slope = wet to saturated
Side slopes from 1 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Wetland herbaceous plants (aquatic and emergent)
Emergent wet to saturated zone

Alisma plantago-aquatica,	Water Plantain
Carex obnupta,	Slough Sedge
Eleocharis ovata,	Ovate Spike rush
Eleocharis palustris,	Creeping Spike rush
**Lemna minor,*	Common Lesser Duckweed*
Myosotis laxa,	Small-flowered Forget-me-not
**Potamogeton natans,*	Floating-leafed Pondweed
**Sagittaria latifolia,*	Broadleaf Arrowhead; Wapato
Scirpus acutus,	Hardstem Bulrush
Sparganium emersum,	Narrowleaf Bureed
Veronica americana	American Speedwell

Moist to wet zone

Alopecurus geniculatus,	Water foxtail
Beckmannia syzigachne,	American Slough Grass
Carex densa	Dense Sedge- moist-wet
Carex deweyanna,	Dewey Sedge- moist-wet
Carex hendersonii,	Henderson Sedge
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge- moist-wet
Juncus acuminatus	Tapertip Rush- moist-wet
Juncus effusus var. pacificus	Common Rush
Juncus effufus var. gracilis	Common Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus oxymeris,	Pointed Rush
Juncus tenuis,	Slender Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus unilateralis	One-sided Rush- moist-wet
Lupinus polyphyllus,	Large-leaved Lupine
Scirpus microcarpus,	Small flowered (or fruited) Bulrush

Grasses and Groundcovers: varying zones, see **Exhibit G-1** for grass seed recommendations and specifications.

Arctostaphyllos uva-ursi,	Kinnick-Kinnick - dry
Aster suspicatus,	Douglas' Aster - moist-dry
Aster hallii	Hall's Aster- moist-dry
Bidens cernua,	Nodding Beggarticks- moist -wet
Bromus carinatus,	California Brome Grass - moist-dry
Bromus sitchensis,	Alaska Brome - moist-dry
Bromus vulgaris,	Columbia Brome Grass- moist-dry
Clarkia amoena	Summer's Darling- moist-dry
Clarkia purpurea	Four Spot Godetia- moist-dry
Collomia grandiflora	Large Leaf Collomia - moist-dry
Danthonia californica	California Oatgrass- moist-dry
Epilobium densiflora	Dense Spike Primrose- moist-dry
Eriophyllum lanatum	Oregon Sunshine- moist-dry
Festuca roemeri var. *roemeri*	Roemer's Fescue - dry
Glyceria occidentalis,	Western Mannagrass- moist-wet
Grindelia integrifolia	Gumweed- moist-dry
Iris tenax	Oregon Iris- moist-dry
Koeleria macrantha	Junegrass- moist-dry
Lupinus micranthus,	Small Flowered Lupine - moist-dry
Lupinus polyphyllus	Large Leaf Lupine- moist-dry
Lupinus rivularis	Riverbank Lupine- moist-dry
Madia elegans	Showy Tarweed- moist-dry
Potentilla gracilis var. gracilis	Graceful Cinquefoil- moist-dry
Prunella vulgaris var. *vulgaris*	Heal All- moist-dry
Ranunculus occidentalis	Western buttercup- moist-dry
Sisyrinchium idahoense,	Blue-eyed Grass - moist-dry

Shrub: moist to saturated zones

Acer circinatum,	Vine Maple
Blechnum spicant,	Deer Fern
Cornus sericea,	Red-stemmed dogwood
Crateagus douglasii,	Black Hawthorn
Rhamnus purshiana,	Cascara
Rubus spectabilis,	Salmonberry
Rosa gymnocarpa,	Baldhip Rose
Rosa pisocarpa,	Swamp Rose
Oemlaria cerasiformis,	Indian Plum
Physocarpis capitatus,	Pacific Ninebark
Polystichum munitum,	Sword fern
Prunus emarginata,	Bitter Cherry

Salix fluviatalis,	Columbia Willow
Salix hookeriana,	Hookers Willow
Salix sitchensis,	Sitka Willow

Shrub: moist to dry zones

Mahonia aquifolium,	Tall Oregon Grape
Mahonia nervosa,	Dull Oregon Grape
Rosa nutkana,	Nootka Rose
Rubus parviflorus,	Thimbleberry
Spiraea betulifolia,	Shiny-leaf Spiraea
Symphoricarpus alba,	Snowberry
Sambucus racemosa,	Red Elderberry
Spiraea douglasii,	Douglas Spiraea
Viburnum edule,	Highbush Cranberry; Squashberry

Shrub dry zones

Ceanothus cuneatus	Buckbrush
Ceanothus integerrimus	Deerbrush
Corylus cornuta,	Western Beaked Hazelnut
Holodiscus discolor,	Oceanspray
Lonicera involucrata,	Black twinberry
Mahonia aquifolium,	Tall Oregon Grape
Philadelphis lewesii,	Mock Orange
Ribes sanguineum,	Red Flowering Currant
Salix scouleriana,	Scouler's Willow

Conifer and Evergreen Trees - varying zones

Abies grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense Cedar
Castinopsis chrysophylla,	Chinquapin- dry
Pinus ponderosa,	Ponderosa Pine- dry
Pinus monticola,	Western White Pine- dry-moist
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Sequoia sempervirons,	Coast Redwood- moist
Thuja plicata,	Western Red Cedar- moist-wet

Deciduous Trees - varying zones

Acer macrophyllum,	Big leaf Maple- moist- dry
Alnus rhombifolia	White Alder- moist-wet
Alnus rubra,	Red Alder- moist-wet
Amelanchier alnifolia,	Serviceberry- dry
Cornus nuttalii,	Western Flowering Dogwood- moist-dry

Fraxinus latifolia,	Oregon Ash- moist-wet
Malus fusca,	Pacific crabapple- moist-wet
Oemleria cerasiformis,	Indian Plum- moist-dry
Populus balsamifera,	Black Cottonwood- moist-wet
Salix lucida var.' lasiandra',	Pacific Willow- moist-wet
Quercus garryana,	Oregon White Oak- moist-dry
Quercus kelloggii	California Black Oak - dry

Exhibit G-1

SEED SPECIFICATIONS FOR STORMWATER MANAGEMENT MANUAL

Species listed below should only be used in the listed moisture regime for optimal success. *Sow rates for **small seeded mixes** shall contain a **minimum of 20 lbs/per acre in combination** for stormwater management facilities and **30 lbs/acre for erosion control** purposes. **Sow rates for large/medium seeded** mixes should contain a **minimum of 25 lbs per acre** in combination for stormwater management facilities and 40 pounds per acre **for erosion control** purposes.*

Common name	Scientific Name	Optimal Sow Season	Native or to add diversity?	Swale or Pond Sow Rate (Hand)	Erosion Control Sow Rate	Moisture	Exposure	Seed size	Commercial accessibility of local eco-type
Grasses									
American sloughgrass	Beckmannia syzigachne	fall/spring	D	2 lbs/ac	NR	inundated to wet	sun	medium	easy to medium, Willamette Valley
Blue wildrye	Elymus glaucus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun to shade	large	easy, Portland Metro
California brome	Bromus carinatus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun	large	easy, Portland Metro
California oatgrass	Danthonia californica	fall/spring	M	**30 lbs/ac**	NR		sun	large	easy to medium, Willamette Valley
Columbia brome	Bromus vulgaris	fall/spring	D	5 lbs/ac	NR	xeric to mesic	shade	large	medium, Portland Metro
Junegrass	Koeleria macrantha	fall/spring	M	**20 lbs/ac**	NR	xeric to mesic	sun	small	easy to medium, PDX or Willamette Valley
Meadow barley	Hordeum brachyantherum	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	wet to mesic	sun	large	easy to medium, Willamette Valley
Pine bluegrass	Poa secunda								
Rice cutgrass	Leersia oryzoides	fall/spring	D	5 lbs/ac	NR	inundated to wet	sun	medium	medium to difficult, Portland Metro
Roemer's fescue	Festuca roemeri	fall/spring	D	2 lbs/ac	NR	xeric to mesic	sun	small	difficult, Willamette Valley
Sitka brome	Bromus sitchensis	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	wet to mesic	sun/shade	large	easy, Willamette Valley
Slender hairgrass	Deschampsia elongata	early fall/spring	M	**20 lbs/ac**	30 lbs/acre	wet to xeric	sun	small	easy, Portland Metro
Slender wheatgrass	Elymus trachycaulus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun	large	medium to difficult, Willamette Valley
Spike bentgrass	Agrostis exarata	early fall/spring	D	5 lbs/ac	30 lbs/acre	saturated to wet	sun	small	easy to medium, Portland Metro
Tall mannagrass	Glyceria elata	fall/spring	D	2 lbs/ac	NR	saturated to mesic	shade	small	medium to difficult, Portland Metro
Tufted hairgrass	Deschampsia cespitosa	fall/spring	D	2 lbs/ac	NR	saturated to wet	sun	small	easy, Willamette Valley
Water foxtail	Alopecurus geniculatus	fall/spring	M	**25 lbs/ac**	NR	inundated to wet	sun	medium	easy, PDX or Willamette Valley
Western fescue	Festuca occidentalis	fall/spring	M	**20 lbs/ac**	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Western mannagrass	Glyceria occidentalis	fall/spring	M	**25 lbs/ac**	NR	saturated to wet	sun	medium	easy to medium, Willamette Valley
Sedges, Rushes - soil moisture as indicated into summer months									
Carex obnupta	Slough sedge	fall/spring	D	2 lbs/ac	NR	inundated to mesic	sun/shade	medium	medium to difficult, PDX
Carex scoparia	Pointed broom sedge	fall/spring	D	2 lbs/ac	NR	wet to mesic	sun	medium	medium to difficult, PDX
Carex stipata	Sawbeak sedge	fall/spring	D	2 lbs/ac	NR	inundated to mesic	sun	medium	medium, Willamette Valley
Eleocharis ovata	Ovate spikerush	fall/spring	D	1 lb/ac	NR	inundated to wet	sun	small	easy, PDX or Willamette Valley
Eleocharis palustris	Creeping spikerush	fall/spring	D	2 lbs/ac	NR	inundated to wet	sun	small	easy to medium, Willamette Valley
Juncus acuminatus	Tapertip rush	fall/spring	D	0.25 lbs/ac	NR	inundated to wet	sun	small	medium, Willamette Valley, PDX
Juncus bufonius	Toad rush	fall/spring	D	0.25 lbs/ac	NR	wet to mesic	sun	small	medium, Willamette Valley
Juncus patens	Spreading rush	fall/spring	D	0.50 lb/ac	NR	wet to mesic	sun/shade	small	easy, PDX
Forbs									
Achillea millefolium	Western Yarrow	fall	D	0.25 lbs/ac	NR	wet to mesic	sun	medium	easy, PDX or Willamette Valley
Aquilegia formosa	Western Columbine	fall	D	1.0 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Alisma media	Water plantain	fall/spring	D	1.0 lb/ac	NR	inundated to wet	sun	medium	easy to medium, Willamette Valley
Collomia grandiflora	Large flowered collomia	fall/spring	D	.50 lbs/ac	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Collinsia rattanii	Blue eyed mary	fall/spring	D	.25 lbs/ac	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Epilobium densiflora	Dense spike primrose	fall	D	1.0 lb/ac	NR	wet to mesic	sun	small	medium, Willamette Valley
Eriophyllum lanatum	Wooly sunshine	fall	D	1.0 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Gilia capitata	Blue gilia	fall/spring	D	2 lbs/acre	1 lb/ac (w/	xeric to mesic	sun	medium	medium, Willamette Valley
Lotus purshianus	Spanish clover	fall	D	2 lbs/acre	1 lb/ac (w/	xeric to mesic	sun	medium	medium, Willamette Valley
Lupinus albicaulis	Sickle keel lupine	fall	D	1 lb/ac	1 lb/ac (w/	xeric to mesic	sun	large	medium, Willamette Valley
Iris tenax	Oregon iris	fall	D	2 lbs/ac	NR	xeric to mesic	sun	large	easy to medium, Willamette Valley
Camassia quamash	Common camas	fall	D	1 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Camassia quamash va	Great camas	fall	D	1 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Lupinus micranthus	Small flowered lupine	fall	D	1 lb/ac	NR	xeric to mesic	sun	medium	medium to difficult, Willamette Valley
Ranunculus occidental	Western buttercup	fall	D	1 lb/ac	NR	xeric to mesic	sun	medium	medium to difficult, Willamette Valley
Sidalcea campestris	Checker mallow	fall	D	1 lb/ac	NR	xeric to mesic	sun	large	medium to difficult, Willamette Valley
Lupinus rivularis	Stream lupine	fall	D	1 lb/ac	1 lb/ac (w/	xeric to mesic	sun	large	medium, Willamette Valley
Plagiobothrys figuratus	Popcorn flower	fall/spring	D	1.0 lb/ac	NR	inundated to wet	sun	small	medium to difficult, Willamette Valley
Prunella vulgaris var. la	Self heal	fall/spring	D	2 lbs/ac	1 lb/ac (w/	wet to mesic	sun/shade	medium	easy to medium, PDX or Willamette Valley
Solidago canadensis	Goldenrod	fall	D	0.50 lbs/ac	NR	xeric to mesic	sun	small	easy to medium, PDX or Willamette Valley
Recommended Non-Native Cover Crop Species									
Festuca rubra var. com	Chewings fescue	year round	M	20 lbs/ac	30-40				n/a
Triticum spp.	Wheat	year round	M	50 lbs/ac	80				n/a
Avena spp.	Oats	year round	M	50 lbs/ac	80				n/a
Regreen	Sterile wheat hybrid	year round	M	40 lbs/ac	50				n/a
Agropyron spp.	Wheatgrass	year round	M	30 lbs/acre	40				A. trachycaulus (W.V. source)
Nuisance Grass Species not recommended for use on Erosion Control or Stormwater Projects									
Species	***Common name***		***State Listed Noxious Weed?***			***City:***			
Agropyron repens	Quackgrass		yes (B-list)	[redacted]		Nuisance List Portland Plant List			
Alopecuris pratensis	Meadow foxtail		no	[redacted]		Nuisance List Portland Plant List			
Anthoxanthum odoratu	Sweet vernal grass		no	[redacted]		Nuisance List Portland Plant List			
Arrhenatherum elatius	Tall oatgrass		no	[redacted]		Nuisance List Portland Plant List			
Brachypodium sylvatic	False brome		yes (B-list)	[redacted]		Nuisance List Portland Plant List			
Bromus diandrus	Ripgut		no	[redacted]		Nuisance List Portland Plant List			
Bromus hordaceus	Smooth brome		no	[redacted]		Nuisance List Portland Plant List			
Bromus inermis	Smooth brome		no	[redacted]		Nuisance List Portland Plant List			
Bromus japonicus	Japanese brome		no	[redacted]		Nuisance List Portland Plant List			
Bromus sterilis	Poverty grass		no	[redacted]		Nuisance List Portland Plant List			
Bromus tectorum	Cheatgrass		no	[redacted]		Nuisance List Portland Plant List			
Festuca arundinacea	Tall fescue		no	[redacted]		Nuisance List Portland Plant List			
Holcus lanatus	Velvet grass		no	[redacted]		Nuisance List Portland Plant List			
Lolium multiflorum	Annual ryegrass		no	[redacted]		Nuisance List Portland Plant List			
Phalaris arundinacea	Reed canary grass		no	[redacted]		Nuisance List Portland Plant List			
Phalaris aquatica	Harding grass		no	[redacted]		Nuisance List Portland Plant List			
Phleum pratensis	Timothy		no	[redacted]		Nuisance List Portland Plant List			
Phragmites australis	Common reed		no	[redacted]		Nuisance List Portland Plant List			
Vulpia myoros	Rat-tailed fescue		no	[redacted]		Nuisance List Portland Plant List			

G.2 DESIGN CONCEPTS AND PRINCIPLES

The City of Eugene requires developers to design stormwater facilities in project landscape areas, using surface retention facilities such as those shown in the simplified approach. The resulting integrated stormwater landscape can meet many, if not all, of landscape requirements. The benefits of integrated designs include construction cost savings, combined maintenance, aesthetic benefits, and the greater likelihood of maintaining long-term functionality. A well-designed and established landscape will also prevent post-construction soil erosion. These approaches can also help reduce urban heat island effects and contribute to other sustainable principles.

An integrated design may require changing the size of some site elements, such as the parking lot layout. Also see Parking lot Design Tips in Chapter 2 of this document.

In order to integrate stormwater management with the project landscape areas, it is essential that impervious surface grading be directed toward the stormwater facility areas. Surface stormwater facilities also must be depressed to allow sheet flow into the area. Since these design approaches are still new to many construction contractors it is advisable to clearly show these details in cross section and plan view drawings.

Pollution Prevention

Stormwater pollution prevention practices related to landscaping can be categorized into two broad categories:

- Toxic Substance Use Reduction
- Pollutant Source Reduction

Toxic Substance Use Reduction

Projects shall be designed to minimize the need for toxic or potentially polluting materials such as herbicides, pesticides, fertilizers, or petroleum based fuels within the facility area before, during, and after construction. Use of these materials creates the risk of spills, misuse, and future draining or leaching of pollutants into facilities or the surrounding area.

Pollutant Source Reduction

Materials that could leach pollutants or pose a hazard to people and wildlife shall not be used as components of a stormwater facility. Some examples of these materials are chemically treated railroad ties and lumber and galvanized metals. Many alternatives to these materials are available.

Soils

Soil analysis shall be conducted **within the stormwater facility area** to determine the viability of soils to assure healthy tree and vegetation growth and to provide adequate infiltration rates through the topsoil, or soil in these areas shall be amended. These tests can help the designer specify appropriate levels and types of soil amendments.

Projects should stockpile existing topsoil for re-use on the site to minimize the need to import topsoil. Appropriate erosion control measures, as required by the City, shall be used. Soil analysis tests shall be performed on stockpiled soil if it will be used within the facility area.

Topsoil is not required to be placed in the bottom of wet ponds or constructed wetland areas having a permanent pool depth of 6" or more. At the time of final inspection all surface area soils shall be covered with plants and/or mulch sufficient to prevent erosion.

Site Preparation and Grading

Unwanted vegetation in the facility area shall be removed during site preparation with equipment appropriate for the type of material encountered and site conditions. It is recommended that the maximum amount of pre-existing native vegetation be retained and protected.

No material storage or heavy equipment is allowed within the stormwater facility area after site clearing and grading has been completed, except to excavate and grade as needed to build the facility.

After the facility area is cleared and graded, all disturbed subsoil shall be tilled before capping with 18 inches of topsoil. If existing areas surrounding the stormwater facility are disturbed by construction, the top 18 inches of soil shall be tilled. No tilling shall occur within the drip line of existing trees. After tilling is completed, no other construction traffic shall be allowed in the area, except for planting and related work.

All construction and other debris shall be removed before topsoil is placed. Unless otherwise specified, the City will expect the landscape contractor to be responsible for final grading and for ensuring that surface and stormwater runoff flows are functioning as designed.

Mulch

Approved mulching materials and practices include organic materials such as compost, bark mulch, leaves, sawdust, straw, or wood shavings, as well as small river gravel, pumice, or other inert materials, applied in a 1-foot radius (measured from the center of the plant) around specific trees or shrubs. For ground cover plantings, the mulch shall be applied to cover all soil between plants. Care should be exercised to use the appropriate amount of mulch. Over-use can cause excessive nutrients to leach into the facility. Mulch shall be weed-free. Manure mulching and high-fertilizer hydroseeding are prohibited in a facility area during and after construction.

Irrigation

Permanent irrigation systems are not allowed for city-maintained facilities, unless approved by PW. Temporary irrigation systems or alternative methods of irrigation for landscape establishment shall be specified. Permanent irrigation systems are required for private facilities, but designers are encouraged to minimize the need for permanent irrigation. Innovative methods for watering vegetation are encouraged, such as the use of cisterns and air conditioning condensate.

Facility Screening

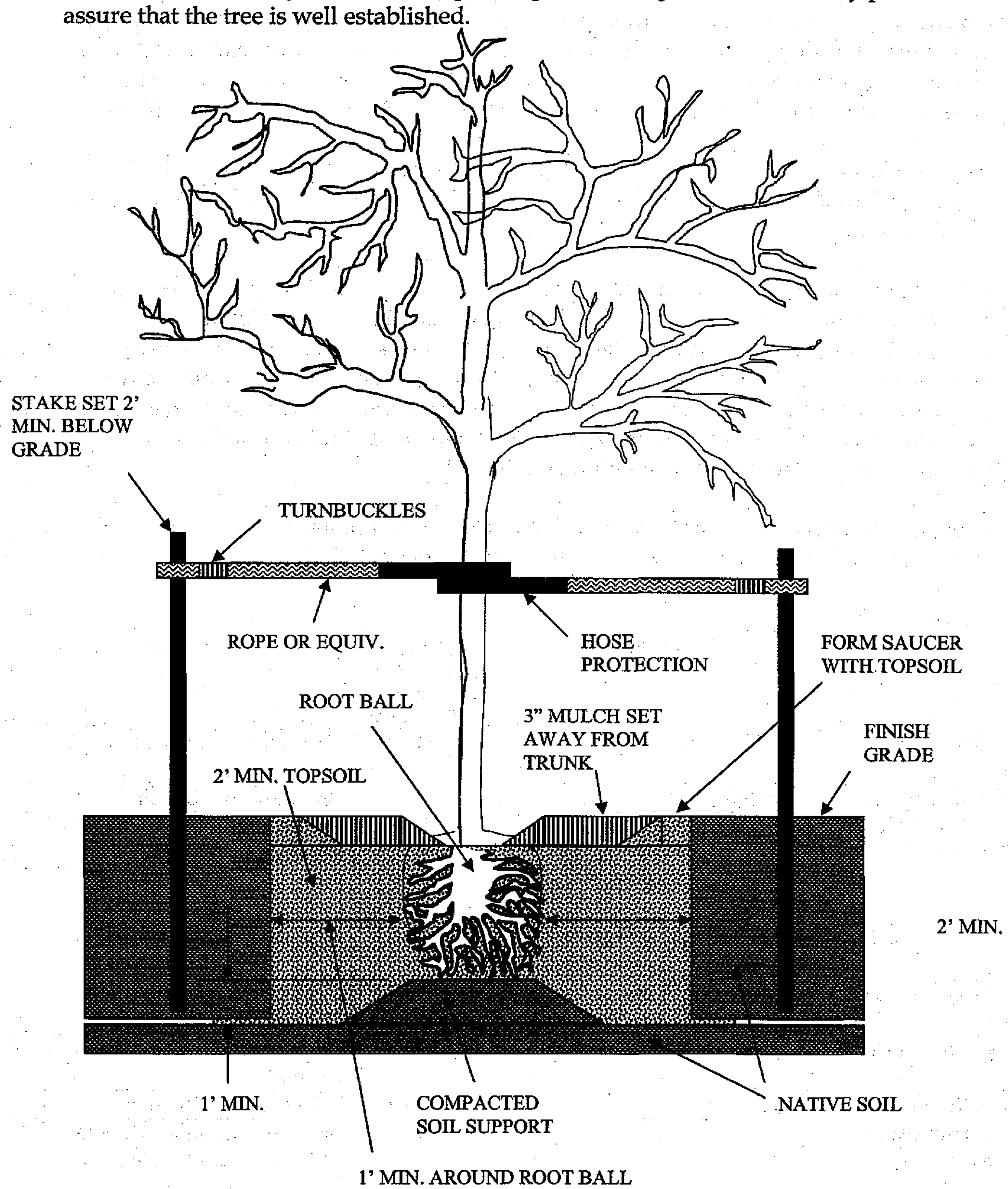
Facility elements such as chain link fences, concrete bulkheads, outfalls, rip-rap, gabions, large steel grates, steep side slopes, manhole covers/vault lids, berm embankments planted only with grasses, exposed pipe, blank retaining walls greater than 2 feet high, and access roads are generally not aesthetic. When these elements are part of City-maintained facilities or private facilities that face public right-of-way or other private property, PW requires them to be screened with plant materials. The quantities of landscape materials that are required by this chapter have been estimated to provide sufficient screening in most of the stormwater facilities. Attention will need to be paid to site conditions that may require adjustments in planting layout and/or the need for additional trees and shrubs. It is not the intent of this screening requirement to dictate a specific solution such as a linear hedge. Designers are encouraged to integrate the facility landscaping with the screening objective.

Commercial Sources for Native Plant Material:

Bareroot (Seedling) Trees/ Shrubs	
Aprovecho Research Center	541-942-8198
Balance Restoration Nursery	541-942-5530
Bloomers Nursery	541-687-5919
Buggy Crazy	541-258-5590
Doak Creek Native Plants	541-484-9206
Down to Earth	541-342-6820
Duckworth's Nursery	541-345-5408
Gray's Garden Center	541-345-1569
Hansen Nursery	541-756-1156
Log House Plants	541-942-2288
Lorane Hills Farm & Nursery	541-344-8943
Native Grounds Nursery	541-466-3561
Northwest Native Trees	541-736-0232
Pleasant Hill Nursery	541-746-7178
Sevenoaks Native Nursery	541-757-6520
Trillium Gardens	541-937-3073
Understory Plants	541-683-2612
Wild Garden Seed	541-929-4068
Wild Goose Nursery	541-607-6183
Willamette Gardens	541-754-0893
Native Seed	
Pacific Northwest Natives	541-928-8239
Mid-Valley Farms	541-936-6061
North American Revegetation	541-928-9095
Triangle Farms	503-873-5190

Note: The Nursery list is adapted from the Emerald Chapter of the Native Plant Society of Oregon's "Local Native Nurseries" handout. More information is available at http://www.emeraldnpso.org/nurseries.html. This list is not all-inclusive and is only up-to-date at the time of this manual's release. For a more inclusive list of nurseries that supply native plants, contact: www.tardigrade.org/natives/nurseries.html. The City of Eugene does not endorse any of these nurseries and provides this list for information purposes only.

Tree Planting Detail for Trees of 3" Caliper or Larger, usually used for street trees applications. This detail is not required for smaller trees. However, all trees must be secured sufficiently at the time of planting and throughout the warranty period to assure that the tree is well established.



Parking Lot Trees

COE has included the parking lot tree list to assist designers in selection of trees most appropriate for the potentially numerous micro-climates that might exist in parking lots and often associated proximity to building walls. It is likely that most parking lots will be hot in summer months until the trees become established. COE has attempted to point out native species in the list and provide their suitability to various conditions.

Trees are listed by the scientific name of the species first, then the common name. Where applicable, names of cultivars are presented in single quote marks with the common name.

The recommended minimum clearance from the pavement provides guidance on the amount of planting space each tree needs. It is expressed as the distance from the center of the planted tree trunk to the nearest paved surface. Comments provide guidance as to best applications of the different trees and additional information that may help in tree selection. For example, some trees are well suited to landscaped areas that will receive stormwater runoff, while others may not tolerate the additional moisture from runoff, largely depending on the soil.

There are two tables. The first consists of trees that are not native to the Portland area and the second consists of native trees listed on the Portland Plant List.

Non-native trees

Species name	Common Name	Min. Distance from Pavement	Comments
Abies amabilis	Silver Fir	4 feet	Conifer, evergreen. Native to Oregon Cascades.
Acer campestre	Hedge maple	2 feet	Broadleaf, deciduous.
Acer rubrum	Red maple 'Embers Red,' 'October Glory,' 'Red Sunset,' 'Gerling,' 'Autumn Flame'	3 feet	Broadleaf, deciduous. Good for stormwater facilities
Acer saccharum	Sugar Maple (Except 'Legacy')	3 feet	Broadleaf, deciduous.
Calocedrus decurrens	Incense Cedar	3 feet	Conifer, evergreen Drought tolerant
Carpinus betulus	European Hornbeam	2 feet	Broadleaf, deciduous. Shade tolerant.
Celtis occidentalis	Hackberry	3 feet	Broadleaf, deciduous.
Cercidiphyllum japonicum	Katsura Tree	3 feet	Broadleaf, deciduous. Prefers well-drained soils Needs summer irrigation

Species name	Common Name	Min. Distance from Pavement	Comments
Cladrastis kentuckea	Yellowwood	3 feet	Broadleaf, deciduous. Prefers summer irrigation and well-drained soil.
Cornus kousa var. *chinensis*	Chinese Dogwood	3 feet	Broadleaf, deciduous. Small tree. Fruits, but is not messy. Needs summer water.
Crataegus x *lavallei*	Lavalle Hawthorn	2 feet	Broadleaf, deciduous. Fruit can be messy.
Fagus grandifolia	American Beech	4 feet	Broadleaf, deciduous.
Fagus sylvatica	European Beech	4 feet	Broadleaf, deciduous.
Fagus sylvatica	European Beech 'Roseo-marginata,' 'Tricolor'	3 feet	Broadleaf, deciduous.
Fraxinus americana	White Ash	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Fraxinus excelsior	European Ash	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Fraxinus pennsylvanica	Green Ash 'Marshall,' 'Patmore,' 'Summit,' 'Urbanite'	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Ginkgo biloba	Ginkgo 'Shangri-la,' 'Saratoga'	3 feet	Measured as a broadleaf; deciduous. Use the male only. Female produces messy, smelly fruit.
Liquidambar styraciflua	Sweetgum	4 feet	Broadleaf, deciduous.
Liriodendron tulipifera	Tulip Tree or Tulip Poplar	4 feet	Broadleaf, deciduous.
Magnolia grandiflora	Southern Magnolia	4 feet	Broadleaf, evergreen.
Magnolia kobus	Kobus Magnolia	2 feet	Broadleaf, deciduous.
Metasequoia glyptostroboides	Dawn Redwood	4 feet	Conifer, deciduous.
Nothofagus dombeyi	South American Beech or Southern Beech	3 feet	Broadleaf, evergreen.
Nothofagus obliqua	Roble Beech	3 feet	Broadleaf, deciduous.
Nyssa sylvatica	Black Gum or Black Tupelo	3 feet	Broadleaf, deciduous. Good for stormwater facilities.
Ostrya virginiana	American Hornbeam	2 feet	Broadleaf, deciduous.
Pinus contorta	Shore Pine	3 feet	Conifer, evergreen. A smaller tree.
Pinus monticola	Western White Pine	3 feet	Conifer, evergreen.
Quercus bicolor	Swamp White Oak	3 feet	Broadleaf, deciduous. Tolerates wet soil.
Quercus coccinea	Scarlet Oak	3 feet	Broadleaf, deciduous. Intolerant of wet soil.

Species name	Common Name	Min. Distance from Pavement	Comments
Quercus frainetto	Hungarian Oak 'Forest Green'	3 feet	Broadleaf, deciduous.
Quercus nigra	Water Oak	3 feet	Broadleaf, evergreen. Tolerates wet conditions.
Quercus phellos	Willow Oak	3 feet	Broadleaf, deciduous.
Quercus robur	English Oak	3 feet	Broadleaf, deciduous.
Quercus rubra	Northern Red Oak	4 feet	Broadleaf, deciduous.
Quercus velutina	Black Oak	4 feet	Broadleaf, deciduous.
Sequoia sempervirens	Coast Redwood	6 feet	Conifer, evergreen. Grows very tall.
Sequoiadendron giganteum	Giant Sequoia	8 feet	Conifer, evergreen. Trunk quickly becomes massive, needs ample space.
Sophora japonica	Japanese Pagoda Tree	3 feet	Broadleaf, deciduous.
Taxodium distichum	Bald Cypress	4 feet	Conifer, deciduous. Tolerates extremely wet conditions, but does not require it.
Umbellularia californica	California Laurel, Oregon Myrtle, Bay	4 feet	Broadleaf, evergreen. Drought tolerant.
Zelkova serrata	Sawleaf Zelkova 'Green Vase,' 'Halka,' 'Village Green'	3 feet	Broadleaf, deciduous.

Native Parking Lot Trees

Species Name	Common Name	Min. Distance from Pavement	Comments
Abies grandis	Grand Fir	4 feet	Conifer, evergreen. Can grow very tall.
Acer macrophyllum	Big Leaf Maple	4 feet	Broadleaf, deciduous.
Alnus rhombifolia	White Alder	3 feet	Broadleaf, deciduous. Moisture loving. ***Short live species.*** *
Alnus rubra	Red Alder	3 feet	Broadleaf, deciduous. Moisture loving. ***Short live species.*** *
Calocedrus decurrens	Incense Cedar	4 feet	Conifer, evergreen. Prefers moist conditions and some shade.
Crataegus douglasii, var. douglasii	Black Hawthorn, wetland form	3 feet	Broadleaf, deciduous. A smaller tree. Wetland form tolerates wet areas.
Fraxinus latifolia	Oregon Ash	3 feet	Broadleaf, deciduous. Tolerates wet conditions.

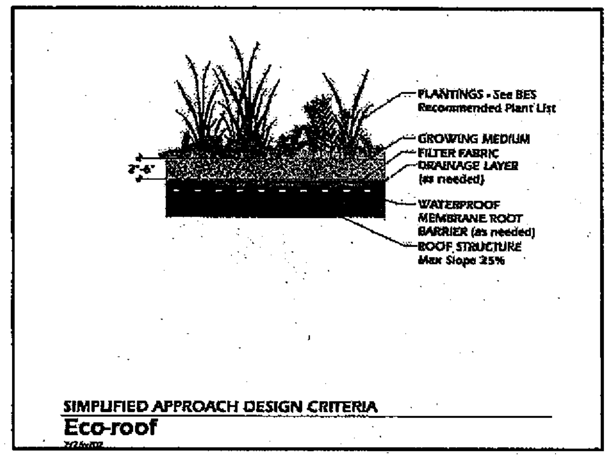
Pinus ponderosa, ssp. Valley	Ponderosa Pine, Valley subspecies	4 feet	Conifer, evergreen. Prefers drier conditions, but Valley subspecies is adapted to Willamette Valley climate.
Pseudotsuga menziesii	Douglas Fir	4 feet	Conifer, evergreen. Can grow very tall.
Quercus garryana	Oregon White Oak	4 feet	Broadleaf, deciduous. Drought tolerant.
Quercus kelloggii	Californai Black Oak	4 feet	Broadleaf, deciduous. Drought tolerant.
Rhamnus purshiana	Cascara	3 feet	Broadleaf, deciduous. A smaller tree.
Thuja plicata	Western Red Cedar	4 feet	Conifer, evergreen. Prefers moist conditions and some shade. **Does not do well in direct sunlight, Shade tolerant**
Thuja plicata	Western Red Cedar 'Hogan'	4 feet	Conifer, evergreen. Prefers moist conditions and some shade. 'Hogan' is a narrow-growing variety.

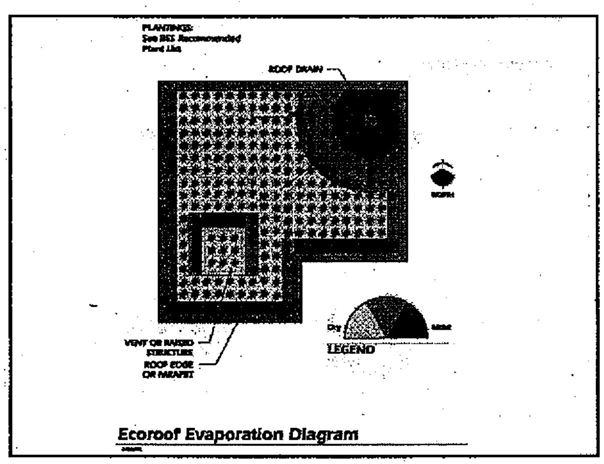
* According to the "Western Tree Book" maximum age of a Red Alder is thought to be 100 years. Relatively speaking these trees have a life span sufficient for urban parking lot swales. A report by the Portland Planning Bureau in 1997 indicated that the life expectancy of most trees in non-residential areas was 20-40 years.

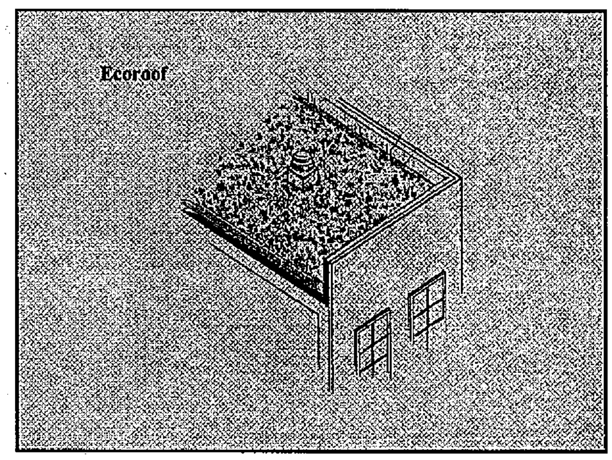
Appendix H

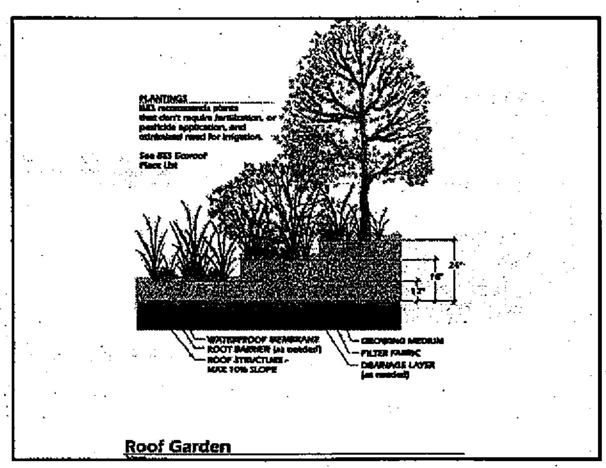
Supplemental Drawings and Example Landscaping Plans

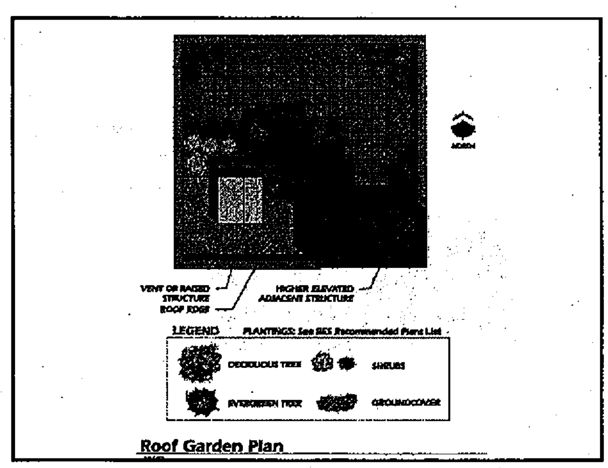
Stormwater Management Manual

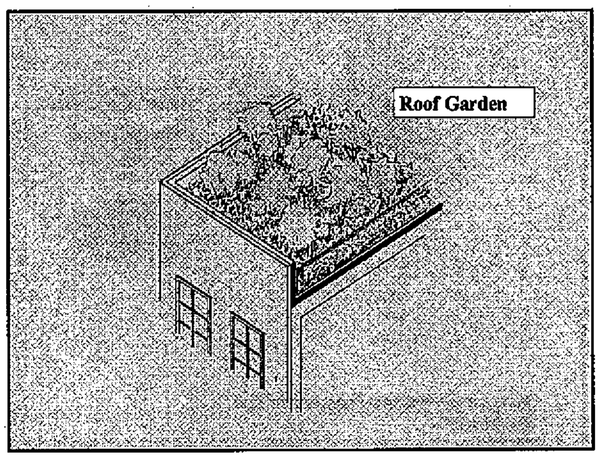


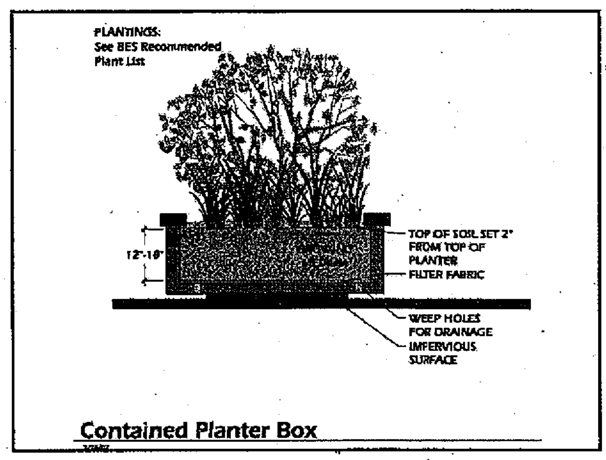


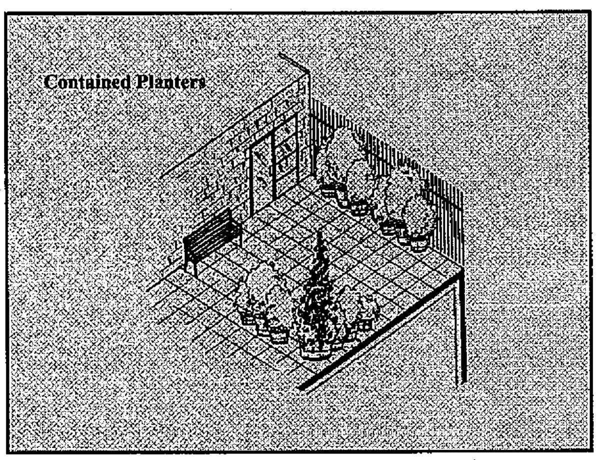


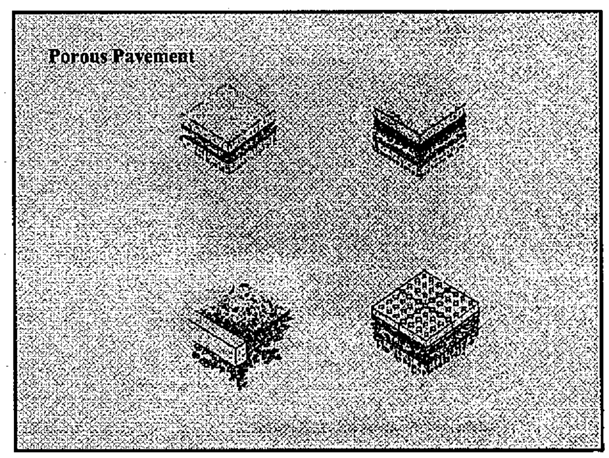


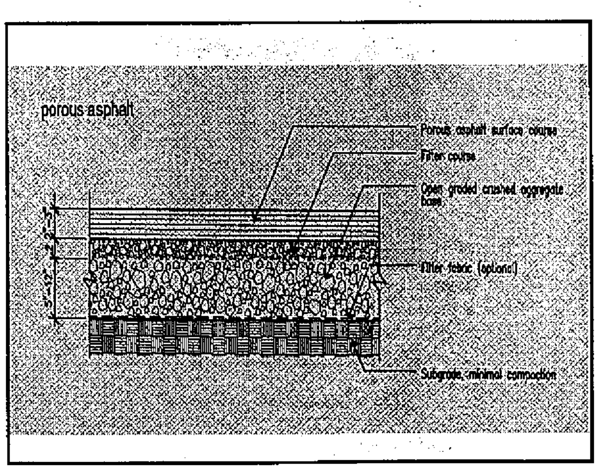


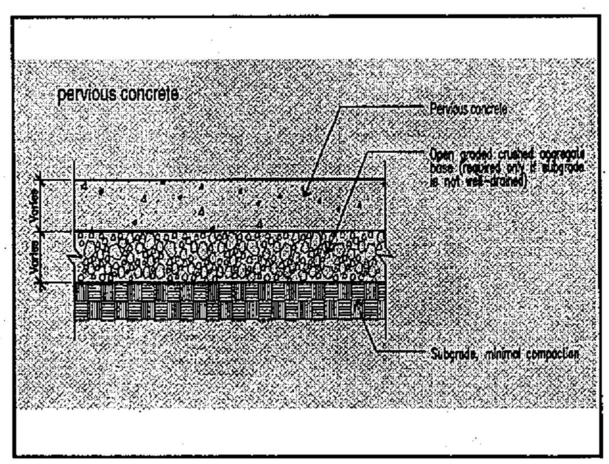

Roof Garden

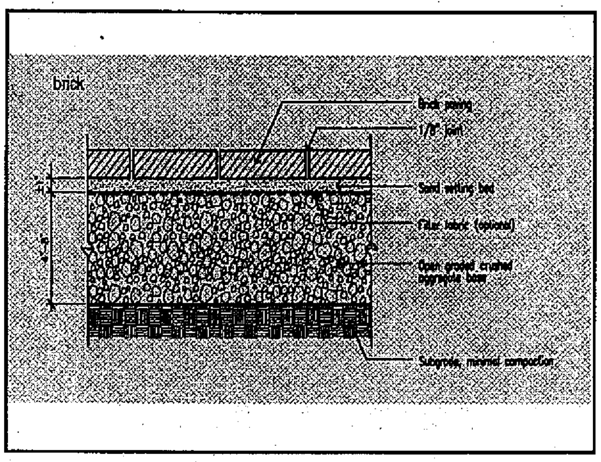

PLANTINGS:
See BES Recommended
Plant List
12"-18"
TOP OF SOIL SET 2"
FROM TOP OF
PLANTER
FILTER FABRIC
WEEP HOLES
FOR DRAINAGE
IMPERVIOUS
SURFACE
Contained Planter Box

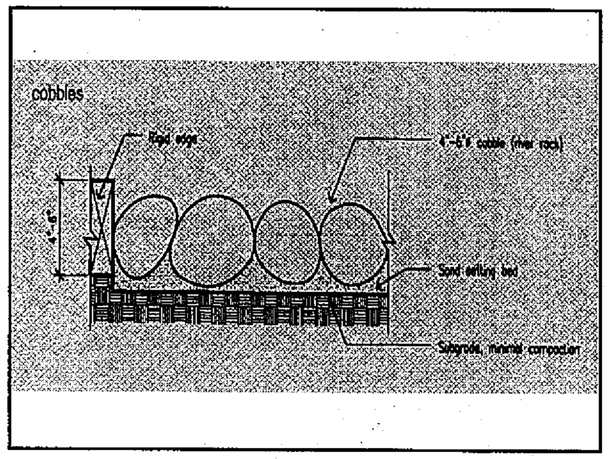

Contained Planters

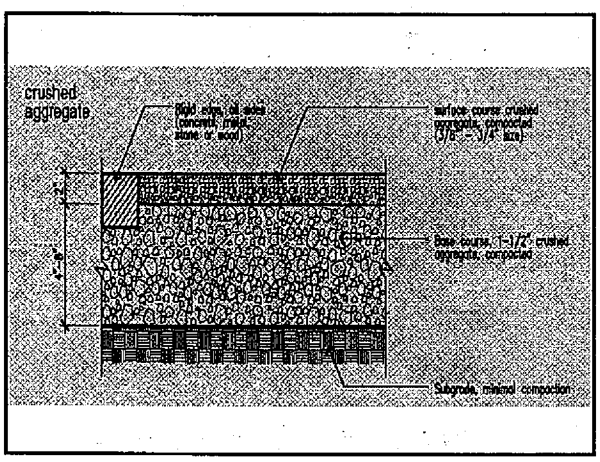

Porous Pavement

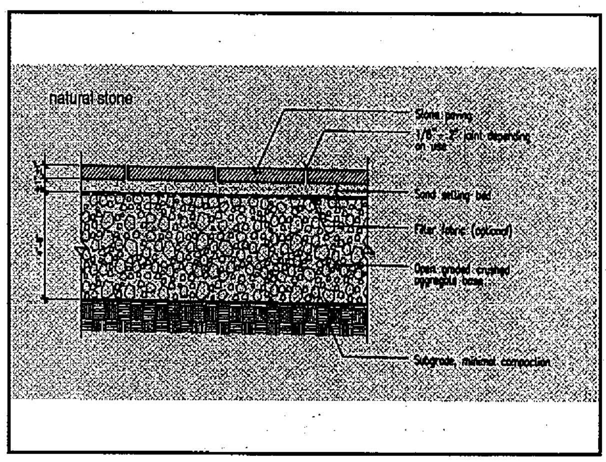

porous asphalt
Porous asphalt surface course
Filter course
Open graded crushed aggregate base
Filter fabric (optional)
Subgrade, minimal compaction

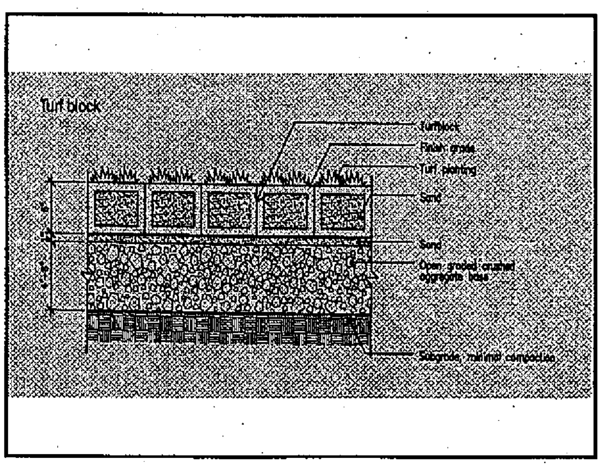

pervious concrete
Pervious concrete
Open graded crushed aggregate base (required only if subgrade is not well-drained)
Varies
Varies
Subgrade, minimal compaction

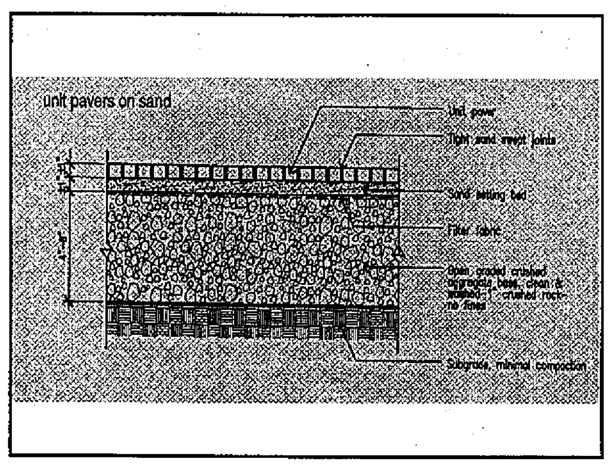

brick
Brick paving
1/8" joint
Sand setting bed
Filter fabric (optional)
Open graded crushed aggregate base
Subgrade, minimal compaction

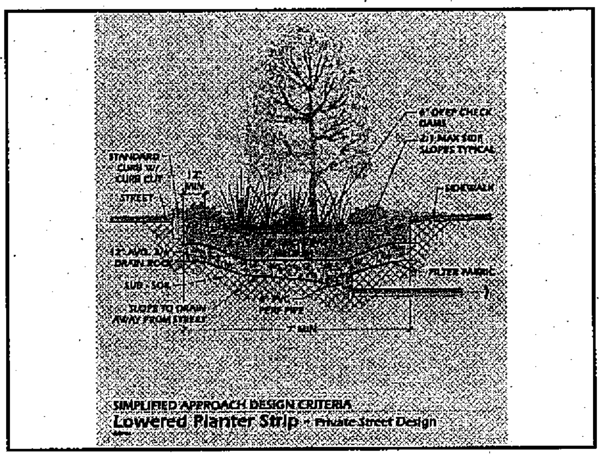

cobbles
Rigid edge
4"-6" cobble (river rock)
Sand setting bed
Subgrade, minimal compaction

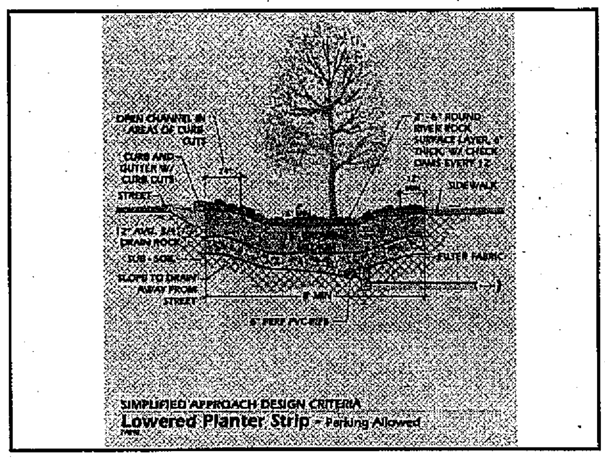

crushed aggregate
Rigid edge, all sides (concrete, metal, stone or wood)
surface course crushed aggregate, compacted (3/8" - 3/4" size)
Base course, 1-1/2" crushed aggregate, compacted
Subgrade, minimal compaction

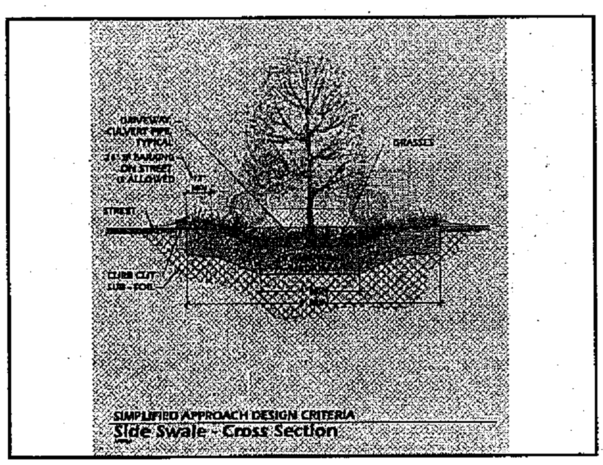

natural stone
Stone paving
Sand setting bed
Filter fabric (optional)
Open graded crushed aggregate base
Subgrade, minimal compaction

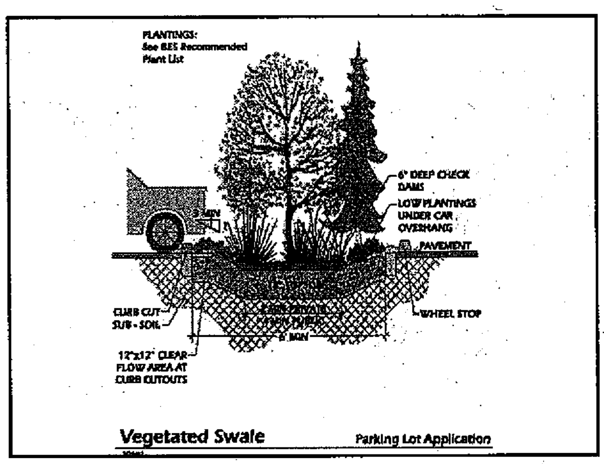

Turf block
Turfblock
Finish grade
Turf planting
Sand
Sand
Open graded crushed aggregate base
Subgrade, minimal compaction

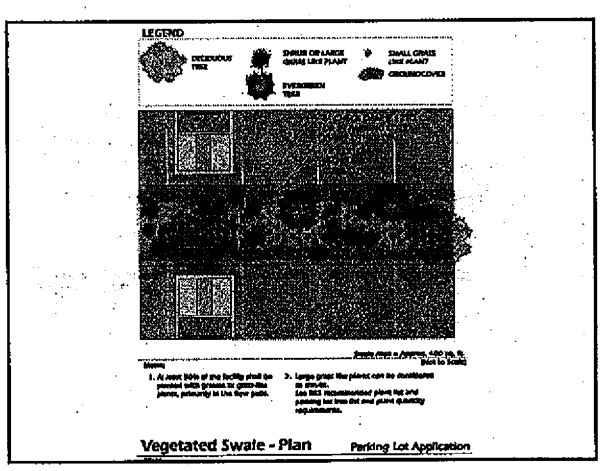

unit pavers on sand
Unit paver
Tight sand swept joints
Sand setting bed
Filter fabric
Subgrade, minimal compaction

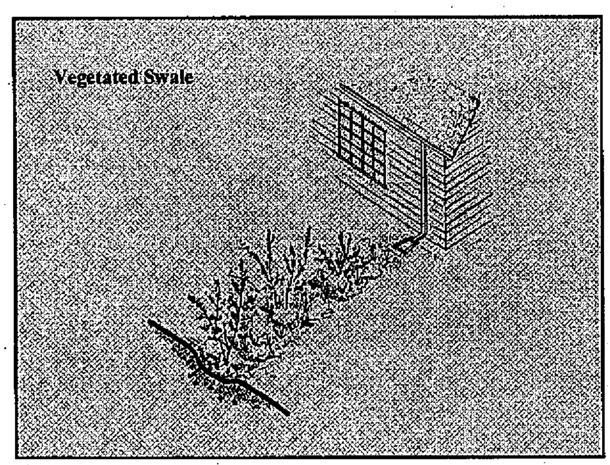

SIMPLIFIED APPROACH DESIGN CRITERIA
Lowered Planter Strip - Private Street Design


SIMPLIFIED APPROACH DESIGN CRITERIA
Lowered Planter Strip - Parking Allowed

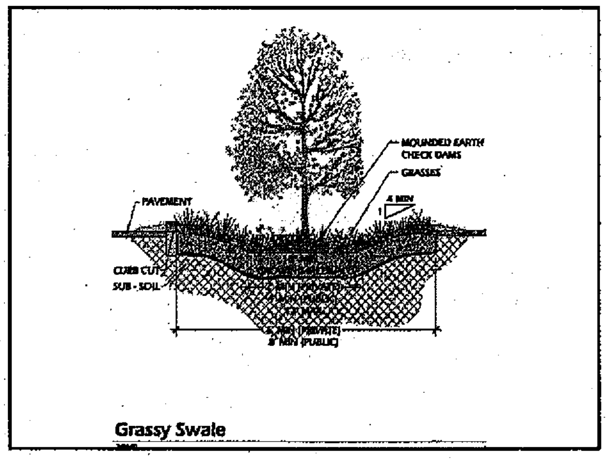

SIMPLIFIED APPROACH DESIGN CRITERIA
Side Swale - Cross Section

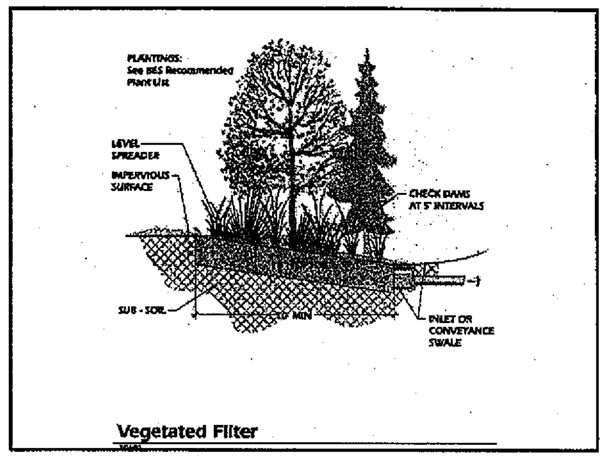

PLANTINGS:
6" DEEP CHECK DAMS
LOW PLANTINGS UNDER CAR OVERHANG
PAVEMENT
WHEEL STOP
CURB CUT
SUB - SOIL
Vegetated Swale
Parking Lot Application

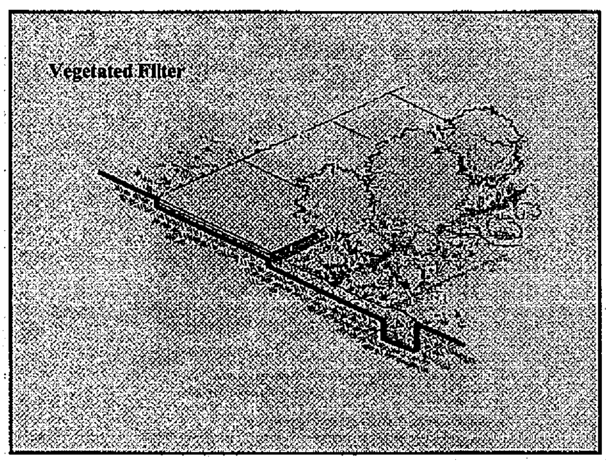

LEGEND
Vegetated Swale - Plan
Parking Lot Application

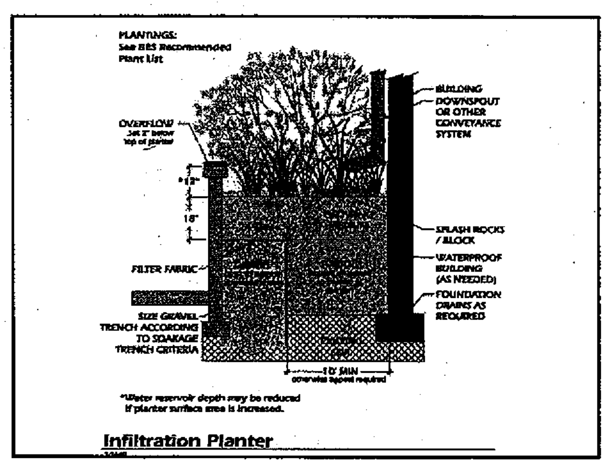

Vegetated Swale

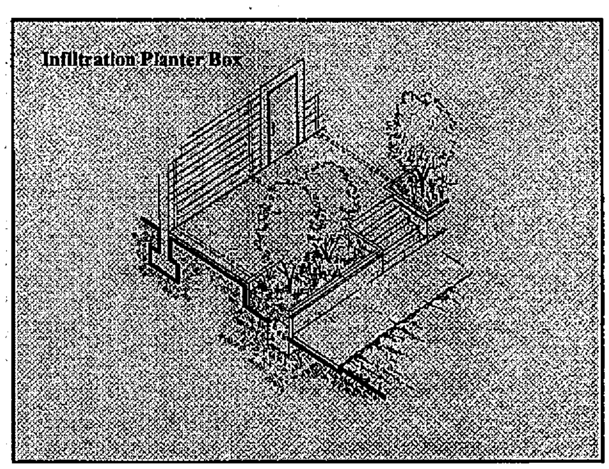
Appendix H

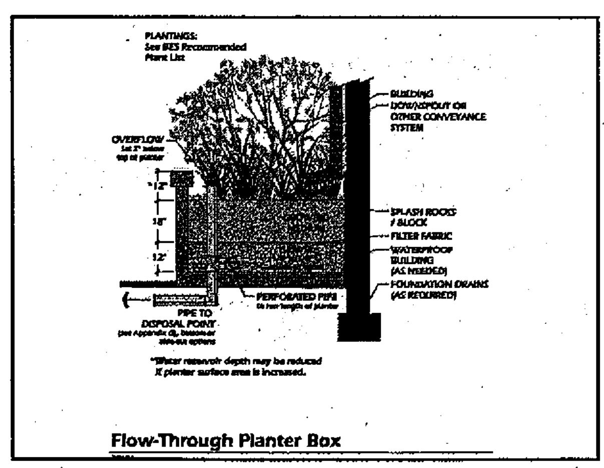

Grassy Swale

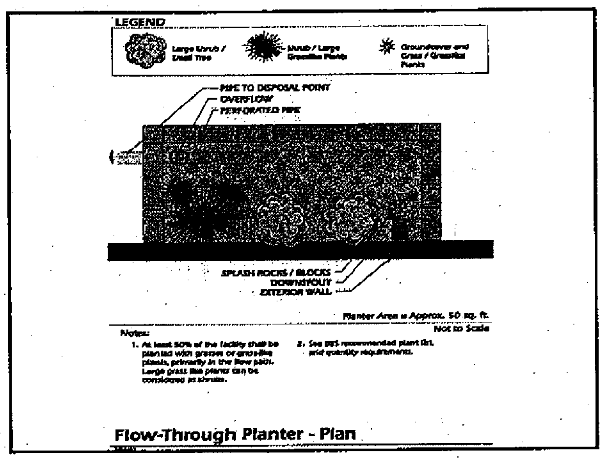

Vegetated Filter

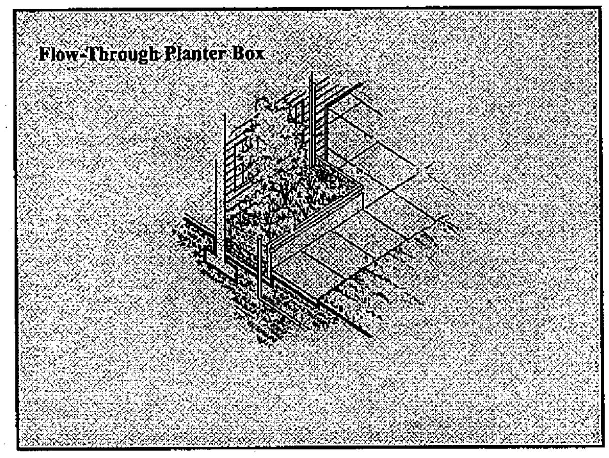

Vegetated Filter

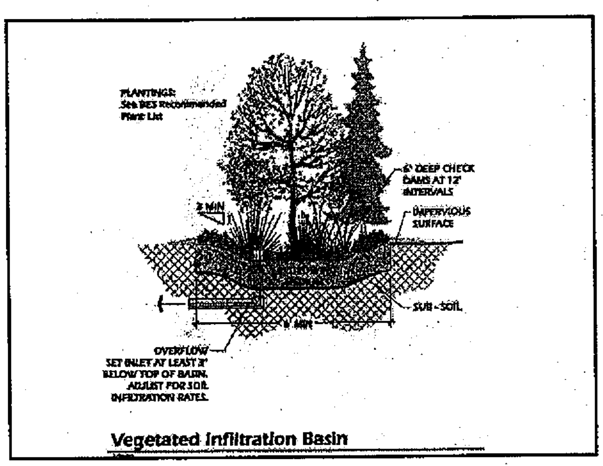

Infiltration Planter

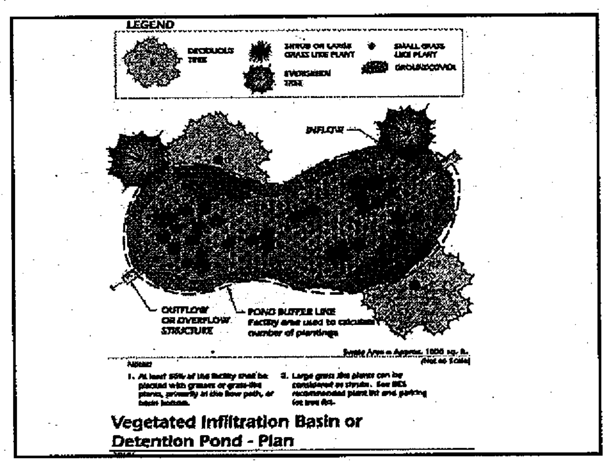

Infiltration Planter Box

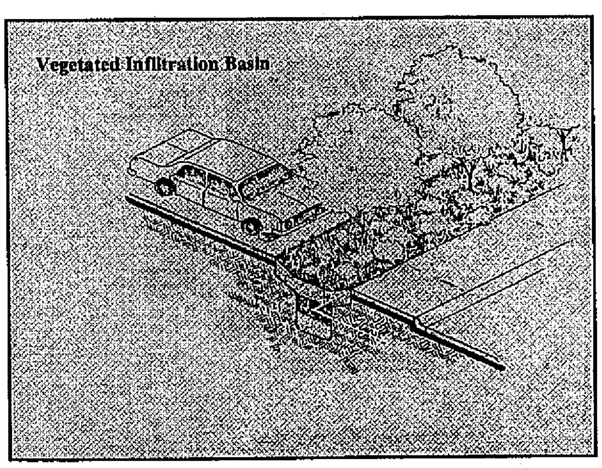

Flow-Through Planter Box

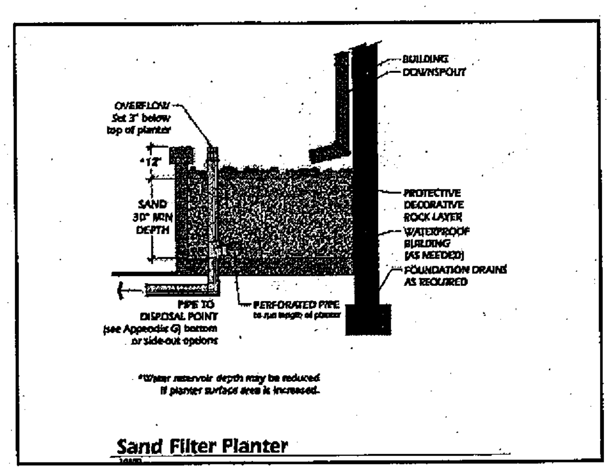

LEGEND
Flow-Through Planter - Plan

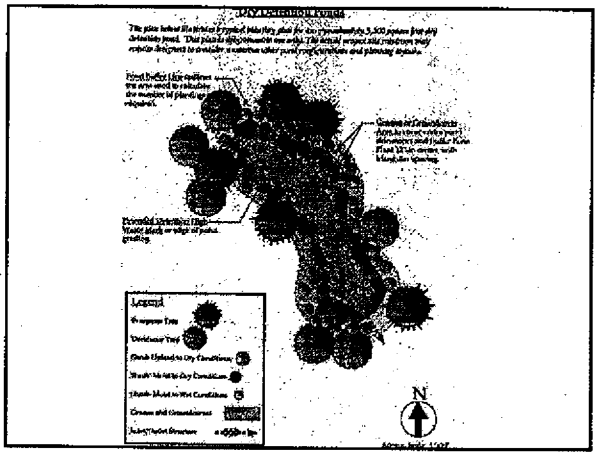

Flow-Through Planter Box

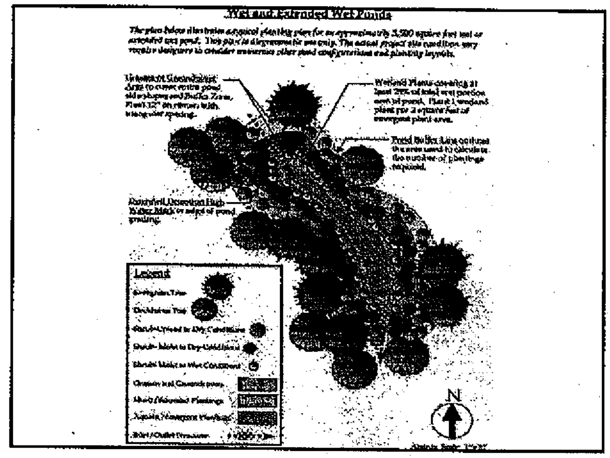

Vegetated Infiltration Basin


LEGEND
Vegetated Infiltration Basin or
Detention Pond - Plan


Vegetated Infiltration Basin


Sand Filter Planter


Legend
N

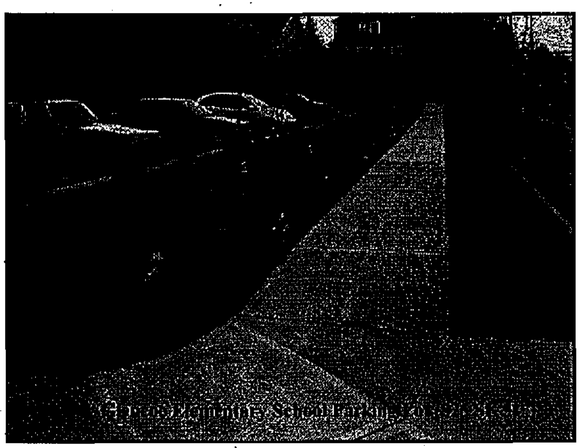

Wet and Extended Wet Ponds
Legend
N

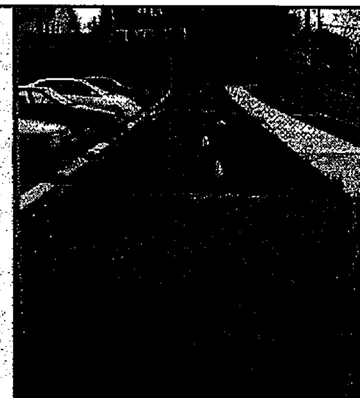
Appendix I

Stormwater Management Facility Photos

Stormwater
Management Manual

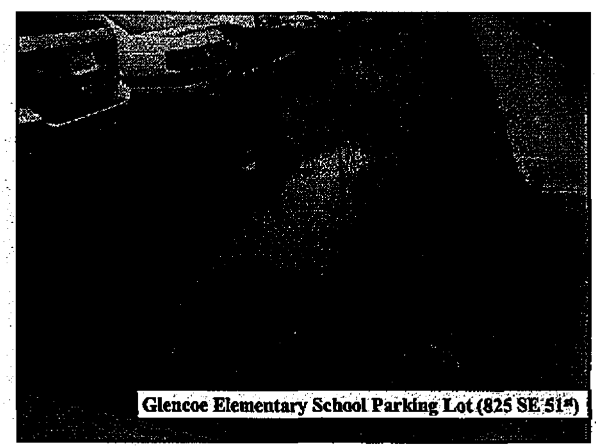
Parking Lot Examples



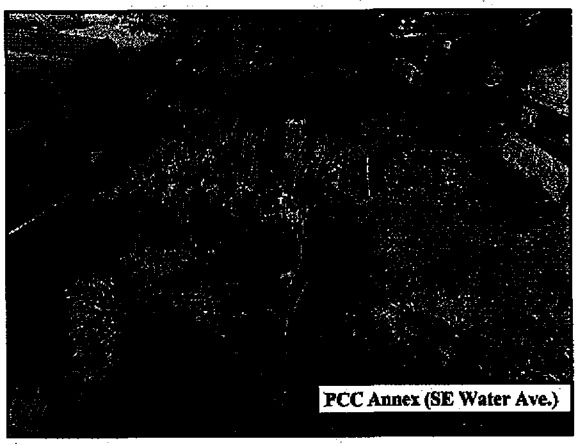


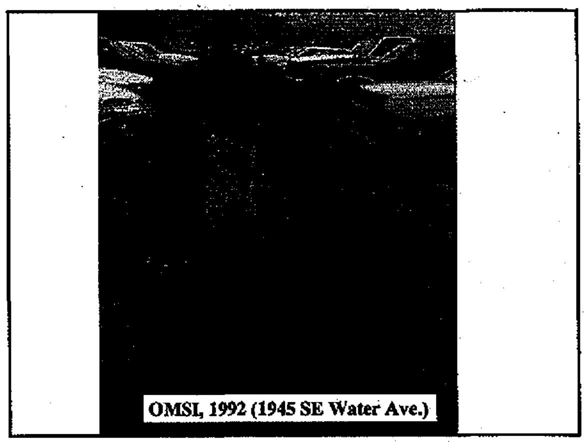
Glencoe Elementary School Parking Lot (825 SE 51st)

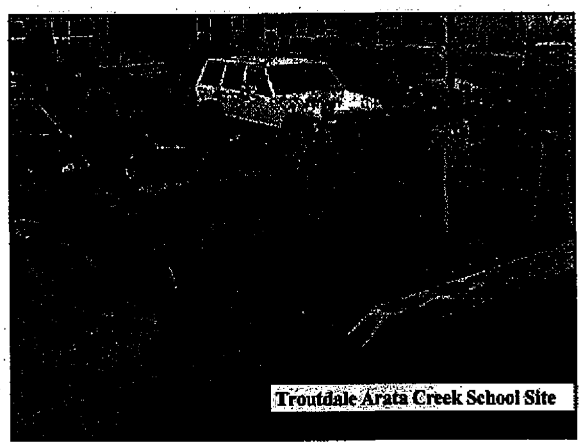
Glencoe Elementary School Parking Lot (825 SE 51st)



Glencoe Elementary School Parking Lot (825 SE 51st)

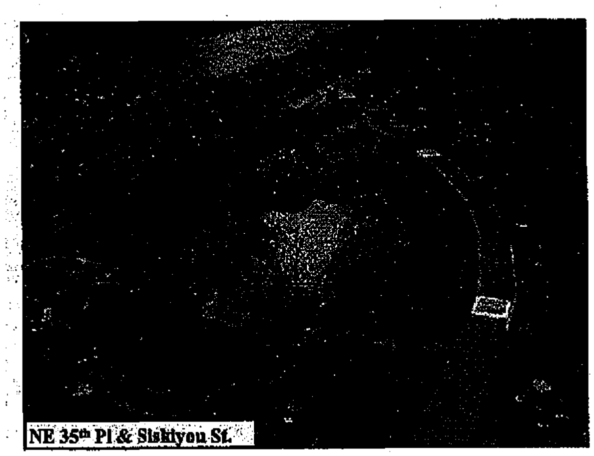

PCC Annex (SE Water Ave.)

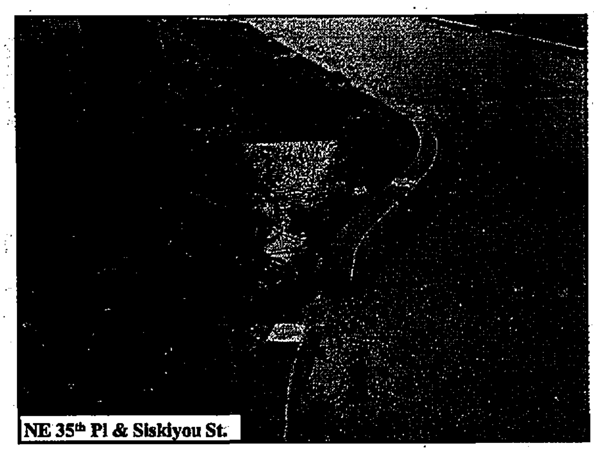

OMSI, 1992 (1945 SE Water Ave.)

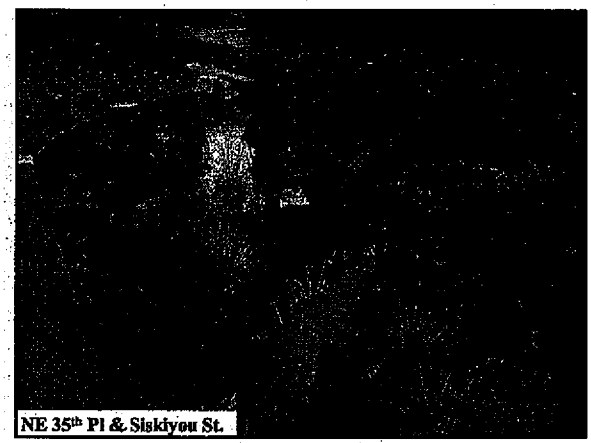

Troutdale Arata Creek School Site

Street Examples

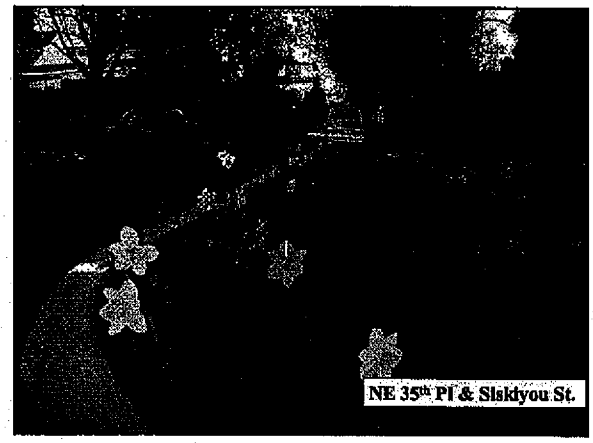
Site Location	Page/ Slide
NE 35th Pl. & Siskiyou	11-16
SE 56th & Ankeny	17-19
N Leadbetter Road	20,21
SW Lodi Lane (& Shattuck) Subdivision	22
Seattle Street Edge Alternative Project	23-25
Seattle- Cascade & Broadview	26


NE 35th Pl & Siskiyou St.

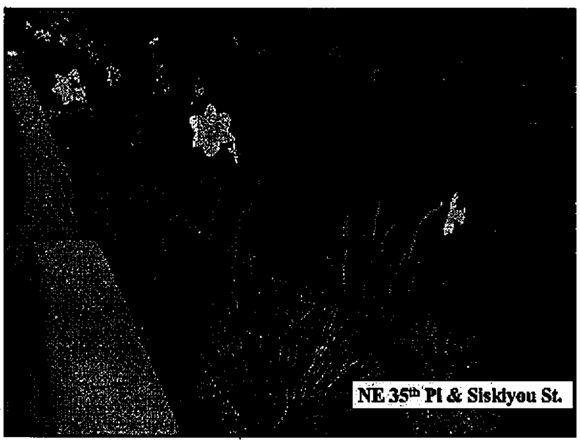

NE 35th Pl & Siskiyou St.



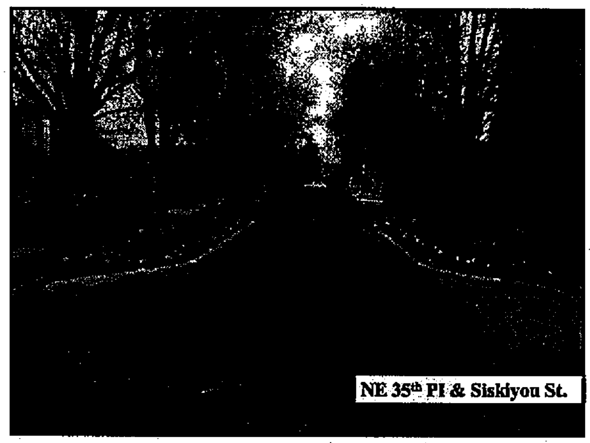
NE 35th Pl & Siskiyou St.



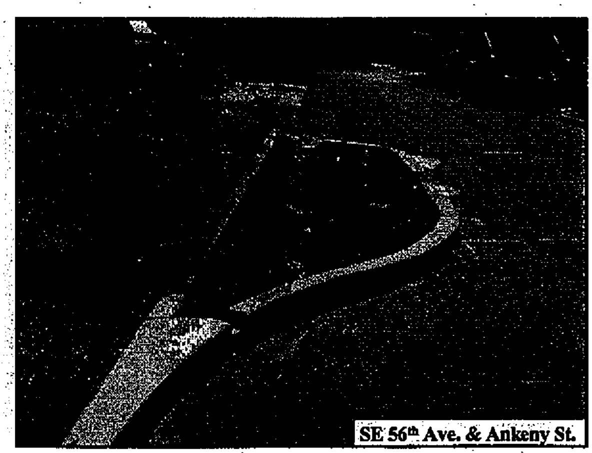
NE 35th Pl & Siskiyou St.



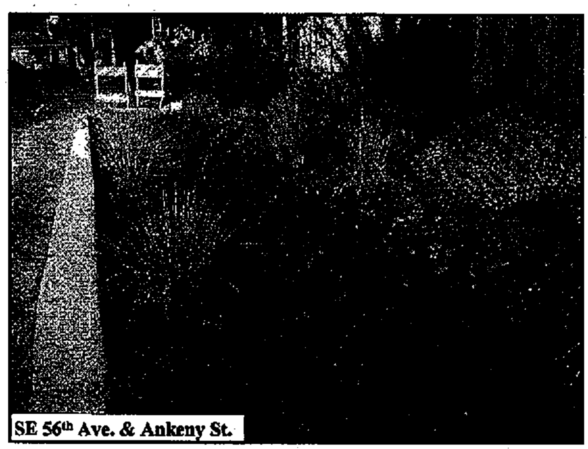
NE 35th Pl & Siskiyou St.



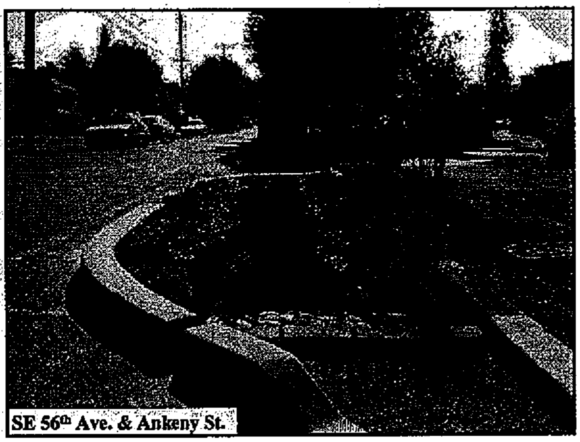
NE 35th Pl & Siskiyou St.



SE 56th Ave. & Ankeny St.

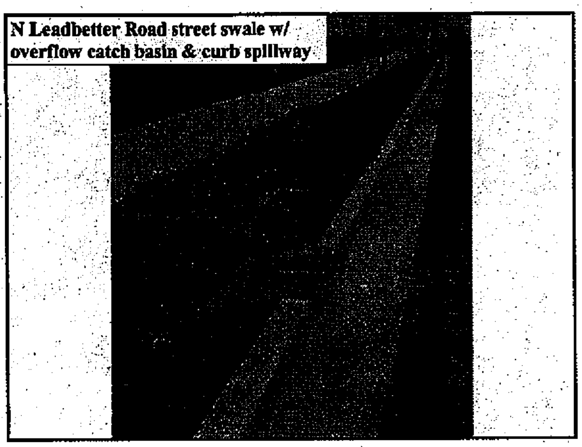


SE 56th Ave. & Ankeny St.



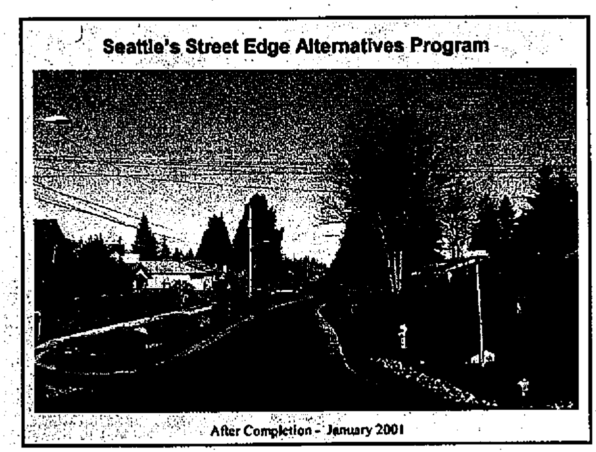
SE 56th Ave. & Ankeny St.

N Leadbetter Road street swale w/ overflow catch basin & curb slots



N Leadbetter Road street swale w/ overflow catch basin & curb spillway

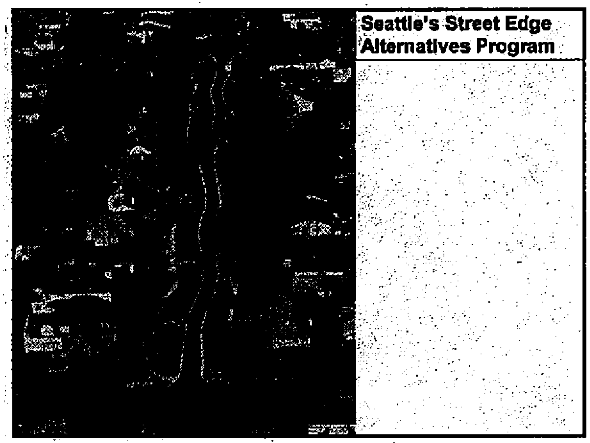
North side of SW Lodi Lane (& Shattuck), sand filter/ street swale

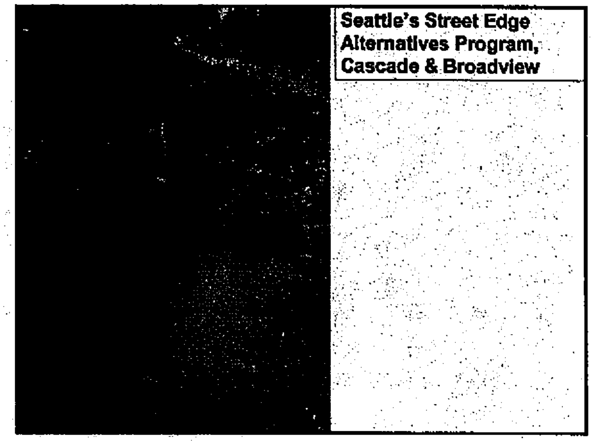


Seattle's Street Edge Alternatives Program

After Completion - January 2001

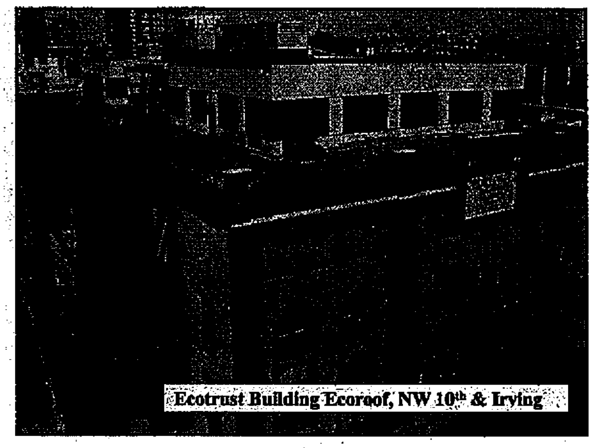
Seattle's Street Edge Alternatives Program

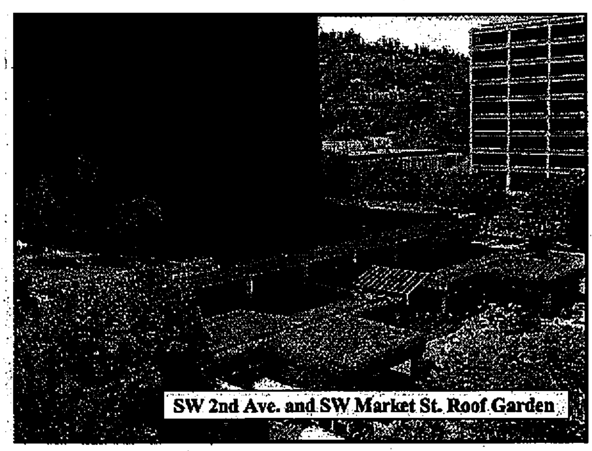


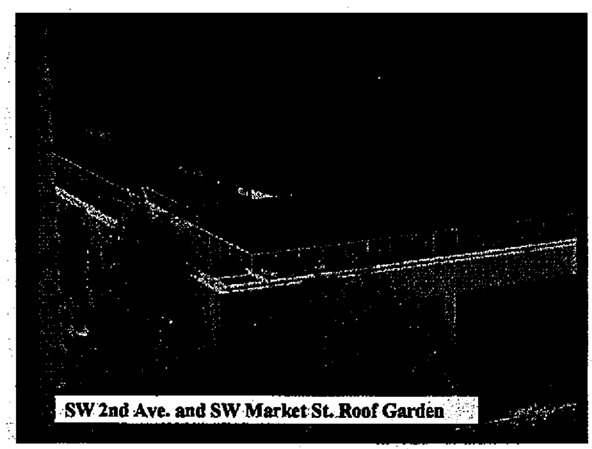


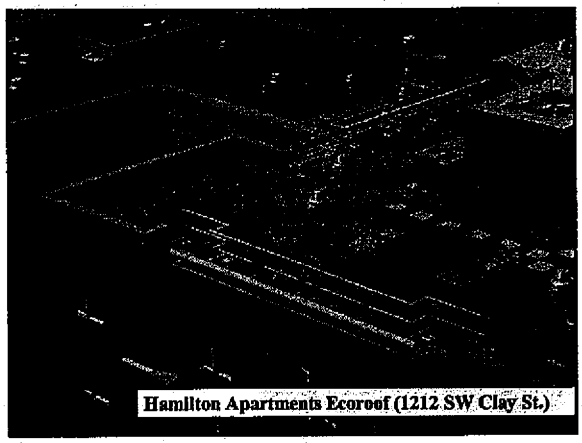
Ecoroofs and Roof Gardens

Site Location	Page/ Slide
Ecotrust Building (NW 10th & Irving)	28
SW 2nd Ave. & Market St.	29, 30
Hamilton Apartments (1212 SW Clay St.)	31, 32
Multnomah County (501 SE Hawthorne)	33
2021 SE Clinton St.	34
Buckman Terrace Apartments (303 NE 16th Ave.)	35, 36


Ecotrust Building Ecoroof, NW 10th & Irving

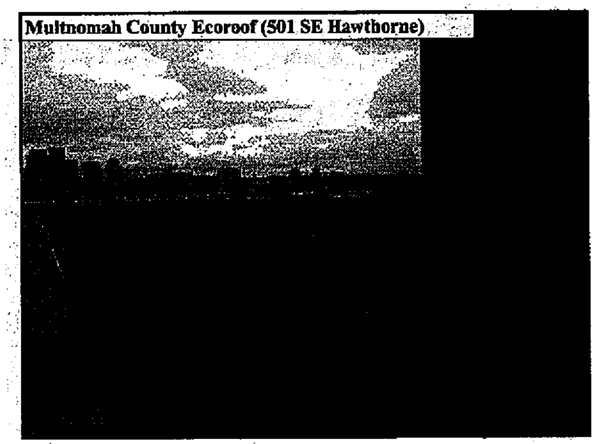

SW 2nd Ave. and SW Market St. Roof Garden


SW 2nd Ave. and SW Market St. Roof Garden

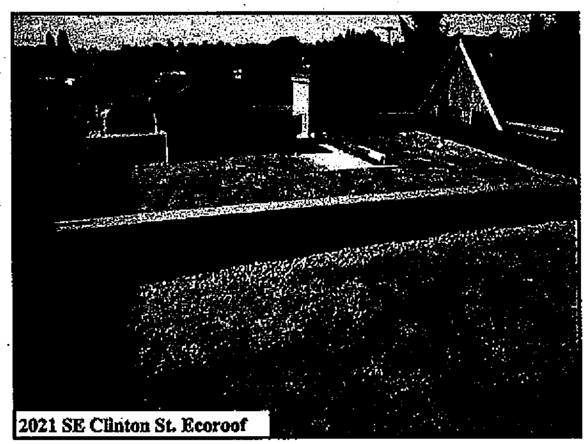


Hamilton Apartments Ecoroof (1212 SW Clay St.)

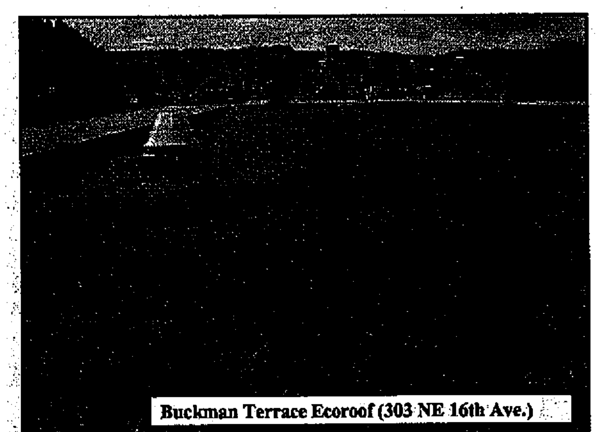
Hamilton Apartments Ecoroof (1212 SW Clay St.)



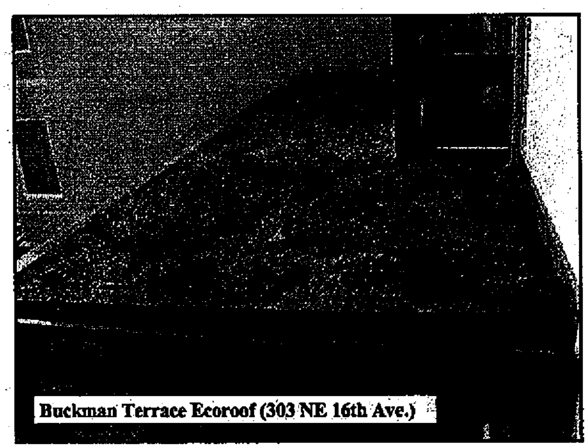
Multnomah County Ecoroof (501 SE Hawthorne)



2021 SE Clinton St. Ecoroof

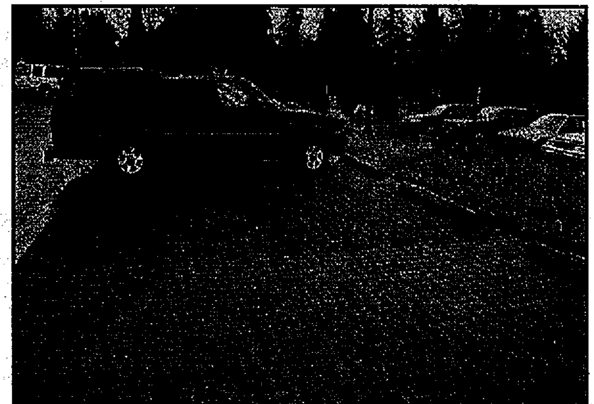


Buckman Terrace Ecoroof (303 NE 16th Ave.)



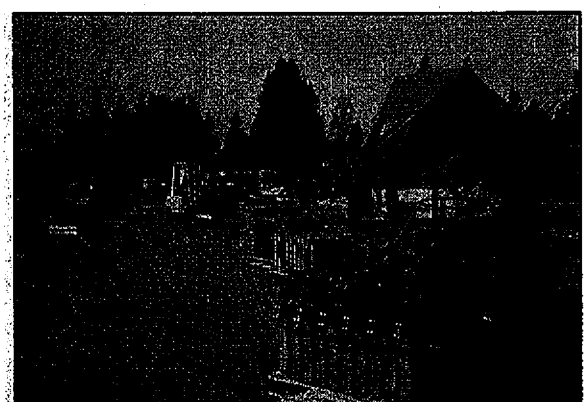
Buckman Terrace Ecoroof (303 NE 16th Ave.)

Pervious Pavement

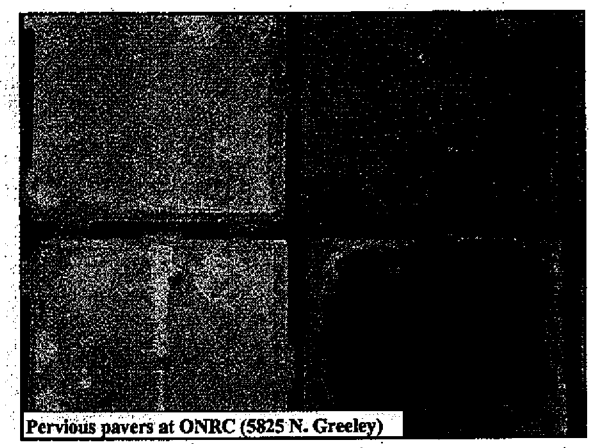

Multnomah Arts Center Eco-Stone Parking Lot


Multnomah Arts Center Eco-Stone Parking Lot

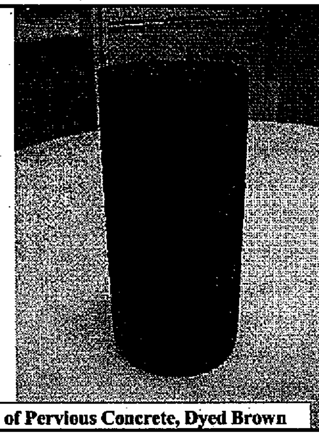

Installation of Eco-Loc Paver Parking Lot in Washington


Installation of Eco-Loc Paver Parking Lot in Washington


Pervious pavers at ONRC (5825 N. Greeley)



Pervious pavers at ONRC (5825 N. Greeley)

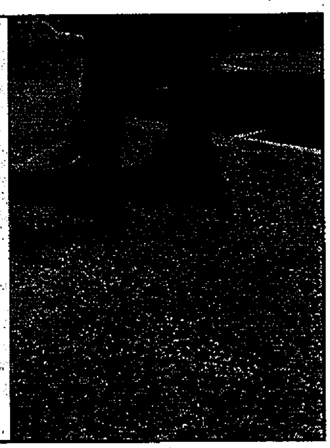


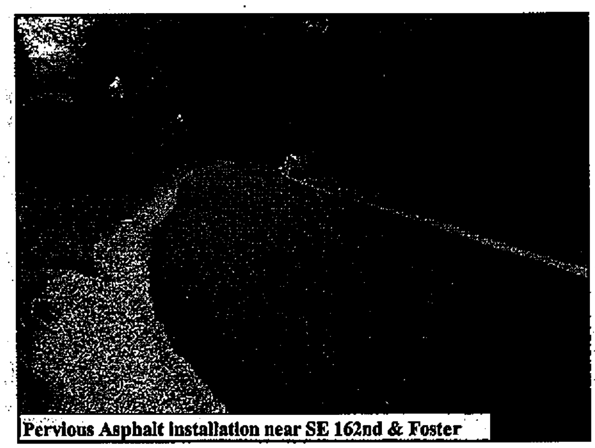
Core-Sample of Pervious Concrete, Dyed Brown

Pervious concrete installation at NE 94th & Broadway pump station site

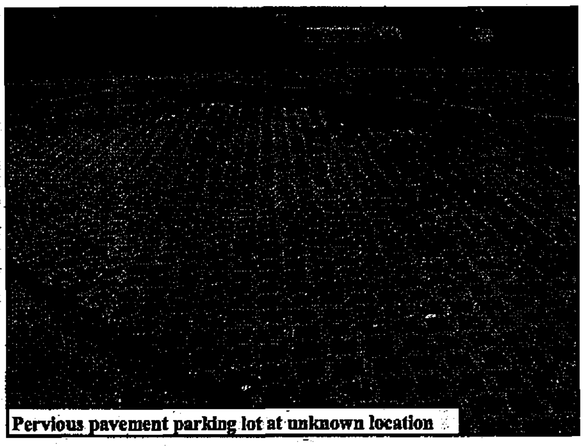
Clean Water Services' pervious concrete parking lot in Beaverton

Clean Water Services
Pervious Concrete
Parking Lot





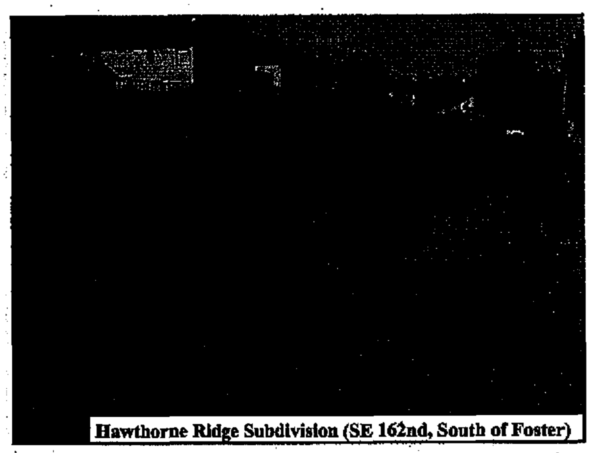
Pervious Asphalt installation near SE 162nd & Foster



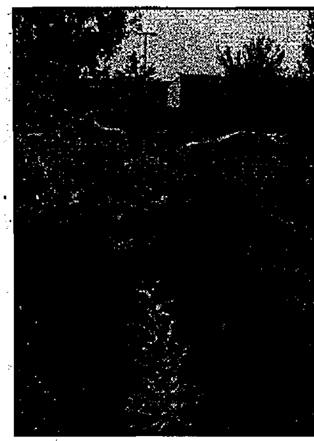
Pervious pavement parking lot at unknown location

Vegetated Swales

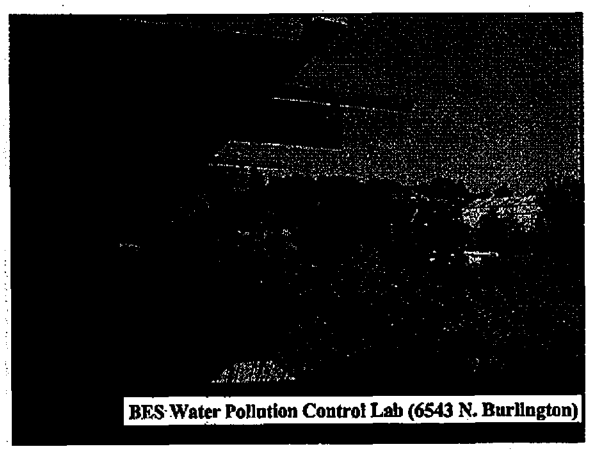
Site Location	Page/ Slide
Hawthorne Ridge Subdivision (SE 162 S. of Foster)	51
OMSI (1945 SE Water Ave.)	52
BES Water Pollution Control Lab (6543 N. Burlington)	53



Hawthorne Ridge Subdivision (SE 162nd, South of Foster)



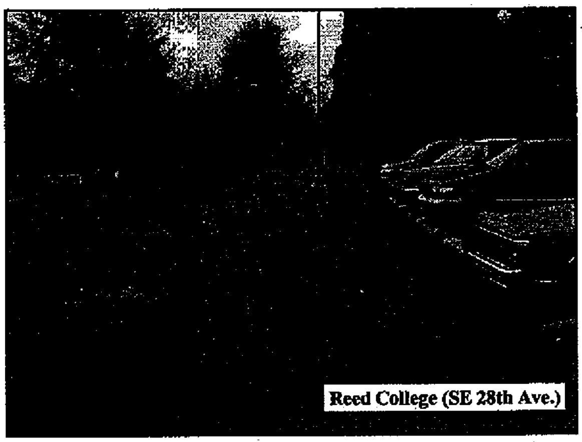
OMSI Vegetated Swale
(1945 SE Water Ave.)



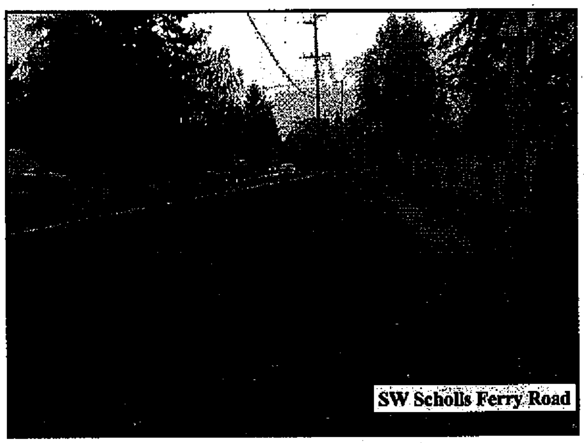
BES Water Pollution Control Lab (6543 N. Burlington)

Grassy Swales

Site Location	Page/ Slide
Reed College (SE 28th Ave.)	55
Russell Pond Site (NE 88th Ave. & Freemont Dr.)	56
SW Scholls Ferry Road	57

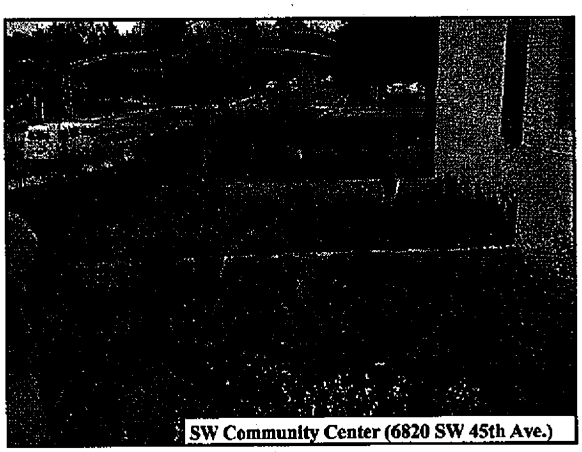

Reed College (SE 28th Ave.)


Russell Pond Site (NE 88th Ave. and Freemont Dr.)


SW Scholls Ferry Road

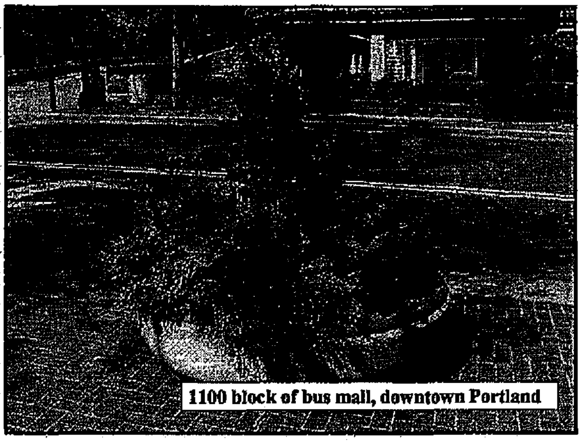
Vegetated Filters

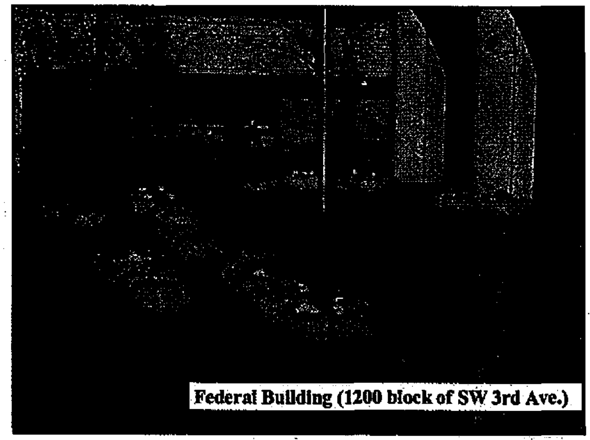
Site Location	Page/ Slide
SW Community Center (6820 SW 45th Ave.)	59


SW Community Center (6820 SW 45th Ave.)

Contained Planters

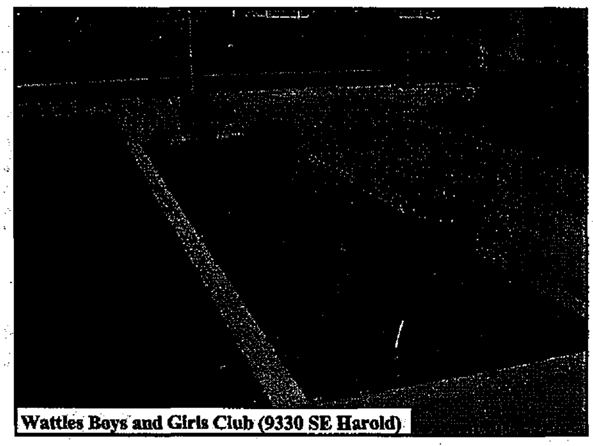
Site Location	Page/ Slide
1100 block of bus mall, downtown Portland	61
Federal Building (1200 block of SW 3rd Ave.)	62


1100 block of bus mall, downtown Portland

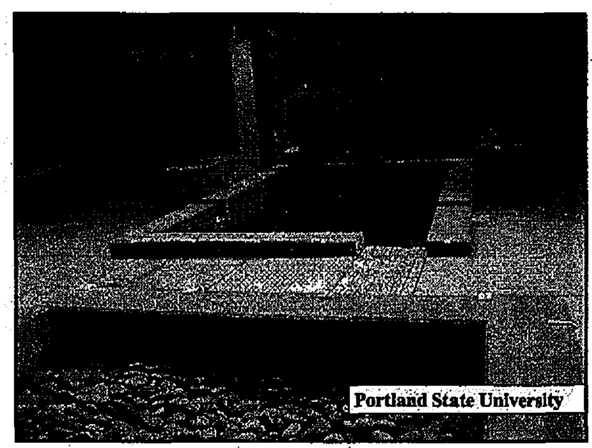

Federal Building (1200 block of SW 3rd Ave.)

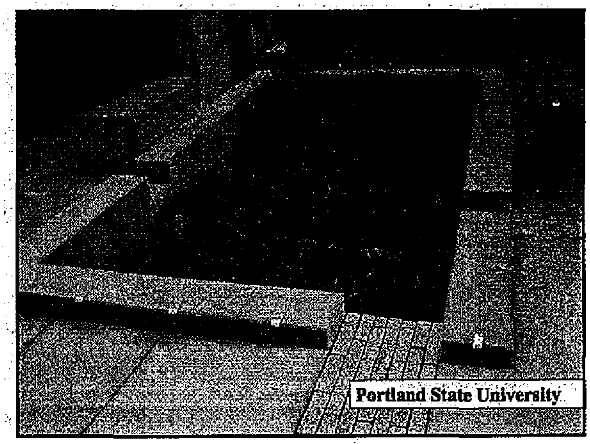
Infiltration Planters

Site Location	Page/ Slide
Wattles Boys and Girls Club (9330 SE Harold	64
Portland State University	65-67


Wattles Boys and Girls Club (9330 SE Harold)

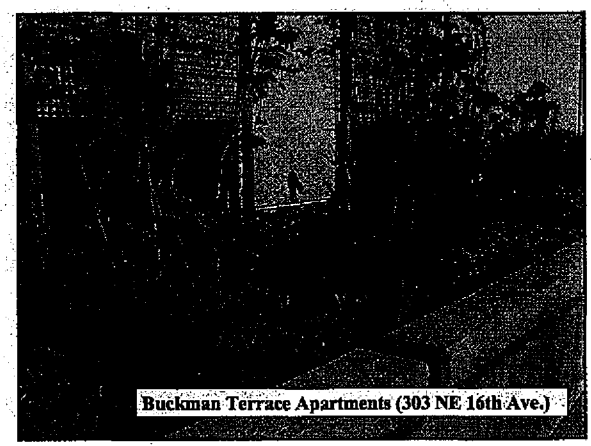

Portland State University


Portland State University

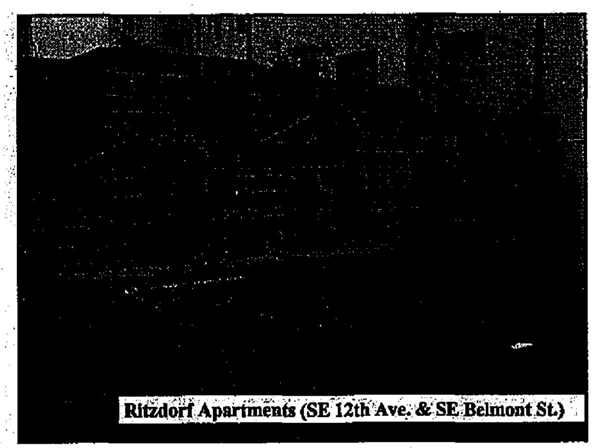

Portland State University

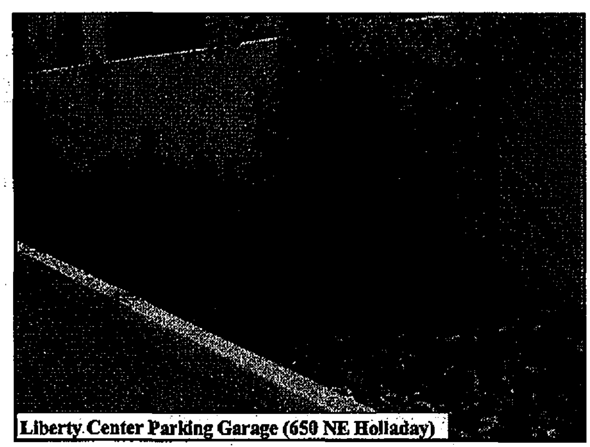
Flow-Through Planters

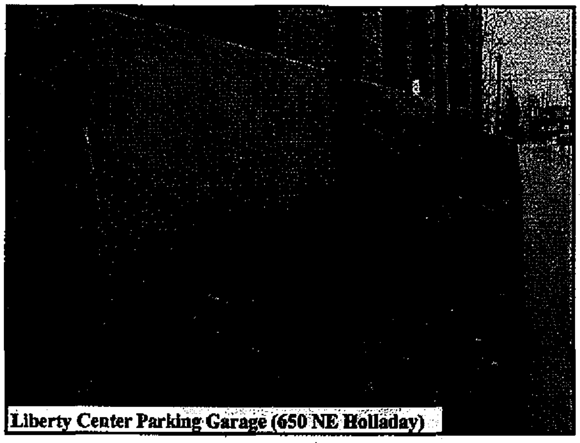
Site Location	Page/ Slide
Buckman Terrace Apartments (303 NE 16th Ave.)	69, 70
Ritzdorf Apartments (SE 12th Ave. & Belmont)	71
Liberty Center Parking Garage (650 NE Holladay)	72-74
Flow-Through Planter Test in New Zealand	75, 76

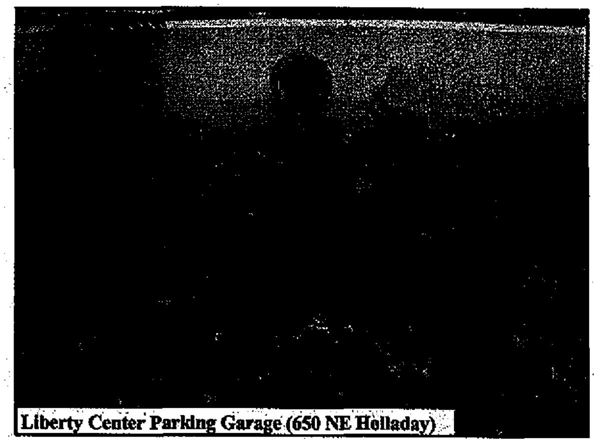

Buckman Terrace Apartments (303 NE 16th Ave.)


Buckman Terrace Apartments (303 NE 16th Ave.)

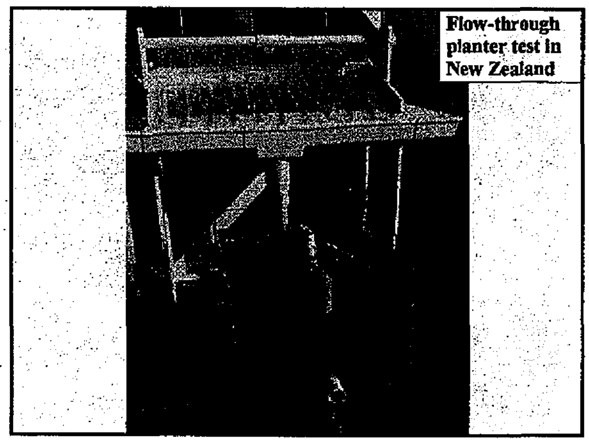

Ritzdorf Apartments (SE 12th Ave. & SE Belmont St.)


Liberty Center Parking Garage (650 NE Holladay)


Liberty Center Parking Garage (650 NE Holladay)

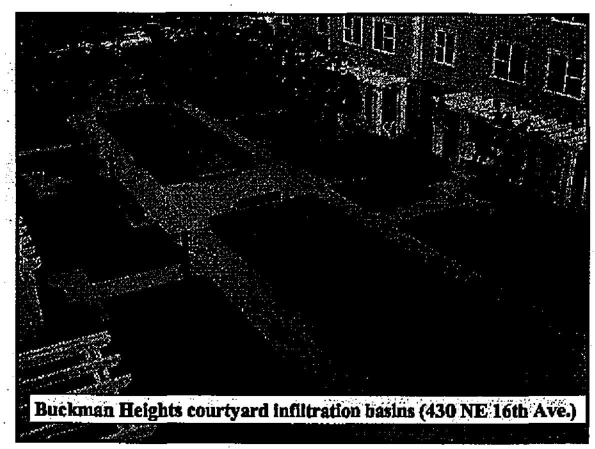

Liberty Center Parking Garage (650 NE Holladay)

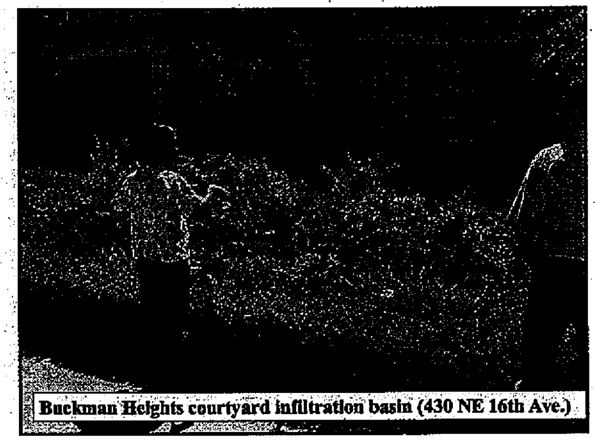

Flow-through planter test in New Zealand


Flow-through planter test in New Zealand

Vegetated Infiltration Basins

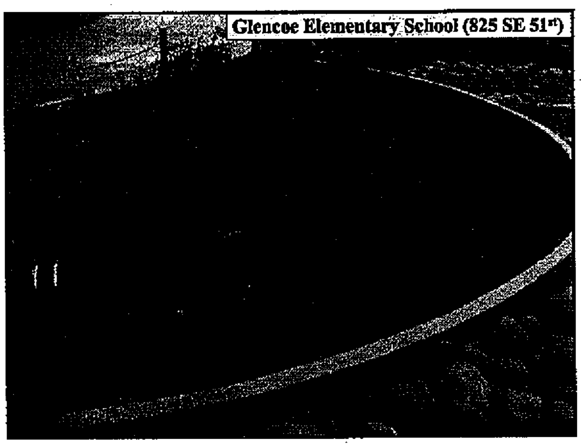
Site Location	Page/ Slide
Buckman Heights Apartments (430 NE 16th Ave.)	78-80
Glencoe Elementary School (825 SE 51st)	81, 82
Macintyre Estates Subdivision (SE 139th & Steele)	83, 84
Wattles Boys and Girls Club (9330 SE Harold)	85


Buckman Heights courtyard infiltration basins (430 NE 16th Ave.)



Buckman Heights courtyard infiltration basin (430 NE 16th Ave.)

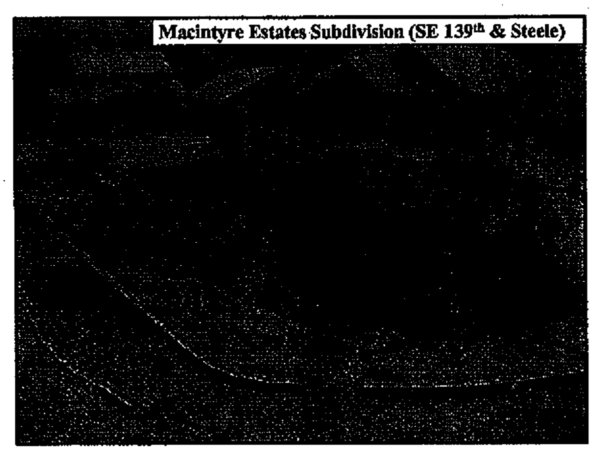
Buckman Heights courtyard planter overflow (430 NE 16th Ave.)



Glencoe Elementary School (825 SE 51st)

Glencoe Elementary School (825 SE 51st)

Macintyre Estates Subdivision (SE 139th & Steele)

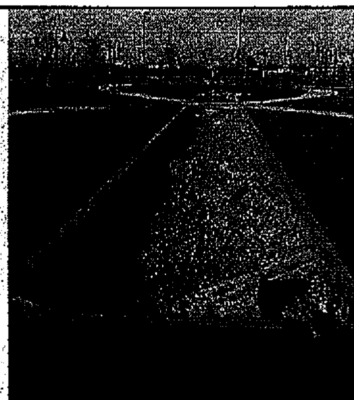


Macintyre Estates Subdivision (SE 139th & Steele)


Wattles Boys and Girls Club (9330 SE Harold)

Sand Filters

Site Location	Page/ Slide
Cascade Station (NE Airport Way & I-205)	87, 88

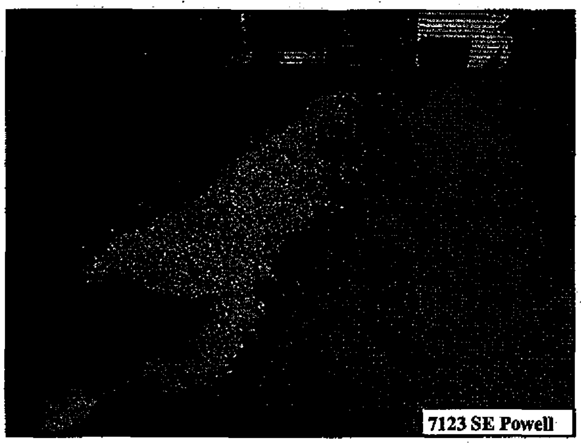

Cascade Station (NE Airport Way & I-205)

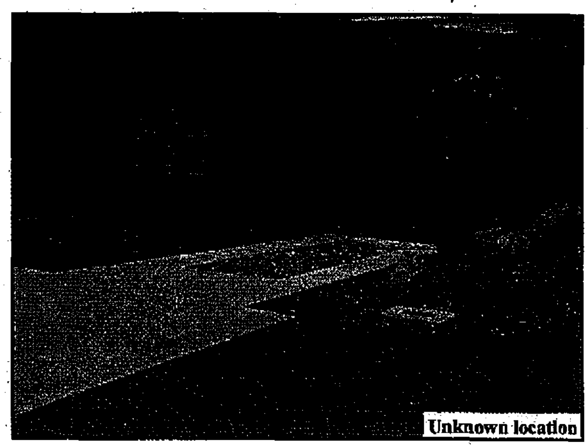

Cascade Station (NE Airport Way & I-205)

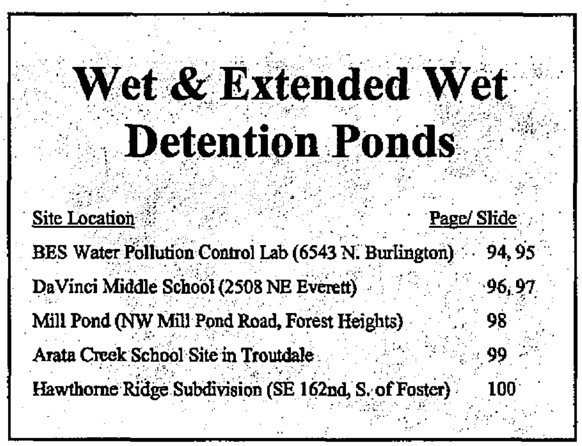
Soakage Trenches

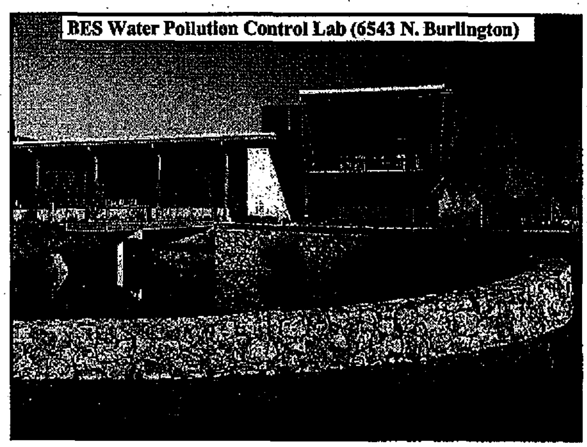
Site Location	Page/ Slide
7123 SE Powell	90, 91
Unknown location	92

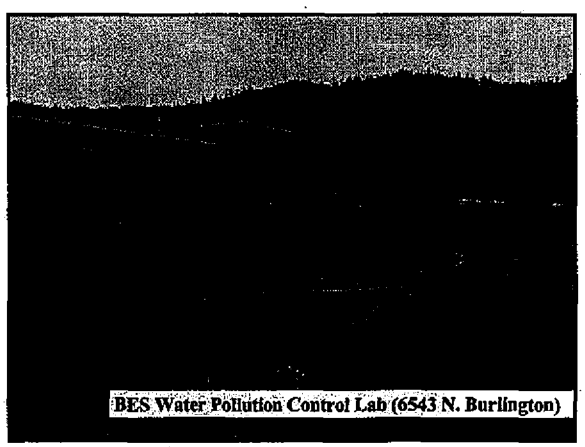

7123 SE Powell

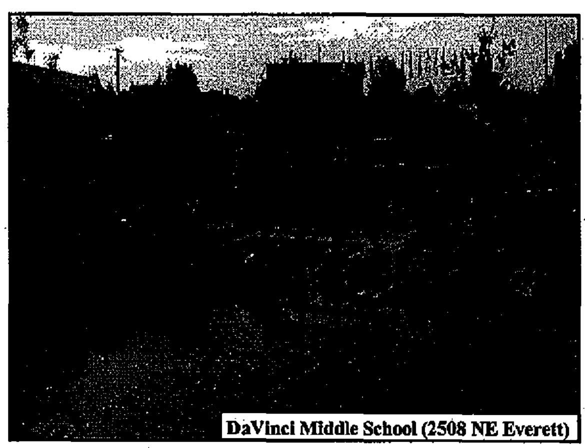

7123 SE Powell

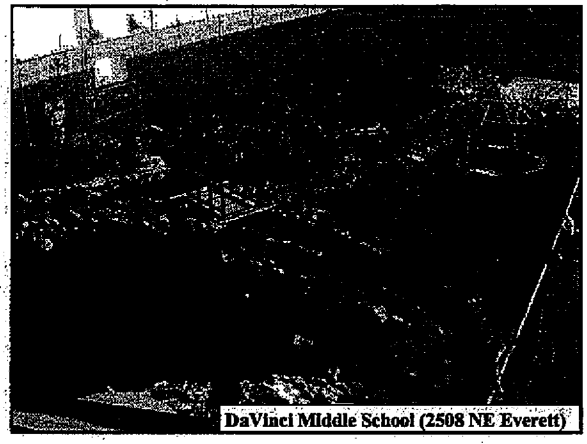

Unknown location

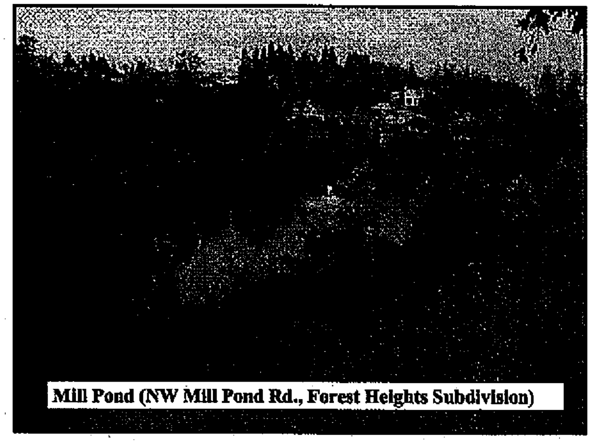

Wet & Extended Wet
Detention Ponds
Site Location Page/ Slide
BES Water Pollution Control Lab (6543 N. Burlington) 94, 95
DaVinci Middle School (2508 NE Everett) 96, 97
Mill Pond (NW Mill Pond Road, Forest Heights) 98
Arata Creek School Site in Troutdale 99
Hawthorne Ridge Subdivision (SE 162nd, S. of Foster) 100

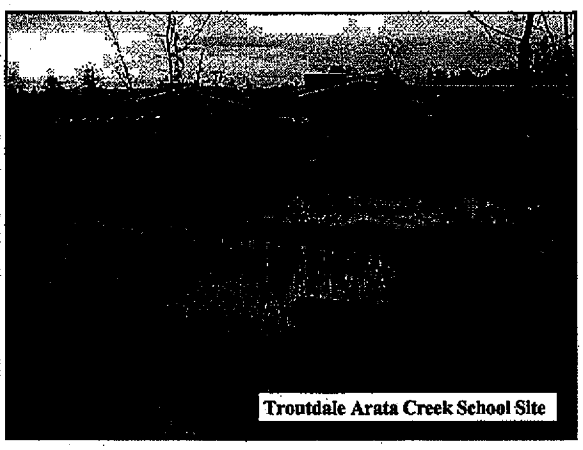

BES Water Pollution Control Lab (6543 N. Burlington)

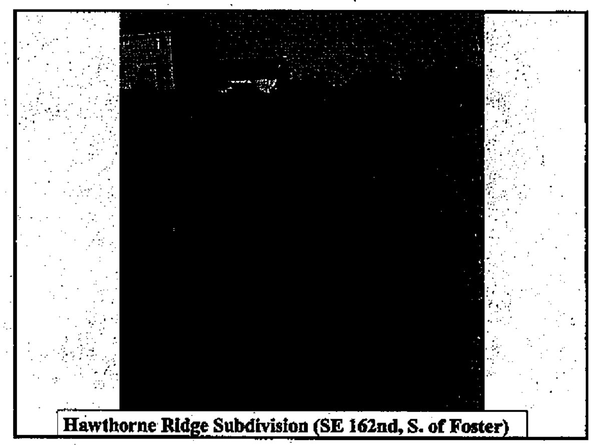

BES Water Pollution Control Lab (6543 N. Burlington)


DaVinci Middle School (2508 NE Everett)


DaVinci Middle School (2508 NE Everett)

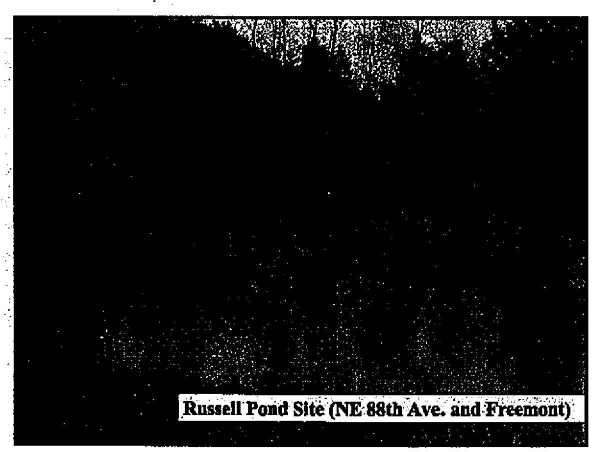

Mill Pond (NW Mill Pond Rd., Forest Heights Subdivision)


Troutdale Arata Creek School Site

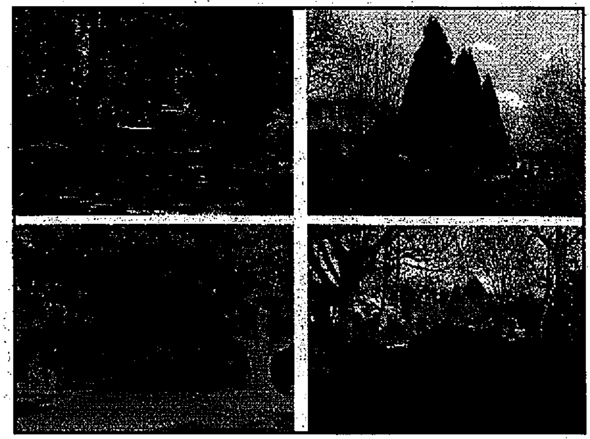

Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)

Constructed Treatment Wetlands

Site Location	Page/ Slide
Russell Pond Site (NE 88th & Freemont)	102

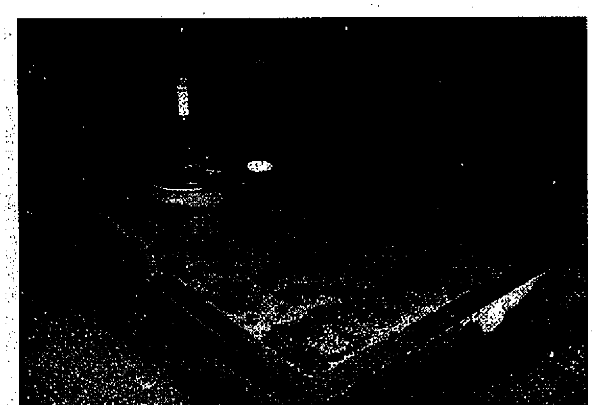

Russell Pond Site (NE 88th Ave. and Freemont)

Tree Credit Examples



Buckman Terrace tree preservation and at grade infiltration plante (303 NE 16th Ave.)

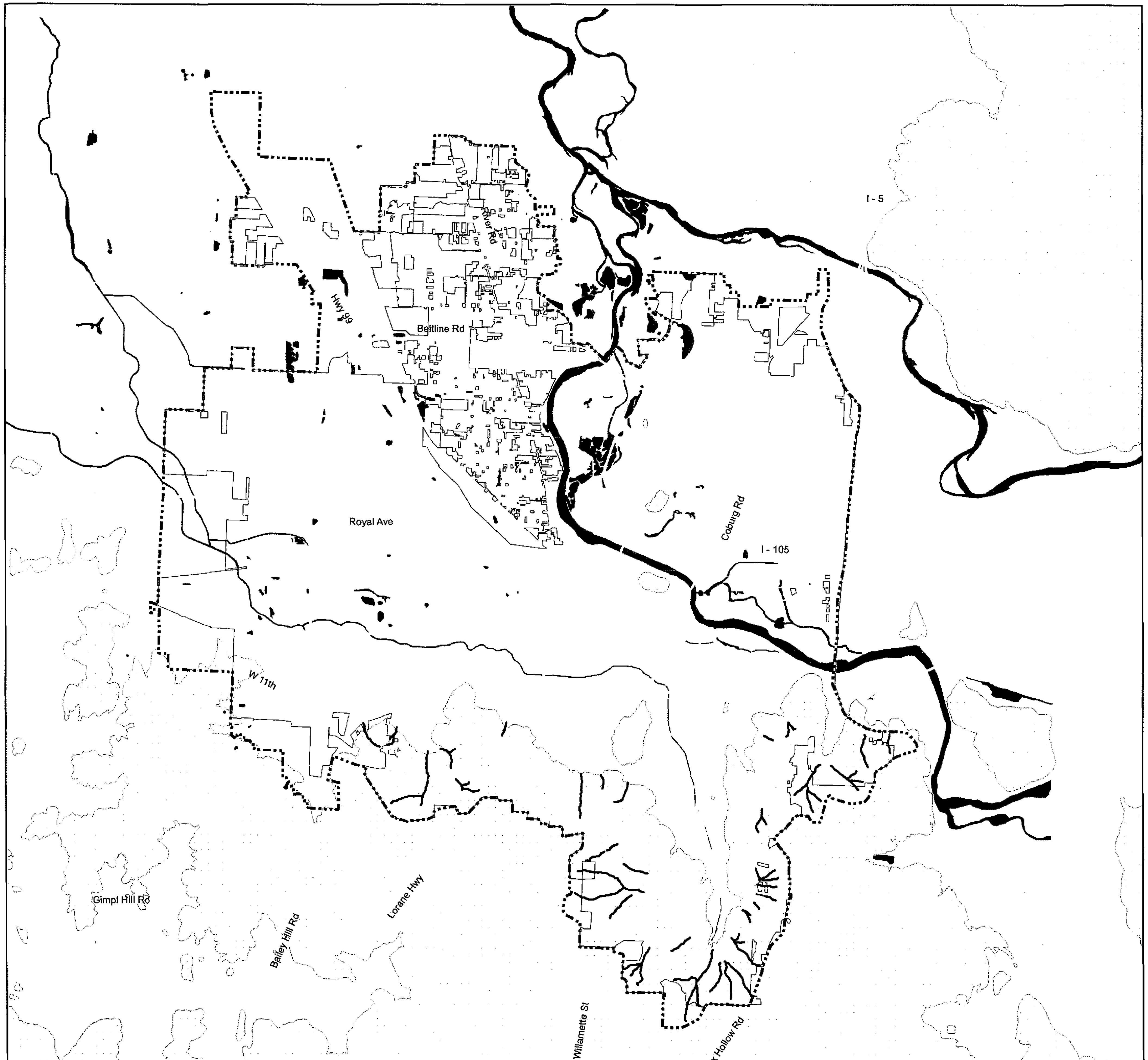
Rainwater Harvesting



Cistern at ONRC (5825 N. Greeley)

APPENDIX J

HEADWATERS STREAMS MAP



Headwaters Streams Map

LEGEND

Headwater Stream*

Eugene Urban Growth Boundary

City Limits

500 ft Elevation Line

Rivers and Streams

Definition:

* Headwater Streams: a waterbody having a minimum length of 500 feet and provides a drainage area of 10 acres or more, and is identified on the City of Eugene's Sensitive Areas Map having all or a portion of its length greater than 10% slope and affected by highly erodible soils

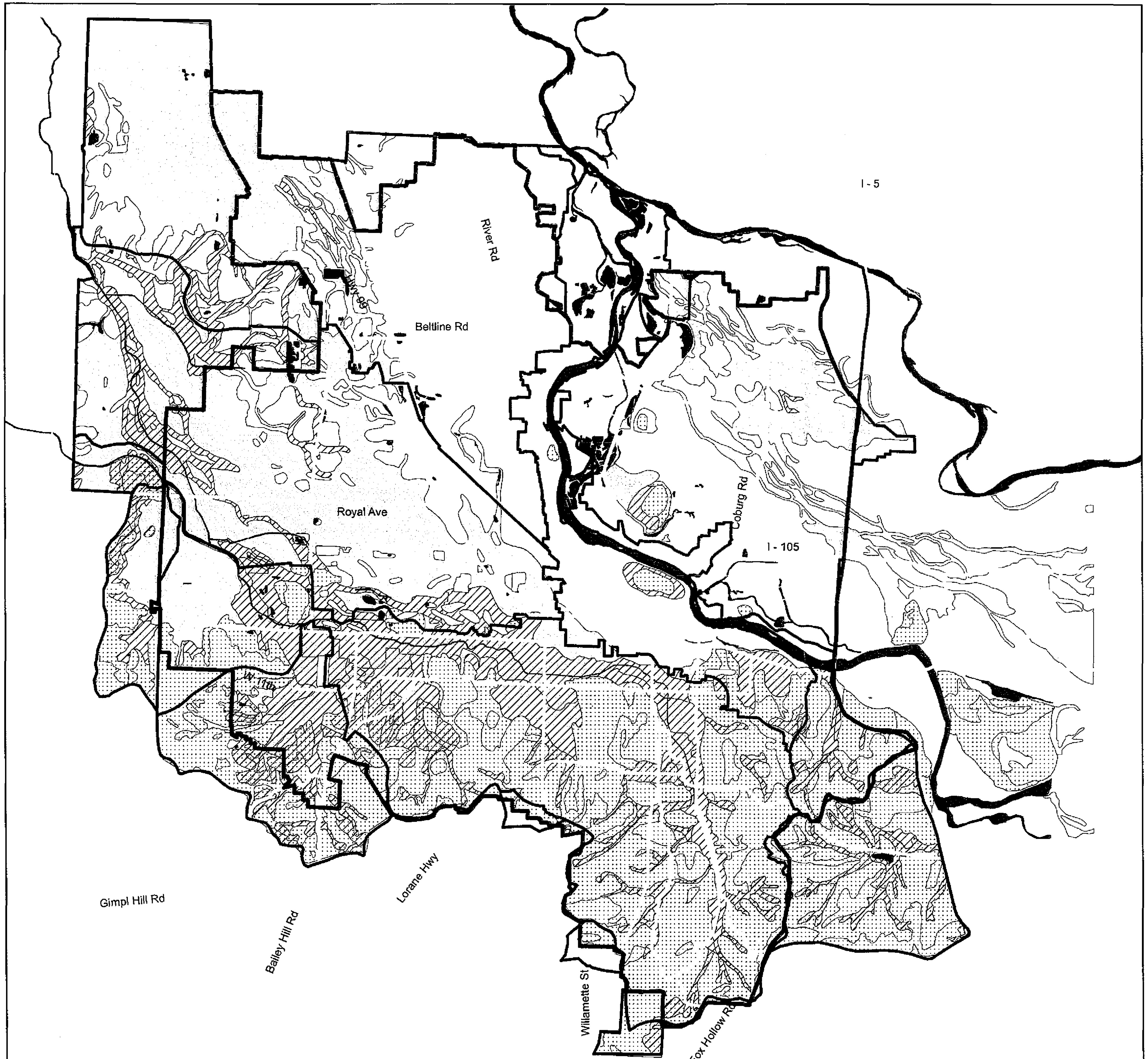
1 0.5 0 1 2 3 Miles

Map produced by City of Eugene PW Eng Info Team, June 02 2006 (ref# 0605-1467)

Map based on imprecise source data, subject to change

APPENDIX K

INFILTRATION LIMITED AREAS MAP



Infiltration Limited Areas

LEGEND

Eugene Urban Growth Boundary

Storm Water Basins

Rivers and Streams

Infiltration Limiting Criteria

Depth to Bedrock less than 5 feet*

Permeability less than 0.6 inches/hour*

Depth to Groundwater less than 6 feet*

Slopes greater than 15 percent

This map displays areas that are not likely to meet the City's proposed subsurface infiltration design requirements. Detailed site-specific information will be required for all proposed infiltration facilities whether required by the City or initiated by the property owner.

** from USDA Natural Resources Conservation Services*

Figure 1. Infiltration limited areas in Eugene

1 0.5 0 1 2 3 Miles

Map produced by City of Eugene PW Eng Info Team, May 25 2006 (ref# 0605-1467)

N

Map based on imprecise source data, subject to change

Oregon

Theodore R. Kulongoski, Governor

Department of Land Conservation and Development

635 Capitol Street NE, Suite 150
Salem, Oregon 97301-2524
Phone: (503) 373-0050
First Floor/Costal Fax: (503) 378-6033
Second Floor/Director's Office: (503) 378-5518
Web Address: http://www.oregon.gov/LCD

NOTICE OF ADOPTED AMENDMENT

July 25, 2006

TO: Subscribers to Notice of Adopted Plan or Land Use Regulation Amendments

FROM: Mara Ulloa, Plan Amendment Program Specialist

SUBJECT: City of Eugene Plan Amendment
DLCD File Number 001-06

The Department of Land Conservation and Development (DLCD) received the attached notice of adoption. Due to the size of amended material submitted, a complete copy has not been attached. A copy of the adopted plan amendment is available for review at the DLCD office in Salem and the local government office.

Appeal Procedures*

DLCD ACKNOWLEDGMENT or DEADLINE TO APPEAL: August 10, 2006

This amendment was submitted to DLCD for review 45 days prior to adoption. Pursuant to ORS 197.830 (2)(b) only persons who participated in the local government proceedings leading to adoption of the amendment are eligible to appeal this decision to the Land Use Board of Appeals (LUBA).

If you wish to appeal, you must file a notice of intent to appeal with the Land Use Board of Appeals (LUBA) no later than 21 days from the date the decision was mailed to you by the local government. If you have questions, check with the local government to determine the appeal deadline. Copies of the notice of intent to appeal must be served upon the local government and others who received written notice of the final decision from the local government. The notice of intent to appeal must be served and filed in the form and manner prescribed by LUBA, (OAR Chapter 661, Division 10). Please call LUBA at 503-373-1265, if you have questions about appeal procedures.

*__NOTE:__ **THE APPEAL DEADLINE IS BASED UPON THE DATE THE DECISION WAS MAILED BY LOCAL GOVERNMENT. A DECISION MAY HAVE BEEN MAILED TO YOU ON A DIFFERENT DATE THAN IT WAS MAILED TO DLCD. AS A RESULT YOUR APPEAL DEADLINE MAY BE EARLIER THAN THE ABOVE DATE SPECIFIED.**

Cc: Gloria Gardiner, DLCD Urban Planning Specialist
Marguerite Nabeta, DLCD Regional Representative
Amanda Punton, DLCD Natural Resource Specialist
Peggy Keppler, City of Eugene

<paa> yal

FORM 2 Notice of Adoption

THIS FORM MUST BE MAILED TO DLCD
WITHIN 5 WORKING DAYS AFTER THE FINAL DECISION
PER ORS 197.610, OAR CHAPTER 660 - DIVISION 18

DATE STAMP
DEPT OF
JUL 21 2006
LAND CONSERVATION AND DEVELOPMENT
For DLCD Use Only

Jurisdiction: City of Eugene
Local file number: None

Date of Adoption: 7/17/2006
Date Mailed: 7/20/2006

Date original Notice of Proposed Amendment was mailed to DLCD: 3/28/2006

- ☐ Comprehensive Plan Text Amendment
- ☐ Comprehensive Plan Map Amendment
- ☐ Land Use Regulation Amendment
- ☐ Zoning Map Amendment
- ☐ New Land Use Regulation
- ☒ Other: Land Use Decision - Administrative Order

Summarize the adopted amendment. Do not use technical terms. Do not write "See Attached".

The administrative order adopts the Stormwater Management Manual required by Eugene Code (EC) 9.6790. The Stormwater Management Manual sets forth stormwater facility design requirements, operation and maintenance provisions, and source control requirements. The Stormwater Management Manual is consistent with the goals set forth in EC 9.6790 and is intended to protect life and property from flood drainage hazards, reduce impacts of urbanization on the City's water quality, protect headwater areas from erosive affects of increased stormwater runoff, protect the City's stormwater system from oil and grease, and prevent stormwater pollution by eliminating pathways that introduce pollutants into stormwater.

Describe how the adopted amendment differs from the proposed amendment. If it is the same, write "SAME". If you did not give Notice for the Proposed Amendment, write "N/A".

Added section 1.9 to Chapter 1.0, Credits and Incentives for Private Stormwater Facilities, deleted subsections 2.7.1 and 2.7.2 from Chapter 2, Landscape Application and Landscape Design and Management, deleted vegetated swale and street swale from Exhibit 2-1, revised the introduction to the Manufactured Treatment Technology section (Chapter 2), various technical edits and grammatical corrections.

Plan Map Changed from: N/A to:

Zone Map Changed from: N/A to:

Location: N/A
Acres Involved:

Specify Density: Previous: N/A
New:

Applicable Statewide Planning Goals: 1, 2 and 6

Was and Exception Adopted? ☐ YES ☒ NO

DLCD File No.: 001-06 (15118)

Did the Department of Land Conservation and Development receive a Notice of Proposed Amendment......

Forty-five (45) days prior to first evidentiary hearing? ☒ Yes ☐ No

If no, do the statewide planning goals apply? ☐ Yes ☐ No

If no, did Emergency Circumstances require immediate adoption? ☐ Yes ☐ No

Affected State or Federal Agencies, Local Governments or Special Districts:

City of Eugene

Local Contact: Peggy Keppler Phone: (541) 682-2869 Extension:

Address: 858 Pearl Street, First Floor City: Eugene

Zip Code + 4: 97401-2727 Email Address: peggy.a.keppler@ci.eugene.or.us

ADOPTION SUBMITTAL REQUIREMENTS

This form **must be mailed** to DLCD **within 5 working days after the final decision** per ORS 197.610, OAR Chapter 660 - Division 18.

1. Send this Form and **TWO (2) Copies** of the Adopted Amendment to:

ATTENTION: PLAN AMENDMENT SPECIALIST
DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT
635 CAPITOL STREET NE, SUITE 150
SALEM, OREGON 97301-2540

2. Submit **TWO (2) copies** the adopted material, if copies are bounded please submit **TWO (2) complete copies** of documents and maps.

3. Please Note: Adopted materials must be sent to DLCD not later than **FIVE (5) working days** following the date of the final decision on the amendment.

4. Submittal of this Notice of Adoption must include the text of the amendment plus adopted findings and supplementary information.

5. The deadline to appeal will not be extended if you submit this notice of adoption within five working days of the final decision. Appeals to LUBA may be filed within **TWENTY-ONE (21) days** of the date, the Notice of Adoption is sent to DLCD.

6. In addition to sending the Notice of Adoption to DLCD, you must notify persons who participated in the local hearing and requested notice of the final decision.

7. **Need More Copies?** You can copy this form on to 8-1/2x11 green paper only; or call the DLCD Office at (503) 373-0050; or Fax your request to:(503) 378-5518; or Email your request to **mara.ulloa@state.or.us** - ATTENTION: PLAN AMENDMENT SPECIALIST.

ADMINISTRATIVE ORDER NO. 58-06-06-F
of the
City Manager of the City of Eugene

ADOPTING THE STORMWATER MANAGEMENT MANUAL.

The City Manager of the City of Eugene finds as follows:

A. Section 2.019 of the Eugene Code, 1971 (EC) authorizes the City Manager to adopt rules for administration and implementation of any provisions of that Code. In addition, EC 9.6790, added to the Code by Ordinance No. 20369 adopted by the City Council on June 12, 2006, requires that the City Manager adopt, in accordance with EC 2.019, a Stormwater Management Manual. The Stormwater Management Manual may contain forms and facility agreements and shall include requirements that are consistent with delineated goals.

B. In accordance with the procedures set forth therein, on May 2, 2006, the City Manager issued Administrative Order No. 58-06-06 proposing the adoption of the Stormwater Management Manual. Notice was posted at the City Manager's office, 777 Pearl Street, at Public Works Engineering, 858 Pearl Street, and at the Eugene Library Reference Center, and was published in the Register Guard, a newspaper of general circulation on May 7, 8, 9, 10 and 11, 2006. The proposed Stormwater Management Manual was made available for review at the City Manager's Office, at Public Works Engineering, and at the Eugene Library Reference Center. Additionally, notice of the proposed adoption of the Stormwater Management Manual was sent to the Department of Land Conservation and Development on March 28, 2006.

C. The notice provided that interested persons could submit written comments thereon for a period of thirty (30) days from the first date of publication, or at the public hearing to be held on June 8, 2006, at 4:00 p.m. at 858 Pearl Street, Lyle Conference Room, Eugene, Oregon. Written comments were received from Rob Handy, Becky Riley, Jerry Finigan, Teresa Damron, Kate Perle, Ellen Hyman, Rachel DeBuse, Tammie Stark, Megan Kemple, Jenya Lemeshow, and Bruce H. Anderson.

D. The following comments were received in response to this notice, or at the June 8, 2006 public hearing, to which I make the following specific findings:

<u>Comment 1</u>: Eugene needs to do more to preserve natural drainage systems in the urban area.

Finding: Concern was expressed during the stormwater development standards ordinance adoption and manual review that, upon development, roadside swales and open waterways would be replaced with engineered (piped) systems for conveying stormwater. Residents stated that, given their multiple benefits, roadside ditches, swales and open waterways should be preserved and utilized rather than replaced by piped systems. The citizens urged Council to take steps to preserve these natural drainage systems.

The type of system used to convey stormwater is not dictated by the recently adopted stormwater development standards Code provisions, existing City Code, existing design standards, or the proposed Stormwater Management Manual, but rather is decided based upon feasibility, cost, and preference. And nothing in the recently adopted Code provisions, existing City Code provisions, existing design standards or the proposed Stormwater Management Manual prohibits the use of natural drainage systems for stormwater. The type of system used to convey stormwater is typically decided based upon feasibility, cost, and preference. No changes have been made as a result of this comment.

Comment 2. Explore "low impact development" standards.

Finding: Staff will continue to research stormwater management technology and incorporate strategies and methodologies that preserve and enhance water quality during updates to the Manual. The Stormwater Management Manual will be reviewed and updated on a regular basis to incorporate improved technology. This comment did not request or require any changes to the Manual.

Comment 3: Rainwater Harvesting. A number of citizens testified at the public hearing on the manual (and also on the ordinance) and submitted written testimony requesting that the city encourage and support rainwater harvesting.

Finding: Rainwater harvesting is one of the approved stormwater facilities listed in the Stormwater Management Manual. Neither the Code provisions nor the Manual require an applicant to use a specific facility or disallows an applicant from using any of the approved facilities. Rainwater harvesting can be a useful tool for irrigation, water conservation, and stormwater mitigation. The Stormwater Management Manual identifies which facilities qualify for pollution reduction, flow control, and destination and then describes how to design, operate and maintain the facilities to meet stormwater mitigation. Rainwater harvesting, through the use of cisterns and storage tanks, may be used for pollution reduction and flow control. The Manual does not regulate uses of the harvested water.

Testimony at the public hearing stated that the Manual is too onerous for residential applications and that it discourages home owners from implementing rainwater harvesting. The Manual is not intended to discourage rainwater harvesting or water conservation. Staff will work with Eugene Water & Electric Board staff and Eugene Building Permit staff to develop a fact sheet/information brochure on residential rainwater harvesting.

To address this concern, a statement has been added to the Manual clarifying that these design standards pertain only to stormwater management regulated by the provisions of the Eugene Code, 1971 added or amended by Ordinance 20369 and development permit applications requesting stormwater SDC credits. Aspects of the installation and use of rainwater harvesting systems may be regulated by State of Oregon structural and plumbing codes, as well as local land use regulations. Permitting requirements, separate from stormwater facilities information in the Stormwater Management Manual, will apply.

<u>Comment 4</u>: Adoption of the stormwater management manual preempts the completion of River Road/Santa Clara Stormwater Basin Plan. Several persons from the River Road and Santa Clara neighborhoods asked that the city refrain from adopting the Manual until after the Basin Plan was completed.

Finding: EC 9.6790, which was added to the Code by Ordinance 20369 adopted by the City Council on June 12, 2006, directs the City Manager to adopt a stormwater facility design manual. The Code provisions adopted by Ordinance 20369 and the River Road/Santa Clara Stormwater Basin Plan are complimentary but independent of each other. Given the in-depth analysis and comparison of options for addressing runoff from new development that was done in the earlier basin planning process, the consistent outcome for all of the other six basins, and the benefits of applying consistent stormwater quality development standards city-wide, additional analysis on that point is not a part of the current work plan. The draft River Road/Santa Clara Basin Plan reflects that implementing on-site stormwater development standards city-wide is the most appropriate strategy for addressing the water quality impacts associated with future development and it is not expected that the River Road/Santa Clara Basin Plan will result in any changes to the stormwater development standards Code provisions.

Delaying adoption of the Stormwater Management Manual pending completion of the River Road/Santa Clara Basin Plan is not warranted given that the City Manager is directed by EC 9.6790 to adopt the Manual and because the River Road/Santa Clara Basin Plan is independent of the stormwater management regulations and design standards. Therefore, no changes have been made as a result of this comment.

<u>Comment 5</u>: Why is it implied that the River Road/Santa Clara Basin has drainage and flood protection strategies?

Finding: Even though the 2002 City of Eugene Stormwater Basin Master Plans did not finalize the River Road/Santa Clara Basin Plan, Volume I of the 2002 Basin Plans (City-Wide Summary) and the 1990 River Road – Santa Clara Drainage Master Plan completed by OTAK does provide the drainage and flood strategies for River Road/Santa Clara. This comment was not directed at any changes to the Manual.

<u>Comment 6</u>: The following specific language changes to suggested: Sec. 1.3 add "and propane dealers" to Bulk Fuel Terminal; define "Urban Transition Area"; Sec. 1.4 add "increased level of pollutants discharged into rivers and streams" to development impacts; include "and increased volumes of pollutants" to "increases in stormwater runoff peak flow rates and volumes resulting from development"; include "and development" to "post-development site"; Sec. 2.2 change "intended to save the project developer and the city time

and expense" to "intended to mimic the natural hydrologic cycle by slowing and infiltrating stormwater, and save"; add "and should be encouraged where conditions allow for favorable outcomes" to "these facilities help infiltrate or retain water on-site"; change "were developed as a simple and quick tool" to "were developed as an effective, simple and quick tool"; Sec. 4.1.1 include "outdoor motorized vehicle sales and storage" to site uses and characteristics that trigger source controls; Sec 4.1.3 add "and other surface runoff" to "signage is required for certain site uses and activities that may pollute stormwater"; change "need to be" to "must be"; Sec. 4.5.1 add "herbicides and creosote treated wood products" to high risk category; Sec. 4.8.2 add "no net increase of runoff shall result from private construction dewatering activities" to construction dewatering.

Finding: Staff reviewed the proposed language changes to the Manual and incorporated two language changes that clarified the intent and purpose of the facilities. The other comments were not included because the comments are not necessary or helpful in administering the Manual.

Comment 7: Can driveways be paved with pervious materials?

Finding: Yes, porous asphalt and concrete materials are available. Inquiry and response only.

Comment 8: Who is accountable for stormwater management facilities that receive stormwater runoff from public right of way?

Finding: City maintenance crews will operate and maintain facilities that are in public rights of way and public easements. Inquiry and response only.

Comment 9: Can't runoff be generated by events other than rain, i.e. 'home' car washing, pressure washing?

Finding: Yes, but the volume of runoff generated by these types of activities does not impact the design of stormwater facilities. These activities are addressed by the city's stormwater education program (to encourage water quality friendly approaches to car washing, for example) and the city's illicit discharge and spill response programs (which include enforcement for illegal discharges to the municipal stormwater system). Inquiry and response only.

Comment 10: Would a drywell be an authorized pretreatment facility for the paved area beneath the cover over fuel dispensing facilities and its surrounding traffic areas?

Finding: No. Inquiry and response only.

Comment 11: There should be a definition that applies to the River Road/Santa Clara area (urban transition area).

Finding: The River Road/Santa Clara area and urban transition areas are already identified in the City Code and land use regulations. As such, no changes were made to the design manual.

<u>Comment 12</u>: Will all pollution reduction and flow control facilities designed using the SIM form always comply with the requirements, regardless of location and surrounding level of urbanization?

Finding: Yes, the sizing factors were developed based on the most conservative design parameters, including the lowest infiltration rates, and impervious surface area at full build-out based upon Metro Plan land use designations. Inquiry and response only.

<u>Comment 13</u>: Will the performance approach for downsizing facilities be allowed when headwater flow controls are not required?

Finding: Yes. The performance approach is an alternative to the simplified approach to sizing facilities. The performance approach may be used for sizing pollution reduction and/or flow control facilities regardless of location, and requires calculations to verify that a facility design meets the requirements for a particular site. The simplified approach assumes (conservatively) that both pollution reduction and flow control requirements apply. In non-headwaters areas, where flow control requirements do not apply, the manual indicates that the performance approach may be used to downsize facilities, in acknowledgement that by using the simplified approach a facility may be over-designed.

Application of flow control requirements is limited to the headwaters area due to its unique physical characteristics that make it especially vulnerable to erosion and downcutting of streams and drainages with steep slopes, highly erodible soils, and high runoff velocities during rainfall events. Inquiry and response only.

<u>Comment 14</u>: Can initial feasibility testing for infiltration be waived if existing testing data is on file, regardless of the date?

Finding: Yes, provided the site is unchanged. Inquiry and response only.

<u>Comment 15</u>: What provisions for access for operation and maintenance will/should be applied in the River Road/Santa Clara basin?

Finding: Applicants are required to submit an operation and maintenance plan which describes and visually depicts access to the facility for operations and maintenance purposes. The Eugene Code, 1971 requires that all stormwater facilities constructed pursuant to code requirements be operated and maintained by the owner. Applicants requesting city maintenance of their proposed facilities, must provided access for city equipment before the city will enter into an agreement with the applicant to take on maintenance responsibilities. Inquiry and response only.

Comment 16: **Public stormwater facilities shall be designed so permanent long-term irrigation systems are not needed. What about private stormwater management facilities?**

Finding: Methods of irrigation for private facilities is up to the applicant. Plantings are an essential element for many of the various treatment systems. The applicant will be required to maintain the vegetative aspects of the facilities. Failure to properly maintain the facilities will be considered a public nuisance and enforcement policies are established in Chapter 6 of the Eugene code. Inquiry and response only.

Comment 17: **Shut off valves are required to protect the city sewer systems or onsite infiltration facilities. What would these facilities be in the River Road/Santa Clara?**

Finding: Shut off valves are required at fuel dispensing facilities and are intended to protect both the wastewater and stormwater systems depending on where a contamination spill may occur. The covered area over the fuel dispensing area drains to the city wastewater system or an approved pretreatment facility. A shut off valve is required to be installed before the domestic wastewater tie-in. This valve remains closed and only opened to allow incidental drainage. The uncovered areas surrounding the fueling pads drain to an approved pollution reduction facility before discharging to an approved destination stormwater facility. A shut off valve is required before the approved discharge point. The valves remain open to facilitate stormwater flows and shall be immediately closed in the event of a spill. The Manual was edited to clarify this intent.

Comment 18: **Liquid materials shall be stored and contained in such a manner that if the container(s) is ruptured, the contents will not discharge, flow, or be washed into the a receiving system. Could the "drainage system" include drywells?**

Finding: Yes. Inquiry and response only.

Comment 19: **Is pavement for all the *solid waste storage areas, containers, and trash compactors* (specifically the multi-residential) going to add unnecessary impervious surfaces to the River Road/Santa Clara Basin?**

Finding: No. To best serve water quality goals there are cases where pervious pavements are not appropriate. Impervious pavement is used in areas where solid waste, etc., is stored to keep containments that spill or leach from the contained material from infiltrating into the soil. Inquiry and response only.

Comment 20: **Can the paved waste storage area required under a structural cover or trash compactor be paved using pervious pavers? Can the paved material transfer areas required under and around loading and unloading areas be paved using pervious pavers? Can wash pads under and around washing activities be pervious pavement?**

Finding: No. See findings for comment 19.

<u>Comment 21</u>: Non-gravity drainage options for paved surfaces under *solid waste storage areas, containers, and trash compactors:* Activity areas that do not have gravity wastewater service can install a pressurized system. Are either of these viable options in the River Road/Santa Clara Basin? Non-gravity drainage options for paved surfaces under *Material transfer areas/loading docks:* Activity areas that cannot achieve gravity wastewater service may be allowed to install a pressurized system. Is this appropriate in the River Road/Santa Clara Basin?

Finding: Yes, both options are viable. Pressurized systems are only necessary when the paved surface is lower than the wastewater tie-in. Inquiry and response only.

<u>Comment 22</u>: Soil management in section 4.8.2 of the *Manual* should specify minimum weight standard for temporary plastic sheeting covering stockpiles.

Finding: Protecting stockpiles of contaminated soils from coming into contact with stormwater with plastic film or sheeting is a temporary requirement. Contaminated soils must be decontaminated or removed to an approved disposal site. While the contaminated soils remain, the general outcome of this requirement of this section is that applicants apply a plastic material that prevents stormwater from coming into contact with the stockpiled materials. Materials that fail to meet this requirement will be in violation of the Code and the applicant will be instructed to replace the materials with another at their own cost. No changes were made as a result of this comment.

<u>Comment 23</u>: In regards to 4.8.2 (3) Post-Construction Surface Drainage Systems, with increased density in the River Road/Santa Clara Basin, how will a system of virtually 100% private on site infiltration systems impact the management of stormwater flows and pollutants into the East Santa Clara Waterway?

Finding: As related to *Stormwater and Groundwater Management for Development on Land with Suspected or Known Contamination*, post construction surface drainage systems have four methods of approved disposal. Both of the infiltration alternatives and the disposal into a receiving stream require the applicant to obtain authorization from the city and the Oregon Department of Environmental Quality. The Army Corps of Engineers must also authorize disposal into a receiving stream. Development applications that come into the city for review that show 100% on-site infiltration will have minimal impact on the East Santa Clara waterway. Retaining the flows on site will reduce the peak flows in the stream and pollutants will be collected and treated at the site. Inquiry and response only.

I. Staff has recommended that the Stormwater Management Manual be adopted as amended in response to the comments received. I concur with that recommendation and find that adoption of the Stormwater Management Manual as attached hereto as Exhibit B is necessary in order to meet the requirements of Section 9.6790 of the Eugene Code, 1971.

Now, therefore, based on the above findings, the findings in Administrative Order 58-06-06, the legislative findings attached hereto as Exhibit A, which are adopted in support of this Administrative Order, I hereby order that:

1. The Stormwater Management Manual, a copy of which is attached hereto as Exhibit B, is hereby adopted

2. The Stormwater Management Manual Appendix A is included for informational purposes only, and is not adopted by this Administrative Order.

Dated and effective this 17th day of July, 2006.

Dennis M. Taylor
City Manager

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EXHIBIT A

FINDINGS IN SUPPORT OF THE ADOPTION OF ADMINISTRATIVE ORDER NO. 58-06-06-F

Introduction

The City of Eugene has added provisions to Chapter 9 of the Eugene Code (EC), the City of Eugene's adopted land use code, in order to protect life and property from flood and drainage hazards, reduce the impacts that urbanization is having on the City's water quality, protect waterways in the headwater areas from erosive affects of increases in stormwater runoff, protect the City's stormwater system from oil and grease from stormwater runoff, and prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater (hereinafter referred to as "the Stormwater Regulations"). The Stormwater Regulations will require that developers comply with standards that are based, in part, on facilities and methodologies set forth in the Stormwater Management Manual. The Stormwater Regulations provide that the Stormwater Management Manual will be adopted by the City in the manner set forth in EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures.

This administrative order that adopts the Stormwater Management Manual is a not a land use regulation. However, the administrative order, that implements the City's adopted land use code, is potentially a land use decision. The City recognizes that state law does not require a local government to show compliance with the Statewide Planning Goals when making an administrative land use decision. However, because the administrative order implements an acknowledged land use regulation (the City's adopted land use code), the findings set forth below are intended to demonstrate that the standards are consistent with the Statewide Planning Goals.

Findings of Consistency with the Statewide Planning Goals

(1) The administrative order is consistent with applicable statewide planning goals adopted by the Land Conservation and Development Commission.

<u>Goal 1 - Citizen Involvement</u>. *To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.*

The City has acknowledged provisions for citizen involvement that insure the opportunity for citizens to be involved in all phases of the planning process and set out requirements for such involvement. The action taken did not amend the citizen involvement program.

Throughout the Stormwater Management Manual drafting process, the City provided numerous opportunities for citizen involvement. The City initiated the public involvement in 1999 when it convened a fourteen-member Stormwater Department Advisory Committee (DAC) to provide feedback to Eugene Public Works on the results of the Stormwater Basin Planning efforts. The 1999

DAC met from February 1999 through June 2000. The result of this long-term planning effort was called the proposed "stormwater management strategy," and included a capital project list, waterway protection measures and stormwater development standards. The 1999 DAC approved, with some modification, city staff's proposed stormwater management strategy. This stormwater management strategy served as the starting point for the Water Quality Implementation DAC Subcommittee (the 2005 DAC).

City staff conducted broader public outreach from October 2000 through May 2001 on the proposed stormwater management strategy (*i.e.,* capital projects list and proposed stormwater development standards) to receive further community feedback. This outreach included presentations to 10 neighborhood groups, as well as the Neighborhood Leaders Council, Long Tom Watershed Council, League of Women Voters, American Society of Landscape Architects and Oregon Landscape Contractors.

The 2005 DAC was initiated in August 2005. The membership of the 2005 DAC included representatives of special interests (Chamber of Commerce, Lane County Home Builders' Association, Citizens for Public Accountability); technical expertise in architecture, engineering, site design, land use and the environment; and a neighborhood representative. The Committee met six times between August and November 2005 to review and provide input on the draft Stormwater Development Standards ordinance (August 8, August 25, October 3, October 25, October 31 and November 10).

On June 8, 2006, a public hearing was held. Department of Land Conservation and Development notice, notice to interested parties and newspaper publication was provided for that hearing.

The process for adopting this administrative order complies with Goal 1 because it complies with, and surpasses, the requirements of the State's citizen involvement provisions.

<u>Goal 2 - Land Use Planning</u>. *To establish a land use planning process and policy framework as a basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.*

The record shows that there is an adequate factual base for the adoption of this administrative order.

Goal 2 requires that plans be coordinated with the plans of affected governmental units and that opportunities be provided for review and comment by affected governmental units. The Goal 2 coordination requirement is met when the City engages in an exchange, or invites such an exchange, between the City and any affected governmental unit and when the City uses the information obtained in the exchange to balance the needs of the citizens. This administrative order does not affect any other governmental units.

There are no Goal 2 exceptions required for this administrative order. Therefore, the administrative order is consistent with Goal 2.

Goal 3 - Agricultural Lands. To preserve and maintain agricultural lands.

The administrative order applies to property located within the urban growth boundary and does not affect any land designated for agricultural use. Therefore, Goal 3 does not apply.

Goal 4 - Forest Lands. To conserve forest lands by maintaining the forest land base and to protect the state's forest economy

The administrative order applies to property located within the urban growth boundary and does not affect any land designated for forest use. Therefore, Goal 4 does not apply.

Goal 5 - Natural Resources, Scenic and Historic Areas, and Open Spaces. To protect natural resources and conserve scenic and historic areas and open spaces.

The administrative order does not create or amend the City's list of Goal 5 resources, does not amend a code provision adopted in order to protect a significant Goal 5 resource or to address specific requirements of Goal 5, does not allow new uses that could be conflicting uses with a significant Goal 5 resource site and does not amend the acknowledged urban growth boundary. Therefore, Goal 5 does not apply.

Goal 6 - Air, Water and Land Resources Quality. To maintain and improve the quality of the air, water and land resources of the state.

Goal 6 addresses waste and process discharges from development, and is aimed at protecting air, water and land from impacts of those discharges. This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as groundwater pollution.

The proposed administrative order will implement the City's Stormwater Development Standards is one component of the larger Stormwater Program initiated by the Oregon Department of Environmental Quality (DEQ)'s approval of the City's National Pollutant Discharge Elimination System (NPDES) permit. The City's NPDES Stormwater permit, first issued by DEQ in 1994, and subsequently re-issued in March 2004, includes measures which in total fulfill the applicable federal Clean Water Act requirements for large municipalities over 100,000 in population.

The proposed administrative order will provide the stormwater facility design specifics, operation and maintenance requirements and specific source control requirements that will work in tandem with the City's Stormwater Development Standards. The Stormwater Development Standards will regulate the location, design, construction, and maintenance of stormwater facilities that capture and treat stormwater runoff from new development and significant re-development to reduce impacts that urbanization has on water quality; protect waterways in headwater areas from the erosive effects of increased stormwater runoff peak flow rates and volumes resulting from development; restrict the discharge of oil and grease from land uses that produce high concentrations of these pollutants; and prevent stormwater pollution by eliminating pathways that may introduce pollutants. This administrative order is consistent with the City's existing measure to provide for clean air, water and land resources; therefore, these amendments are consistent with Goal 6.

Goal 7 - Areas Subject to Natural Disasters and Hazards. To protect people and property from natural hazards.

The administrative order does not affect the City's restrictions on development in areas subject to natural hazards. Further, the administrative order does not allow for new development that could result in a natural hazard. Therefore, Goal 7 does not apply.

Goal 8 - Recreational Needs. To satisfy the recreational needs of the citizens of the state and visitors and, where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

The administrative order does not affect the City's provisions for recreation areas, facilities or recreational opportunities. Therefore, Goal 8 does not apply.

Goal 9 - Economic Development. To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.

The administrative order does not impact the supply of industrial or commercial lands. Therefore, the administrative order is consistent with Goal 9. The administrative order does not render any property unusable for commercial or industrial uses. In fact, the Stormwater Development Standards, the standards that the proposed administrative order will implement, are drafted to ensure that neither the administrative order nor the code provisions that the administrative order is implementing have such an effect on a property. Those provisions are:

1. The pollution reduction and flow control regulations do not apply to: (1) land use applications that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development; (2) development permit applications that will result in less than 1,000 square feet of new or replaced impervious surface within a 12-month period; (3) development permit applications to construct or alter one- or two-family dwellings; or, (4) development permit applications to replace more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system on the development site.

2. An applicant can seek an adjustment to the requirement that the selected pollution reduction facilities treat all of the stormwater runoff that will result from the water quality design storm if the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious

surface and is isolated from the pollution reduction facility; (2) the area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

3. An applicant can seek an adjustment to the requirement that all pollution reduction facilities must be selected, sited and constructed in accordance with the Stormwater Management Manual and that all facilities must be designed using one of the three methodologies outlined in the Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

4. An applicant can seek an adjustment to the requirement that the applicant demonstrate that peak rates of flow delivered to an existing open waterway at a point above 500 feet will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the subject development if the proposed flow control facility will control flow rates as much as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility; (2) the area generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

5. An applicant can seek an adjustment to the requirement that all flow control facilities must be selected from and sited, designed and constructed according to the Stormwater Management Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

6. An applicant can seek an adjustment to the requirement that all oil control facilities be sited,

designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Manual.

7. An applicant can seek an adjustment to the requirement that all source controls be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Manual.

Considering the above-listed provisions in the Stormwater Development Standards, the application of this administrative order to a property zoned and designated for commercial or industrial use does not result in a diminution in the area's supply of commercial or industrial land. Therefore, this administrative order is consistent with Goal 9.

<u>Goal 10 - Housing</u>. To provide for the housing needs of citizens of the state.

The administrative order does not impact the supply of residential lands. Therefore, the administrative order is consistent with Goal 10. The administrative order does not render any property unusable for residential uses. In fact, the Stormwater Development Standards, the standards that the proposed administrative order will implement, are drafted to ensure that neither the administrative order nor the code provisions that the administrative order is implementing have such an effect on a property. Those provisions are:

1. The pollution reduction and flow control regulations do not apply to: (1) land use applications that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development; (2) development permit applications that will result in less than 1,000 square feet of new or replaced impervious surface within a 12-month period; (3) development permit applications to construct or alter one- or two-family dwellings; or, (4) development permit applications to replace more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system on the development site.

2. An applicant can seek an adjustment to the requirement that the selected pollution reduction facilities treat all of the stormwater runoff that will result from the water quality design storm if the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the pollution reduction facility; (2) the area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

3. An applicant can seek an adjustment to the requirement that all pollution reduction facilities must be selected, sited and constructed in accordance with the Stormwater Management Manual and that all facilities must be designed using one of the three methodologies outlined in the Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

4. An applicant can seek an adjustment to the requirement that the applicant demonstrate that peak rates of flow delivered to an existing open waterway at a point above 500 feet will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the subject development if the proposed flow control facility will control flow rates as much as possible and one of the following applies: (1) the area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility; (2) the area generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility; (3) constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage other natural resources; or, (4) the area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

5. An applicant can seek an adjustment to the requirement that all flow control facilities must be selected from and sited, designed and constructed according to the Stormwater Management Manual if all of the following requirements are met: (1) the proposed alternative design will achieve equal, or superior, results for reducing pollution, maintainability and safety and the proposed siting does not adversely affect structures or other properties; (2) the applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer; (3) the applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design; and, (4) the applicant has submitted a signed statement that the applicant will replace the alternative facility if the facility does not function as proposed.

6. An applicant can seek an adjustment to the requirement that all oil control facilities be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Manual.

7. An applicant can seek an adjustment to the requirement that all source controls be sited, designed and constructed according to the Stormwater Management Manual if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Manual.

Considering the above-listed provisions in the Stormwater Development Standards, the application of this administrative order to a property zoned and designated for residential use does not result in a diminution in the area's supply of residential land. Therefore, this administrative order is consistent with Goal 10.

<u>Goal 11- Public Facilities and Services</u>. *To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.*

The Eugene-Springfield metropolitan area has an acknowledged Public Facilities and Services Plan (PFSP). The PFSP describes the public stormwater facilities necessary to support the land uses designated in the Eugene-Springfield Metropolitan Area General Plan (Metro Plan) within the urban growth boundary. This administrative order is consistent with the adopted Eugene-Springfield Metro Area PFSP. Further, this administrative order does not affect the City's provision of any public facilities and services, including stormwater facilities and services. Therefore, Goal 11 does not apply.

<u>Goal 12- Transportation</u>. *To provide and encourage a safe, convenient and economic transportation system.*

Goal 12 is implemented through the Transportation Planning Rule (TPR). The Eugene-Springfield Metropolitan Area Transportation Plan (TransPlan) provides the regional policy framework through which the TPR is enacted at the local level.

The Transportation Planning Rule (OAR 660-012-0060) states that land use changes that significantly affect a transportation facility shall require mitigation measures to address the anticipated impacts. The rule states that:

(1) Amendments to functional plans, acknowledged comprehensive plans, and land use regulations which significantly affect a transportation facility shall assure that allowed land uses are consistent with the identified function, capacity, and performance standards (e.g. level of service, volume to capacity ratio, etc.) of the facility. This shall be accomplished by either:
   - *(a) Limiting allowed land uses to be consistent with the planned function, capacity, and performance standards of the transportation facility;*
   - *(b) Amending the TSP to provide transportation facilities to support the proposed land uses consistent with the requirements of this division.*
   - *(c) Altering land use designations, densities, or design requirements to reduce demand for automobile travel and meet travel needs through other modes; or*
   - *(d) Amending the TSP to modify the planned function, capacity and performance standards, as needed, to accept greater motor vehicle congestion to promote mixed use, pedestrian-friendly development where multi modal travel choices are provided.*

(2) A plan or land use regulation amendment significantly affects a transportation facility if it:

(a) *Changes the functional classification of an existing or planned transportation facility;*
(b) *Changes standards implementing a functional classification system;*
(c) *Allows types or levels of land uses that would result in levels of travel or access that are inconsistent with the functional classification of a transportation facility; or*
(d) *Would reduce the performance standards of the facility below the minimum acceptable level identified in the TSP.*

Adoption of this administrative order will not change the functional classification of an existing or planned transportation facility. Nor will it change standards implementing a functional classification system. Further, it will not allow types or levels of land uses which would result in levels of travel or access which are inconsistent with the functional classification of a transportation facility or reduce the performance standards of any facility. Therefore, Goal 12 is not implicated by this administrative order.

Goal 13 - Energy Conservation. To conserve energy.

The administrative order does not impact energy conservation. Therefore, Goal 13 does not apply.

Goal 14 - Urbanization. To provide for an orderly and efficient transition from rural to urban land use.

The administrative order does not affect the City's provisions regarding the transition of land from rural to urban uses. Therefore, Goal 14 does not apply.

Goal 15 - Willamette River Greenway. To protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

The Willamette River Greenway area within the Eugene Urban Growth Boundary is governed by existing local provisions that have been acknowledged as complying with Goal 15. Those provisions are unchanged by this administrative order. Therefore, Goal 15 does not apply.

Goals 16 - 19. Estuarine Resources, Coastal Shorelands, Beaches and Dunes, and Ocean Resources.

These Statewide Planning Goals do not apply to the actions taken.

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CERTIFICATE OF MAILING

I certify that on July 20, 2006, I served a true and correct copy of Form 2, Notice of Adoption, and two copies of the Adopted Amendment, on the Plan Amendment Specialist for the Department of Land Conservation and Development, by causing the same to be deposited in the United States Mail at Eugene, Oregon, enclosed in a sealed envelope with postage prepaid, and addressed as follows:

Attention: Plan Amendment Specialist
Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, OR 97301-2540

Kathryn P. Brotherton

Kathryn P. Brotherton, OSB #98153

EUGENE

City Attorney
Civil Department

City of Eugene
360 East 10th Avenue, Suite 300
Eugene, Oregon 97401
(541) 682-5080

July 20, 2006

Attention: Plan Amendment Specialist
Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, OR 97301-2540

Re: *Notice of Adoption*

Enclosed please find Form 2, Notice of Adoption, two copies of Administrative Order No. 58-06-06-F, the adopted Stormwater Management Manual, and a Certificate of Mailing.

HARRANG LONG GARY RUDNICK P.C. –
CITY ATTORNEYS

Kathryn P. Brotherton

Kathryn P. Brotherton

KPB:abm
Enclosures

cc: Peggy Keppler

STORMWATER MANAGEMENT MANUAL

July 2006

WATER QUALITY

NATURAL RESOURCE

FLOOD CONTROL

EUGENE

STORMWATER MANAGEMENT MANUAL
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LIST OF EXHIBITS

Chapter 1.0
GENERAL POLICIES

Summary of Chapter 1.0

This chapter outlines the City of Eugene's stormwater management requirements and identifies who is required to conform to these requirements. It includes:

1.1 PURPOSE OF MANUAL

Stormwater management is a key element in maintaining and enhancing the City's livability. There is a direct link between stormwater and the City's surface and ground waters. As the City is developed, the impervious surfaces that are created increase the amount of runoff during rainfall events, disrupting the natural hydrologic cycle. Without control, these conditions erode stream channels and prevent groundwater recharge. Parking lots, roadways, and rooftops increase the pollution levels and temperature of stormwater runoff that is transported to streams, rivers, and groundwater resources. Protecting these waters is vital for a great number of uses, including fish and wildlife habitat, recreation, and drinking water.

The purpose of this manual is to provide stormwater management principles and techniques that help preserve or mimic the natural hydrologic cycle and achieve water quality goals. This *Stormwater Management Manual* provides developers and design professionals with specific requirements for reducing the impacts of stormwater runoff quantity and pollution resulting from new development.

This manual is for development subject to the stormwater development standards adopted by City ordinance (See **Appendix A**). This manual also provides standards for determining qualification for stormwater SDC and user fee credits.

1.2 SUMMARY OF MANUAL CONTENTS

Chapter 1.0: General Policies, outlines the purpose and use of this manual and defines terms. It outlines pollution reduction, flow control, and destination design standards, explains the rules for connecting to existing systems, and differentiates public and private stormwater management systems. This chapter also identifies special circumstances on a proposed development site that may make it impractical to implement on-site pollution reduction or flow control to the standards specified in this manual.

Chapter 2.0: Stormwater Management Facility Design, provides methods for selecting and designing stormwater management facilities that accomplish pollution reduction, flow control, and/or destination goals. The "simplified," "presumptive," and "performance" approaches are presented.

Chapter 3.0: Operations & Maintenance, presents operations and maintenance (O&M) submittal requirements and provides templates for stormwater management facility O&M plans.

Chapter 4.0: Source Controls, addresses site activities and characteristics with the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 3.0.

Appendix A: Eugene City Code Section 9.6790-9.6796 includes the section of City Code that addresses stormwater management policies and standards and that officially recognizes the City's *Stormwater Management Manual.*

Appendix B: Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies includes the City's testing protocol for acceptance of stormwater pollution reduction facilities.

Appendix C: Santa Barbara Urban Hydrograph Method describes the Santa Barbara Urban Hydrograph method of computing stormwater runoff hydrographs. It includes the City's 24-hour rainfall depths, formulas for computing time of concentration, and runoff curve numbers.

Appendix D: Simplified Approach Sizing Calculations, provides a sample of the method used to calculate the simplified approach sizing factors.

Appendix E: Water Quality Design Storm Development , outlines the rational behind the development of Eugene's pollution reduction storm rate and volume, and associated goal of treating 80% of the average annual rainfall.

Appendix F: Flood Control Design Storm Tables, outlines the rainfall intensity, duration and frequency curves, storm recurrence intervals, and storm events for planning and designing stormwater flood control facilities.

Appendix G: Facility Planting & Soil Recommendations, presents plant species recommendations for each vegetated stormwater management facility type, as well as recommended soil specifications.

Appendix H: Supplemental Drawings, includes color drawings of many stormwater management facilities. It also includes example planting plans and supplemental plan-view and cross-sectional drawings.

Appendix I: Stormwater Facility Photos, provides a number of stormwater management facility photos.

Appendix J: Headwater Streams Map, presents headwater streams identified for flow controls.

Appendix K: Infiltration Limited Areas Map, presents areas which may be infiltration limited due to generalized site conditions such as soil type and groundwater depth.

References & Resources

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1.3 DEFINITIONS

Note: Definitions are intended to be consistent with Eugene Code Chapter 9, Land Use; Chapter 6, Environment and Health; and Chapter 7, Public Improvements.

Above-Ground Storage of Liquid Materials **(Section 4.3)**: Places where exterior storage (either permanent or temporary) of liquid chemicals, food products, waste oils, solvents, or petroleum products in above-ground containers, in quantities of 50 gallons or more exist.

***Aboveground Storage Tank (AST)*:** A stationary container, vessel, or other permanent holding device designated for the storage and/or distribution of a liquid product.

Applicant: Any person, company, or agency that applies for a permit through the City of Eugene.

***Approved Receiving System (Destination)*:** Any system approved by PW to receive stormwater runoff or other discharges. Receiving systems include, but are not limited to, groundwater; on-site, off-site, or public stormwater; wastewater; and waters of the state.

***Batch Discharge*:** The controlled discharge of a discrete, contained volume of water or wastewater. Batch discharges into the public wastewater system must conform to the requirements of Eugene Code sections 6.501-6.596: Industrial Pretreatment Program.

***Bulk Fuel Terminal*:** Any area with its primary function dedicated to the storage and distribution of fuel to distributors (such as gas stations).

***Bulk Materials*:** Non-containerized materials.

***Bulk Material Transportation Route*:** Any path routinely used to transport materials regulated in Section 4.5 onto, off of, or within a site. Bulk material transportation routes shall be constructed with impervious surfaces and shall provide spill containment.

Capacity: The capacity of a stormwater drainage system is the flow volume or rate that a facility (e.g., pipe, pond, vault, swale, ditch, drywell, etc.) is designed to safely contain, receive, convey, reduce pollutants from or infiltrate stormwater that meets a specific performance standard. There are different performance standards for pollution reduction, detention, conveyance, and destination, depending on location. Example: Public stormwater pipes are required to convey the 10-year storm without surcharge, and the 25-year storm without damage to property or endangering human life or public health. Public infiltration sumps are required to infiltrate the 10-year storm with a safety factor of two.

Catch Basin: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, catch basins have grated lids, allowing stormwater from the surface to pass through for collection. Catch basins also include a sump bottom and submerged outlet pipe (down-turned 90 degree elbow, hood, or baffle board) to trap coarse sediment and oils.

Constructed Treatment Wetlands: A facility that exhibits wetland characteristics but was constructed for the express purpose to perform a utility need, such as a sedimentation pond, and is not eligible for mitigation credit or subject to the jurisdictional requirements of federal and state wetland law. See **Chapter 2.0** for information regarding the design of constructed treatment wetlands.

Contained Planter Box: A structural facility filled with topsoil and planted with vegetation. When placed over impervious surfaces such as sidewalks or rooftops, contained planter boxes intercept rainfall that would otherwise contribute to stormwater runoff. See **Chapter 2.0** for information regarding the design of contained planter boxes.

Containerized: The storage of any product, by-product, or waste that is completely held or included on all sides, within a discrete volume or area.

Containment: The temporary storage of potentially contaminated stormwater or process wastewater when a City wastewater system is not available for appropriate disposal.

Control Structure: A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices. See **Chapter 2.0** for information regarding the design of control structures.

Conveyance: The transport of stormwater from one point to another.

Covered Vehicle Parking Areas **(Section 4.9)**: Covered vehicle parking structures used to cover parked vehicles other than single-level covers, such as canopies, overhangs, and carports. Single- and two-family residential covered vehicle parking areas are exempt.

Destination: The ultimate discharge point for the stormwater runoff from a particular site, also known as stormwater disposal. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

Detention Facility: A facility designed to receive and hold stormwater and release it at a slower rate, usually over a number of hours. The full volume of stormwater that enters the facility is eventually released.

Detention Tank, Vault, or Oversized Pipe: A structural subsurface facility used to provide flow control for a particular drainage basin. See **Chapter 2.0** for information regarding the design of detention tanks, vaults, and oversized pipes.

Development: Any human-induced change to improved or unimproved real estate, whether public or private, for which a permit is required, including but not limited to construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration such as dredging, grading, paving, parking or storage facilities, excavation, filling, or clearing.

Development Permit: A permit authorized or required by the Oregon Structural Specialty Code and Oregon One and Two Family Dwelling Code, including but not limited to permits for:

1. New buildings.
2. Additional square footage added to a building.
3. Building demolition.
4. Foundations.
5. Change of occupancy.
6. Grading/Fill.
7. Site improvements.

Development Footprint: The new or redeveloped area covered by buildings or other roof structures and other impervious surface areas, such as roads, parking lots, and sidewalks.

Disposal: See definition of *Destination*.

Drainage Basin: A specific area that contributes stormwater runoff to a particular point of interest, such as a stormwater management facility, stream, wetland, or pipe.

Drainage way: An open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water. It may be permanently or temporarily inundated.

Driveway: The area that provides vehicular access to a site. A driveway begins at the property line and extends into the site. In parking areas, the driveway does not include vehicular parking, maneuvering, or circulation areas.

Dry Detention Pond: A surface vegetated basin used to provide flow control for a particular drainage basin. Stormwater temporarily fills the dry detention pond during large storm events and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of dry detention ponds.

Drywell: A structural subsurface facility with perforated sides or bottom, used to infiltrate stormwater into the ground. See **Chapter 2.0** for information regarding the design and use of drywells.

Eco-Roof: A lightweight low-maintenance vegetated roof system used in place of a conventional roof. Eco-roofs provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of eco-roofs.

Equipment and/or Vehicle Washing Facilities (**Section 4.7**): Designated equipment and/or vehicle washing or steam cleaning areas. This includes smaller activity areas such as wheel washing stations.

Extended Wet Detention Pond: A surface vegetated basin with a permanent pool of water and additional storage volume, used to provide pollution reduction and flow control for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. During large storm events, stormwater temporarily fills the additional storage volume and is slowly released over a number of hours, reducing peak flow rates. See **Chapter 2.0** for information regarding the design of extended wet detention ponds.

Exterior Materials Storage Area: Any exterior materials storage location that is not completely enclosed by a roof and sidewalls.

Exterior Storage of Bulk Materials (**Section 4.5**): Outdoor areas used to stockpile erodible materials.

Flood Control: The practice of managing stormwater drainage and flood protection. Drainage and flood protection strategies are outlined in the adopted City of Eugene Stormwater Basin Master Plans.

Flow Control: The practice of limiting the peak flow rates and volumes. Flow control is intended to protect downstream properties, infrastructure, and resources from the increased stormwater runoff peak flow rates and volumes resulting from development.

Flow Control Facility: Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development water quantity leaving the development site.

Flow-Through Planter Box: A structural facility filled with topsoil and gravel and planted with vegetation. The planter is completely sealed, and a perforated collection pipe is placed under the soil and gravel, along with an overflow provision, and directed to an acceptable destination point. The stormwater planter receives runoff from impervious surfaces, where it is filtered and retained for a period of time. See **Chapter 2.0** for information regarding the design of flow-through planter boxes.

Fuel Dispensing Facilities (**Section 4.2**): Areas where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers (including fuel islands, above ground fuel tanks, fuel pumps, and the surrounding pad). This definition applies to large-sized gas stations as well as single-pump fueling operations.

Grassy Swale: A long, narrow, trapezoidal or semicircular-shaped channel, planted with a dense grass mix. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. See **Chapter 2.0** for information regarding the design of grassy swales.

Hazardous Material: Any material or combination of materials that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or that may pose a present or potential hazard to human health, safety, or welfare, or to animal or aquatic life or the environment when improperly used, stored, transported or disposed of, or otherwise managed. For purposes of chemical regulation by this manual, moderate to high toxicity and confirmed human carcinogenicity are the criteria used to identify hazardous substances. (Note: This manual does not use the Resource Conservation and Recovery Act (RCRA) definition of hazardous. For the purpose of this manual, hazardous material is intended to include hazardous, toxic, and other harmful substances.)

Hazardous Material Containment Zone (HMC Zone): An area where a specific individual activity involving use of a hazardous material takes place, and where chemical quantities at that location are expected to exceed defined thresholds. HMCs may include (but are not limited to) storage and/or process areas, transportation routes, work areas, and loading/unloading facilities.

Headwaters Area: The area within Eugene city limits that is above 500 feet.

Headwater Streams: Streams that: (1) are identified on the Headwater Streams Map (**Appendix J** of the Stormwater Management Manual) as having all or a portion of their length located on slopes greater than 10%; (2) are identified on the Sensitive Areas Map as having all or a portion of their length located in areas with highly erodible soils; (3) are at least 500 feet or longer; and, (4) drain at least 10 acres.

High-Risk Site: A site with characteristics and/or activities that have the potential to generate pollutants that may not be addressed solely through the pollution reduction facilities presented in Chapter 2.0. High-risk site characteristics and activities are listed in **Section 4.1.1**.

Impervious Surface/ Area: Any surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from conditions pre-existing to development. Types of impervious surface include, but are not limited to, rooftops, asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

Infiltration: The percolation of water into the ground.

Infiltration Planter Box: A structural facility filled with topsoil and gravel and planted with vegetation. The planter has on open bottom, allowing water to infiltrate into the ground. Stormwater runoff from impervious surfaces is directed into the planter box, where it is filtered and infiltrated into the surrounding soil. See **Chapter 2.0** for information regarding the design of infiltration planter boxes.

Inlet: A structural facility located just below the ground surface, used to collect stormwater runoff for conveyance purposes. Generally located in streets and parking lots, inlets have grated lids, allowing stormwater from the surface to pass through for collection. The term "inlet" can also be used in reference to the point at which stormwater from impervious surfaces or conveyance piping enters a stormwater management facility.

LD-50: The lethal dose of a substance that is expected to kill approximately 50 percent of experimental animals through oral ingestion. (Refer to product Material Safety Data Sheet.)

Local Dispensing Location: An area within 15 feet of an aboveground storage tank (AST) and used to dispense fuel directly from the AST, typically through a flexible hose.

Manufactured Stormwater Treatment Technology: A proprietary structural facility or device used to remove pollutants from stormwater. Refer to **Chapter 2.0** and **Appendix B** for approval criteria related to manufactured stormwater treatment technologies.

Material Transfer Areas/Loading Docks **(Section 4.6)**: Areas designed to accommodate a truck/trailer being backed up to or into them, and used specifically to receive or distribute materials to and/or from trucks/trailers. Includes loading/unloading facilities with docks, and large bay doors without docks.

Maximum Extent Practicable (MEP): See definition of *Practicable.*
Multi-Level Parking Structure: Any parking facility with greater than one continuous level of parking.

Off-site stormwater facility: Any stormwater management facility located outside the property boundaries of a specific development, but designed to reduce pollutants from and/or control stormwater flows from that development.

On-site stormwater facility: Any stormwater management facility necessary to control stormwater within an individual development project and located within the project property boundaries.

Operations and Maintenance (O&M): The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives. See **Chapter 3.0** regarding operations and maintenance requirements for stormwater management facilities.

Outfall: A location where collected and concentrated water is discharged. Outfalls include discharge from stormwater management facilities, drainage pipe systems, and constructed open channels. See **Chapter 2.0** for information regarding the design of outfalls.

Parking Area: Any area which can be used by motor vehicles, recreational vehicles, trailers, and boats for parking, including driveways and access aisles providing access to the parking stalls.

Permeable Pavement: See definition of *Pervious Pavement.*

Pervious Pavement: The numerous types of pavement systems that allow stormwater to percolate through them and into subsurface drainage systems or the ground. See **Chapter 2.0** for design requirements related to pervious pavement. Also referred to as porous or permeable pavement.

Pollutant: An elemental or physical product that can be mobilized by water or air and creates a negative impact on the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

Pollutants of Concern: Watershed-specific parameters identified by the Oregon Department of Environmental Quality (DEQ) as having a negative impact on the receiving water body. Pollutants of concern can include suspended solids, heavy metals, nutrients, bacteria and viruses, organics, floatable debris, and increased temperature.

Pollution Reduction Facility: Any structure or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.
Porous Pavement: See definition of *Pervious Pavement.*

Post-Developed Condition: As related to new development: A site's ground cover after development.

Practicable: Available and capable of being done as determined by the City, after taking into consideration cost, existing technology, and logistics in light of overall project purpose.

Pre-Developed Condition: As related to new development: A site's ground cover prior to the proposed development.

Privately Engineered Public Improvement (PEPI): A public facility that is designed, constructed and financed by a private developer, entity, or its agent.

Public facility: A street, right-of-way, sewer, drainage, stormwater management, or other facility that is either currently owned by the City or will be conveyed to the City for maintenance responsibility after construction. A stormwater management facility that receives direct stormwater runoff from a public right-of-way shall become a public (City-maintained) facility unless the right-of-way is not part of the City's road maintenance system.

Public works project: Any development conducted or financed by a local, state, or federal governmental body and includes local improvements and public improvements.

Rainwater Harvesting: The practice of collecting and using stormwater for purposes such as irrigation and toilet flushing. See **Chapter 2.0** for information regarding rainwater harvesting.

Recycled Land **(Section 4.8)**: Land that currently has or previously has had pollutants detected in the soil or groundwater at concentrations that exceed risk-based cleanup levels or state/federal cleanup standards for the particular pollutant(s) of concern.

Redevelopment: Any development that requires demolition or complete removal of existing structures or impervious surfaces at a site and replacement with new impervious surfaces. Maintenance activities such as top-layer grinding and re-paving are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment. Utility trenches in streets are not considered redevelopment unless more than 50% of the street width is removed and re-paved.

Retention Facility: A facility designed to receive and hold stormwater runoff. Rather than storing and releasing the entire runoff volume, retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation. In this way, the full volume of stormwater that enters the facility is not released off-site.

Roadway: Any paved surface used to carry vehicular traffic (cars/trucks, forklifts, farm machinery, or any other large machinery).

Roof Garden: A heavyweight roof system of waterproofing material with a thick soil and vegetation cover. Roof gardens provide stormwater management by capturing, filtering, and evaporating rainfall. See **Chapter 2.0** for information regarding the design of roof gardens.

Runoff: Stormwater flows across the ground surface during and after a rainfall event.

Sand Filter: A structural facility with a layer of sand, used to filter pollutants from stormwater. See **Chapter 2.0** for information regarding the design of sand filters.

Santa Barbara Urban Hydrograph (SBUH): A hydrologic method used to calculate runoff hydrographs. See **Appendix C** for information regarding the use of the Santa Barbara Urban Hydrograph method.

Soakage Trench: A long linear excavation backfilled with sand and gravel, used to filter pollutants from and infiltrate stormwater into the ground. See **Chapter 2.0** for information regarding the design of soakage trenches.

Solid Waste Storage Areas, Containers, and Trash Compactors (**Section 4.4**): Outdoor areas with one or more facilities that store solid waste (both food and non-food waste). Single- and two-family residential solid waste storage areas, containers, and trash compactors are exempt.

Stormwater: Water runoff that originates as precipitation on a particular site, basin, or watershed.

Stormwater Facility Landscaping: The vegetation (plantings), topsoil, drain rock, and other surface elements associated with stormwater management facility design.

Stormwater Management: The overall culmination of techniques used to reduce pollutants from, detain and/or retain, and provide a destination for stormwater to best preserve or mimic the natural hydrologic cycle on a development site. Public health and safety, aesthetics, maintainability, capacity of existing infrastructure and sustainability are important characteristics of a site's stormwater management plan.

Stormwater Management Facility: Any structure or configuration of the ground that is used, or by its location, becomes a place where stormwater flows or is accumulated, including but not limited to, pipes, sewers, curbs, gutters, manholes, catch basins, ponds, open drainage ways, runoff control facilities, wetlands, and their accessories.

Stormwater Re-use: See definition of *Rainwater Harvesting*.

Street Swale: A vegetated or grassy swale located next to a public or private street for the purpose of managing stormwater. See **Chapter 2.0** for information regarding the design of street swales.

Sump: As used in this manual: A large public drywell (see definition) used to infiltrate stormwater from public streets. Sumps are generally 48 inches in diameter and 30 feet deep. The term "sump" can also be used to reference to any volume of a facility below the point of outlet, in which water can accumulate. See **Chapter 2.0** for information regarding the use and design of sumps.

Surface Conveyance: The transport of stormwater on the ground surface from one point to another.

Surface Infiltration Facility: A facility designed to receive and infiltrate stormwater runoff at the ground surface to meet stormwater destination requirements.

Surface Retention Facility: A facility designed to receive and hold stormwater runoff at the ground surface. Rather than storing and releasing the entire runoff volume, surface retention facilities permanently retain a portion of the water on-site, where it infiltrates, evaporates, or is absorbed by surrounding vegetation.

Tenant Improvements: Structural upgrades made to the interior or exterior of buildings. Tenant improvements may trigger **Chapter 4.0** Source Controls if they take place on sites with specified high-risk activities.

Time of Concentration (T_c)*:* The amount of time it takes stormwater runoff to travel from the most distant point (measured by travel time) on a particular site or drainage basin to a particular point of interest. See **Appendix C** for calculations related to time of concentration.

Total Suspended Solids (TSS): Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter.

Underground Injection Control (UIC): A federal program under the Safe Drinking Water Act, delegated to the Oregon Department of Environmental Quality (DEQ), which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. See **Section 1.4.4** for information regarding the UIC program.

Vegetated Facilities: As used in this manual: Stormwater management facilities that rely on plantings to enhance their performance. Plantings can enhance many facility functions, including infiltration, pollutant removal, water cooling, flow calming, and prevention of erosion.

Vegetated Filter Strip: A gently sloping, densely vegetated area used to filter, slow, and infiltrate stormwater. See **Chapter 2.0** for information regarding the design of vegetated filter strips.

Vegetated Infiltration Basin: A vegetated surface facility that temporarily holds and infiltrates stormwater into the ground. See **Chapter 2.0** for information regarding the design of vegetated infiltration basins.

Vegetated Swale: A long, narrow, trapezoidal or semicircular channel, planted with a variety of trees, shrubs, and grasses. Stormwater runoff from impervious surfaces is directed through the swale, where it is slowed and in some cases infiltrated, allowing pollutants to settle out. Check dams are used to create small ponded areas to facilitate infiltration. See **Chapter 2.0** for information regarding the design of vegetated swales.

Water Body: Water bodies include rivers, streams, sloughs, drainages including intermittent streams and seeps, ponds, lakes, aquifers, wetlands, and coastal waters.

Watercourse: A channel in which a flow of water occurs, either continuously or intermittently, with some degree of regularity. Watercourses may be either natural of artificial.

Water Quality: A term used to describe the chemical, physical, and biological characteristics of stormwater. Pollution reduction and flow control are two components of water quality management in stormwater runoff.

Water Quality Design Storm: A theoretical storm for estimating the amount of stormwater runoff to be treated. Facilities designed to store and treat a volume of stormwater shall be sized in accordance with Section 1.5.2 of this *Stormwater Management Manual.*

Wet Pond: A surface vegetated basin with a permanent pool of water, used to provide pollution reduction for a particular drainage basin. The permanent pool of water provides a storage volume for pollutants to settle out. See **Chapter 2.0** for information regarding the design of wet ponds.

Wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, and similar areas except those constructed as water quality or quantity control facilities. Specific wetland designations shall be made by the Corps of Engineers and the Division of State Lands.

1.4 STORMWATER DESTINATION

1.4.1 The Purpose of Stormwater Destination

Stormwater destination refers to the ultimate discharge point for stormwater generated by large, intense rainfall events from a particular development site. While many of the stormwater management facilities from Chapter 2.0 are designed to provide pollution reduction, flow control, or both, most of them do not infiltrate stormwater from large, intense rainfall events sufficiently enough to be considered the only stormwater destination for the site. In addition to water quality measures, destination measures from Chapter 2.0 are required and must be approved by PW (for off-site flow or infiltration within the public right-of-way and for infiltration on private property). It should be noted that the destination method might have an impact on the pollution reduction and flow control requirements for a site. Therefore, it is advantageous to determine the method of destination first.

Destinations can be grouped into two general categories: on-site infiltration and off-site flow. On-site infiltration methods include surface infiltration techniques, soakage trenches, drywells, and infiltration sumps. Off-site flow methods include discharge to drainage ways (including roadside ditches and natural drainages and streams), rivers, and off-site stormwater facilities. The appropriate destination point is site-specific and depends on a number of factors, including soil type, slopes, and availability of public and private infrastructure.

1.4.2 Destination Design Methodology

The City of Eugene has developed a flood control strategy for each of the drainage basins within the Urban Growth Boundary and published its findings in the adopted Stormwater Basin Master Plans. To evaluate the capacity of storm drainage facilities for the desired level of protection the Flood Control Design Storm information is provided in **Appendix F.**

1.4.3 Destination Standards

<u>ON-SITE INFILTRATION</u>

Where complete on-site infiltration is used for the destination of stormwater, the following standards shall apply:

> **Surface Infiltration Facilities:** Surface infiltration facilities must demonstrate the ability to store and infiltrate the Flood Control Design Storm. See **Section 2.2.2** for detailed surface infiltration facility sizing and design procedures, including safety factors.

Drywell, Infiltration Sump, and Soakage Trench Systems: The peak flow rate from the Flood Control Design Storm must be calculated using the Rational Method (Q=C*I*A), and a safety factor of 2 shall be applied. The intensity shall correspond to the calculated time of concentration (5-minute minimum, see the City of Eugene's *Public Improvements Design Standards Manual* for rainfall intensity charts, for 5-minute time of concentration intensity = 3.1 "/hr).

Sites proposing to use subsurface infiltration systems must either be located outside infiltration limited areas as identified on the City's Infiltration Limited Areas Map (See **Appendix K**) or the design professional must prove the viability of on-site infiltration using the drywell testing procedure outlined in Chapter 2.0.

<u>OFF-SITE DISCHARGE TO SURFACE FLOW</u>

Where stormwater is discharged to an off-site surface flow conveyance facility, such as a ditch, drainage way, stream, or river, the following standards shall apply:

Beginning at the point of discharge from the site, the surface conveyance facility must have the capacity to convey flows from the Flood Control Design Storm from all contributing upstream drainage areas. The Flood Control Design Storm peak flow rate shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Eugene's *Public Improvements Design Standards Manual* for rainfall intensity charts and list of approved hydrologic modeling methods.

<u>OFF-SITE DISCHARGE TO PIPED FLOW</u>

Where stormwater is discharged to an off-site piped conveyance facility the following standards shall apply:

<u>For development with an increase in net impervious area</u>: Beginning at the point of discharge from the site, the piped conveyance facility must have the capacity to convey flows from the Flood Control Design Storm from all contributing upstream drainage areas without surcharge. If no other stormwater options are available, the existing piped conveyance facility may surcharge, but the hydraulic grade line must remain 6" below gutter elevation where water could surcharge into the street, catch basins, manholes, curb inlets. The Flood Control Design Storm flow rates shall be calculated using the Rational Method (Q=C*I*A), with intensity corresponding to the calculated time of concentration (5-minute minimum), or other approved hydrologic modeling method for conveyance. See the City of Eugene's *Public Improvements Design Standards*

Manual for rainfall intensity charts and list of approved hydrologic modeling methods.

For development with no net increase in impervious area: Existing downstream pipe conveyance facilities may be allowed to surcharge under certain circumstances. See the City of Eugene's *Public Improvements Design Standards Manual* for allowable surcharge criteria.

100-YEAR ESCAPE ROUTE

All projects must demonstrate where stormwater from the 100-year storm event will go, and that public safety concerns and property damage will be avoided. This may include storage in parking lot, street, or landscaping areas.

Also see the City of Eugene's *Public Improvements Design Standards Manual* for more information regarding the conveyance and destination of stormwater.

1.4.4 Underground Injection Control Structures (UICs)

This section provides general information only. Complete regulations and requirements are available on the Oregon Department of Environmental Quality (DEQ) website: **http://www.deq.state.or.us/wq/groundwa/uichome.htm**

The federal Underground Injection Control (UIC) Program (under the Safe Drinking Water Act) regulates the injection of water below the ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. DEQ administers the UIC Program in Oregon.

DEQ defines a UIC as any system, structure, or activity that discharges fluid below the ground or subsurface. UICs can pollute groundwater and surface water if not properly designed, sited, and operated. Stormwater systems such as sumps, drywells, and soakage trenches are examples of UICs subject to DEQ regulation.

Owners or operators of new and existing UICs are required to register and provide inventory data to DEQ. This information helps DEQ determine if the UIC is eligible for "rule authorization." Rule authorization allows the owner or operator to operate the UIC without a permit from DEQ. UICs that do not qualify for rule authorization must either be closed, modified to meet requirements for rule authorization, or the owner must submit a water pollution control facility permit application to DEQ and obtain a permit.

CRITERIA FOR RULE AUTHORIZATION

UICs must be registered and approved by DEQ before construction. DEQ has set minimum criteria for rule authorization (OAR 340-044-0018), identified below:

- No other waste is mixed with stormwater.
- Site development, design, construction, and management practices have minimized stormwater runoff.
- No other method of stormwater disposal, including construction or use of surface discharging storm drains or surface infiltration designs, is appropriate.
- No domestic drinking water wells are present within 500 feet.
- No public drinking water supply wells are present within 500 feet or a two-year time of travel.
- No soil or groundwater contamination is present.
- The UIC is not deeper than 100 feet and does not discharge within 10 feet of the highest seasonal groundwater level.
- A confinement barrier or filtration medium is present, or best management practices (BMPs) are used to prevent or treat stormwater contamination. Stormwater management efforts should focus on maximizing source controls, use of vegetated pollution controls, and infiltration through surface infiltration or shallow subsurface facilities.
- Design and operation prevents accidental or illicit spills and allows for temporary blocking.

Compliance with these criteria must be demonstrated during the registration process. Compliance can generally be more readily accomplished if stormwater management efforts focus on maximizing source controls, using surface vegetated pollution control options such as swales and planters, and disposing of stormwater through surface infiltration or shallow subsurface facilities.

RULE AUTHORIZATION PROCESS

The City of Eugene is managing the rule authorization process for public facilities (UICs that drain public right-of-ways). To allow adequate time to complete the UIC process, registration and inventory information for proposed public UICs should be submitted to the City of Eugene as soon as possible after it has been determined that new or existing public right-of-way will be constructed or improved. Contact PW at 541-682-5291 to get the public UIC process started.

Registration and inventory information for UICs proposed to serve private property should be submitted directly to Ms. Barbara Priest, Oregon DEQ, (503) 229-5945.

Registration and inventory data should be submitted at least 60 days in advance of potential start of work. In some cases, DEQ and the City will need additional information from the applicant in order to make a determination on the potential for use of a UIC.

The registration, rule authorization and permit process is explained in more detail on DEQ's permit webpage: **http://www.deq.state.or.us/pubs/permithandbook/wquic.htm** For technical questions, call the DEQ UIC Program at 503-229-5945. For copies of UIC registration applications or forms, call 1-800-452-4011.

1.5 POLLUTION REDUCTION

1.5.1 The Purpose of Pollution Reduction

Urbanization is recognized as having a serious impact on Eugene's waters. As land is developed, impervious area and surface runoff increase. This runoff collects and transports pollutants to downstream receiving waters. Pollutants of concern include:

- Suspended solids (sediment)
- Heavy metals (dissolved and particulate, such as lead, copper, zinc, and cadmium)
- Nutrients (such as nitrogen and phosphorus)
- Bacteria and viruses
- Organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers)
- Floatable debris
- Increased thermal load (temperature)

In response to the water quality impacts of urbanization, Congress passed the Clean Water Act amendments of 1987, mandating the U.S. Environmental Protection Agency (EPA) to issue regulations to control urban stormwater pollution. The regulations, published in 1990, require larger cities such as Eugene to obtain a National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit for their municipal separate storm sewer discharges. Compliance with the NPDES permit requires the City to establish a comprehensive stormwater management program. Eugene's citywide management program includes design standards for source control devices as well as best management practices designed to improve stormwater quality. This *Stormwater Management Manual* is part of Eugene's NPDES stormwater management program to improve the quality of Eugene's waters.

1.5.2 Pollution Reduction Design Methodologies

Pollution reduction facilities shall be designed using the Water Quality Design Storm (see definition of Water Quality Design Storm). Pollution reduction facilities are sized using two different methods. Vegetated filters, oil/water separators, and some proprietary treatment systems are sized to treat a rate of flow draining through them. Other pollution reduction facilities are sized to treat a volume of runoff.

Flow rate-based pollution reduction facilities (such as swales and filters) designed to treat runoff generated by a rainfall intensity of 0.13 inches per hour for off-line flow-through type facilities and 0.22 inches per hour for on-line flow-through type facilities, and flow volume-based facilities (such as wet ponds) designed to treat runoff generated by 1.4 inches of rainfall over 24 hours (with NRCS Type 1A rainfall distribution) will treat approximately 80 percent of the average annual rainfall. Facilities that must be sized by routing a hydrograph through the facility (rate-based facilities with a storage volume component) may utilize a continuous simulation program or single-storm hydrograph-based analysis method, such as SBUH (with 1.4 inches of rainfall over 24 hours and NRCS Type 1A rainfall distribution) to demonstrate capture and treatment 80% of the average annual rainfall volume. See **Appendix E** for more detailed information regarding the formulation of Eugene's pollution reduction standards and Water Quality Design Storm.

One of the three design methodologies from **Chapter 2.0** must be used to design pollution reduction facilities to meet these requirements. The above rainfall intensities are to be used in the Rational Method (Q=CIA) equation to calculate pollution reduction runoff rates for flow rate based facilities. The above 24-hour storm is to be used in the Soil Conservation Service (SCS, now Natural Resources conservation Service) methodology to design volume based facilities. These Water Quality Design Storms are used to size rate-based pollution reduction facilities unless the **Simplified Approach** from Chapter 2.0 is used.

Exhibit 1-1: Pollution Reduction Facility Removal Capabilities

	The facility can likely remove the parameter
	The facility can potentially remove the parameter, depending on design
	The facility cannot likely remove the parameter

Pollution Control Facility Type	Bacteria	Temperature	Nutrients	Pesticides (DDT, Dieldrin, Aldrin)	PCB	PCB FW	PCB NT	PCB	2,3,7,8 TCDD (Dioxin)	PAH	Trace Metals (Pb, As, Fe, Mn)
Eco-roof											
Roof garden											
Pervious pavement											
Tree credit											
Contained planter box											
Infiltration planter box											
Flow-through planter box											
Vegetated swale											
Grassy swale											
Street swale/planter											
Vegetated filter strip											
Vegetated infiltration basin											
Wet pond											
Extended wet detention pond											
Constructed treatment wetland											
Sand filter											
Manufactured filtration device											
Rainwater harvesting											

Note: This table is for guidance only. Actual pollutant removal capabilities are based on specific facility design and site parameters.

OIL CONTROL FOR HIGH-RISK VEHICLE AND EQUIPMENT TRAFFIC AREAS

Oil controls can include either (1) spill control manholes (**Exhibit 2-25**) or (2) the incorporation of Lynch-type catch basins within the parking lot or at the outlet to swales or other pollution reduction facilities. The discharge of stormwater with a visible sheen off-site or into on-site UICs is prohibited.

1.6 FLOW CONTROL

1.6.1 The Purpose of Flow Control

Prior to development, rainfall appears as stream flow, evaporates into the atmosphere, or infiltrates into the ground where it recharges groundwater aquifers or surface water bodies. Urbanization results in the loss of forest, agricultural land, and open space and increases the amount of impervious area. As a result, development can have the following hydrologic impacts:

- Increased stormwater flow rates
- Increased stormwater runoff volumes
- Decreased groundwater recharge and base flows into streams
- Seasonal flow volume shifts

Flow control is intended to protect downstream properties, infrastructure, and natural resources from the increases in stormwater runoff peak flow rates and volumes resulting from development.

The City's policy is to ensure that runoff leaving the post-development site:

- does not exceed the capacity of the receiving conveyance facility or water body.
- does not increase the potential for stream bank and stream channel erosion.
- does not create or increase any upstream or downstream flooding problems.

The basic design concept for flow control (detention and retention) is simple: water from developed areas is managed with a variety of flow control techniques and released to downstream conveyance systems at a slower rate (detention) and lower volume (retention). Managing flows in this way attempts to mimic the site's natural rainfall runoff response prior to development (See **Exhibit 1-2**).

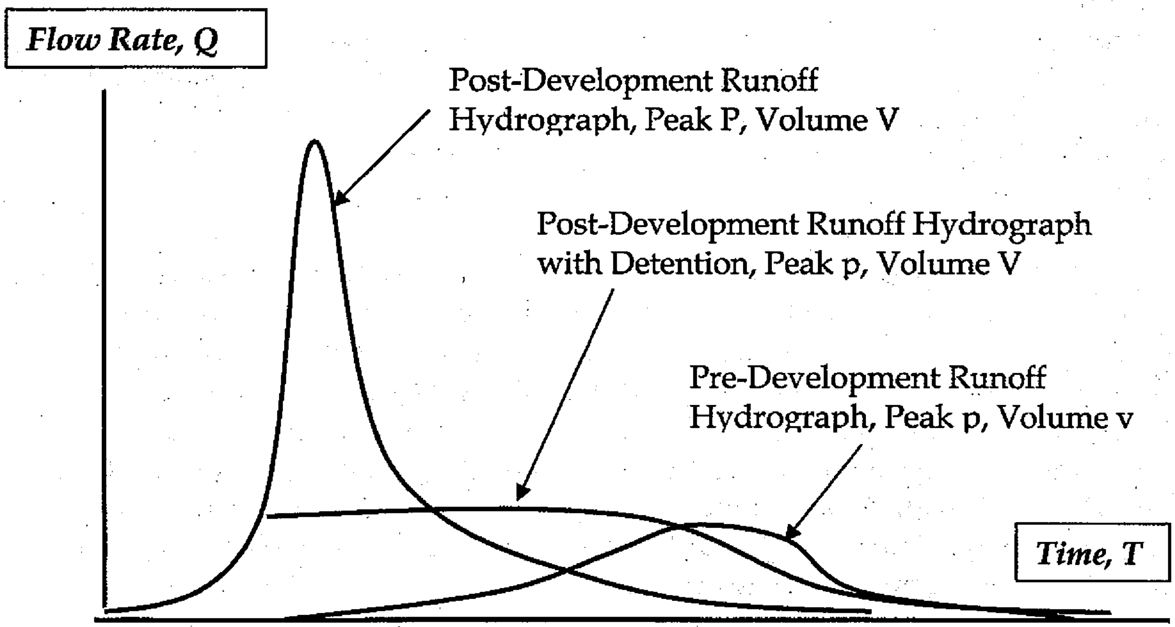
Detention facilities temporarily store stormwater runoff in a pond, tank, vault, or pipe. The water is slowly released from the facility, typically over a number of hours.

Retention facilities also store stormwater runoff. Rather than storing and releasing the entire runoff volume, however, the facility permanently retains a portion of the water on-site, where it infiltrates and recharges the groundwater aquifer, and in the case of surface retention facilities, evaporates or is absorbed and used by surrounding vegetation. In this way, retention facilities reduce the total volume of water released downstream. Surface treatments (such as eco-roofs or pervious pavements) that cover or replace traditional impervious surfaces and vegetated facilities such as swales, filters, ponds, and planter boxes are all examples of retention facilities.

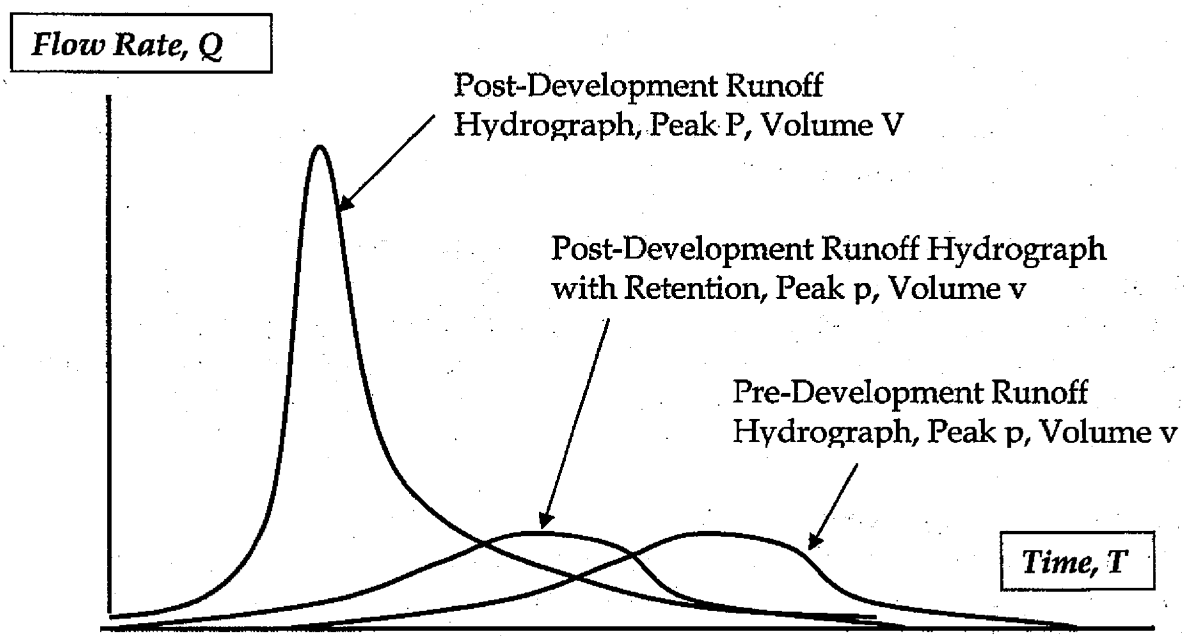
In the past, flow control plans often relied solely on detention facilities. Facilities that control only peak flow rates, however, allow the duration of high flows to increase, causing the potential for increased erosion downstream. For example, after development with detention, the magnitude of the 2-year peak flow rate may not increase, but the amount of time that the flow rate occurs will increase. Retention systems, on the other hand, are particularly effective at lowering the overall runoff volume, reducing the amount of time that the peak flow rate occurs. In addition, by infiltrating stormwater, retention systems recharge groundwater that serves as the base flow for streams during the dry season. Therefore, stream systems that require erosion protection, including salmonid habitat streams, warrant the use of retention systems. Where retention systems cannot be used, detention systems that control the duration of the geomorphically significant flow (i.e., flow capable of moving sediment) shall be used. Such detention systems employ lower release rates and are therefore larger in volume.

Time of concentration, or the time it takes rainfall to accumulate and run off a site, is another important factor in determining downstream hydrologic impacts created by development. Flow rates from individual sites may be controlled, but when they are combined quickly in fast-flowing conveyance pipes, the downstream effect will still be increased in-stream flow rates and volumes. Breaking flow patterns up into surface retention systems helps increase a site's time of concentration and lessons downstream impacts.

Exhibit 1-2: Illustration of the effect of detention and retention facilities on post-developed hydrographs (large storm events)



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Detention Facility in Place.



General Relationship Between Pre-Development Hydrograph, Post-Development Hydrograph, and Post-Development Hydrograph with Retention Facilities in Place.

1.6.2 Flow Control Strategies

Background:
Many tributary streams in Eugene show evidence of excessive stream bank and channel erosion. Any development that discharges stormwater runoff off-site that eventually flows into a headwater stream or drains into a pipe that discharges into a headwater stream shall be designed to control and minimize increases in flows to reduce the potential for further aggravation of in-stream erosion problems.

The added controls are based on the geomorphically significant flow, which is the flow that initiates sediment movement in the channels. The erosion-causing flow varies from channel to channel. Unless more specific data are available, the City assumes that the erosion-causing flow is equivalent to the Water Quality Design Storm, and the requirements of this manual are based on that assumption. **Specifically, the more restrictive control requirement is to limit the post-development peak flow rate from the Water Quality Design Storm to the pre-development peak flow rate from the Water Quality Design Storm. The facilities shall also control the post-development flows from the Flood Control Design Storm peak flows to the pre-development levels.**

General Requirement:
Flow controls are required in the Headwaters Area of Eugene. For new development in this area, on-site infiltration or on-site retention (such as pervious pavement, planters, swales, and other surface vegetated facilities) is preferred to control stormwater volumes and flow rates. Regardless of the method used, flow control shall be sufficient to maintain peak flow rates at their pre-development levels for storms larger than the Water Quality Design Storm and smaller than the Flood Control Design Storm. (See definition of pre-developed condition in **Section 1.3**)

Circumstances when more restrictive flow control is required:
Development projects proposing to discharge stormwater off-site must evaluate the capacity of the off-site receiving system (i.e. storm sewer, ditch, drainageway, etc.) against the standards presented in **Section 1.4**. Additional flow control may be required on-site if off-site receiving systems do not have sufficient capacity to accept the additional flows.

Circumstances when flow control is required:
- Development in the headwaters area that drains directly to a headwaters stream or drains into a pipe that discharges into a headwaters stream. (See **Appendix J Headwaters Streams Map**)

IMPORTANT NOTES:

- Pollution reduction requirements still apply if a development site is exempt from flow control requirements.
- Development must still properly dispose of stormwater using approved methods in accordance with **Section 1.4** of this manual.

SUMMARY OF THE CITY'S FLOW CONTROL REQUIREMENTS:

1) **Flow Control requirements apply to a development in the headwaters area that drains directly to a headwaters stream or drains into a pipe that discharges into a headwaters stream. (See Appendix J; Headwaters Streams Map).**
2) On-site infiltration is required to the maximum extent practicable.
3) Where complete on-site infiltration is not practicable, on-site retention (flow volume control) facilities should be used.
4) Piping systems that provide conveyance from a site to an ultimate discharge point must have adequate capacity per City's standard, or additional flow control on-site may be required.

1.7 OPEN DRAINAGE

A drainage way is an open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water. It may be permanently or temporarily inundated. Open drainage provides many important functions to both our stormwater conveyance system and the environment. Drainage ways provide both flow management (regulation of stream flow, retention and detention of water, flood control, contribution to seasonal base flows, and groundwater recharge) and water quality protection (filtration of pollutants and reduction of stormwater temperatures). Open drainage ways may either be privately or publicly maintained, but maintenance operations should not hinder the functionality of the public use of the facility.

1.7.1 Interlot Drainage

Interlot drainage refers to overland drainage without a defined channel (sheet drainage) and some French drain systems. This may include minor open channels and enclosed storm drain pipe systems, upon private properties that serves only to collect and remove stormwater runoff generated within the boundaries of private properties. All maintenance of interlot drainage systems is the responsibility of the property owner or abutting property owners.

If water from an interlot system exits a private property onto an adjacent private property, the maintenance system is the joint responsibility of the private property owners involved.

1.7.2 Disturbances or Development within Drainage ways

Disturbances or development within drainage ways may be allowed when all of the following conditions exist:

1) The disturbance or development will not impede or reduce flows within the drainage way.
2) The disturbance or development will not increase erosion downstream.
3) The disturbance or development will not cause detrimental impacts to stream side habitat values; the migration, rearing, feeding, or spawning of fish; or to habitat needs of other aquatic species in either the immediate stream reach or in downstream water bodies.
4) Where the development involves a constructed crossing of the drainage way for vehicular or pedestrian access.
5) The constructed pipe system is sized to convey all of the runoff from upstream watershed when the upstream watershed is completely developed.

Alterations to natural drainage ways require either a grading/fill permit from the Building Permit Services or privately engineered public improvement construction permit from Public Works Engineering.

1.7.3 Maintenance Guidelines

Cleaning operations may be done only as needed to maintain the conveyance capacity of the drainage way.

Cleaning operations should be done during the drier months when equipment can gain access to the channel banks without damage. Upon completion of the work, the banks shall not be left rutted or torn up or in a condition which would encourage rain water erosion. After cleaning operations, the banks along the channel shall be repaired of all damage caused by the maintenance activities in order to prevent accelerated erosion of the banks.

When and where necessary, City Maintenance staff will perform cleaning operations to maintain the conveyance capacity of major channels that are located within public drainage easements that have sufficient access available for equipment to perform the necessary cleaning. City Maintenance staff may perform emergency cleaning on any blockage which is causing water to back up into the City stormwater system or is creating a hazard to the public.

Unless a drainage way is publicly owned or covered by a recorded maintenance agreement that states otherwise; private property owners are responsible for vegetation management and debris removal. No mowing shall be performed on the banks of channels.

1.7.4 Easement Guidelines

Drainage easements are to assure that the current flow rate and pattern of the drainage way continues to be adequately conveyed through the development site. Current flow volumes and/or drainage way capacities will be determined by reviewing existing data, which may include available hydrologic records, drainage basin hydrology, historical data, high water marks, soil inundation records, photographs of past flooding, and other similar information. The City of Eugene developed the 2002 Eugene Stormwater Basin Master Plans as a resource for designing stormwater management.

Public drainage easements may be accepted by the City when all of the following criteria are met:

1) The storm drainage conveys water from public rights of way or is part of an identified public drainage system.

2) Capacity of the drainage facility is approved by the City as to meeting expected future development needs.
3) Existing systems are inspected by City staff prior to acceptance and all deficiencies discovered during the inspection are removed.
4) Maintenance access is provided.

1.8 OTHER REGULATORY STORMWATER PROGRAMS

Conformance with this manual's requirements does not relieve the applicant of other applicable local, state, or federal regulatory or permit requirements. This chapter is intended to complement any additional regulation, and is not expected to conflict with, exclude, or replace those regulations. In case of a conflict, the most stringent local, state, or federal regulations apply. Some of the more common additional regulations that may apply are summarized below.

1.8.1 Illicit Discharge Program

The City expects spill response supplies, such as absorbent material and protective clothing, to be available at all potential spill areas. Employees should be familiar with the site's operations and maintenance plan and/or proper spill cleanup procedures.

1.8.2 Industrial Pretreatment Program

Some facilities may be required to obtain a State of Oregon NPDES stormwater permit before discharging to the City's storm sewer system or to waters of the state. Applicants may also be required to obtain an industrial wastewater permit for discharges to the wastewater system. Facilities subject to these requirements are generally commercial or industrial facilities. Typical discharges include process wastewater, cooling water, or other discharges generated by some of the sources in this chapter that drain to the City stormwater or wastewater systems. (Contact PW staff at 541-682-5291 for a list of current wastewater discharge limits.)

An evaluation will be done during the building permit review process to determine if an industrial discharge permit is required. If a permit is required, the industrial permit application process will be independent of the building permit review/issuance process. However, building permit applications may have to be revised to accommodate industrial permitting compliance requirements (*i.e.* sampling points, pretreatment facilities, *etc.*).

1.8.3 Oregon DEQ Underground Injection Control (UIC) Program

The Oregon Department of Environmental Quality (DEQ) identifies drywells, sumps, and piped soakage trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. Because the UIC Program states that these types of wells may have a direct impact on groundwater, registration or permitting with DEQ is required. See **Section 1.4.4** for additional information.

1.8.4 Other Local, State, and Federal Programs

The requirements presented in this chapter do not exclude or replace the requirements of other applicable codes or regulations, such as the hazardous substances storage requirements of articles 79 and 80 of the Oregon State Fire Code; the spill prevention control and containment (SPCC) regulations of 40 CFR 112 (EPA); the Resource Conservation and Recovery Act (RCRA); or any other applicable local, state, or federal regulations or permit requirements.

Additional City of Eugene and Oregon Department of Environmental Quality (DEQ) permit requirements may apply. Contact PW staff at 541-682-5291 for additional information about stormwater or wastewater discharges to City-owned wastewater or stormwater systems.

1.9 Credits and Incentives for Private Stormwater Facilities

Stormwater quantity credits for SDCs and user fees are based on a public system benefit from development reducing the quantity of stormwater entering the public system through on-site retention methods. Developments utilizing private means for reducing the quantity of water discharged from a development site to the public system can reduce the demand for additional capacity in downstream public water conveyance facilities. Establishing stormwater quantity SDC and user fee credits provides a general recognition of reduced demand.

Stormwater quality credits for SDCs and user fees are based on a public system benefit from development treating stormwater quality through privately constructed and maintained facilities and effective impervious area reduction techniques. Developments utilizing private means for water quality treatment can reduce the demand for downstream public facilities for water quality treatment. Establishing stormwater quality SDC and user fee credits provides a general recognition of reduced demand and provides a modest incentive for meeting and exceeding minimum water quality treatment requirements.

Implementation of stormwater quality SDC and user fee credits are related to adoption of stormwater development standards which require water quality treatment at sites of new development. Adopted standards provide a basis for evaluation of the degree of impact reduction of a development. These credits recognize impact reduction and provide incentives for pollution reduction across three types of development sites: 1) those not subject to the standards for stormwater pollution reduction but which treat all or a portion (minimum 20%) of the impervious area of the development site; 2) sites where a portion of the site impervious area is subject to the standards for stormwater pollution reduction but treat runoff from 20% or more impervious area than the minimum required; and, 3) sites where all of the site impervious area is subject to the standards for stormwater pollution reduction which reduce a minimum of 20% of the total impervious area of the development.

See the adopted Eugene SDC methodologies document, Appendix D, Section 6.0 for additional criteria for SDC credits.

See the adopted Eugene Stormwater Service Charges methodology document for additional criteria for user fee credits.

Chapter 2.0
STORMWATER MANAGEMENT FACILITY DESIGN

Summary of Chapter 2.0

This chapter provides procedures for selecting and designing facilities that provide stormwater pollution reduction, flow control, and/or destination benefits. It includes:

To Use This Chapter:

1) Use the ordinance in **Appendix A** and **Chapter 1.0** to determine the pollution reduction, flow control, and destination requirements for the project.
2) Select stormwater management facilities from **Section 2.9: Facility Selection and Design** to meet pollution reduction, flow control, and/or destination requirements for the project.
3) Size facilities using the **simplified approach**, **presumptive approach**, or **performance approach** presented in this chapter. For simplified approach facilities, use **Form SIM** for sizing. For presumptive or performance approach facilities, use specific sizing criteria presented with each facility type and hydrologic analysis methods listed in **Section 2.3**. Integrate the facilities into the project's overall site plan.
4) Prepare drawings and specifications for each stormwater management facility in accordance with the design criteria in **Section 2.9: Facility Selection and Design**.
5) Consult **Chapter 3.0** for the operations and maintenance guidelines for each stormwater management facility.

2.1 INTRODUCTION

Facilities presented in this chapter receive credit toward compliance with pollution reduction, flow control, destination, or in some cases a combination of the three. Three methodologies are included in this chapter for the sizing and design of stormwater management facilities: the simplified, presumptive, and performance approach. Each design approach has limitations on applicability. See **Exhibit 2-1** for a list of the facility types, their applicable design methodologies, and stormwater management credits given.

Exhibit 2-1: Stormwater Management Facility Application Table

Stormwater Management Facility Type	Credit Given with Associated Design Approach		
	Pollution Reduction	Flow Control	Destination
Eco-roof & roof garden	Simplified	Simplified	NA
Pervious pavement	Simplified	Simplified	Performance
Contained planter	Simplified	Simplified	NA
Tree credit	Simplified	Simplified	NA
Infiltration planter	Simplified[1]	Simplified	Presumptive[3]
Flow-through planter	Simplified[1]	Simplified	NA
Swales < 15,000 sq-ft impervious area	Simplified[1]	Simplified	Presumptive[3]
Swales > 15,000 sq-ft impervious area	Presumptive	NA	Presumptive[3]
Vegetated filter strip	Simplified[1]	Simplified	Presumptive[3]
Vegetated infil. basin	Simplified[1]	Simplified	Presumptive[3]
Sand filter	Simplified[1]	Simplified	Presumptive[3]
Wet pond	Presumptive	NA	NA
Extended wet det. pond	Presumptive	Presumptive	NA
Dry detention pond	Presumptive[4]	Presumptive	NA
Treatment wetland	Presumptive	Presumptive	NA
Manufactured treatment technology	Performance	NA	NA
Structural det. facility	NA	Presumptive	NA
Spill control manhole	Presumptive[2]	NA	NA
Rainwater harvesting	Performance	Performance	NA
Soakage trench	NA	Presumptive	Presumptive
Infiltration sump	NA	Presumptive	Presumptive
Drywell	NA	Presumptive	Presumptive

Exhibit 2-1 Notes:

[1]The performance approach may be used to downsize these simplified approach facilities when flow control is not required.
[2]Spill control manholes receive credit for oil removal only; additional pollution reduction facilities will be required to meet basic water quality management.
[3]The **Surface Infiltration Facility** design criteria must be used to receive destination credit.
[4]Vegetated or grassy swales must be integrated into the bottom of dry detention ponds to receive pollution reduction credit.

2.2 DESIGN METHODOLOGIES

2.2.1 Simplified Approach

The simplified approach is a relatively easy process for selecting and designing combined pollution reduction and flow control facilities, intended to save the project developer and the City time and expense. Combination facilities can be more practical to build than separate pollution reduction and flow control facilities. Simplified approaches facilitate the surface retention of stormwater, which provides a number of benefits, including pollution reduction, groundwater recharge and protection, peak flow reduction, and volume reduction. Rather than detaining stormwater and releasing it off-site at increased post-developed volumes, these facilities help infiltrate or retain water on-site. In areas with surface drainage ways and streams, on-site retention lessens the "flashy" high- and low-flow impacts created by development in watershed basins. Stream erosion and temperature impacts are also decreased. Overall, these facilities help mimic the natural hydrologic cycle by slowing and infiltrating stormwater.

Simplified Approach Sizing

Facilities designed in accordance with the simplified approach are presumed to comply with the City's pollution reduction and flow control requirements. As sized with **Form SIM** sizing factors, the simplified approach facilities do not sufficiently dispose of large storm events. Additional facilities, designed using the presumptive or performance approach, are required that meet the destination requirements.

Sizing factors for the simplified approaches (shown on **Form SIM** below) were developed as an effective, simple, and quick tool to use for site planning and to accelerate permit review and approval. Generalized assumptions were used that may result in conservative sizing for some development sites. Manual users have the option to use the sizing factors as given on Form SIM, or follow the performance approach and submit an alternative facility size, along with supporting engineering calculations for City review for compliance with the performance criteria. The performance approach may be used to downsize facilities in circumstances when flow control is not required.

Appendix D: *Simplified Approach Sizing Calculations* provides information about how facility sizing factors were developed, and guidance on how the same methodology can be used to develop alternative facility sizes. An approved hydrologic analysis method (**Section 2.3**), such as a Santa Barbara Urban Hydrograph (SBUH) based approach or continuous simulation model, must be used to generate flow rates and volumes for design analysis. When facilities are downsized to meet pollution reduction requirements only, flows above the pollution reduction design flow must be routed around the facility with an approved diversion structure (**Section 2.5**).

The first four simplified approaches on Form SIM (pervious pavements, eco-roofs and roof gardens, contained planter boxes, and tree credits) are impervious area reduction or mitigation techniques to reduce the overall square-footage of impervious area that requires stormwater management. These facilities intercept rainfall, and are not generally designed to receive stormwater runoff. The second group of simplified approaches on Form SIM (infiltration and flow-through planter boxes, vegetated and grassy swales, vegetated filter strips and infiltration basins, and sand filters) is designed to receive stormwater runoff from impervious surfaces.

Simplified Approach Applications

Applicants using the simplified approach shall submit **Form SIM** as part of their permit application, along with construction drawings and details. **Page 2 of Form SIM** can be used to claim stormwater management credit for planting new trees and retaining existing tree canopy on-site.

A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be included. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects that utilize simplified approach facilities must also fulfill Stormwater Destination requirements.

Form SIM: Simplified Approach for Stormwater Management

The city has produced this form to assist with a quick and simple approach to manage stormwater on-site.
Facilities sized with this form are presumed to comply with pollution reduction and flow control requirements.

New or Replaced Impervious Site Area [ ] **Box 1**

(do not include roof areas that will be infiltrated on-site with drywells or soakage trenches)

INSTRUCTIONS

1. Enter square footage of new or redeveloped impervious site area in Box 1 at the top of this form.
2. Select impervious area reduction techniques from rows 1-4 to reduce the site's resulting stormwater management requirement. Tree credit can be calculated using the tree credit worksheet on the next page. Sum square footage of rows 1-4 and enter Total Impervious Area Reduction in Box 2.
3. Subtract Box 2 from Box 1 and enter number in Box 3. This is development area that is required to provide treatment facilities for its stormwater runoff.
4. Select desired stormwater management facilities from rows 5-11. In Column 1, enter the square footage of impervious area that each facility will manage.
5. Multiply each impervious area from Column 1 by the corresponding sizing factor in Column 2, and enter the result in Column 3. This is the facility surface area needed to manage runoff from the impervious area.
6. Total Column 1 (Rows 5-11) and enter the resulting "Impervious Area Managed" in Box 4.
7. Subtract Box 4 from Box 3 and enter the result in Box 5. When this number reaches 0, poluution reduction and flow control requirements have been met. Submit this form with the application for permit.
8. If Box 5 is greater than 0 square feet, add square footage or facilities to Column 1 and recalculate, or use additional facilities from Chapter 2.0 of the Stormwater Management Manual to manage stormwater from these remaining surfaces.

Impervious Area Reduction Technique	Column 1: Impervious Area Managed = Facility Surface Area	
1) Pervious Pavement(s)	______	sf
2) Eco-Roof / Roof Garden	______	sf
3) Contained Planter	______	sf
4) Tree Credit (See Next Page)	______	sf

Total Impervious Area Reduction (Sum 1 thru 4) [ ] **Box 2**

New Impervious Management Area (Box 1 - Box 2) [ ] **Box 3**

Stormwater Management Facility	Column 1: Impervious Area Managed			Column 2: Sizing Factor		Column 3: Facility Surface Area	Unit
5) Infiltration Planter	______	sf	x	0.07	=	[ ]	sf
6) Flow-Through Planter	______	sf	x	0.07	=	[ ]	sf
7) Vegetated Swale	______	sf	x	0.09	=	[ ]	sf
8) Grassy Swale	______	sf	x	0.1	=	[ ]	sf
9) Vegetated Filter Strip	______	sf	x	0.2	=	[ ]	sf
10) Vegetated Infil. Basin	______	sf	x	0.11	=	[ ]	sf
11) Sand Filter	______	sf	x	0.06	=	[ ]	sf

Total Impervious Area Managed (Sum 5 thru 11) [ ] **Box 4**

See Chapter 2.0: drywell and soakage trench sizing and design requirements.

Box 3 - Box 4 [ ] **Box 5**

Development Site (Information):

Tax Map/Lot	
Street Address	
Total Sq. ftg.	
Soil Type	
Perc Rate	

Form SIM (Page 2): Tree Credit Worksheet

See **Tree Credits** section for more information regarding the use of trees to meet stormwater management requirements.

New Evergreen Trees

To receive stormwater management credit, new evergreen trees must be planted within 25 feet of ground-level impervious surfaces. New trees cannot be credited against rooftop surfaces. Minimum tree height (at the time of planting) to receive credit is 6 feet.

Enter number of new evergreen trees that meet qualification requirements in Box A		**Box A**
Multiply Box A by 200 and enter result in Box B		**Box B**

New Deciduous Trees

To receive stormwater management credit, new deciduous trees must be planted within 25 feet of ground-level impervious surfaces. New trees cannot be credited against rooftop surfaces. Minimum tree caliper (at the time of planting) to receive credit is 2 inches.

Enter number of new deciduous trees that meet qualification requirements in Box C		**Box C**
Multiply Box C by 100 and enter result in Box D		**Box D**

Existing Tree Canopy

To receive stormwater management credit, existing tree canopy must be preserved during and after construction. Existing tree canopy must be within 25 feet of ground-level impervious surfaces. Existing trees cannot be credited against rooftop surfaces. Minimum tree caliper to receive credit is 4 inches. No credit will be given to existing tree canopy located within environmental zones.

Enter square-footage of existing tree canopy that meets qualification requirements in Box E		**Box E**
Multiply Box E by 0.5 and enter the result in Box F		**Box F**

Total Tree Credit

Add boxes B, D, and F and enter the result in Box G		**Box G**

For sites with less than 1,000 square-feet of new or redeveloped impervious area:
The amount in Box G is to be entered as "Tree Credit" on Form SIM. ** Stop Here **

For sites with more than 1,000 square-feet of new or redeveloped impervious area:

Multiply Box 1 of Form SIM by 0.1 and enter the result in Box H		**Box H**
Enter the lesser of Box G and H in Box I.		**Box I**

This is the amount to be entered as "Tree Credit" on Form SIM. **Stop Here**

2.2.2 Presumptive Approach

Facilities that utilize this design approach are classified as "presumptive," *i.e.*, facilities that are *presumed* to be in compliance with the City's pollution reduction, flow control, and/or destination requirements if the presented sizing and design requirements are followed.

There are a few key differences between the presumptive and simplified approach sizing methodologies. Stormwater management goals that require the presumptive approach to be used for a particular facility type do not lend themselves well to simplified sizing. More detailed hydrologic calculations must be performed to adequately design the facility to achieve the desired goal. Another difference is that the presumptive approach presents sizing methodologies that meet the requirements of one particular goal (pollution reduction, flow control, or destination), rather than multiple goals. See **Exhibit 2-1** for the table that specifies the design approaches that are applicable to each management goal, for each facility type.

Presumptive Approach Application

In addition to detailed construction drawings and details shown on permit drawings, all applicants using the presumptive approach for stormwater management are required to submit a detailed stormwater report. This report shall include a general description of the stormwater facility and how it is intended to function. It shall include detailed hydraulic calculations, as summarized in **Exhibit 2-2**. A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be provided. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects using facilities designed under the presumptive approach must also fulfill Stormwater Destination requirements.

Exhibit 2-2:
Checklist of Calculations to be Included in Stormwater Report

<u>Stormwater Facility Type</u>
A= Grassy Swale, and Subsurface Infiltration Facilities
B= Wet Pond
C= Extended Wet Detention Pond, and Surface Infiltration Facilities
D= Dry Detention Pond
E= Constructed Treatment Wetland
F= Detention Tank, Vault, or Pipe
G= Manufactured Treatment Technology or Spill Control Manhole

Parameter or Calculated Value to be Included in the Stormwater Report	A	B	C	D	E	F	G
Site Variables:							
Site soil type (A, B, C, or D)	x	x	x	x	x	x	x
Contributing area (acres)	x	x	x	x	x	x	x
Pre-developed curve number CN			x	x	x	x	
Pre-developed time of concentration T of C (minutes)			x	x	x	x	
Post-developed curve number CN	x	x	x	x	x	x	x
Post-developed time of concentration T of C (minutes)	x	x	x	x	x	x	x
Distance from ground surface to max. height of seasonal groundwater (feet)	x	x	x	x	x	x	x
Hydrographs:							
Pre-developed hydrographs for the water quality and flood control storms, including peak rates & total volumes			x	x	x	x	
Post-developed hydrographs for the water quality and flood control storms, including peak rates & total volumes (only if routed through the facility)			x	x	x	x	
Post-developed hydrographs for the water quality and flood control storms after being routed through the facility, including peak rates & total volumes			x	x	x	x	
Facility Geometry:							
Table showing area and volume of the facility every 6" in elevation		x	x	x	x	x	
Side slopes (h: v or %)	x	x	x	x	x		
Longitudinal slope (h: v or %)	x				x		
Bottom width and length (feet)	x	x	x	x	x		
Overall width and length (feet)	x	x	x	x	x		
Hydraulic Controls:							
Orifice or weir descriptions, sizes, and elevations, including by-pass facilities			x	x	x	x	
Elevation, size, and type of overflow spillway or pipe	x	x	x	x	x	x	x
Calculated Values:							
Pollution reduction flow rate	x						x
Pollution reduction permanent pool volume and elevation		x	x		x		
Forebay volume and elevation		x	x	x	x		
Hydraulic residence time for the pollution control storm	x				x		
Storm routing data showing the peak water surface elevation in the facility for the 2 water quality & flood control storms (only if routed through the facility)	x	x					x

Detailed storm routing data for the water quality and flood control storms, showing inflow rate, outflow rate, and water surface elevation in the facility every 10 minutes throughout the storm.			x	x	x	x	

PRESUMPTIVE SURFACE INFILTRATION DESTINATION DESIGN APPROACH

Where soil conditions allow for percolation near the ground surface, surface infiltration facilities can be used to dispose of stormwater from large storm events to meet destination standards. The infiltration of stormwater near the ground surface helps increase the separation to groundwater, providing a greater filtration layer and decreasing the risk of groundwater contamination. It also serves to mimic the predevelopment hydrologic cycle, decreasing downstream impacts and recharging groundwater and increasing evapotranspiration.

Examples of surface infiltration facilities that can be designed under this approach include vegetated, grassy, and street swales, infiltration planters, and vegetated infiltration basins. While the design procedure in this section accounts for complete on-site infiltration of stormwater, facilities sized per the simplified approach are not sized adequately to meet destination standards and must include an overflow to an acceptable destination point. Surface infiltration facilities are not classified as underground injection controls (UICs) by DEQ, and therefore do not need to be registered.

Surface Infiltration Facility Design Approach to Meet Destination Standards

1) Determine the preliminary facility size by calculating the runoff volume generated by the 5-year storm (3.6 inches of rainfall over 24 hours, NRCS Type 1A rainfall distribution-from Table C-1). The SBUH method can be used to determine this volume, or the volume can be approximated by the following formula:

   Runoff Volume (cubic feet) = 0.3 feet * Impervious Area (square-feet)

   The facility will need to be capable of containing this volume of runoff through a combination of above ground storage and below ground storage within voids in a subsurface rock trench.

2) Surface infiltration facilities require infiltration tests during the design phase of the project. For public facilities, double-ring infiltrometer tests shall be conducted, in accordance with ASTM D3385-94 and City review for compliance with testing methods. For private facilities, the falling head infiltration test procedure specified in **Section 2.4.2** shall be used. The minimum acceptable infiltration rate for surface infiltration facilities to meet destination standards is 0.5 inches per hour. A clogging factor of 4 is then applied to the resulting infiltration rate to be used in the design of the facility.

3) The design infiltration rate (measured infiltration rate divided by 4) is then used to check the facility drawdown time. When full, the facility drawdown time shall not exceed 30 hours.

4) The wet seasonal high water table must be determined, and a minimum 4-foot clearance to bottom of facility must be maintained.

5) The 100-year base flood elevation shall be determined and must show that structures will not be flooded and that property damage and safety risks will be avoided.

6) Minimum setbacks from surface infiltration facilities to structures are shown in **Exhibit 2-4.**

7) All areas to be used as surface infiltration facilities shall be back-filled with a suitable sandy loam planting and filtration medium. Minimum depth shall correspond to each facility type's specification. The borrow source of this medium, which may be the same or a different location from the facility area itself, must be tested as follows:

   If the borrow area is undisturbed soil one test is required per 200 square-feet of borrow area. The test consists of "grab" samples at 1-foot depth intervals to the bottom of the borrow area. All samples at the testing location are then mixed, and the resulting sample is laboratory tested to meet the following criteria:

   USDA minimum textural analysis requirements: A textural analysis is required from the site-stockpiled topsoil. If topsoil is imported, a textural analysis shall be performed for each location where the topsoil was excavated.

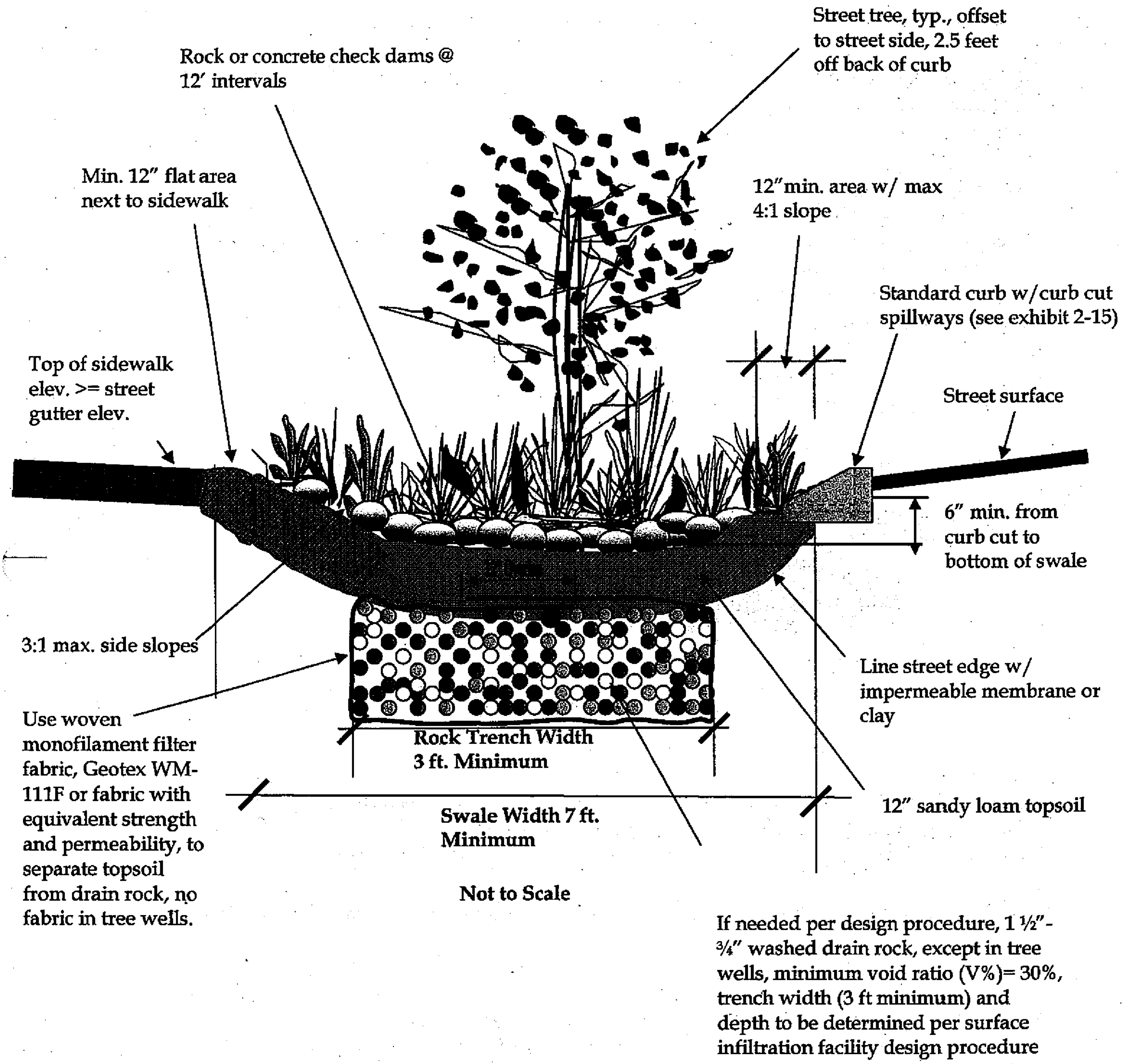
   Requirements:
   Sand 35 – 60%
   Silt 30 - 55% (Loam)
   Clay 10 – 25%

   The soil shall be a uniform mix, free of stones, stumps, roots, or other similar objects larger than two inches.

8) Surface infiltration facility areas shall be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular construction traffic, except that specifically used to construct the facility, shall be allowed within 10 feet of surface infiltration facility areas.

9) For surface infiltration facilities, post-construction field infiltration testing will be required. Methods consistent with those used during design of the facilities shall be used. The resulting infiltration rate must show that the facility drawdown time will not exceed 30 hours.

Exhibit 2-3: Example Cross-Section of Vegetated Street Swale, Modified To Receive Credit for Destination



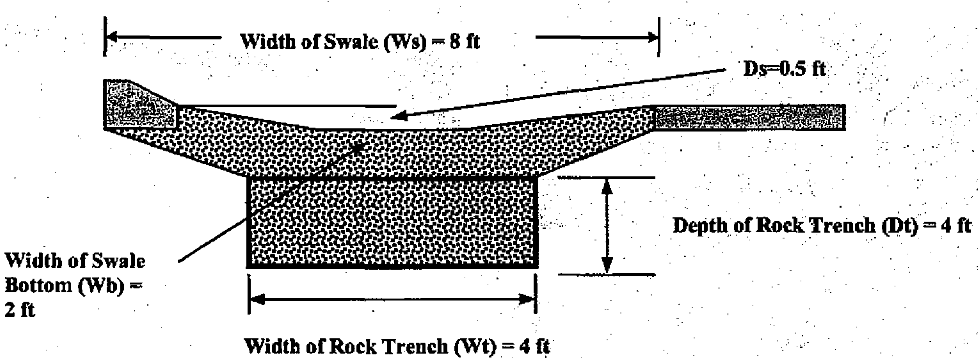
SURFACE INFILTRATION FACILITY SIZING EXAMPLE

Facility Type: Vegetated Street Swale

Objective: Find swale dimensions needed to meet destination standards.

Givens: Design Storm (P) = 5 year, 24 hour storm = 3.6 total inches = **0.3 feet**
Maximum Drawdown Time (Td) = **30 hours**
Infiltration Rate Safety Factor = **4**

Site Characteristics:
Impervious Area (Ai) = 200′ x 28′ = **5,600 square feet**
Measured Infiltration Rate (Im), using Double-Ring Infiltrometer Test = 12″/hr = **1′/hr**
Swale width (Ws) = **8 feet**
Swale bottom width (Wb) = **2 feet**
Swale depth (Ds) = **0.5 feet**
Rock trench width (Wt) = **4 feet**
Rock trench depth (Dt) = **4 feet**
Void Ratio of Rock Trench (VR) dimensionless = **0.30**



Calculations:
Runoff Volume (Vr) cubic feet = P * Ai = 0.3 * Ai = 0.3 * 5,600 = **1,680 cubic feet**
Design Infiltration Rate (Id) feet per hour = Im / 4 = **0.25 ft/hr**
Swale Storage Volume (Vs) = L * [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]

Check #1: Runoff Volume (Vr) must be less than or equal to Swale Storage Volume (Vs)

Vr <= Vs

(0.3 * Ai) <= L * [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]

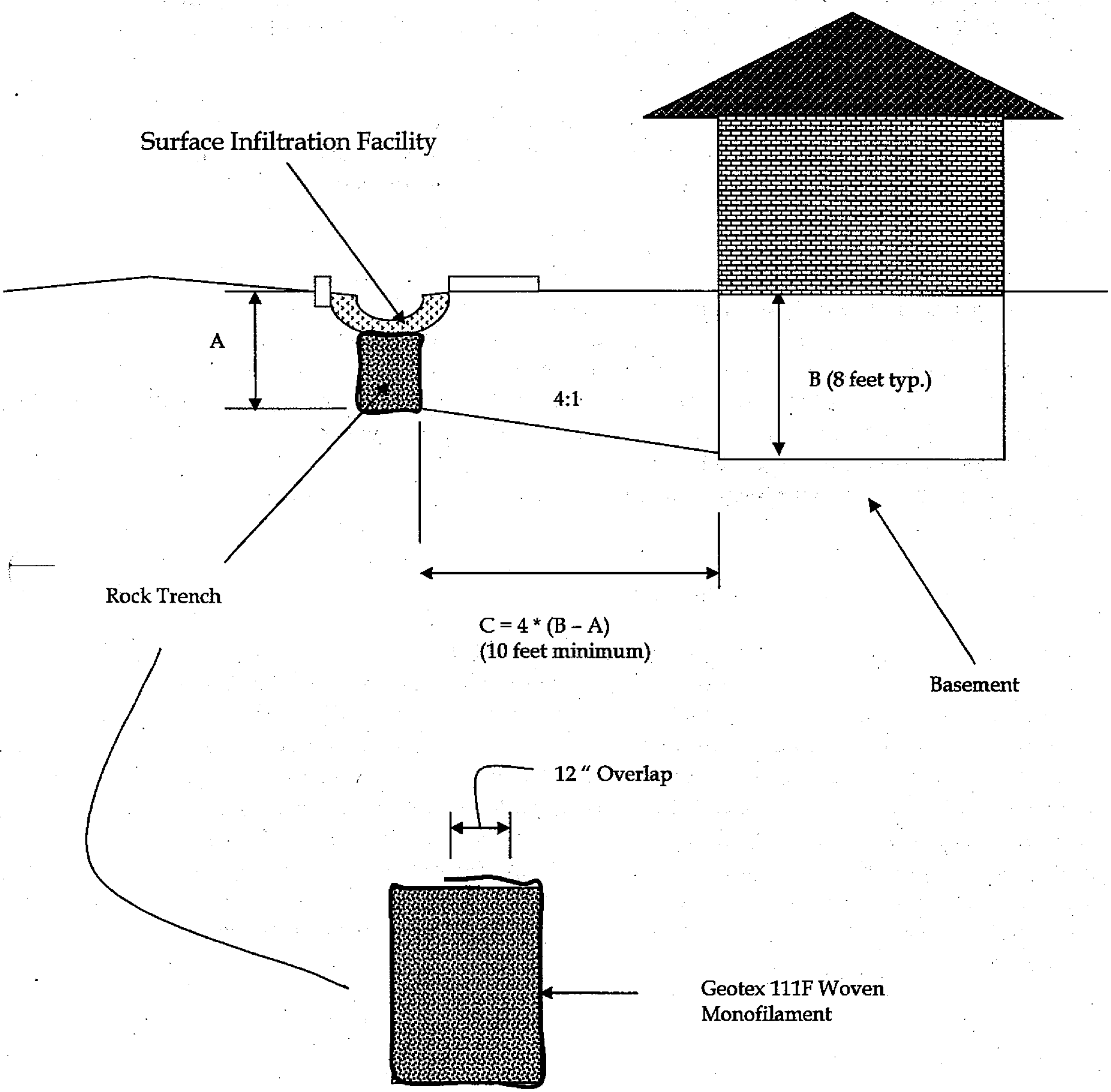
To find L: L = (0.3 * Ai) / [(0.5 * Ds * (Ws + Wb)) + (VR * Wt * Dt)]
L = (0.3 * 5,600) / [(0.5 * 0.5 * (8 + 2)) + (0.30 * 4 * 4)] = <u>230 feet</u>

Check #2: Swale drawdown time must not exceed maximum allowable (Td) = 30 hours

(0.3 * Ai) / (Id * Wt * L) <= 30 hours

(0.3 * 5,600) / (0.25 * 4 * 230) = <u>7.3 hours</u> < 30 hours, therefore OK

Exhibit 2-4: Surface Infiltration Facility Setback Detail



2.2.3 Performance Approach

The list of accepted stormwater management facilities is continually changing as new products are developed and more is learned about the performance of facilities already in use. Design professionals may propose facilities other than those included in this manual by using the performance approach.

The performance approach requires detailed engineering design and calculations, as well as documented evidence of the proposed design's performance. The City will accept the proposed design for meeting pollution reduction requirements if the design professional demonstrates that it:

- Will perform at the required efficiency and capture and treat 80 percent of the average annual rainfall. See **Appendix B**: Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies, which is actually a function of influent concentration. Also see Appendix B for required testing protocol, related definitions, and additional requirements. Documented performance is required and shall include published data, with supporting cited research, demonstrating removal of target pollutants at required levels.
- Can be maintained to perform at the maintenance level set forth in **Chapter 3** of this Manual.

Performance Approach Application

In addition to detailed construction drawings and details to be shown on permit drawings, all applicants using the performance approach for stormwater management are required to submit a detailed stormwater report. This report shall include a description of the stormwater facility, how it is intended to function, and documented evidence of the proposed design's performance. It shall include detailed hydraulic calculations as summarized in **Exhibit 2-2** and must demonstrate the performance criteria listed above. A copy of the operations and maintenance plan (see **Chapter 3.0**) shall also be included. In addition, a geotechnical report is required by the City to evaluate the suitability of the proposed facility location. Projects using facilities designed under the performance approach must also fulfill Stormwater Destination requirements.

2.3 HYDROLOGIC ANALYSIS

With the exception of pollution reduction and flow control facilities designed using the simplified approach, stormwater management facilities should be designed using hydrologic analysis methods described below. If one of the hydrologic analysis methods discussed below is not used, City staff must pre-approve the alternative method before the plans and calculations are submitted. Regardless of how the hydrologic calculations are performed, all hydrologic submittals shall include data necessary to facilitate the City's review. This data is summarized in **Exhibit 2-2**.

2.3.1 Pollution Reduction

Flow Rate-Based Facilities: With the exception of facilities sized using the simplified approach, City staff will use the Rational Method with rainfall intensities presented in **Section 1.5.2** to verify flow rates used to size rate-based pollution reduction facilities. The design professional may, in addition to the Rational Method, use SBUH, NRCS TR-55, HEC-1, or SWMM to demonstrate treatment of 80% of the average annual rainfall.

Flow Volume-Based Facilities: Volume-based pollution reduction facilities included in this manual (wet ponds and extended wet detention ponds) are required to use the pre-determined volume of 1.4 inches over 24 hours with a Vb/Vr ratio of 2 to be in presumptive compliance.

Combination Rate/Volume Facilities: With the exception of facilities sized using the simplified approach, City staff will use a software program based on the Santa Barbara Urban Hydrograph (SBUH) method, or a continuous simulation model with Eugene rainfall data, to verify the sizing of flow rate-based pollution reduction facilities that also rely on a storage volume component. An example of this includes the downsizing of simplified approach facilities (such as infiltration basins) to achieve pollution reduction only. When using SBUH, a 1.4 inch, 24-hour storm with NRCS type 1A rainfall distribution shall be used. The design professional may also use NRCS TR-55, HEC-1, or SWMM.

2.3.2 Flow Control

With the exception of facilities sized using the simplified approach, City staff will use a software program based on the Santa Barbara Urban Hydrograph (SBUH) to check design calculations for flow control facilities. The design professional may, in addition to the SBUH, use the Rational Method, NRCS TR-55, HEC-1, or SWMM to demonstrate compliance with flow control standards.

2.3.3 Destination

The Rational Method must be used to design the infiltration flow rate for infiltration sumps, drywells, and soakage trenches. If surface infiltration facilities, such as vegetated, grassy, or street swales, vegetated infiltration basins, and infiltration planters are proposed to meet destination requirements, the **Surface Infiltration Facility** sizing methodology must be used to meet presumptive compliance. The surface infiltration facility sizing methodology relies on the determination of the 5-year storm runoff volume, which can be calculated using the simple approximation formula provided, SBUH, NRCS TR-55, HEC-1, or SWMM.

2.3.4 Conveyance

Reference the City of Eugene's *Public Improvement Design Standards Manual* for acceptable hydrologic analysis methods for the stormwater conveyance. The Rational Method will be used to verify design calculations for pipe or surface conveyance facility sizing. HEC-1 or SWMM may be used for projects greater than 40 acres in size.

2.3.5 Hydrologic Analysis Method Resources

The **Santa Barbara Urban Hydrograph (SBUH) Method (See Appendix C)** may be applied to small, medium, and large projects. It is a recommended method for completing the analysis necessary for designing flow control facilities when not using the simplified approach.

The **SCS TR-55 Method** may be applied to small, medium, and large projects. This is also one of the recommended methods for completing hydrologic analysis necessary for designing flow control facilities when not using the simplified approach. (Refer to SCS Publication 210-VI-TR-55, Second Edition, June 1986.)

The **HEC-1 Method** may be used on medium and large projects. (Refer to the HEC User's Manual.)

The **SWMM Method** may be used on medium and large projects. (Refer to the SWMM User's Manual.)

2.4 INFILTRATION TESTING

To size stormwater management facilities, it is often necessary to know the infiltration rate of the soil at the actual facility location. The following general criteria apply to all proposed infiltration facilities:

1) For all infiltration facilities, a minimum infiltration rate of 0.5 inches per hour is required. Infiltration rates shall be determined by performing either infiltration testing in compliance with this section or Chapter 2 of the Eugene Public Improvement Design Standards Manual.
2) Testing can be classified into three categories, (1) initial feasibility testing, (2) design testing, and (3) post-construction testing. (see **Exhibit 2-5**)
3) Testing shall be conducted or observed by a qualified professional. This professional shall either be a registered professional engineer in the State of Oregon, or a soils scientist or geologist licensed in the State of Oregon.
4) All field-testing must be done in the proposed area of the facility.
5) Testing data shall be documented, including a description of the infiltration testing method.

2.4.1 Initial Feasibility Testing

Initial feasibility testing is conducted to determine whether full-scale testing is necessary, and is meant to screen unsuitable sites and reduce testing costs. It involves either one field test per facility (regardless of type or size) or previous testing data, such as the following:

- Septic percolation testing on-site, within 200 feet of the proposed facility location and on the same contour; or
- Previous written geotechnical reporting on the site location as prepared by a qualified geotechnical expert; or
- NRCS Lane County Soil Mapping showing unfeasible conditions such as a hydrologic group "D" soil in a low-lying area.

If the results of initial feasibility testing as determined by a qualified professional (registered professional engineer, landscape architect, or geologist) show that an infiltration rate of greater than 0.5 inches per hour is probable, then the design and post-construction testing shall be in accordance with **Exhibit 2-5**. PW will waive design-testing if existing testing data is on file with the City for the site. In the case of infiltration testing, an encased soil boring may be substituted for a test pit, if desired.

Exhibit 2-5: Infiltration Testing Summary Table

Type of Facility	Initial Feasibility Testing (Section 2.4.1)	Design Testing (Section 2.4.2)	Post-Construction Testing (Section 2.4.3)
Drywell System	Required	One test pit and one falling head test per drywell.	(see **drywell** section for procedure)
Soakage Trench	Required	One test pit and one falling head test per soakage trench.	Not applicable.
Infiltration Sump System	Required	Testing of an existing sump in the vicinity, or construction and testing of one sump.	All infiltration sumps must be field-tested after construction. (see **infiltration sump** section for procedure)
Surface Infiltration Facility	Required	One double-ring infiltrometer test (for public facilities) or one falling head test (for private facilities) per facility area	All surface infiltration facilities must be field tested after construction.

2.4.2 Design Testing

The following **test pit** procedure shall be followed:

1) Excavate a test pit or dig a standard soil boring to a minimum depth of 4 feet below the proposed facility bottom elevation. Also conduct Standard Penetration Testing (SPT) every 2 feet to a depth of 4 feet below the facility bottom.
2) Determine depth to highest seasonal groundwater table (if within 4 feet of proposed bottom) upon initial digging or drilling.
3) Determine USDA or Unified Soil Classification System textures at the proposed bottom and 4 feet below the bottom of the facility.
4) Determine depth to bedrock (if within 4 feet of proposed bottom).
5) The soil description should include all soil horizons.
6) The location of the test pit or boring shall correspond to the facility location; test pit/soil boring stakes are to be left in the field for inspection purposes and shall be clearly labeled as such.

The following **falling head infiltration test** procedure shall be followed:

1) Install casing (solid 5-inch diameter, 30-inch length) to 24 inches below proposed facility bottom (see **Exhibit 2-6**).
2) Remove any smeared soiled surfaces and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester's discretion, a 2-inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with clean water to a depth of 24 inches and allow to pre soak for 24 hours.
3) 24 hours later, refill casing with another 24 inches of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a total of four observations. Upon the tester's discretion, the final field rate may either be the average of the four observations or the value of the last observation. The final rate shall be reported in inches per hour.
4) Testing may be done through a boring or open excavation.
5) The location of the test shall correspond to the facility location.
6) Upon completion of the testing, the casings shall be immediately pulled, and the test pit shall be back-filled.

Where required, the **double-ring infiltrometer test** procedure must follow ASTM D3385-94, standard test method for infiltration rate of soils in field using double-ring infiltrometer.

Note: For soils types known as Cascade silt loams (soils with a fragipan that causes a perched water table in winter months), testing must be done between June 1 and October 1.

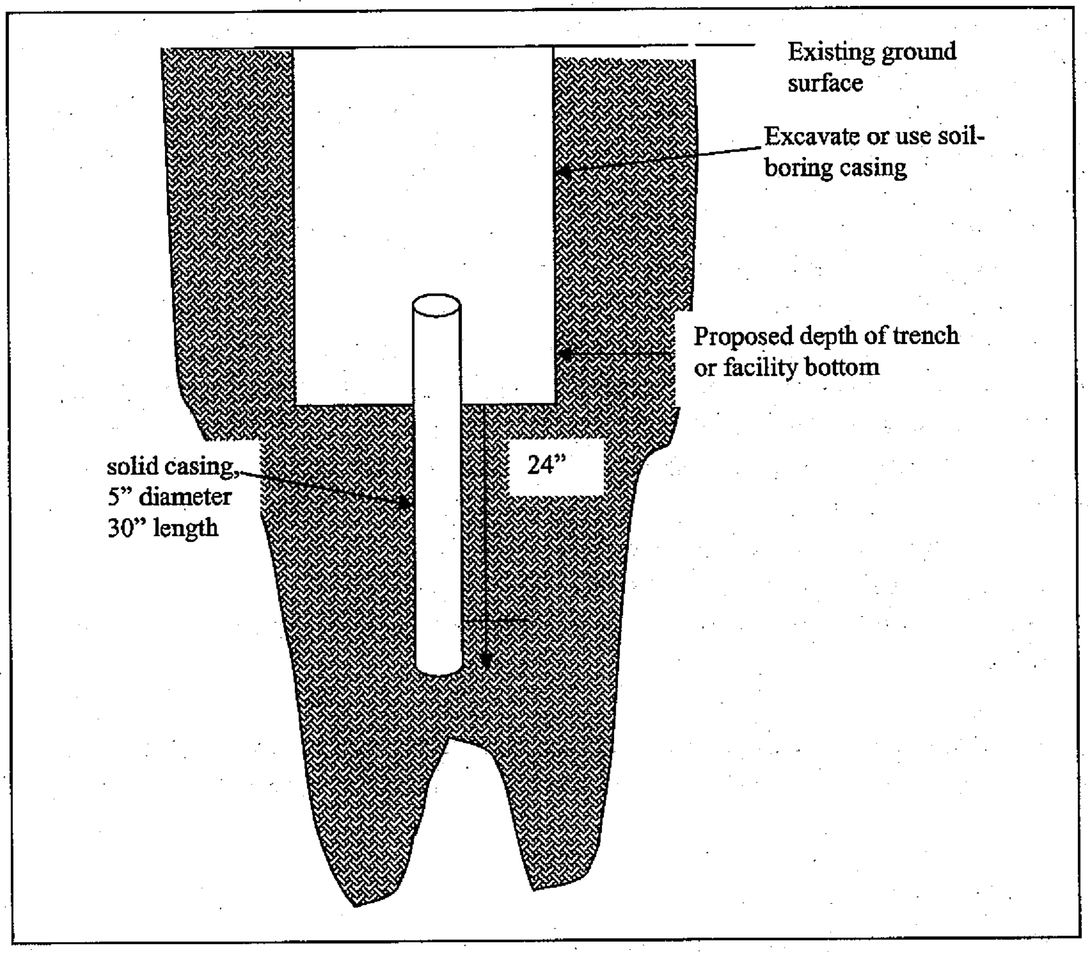
2.4.3 Post-Construction Testing

See surface infiltration facility, sump, and drywell design sections for post-construction infiltration testing procedures.

2.4.4 Laboratory Testing

Grain-size sieve analysis and hydrometer tests where appropriate may be used to determine USDA soils classification and textural analysis. Visual field inspection by a qualified professional may also be used, provided it is documented. The use of laboratory testing to establish infiltration rates is prohibited.

Exhibit 2-6: Falling Head Test



2.5 CONTROL STRUCTURES FOR DETENTION SYSTEMS

This section presents the methods and equations for the design of flow restricting control structures, for use with extended wet detention ponds, dry detention ponds, and structural detention facilities. It includes details and equations for the design of orifices, and equations for rectangular sharp crested weirs and v-notch weirs.

Detention control structures shall be either weir structures or orifice structures. Weir structures may be enclosed in a catch basin, manhole, or vault, or may be installed in the open, provided they are accessible for maintenance and are not exposed to damage. Riser type restrictor devices also provide some incidental oil/water separation and spill control. Weir structures provide some oil/water separation when fitted with a baffle plate located upstream of the weir.

2.5.1 Design Methodologies

The following criteria apply to control structure design.

- The control structure shall be designed to pass the 100-year storm event as overflow without causing flooding of the contributing drainage area.

Orifices

- Orifices may be constructed on a "tee" riser section (see **Exhibit 2-7**) or on a baffle (see **Exhibit 2-8**).

- The minimum allowable diameter for an orifice used to control flows in a public facility is 2 inches. Private facilities may utilize a 1-inch diameter orifice if additional clogging prevention measures are implemented. The orifice diameter shall always be greater than the thickness of the orifice plate.

- Multiple orifices may be necessary to meet the flood control design storm performance for a detention system. However, extremely low flow rates may result in small orifices (< 2 inches) that are prone to clogging. In these cases, retention facilities that do not rely on orifice structures shall be used to the maximum extent practicable to meet flow control requirements. Large projects may also result in high flow rates that necessitate excessively large orifice sizes that are impractical to construct. In such cases, several orifices may be located at the same elevation to reduce the size of each individual orifice.

Orifice Sizing Equation:

$$Q = CA\sqrt{2gh}$$

where:

Q = Orifice discharge rate, cfs
C = Coefficient of discharge, feet (suggested value = 0.60 for plate orifices)
A = Area of orifice, square feet
h = hydraulic head, feet
$g = 32.2\ \text{ft/sec}^2$

The diameter of plate orifices is typically calculated from the given flow. The orifice equation is often useful when expressed as an equivalent orifice diameter in inches.

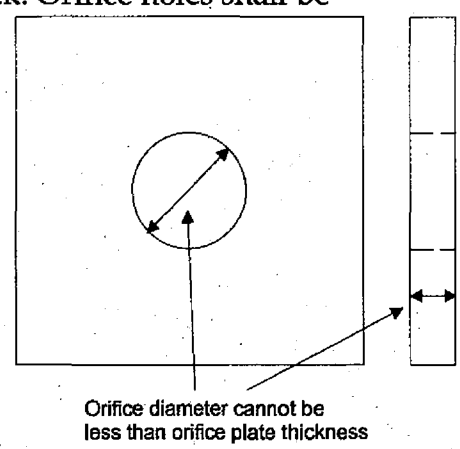
$$d = \sqrt{\frac{36.88\,Q}{\sqrt{h}}}$$

where:

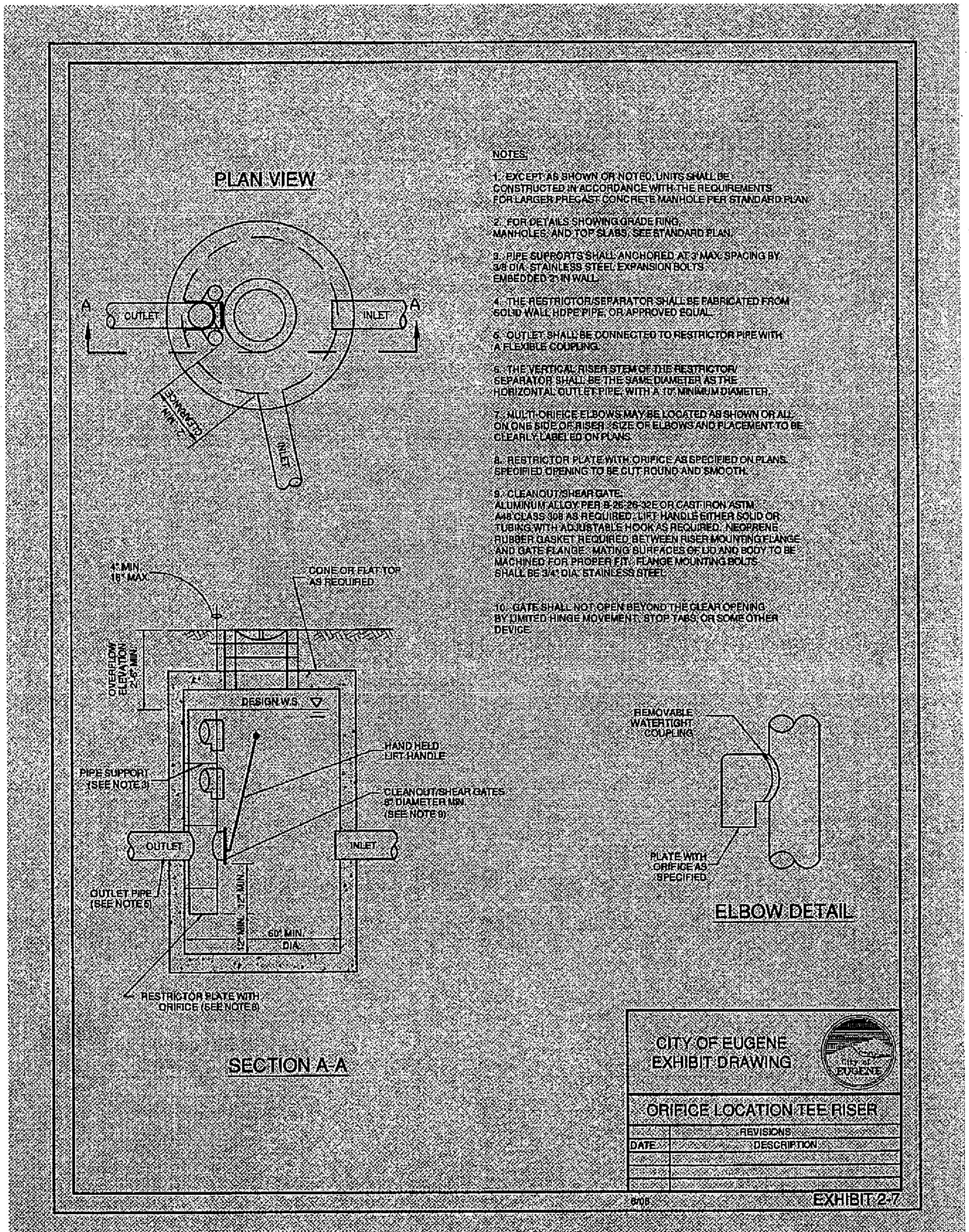
Q = flow, cfs
d = orifice diameter, inches
h = hydraulic head, feet

- Orifices shall be protected within a manhole structure, or by a minimum 18-inch-thick layer of 1½″ to 3″ evenly graded, washed rock. Orifice holes shall be externally protected by stainless steel or galvanized wire screen (hardware cloth) with a mesh of 3/4″ or less. Chicken wire shall not be used for this application.

- Orifice diameter shall be greater than or equal to the thickness of the orifice plate (see diagram).



- If less than 3″, the orifice shall not be made of concrete. A thin material (e.g., stainless steel, HDPE or PVC) shall be used to make the orifice plate; the plate shall be attached to the concrete or structure.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

NOTES

1. EXCEPT AS SHOWN OR NOTED, UNIT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS FOR LARGE PRE CAST CONCRETE MANHOLES.

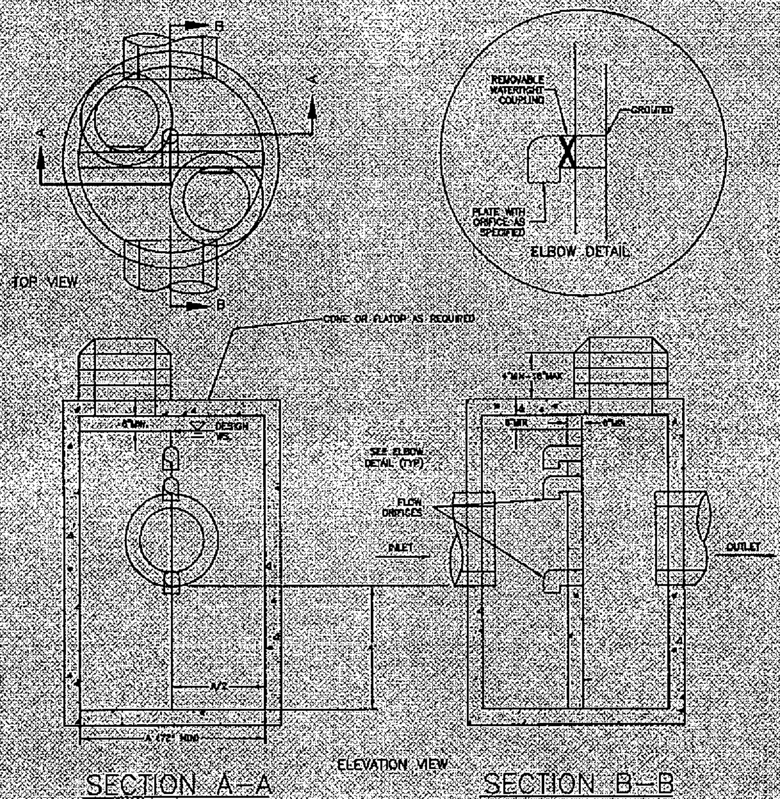
2. SEE PROJECT PLANS FOR SIZE AND LOCATION OF ORIFICES.

3. PIPE SIZES, SLOPES AND ALL ELEVATIONS AS SHOWN IN THE PLANS.

4. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.

5. PRE CAST BAFFLE WALL SHALL BE KEYED AND GROUTED IN PLACE.

6. ORIFICE PLATES TO BE 1/4" THICK MIN. HDPE OR APPROVED EQUAL AND ATTACHED WITH 1/2" STAINLESS STEEL BOLTS.



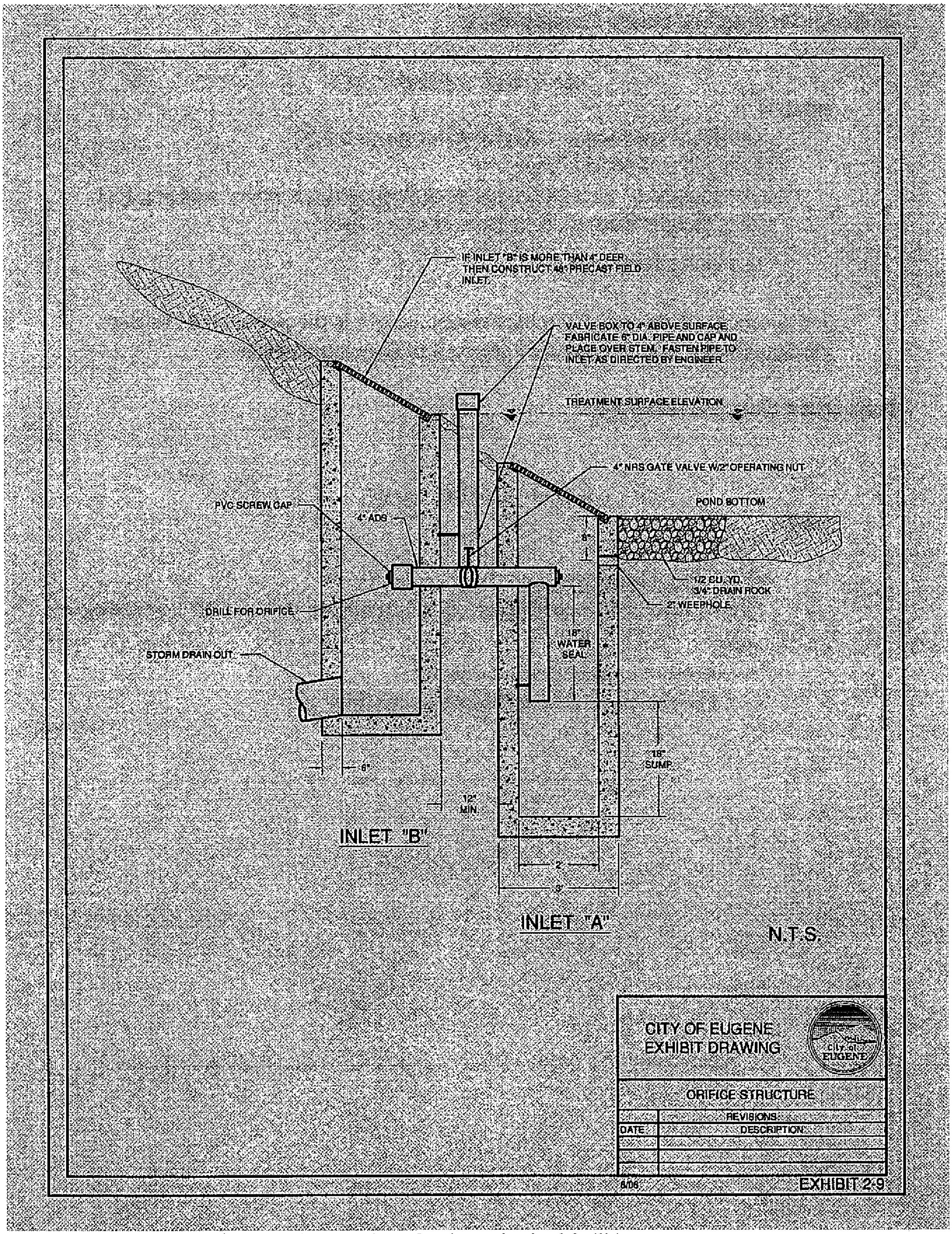
CITY OF EUGENE
EXHIBIT DRAWING

ORIFICE LOCATION BAFFLE RISER

REVISIONS	
DATE	DESCRIPTION

6/06 EXHIBIT 2-8

Note: See Eugene Standard Construction Drawings, for city-maintained facilities.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Rectangular Notched Sharp Crested Weir

$$Q = C(L - 0.2H) * H^{1.5}$$

where:

Q= Weir discharge, cubic feet per second (cfs)
C = 3.27 + 0.40*H/P, feet
P = Height of weir bottom above downstream water surface, feet
H = Height from weir bottom to crest, feet
L = Length of weir, feet*

* For weirs notched out of circular risers, length is the portion of the riser circumference not to exceed 50 percent of the circumference.

V-Notched Sharp Crested Weir

$$Q = C_d \left(\text{Tan} \frac{\theta}{2}\right) H^{\frac{5}{2}}$$

where:

Q = Weir discharge, cfs
C_d = Contraction coefficient, feet (suggested value = 2.5 for 90 degree weir)
θ = Internal angle of notch, degrees
H = Height from weir bottom to crest, feet

2.6 ACCESS FOR OPERATIONS AND MAINTENANCE

Adequate access for operations and maintenance must be provided to all stormwater management facilities and their components. Public facilities shall have access routes at least 10 feet wide, not to exceed 10 percent in slope, and shall be located adjacent to public rights-of-way wherever feasible. Access routes greater than 100 feet in length shall provide a vehicle turn-around (see *Public Improvement Design Standards Manual*) for the maintenance vehicles. Where structural surfaces are needed to support maintenance vehicles, access routes shall be constructed of gravel or other permeable paving surface where possible. Public facility vehicular access routes shall be designed for H-20 loading.

2.7 LANDSCAPING

2.7.1 Landscaping Applications

The design must include elements that ensure landscape plant survival and overall stormwater facility functional success. Construction specifications and/or drawings need to include the following elements:

- Irrigation system to be used for the establishment period and permanent long-term. Note that public stormwater management facilities shall be designed so permanent long-term irrigation systems are not needed.

- Landscape plan showing the location of landscape elements, including size and species of all proposed plantings, and existing plants and trees to be preserved.

- Plant list/table, including scientific name, size at time of planting, quantity, type of container, evergreen or deciduous, appropriate planting season, native or non-native to region, and other information in accordance with the facility-specific planting section and landscape industry standards.

- Topsoil stockpile location, including source of topsoil, if imported. Include erosion protection per the City's *Erosion Prevention Code and its corresponding Administrative Order(s)*. Soil analysis for all topsoil to be used within the facility area.

2.7.2 Landscaping Design and Management

Vegetation is a key element in the performance of many stormwater management facilities. Facility-specific planting practices are shown in **Section 2.9**. These practices are based on experience and/or standard landscape industry methods for design and construction, and are required to be covered by a 2-year warranty period.

At the end of the first year and again at the end of the 2-year warranty period, all plants that do not survive must be replaced. Establishment procedures, such as control of invasive weeds, animal and vandal damage, mulching, re-staking, watering, and mesh or tube protection replacement, shall be implemented to the extent needed to ensure plant survival.

Designers may elect to use an Alternative Revegetation approach, which allows smaller materials to be planted in larger quantities. If this approach is chosen, the following practices shall apply:

1) A 5-year warranty period from the time of plant installation shall be provided.
2) Plants must be installed during the dormant season, typically defined as December through March.
3) A survival rate of 75 percent (no replacements) must be achieved for all bare root plants measured in the third and fifth year after installation. If the survival rate falls below this threshold, a number of additional plants, sufficient to meet the 75% survival rate must be installed. The number of additional plants required will be based on the mortality rate of the initial planting.
4) Density of plantings shall be at least one tree and one shrub per 50 square feet of facility area. These plants are bare root (seedlings) and range in size from 10 inches to 24 inches tall.
5) Bareroot seedlings must be dormant in order to harvest from farm sites for planting.
6) All plants must be native from local seed sources and found on the Eugene Plant List. A minimum of four different species of trees and shrubs must be used. At least half of the trees must be evergreen. Ground covers must be native grasses ad wildflowers from local seed sources. See **Appendix G** for a list of native plant suppliers.
7) During the period between harvest and installation, the plants must be kept in a temperature-controlled facility. Temperature must be kept between 33 and 36 degrees Fahrenheit, and plant roots must be kept moist at all times. Plants must be planted within 24 hours of removal from the temperature-controlled facility.

Stormwater facilities located in the public street right-of-way are not required to use evergreen trees to meet landscaping requirements.

Where the plant material schedules of this manual and Eugene Code differ, the designer shall use the larger quantity and sizes. (In calculating quantities, fractions should be rounded to the higher number.)

In some cases landscaping required by Eugene Code may be counted toward meeting the facility-specific landscape requirements for stormwater management if the plantings are located within the facility area. Similarly, in some cases plantings that meet the schedules in this chapter may also meet Eugene Code landscape requirements.

It is critical that selected plant materials are appropriate for soil, hydrologic, and other facility and site conditions. For City-maintained facilities located outside of the public right-of-way, all plants within the facility area shall be appropriate native species from the **recommended plant lists in Appendix G** (no nuisance or prohibited plants).

The design for plantings shall minimize the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis. Plantings shall be designed to minimize the need for mowing, pruning, and irrigation.

Grass or wildflower seed shall be applied at the rates specified by the suppliers. If plant establishment cannot be achieved with seeding by the time of substantial completion of the stormwater facility portion of the project, the contractor shall plant the area with wildflower sod, plugs, container plants, or some other means to complete the specified plantings and protect against erosion before water is allowed to enter the facility.

2.8 OUTFALL DESIGN

Outfalls should be located above the downstream mean low water level, unless a pipe velocity of 3′ per second can be maintained with the pipe outfall located below the water surface level. **Exhibit 2-10** shows a typical outfall layout. Publicly accessible outfalls greater than 15 inches in diameter shall include grated protection in accordance with **Exhibit 2-14**. All outfalls shall be provided with a rock splash pad or other approved erosion control/energy dissipation measures. Rock protection at outfalls from small diameter pipes shall be as follows:

RIP-RAP PAD DIMENSIONS FOR SMALL OUTFALLS

2″ Pipe: 12″ wide x 24″ long x 2″ deep, Average Stone Size = 1″
4″ Pipe: 24″ wide x 36″ long x 4″ deep, Average Stone Size = 2″
6″ Pipe: 36″ wide x 48″ long x 6″ deep, Average Stone Size = 4″

Rock protection at outfalls from pipes greater than 6 inches shall be designed in accordance with **Exhibit 2-11,** unless otherwise approved by the City. **Exhibit 2-12** shows riprap class selection.

Engineered energy dissipaters, including stilling basins, drop pools, hydraulic jump basins, baffled aprons, and bucket aprons, are required for outfalls with velocity at design flow greater than 20 feet per second (fps). These shall be designed by a professional engineer using published references such as *Hydraulic Design of Energy Dissipaters for Culverts and Channels* (U.S. Department of Transportation, Federal Highway Administration) and other references. The construction plan submittal shall identify the design reference.

Drainage ways and rivers may have steep slopes or banks and may have unstable landforms (i.e. slump). Geotechnical investigation and analysis to determine the stability of the stream or river bank shall be provided with the stormwater study.

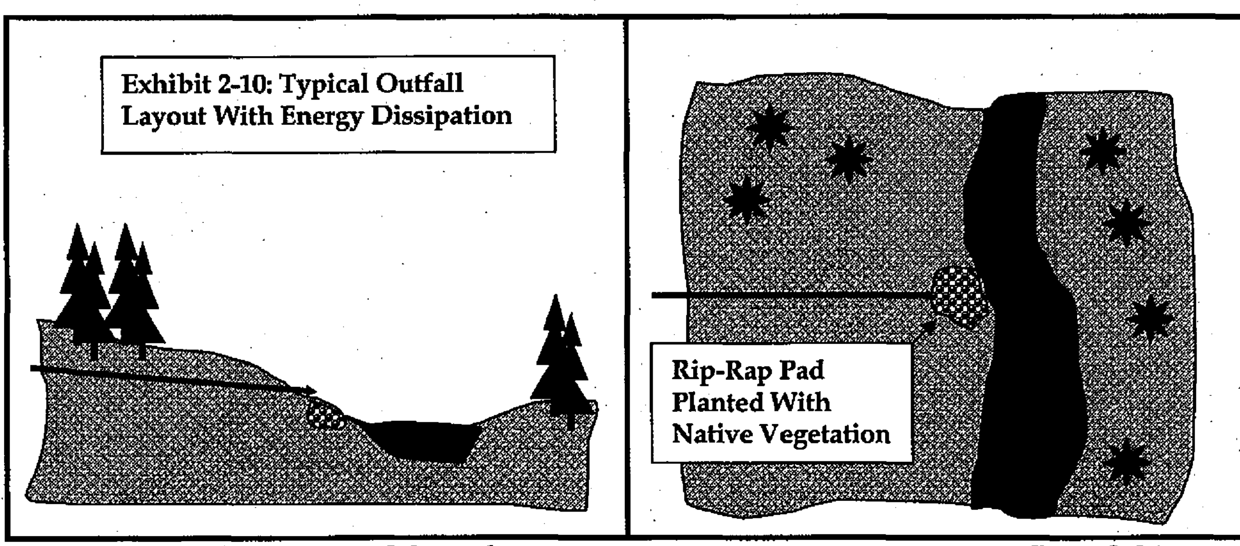


Exhibit 2-10: Typical Outfall Layout With Energy Dissipation

Exhibit 2-11
ROCK PROTECTION AT OUTFALLS FOR PIPES GREATER THAN 6 INCHES IN DIAMETER

Discharge Velocity at Design Flow (fps)			REQUIRED PROTECTION Minimum Dimensions				
			Type	Depth*	Width	Length**	Height
0	To	5	Riprap*	2 x (max stone size)	Diameter + 6 ft.	As calculated	Crown + 1 ft.
6	To	10	Riprap*	2 x (max stone size)	Diameter + 6 ft. or 3x dia. which-ever is greater	As calculated	Crown + 1 ft.
11	To	20	Gabion or Riprap*	2 x (max stone size)	Diameter + 6 ft. or 4x dia. which-ever is greater	As calculated	Crown +1 ft.
Over 20			Engineered Energy Dissipater Required				

* Riprap size shall be determined using the following formulae*** and the City's *Standard Construction Specifications*

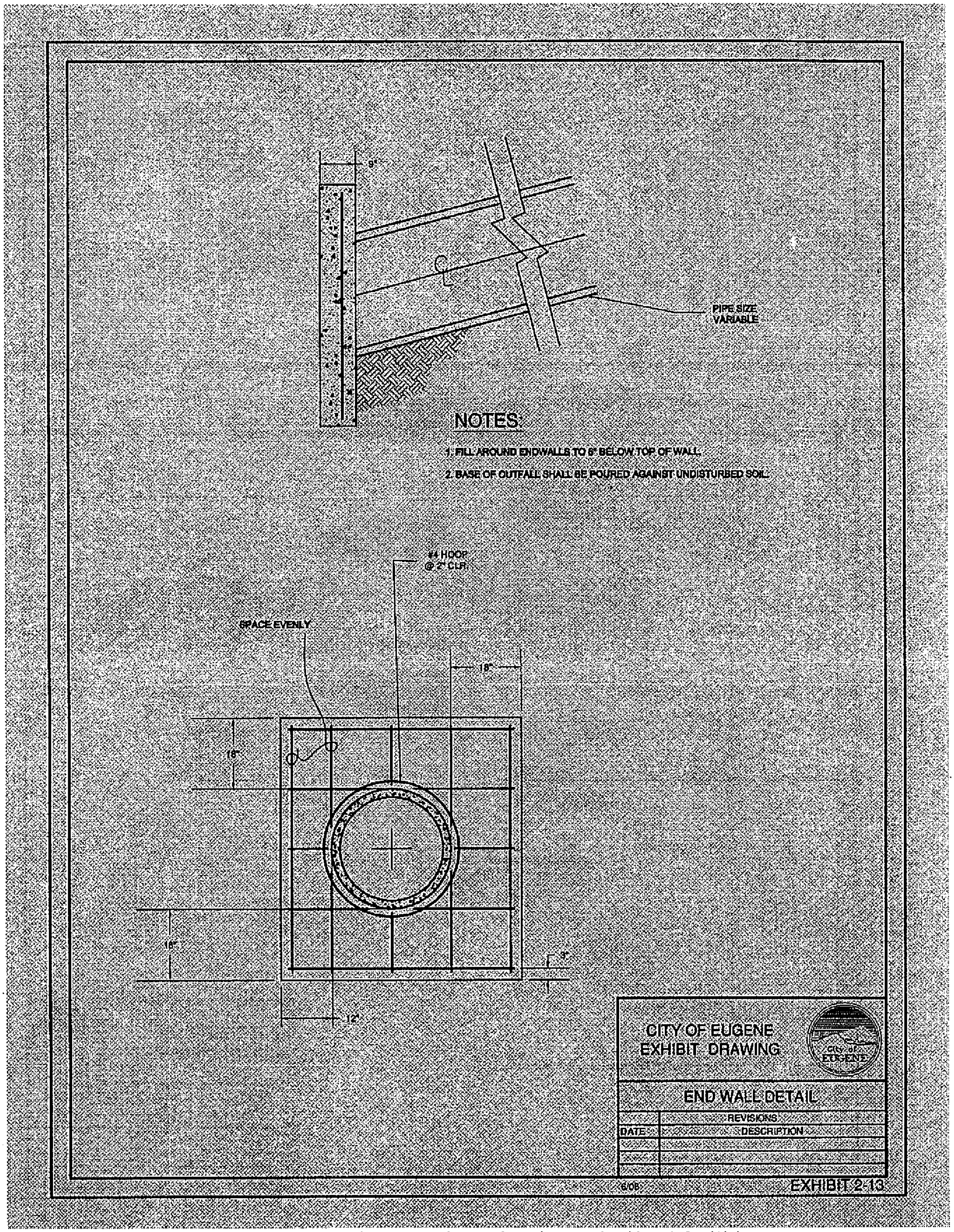
V = Average velocity (ft/s) *Riprap size ds=0.25*Do*Fo (6" minimum)
Do = Pipe diameter (ft) Depth=2*ds (1 foot minimum)
ds = Riprap diameter (ft) **Apron length Lsp= Do(8+17*Log Fo)
Lsp = Apron length (ft)
depth = Thickness (ft)
Fo = $V/(g*Do)^{0.5}$ $g = 32.2$ ft/s^2

***US Army Corps of Engineers design formulas from *Erosion and Riprap Requirements at Culvert and Storm Outlets,* January 1970

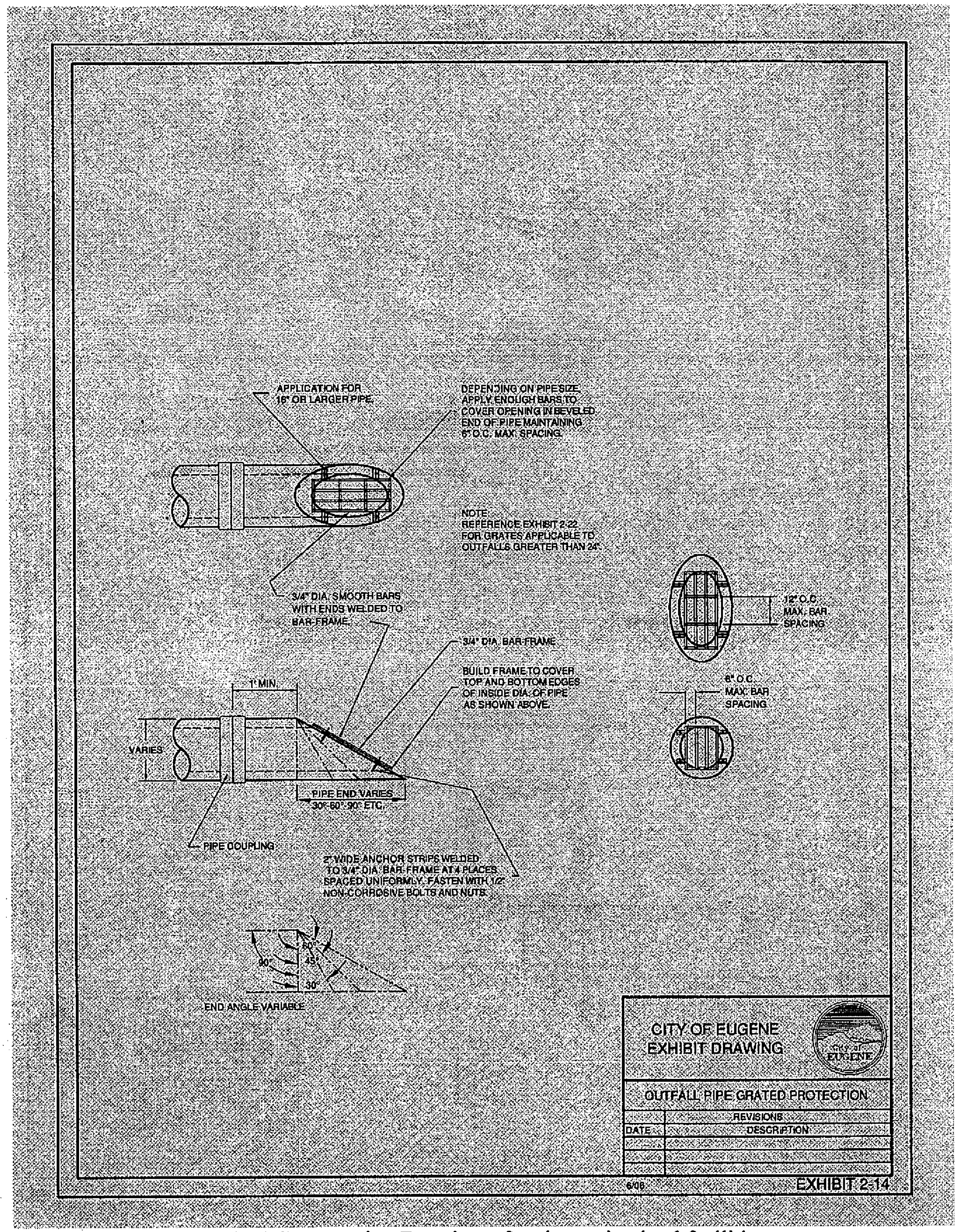
Exhibit 2-12: RIPRAP CLASS SELECTION

Weight (lbs)	Spherical Size (inches)	% by Weight	Average Stone Size (inches)
Class 50			6.3
30 – 50	8.5 – 10	20	
15 – 30	6.7 – 8.5	30	
2 – 15	3.5 – 6.7	40	
0 – 2	0 – 3.5	10	
Class 100			7.6
60 – 100	10.6 – 12.8	20	
25 – 60	8.0 – 10.6	30	
2 – 25	3.5 – 8.0	40	
0 – 2	0 – 3.5	10	
Class 250			11.3
200 – 250	15.0 – 18.0	20	
100 – 200	12.0 – 15.0	30	
10 – 100	6.0 – 12.0	40	
0 – 10	0 – 6.0	10	
Class 700			15.2
500 – 700	21.5 – 24.0	20	
200 – 500	15.9 – 21.5	30	
20 – 200	7.4 – 15.9	40	
0 – 20	0 – 7.4	10	
Class 2000			21.7
1400 – 2000	30.4 – 34.0	20	
700 – 1400	24.0 – 30.4	30	
40 – 700	9.3 – 24.0	40	
0 – 40	0 – 9.3	10	

Reference: Erosion and Riprap Requirements at Culverts and Storm-Drain Outlets
U.S. Army Engineers, Jan 1970

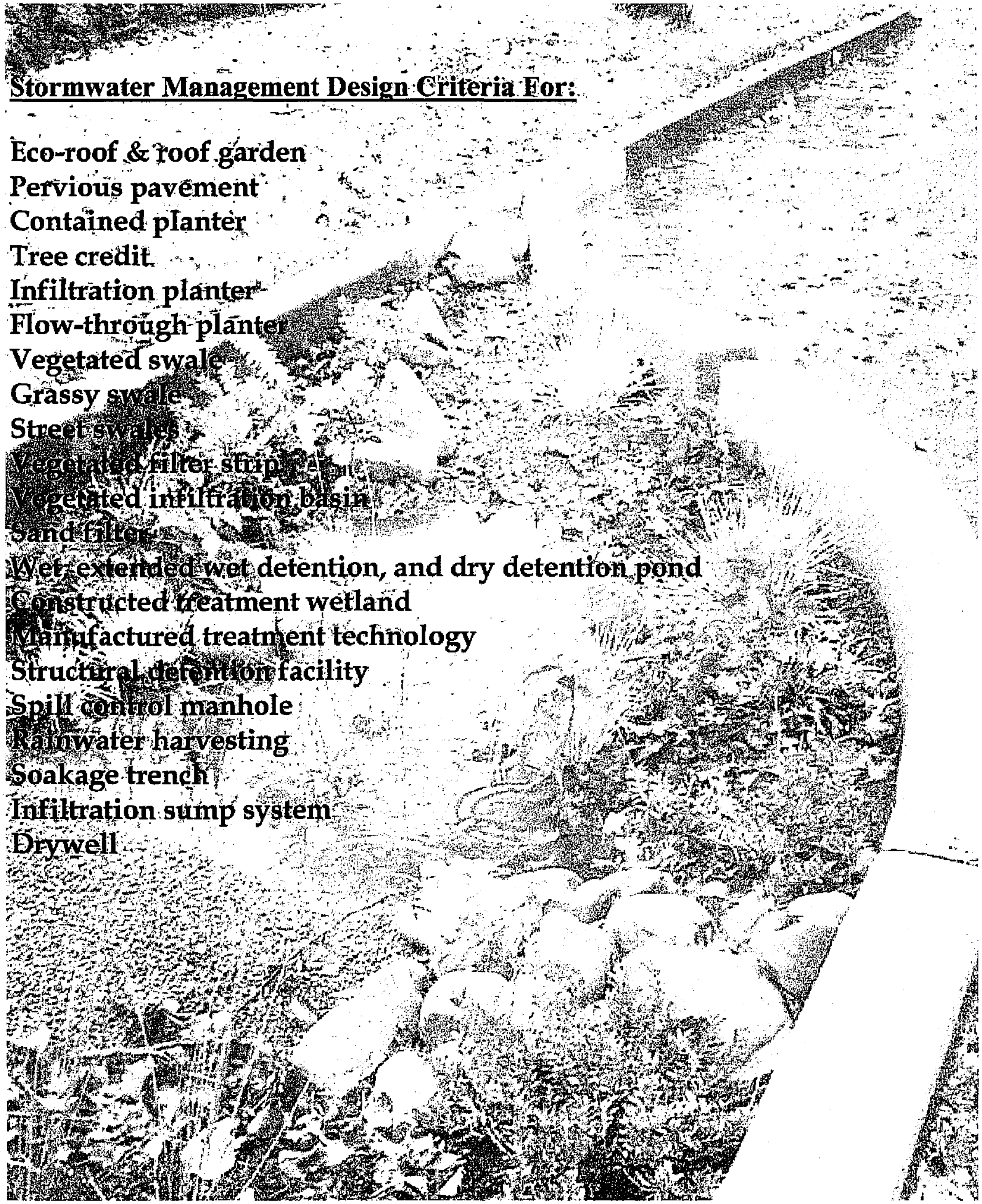


Note: See Eugene Standard Construction Drawings, for city-maintained facilities.



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

2.9 FACILITY SELECTION AND DESIGN



Stormwater Management Design Criteria For:

Eco-roof & roof garden
Pervious pavement
Contained planter
Tree credit
Infiltration planter
Flow-through planter
Vegetated swale
Grassy swale
Street swales
Vegetated filter strip
Vegetated infiltration basin
Sand filter
Wet, extended wet detention, and dry detention pond
Constructed treatment wetland
Manufactured treatment technology
Structural detention facility
Spill control manhole
Rainwater harvesting
Soakage trench
Infiltration sump system
Drywell

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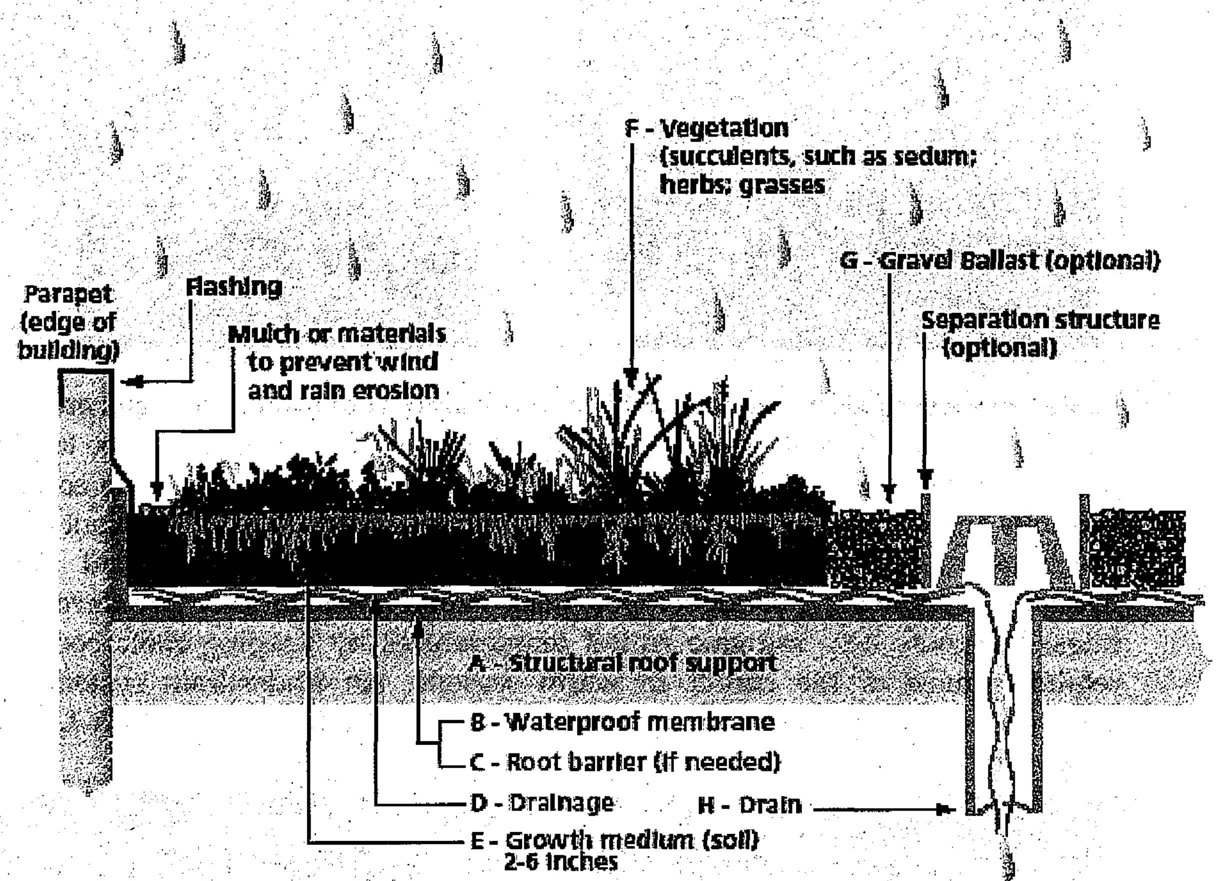
Eco-Roof & Roof Garden



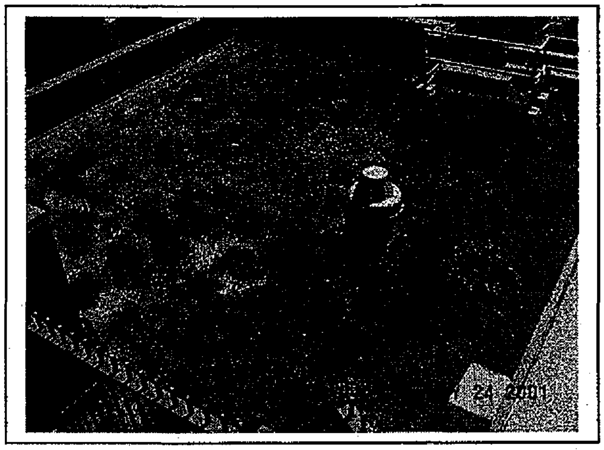
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Impervious Area Reduction....................	SIM
√ Pollution Reduction................................	SIM
√ Flow Control..	SIM
Destination..	NA

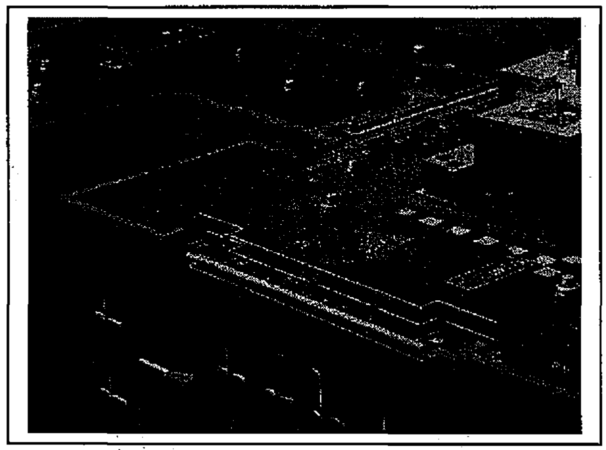
This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

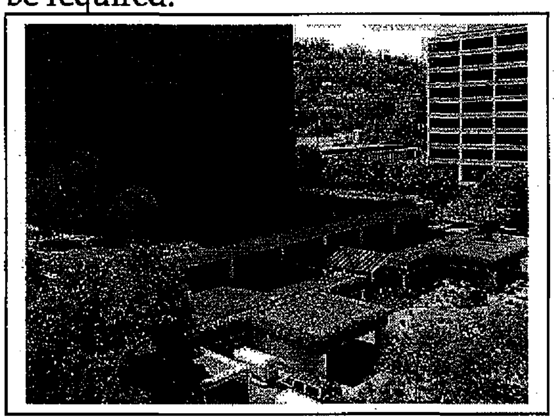
Notes: 1) This facility is an impervious surface reduction technique. Its applicability is limited to rooftops or decks above building structures.

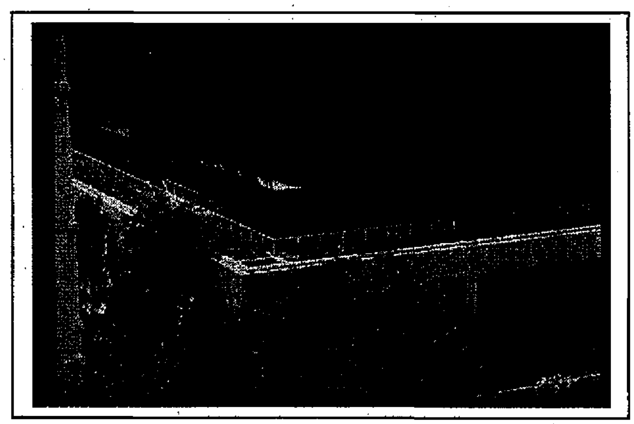
Eco-Roof & Roof Garden





Eco-Roof Description: An eco-roof is a lightweight roof system of waterproofing material with a thin soil/vegetation protective cover. The eco-roof can be used in place of a traditional roof as a way to limit impervious site area. The eco-roof captures and depending on the season, evapotranspirates 10 to 100 percent of the precipitation. Eco-roofs attempt to mimic pre-developed ground cover hydrology, reducing post-developed peak runoff rates to near pre-developed rates. Eco-roofs help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in warm seasons. An underdrain system and overflow to an approved conveyance/ destination method per **Section 1.4** will be required.





Roof Garden Description: A roof garden is a heavy weight roof system of waterproofing material with a thick soil/vegetation protective cover. The roof garden can be used in place of a traditional roof to limit impervious site area. The roof garden captures and then evapotranspirates 50 to 100% of precipitation, depending on the season. Roof gardens attempt to mimic pre-developed hydrology, therefore reducing post-developed peak runoff rates to near pre-developed rates. They help mitigate runoff temperatures by keeping roofs cool and retaining most of the runoff in warm seasons. Roof gardens should not be used on slopes greater than 10%. A drain system and overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Eco-Roof & Roof Garden

Design Requirements:

General Specifications: Good quality waterproofing material must be used on the roof surface. Soil of adequate fertility and drainage capacity at depths of 2-6 inches, and weight of 10 to 30 pounds per square foot, shall be applied. The building structure must be shown to be adequate to hold the additional weight. Vegetation shall be self-sustaining plants, without the need for fertilizers or pesticides. Soil coverage to prevent erosion shall be established immediately upon installation by using mulch, vegetation mats, or other approved protection method. Ninety-percent plant coverage shall be achieved within 2 years. Temporary irrigation to establish plants is recommended. A permanent irrigation system using potable water may be used, but an alternative means of irrigation, such as air conditioning condensate or other non-potable sources is recommended. Alternative sources should be analyzed to determine if the source has chemicals that might harm or kill the vegetation. Maximum roof slope shall be 25%, unless the applicant can provide documentation for runoff control on steeper slopes.

A. **Structural Roof Support:** The structural roof support must be sufficient to hold the additional weight of the eco-roof. For retrofit projects, check with an architect, structural engineer, or roof consultant to determine the condition of the existing building structure and what might be needed to support an eco-roof. This might include additional decking, roof trusses, joists, columns, and/or foundations. Generally, the building structure must be adequate to hold an additional 10 to 25 pounds per square-foot (psf) saturated weight, depending on the vegetation and growth medium that will be used. (This is in addition to snow load requirements.) An existing rock ballast roof may be structurally sufficient to hold a 10-12 psf eco-roof. (Ballast typically weighs 10-12 psf.)

   For New Construction the project architects and structural engineers shall address the structural requirements of the eco-roof during the design process. Greater flexibility and options are available for new buildings than for re-roofing. The procedures for the remaining components (B through H) are the same for both re-roofing and new construction.

B. **Waterproof Membrane (Impermeable Material):** Waterproof membranes are made of various materials, such as modified asphalts (bitumens), synthetic rubber (EPDM), hypolan (CPSE), and reinforced PVC. Some of the materials come in sheets or rolls and some are in liquid form. They have different strengths and functional characteristics. Some of these products require root inhibitors (refer to C) and other materials to protect the membrane.

Numerous companies manufacture waterproofing materials appropriate for eco-roofs.

Protection Boards or Materials: These materials protect the waterproof membrane from damage during construction and over the life of the system, usually made of soft fibrous materials.

C. **Root Barrier (If needed):** Root barriers are made of dense materials that inhibit root penetration. The need for a root barrier depends on the waterproof membrane selected. Modified asphalts usually require a root barrier, while synthetic rubber (EPDM) and reinforced PVC generally do not. Check with the manufacturer to determine if a root barrier is required for a particular product. Note: membranes impregnated with pesticides are not allowed. Manufacturers must provide City with evidence that membranes impregnated with copper will not leach out at concentrations of concern.

D. **Drainage Layer (If needed):** There are numerous ways to provide drainage. Products range from manufactured perforated plastic sheets to a thin layer of gravel. Some eco-roof designs do not require any drainage layer other than the growth medium itself, depending on roof slope and size (for example, pitched roofs and small flat roofs).

E. **Growth Medium (Soil):** The growth medium is generally 2 to 6-inches thick and well drained. It weighs from 10 to 25 pounds per square-foot when saturated. A simple mix of one-fourth topsoil, one-fourth compost, and one-half pumice perlite may be sufficient for many applications. Some companies have their own growth medium specifications. Other components could include digested fiber, expanded clay or shale, or coir.

F. **Vegetation:** Eco-roof and roof garden vegetation should have the following attributes:
- Drought-tolerant, requiring little or no irrigation after establishment
- A growth pattern that allows the plant to thoroughly cover the soil. At least 90% of the overall surface shall be covered.
- Self-sustaining, without the need for fertilizers, pesticides, or herbicides
- Able to withstand heat, cold, and high winds
- Very low-maintenance, needing little or no mowing or trimming
- Perennial or self-sowing
- Fire resistant

A mix of sedum/ succulent plant communities is recommended because they possess many of these attributes. Herbs, forbs, grasses, and other low groundcovers can also be used to provide additional benefits and aesthetics;

however, these plants may need more watering and maintenance to survive and keep their appearance.

***Link to Eco-Roof Landscaping Plan Example**
***Link to Eco-Roof and Roof Garden Recommended Plants**

Installation: Four methods (or combinations of them) are generally used to install the vegetation: vegetation mats, plugs/ potted plants, sprigs, and seeds.

1. **Vegetation mats** are sod-like, pre-germinated mats that achieve immediate full plant coverage. They provide immediate erosion control, do not need mulch, and minimize weed intrusion. They also need minimal maintenance during the establishment period and little ongoing watering and weeding.
2. **Plugs or potted plants** may provide more design flexibility than mats. However, they take longer to achieve full coverage, are more prone to erosion, need more watering during establishment, require mulching and more weeding.
3. **Sprigs** are hand-broadcast. They require more weeding, erosion control, and watering than mats.
4. **Seeds** can be either hand-broadcast or hydraseeded. Like sprigs, they require more weeding, erosion control, and watering than mats.

G. **Gravel Ballast (If needed):** Gravel ballast is sometimes placed along the perimeter of the roof and at air vents or other vertical elements. The need for ballast depends on operational and structural design issues. It is sometimes used to provide maintenance access, especially to vertical elements requiring periodic maintenance. In many cases, very little, if any, ballast is needed. In some situations a header or separation board may be placed between the gravel ballast and adjacent elements (such as soil or drains). If a root barrier is used, it must extend under the gravel ballast and growth medium, and up the side of the vertical elements.

H. **Drain:** As with a conventional roof, an eco-roof must safely drain runoff from the roof to an approved stormwater destination. See **Section 1.4** for stormwater destinations.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from roof lines
2) Profile view of facility, including typical cross-sections with dimensions

3) Growing medium specification, including weight
4) Filter fabric specification
5) Drainage layer specification
6) Waterproof membrane specification, including root barriers
7) Planting and irrigation plan
8) Final stormwater destination

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Roof Structure	Call for inspection
Waterproof membrane	Call for inspection
Drainage layer/ plumbing & pipes	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

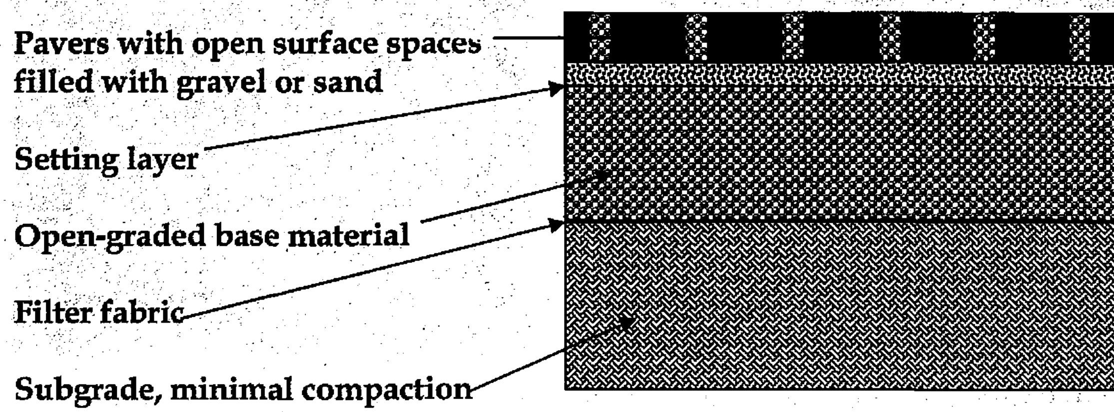
*** Link to eco-roof and roof garden O&M form**

Additional photos and drawings:

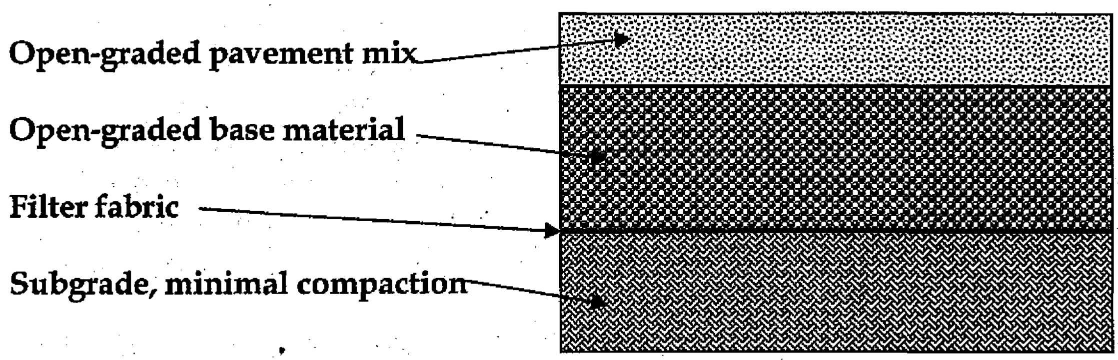
*** Link to eco-roof and roof garden photos**
*** Link to eco-roof and roof garden drawings**

Pervious Pavement

Pervious Concrete Block or "Paver" Systems



Pervious (Open Graded) Concrete and Asphalt Mixes



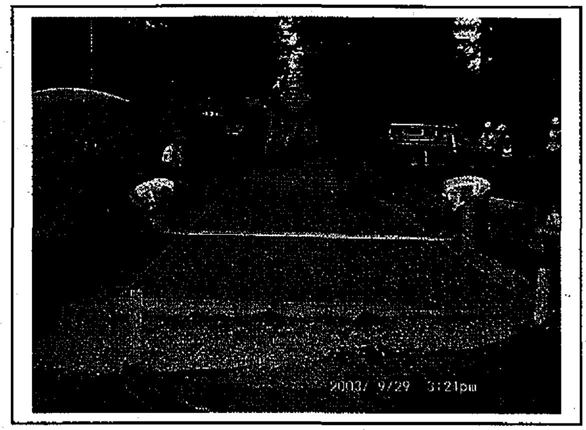
Stormwater Management Goals Achieved **Acceptable Sizing Methodologies**

√ Impervious Area Reduction
√ Pollution Reduction.............................. SIM
√ Flow Control...................................... SIM
√ Destination.. PERF
This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility is an impervious surface reduction technique. It is applicable for use in parking lots, driveways, and in some cases streets.

Pervious Pavement



Description: There are many types of pervious pavement on the market today. Numerous products and design approaches are available, including special asphalt paving; manufactured products of concrete, plastic, and gravel; paving stones; and brick. It may be used for walkways, patios, plazas, driveways, parking lots, and some portions of streets, subject to compliance with building codes. To receive credit, the material must be installed and maintained to manufacturer's specifications. Pervious pavement accepts only precipitation, not stormwater runoff. These materials may not be allowed in certain areas (see **Chapter 4.0** for restrictions). A professional engineer, registered in the state of Oregon must design pervious pavement systems that will be supporting vehicular traffic. For EPA's "Porous Pavement Phase I Design and Operational Criteria" (EPA-600/2-80-135), go to: **http://www.epa.gov/ednnmrl/repository/abstrac2/abstra2.htm**. For Portland's Bureau of Environmental Service's report on pervious pavement demonstration projects, vendors, and other resources, go to: **http://www.cleanrivers-pdx.org/pdf/alternative_paving.pdf**.

Design Considerations: When designing pervious pavement systems, the infiltration rate of the native soil is a key element in determining the depth of base rock for the storage of stormwater, or for determining whether an underdrain system is appropriate. Traffic loading and design speed are important considerations in determining which type of pervious pavement is applicable. Pedestrian ADA accessibility, aesthetics, and maintainability are also important considerations, depending on pavement use.

Construction Considerations: Installation procedures can be detrimental to the success of pervious pavement projects, particularly pervious asphalt and concrete pavement mixes. The subgrade and base rock cannot be overly compacted with the inclusion of fine particulates or the void ratio critical to providing storage for large storm events will be lost. Weather conditions at the time of installation can affect the final product, as in the case of high or low temperatures with pervious asphalt and excessive rainfall with pervious concrete. Pavement infiltration rates shall be verified prior to final acceptance.

Design Requirements:

Soil Suitability: Pervious pavement systems are appropriate for all soil types, but will require underdrain systems to an approved stormwater destination (per **Section 1.4**) for soils that do not infiltrate well (less than 0.5 inches per hour, generally NRCS soil type D). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the base rock and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.), unless an underdrain system is used.

Dimensions and Slopes: Minimum/ maximum dimensions and other specifications are product-specific and shall comply with manufacturer's recommendations. Slopes shall be less than 10% in all cases.

Setbacks: Not applicable.

Sizing: Pervious pavement systems are not considered to be impervious surfaces, and therefore do not trigger pollution reduction and flow control requirements. A high-flow overflow or underdrain system must be provided to an approved destination point per **Section 1.4**.

Limitations: Pervious pavements shall not be used on sites with a likelihood of high oil and grease concentrations. These site uses include vehicle wrecking or impound yards, fast food establishments, automotive repair and sales, and parking lots that receive a high number of average daily trips (> 1,000).

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions, grades, grade breaks, and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Pervious pavement materials and installation procedure specifications
4) Subgrade and base course specifications
5) Filter fabric specification (if applicable)
6) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Pervious Pavement

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Subgrade	
Filter fabric (if applicable)	
Underdrain piping (if applicable)	Call for inspection
Base rock	
Pervious pavement installation	Call for inspection

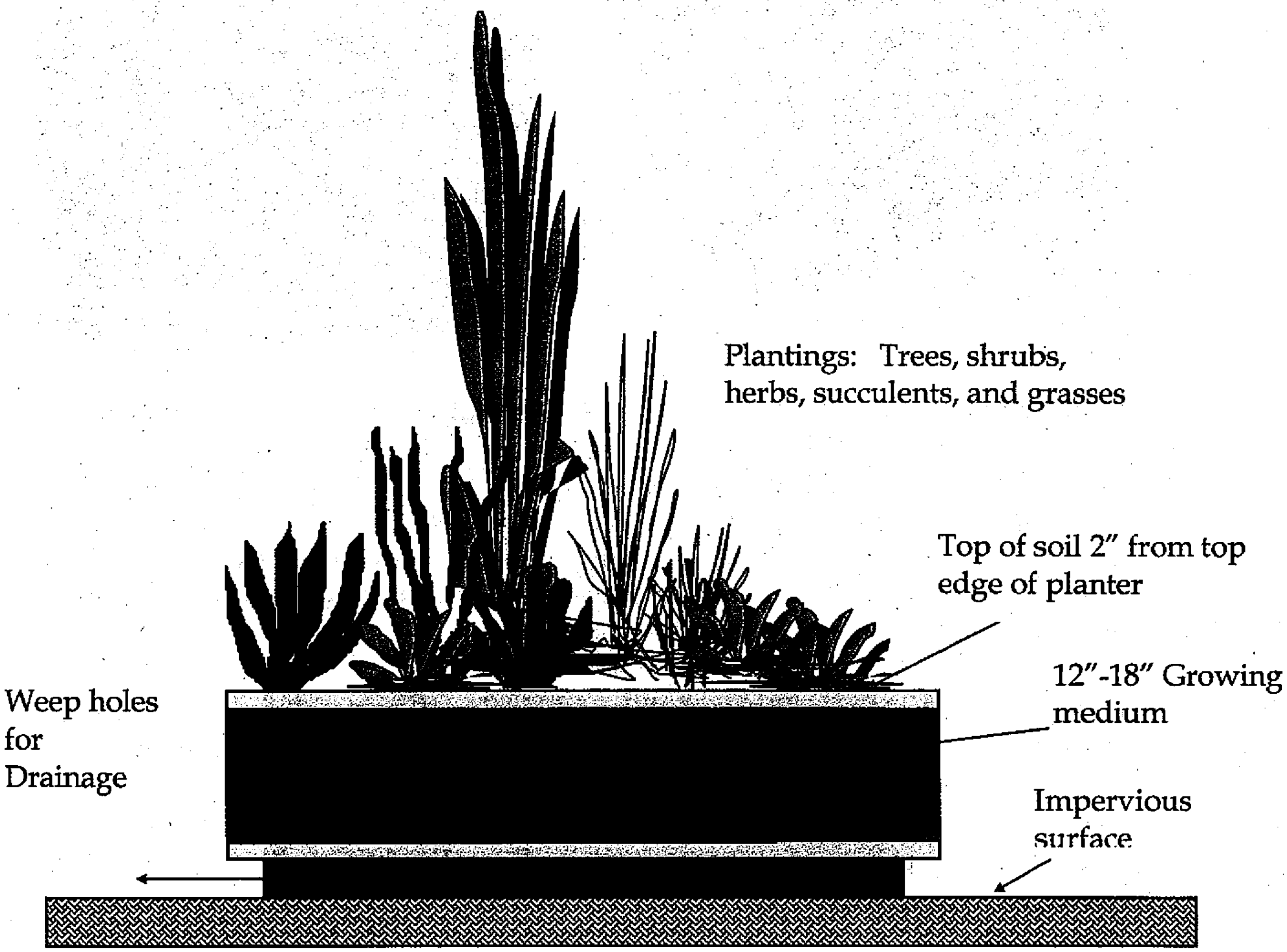
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to pervious pavement O&M form**

Additional photos and drawings:

*** Link to pervious pavement photos**
*** Link to pervious pavement drawings**
- *** Link to pervious Asphalt drawing**
- *** Link to pervious concrete drawing**
- *** Link to brick drawing**
- *** Link to cobble drawing**
- *** Link to crushed aggregate drawing**
- *** Link to natural stone drawing**
- *** Link to turf block drawing**
- *** Link to unit pavers on sand drawing**

Contained Planter



Section Not to Scale

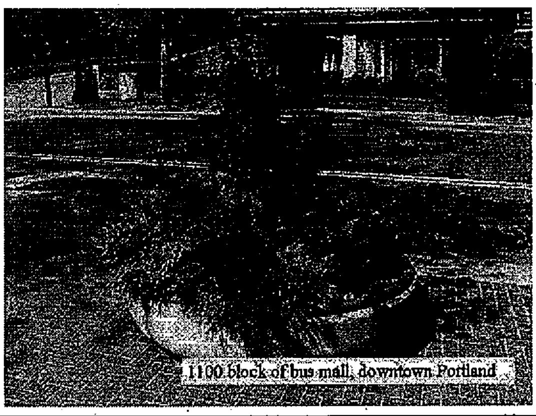
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Impervious Area Reduction	SIM
√ Pollution Reduction	SIM
√ Flow Control	SIM
Destination	NA

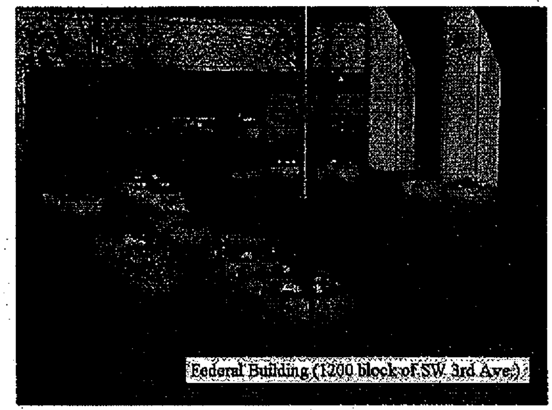
This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility is an impervious surface reduction technique. It may be placed over sidewalk, parking lot, flat roof, and plaza areas to reduce the effective impervious area.

Contained Planter


1100 block of bus mall, downtown Portland


Federal Building (1200 block of SW 3rd Ave.)

Description: Contained planters are used for planting trees, shrubs, and ground cover for placement over impervious surface. The planter may be a prefabricated pot of various dimensions or may be constructed in place and have an infinite variety of shapes and sizes. Contained planters accept precipitation only, not stormwater runoff. Planters are placed on impervious surfaces, such as sidewalks, plazas and rooftops. Drainage is allowed through the bottom of the planter onto the impervious surface.

Design Considerations: Plants shall be relatively self-sustaining, with little need for fertilizers or pesticides. Irrigation is optional, although plant viability must be maintained. Planters tend to dry out more quickly due to reflective heat, insulation to protect roots may be necessary. Trees are encouraged and may receive added stormwater management credit on the tree credit section of Form SIM.

Design Requirements:

Soil Suitability: Contained planters are appropriate for all soil types, as they are placed over impervious surface. Topsoil shall be used within the top 12 to 18 inches of the facility.

Setbacks: Not applicable.

Planter Walls: Planter walls shall be made of stone, concrete, brick, clay, plastic, wood, or other stable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Contained planters are given stormwater management credit for the square-footage of impervious surface that they cover, at a 1 to 1 ratio.

Contained Planter

Landscaping: Contained planters shall be planted to cover at least 50% of the planter surface.

***Link to Planter Recommended Plants**

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and location
2) Planter wall material specification
3) Growing medium specification
4) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Structural planter components	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to contained planter O&M form**

Additional photos and drawings:

*** Link to contained planter photos**
*** Link to contained planter drawings**

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Tree Credits

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Impervious Area Reduction....................	SIM
√ Pollution Reduction..............................	SIM
√ Flow Control..	SIM
Destination...	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) This facility intercepts rainfall and provides shade for impervious surfaces. Trees may only receive credit against the construction of ground-level impervious surfaces.

Tree Credits

Description: Trees intercept precipitation and provide several stormwater management benefits:

- Flow control: Trees hold water on the leaves and branches and allow it to evaporate, retaining flow and dissipating the energy of runoff. These functions are most measurable for storms of less than 0.5 inches over 24 hours. While deciduous trees are not as effective during winter months, evergreen trees are effective year round for these smaller storms and portions of larger storms. Generally, large trees with small leaves are the most efficient rainfall interceptors. Trees also facilitate stormwater infiltration and groundwater recharge.

- Pollution reduction/ stormwater cooling: Trees can provide shade over large areas of impervious surface. This provides two direct benefits. First, the hard surface is protected from direct solar exposure, which reduces heat gain. The less heat gain there is in pavement, the less heat is absorbed by stormwater as it flows over the surface. Second, by shading pavement, the trees help reduce or minimize air temperature increases caused by the hot pavement. Cooler air may help prevent stream temperature increases associated with air temperatures.

New trees planted within 25 feet of ground-level impervious surfaces are eligible for stormwater management credit. 100 square feet of credit is given for new deciduous trees, and 200 square feet of credit is given for new evergreen trees (See minimum sizes below). Stormwater management credits also apply to existing trees kept on a site if the trees' canopies are within 25 feet of ground-level impervious surfaces. The credit is the square-footage equal to one-half of the existing tree canopy. No more than 10% can be mitigated through the use of trees.

Tree Credits

Trees used for stormwater management credit shall be clearly labeled on permit drawings.

NEW EVERGREEN AND DECIDUOUS TREES:

Trees shall be maintained and protected on the site after construction and for the life of the development (50-100 years or until any approved redevelopment occurs in the future). During the life of the development, trees approved for stormwater credit shall not be removed without approval from the City. Trees that are removed or die shall be replaced within 6 months with like species. Trees shall be pruned in conformance with the Eugene Code 6.350, 7.280; Administrative Rules R 6.350, 7.280; Oregon Safety and Health Administration regulations, and the American National Standards Institute (A.N.S.I) Z133.1.300.

The trees selected shall be suitable species for the site conditions and the design intent. Trees should be relatively self-sustaining and long-lived. Native conifers are highly encouraged, as many of these trees naturally grow in harsh/rocky conditions. Temporary irrigation shall be provided for native plantings. Long-term irrigation is not required. New deciduous trees must be at least 2 caliper inches and new evergreen trees must be at least 6 feet tall to receive simplified approach credit. Trees planted to meet stormwater facility planting requirements cannot also receive simplified approach credit.

By City ordinance, the Urban Forester is authorized to set standards for tree sizes planted on public rights-of-way. A permit or authorization is required from Urban Forestry to plant, prune, or remove right-of-way trees. Right-of-way trees shall be at least 1.5 caliper inches for residential and 2 caliper inches for collector and arterial streets or trees abutting commercially-zoned properties. For parks and other public areas, the tree standard is 1.5-2 caliper inches. Tree planting shall also be in compliance with land use and street tree requirements.

Tree Credits

Approved Trees

The following tree and arborescent shrub* species are approved outright for use as simplified approach tree credits. Other species may be given credit, as approved.

Acer macrophyllum	Juniperus occidentalis*	Quercus garryana
Alnus rubra	Libocendrus decurrens	Rhamnus purshiana
Arbutus menziesii	Pinus contorta	Sequoia sempervirens
Castanopsis chrysophylla*	Pinus monticola	Thuja plicata
Chamacyparis lawsoniana	Pinus ponderosa	Tsuga heterophylla
Cornus nuttallii	Pseudotsuga menziesii	Umbellularia californica
Fraxinus latifolia	Quercus chrysolepis*	

EXISTING TREES:

Mature evergreen and deciduous trees can have significant benefits in addition to stormwater management. They already provide habitat for urban wildlife, energy and cost conservation, aesthetics, visual screens, heritage value, windbreaks, and recreation.

The stormwater credit applies to existing trees of 4-inch caliper or larger. Credit is based on one-half of the square footage of the tree canopy, measured within the drip-line.

Protection during construction shall be in the conformance with the City's tree preservation standards. The applicant will have to provide documentation required by the City to ensure the tree will remain healthy after construction and during the life of the project. During the life of the development, trees approved for stormwater credit shall not be removed without approval from the City. Stormwater management functions of any removed trees shall be replaced on the site with other trees or stormwater management approaches. Trees that die shall be replaced within 6 months. Trees shall be pruned in conformance with the Eugene Code 6.350, 7.280; Administrative Rules R 6.350, 7.280; Oregon Safety and Health Administration regulations, and the American National Standards Institute (A.N.S.I) Z133.1.300.

Tree Credits

Checklist of minimal information to be shown on the permit drawings:

1) Trees to be given stormwater management credit shall be clearly labeled as such, with the size and species included.
2) Approximate setbacks from property lines and structures shall be shown.
3) Temporary irrigation measures shall be shown, if applicable.
4) Form SIM must be submitted, clearly showing that less than 10% of the impervious area is being mitigated with tree credits.

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to new tree O&M form**

Additional photos:

*** Link to tree photos**

Tree Credits

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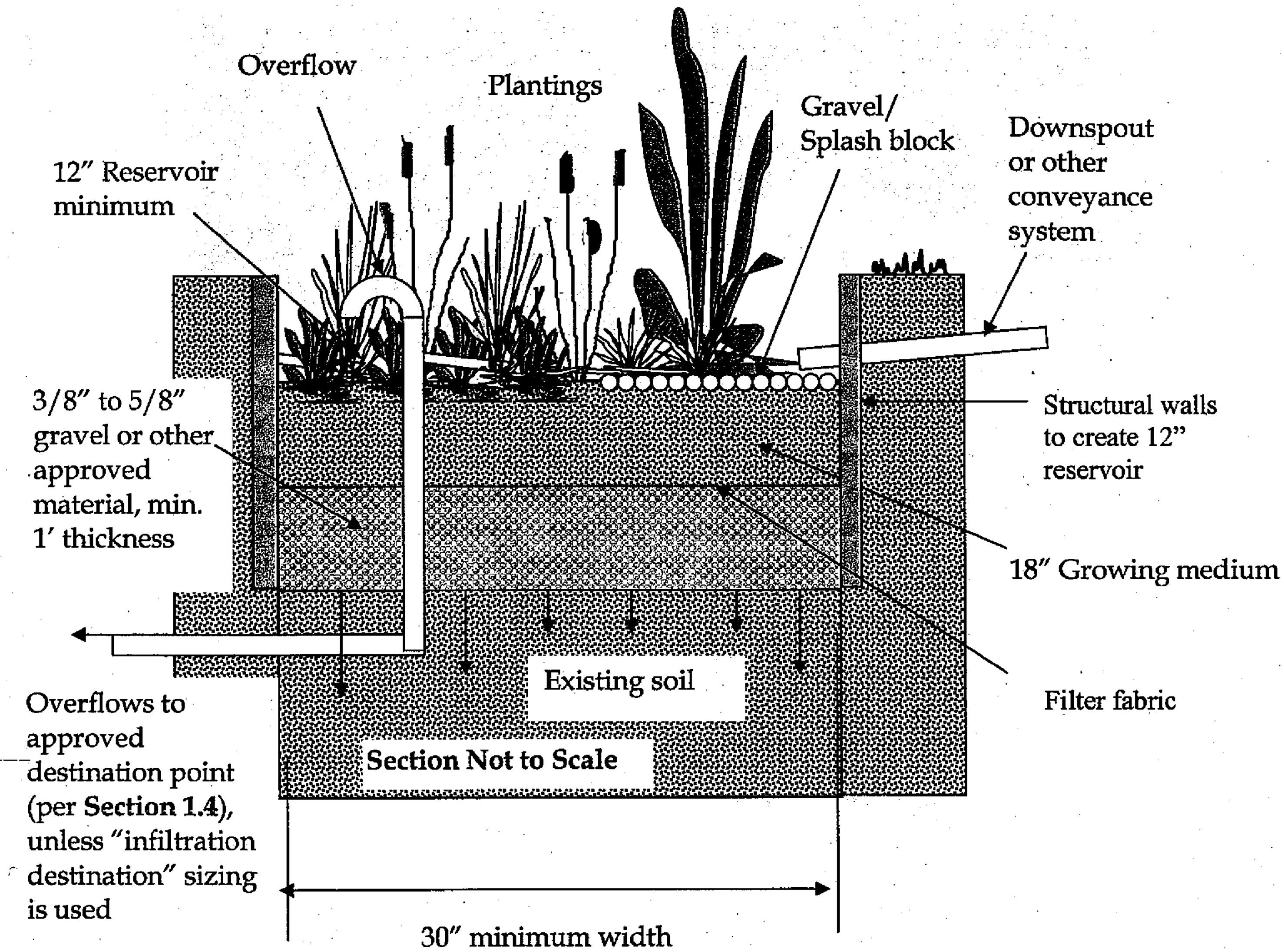
Infiltration Planter



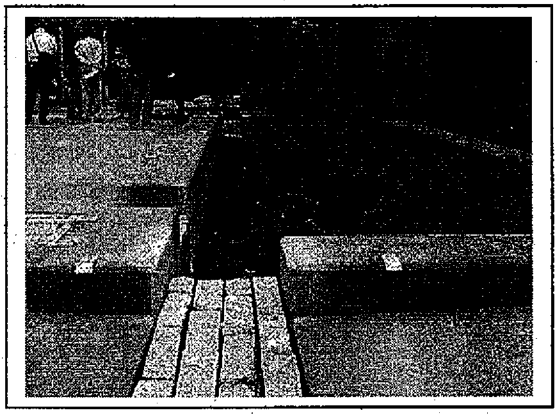
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	SIM, PERF[1]
√ Flow Control	SIM
√ Destination	PRES[2]

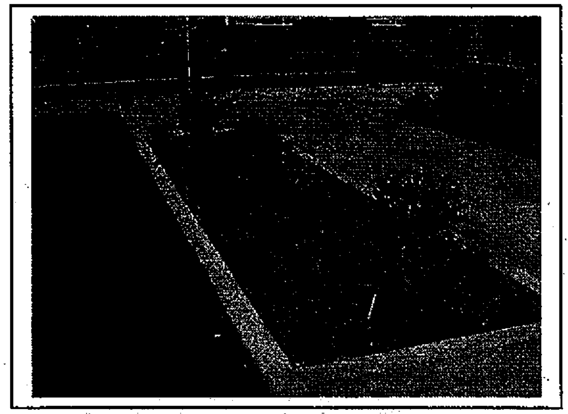
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution control. **2)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.
Infiltration planters may be designed to manage runoff from rooftops, and if submerged into the ground, parking lots and streets in many cases.

Infiltration Planter





Description: Infiltration planters are structural landscaped reservoirs used to collect, filter, and infiltrate stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground. In addition to providing pollution reduction, flow rates and volumes can also be managed with infiltration planters. Planters can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required, unless the facility is sized per **Surface Infiltration Facility** guidelines presented in this chapter.

Design Considerations: When designing infiltration planters, the infiltration rate of the native soil is a key element in determining size and viability.

Construction Considerations: Infiltration planter areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of planter areas. Infiltration rates shall be verified prior to construction.

Design Requirements:

Soil Suitability: Infiltration planters are appropriate for soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the facility and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.) Topsoil shall be used within the top 18 inches of the facility.

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum planter width is 30 inches. Planters shall be constructed without slope.

Infiltration Planter

Setbacks: Required setback from property lines is 5 feet, and 10 feet from structures.

Planter Walls: Planter walls shall be made of stone, concrete, brick, wood, or other durable material. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Individual infiltration planters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.07 may be used to receive credit for pollution and flow control. A high-flow overflow must be provided, or to receive credit for stormwater destination, the **Surface Infiltration Facility** design criteria from this chapter must be used. In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor. Planters shall be designed to pond water for less than 12 hours after each storm event.

Landscaping: Plantings shall be designed at the following quantities per **100** square feet of facility area. Facility area is equivalent to the area of the planter calculated from Form SIM.

4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants: 1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Note: Tree planting is not required in planters, but is encouraged where practical. Tree planting is also encouraged near planters.

***Link to Flow-Through Planter Landscaping Plan Example**
***Link to Planter Recommended Plants**

Infiltration Planter

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Planter wall material and waterproofing membrane specification
4) Growing medium specification
5) Drain rock specification
6) Filter fabric specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
8) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Planter grading/ excavation	
Structural components/ liner	
Piping	Call for inspection
Drain rock	
Filter fabric	
Growing medium	
Plantings	Call for inspection

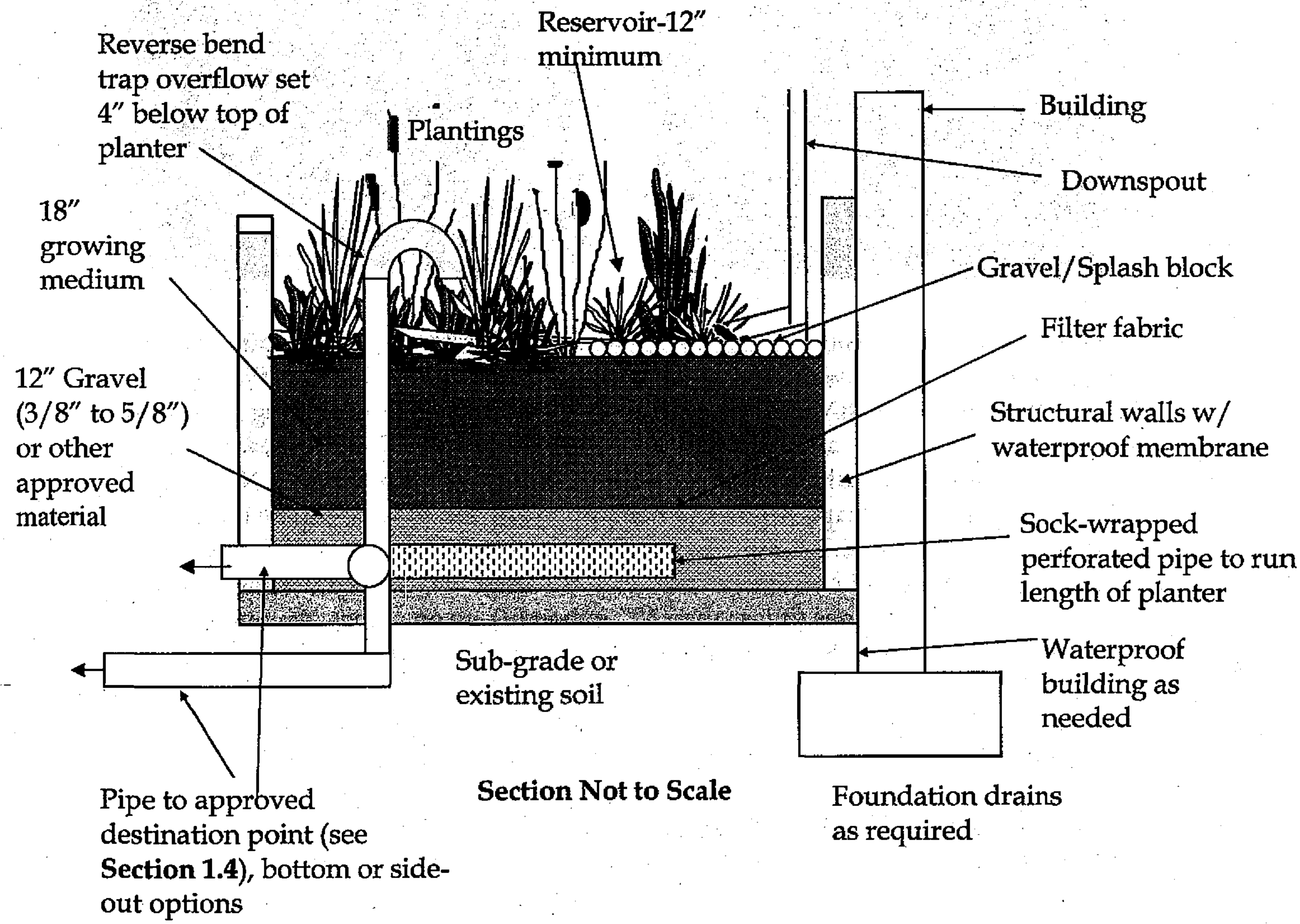
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to infiltration planter O&M form**

Additional photos and drawings:

*** Link to infiltration planter photos**
*** Link to infiltration planter drawings**

Flow-Through Planter



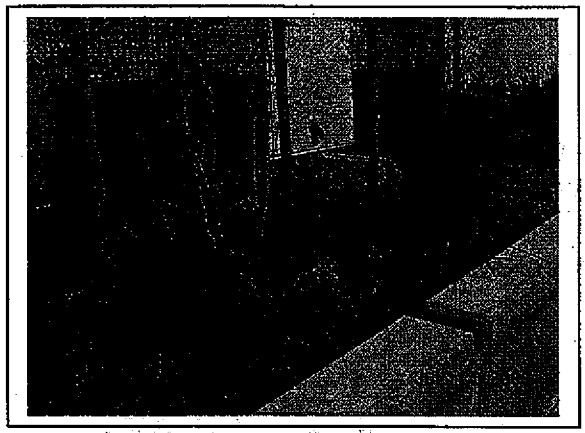
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	SIM, PERF[1]
√ Flow Control	SIM
Destination	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Flow-through planters may be designed to manage runoff from rooftops, and if submerged into the ground, parking lots and streets in some cases.

Flow-Through Planter



Description: Flow-through planters are structural landscaped reservoirs used to collect and filter stormwater runoff, allowing pollutants to settle and filter out as the water percolates through the planter soil. In addition to providing pollution reduction, flow rates and volumes can also be managed with flow-through planters. Planters should be integrated into the overall site design. Numerous design variations of shape, wall treatment, and planting scheme can be used to fit the character of a site. Because they include a waterproof lining, flow-through planters are extremely versatile and can be used next to foundation walls, adjacent to property lines (if less than 30" in height), or on slopes. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Design Considerations: When designing flow-through planters, the structural walls can often times be incorporated with building foundation plans.

Construction Considerations: Special attention needs to be paid to the planter waterproofing if constructed adjacent to building structures.

<u>**Design Requirements:**</u>

Soil Suitability: Flow-through planters are appropriate for all soil types. Topsoil shall be used within the top 18 inches of the facility.

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum planter width is 18 inches. Planter slopes shall be less than 0.5%.

Setbacks: Not applicable.

Planter Walls: Planter walls shall be made of stone, concrete, brick, or wood. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Flow-Through Planter

Sizing: Individual flow-through planters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.06 may be used to receive credit for pollution reduction and flow control. A high-flow overflow must be provided to an approved destination point per **Section 1.4**. In cases when pollution reduction is the only stormwater management goal, the performance approach may be used to downsize the simplified approach sizing factor. Planters shall be designed to pond water for less than 12 hours after each storm event.

Landscaping: Plantings shall be designed at the following minimum quantities per **100** square feet of facility area. Facility area is equivalent to the area of the planter calculated from Form SIM.

4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Note: Tree planting is not required in planters, but is encouraged where practical. Tree planting is also encouraged near planters.

***Link to Flow-Through Planter Landscaping Plan Example**
***Link to Planter Recommended Plants**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions
2) Profile view of facility, including typical cross-sections with dimensions
3) Planter wall material and waterproofing membrane specification
4) Growing medium specification
5) Drain rock specification
6) Filter fabric specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
8) Stormwater destination
9) Landscaping plan

Flow-Through Planter

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Planter grading/ excavation	
Structural components/ liner	
Piping	Call for inspection
Drain rock	
Filter fabric	
Growing medium	
Plantings	Call for inspection

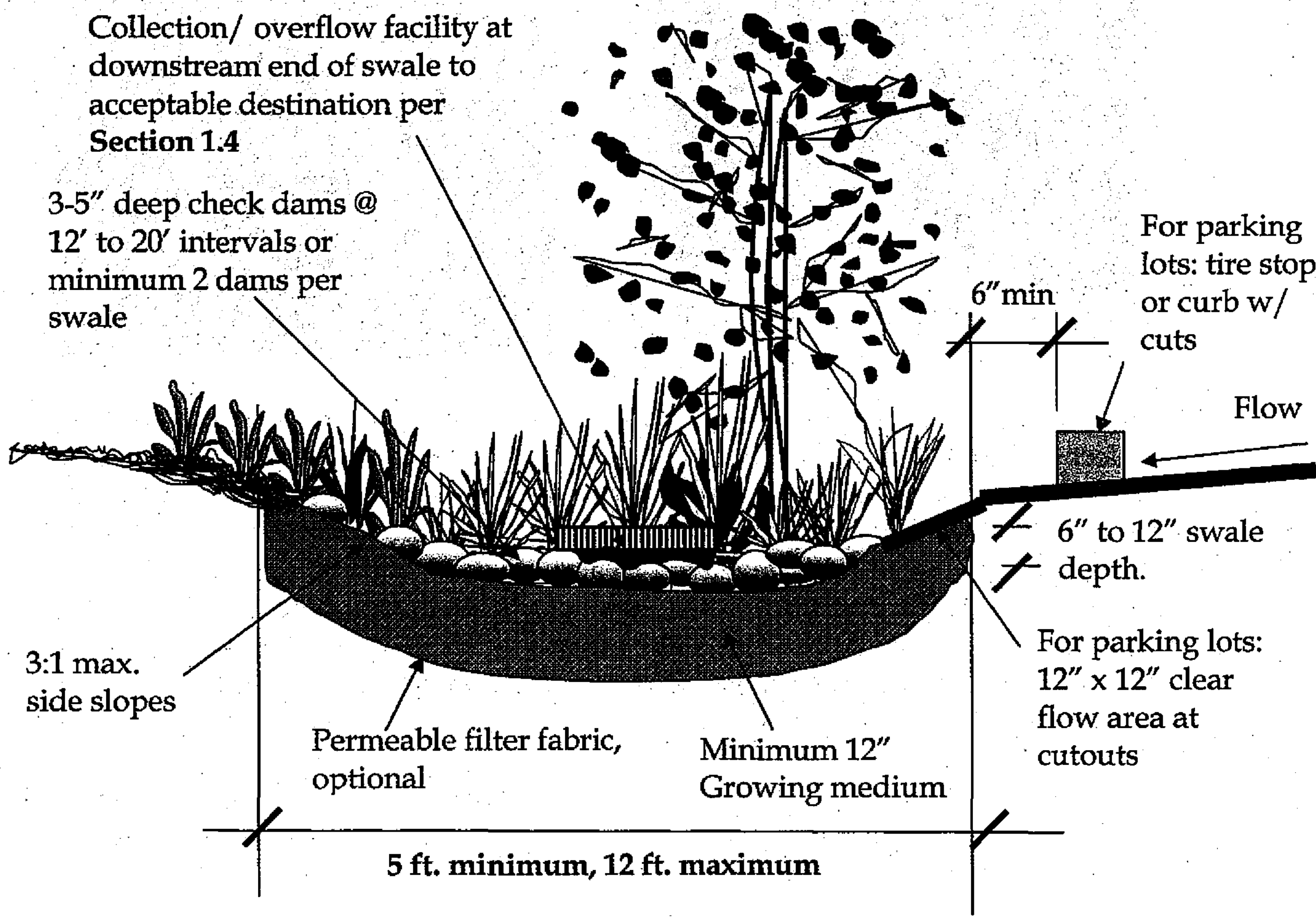
Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to flow-through planter O&M form**

Additional photos and drawings:

*** Link to flow-through planter photos**
*** Link to flow-through planter drawings**

Vegetated Swale



Section Not to Scale

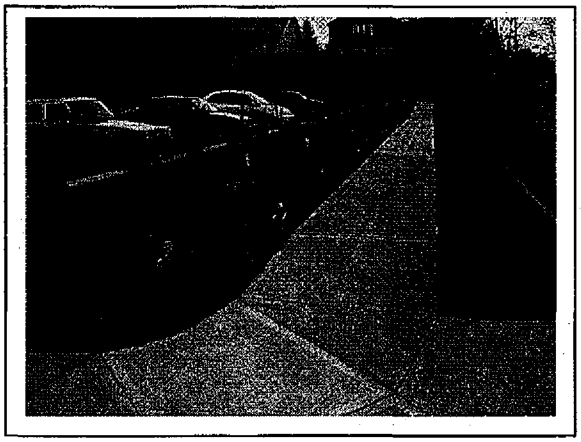
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction..............................	SIM, PERF[1], PRES[2]
√ Flow Control.......................................	SIM
√ Destination...	PRES[3]

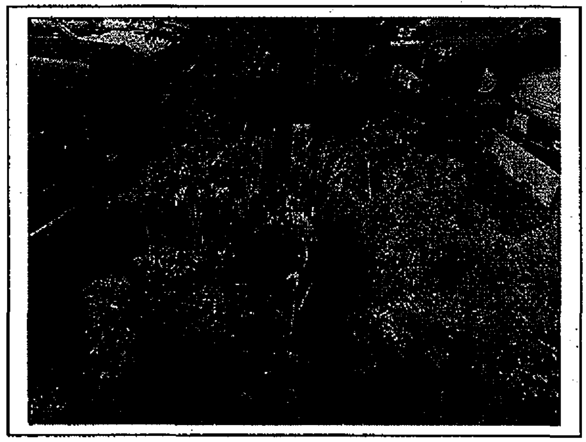
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Vegetated swales can be used to manage runoff from parking lots, rooftops, and private streets. For public street runoff, the street swale criteria must be used. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Vegetated Swale





Description: Vegetated swales are long narrow landscaped depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows from one bay to the next through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed with vegetated swales, as check dams are provided every 12 to 20 feet to slow and pool water. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale.

Design Considerations: When designing vegetated swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility.

Construction Considerations: Vegetated swale areas should be clearly marked before site work begins to avoid soil disturbance and compaction during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

<u>**Design Requirements:**</u>

Soil Suitability: Vegetated swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix F** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 3 horizontal to 1 vertical. Minimum flat bottom width is 2 feet for private swales, and 4 feet for public swales. Maximum longitudinal slope is 6% (temporary erosion control measures will be required on slopes greater than 2%, to stabilize soils until sufficient vegetative growth is established).

Vegetated Swale

Setbacks: Required setback from top of bank of swale is 10 feet from structures unless lined with impermeable fabric or approved by City.

Sizing: Vegetated swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.09 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4.** In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

- Maximum design velocity of 0.9 feet per second.
- Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
- Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent .
- Designed using a Manning "n" value of 0.35.
- 3:1 (or flatter) side slopes in the treatment area.

A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) Maximum bottom width shall be 8 feet.

3) Vegetation shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

4) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

5) Access routes to the swale for maintenance purposes must be shown on the plans. Public swales will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete, or soil by integrating them into the grading of the swale. Check dams shall be 12 inches in length, by the width of the swale, by 3 to 6 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the swale, including bottom and side slopes, as calculated from Form SIM. Minimum plant material quantities per 100 square feet of facility area are as follows:

1 - Evergreen or deciduous tree (planted around the perimeter of the swale):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Vegetated Swale

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to vegetated swale O&M form**

Additional photos and drawings:

*** Link to vegetated swale photos**
*** Link to vegetated swale drawings**

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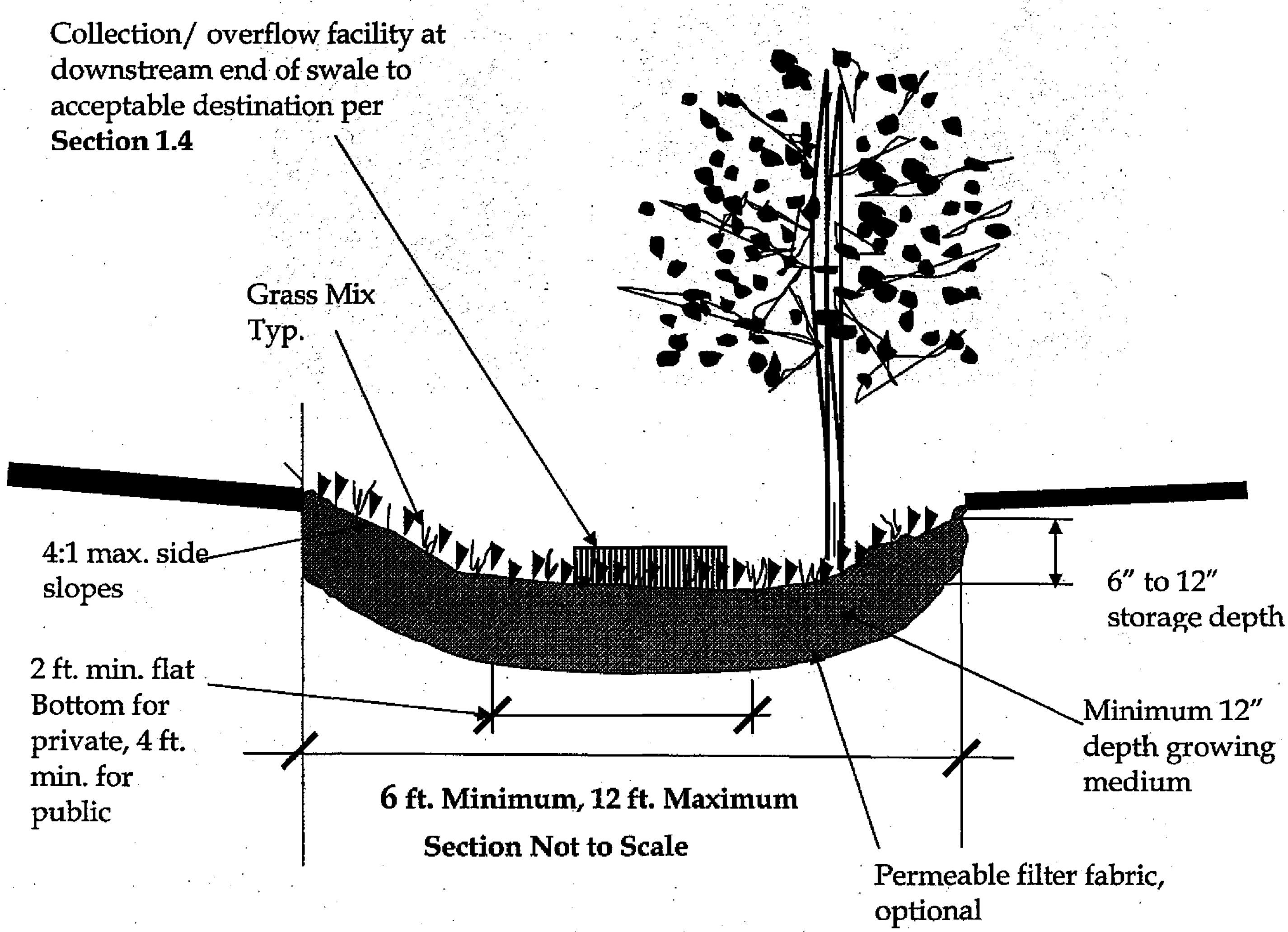
Grassy Swale



Stormwater Management Goals Achieved Acceptable Sizing Methodologies

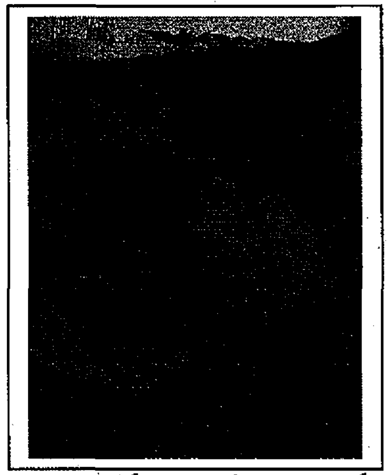
√ Pollution Reduction.............................. SIM, PERF[1], PRES[2]
√ Flow Control.. SIM
√ Destination.. PRES[3]

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Grassy swales can be used to manage runoff from parking lots, rooftops, and private streets. For public street runoff, the street swale criteria must be used. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Grassy Swale



Description: Grassy swales are long narrow grassy depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed for small projects (<15,000 square feet of impervious surface) with grassy swales. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale.

Design Considerations: When designing grassy swales, slopes and depth should be kept as mild as possible to avoid safety risks and prevent erosion within the facility.

Construction Considerations: Grassy swale areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

<u>**Design Requirements:**</u>

Soil Suitability: Grassy swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 4 horizontal to 1 vertical. Minimum flat bottom width is 2 feet for private swales, and 4 feet for public swales. Minimum length is 100 feet. Maximum longitudinal slope is 5%, while minimum slope is 0.5%. Maximum surrounding ground slopes shall be 10%.

Grassy Swale

Setbacks: Required setback from is 10 feet from building foundations unless lined with impermeable fabric.

Sizing: Grassy swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.1 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4**. In cases when pollution reduction is the only stormwater management goal, or there is more than 15,000 square feet of impervious area to manage, the Presumptive Approach must be used size the swale for pollution reduction, and additional facilities will be required to meet flow control requirements, where applicable.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

   - Maximum design depth of 0.33 feet.
   - Maximum design velocity of 0.9 feet per second.
   - Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
   - Minimum longitudinal slope of 0.5 percent, maximum slope of 5 percent. For slopes greater than 2 percent, check dams shall be used (one 3 to 5-inch high dam every 12 feet).
   - Designed using a Manning "n" value of 0.25.
   - 4:1 (or flatter) side slopes in the treatment area.

   A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

   Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) The swale shall incorporate a flow-spreading device at the inlet. The flow spreader shall provide a uniform flow distribution across the swale

bottom. In swales with a bottom width greater than 6 feet, a flow spreader shall be installed at least every 50 feet.

3) To minimize flow channelization, the swale bottom shall be smooth, with uniform longitudinal slope, and with a minimum bottom width of 2 feet for private facilities and 4 feet for public facilities. Maximum bottom width shall be 8 feet.

4) Grasses or sod shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

5) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

6) Access routes to the swale for maintenance purposes must be shown on the plans. Public swales will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope.

Landscaping: Plantings shall be designed at the following quantities per **200** square feet of facility area. Facility area is equivalent to the area of the swale calculated from Form SIM. (Note: Facilities smaller than 200 square feet shall have a minimum of one tree per facility.):

1 Evergreen or Deciduous tree:

Evergreen trees:	Minimum height: 6 feet.
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.

Grass: Seed or sod is required to completely cover the grassy swale bottom and side slopes. (Shrubs are optional)

For the swale flow path, approved native grass mixes are preferable and may be substituted for standard swale seed mix. Seed shall be applied at the rates specified by the supplier. The applicant shall have plants established at the time of facility completion (at least 3 months after seeding). No runoff shall be allowed to flow in the swale until grass is established. Trees and shrubs may be allowed in the flow path within swales if the swale exceeds the minimum length and widths specified.

Native wildflowers, grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

***Link to Grassy Swale Recommended Seed Mixes**

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings/ seeding/ sod	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to grassy swale O&M form**

Additional photos and drawings:

*** Link to grassy swale photos**
*** Link to grassy swale drawings**

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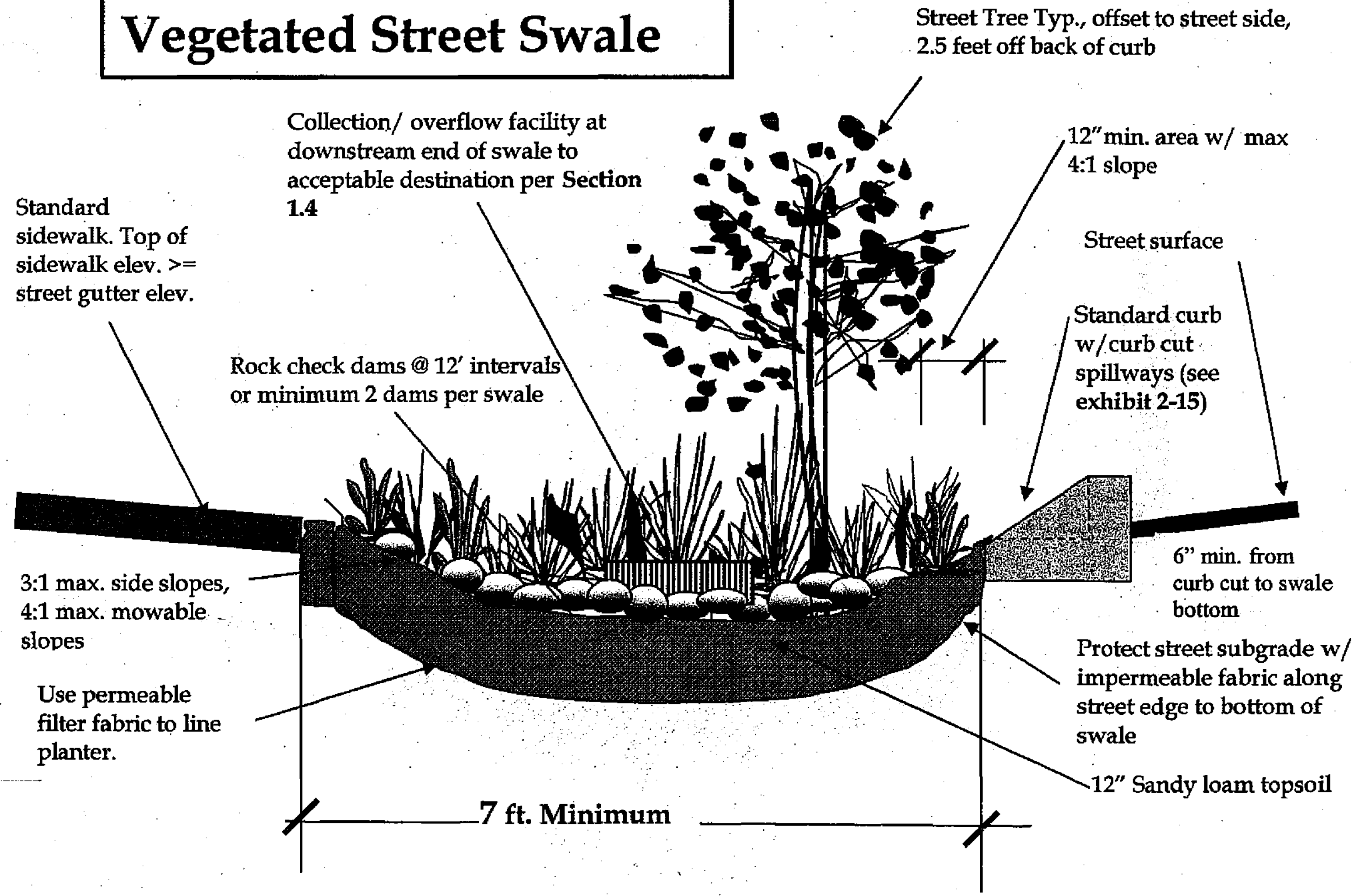
Street Swales

Vegetated Street Swale



Section Not to Scale

Stormwater Management Goals Achieved Acceptable Sizing Methodologies

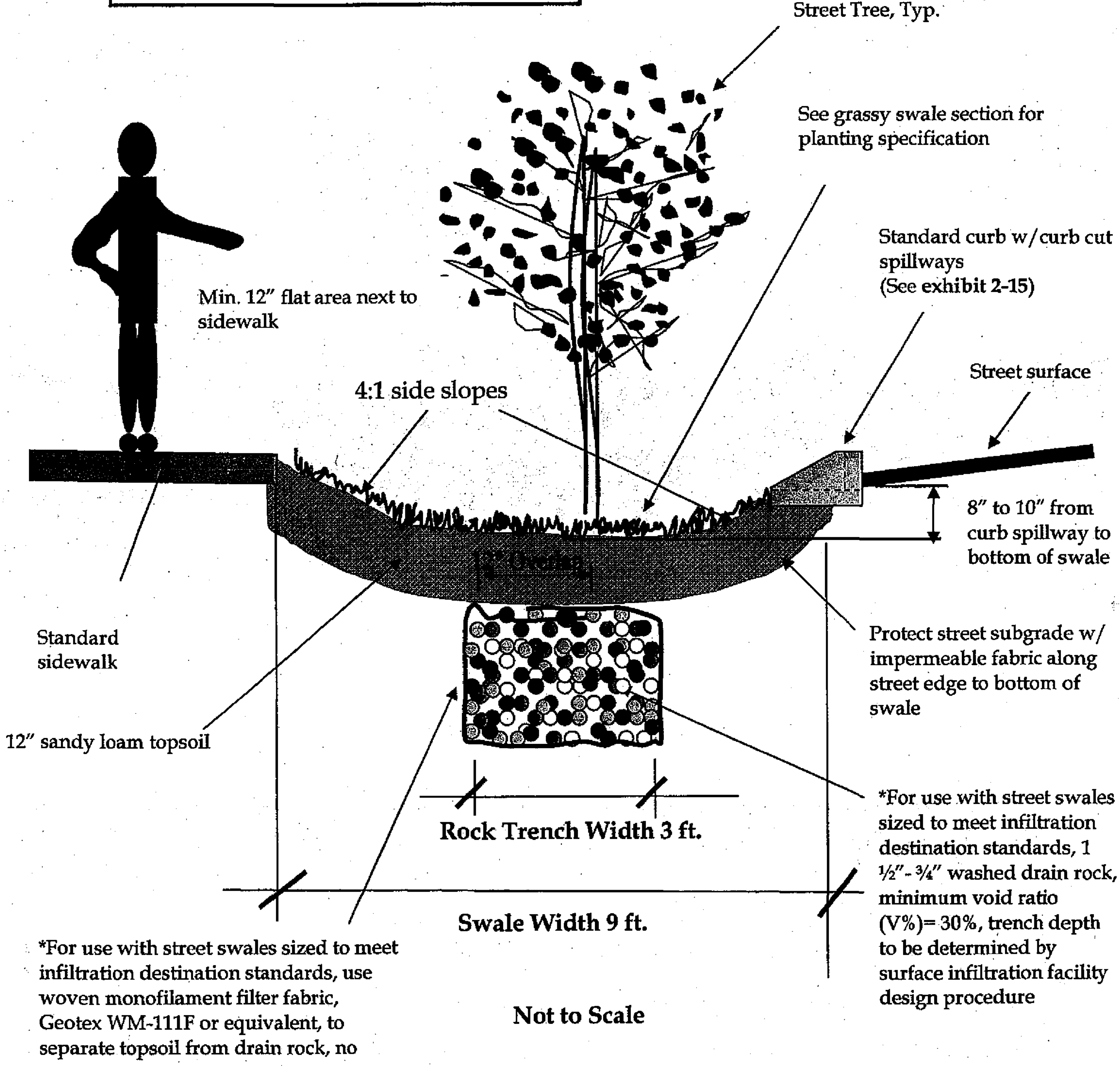
√ Pollution Reduction................................ SIM, PERF[1], PRES[2]
√ Flow Control.. SIM
√ Destination.. PRES[3]
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Street swales can be used to manage runoff from parking lots, rooftops, and private streets. **2)** For projects with more than 15,000 square-feet of impervious area to manage, the presumptive approach may be used to size the swale for pollution reduction, and additional facilities may be required to meet flow control requirements. **3)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

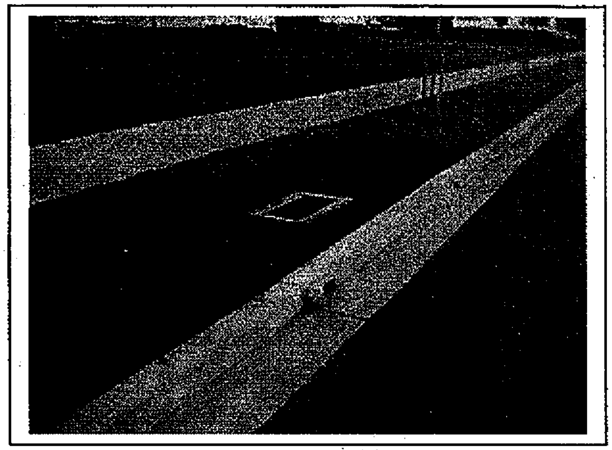
Street Swales

Grassy Street Swale



***Note:** Overflow to an approved destination point is required, unless swale is sized in accordance with **Surface Infiltration Facility** design procedure.

Street Swales



Description: Street construction poses particular challenges related to stormwater management design. Lack of available space is often the most difficult hurdle in locating stormwater pollution reduction and flow control facilities in or near allocated rights-of-way. Specific street swale designs that incorporate pollution reduction, flow control, and volume control into the cross-section of the street have been developed. For more information and ideas about stormwater friendly street designs, Metro has developed three handbooks: "Creating Livable Streets," "Green Streets," and "Trees for Green Streets." These handbooks can be purchased from Metro at: **www.metro-region.org.**

Street swales are long narrow landscaped depressions used to collect and convey stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or flows from one bay to the next through the facility. In addition to providing pollution reduction, flow rates and volumes can also be managed with street swales, as check dams are provided every 12 to 20 feet to slow and pool water. Swales should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the swale, unless the swale is designed per the surface infiltration facility criteria presented in this chapter.

Design Considerations: When designing street swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility. All applicable City requirements for other street elements (curbs, sidewalks, trees, etc.) must be met.

Construction Considerations: Street swale areas should be clearly marked before site work begins to avoid soil disturbance and compaction during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of swale areas.

Street Swales

Design Requirements:

Soil Suitability: Street swales are appropriate for all soil types. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Dimensions and Slopes: Facility storage depth may vary from 6 to 12 inches. Maximum side slopes are 3 horizontal to 1 vertical for vegetated swales, and 4 horizontal to 1 vertical for grassy swales (to accommodate for mowing). Minimum flat bottom width is 2 feet. Maximum longitudinal slope is 6% (temporary erosion control measures will be required on slopes greater than 2%, to stabilize soils until sufficient vegetative growth is established).

Setbacks: Required setback from building foundations is 10 feet unless lined with impermeable fabric.

Sizing: To meet pollution reduction and flow control requirements, the square-footage of street swales is to be determined using vegetated or grassy swale sizing criteria (shown on **Form SIM**), depending on which surface treatment is being used. The minimum width for street swales is 7 feet for vegetated, and 9 feet for grassy. Street swales sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.09 for vegetated swales and 0.10 for grassy swales may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the swale to an approved destination point, per **Section 1.4**.

Presumptive Approach Sizing Criteria:

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (0.22 inches/hour) at:

   - Maximum design velocity of 0.9 feet per second.
   - Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
   - Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent. For slopes greater than 2 percent, check dams shall be used (one dam every 12 feet).
   - Designed using a Manning "n" value of 0.25 for grassy swales and 0.35 for vegetated swales.

A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.5 inches per hour).

Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) The swale shall incorporate a flow-spreading device at the inlet. The flow spreader shall provide a uniform flow distribution across the swale bottom. In swales with a bottom width greater than 6 feet, a flow spreader shall be installed at least every 50 feet.

3) Minimize flow channelization, with uniform longitudinal slopes, and with a minimum bottom width of 2 feet for private facilities and 4 feet for public facilities. Maximum bottom width shall be 8 feet.

4) Vegetation shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

5) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete, or soil by integrated them into the grading of the swale. Check dams shall be 12 inches in length, by the width of the swale, by 3 to 5 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the swale, including bottom and side slopes, as calculated from Form SIM. Turf grass may be used to cover the entire swale surface area. If plantings are chosen to landscape the swale, the minimum plant material quantities per 100 square feet of facility area shall be as follows:

4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Street Swales

Ground cover plants: 1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually.

Recommended street trees in or near street swales:

With overhead power lines	**Without overhead power lines**
Acer campestre 'Evelyn'	Betula jacquemontii
Carpinus caroliniana	Celtis occidentalis
Cercis Canadensis	Fraxinus pennsylvanica 'Johnson'
Gleditsia triacanthos 'Impcole'	Gleditsia triacanthos 'Skycole'
Koelreuteria paniculata	Nyssa sylvatica
	Quercus shumardii

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All curb cut details and stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Street Swales

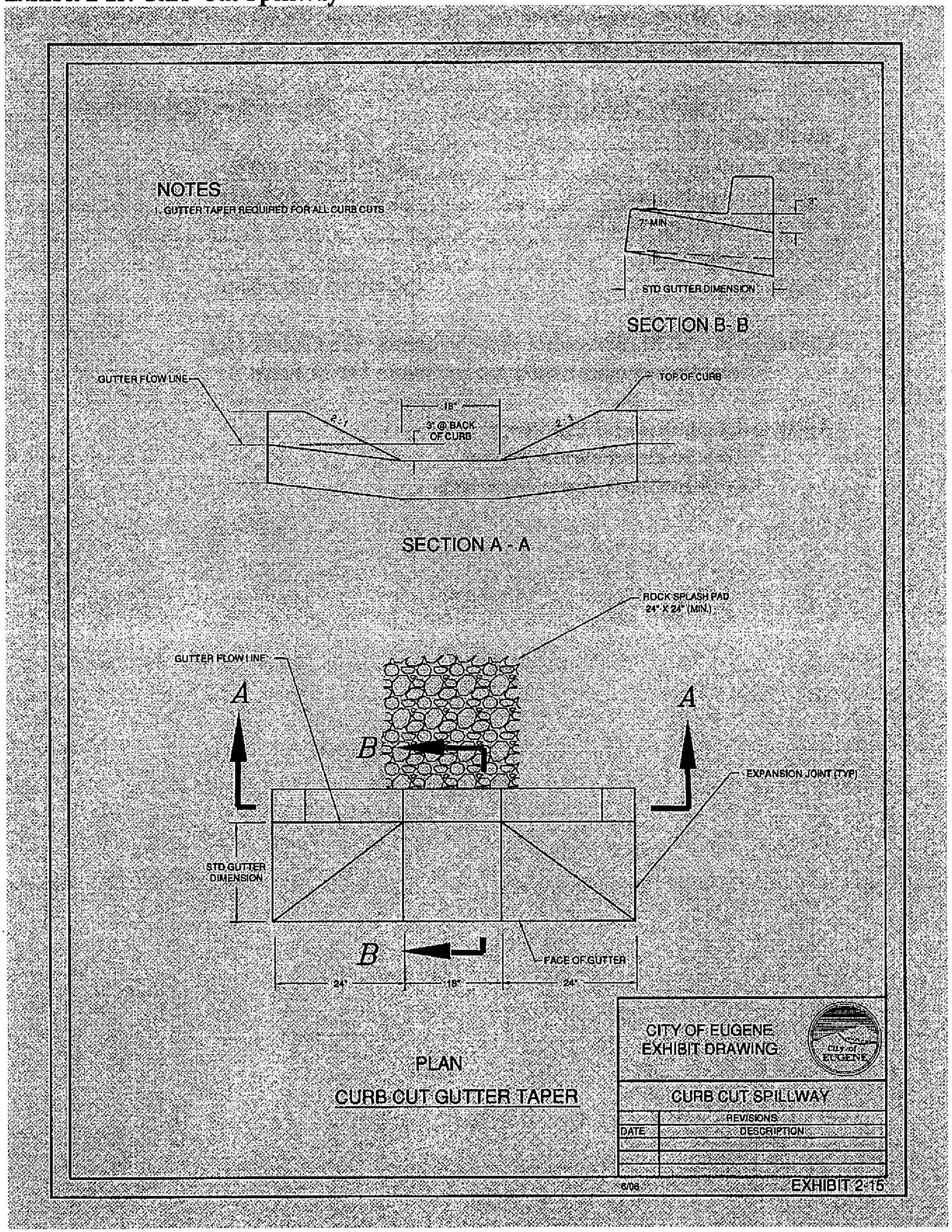
Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Swale grading	
Curbs / curb cuts	Call for inspection
Piping (if applicable)	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

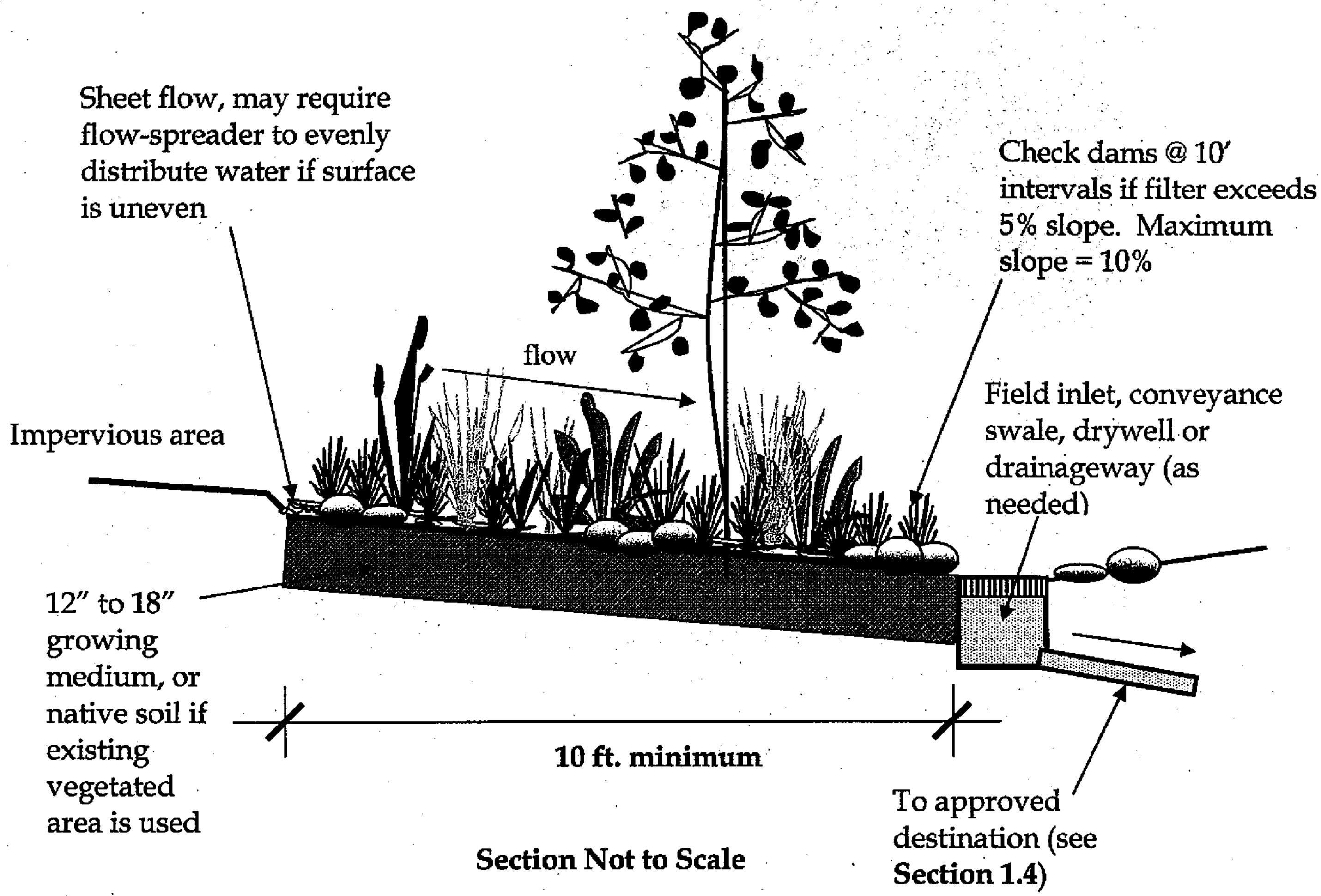
Operations and Maintenance requirements: See **Chapter 3.0.**
*** Link to vegetated and grassy swale O&M form**

Additional photos and drawings:
*** Link to street swale photos**
*** Link to street swale drawings**

Exhibit 2-15: Curb Cut Spillway



Vegetated Filter Strip



Stormwater Management Goals Achieved — **Acceptable Sizing Methodologies**

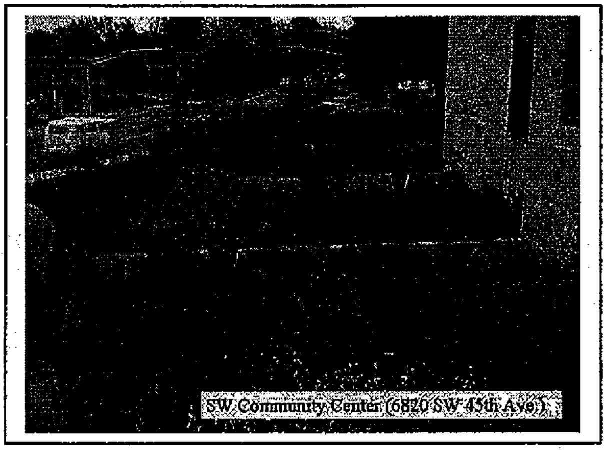
√ Pollution Reduction.............................SIM, PERF[1]
√ Flow Control....................................... SIM
√ Destination[2].. SIM[2]

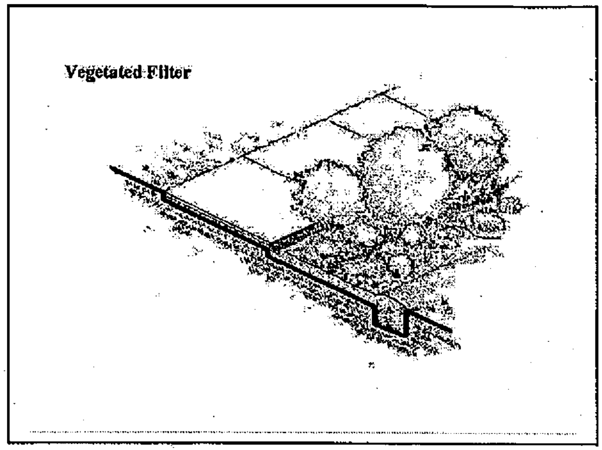
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Vegetated filters can be used to manage stormwater from rooftops, pathways, parking lots, and potentially streets (with flow spreaders or if the runoff is left as unconcentrated sheet flow). **2)** Where soils infiltrate sufficiently, stormwater destination credit may be given for projects with less than 500 square feet of impervious surfaces to manage.

Vegetated Filter Strip





Description: Vegetated filter strips, or vegetated filters, are gently sloping areas used to filter, slow, and infiltrate stormwater flows. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a flow spreader. Flow control is achieved using the relatively large surface area and for slopes greater than 5%, a generous proportion of check dams or terraces. Pollutants are removed through filtration and sedimentation. Filters can be planted with a variety of trees, shrubs, and ground covers, including grasses. Sod may be used for single-family residential sites, where a simple downspout disconnection into lawn or landscaping is used. There are an infinite number of ways to fit this concept into site designs and designers are encouraged to use the site landscape areas for this purpose. An approved conveyance/ destination method per **Section 1.4** will be required at the end of the filter.

Design Considerations: When designing vegetated filters, slopes should be kept as flat as possible to prevent erosion. Spreading the flow evenly across the filter is also important in ensuring that the facility functions correctly and avoids flow channeling.

Construction Considerations: Vegetated filter areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of filter areas. Flow spreaders must be constructed perfectly level to distribute flows evenly across the filter, and for public facilities must be surveyed after construction.

Design Requirements:

Soil Suitability: Vegetated filters are appropriate for all soil types. Unless existing vegetated areas are used for the filter, topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Vegetated Filter Strip

Dimensions and Slopes: Maximum allowable vegetated filter slopes are 10%. Terraces may be used to decrease ground slopes. Minimum slopes are 0.5%.

Setbacks: Required setback is 10 feet from structures unless lined with impermeable fabric.

Sizing: Unless used for very long, narrow projects such as pathways and trails, vegetated filters cannot be used to manage flow from more than 2,000 square-feet of impervious area. Filters shall be a minimum of 10 feet wide x 10 feet long. A Simplified Approach sizing factor of 0.2 may be used to receive credit for pollution reduction and flow control. A high-flow by-pass mechanism will not be required in these cases, but a high-flow overflow must be provided at the downstream end of the filter to an approved destination point, per **Section 1.4.** In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor.

Check Dams: Check dams shall be constructed of durable, non-toxic materials such as rock, brick, or concrete. Check dams shall be 12 inches in length, by the width of the filter, by 3 to 5 inches in height.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. Sod may be used for single-family residential sites, where a simple downspout disconnection into lawn or landscaping is used. For other projects, minimum plant material quantities per **100** square feet of facility area are as follows. The "facility area" is equivalent to the area of the filter, as calculated from Form SIM.

1 - Evergreen or deciduous tree (planted around the perimeter of the swale):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Vegetated Filter Strip

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification (if applicable)
4) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
5) Landscaping plan
6) Flow spreader details and specifications
7) Check dam or terrace details and specifications

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Filter grading (if applicable)	
Flow spreaders/Terraces (if applicable)	
Piping (if applicable)	Call for inspection
Growing medium (if applicable)	
Plantings	Call for inspection

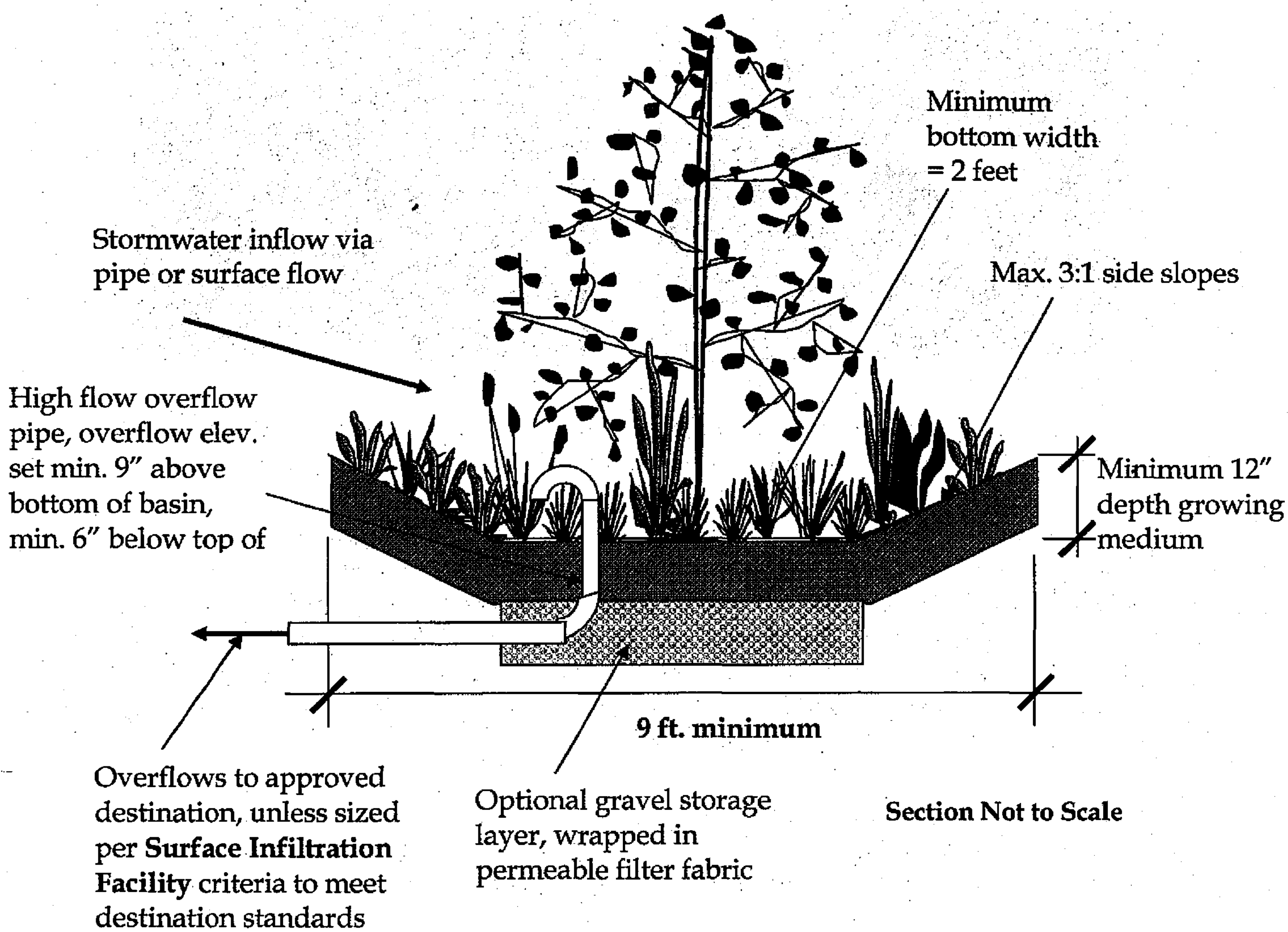
Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to vegetated filter O&M form**

Additional photos and drawings:

*** Link to vegetated filter photos**
*** Link to vegetated filter drawings**

Vegetated Infiltration Basin



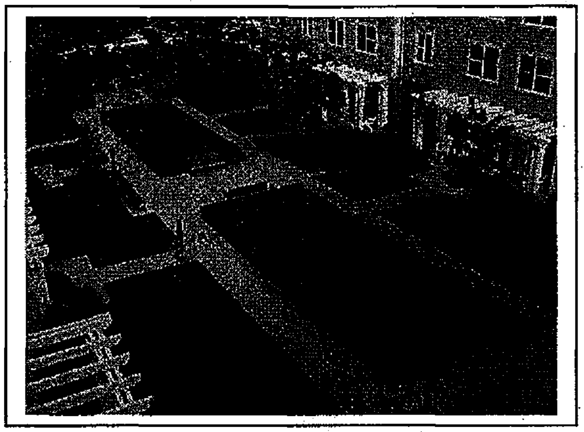
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction...............................	SIM, PERF[1]
√ Flow Control......................................	SIM
√ Destination..	PRES[2]

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution control. **2)** The **Surface Infiltration Facility** sizing methodology from this chapter may be used to achieve stormwater destination. Vegetated infiltration basins can be used to manage stormwater from all impervious surface types, and must be located on private property.

Vegetated Infiltration Basin



Description: Vegetated infiltration basins are shallow landscaped depressions used to collect and hold stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground. In addition to providing pollution reduction, flow rates and volumes can also be managed with vegetated infiltration basins. They should be integrated into the overall site design and can be used to help fulfill a site's required landscaping area requirement. As shown in the example photos, the design can be formal or informal in character and planting scheme. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required, unless the basin is designed per "infiltration swale" guidelines presented in the chapter.

Design Considerations: When designing vegetated infiltration basins, the infiltration rate of the native soil is a key element in determining size and viability. Slopes and depth should be kept as mild as possible to avoid safety risks.

Construction Considerations: Infiltration basin areas should be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular traffic, except that specifically used to construct the facility, should be allowed within 10 feet of infiltration basin areas.

Design Requirements:

Soil Suitability: Vegetated infiltration basins are appropriate for soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C). There shall be no less than three feet of undisturbed infiltration medium between the bottom of the facility and any impervious layer (i.e. hardpan, solid rock, high groundwater levels, etc.). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Vegetated Infiltration Basin

Dimensions: Facility storage depth may vary from 9 to 18 inches. Maximum side slopes are 3 horizontal to 1 vertical. Minimum bottom width is 2 feet.

Setbacks: Required setback is 10 feet from building foundations. Infiltration basins shall meet the following setback requirements from downstream slopes: minimum of 100 feet from slopes of 10%; add 5 feet of setback for each additional percent of slope up to 30%; 200-foot setback for slopes of 30%; infiltration trenches shall not be used where slopes exceed 30%.

Sizing: Vegetated infiltration basins sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.11 may be used to receive credit for pollution reduction and flow control. A high-flow overflow must be provided, or to receive credit for complete stormwater infiltration, the "infiltration swale" design criteria from this chapter must be used. In this case, pre and post-construction infiltration tests are required to demonstrate infiltration performance. In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used in conjunction with a measured infiltration rate to downsize the Simplified Approach sizing factor. Drawdown time (time for the basin to empty water from the water quality design storm) shall not exceed 24 hours.

Landscaping: Vegetation helps improve infiltration functions, protects from rain and wind erosion, and enhances aesthetic conditions. The "facility area" is equivalent to the area of the basin, including bottom and side slopes, plus a 10-foot buffer around the basin. Minimum plant material quantities per 300 square feet of facility area are as follows:

1 - Evergreen or deciduous tree (planted around the perimeter of the basin):

Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees:	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants:	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

For vegetated infiltration basins, the following additional design criteria shall apply:

1) Two staff gauges shall be installed at opposite ends of the bottom of the basin, to enable maintenance staff to measure the depth of accumulated silts.

2) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional geotechnical engineer, shall inspect the soil after the system is excavated to confirm that soils remain in suitable condition for infiltration.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Basin grading	
Piping	Call for inspection
Filter fabric	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

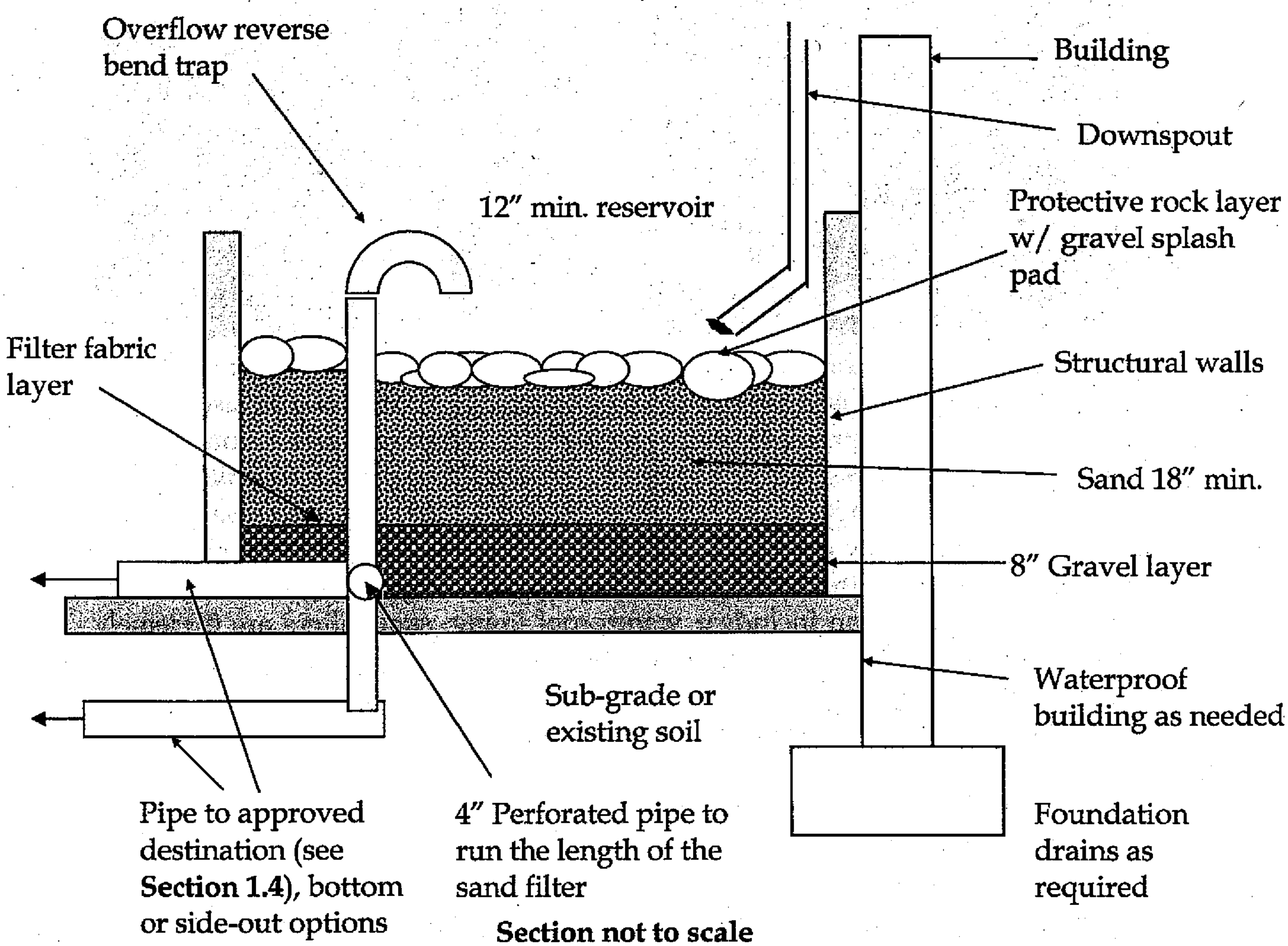
*** Link to vegetated infiltration basin O&M form**

Additional photos and drawings:

*** Link to vegetated infiltration basin photos**

*** Link to vegetated infiltration basin drawings**

Sand Filter



Section not to scale

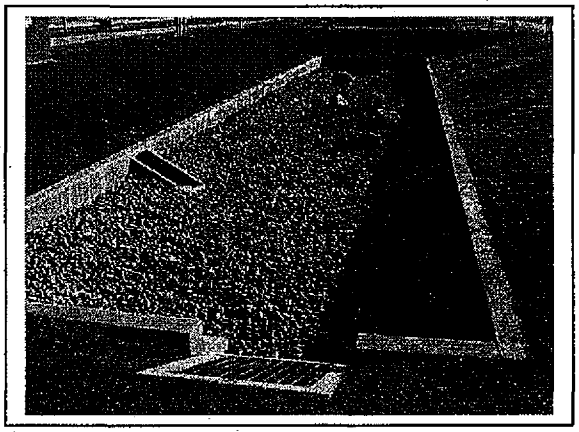
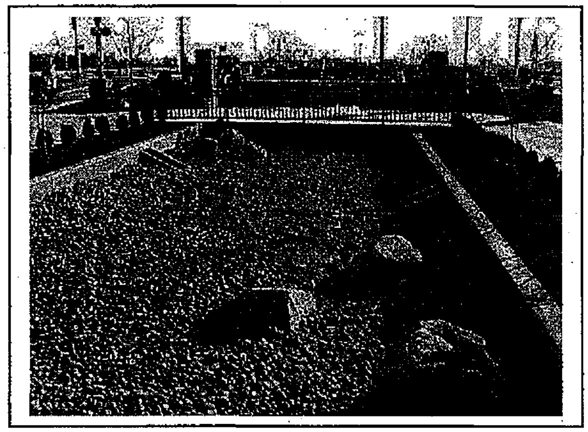
Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	SIM, PERF[1]
√ Flow Control	SIM
√ Destination	PRES[2]

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The Performance Approach may be used to downsize the Simplified Approach sizing factor when the only goal is pollution reduction. Sand filters can be used to manage stormwater from any impervious surface, and must be located on private property. **2)** The **Surface Infiltration Facility** design procedure from this chapter may be used to receive credit for stormwater destination.

Sand Filter

Description: There are two sand filter options. One is designed with an impervious bottom or is placed on an impervious surface. It can be used for all soil types. The other option, for native soils with a minimum infiltration rate of 2 inches per hour (NRCS soil types A and B), allows filtered water to infiltrate into the ground. For both options, pollutant reduction is achieved as the water filters through the sand; flow control is obtained by slowing the discharge rate as the water filters through the sand. Filters may be constructed in-ground or above grade. Because they can include a waterproof lining, sand filters are extremely versatile and can be used next to foundation walls, adjacent to property lines (if less than 30" in height), or on slopes. An overflow to an approved conveyance/ destination method per **Section 1.4** will be required.

Design Considerations: When designing sand filters, the structural walls can often times be incorporated with building foundation plans.

Construction Considerations: Special attention needs to be paid to the filter waterproofing if constructed adjacent to building structures.

<u>**Design Requirements:**</u>

Soil Suitability: Lined sand filters are appropriate for all soil types. Filters designed to infiltrate into native soils are appropriate in soils with a minimum infiltration rate of 0.5 inches per hour (NRCS soil types A, B, & C).

Dimensions and Slopes: Facility storage depth must be at least 12 inches, unless a larger-than-required planter square-footage is used. Minimum sand filter width is 18 inches. Filter slopes shall be less than 0.5%.

Setbacks: Required setback from property lines is 5 feet, unless the sand filter height is less than 30 inches. Required setback from building structures is 10 feet, unless the sand filter is properly lined.

Sand Filter

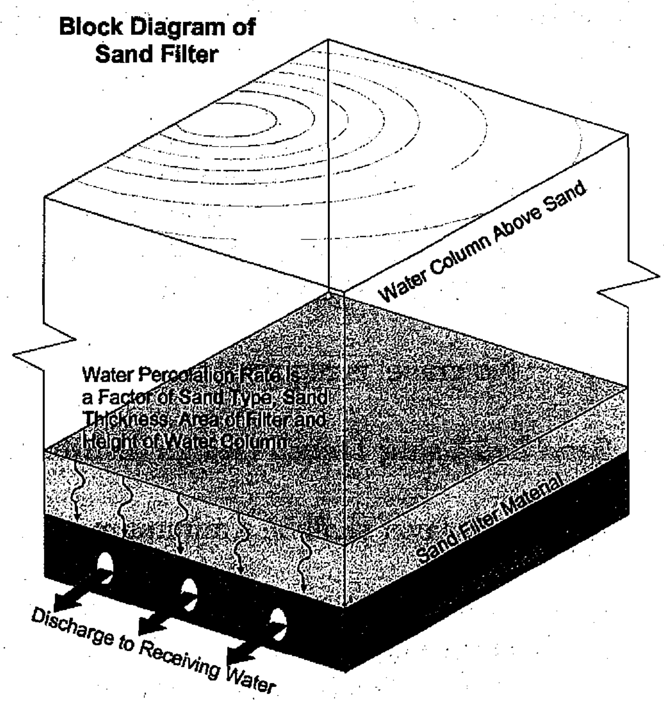
Structural Walls: Sand filter walls shall be made of stone, concrete, brick, or wood. Chemically treated wood that can leach out toxic chemicals and contaminate stormwater shall not be used.

Sizing: Sand filters sized with the Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. For these projects, a Simplified Approach sizing factor of 0.06 may be used to receive credit for pollution reduction and flow control. For projects with more than 15,000 square-feet of impervious surface, additional facilities may be required to meet flow control requirements. A high-flow overflow must be provided to an approved destination point per **Section 1.4.** In cases when pollution reduction is the only stormwater management goal, the Performance Approach may be used to downsize the Simplified Approach sizing factor. Sand filters shall be designed to pond water for less than 4 hours after each storm event.

Vegetation: Plantings are optional in sand filters. For aesthetic purposes, potted plants may be submerged in the sand filter.

For public sand filters, the following additional criteria shall apply:

The sand filter consists of an inlet structure, sand bed, underdrain piping, and basin liner. Criteria for these components are provided below.



Inlet Structure

1) The inlet structure shall spread the flow of incoming water uniformly across the surface of the filter medium during all anticipated flow conditions. This flow shall be spread in a manner that prevents roiling or otherwise disturbing the filter medium.

Sand Bed/ Filter Medium

1) The length-to-width ratio shall be 2:1 or greater.

2) The sand bed configuration may be either of the two configurations shown in **Exhibit 2-16**. All depths shown are final depths. The effects of consolidation and/or compaction must be taken into account when placing medium materials. The surface of the filter medium shall be level.

3) Sand used as filter medium shall be certified by a testing laboratory as meeting or exceeding the specifications presented below:

The filter bed medium shall consist of clean medium to fine sand with no organic material, or other deleterious materials and meeting the following gradation:

Sieve Size	Percent Passing
3/8″	100
#4	95-100
#8	80-100
#16	45-85
#30	15-60
#50	3-15
#100	< 4

Sand Bed with Gravel Filter (Exhibit 2-16:A)

1) The top layer shall be a minimum of 18 inches of approved sand.

2) The sand shall be placed over an acceptable geofabric material covering a layer of ½- to 2-inch washed drain rock. The finished depth of this drain rock shall be sufficient to provide a minimum of 2 inches of cover over the underdrain piping system.

3) No gravel is required below the underdrain piping system.

Sand Bed Using Trench Design (Exhibit 2-16:B)

1) The top layer shall be a minimum of 12 inches of approved sand.

2) The sand shall be placed over an acceptable geotextile fabric material covering a layer of ½ to 2-inch washed drain rock. The finished depth of this drain rock shall be sufficient to provide a minimum of 2 inches of cover over the underdrain piping system.

3) The piping and gravel shall be underlain with geotextile fabric.

Underdrain Piping

1) The underdrain piping system shall consist of appropriately sized (minimum 4-inch diameter) collector manifold with perforated lateral branch lines. The pipe used in this conveyance system shall be schedule 40 polyvinyl chloride (PVC) material or an approved equal. Lateral spacing shall not exceed 10 feet.

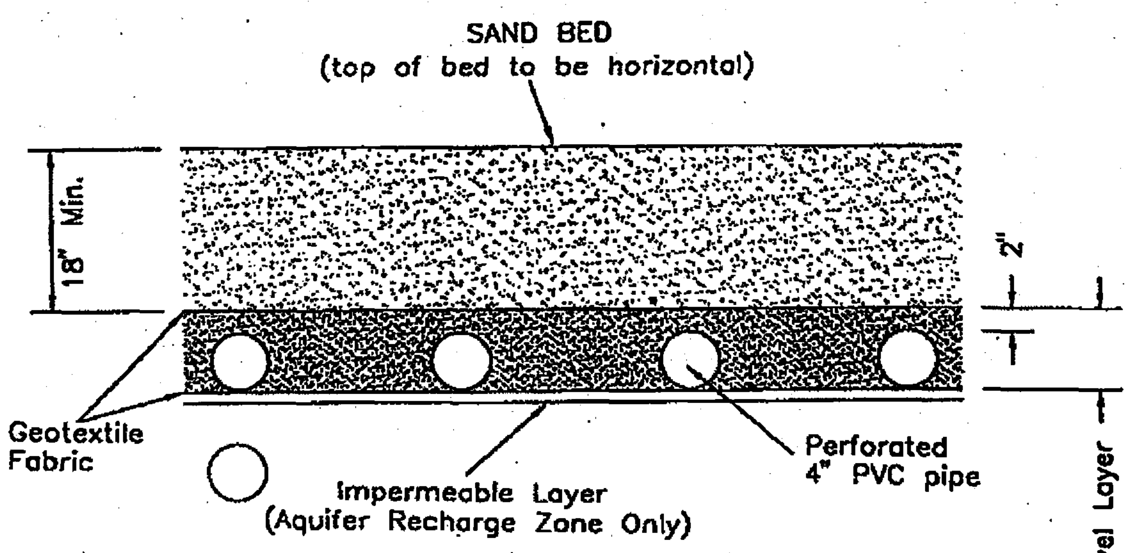
2) The underdrain laterals shall be placed with positive gravity drainage to the collector manifold.

3) The collector manifold shall have a minimum 1 percent grade toward the discharge point.

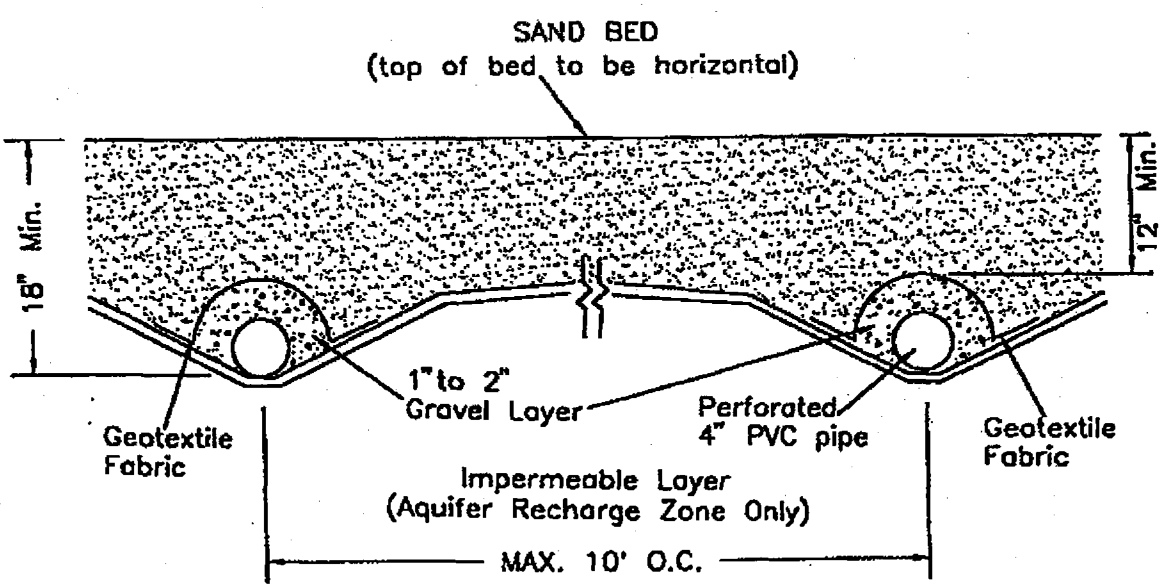
4) All laterals and collector manifolds shall have cleanouts installed, accessible from the surface without removing or disturbing filter media.

Sand Filter

Exhibit 2-16



A. SAND BED PROFILE (with gravel filter)



B. SAND BED PROFILE (trench design)

Sand Filter

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Structural wall material specification
4) Sand specification
5) Filter fabric specification
6) Rock surface layer specification
7) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Sand filter grading	
Structural walls	Call for inspection
Piping	Call for inspection
Sand	
Filter fabric	
Rock layer	
Plantings (if applicable)	

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to sand filter O&M form**

Additional photos and drawings:

*** Link to sand filter photos**

Sand Filter

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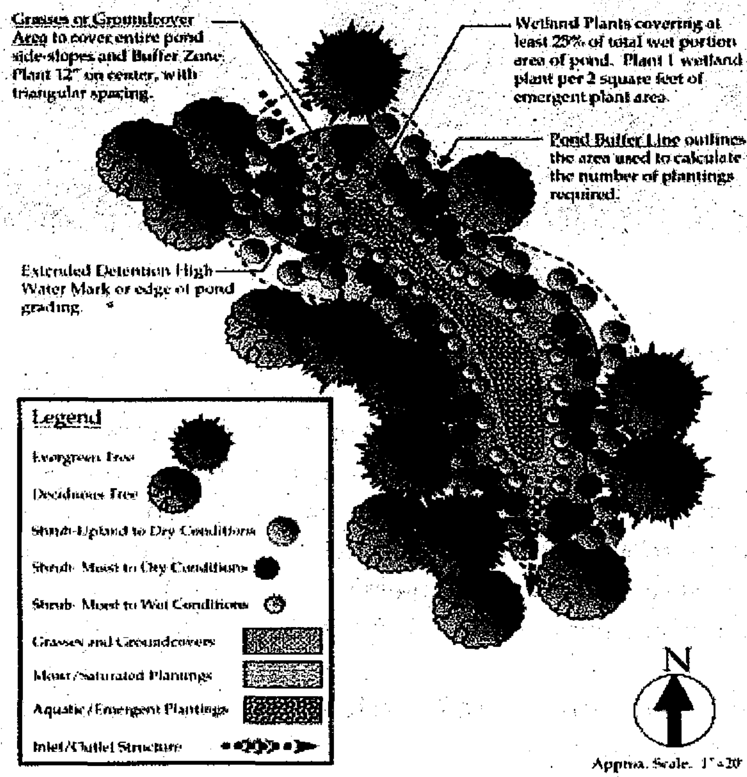
Wet, Extended Wet, & Dry Detention Pond

Wet and Extended Wet Ponds

The plan below illustrates a typical planting plan for an approximately 3,500 square foot wet or extended wet pond. This plan is diagrammatic use only. The actual project site condition may require designers to consider numerous other pond configurations and planting layouts.



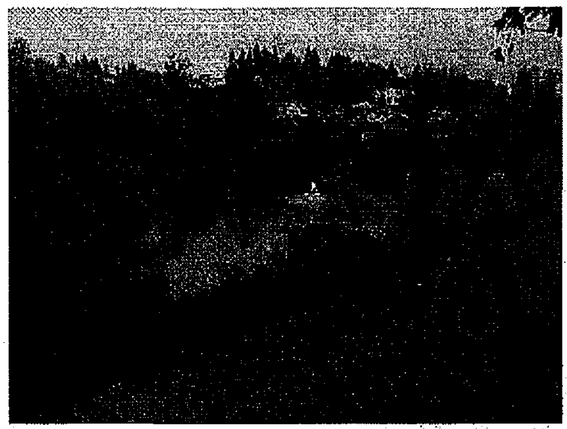
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction	PRES[1]
√ Flow Control	PRES[2]
Destination	NA

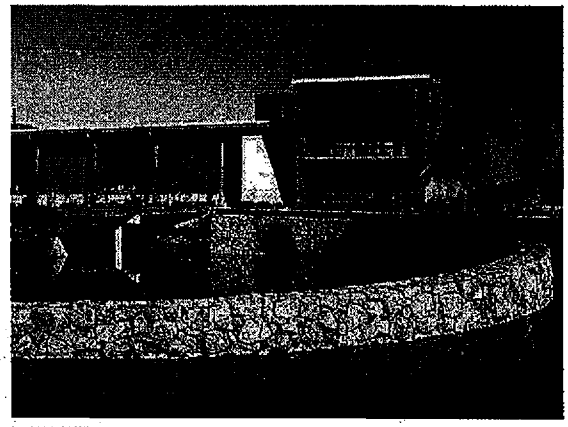
This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Wet and extended wet detention ponds receive credit for pollution reduction. For dry detention ponds to receive credit for pollution reduction, the bottom flow path of the pond must be designed as a vegetated or grassy swale, with sizing and design in accordance with criteria presented in this chapter. **2)** Only extended wet detention and dry detention ponds receive credit for flow control. All ponds must overflow to an acceptable stormwater destination per **Section 1.4.** Wet and extended wet detention ponds can be used to provide pollution reduction for any impervious surfaces, and must be located outside of public rights-of-way.

Wet, Extended Wet, & Dry Detention Pond





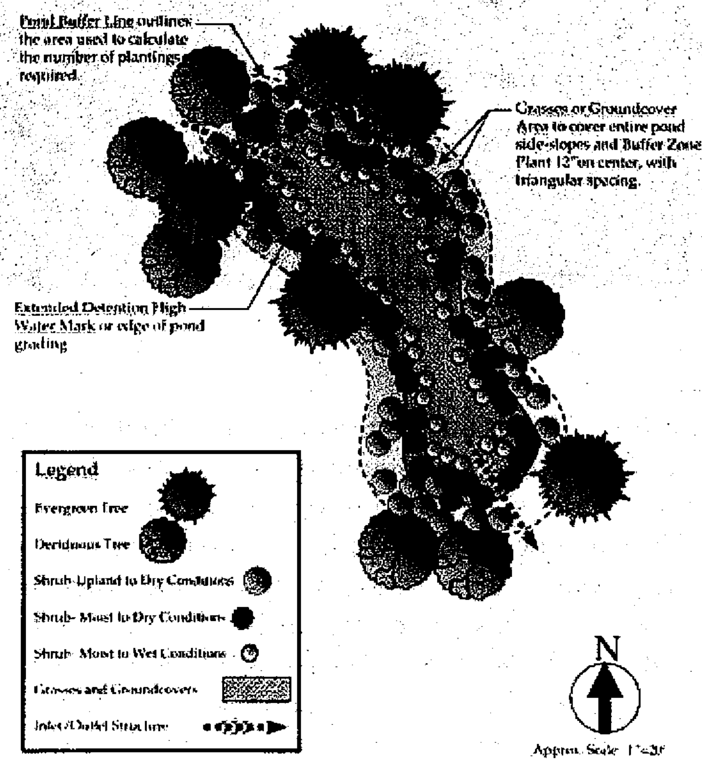
Wet Pond Description: Wet ponds are constructed with a permanent pool of water (called pool storage or dead storage). Stormwater runoff enters the pond at one end and displaces water from the permanent pool. Pollutants are removed from stormwater through gravitational settling and biologic processes. When the sizing criteria presented in this section is used, pollution reduction requirements are presumed to be met. Additional facilities will be required to meet flow control requirements, as applicable. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Extended Wet Detention Pond Description: Extended wet detention ponds are constructed with a permanent pool of water (called pool storage or dead storage) and additional storage above, which fills during storm events and releases water slowly over a number of hours. The permanent pool is sized to provide pollution reduction, and the additional storage above (extended detention area) is sized to meet flow control requirements. Pollutants are removed from stormwater through gravitational settling and biologic processes. When the sizing criteria presented in this section is used, pollution reduction requirements are presumed to be met. The extended detention portion of this facility must be designed using acceptable hydrologic modeling techniques (see **Section 2.3**) to meet applicable flow control requirements (see **Section 1.6.2**). An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

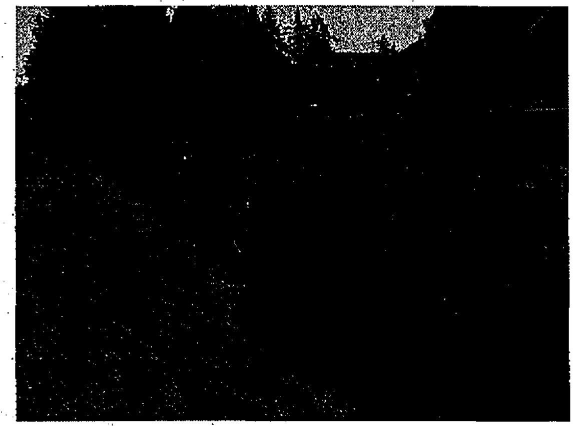
Dry Detention Pond Description: Dry detention ponds are vegetated basins designed to fill during storm events and slowly release the water over a number of hours. Dry detention ponds must be designed using acceptable hydrologic modeling techniques (see **Section 2.3**) to meet applicable flow control requirements (see **Section 1.6.2**. Additional facilities are required to meet pollution reduction requirements, unless the bottom flow path of the pond is designed as a vegetated or grassy swale, per swale sizing and design criteria. An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Dry Detention Ponds

The plan below illustrates a typical planting plan for an approximately 3,500 square foot dry detention pond. This plan is diagrammatic use only. The actual project site condition may require designers to consider numerous other pond configurations and planting layouts.



Wet, Extended Wet, & Dry Detention Pond



Design Considerations: Slopes and depth should be kept as mild as possible to avoid safety risks. Wet and extended wet detention ponds should be designed for large drainage areas (5 to 150 acres) to help avoid problems associated with long periods of stagnant water. The City encourages applicants to design ponds to function as multi-purpose facilities (e.g., parks, open space, recreation facilities, or parking lots), provided that any alternative uses are compatible with the primary stormwater functions and maintenance standards. Instream ponds are not encouraged. If used, they require special approvals from the National Marine Fisheries Service, Oregon Department of Fish and Wildlife, Oregon Division of State Lands, and City of Eugene, in addition to water rights from the Oregon Division of Water Rights.

Construction Considerations: As pond grading generally requires the topsoil to be removed to form the basin shape of the pond, the resulting top layers of soil must to be amended, or topsoil must be brought back in to ready the soil for planting.

Location and Ownership:
- All open ponds to be city-maintained shall be located in a separate open space tract with public drainage easements dedicated to the City.
- Open ponds serving more than one tax lot, or designed to function as multi-use/recreational facilities, shall be located in a separate tract (e.g., Tract A), defined easement, or designated open space.

Setbacks: Ponds shall be constructed to maintain the following setback distances from structures and other facilities. (All distances are measured from the edge of the maximum water surface elevation. The setback limit applies to ponds near the top of slope, not the bottom.)
- Minimum distance from the edge of the pond water surface to property lines and structures: 20 feet, unless an easement with adjacent property owner is provided.

- Distance from the toe of the pond berm embankment to the nearest property line: one-half of the berm height (minimum distance of 5 feet).
- Minimum distance from the edge of the pond water surface to septic tank, distribution box, or septic tank drain field: 50 feet.
- Surrounding slopes shall not exceed 10%. Minimum distance from the edge of the pond water surface to the top of a slope greater than 15 percent: 200 feet, unless a geotechnical report is submitted and approved by the City (**Exhibit 2-17**).
- Minimum distance from the edge of the pond water surface to a well: 100 feet (**Exhibit 2-17**).

Geometry/ Design Requirements:

- Slopes within the pond shall not exceed 3 horizontal to 1 vertical.
- The distance between all inlets and the outlet shall be maximized to facilitate sedimentation. The minimum length-to-width ratio is 3:1, at the maximum water surface elevation. This ratio is critical to prevent "short-circuiting," where water passes directly through the facility without being detained for any length of time. If area constraints make this ratio unworkable, baffles, islands, or peninsulas may be installed, with City approval, to increase the flow path and prevent short-circuiting.
- The maximum water depth of the pond shall not exceed 4 feet. The 0 to 2-foot depth shall be distributed evenly around the perimeter of the pond.
- Minimum freeboard shall be 1 foot above the highest potential water surface elevation (one foot above the emergency overflow structure or spillway elevation).
- Wet and extended wet detention ponds are applicable in NRCS Type C and D soils (A and B soils with impermeable liner). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.
- Dry detention ponds are applicable in NRCS type B, C, and D soils (the pond should most likely be designed as an infiltration basin in type A soils). Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.
- Unless designed with a pollution reduction swale in the bottom flow path, dry detention ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area, and shall provide at least 0.5 feet of dead storage for sediment accumulation.
- Wet and extended wet detention ponds shall be divided into a minimum of two cells. The first cell (forebay) shall contain approximately 10 percent of the design surface area, and shall provide at least 0.5 feet of dead storage for sediment accumulation.
- Public ponds shall be designed with an upstream sedimentation manhole with downturned elbow or tee riser outflow pipe (See **Exhibit 2-18**) to trap oils and reduce the likelihood of a visible sheen on the pond surface.

- Access routes to the pond for maintenance purposes must be shown on the plans. Public ponds will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope. A minimum 30 foot inside turning radius shall be provided.
- Where possible, a dewatering outlet with shut-off valve shall be provided to aid in the maintenance of the permanent pool.
- For wet and extended wet detention ponds, a water budget shall be submitted for review. The water budget must demonstrate that the baseflow to the pond is sufficient such that water stagnation/alga matting will not become a problem.

Outlet/ Overflow:

- If a riser pipe outlet is used, it shall be protected by a trash rack and anti-vortex plate. If an orifice plate is used, it shall be protected with a trash rack with at least 10 square feet of open surface area. In both cases, the rack must be hinged or easily removable to allow for cleaning. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.
- All ponds shall have an emergency overflow spillway or structure designed to convey the 100- year, 24-hour design storm for post-development site conditions, assuming the pond is full to the overflow spillway or structure crest. The overflow shall be designed to convey these extreme event peak flows around the berm structure for discharge into the downstream conveyance system. The overflow shall be designed and sited to protect the structural integrity of the berm. This will assure that catastrophic failure of the berm is avoided, property damage is avoided, and water quality of downstream receiving water bodies is protected (see **Exhibit 2-19**).
- The subgrade of the spillway shall be set at or above the 100-year overflow elevation of the control structure. The spillway shall be located to direct overflows safely into the downstream conveyance system and shall be located in existing soil wherever feasible. The emergency overflow spillway shall be armored with riprap or other flow-resistant material that will protect the embankment and minimize erosion. Riprap shall be designed in conformance with **Section 2.8** and shall extend to the toe of each face of the berm embankment. The emergency overflow spillway weir section shall be designed for the maximum design storm event for post-development conditions, using the following formula:

$$L = \frac{Q_{100}}{3.21H^{1.5}} - 2.4\,H$$

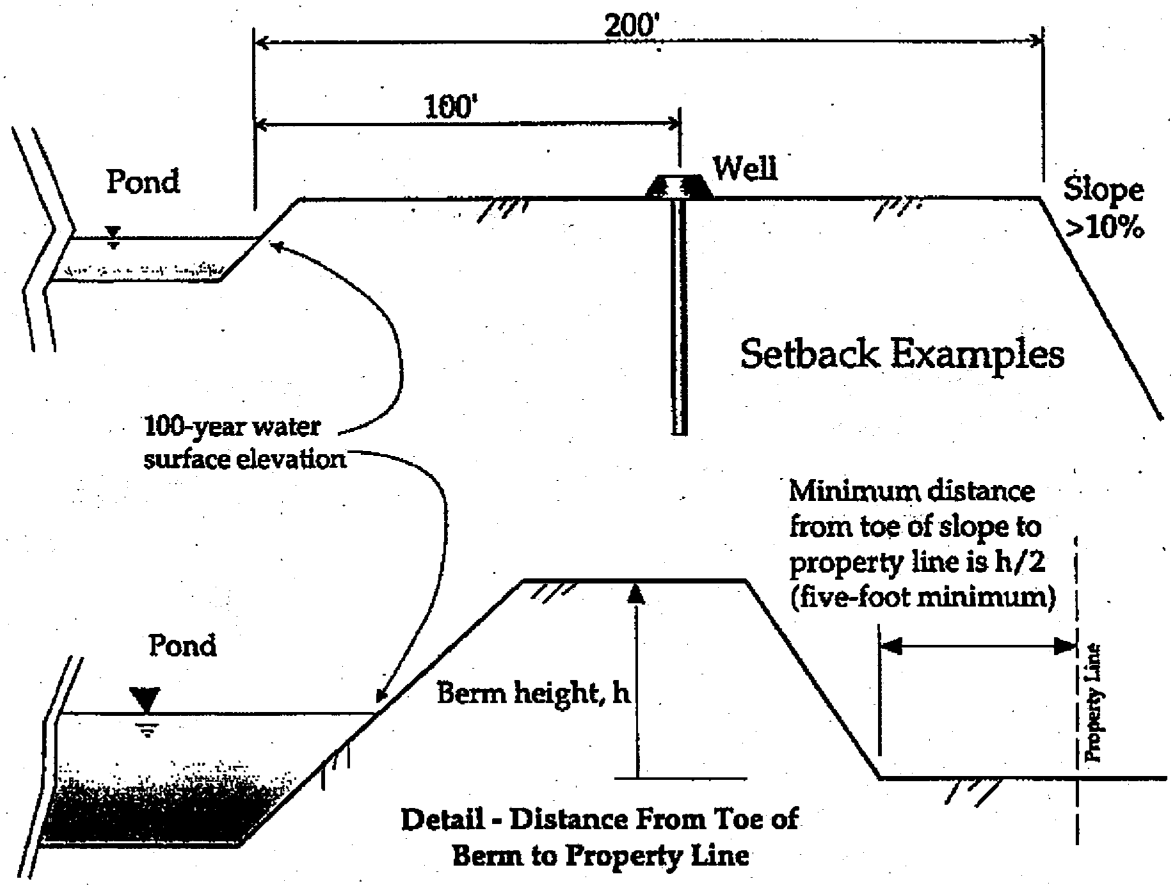
where:

L	= Length of bottom of weir, feet
Q_{100}	= 100-year post-development flow rate, cfs
H	= Height of emergency overflow water surface, feet

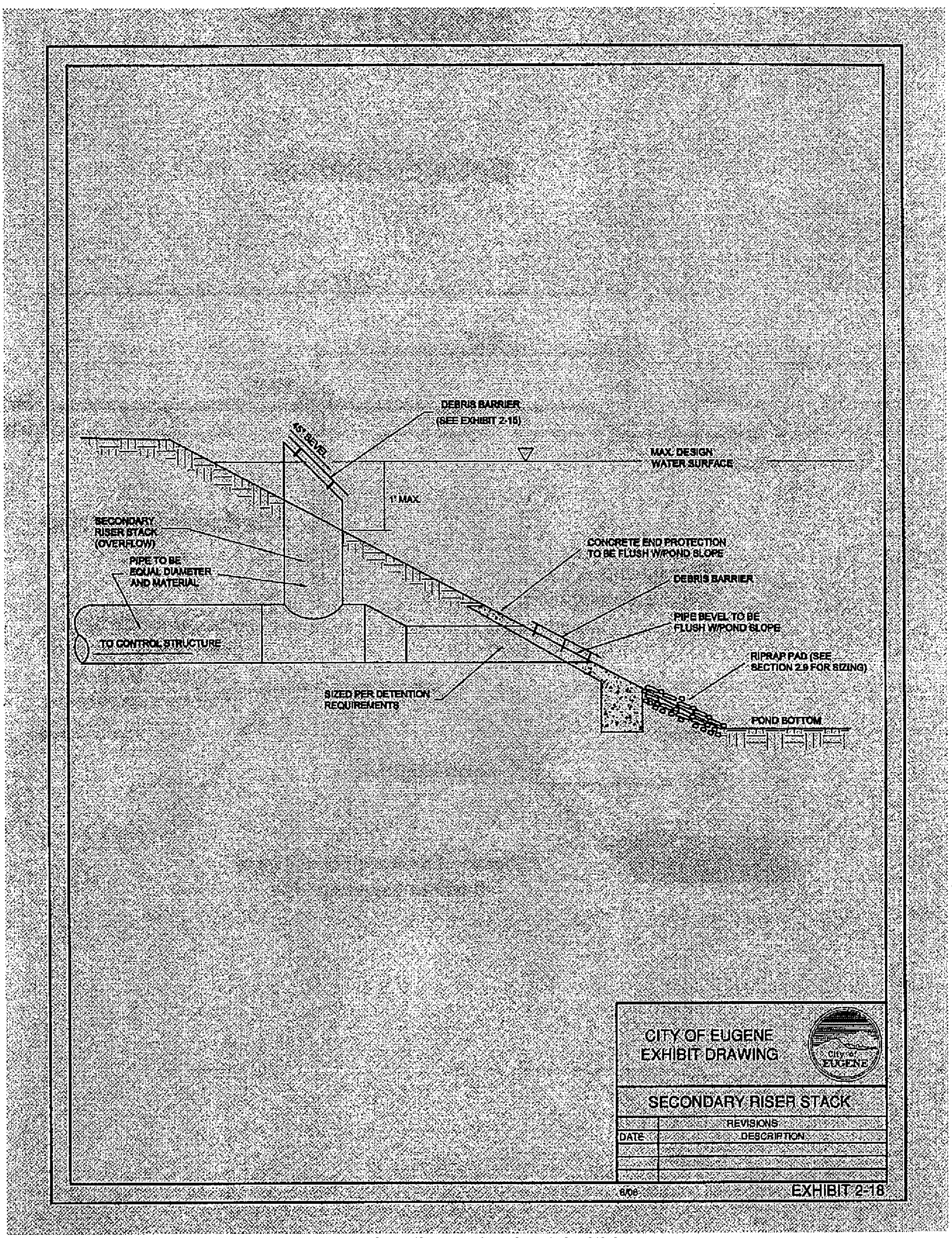
Wet, Extended Wet, & Dry Detention Pond

EXHIBIT 2-17

Setback Details

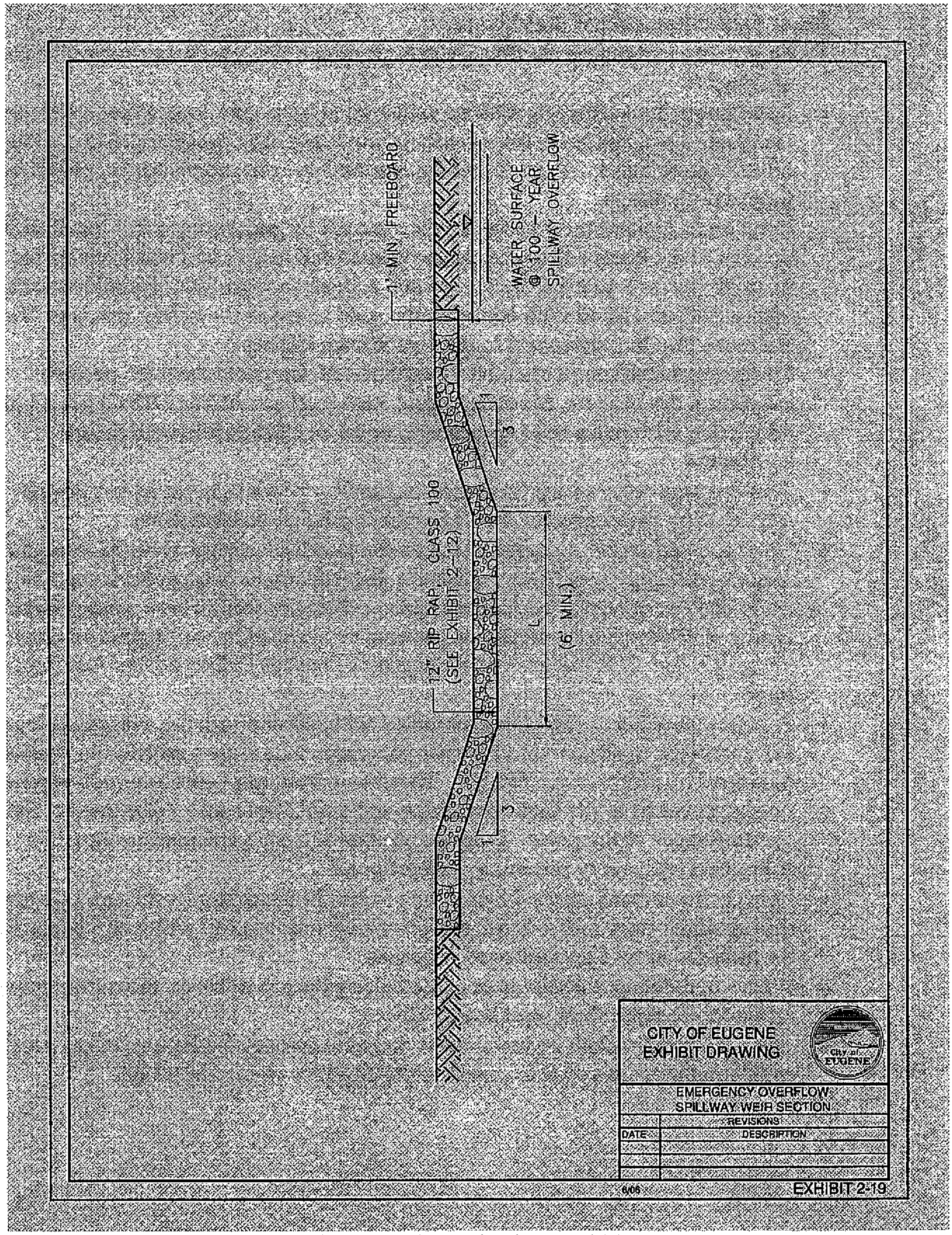


Wet, Extended Wet, & Dry Detention Pond



Note: See Eugene Standard Drawings, for City-maintained facilities.

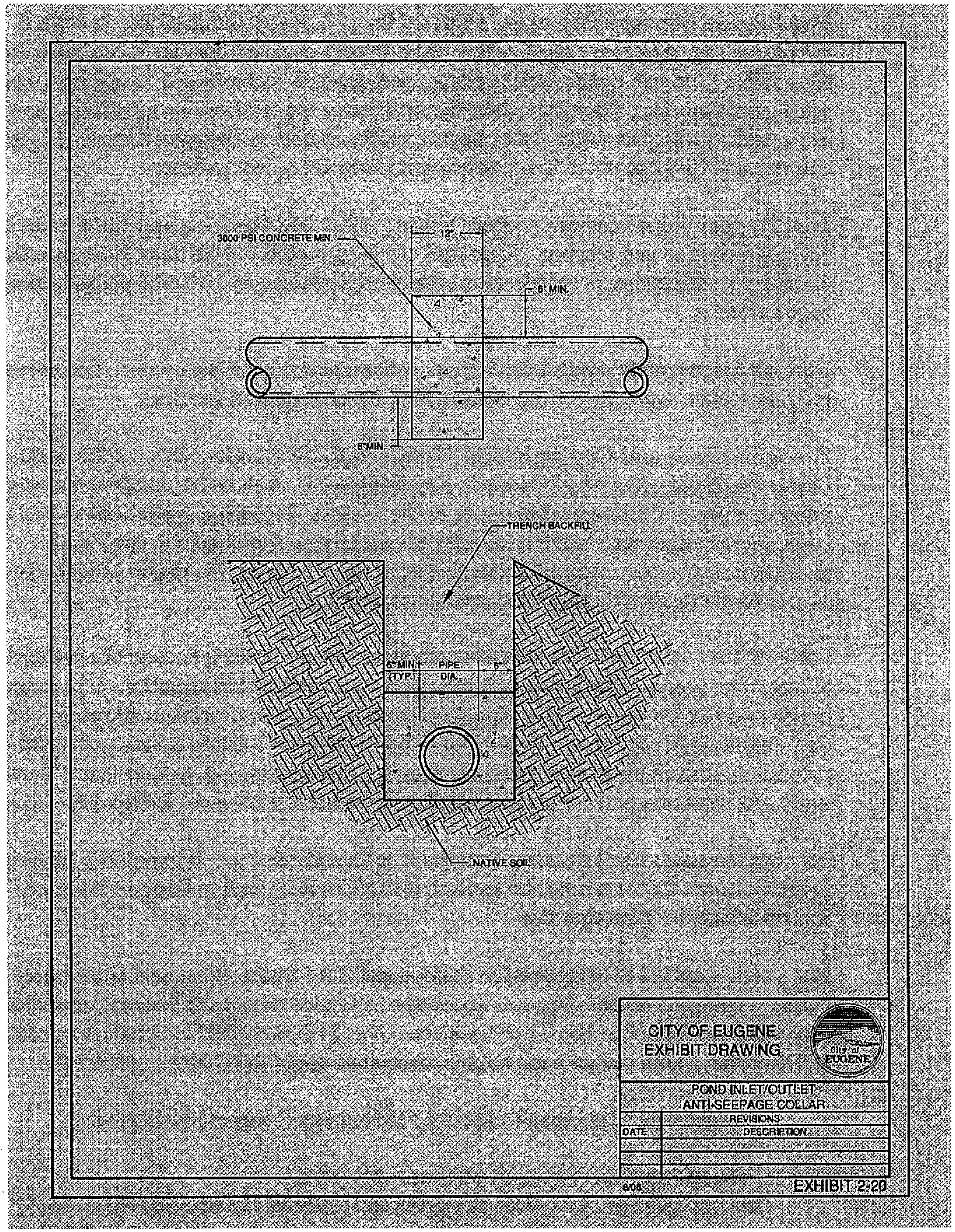
Wet, Extended Wet, & Dry Detention Pond



Note: See Eugene Standard Drawings, for City-maintained facilities.

Berm Embankment/Soil Stabilization:

- Pond berm embankments shall be designed by a civil engineer licensed in the State of Oregon.
- Pond berm embankments shall be constructed on native consolidated soil (or compacted and stable fill soil) that is free of loose surface soil materials, roots, and other organic debris. Topsoil will be required over the consolidated soil to support required plantings.
- Pond berm embankments shall be constructed by excavating a key equal to 50 percent of the berm embankment cross-sectional height and width measured through the center of the berm. (Note: A key in a berm is an excavated trench below the berm filled with soil material used to make the berm. It acts to "key" the berm into the native soil to prevent it from sliding.)
- The berm embankment shall be constructed of compacted soil (95 percent maximum dry density, Modified Proctor Method per ASTM D1557) placed in 6- to 8-inch lifts with hand-held equipment, or 10- to 12-inch lifts with heavy equipment.
- Anti-seepage collars shall be placed on outflow pipes in berm embankments impounding water greater than 8 feet in depth (see **Exhibit 2-20).**
- During construction, exposed earth on the pond side slopes shall be sodden or seeded with appropriate seed mixture. Establishment of protective vegetative cover shall be ensured with appropriate surface-protection best management practices (BMPs) and reseeded as necessary. See the City of Eugene's *Erosion Prevention and Construction Site Management Practices Ordinance and Administrative Rules.*
- Pond embankments shall be constructed with a maximum (i.e. steepest) slope of 3H: 1V on the upstream and downstream face. Side slopes **within** the pond shall be sloped no steeper than 3H: 1V. The use of retaining walls in ponds requires pre-approval from the City. Retaining walls shall not exceed one-third of the circumference of the pond. Detailed structural design calculations must be submitted with every retaining wall proposal.
- Pond berm embankments 6 feet or less in height including freeboard, measured through the center of the berm, shall have a minimum top width of 6 feet, or as recommended by a geotechnical engineer.
- Where maintenance access is provided along the top of berm, the minimum width of the top of berm shall be at least 15 feet.
- Two staff gauges shall be installed at opposite ends of the bottom of the pond, to enable maintenance staff to measure the depth of accumulated silts.



Note: See Eugene Standard Drawings, for City-maintained facilities.

Wet, Extended Wet, & Dry Detention Pond

Fencing and Signage: Fences are required for all City-maintained ponds with a permanent or temporary pool greater than 18 inches deep, interior side slopes steeper than 3H: 1V, or any walls/bulkheads greater than 24 inches high. Generally, a pond with gently sloping sides (less than 3:1) and including a 10-foot-wide safety bench around the facility at the point of slope transition does not require a fence. Applicants can request City approval to use fencing if there are safety concerns.

For City-maintained facilities where fencing is not required, the applicant must have City approval to use fencing. Approval will be granted only if there is no practical alternative. If fencing is required or approved, the design shall address screening requirements.

Fencing for privately owned facilities is at the discretion of the owner. The owner may, however, want to use the criteria for City-maintained facilities.

For both private and City-maintained facilities, Eugene code may prohibit fencing or require screening in some locations. The designer is responsible for determining which sections of Eugene code apply to the project. If fencing is prohibited by Eugene code, the designer may have to modify the facility or site design to provide an alternate means of securing the site (for example, reducing the depth of water or side slopes of the facility to minimize safety concerns).

For both private and City-maintained facilities where fencing is used, fences shall be at least 6 feet high. The 6-foot height may not be required in situations where fences are not needed to prevent climbing (e.g., on steep slopes to prevent slipping). For City-maintained facilities, a minimum of one vehicular locking access gate shall be provided. It shall be 10 feet wide, consisting of two swinging sections each 5 feet wide. At least one pedestrian gate shall be provided, with a minimum 4-foot width.

Fencing materials shall be complementary to the site design. If chain link fencing is proposed for a City-maintained facility, it shall be designed to Oregon Standard Specifications for Construction.

Wet and Extended Wet Detention Permanent Pool Sizing: The permanent pool (or "dead") storage volume, V_{pond}, is equivalent to twice the runoff volume generated by the pollution reduction storm of 1.4 inches over 24 hours (NRCS Type 1A rainfall distribution). This volume can be approximated using the following formula:

Volume = 2 * 1.4 inches * (1 foot/12 inches) * Impervious Surface

Volume = permanent pool volume, cubic feet
Impervious Surface = area of impervious surfaces to manage, square feet

EXAMPLE

A 20-acre site is to be developed. After development, the site will be 60 percent impervious. What is the required volume for a wet pond to meet pollution reduction requirements?

For the post-development condition, the total area is 20 acres and the impervious area has increased to 60 percent, or 12 acres:

Permanent Pool Volume = 2 * 1.4/12 * (43560 * 12) = 121,968 cubic feet

Flow Control for Extended Wet Detention and Dry Detention Ponds: To restrict flow rates exiting the pond to those required by **Section 1.6.2,** a control structure designed in accordance with **Section 2.5** must be used. For extended wet detention ponds, this control structure must be located above the permanent pool elevation. The outlet orifice shall be designed to minimize clogging (see **Section 2.5: Control Structures**).

Landscaping: Shrubs and wetland plantings shall be designed to minimize solar exposure of open water areas. Trees or other appropriate vegetation shall be located around the east, south, and west sides of a facility to maximize shading. Reducing solar exposure has two benefits: it helps reduce heat gain in water before discharging to a receiving water, and it helps maintain a healthy and aesthetic pond condition, reducing algae blooms and the potential for anaerobic conditions to develop.

Facility area is equivalent to the area of the pond, including bottom and side slopes, plus a 10-foot buffer around the pond. Minimum plant material quantities per **250** square feet of the facility area are as follows:

1 - Evergreen or deciduous tree:	
Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.

Wetland plants:	1 per 2 square feet of a pond emergent plant zone. The emergent plant zone shall be at least 25 percent of the total pond water surface area.

Wildflowers, native grasses, and ground covers used for City-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for City-maintained facilities; any exceptions will require City approval.

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

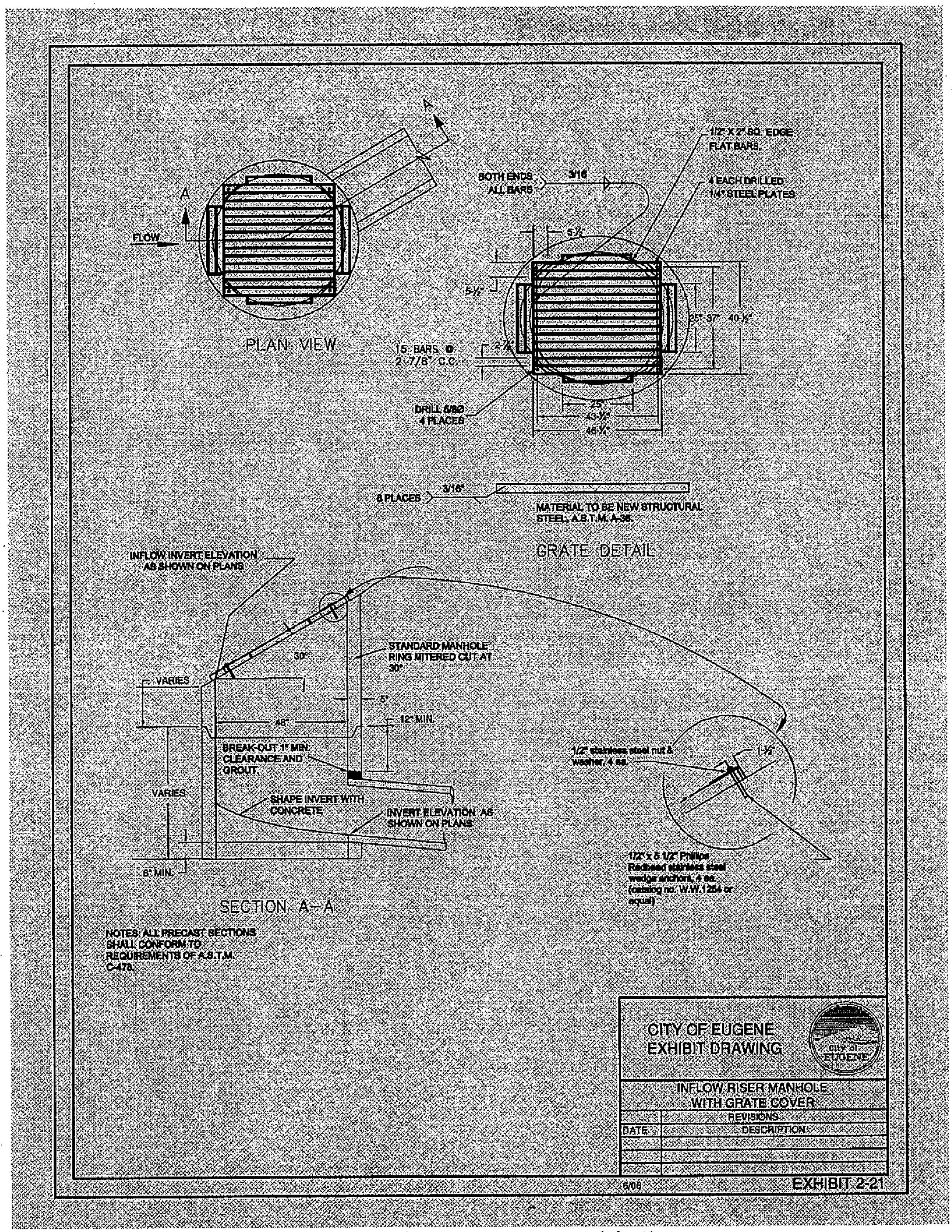
Facility Component	Inspection Requirement
Pond grading	
Piping	Call for inspection
Control (orifice) structure for extended wet detention and dry detention ponds	Call for inspection
Filter fabric or lining (if applicable)	
Growing medium	
Plantings	

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to wet, extended wet detention, & dry detention pond O&M form**

Additional photos and drawings:

*** Link to wet and extended wet detention pond photos**
*** Link to wet and extended wet detention pond drawings**
*** Link to dry detention pond photos**
*** Link to dry detention pond drawings**



Note: See Eugene Standard Drawings for City-maintained facilities.

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Constructed Treatment Wetland

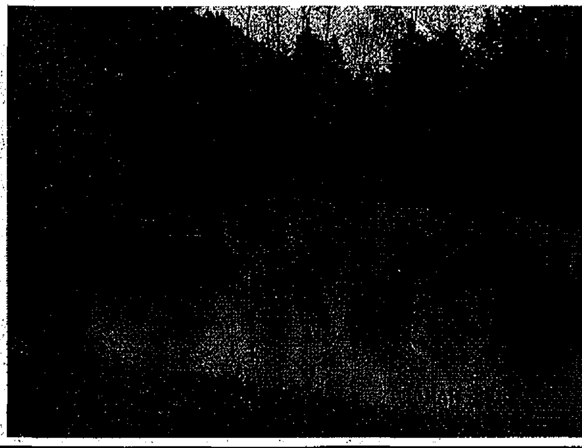
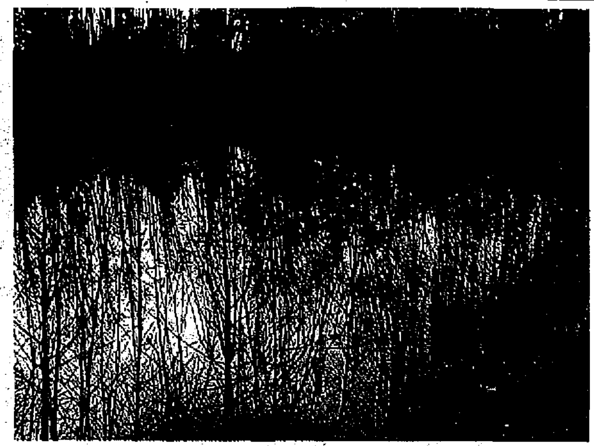
Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
√ Pollution Reduction................................	PRES
√ Flow Control...	PRES
Destination..	NA

This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Wetlands can be used to manage stormwater from any type of impervious surface.

Constructed Treatment Wetland

Description: A wetland is an area inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, and similar areas **except those constructed as pollution reduction or flow control facilities**. The Corps of Engineers and Division of State Lands make specific wetland designations. Constructed treatment wetlands are wetlands designed and constructed for the specific purpose of providing stormwater management. Unlike natural wetlands, constructed treatment wetlands are not regulated by the Corps of Engineers and the Division of State Lands.

Wetlands remove pollutants through several processes, including sedimentation, filtration, and biological uptake. When enough volume is provided, constructed treatment wetlands can also provide a significant level of flow control.

Design Criteria: To receive pollution reduction credit, the wet portion or permanent pool of the wetland shall be equal to that required for wet ponds, or the residence time of the stormwater volume (calculated as the pollution reduction design storm volume divided by the average facility outflow rate) shall be no less than 36 hours. A design team with experience in hydrology, wetland plants, and engineering will be needed to develop a successful wetland pollution reduction facility. A water budget analysis shall be performed with the design of the facility.

Sizing: Drainage area to be served shall be no less than 10 acres. To meet pollution reduction requirements, dead storage within the wetland must equal or exceed wet pond dead storage criteria. To meet flow control requirements, a detailed hydraulic analysis must be performed by a Professional Engineer, showing compliance with flow control standards presented in **Section 1.6.2**.

Constructed Treatment Wetland

Geometry: The configuration of a constructed wetland shall be tailored to each site, rather than limited to one design. Major elements of a wetland can include channels or trenches, shallow marshes, and deeper ponded areas. These elements shall be combined to take advantage of the site topography. Maximum slopes within the wetland area shall be 20%, and maximum slopes of surrounding land shall not exceed 10%. All wetland design shall address habitat, planting, and aesthetic issues.

1) The volume of water to be treated shall be allocated over the treatment area of the facility as follows:

Component	Percent of Design Volume (approx.)	Percent of Facility Surface Area (approx.)
Forebay	10	5
Micropool	10	5
Deep water (> 18″)	50	40
Deep wetland (6″-18″)	20	25
Shallow wetland (<6″)	10	25

Definitions:

Forebay: A relatively deep zone placed where influent water discharges to a stormwater wetland. It traps coarse sediments, reduces incoming velocity, and helps distribute runoff evenly over the wetland.

Micropool: A deep (4 to 6 feet) pool placed at the outlet of a stormwater wetland forebay.

Deep-water: The area within a stormwater wetland that has a water depth greater than 18 inches.

Deep wetland: The area within a stormwater wetland that has a water depth between 6 and 18 inches.

Shallow wetland: The area within a stormwater wetland that has a water depth less than 6 inches.

2) The minimum length-to-width ratio shall be 3:1, unless otherwise approved by the City. If area constraints make this ratio unworkable, baffles, islands, or peninsulas may be installed, with City approval, to increase the flow path and prevent short-circuiting.

3) Where wetland vegetation is to be planted, side slopes shall be no steeper than 5:1. Wetland plant selection shall be consistent with anticipated hydrology.

4) Access routes to the wetland for maintenance purposes must be shown on the plans. Public wetlands will need to provide a minimum 10-foot wide access route, not to exceed 10 percent in slope. A minimum 30 foot turning radius shall be provided.

Flow:

1) Flow velocity through the wetland shall average less than 0.01 feet per second for the water quality design storm event (1.4 inches in 24 hours). If natural slope does not allow for this velocity, berms shall be used to create ponded benches.

2) Flow through the wetland shall be distributed as uniformly as possible across the marsh and ponded section.

Forebay:

1) The forebay area shall be established along the wetland inflow points to capture sediment. The forebay shall have a water depth of about 3 feet and have at least 10 percent and up to 25 percent of the total treatment wetland volume.

An overflow mechanism to an approved conveyance/ destination method per **Section 1.4** will be required.

Soil Suitability: Constructed treatment wetlands are appropriate for NRCS type C and D soils. Topsoil shall be used within the top 12 inches of the facility, or the soil shall be amended per **Appendix G** to support plant growth.

Setbacks: Required setback from the top of the bank to property lines is 5 feet, and 10 feet from building foundations. Infiltration basins shall meet the following setback requirements from downstream slopes: minimum of 100 feet from slopes of 10%; add 5 feet of setback for each additional percent of slope up to 30%; 200-foot setback for slopes of 30%; infiltration trenches shall not be used where slopes exceed 30%.

Landscaping: Shrubs and wetland plantings shall be designed to minimize solar exposure of open water areas. Trees or other appropriate vegetation shall be located around the east, south, and west sides of a facility to maximize shading. Reducing solar exposure has two benefits: it helps reduce heat gain in water before discharging to a receiving water, and it helps maintain a healthy and aesthetic pond condition, reducing algae blooms and the potential for anaerobic conditions to develop.

Facility area is equivalent to the area of the wetland, including bottom and side slopes, plus a 10-foot buffer around the wetland. Minimum plant material quantities per **200** square feet of the facility area are as follows:

1 - Evergreen or deciduous tree:	
Evergreen trees:	Minimum height: 6 feet
Deciduous trees:	Minimum caliper: 1 ½ inches at 6 inches above base.
4 - Large shrubs/small trees	3-gallon containers or equivalent.
6 - Shrubs/large grass-like plants	1-gallon containers or equivalent

Ground cover plants:	1 per 12 inches on center, triangular spacing, for the ground cover planting area only, unless seed or sod is specified. Minimum container: 4-inch pot. At least 50 percent of the facility shall be planted with grasses or grass-like plants.
Wetland plants:	1 per 2 square feet of a pond emergent plant zone. The emergent plant zone shall be at least 25 percent of the total pond water surface area.

Wildflowers, native grasses, and ground covers used for city-maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once or twice annually. Turf and lawn areas are not allowed for city-maintained facilities; any exceptions will require City approval.

***Link to Recommended Plants**

1) Two staff gauges shall be installed at opposite ends of the bottom of the wetland, to enable maintenance staff to measure the depth of accumulated silts.

2) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional geotechnical engineer, shall inspect the soil after the system is excavated to confirm that soils remain in suitable condition for planting.

Constructed Treatment Wetland

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2**.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Growing medium specification
4) Filter fabric specification (if applicable)
5) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection
6) Landscaping plan

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Wetland grading	
Piping	Call for inspection
Filter fabric (if applicable)	
Growing medium	
Plantings	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to constructed treatment wetland O&M form**

Additional photos:

*** Link to constructed treatment wetland photos**

Manufactured Treatment Technology

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction	PERF
Flow Control	NA
Destination	NA

These facilities may or may not be classified as Underground Injection Control structures (UICs), depending on specific manufacturer design.

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) For a list of currently accepted stormwater treatment technologies, call PW at 541-682--5291. Manufactured stormwater treatment technologies can be used to provide pollution reduction for any impervious surface. They can be located on private property, and some are approved for use in public right-of-ways.

For a manufactured stormwater treatment technology to be approved for general use within the City of Eugene, the manufactured stormwater treatment technology must be approved by the Portland Bureau of Environmental Services to meet the 70% removal of TSS standard.[1] Alternatively a manufactured stormwater treatment technology that meets the Portland Bureau of Environmental Services requirement for pretreatment, 50% removal of TSS, maybe used in conjunction with low-profile elbows placed in all catchbasins, curb inlets, area drains, or other flow input devices, that drain the area required for treatment. At the discretion of the City Engineer an alternative manufactured treatment technology maybe approved for use that has not met testing requirements.

Manufacturers wishing to submit technologies for approval will follow the Portland Bureau of Environmental Services "Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies" located in **Appendix B**.

[1] See **Appendix B** for a more detailed definition of "70% removal of TSS", which is actually a function of influent TSS concentration.

In addition, to be approved for use as a publicly owned or city-maintained facility, the manufacturer must also submit detailed information about the facility's design criteria, construction techniques, operation and maintenance procedures, reliability, and cost to City of Eugene PW. This information will be reviewed by PW, which will decide whether or not the facility can be used for public projects.

Manufactured Treatment Technology

Manufactured stormwater treatment technologies on BES's approved list must be designed and constructed in accordance with the manufacturer's recommendations. Eugene may also place special design conditions on the acceptance of the technology, such as sizing requirements that go beyond the manufacturer's recommendations, which must also be followed to obtain plan approval.

In addition to design calculations shown in the Report requirements of **Exhibit 2-2**, the following must be submitted with each manufactured stormwater treatment technology project:

1) Pollution reduction capacity of the facility
2) Flow-through conveyance capacity (i.e., how much flow can be passed through the facility without stirring up and releasing trapped pollutants)

An operations and maintenance manual must also be submitted for City review. See **Chapter 3.0** for O&M plan guidance.

Manufactured stormwater treatment technologies on BES's approved list for general use may not be capable of meeting specific TMDL requirements for certain watersheds. In that case, the treatment technology will not be accepted as a stand-alone pollution reduction facility. Rather, a pollution reduction facility that is presumed by DEQ to meet the TMDL requirement must be used.

Checklist of minimal information to be shown on the permit drawings:

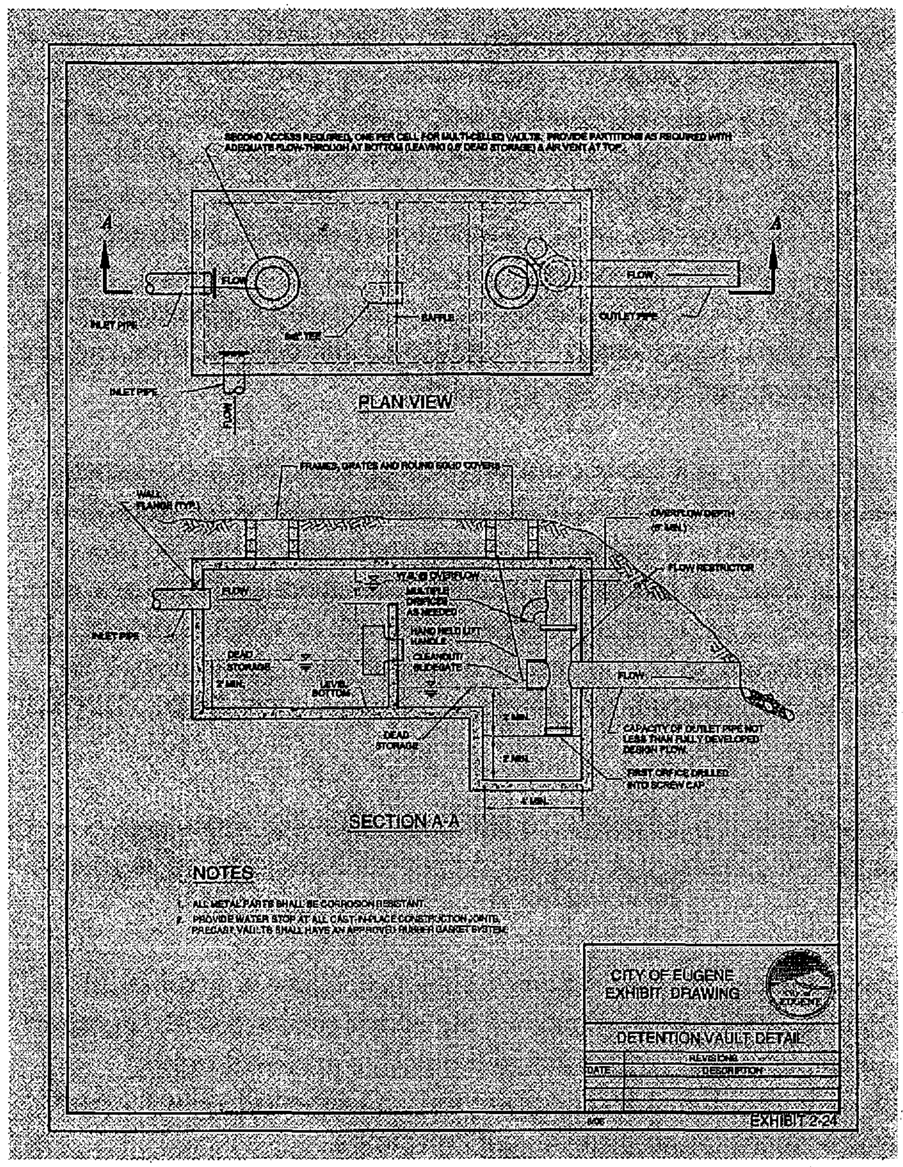
1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Vault excavation	
Piping	Call for inspection
Vault installation	Cal for inspection

Operations and Maintenance requirements: An operations and maintenance plan will be required, including information from the manufacturer, as per **Chapter 3.0.**

Structural Detention Facility



Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
Pollution Reduction............................	NA
√ Flow Control..	PRES
Destination..	NA

This facility is not classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) See Report requirements, **Exhibit 2-2,** for hydrologic and hydraulic calculations that must be submitted with structural detention design. Structural detention facilities may be used to provide flow control for any impervious surface type, and may be located on private property or within the public right-of-way.

Structural Detention Facility

Description: Structural detention facilities such as tanks, vaults, and oversized pipes provide underground storage of stormwater as part of a runoff flow control system. As with any underground structure, they must be designed not only for their function as runoff flow control facilities, but also to withstand an environment of periodic inundation, potentially corrosive chemical or electrochemical soil conditions, and heavy ground and surface loadings. They must also be accessible for maintenance. Facilities in this section must be designed using acceptable hydrologic modeling techniques (See **Section 2.3**) to meet applicable flow control requirements. Additional facilities will be required to meet applicable pollution reduction requirements.

Tanks and vaults typically do not have a built-in design feature for containing sediment, as do multi-cell ponds. When tanks or vaults are used for detention storage, therefore, either a surface sediment containment pond shall be placed upstream of the tank or vault, or the tank/vault shall be oversized to allow for the temporary accumulation of sediment. Where the tank or vault is designed to provide sediment containment, a minimum of ½ foot of dead storage shall be provided, and the tank or vault shall be designed and constructed with 0% (flat) bottom slope.

Tanks and vaults can be used in conjunction with other detention storage facilities, such as ponds or parking lot ponds, to provide initial or supplemental storage.

Because of minimum orifice size specifications, structural flow control facilities (such as detention tanks, vaults, and oversized pipes) for projects with less than 15,000 square feet of impervious surface are not effective and will not be permitted. Projects with less than 15,000 square feet of impervious surface are required to use surface retention facilities to control flows.

Design Requirements:
The following criteria apply to detention tank, vault, and oversized pipe design.

- All areas of a tank or vault shall be within 50 feet of a minimum 36-inch diameter access entry cover. All access openings shall have round, solid locking lids.
- Publicly owned detention tanks, vaults, and pipes are permitted within public rights-of-way. If developments are served with publicly operated and maintained tanks and vaults that are not located within the right-of-way, the tanks/vaults shall be located in separate open space tracts with public sewer easements that are dedicated to the City of Eugene. All privately owned and maintained facilities shall be located to allow easy maintenance and access. (**See Chapter 3.0**: Operation and Maintenance)

Structural Detention Facility

- All tanks and vaults shall be designed as flow-through systems, unless separate sediment containment is provided.
- Minimum size for a public detention pipe shall be 36 inches. If the collection system piping is designed also to provide storage, the resulting maximum water surface elevation shall maintain a minimum 1-foot of freeboard in any catch basin below the catch basin grate. Pipe capacity shall be verified using an accepted methodology approved by the City (see Eugene's Public Improvements Design Standards Manual). The minimum internal height of a vault or tank shall be 3 feet, and the minimum width shall be 3 feet. The maximum depth of the vault or tank invert shall be 20 feet. Pipe material and surface treatment shall conform to the standards for detention tanks and vaults (see **Exhibits 2-22 and 2-24).**
- Detention tanks and vaults shall have a minimum of ½ foot of dead storage, unless upstream sedimentation is provided (see **Exhibits 2-22 and 2-24**).

Flow Control:

- To restrict flow rates exiting the pond to those required by **Section 1.6.2**, a control structure per **Section 2.5** must be used.

Materials and Structural Stability:

- For publicly owned or city-maintained facilities, pipe materials and joints shall conform to the City of Eugene's *Public Improvements Design Standards Manual*. For privately owned and maintained facilities, the pipe material shall conform to the Unified Plumbing Code.
- All tanks, vaults, and pipes shall meet structural requirements for overburden support and traffic loadings, if appropriate. H-20 live loads shall be accommodated for tanks and vaults under roadways and parking areas. End caps shall be designed for structural stability at maximum hydrostatic loading conditions.
- Detention vaults shall be constructed of structural reinforced concrete (3000 psi, ASTM 405). All construction joints shall be provided with water stops.
- In soils where groundwater may induce flotation and buoyancy, measures shall be taken to counteract these forces. Ballasting with concrete or earth backfill, providing concrete anchors or other counteractive measures shall be required. Calculations shall be required to demonstrate stability.
- Tanks and vaults shall be placed on stable, consolidated native soil with suitable bedding. Tanks and vaults shall not be allowed in fill slopes, unless a geotechnical analysis is performed for stability and construction practices.

Structural Detention Facility

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

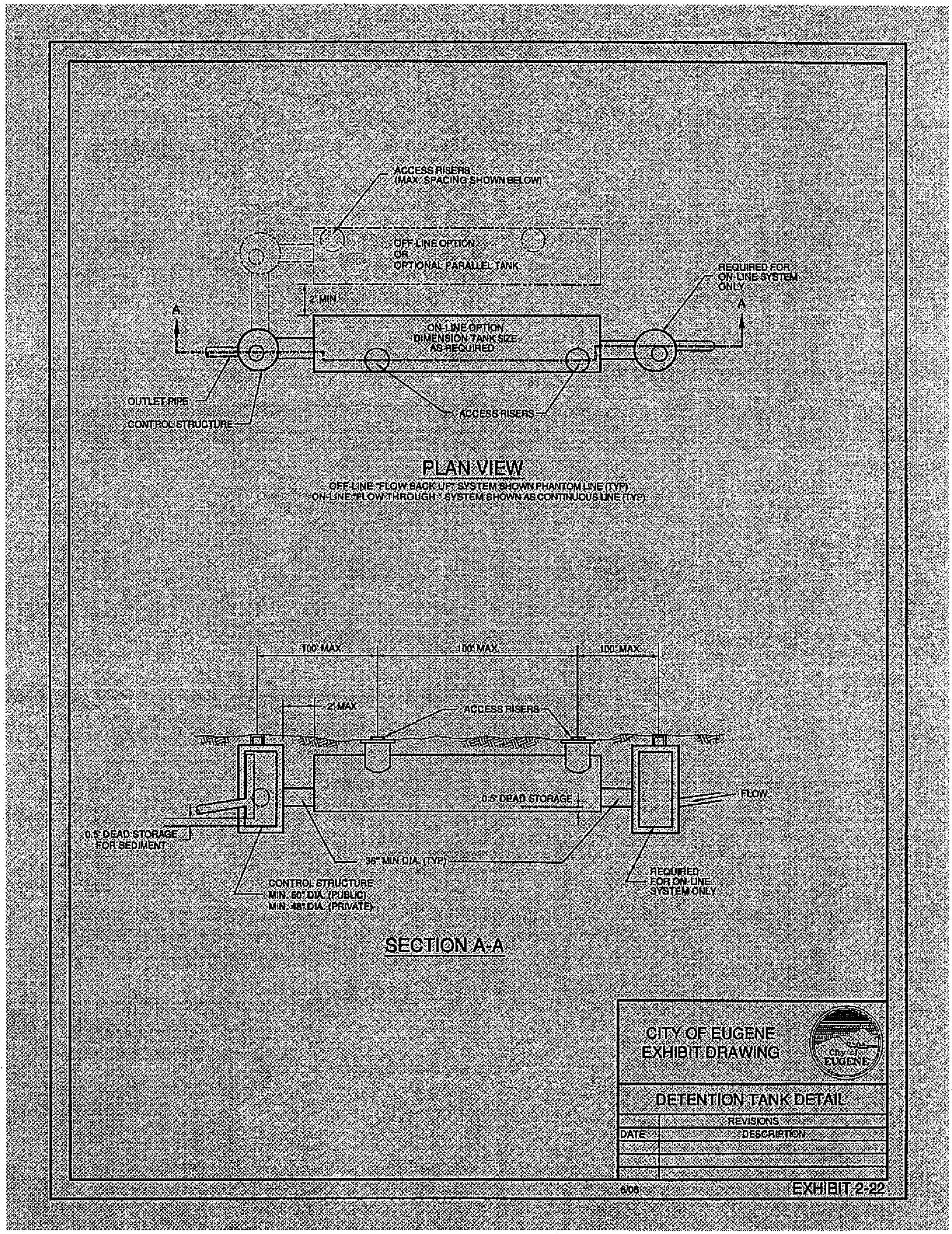
Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Vault excavation	
Piping	Call for inspection
Vault installation	Call for inspection
Control structure (orifice structure)	Call for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

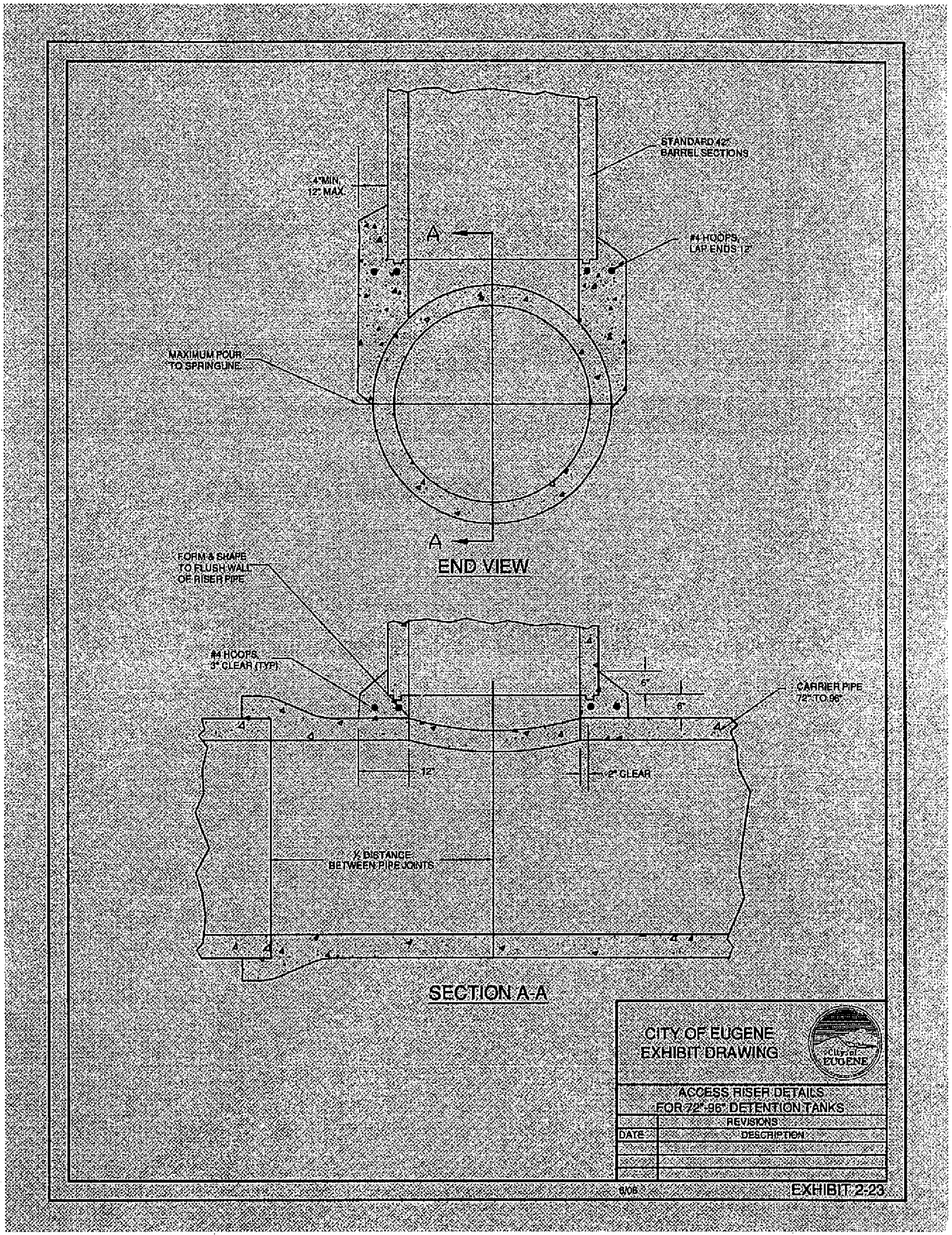
*** Link to tank, vault, and oversized pipe O&M form**

Structural Detention Facility



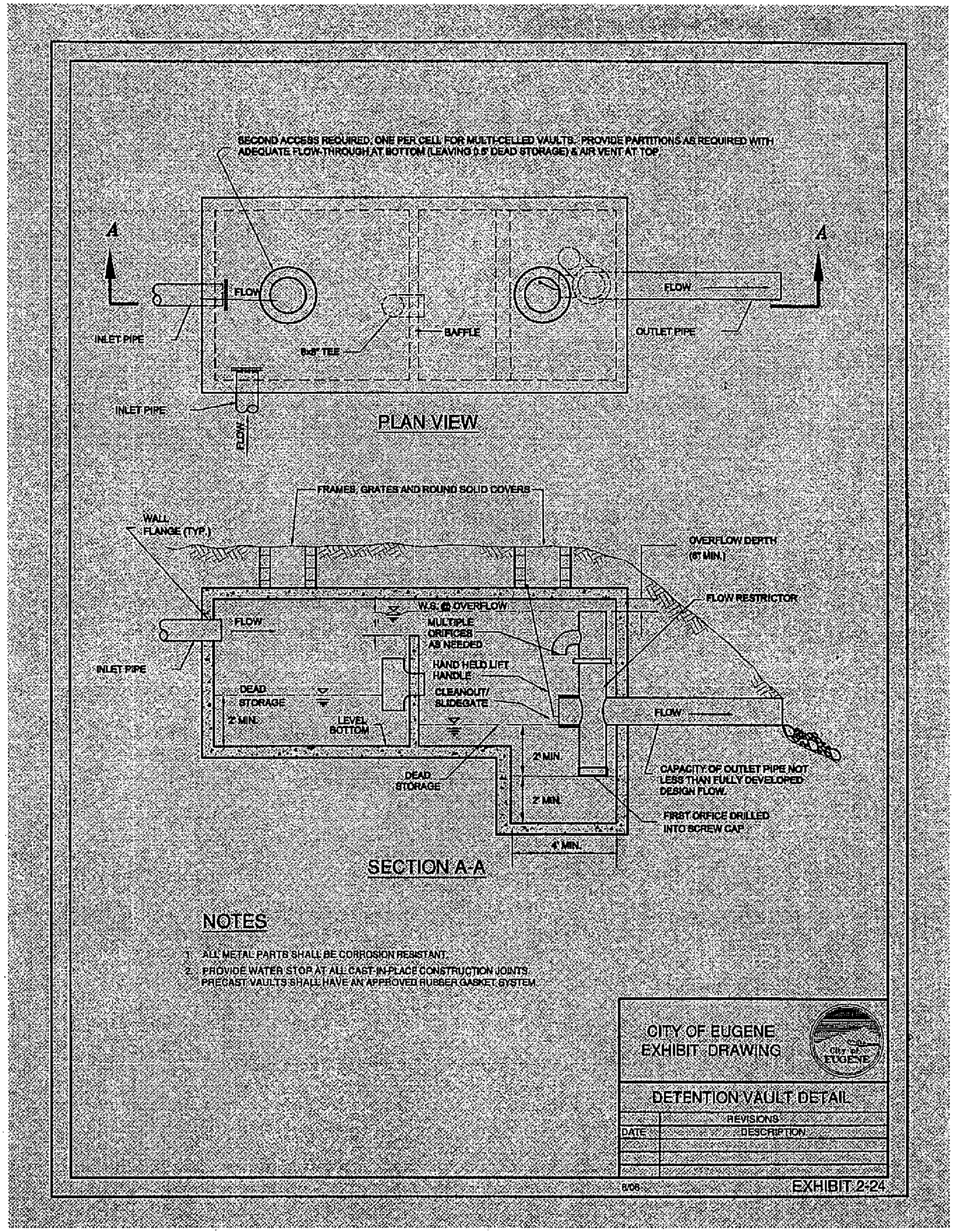
Note: See Eugene Standard Drawings, for city-maintained facilities.

Structural Detention Facility



Note: See Eugene Standard Drawings, for city-maintained facilities.

Structural Detention Facility



Note: See Eugene Standard Drawings, for city-maintained facilities

Structural Detention Facility

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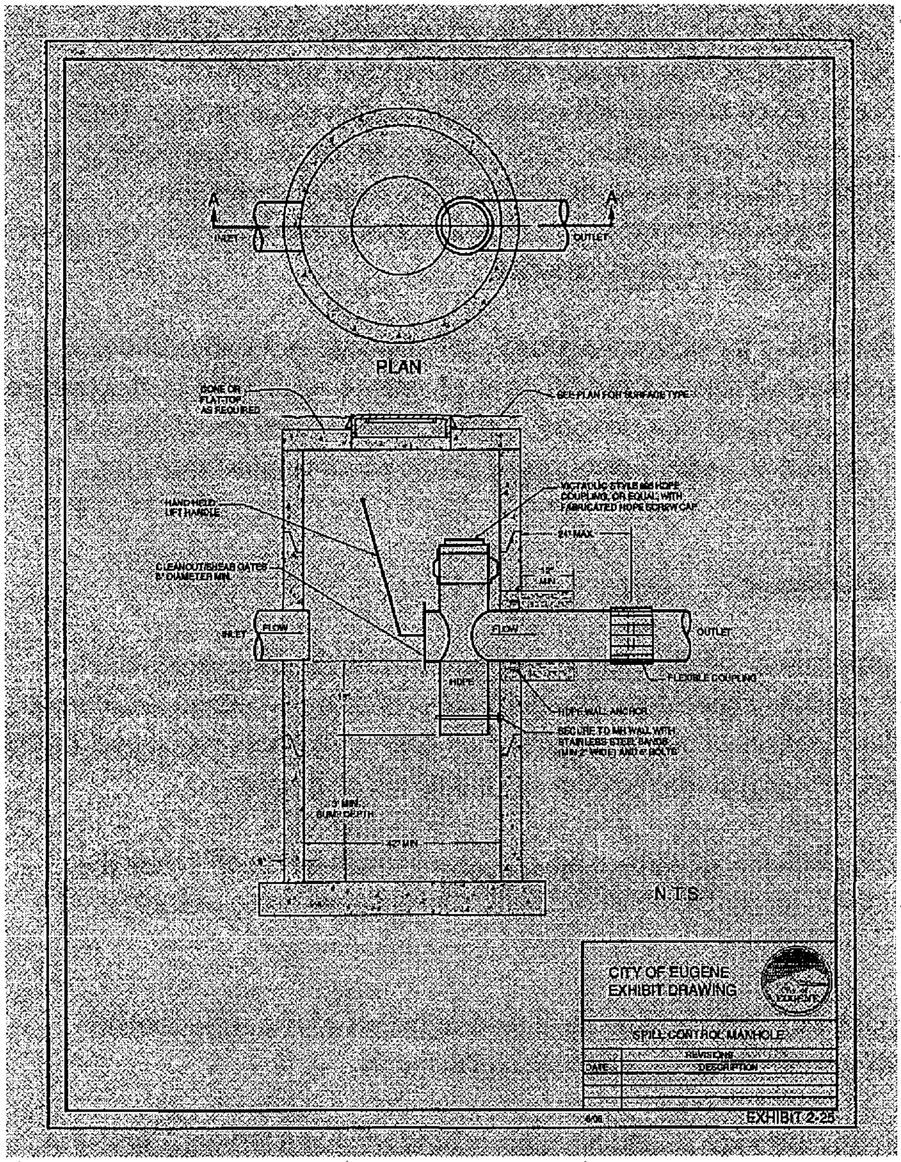
Spill Control Manhole



Note: See Eugene Standard Construction Drawing for City-maintained facilities.

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction[1] (Oil Only)................	PRES[1]
Flow Control......................................	NA
Destination.......................................	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Spill control manholes receive credit for oil removal only. They may be used to remove oil from parking lots and other vehicular access areas.

Spill Control Manhole

Description: Spill control manholes rely on passive mechanisms that take advantage of oil being lighter than water. Oil rises to the surface and can be periodically removed. They consist of a simple underground manhole with a "T" outlet designed to trap small spills. Spill control manholes will not be given credit for basic pollution reduction requirements. They must be used in conjunction with other pollution reduction systems from this chapter to meet oil control and pollution reduction requirements.

Other Options: There may be other acceptable oil controls not listed above. Applicants may propose an alternative oil control option under the performance approach. However, proposal of a new oil control will require an additional review process for approval, which may delay issuance of related building permits.

Design and Sizing Criteria:

- Spill control manholes shall be used in conjunction with an appropriately sized pollution reduction facility. The spill control sump volume shall be 60 cubic feet *or* 20 cubic feet of sump capacity for each cubic feet per second (cfs) of peak pollution reduction design flow, whichever is greater.

- To maintain efficiencies and reduce size, all roof drainage shall enter the stormwater system downstream of the spill control manhole, unless sized accordingly.

- Any pumping devices shall be installed downstream of the spill control manhole to prevent oil emulsification in stormwater.

- Engineered calculations are required, using the Rational Method (Q=C*I*A).

Stormwater Report Requirements For Presumptive Approach: See **Exhibit 2-2.**

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and location.
2) Profile view of facility, including typical cross-section details with dimensions. These details shall match manufacturer specifications and details.
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Spill Control Manhole

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Manhole excavation	
Piping	Call for inspection
Manhole installation	Cal for inspection

Operations and Maintenance requirements: See **Chapter 3.0**.

*** Link to Spill Control Manhole O&M form**

Spill Control Manhole

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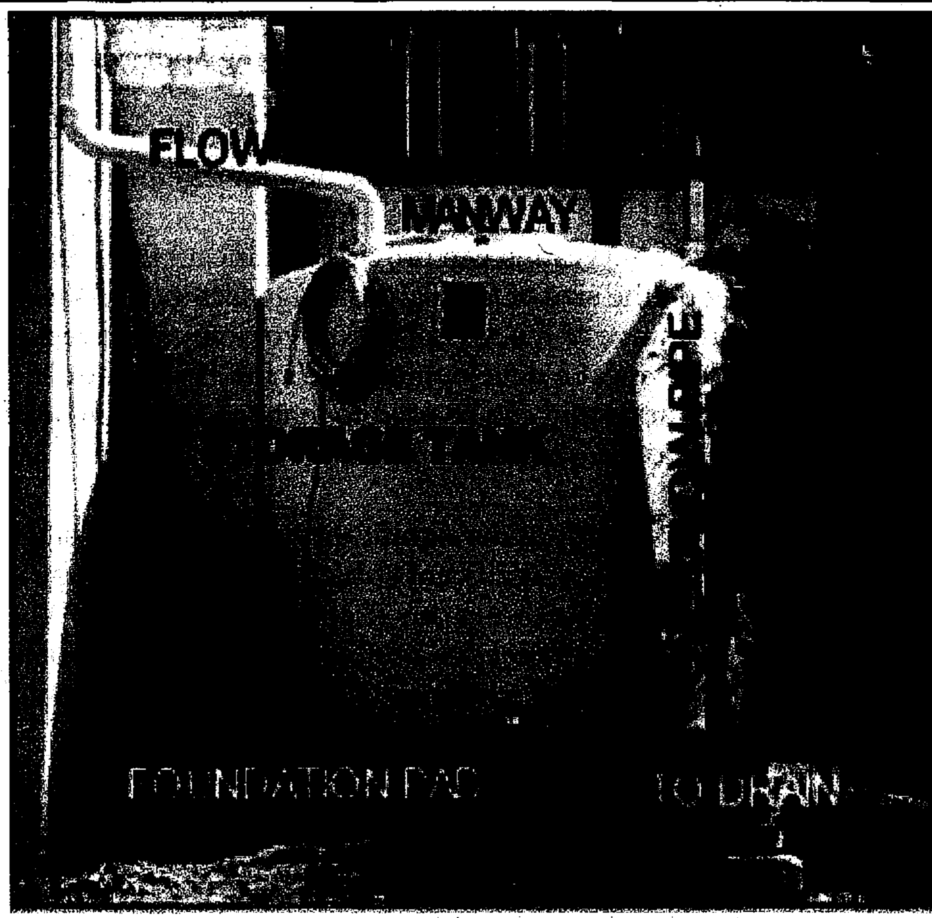
Rainwater Harvesting



Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
√ Pollution Reduction...............................	PERF[1]
√ Flow Control..	PERF[1]
Destination..	NA

This facility is **not** classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) The required water storage volume is a function of drainage area, rate of water usage, and stormwater management goal. Rainwater harvesting systems may be used to manage stormwater from rooftops and depending on the water use, other impervious surfaces, and must be located on private property.

Rainwater Harvesting

Description: Stormwater may be collected and reused for non-potable water uses within a house or building, or for landscape irrigation purposes. Uses can include reusing water in toilets and at hose bibs. Plumbing approval must be obtained with any such system.

Rainwater harvesting can provide several stormwater management benefits:

- Flow control: Rainwater harvesting can provide significant flow-reduction benefits. Depending on the size of the water storage facility and the rate of use, a significant percentage of the annual runoff volume can be reused. Where it isn't feasible to meet a development site's full flow control obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall flow control requirement.

- Pollution reduction: As a result of the significant reduction in off-site flow volume that can be achieved, a significant reduction in the discharge of pollutants associated with stormwater can also be accomplished. Where it isn't feasible to meet a development site's full pollution reduction obligation, rainwater harvesting can be used to manage a portion of the flow and lessen the overall pollution reduction requirement.

Checklist of minimal information to be shown on the permit drawings, or included with the permit submittal package:

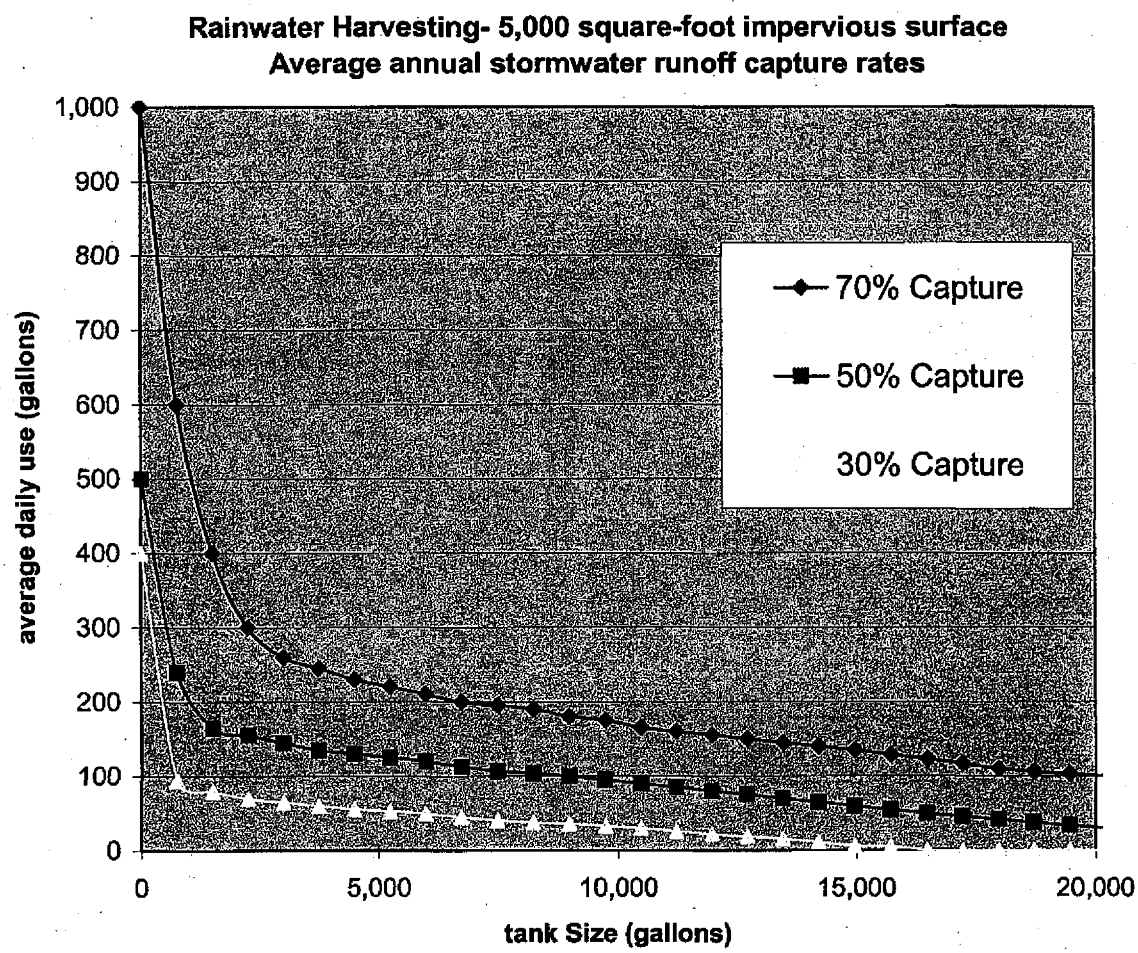
1) Water storage facility details and specifications
2) Pump and associated electrical details and specifications
3) Piping size, material, and placement details and specifications
4) Average daily water use documentation
5) Hydraulic calculations demonstrating compliance with stormwater management requirements (pollution and flow control)
6) Approximate setbacks from property lines and structures shall be shown
7) Overflow connection to approved stormwater destination per **Section 1.4**

Operations and Maintenance requirements: See **Chapter 3.0**.

The following chart represents an analysis done on a 5,000 square-foot project site with 100% impervious surface. 8.5 months of 5-minute rainfall intensity data from the Fernwood rain gage in Portland was used in the analysis, which shows the relationship between water storage volume and average daily water use rate for average annual runoff capture goals of 30%, 50%, and 70%.

For example, if the stormwater management goal is 50% reduction of the annual release volume, the pink line is used to show that if a 2,000-gallon tank were used, the average daily use would need to be approximately 160 gallons per day. A larger tank would necessitate a smaller average daily use rate to achieve the same stormwater management goal of 50% annual volume reduction.

Exhibit 2-26:



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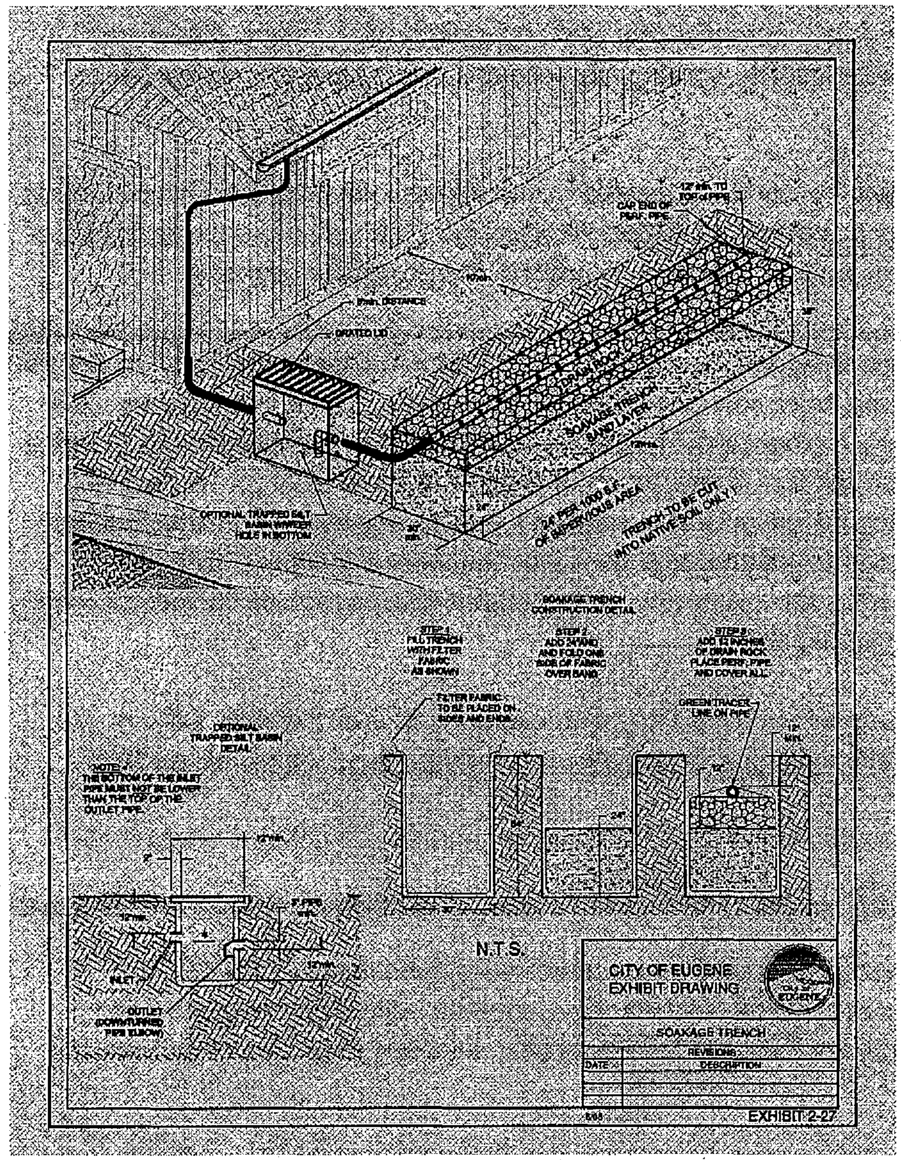
Soakage Trench



Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
Pollution Reduction....................................	NA[1]
√ Flow Control..	PRES
√ Destination..	PRES

This facility is classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Soakage trenches can be used to manage stormwater runoff, and with a sufficient layer of sand or soil for filtration, may be used to meet pollution reduction requirements.

Soakage Trench

A soakage or "infiltration" trench is a shallow trench in permeable soil that is backfilled with sand and coarse stone and lined with filter fabric. The trench surface may be covered with grating, stone, sand, or a grassed cover with a surface inlet.

Soakage trenches can be used to provide a stormwater destination by collecting and recharging stormwater runoff into the ground. The use of soakage trenches is highly dependent on soil type and height of the groundwater table.

Note: DEQ has identified soakage trenches as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be classified as exempt, authorized by rule, or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, pollution reduction is required before disposing stormwater into them, with the exception of soakage trenches that serve rooftops only. All soakage trenches, with the exception of those that drain residential rooftops only, must be registered with DEQ.

More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**

For technical questions call DEQ- UIC Program at 503-229-5945. For copies of applications or forms, call 1-800-452-4011.

Soakage trenches are recognized as a stormwater destination, and with a sufficient layer of sand or soil for filtration, may be used to meet pollution reduction requirements. **Exhibit 2-28** provides detailed drawing of a standard soakage trench.

Soakage Trench Design and Sizing Method

Soil conditions are critical to the success of soakage trenches. Because of this, the use of soakage trenches must be pre-approved by the City. Supporting geotechnical evidence and a documented infiltration test may be required to demonstrate that soakage trenches will work in the project area. Soakage trenches shall be sized in accordance with **Exhibit 2-28**, once City approval has been given for on-site infiltration.

Soakage Trench

General Requirements:

Maximum area to be served:	15,000 square-feet per trench
Soils requirements: (NRCS classification)	A or B; C soils may be used if drawdown times are met
Maximum ground slopes	20 percent
Soil test requirement	ASTM D 3385-88 or City approval

1) If designed as the only stormwater destination, the soakage trench shall infiltrate the entire flood control design storm without overflow.

2) Soakage trenches shall not be accepted in soils with a tested infiltration rate of less than 0.5 inches per hour.

3) There shall be no less than 4 feet of undisturbed depth of infiltration medium between the bottom of the facility and any impervious layer (hardpan, solid rock, etc.) or seasonal high groundwater levels.

4) Drawdown time when full shall not exceed 10 hours.

5) Soakage trenches shall meet the following setback requirements for downstream slopes: minimum of 100 feet from slopes of 20%; add 5 feet of setback for each additional percent of slope up to 30%; infiltration trenches shall not be used within 200 feet of where slopes exceed 30%.

6) The bottom of the soakage trench shall be flat, or clay check-dams may be used to prevent water from collecting near the downstream end.

7) Drain medium shall have filter fabric between the medium and native soils or backfill.

8) Soakage trench areas shall be clearly marked before site work begins to avoid soil disturbance during construction. No vehicular construction traffic, except that specifically used to construct the facility, shall be allowed within 10 feet of soakage trench areas.

9) A soil scientist, or suitably trained person working under the supervision of an Oregon licensed professional engineer, shall inspect the soil after the system is excavated, before trenches are filled with drain medium, to confirm that soils remain in suitable condition to perform at anticipated infiltration rates.

10) Soakage trenches should be located down slope of structures, and are required to be setback at least 10 feet from structures, 5 feet from property lines, and 5 feet from public utility lines.

Checklist of minimal information to be shown on the permit drawings:

1) Facility dimensions and setbacks from property lines and structures
2) Profile view of facility, including typical cross-sections with dimensions
3) Drain rock specification
4) Sand specification
5) Filter fabric specification
6) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection

Inspection Requirements and Schedule:

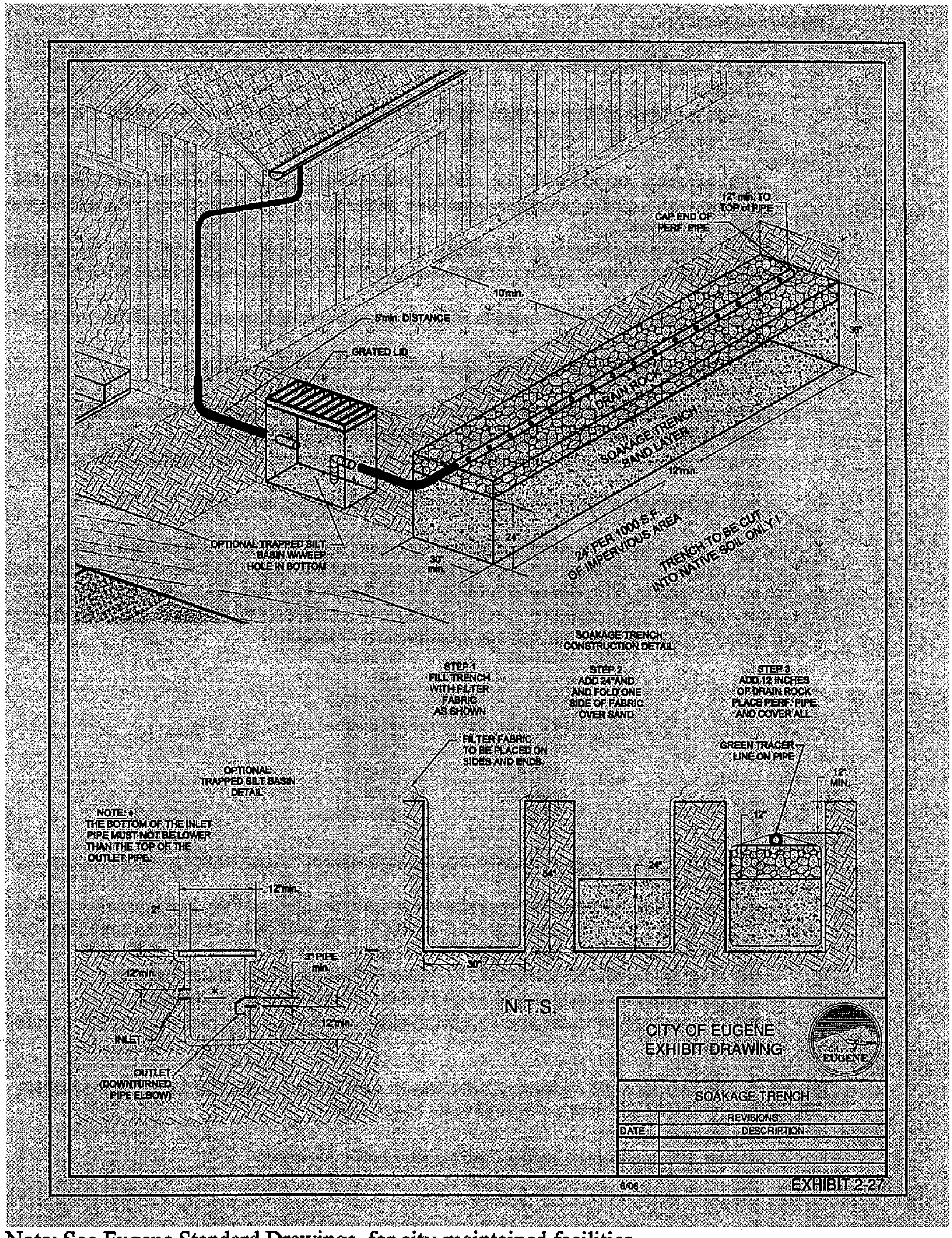
The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Trench grading	
Piping	Call for inspection
Filter fabric	
Sand layer	
Drain rock	

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to soakage trench O&M form**

Soakage Trench



Note: See Eugene Standard Drawings, for city-maintained facilities.

Soakage Trench

Soakage Trench Sizing

- Hydraulic calculations shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's *Public Improvement Design Standards Manual.*
- Soakage trenches shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for a soakage trench design shall be 5 minutes.

Trench

- Soakage trench and perforated pipe must be installed level and parallel to contour of finish grade.
- Soakage trench shall be located no closer than 10 feet to any building structure and not closer than 5 feet from property line.
- Unless a separate pollution reduction facility is used upstream of the trench, the sand filter portion of soakage trench must be filled with a minimum of 24" medium sand meeting OAR 340-71-295 (3)(e).
- Minimum 12" of ¾" – 2 ½" round or crushed rock to cover sand separated by one layer of filter fabric.
- The pipe shall be laid on top of this gravel and covered with filter fabric.
- At least 12" minimum of backfill shall be placed over the trench.
- All trenches shall be constructed on native soil and shall not be subject to vehicular traffic or construction work that will compact the soil, thus reducing permeability.
- Slope shall not exceed 20% without a stamped and signed geotechnical report addressing slope stability.
- Trench shall not be constructed under current or future impervious surface.

Sand

Medium sand meeting OAR 340-71-295 (3)(e) will be required. Sieve analysis of the medium sand is required to be made by a qualified party and a report provided to City of Portland plumbing inspector at the time of inspection. Analysis to comply with ASTM C136, Standard Methods for Sieve Analysis of Fine and Coarse Aggregate and in conjunction and accordance with ASTM C-117, Standard Test Method for Materials Finer than No.200 Sieve in Mineral Aggregates by Washing.

Sieve #	% Passing
3/8	100%
#4	95-100%
#8	80-100%
#16	45-85%
#30	15-60%
#50	3-15%
#100	4% or less

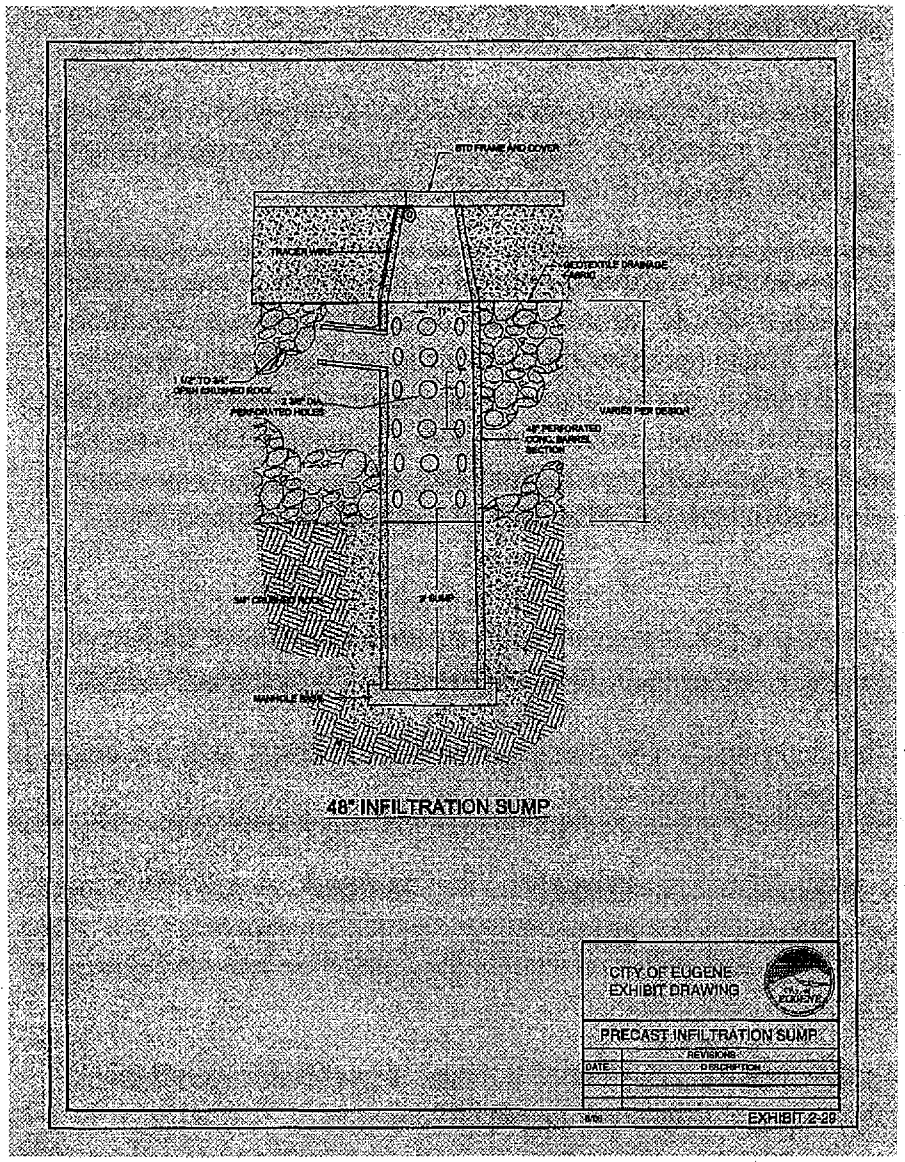
Pipe

- The solid pipe from building or other source to connection with perforated pipe must be installed at a ¼" per foot slope.
- All piping within 10 feet of building must be sch. 40 ABS, sch. 40 PVC, cast iron, sch. 40 ABS, 3" sch. 40 PVC or 3" cast iron pipe may be used for rain drain piping serving not more than 1500 sf of roof or surface area. Use 4" pipe if area is greater than 1500 sf.
- Pipe must have a minimum cover of 12" measured from top of pipe to finished grade.
- The pipe within the trench shall either be PVC D2729 or HDPE Leach field pipe.
- The silt trap shall be installed between the dwelling and the sand filter, a minimum of 5' from the dwelling.

Filter Fabric must be one of the following types/brands: LINQ 125EX; LINQ TYPAR3201; TNS E040; TNS R035; TNS R040; TNS R042; AMOCO 4535; Marafi 140NL.

- At least 12" minimum of backfill shall be placed over this trench.

Infiltration Sump System



Note: See Eugene Standard Drawings, for city-maintained facilities.

Stormwater Management Goals Achieved	Acceptable Sizing Methodologies
Pollution Reduction..............................	NA
√ Flow Control......................................	PRES
√ Destination..	PRES

This facility is classified as an Underground Injection Control structure (UIC).

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Infiltration sump systems are used to manage stormwater from street surfaces.

Infiltration Sump System

INFILTRATION SUMP SYSTEMS

Infiltration sump systems can be used to provide street drainage by collecting and recharging stormwater runoff into the ground. The use of sumps is highly dependent on soil type and height of the groundwater table.

> **Note:** The Oregon Department of Environmental Quality (DEQ) has identified sumps as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be either authorized by rule or authorized by permit by DEQ. In the case of public infiltration sumps, Eugene administers the rule authorization process with DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, site controls and pollution reduction facilities are required prior to disposing stormwater into them.
>
> More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**
>
> For technical questions call DEQ- UIC Program at 503-229-5945, and for copies of applications or forms call 1-800-452-4011.

Sumps are recognized as a destination method for managing stormwater runoff, but are not intended to be used to meet pollution reduction requirements. Sump systems are excluded from use within the following specific areas and land-use types within the City:

- Neighborhood collectors in commercially zoned areas (Refer to *Arterial & Collector Street Plan, City of Eugene, November 1999*)
- Within 500 feet of municipal or domestic drinking water wells, or a two-year time of travel zone, whichever is greater
- In areas with permanent or seasonally-shallow groundwater (< 10 feet below the ground surface)

A "sump system" (see **Exhibit 2-28**) is the total of all sump components at a single location (e.g., an intersection) and consists of inlets, piping, a sedimentation manhole, and one or more sumps. If one sump lacks adequate capacity to handle the design flow, a second sump may be placed in series with the first to provide additional capacity.

Infiltration Sump System

Sedimentation manholes with oil traps receive runoff from inlets before stormwater enters the sumps. The sedimentation manholes settle out most of the large particulate material that can clog sumps' drainage holes, decreasing maintenance needs and increasing long-term effectiveness.

Detailed drawings of a standard sump and standard sedimentation manhole can be found as **Exhibits 2-29** and **2-30** of this manual.

When constructed according to the standard design procedures, the sump system achieves both flow control and destination benefits. A sedimentation manhole reduces pollution through removal of sediment, oils, and grease. Additional pollution reduction facilities, such as street swales, planters or filters, must be used in non-residential streets, or streets with over 1,000 average daily trips.

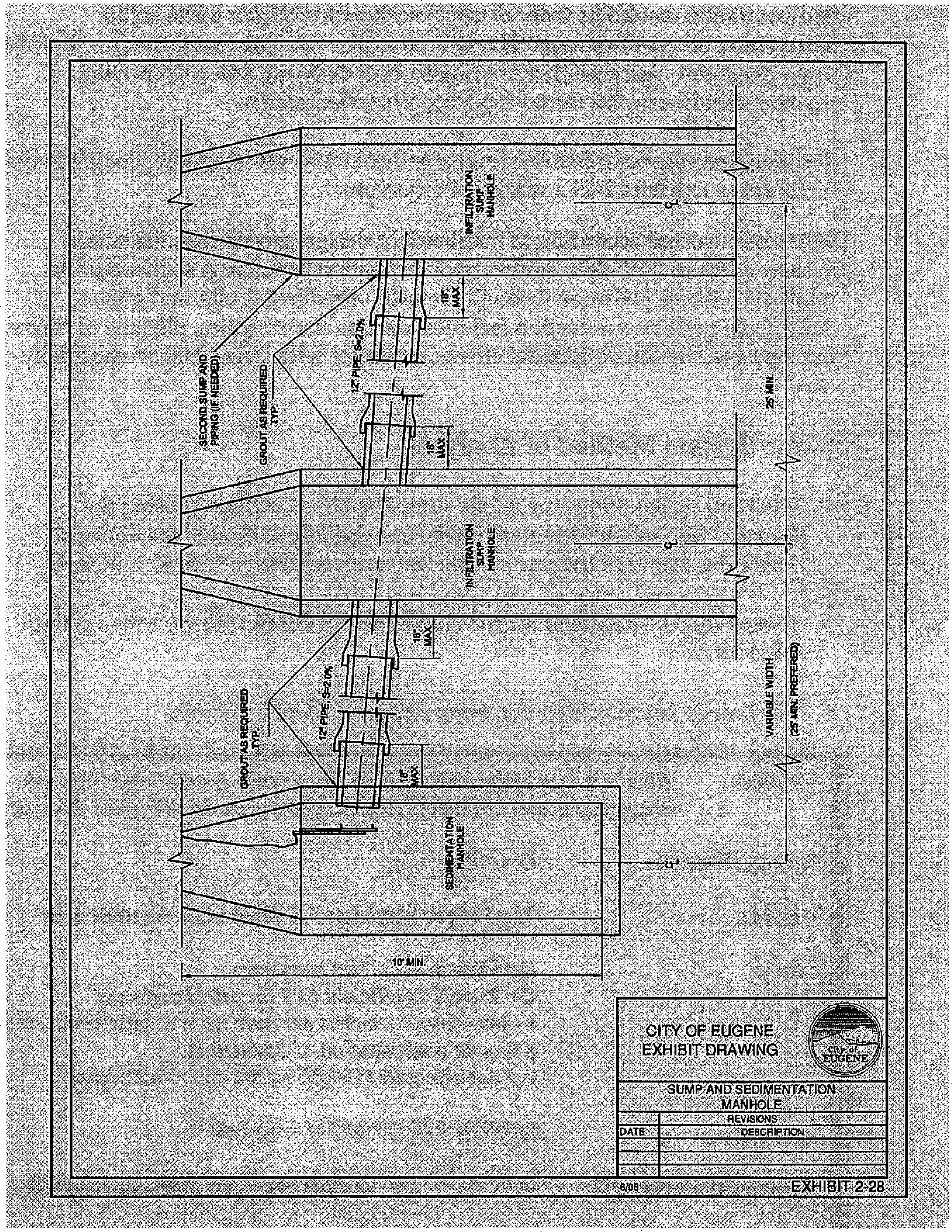
Sump System Method of Analysis

- Hydraulic calculations for public sumps shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's *Public Improvement Design Standards Manual.*
- Sumps shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for sump design shall be 5 minutes.

Example: What is the design percolation rate that a sump system must achieve to adequately dispose of runoff from 10,000 square-feet of paved street area?

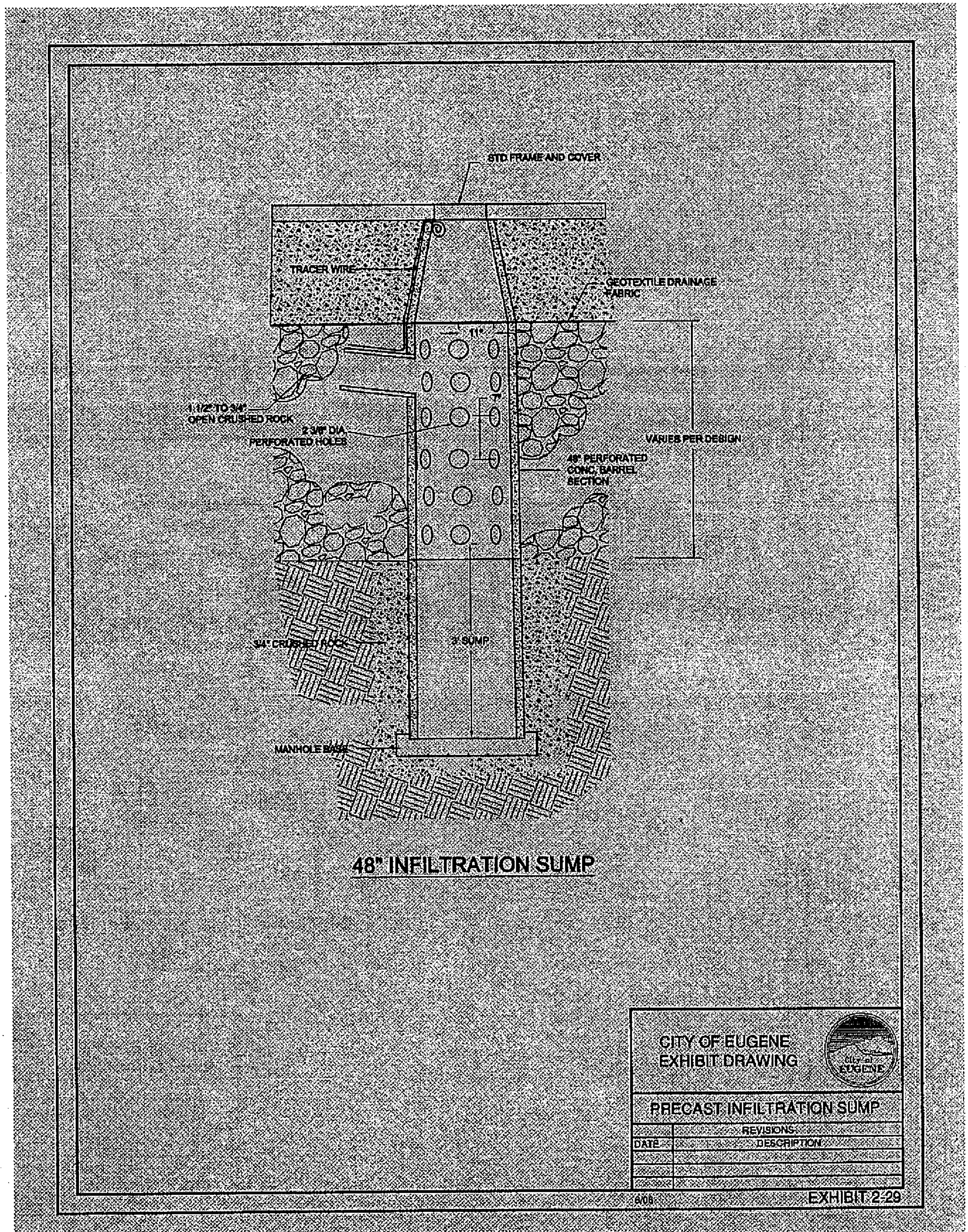
Rational Formula:	Q=C*I*A
Assume:	Time of concentration = 5 minutes for the street area
Where:	Q= Flow in cubic feet per second C= Runoff Coefficient (0.9 for paved surfaces) I= Intensity (3.1 inches per hour for a 10-year storm event and a time of concentration of 5 minutes) A= Area in acres (10,000 square-feet = 0.23 acres)
	Q= (0.9) * (3.1) * (0.23) = 0.64 cfs
Apply safety factor of 2:	Q= 2 * 0.64 cfs = **<u>1.28 cfs or 574.5 gallons per minute</u>**

Infiltration Sump System



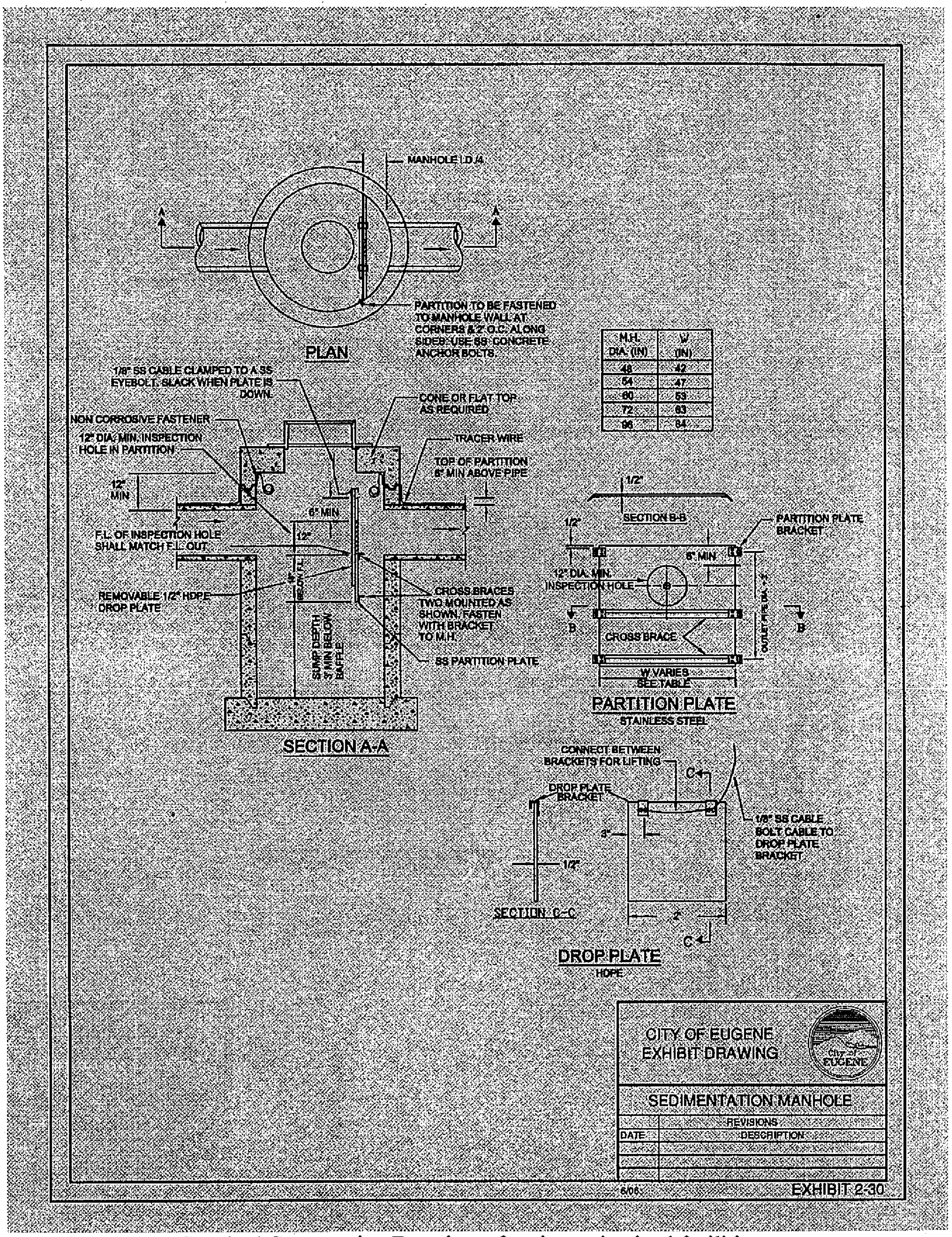
Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System



Note: See Eugene Standard Construction Drawings, for city-maintained facilities.

Infiltration Sump System

Sump System Design Requirements

- Sump systems shall be designed to handle **twice** the flow from the calculated design storm.
- A maximum of two sumps shall be used in series, unless approved by PW.
- The minimum distance between sumps shall be 25 feet.
- The desired distance between the sump and sedimentation manhole is 25 feet. This figure is a guideline and depends on site conditions.
- Sumps shall not be located within 200 feet from the tops of slopes more than 10 feet high and steeper than 2h: 1v.
- The diameter of pipe between the sump and sedimentation manhole shall be 12 inches.
- For Public Sump Systems, see Eugene's *Public Improvement Design Standards Manual* for acceptable pipe material types between the sump and sedimentation manhole.
- Sumps shall not be located in areas with a constant or seasonally high groundwater table, or shallow bedrock. The bottom of the sump shall be at least 10 feet above the seasonal high water table, and at least 3 feet above bedrock.

SUMP TESTING

Soil conditions are critical to the success of sump systems. The use of sumps will not be approved without supporting geotechnical evidence and a documented sump test to demonstrate they will work in that particular area. The geotechnical evidence shall include test sump data to provide information about local underground soil conditions and the potential infiltration capacity of the surrounding soil. Before being accepted by the City, all public sumps shall be tested after construction to ensure they meet or exceed the design capacity. The following sump testing procedure shall be used and must be shown on the construction plans of all public works sump projects:

Infiltration Sump System

SUMP NOTES
Design flows reflect a factor of safety of 2.
All sumps shall be tested by the contractor as directed and approved by the city inspector.
Sump testing shall take place after sump construction is complete and before the construction of the sedimentation manhole. Should a sump test fail to verify adequate capacity, an additional sump, constructed in series with the first sump (a maximum of two sumps per system) shall be required, as approved by PW. Should a test of two sumps in series fail to verify adequate capacity, an alternative public stormwater destination shall be required, as approved by PW.
Notify City inspector, at (541) 682-5560, at least 48 hours before beginning sump testing. A PW representative must be present during all sump capacity tests.
Contractor shall contact the EWEB, to arrange for sump test water supply. Contractor shall be responsible for obtaining necessary permits, authorization, and any fees.
Provide water flow from fire hydrants to sump being tested using 8-inch nominal diameter pipe. Deliver clean potable water to sump. Introduction of sediment is not acceptable and may result in failure of sump capacity test and reconstruction of sump.
Fill sump with water at an initial rate of 300 gallons per minute (gpm) and record water elevation below sump manhole lid, every five minutes. When water surface reaches a constant elevation, increase flow rate to sump to 600 gpm. Record water surface elevations every five minutes. Continue to increase flow rate 300 gpm each time water surface elevation stabilizes, until maximum capacity is reached.
Immediately upon completion of the sump test, provide City inspector with recorded test data. Contractor shall sign the results and submit to the City inspector.
The closest fire hydrant for sump testing is located at the intersection of ____________ & ___________. Contact EWEB to apply for a hydrant use permit.

Infiltration Sump System

Checklist of minimal information to be shown on the permit drawings:

1) Sump and sedimentation manhole location with setbacks to curb, right-of-way lines, and other existing and proposed utilities.
2) Rim and bottom elevation.
3) The sump and sedimentation manhole shall reference the City standard plan numbers.
4) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Operations and Maintenance requirements: Turbid runoff from construction sites shall not be allowed to enter the system at any time. One year after construction is completed and prior to Final Acceptance, the contractor shall verify the design capacity of the sump using the above sump testing procedures. For Public Sump Systems, the sedimentation manhole shall be cleaned prior to City acceptance of ownership and maintenance.

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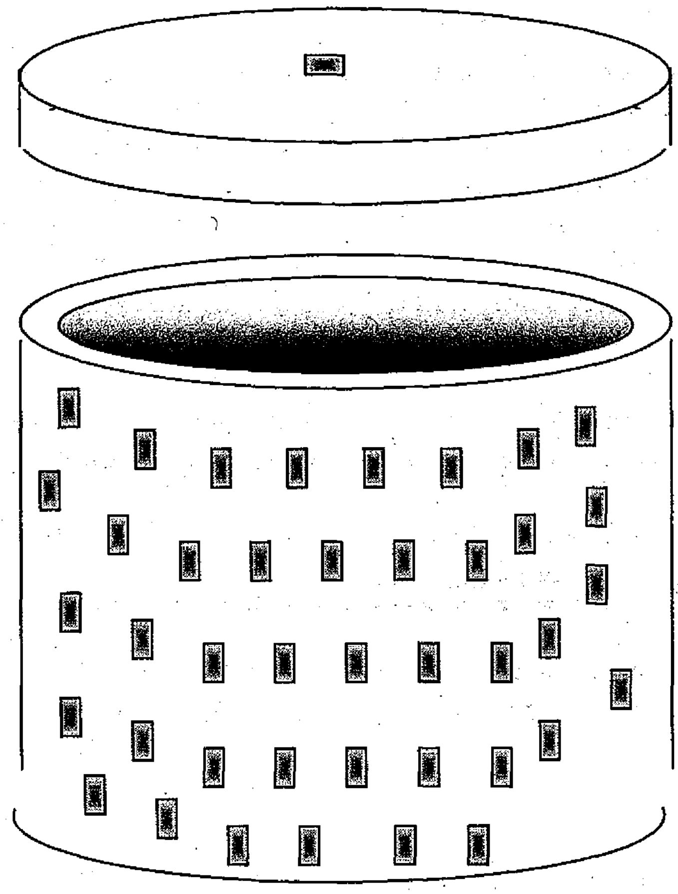
Drywell



Stormwater Management Goals Achieved	**Acceptable Sizing Methodologies**
Pollution Reduction..................................	NA
√ Flow Control....................................	PRES
√ Destination..	PRES

This facility is classified as an Underground Injection Control structure (UIC). .

SIM=Simplified Approach, PRES= Presumptive Approach, PERF= Performance Approach

Notes: 1) Drywells can be used to manage stormwater runoff.

Drywell

Description: Drywells can be used as a stormwater destination by collecting and recharging stormwater runoff into the ground. The use of drywells is highly dependent on soil type and height of the groundwater table.

Note: DEQ identifies drywells as "Class V Injection Wells" under the federal Underground Injection Control (UIC) Program. These facilities must be classified as exempt, authorized by rule, or authorized by permit by DEQ. Since the UIC Program states that these types of wells can have a direct impact on groundwater, pollution reduction is required before disposing stormwater into them, with the exception of drywells that serve rooftops only. All drywells, with the exception of those that drain residential rooftops only, must be registered with DEQ prior to City permit issuance.

More information about the UIC Program can be found in **Section 1.4.4** or at DEQ's website at: **Http://www.deq.state.or.us/wq/groundwa/uichome.htm**

For technical questions call the DEQ UIC Program at 503-229-5945. For copies of applications or forms call 1-800-452-4011.

Drywells are recognized as a stormwater destination, but they are not intended to be used to meet pollution reduction requirements. Unless a drywell used exclusively for roof runoff, pollution reduction facilities must be used to receive runoff before it enters the drywell.

Drywell systems are prohibited where permanent or seasonally shallow groundwater will exist within 10 feet of the bottom of the drywell.

Drywell Design and Sizing Method

Soil conditions are critical to the success of drywells. Because of this, the use of drywells must be pre-approved by the City. Supporting geotechnical evidence and a documented drywell test may be required to demonstrate that drywells will work in the project area. Drywells shall not be located in areas with a constant or seasonally high groundwater table.

Note: Developers should refer to OAR 340, Division 44, "Construction and Use of Waste Disposal Wells or Other Underground Injection Activities" for additional design and regulatory requirements.

Drywell

Drywell Sizing:

- Hydraulic calculations shall be performed using the Rational Method. Information on the use and application of the Rational Method is found in Eugene's Public Improvement Design Standards Manual.
- Drywells shall be designed for the Flood Control Design Storm, with a safety factor of 2.
- The time of concentration for a Drywell design shall be 5 minutes.

General Requirements:

Soils requirements: (NRCS classification)	A or B; C soils may be used if drawdown times are met
Maximum ground slopes	20 percent
Soil test requirement	ASTM D 3385-88 or City approval

1) If designed as the only stormwater destination, the drywell shall infiltrate the entire flood control design storm without overflow.

2) Drywells shall not be accepted in soils with a tested infiltration rate of less than 0.5 inches per hour.

3) There shall be no less than 4 feet of undisturbed depth of infiltration medium between the bottom of the facility and any impervious layer (hardpan, solid rock, etc.) or seasonal high groundwater levels.

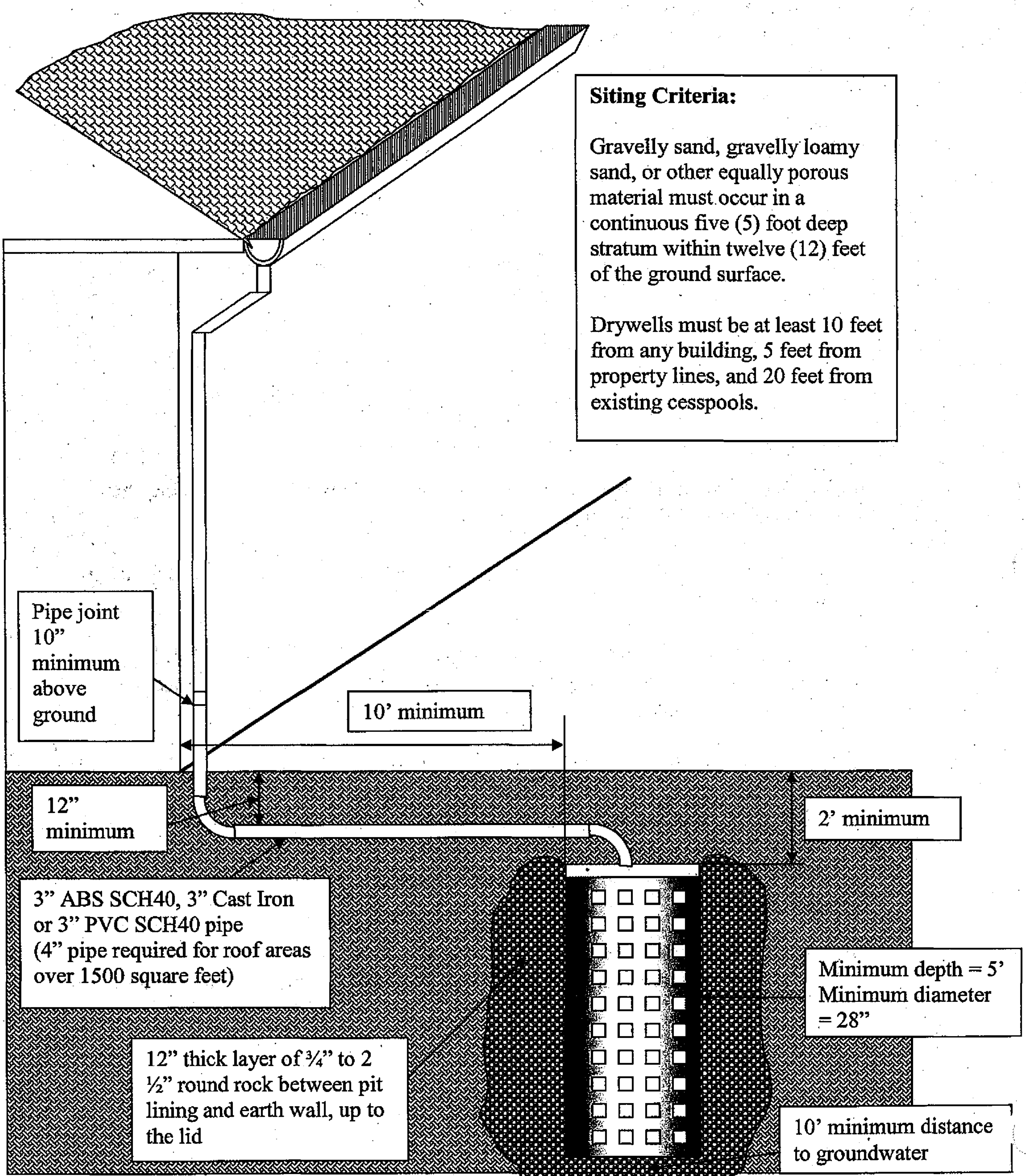
4) Drawdown time when full shall not exceed 10 hours.

5) Drywells shall meet the following setback requirements for downstream slopes: minimum of 100 feet from slopes of 20%; add 5 feet of setback for each additional percent of slope up to 30%; drywells shall not be used within 200 feet of where slopes exceed 30%.

6) Drywells should be located down slope of structures, and are required to be setback at least 10 feet from structures, 5 feet from property lines, and 5 feet from public utility lines.

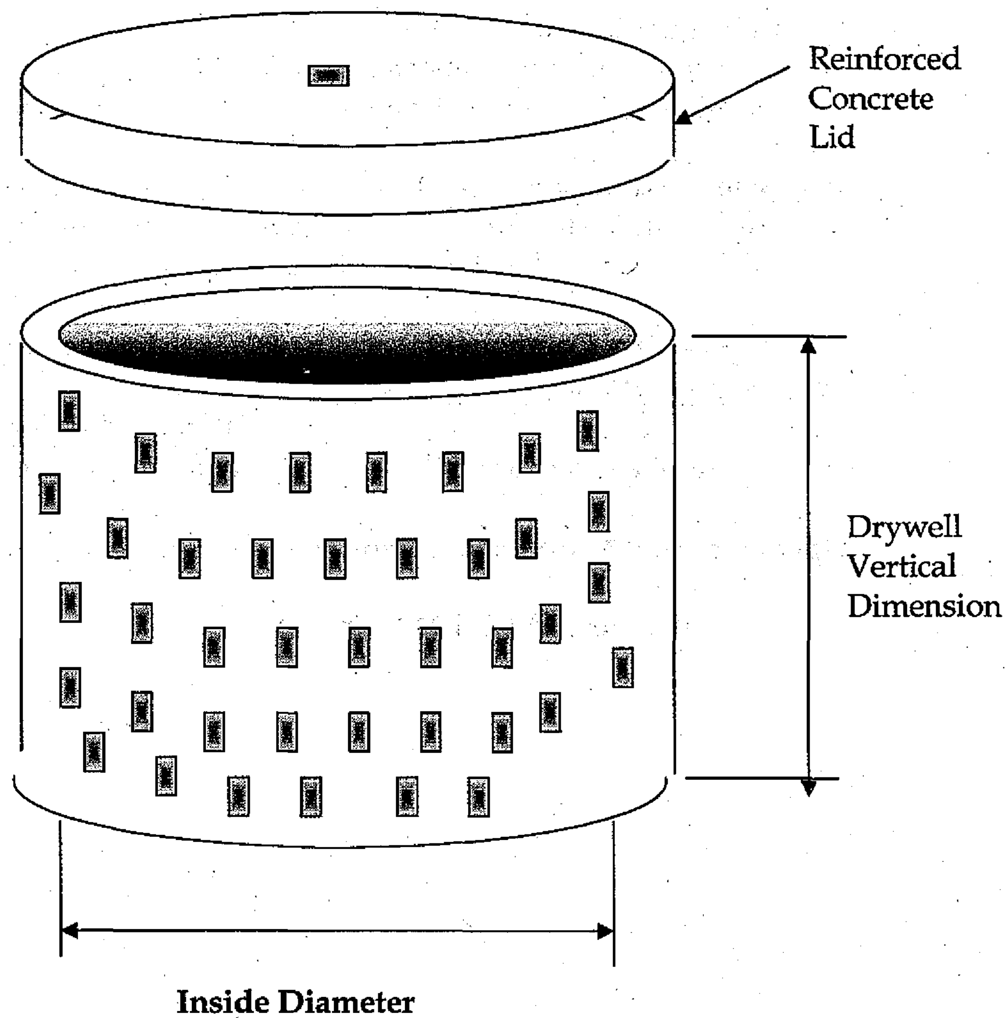
Drywell

Exhibit 2-31: Reinforced Concrete Drywell Typical Configuration



Drywell

Exhibit 2-32: Typical Drywell:



Drywell

Checklist of minimal information to be shown on the permit drawings:

1) Facility location with setbacks from property lines and structures.
2) Depth and diameter of drywell.
3) All stormwater piping associated with the facility, including pipe materials, sizes, slopes, and invert elevations at every bend or connection.

Inspection requirements and schedule: The following table shall be used to determine which stormwater facility components require City inspection, and when the inspection shall be requested:

Facility Component	Inspection Requirement
Drywell excavation	
Piping	Call for inspection
Drywell installation & backfill	Cal for inspection

Operations and Maintenance requirements: See **Chapter 3.0.**

*** Link to drywell O&M form**

Chapter 3.0
OPERATIONS & MAINTENANCE

Summary of Chapter 3.0

This chapter presents operation and maintenance (O&M) requirements for the stormwater management facilities in this manual. It includes:

To Use This Chapter:

1) After using **Chapters 1.0** and **2.0** to complete a stormwater management design for the project, fill out **Form O&M.**
2) Form O&M includes a blank section to insert a **site plan**, or attach a separate site plan sheet showing the location of the stormwater management facilities on the site, sources of stormwater runoff, and ultimate stormwater destination.
3) For **private** facilities: Record a copy of **Form O&M** and the **site plan** with the applicable county Department of Assessment and Taxation.
4) Submit a recorded copy of these sheets, along with the **facility-specific O&M plan** for each stormwater management facility used on-site, with the permit application. The O&M activities listed on the facility-specific O&M forms, which will be on file with PW, may later be revised with PW approval.
5) For **public** facilities: Submit a copy of an O&M plan with the public works permit application. County recording of this plan is not necessary.

Note: Enforcement rules regarding the inspection, operations, and maintenance of stormwater management facilities can be found in the *PW Enforcement Administrative Rules,* not included in this manual. Contact PW at 541-682-4800 for a copy of this document.

3.1 INTRODUCTION O & M

This chapter provides a **facility-specific O&M plan** that identifies the O&M requirements for each type of facility included in this manual. If a stormwater facility that is not included in this manual is used (such as a manufactured stormwater treatment technology) an O&M plan prepared by the proprietor, and facility-specific O&M activities that comply with the requirements of this chapter must still be submitted.

- The operations and maintenance (O& M) strategies in this chapter apply to all stormwater management facilities and related facility components identified in **Chapter 2.0**.

3.2 O&M APPLICATION SUBMITTALS

3.2.1 Privately Maintained Facilities

Form O&M: Operations & Maintenance Plan. The completed form must identify the owner's name, address, and phone number, the site address, financial method used to cover future operation and maintenance, and parties responsible for inspecting and maintaining the facility. It also provides a space to insert a site plan to identify the location of the facility on the site, sources of runoff entering the facility, and ultimate stormwater destination. This form must be included with every private stormwater management facility permit application, and must be recorded with the applicable county before permit issuance.

Facility-specific O&M plans (see page 3-14 through 3-41) The plans identify the specific O&M activities that are required for each type of stormwater management facility. The appropriate plans must be attached to **Form O&M** and submitted as part of the stormwater management facility permit application. The facility-specific O&M plans do not have to be recorded with the county. This allows the future stormwater management facility owner to submit O&M activity revisions, to the City, without the need to re-record the O&M plan with the county.

The facility-specific O&M activities for private facilities may be modified any time after permit issuance. Modifying the O & M activities is optional, and is intended to give the owner an opportunity to adjust maintenance needs according to site-specific history and conditions. Proposed modifications to the O&M plan must be submitted to the City for review and approval.

City Code requires an **Inspection and Maintenance Log** to be kept by facility owners. In general, the log should note all inspection dates, the facility components that were inspected, and any maintenance or repairs made. The facility-specific O&M plans can serve as a checklist for what should be included in the log (e.g. the facility elements that need to be inspected, frequency of inspection, conditions that indicate maintenance is needed, etc.). See page 3-13 for an **inspection and maintenance log sample.**

3.2.2 City-Maintained Facilities

A stormwater management facility that receives stormwater runoff from a public right-of-way shall become a public (City-maintained) facility. Facilities that will become City-maintained shall be constructed in compliance with City Code and the City's Public Improvement Design Standards Manual and shall be constructed under an "Engineering and Construction Agreement". See Section IV of the City's Public

Improvement Design Standards Manual (www.ci.eugene.or.us/pw/engineering/pidsm) for further information.

For facilities built under a privately engineered public improvement (PEPI) permit, a preliminary O&M plan shall be submitted as part of the applicant's public works permit application package. **Form O&M** and **facility-specific O&M plans** may be used to serve as the O&M plan. In addition, the applicant shall demonstrate on the construction plans that the City can achieve the specified O&M activities. Construction of maintenance access roads shall be part of the construction plans and the dedication of public access easements must be affirmed before the construction permit is issued.

Contractors building facilities under a PEPI permit are responsible for maintaining all site stormwater management features, including their associated vegetative components, during a 2-year maintenance warranty period. The contractor shall demonstrate vegetation cover planted, after the initial planting, has one full growth establishment season during the maintenance warranty period or the maintenance warranty period will be extended for one year.

At the end of this period a modified O&M plan for all site features, based on experience with the site over the 2 years, shall be filed with the City. Final facility sign-off will not be given until the modified O&M plan has been submitted.

Contractors working directly for the City shall follow the specifications in their contracts.

3.3 O&M PLAN ENFORCEMENT

Stormwater management facilities, constructed to comply with the requirements of this manual, must be properly operated and maintained for the life of the facility. The facility owner is responsible for all aspects of facility maintenance unless specified otherwise in an Operations and Maintenance Agreement (O&M Agreement) that is approved by the City, signed by all affected parties, and recorded against all affected properties.

City staff has the right and responsibility to inspect private facilities to assure they are being properly operated and maintained. It is the intent of the City to use education and technical assistance to ensure the proper O&M of private facilities. Administrative rules and procedures regarding City inspection and enforcement activities for assurance of proper O&M are not included in this manual

FORM O&M: OPERATIONS & MAINTENANCE PLAN

INSTRUCTIONS

The following are instructions to prepare and file Form O&M: Operations & Maintenance Plan for a stormwater management facility.

Failure to properly operate or maintain the water quality or quantity control facility according to the operation and maintenance plan may result in a civil penalty.

A copy of the operation and maintenance plan shall be filed with the Eugene Public Works. Completed O&M Plans shall be submitted to:

Public Works Parks & Open Spaces

1820 Roosevelt

Eugene, OR 974

The operation and maintenance plan shall be recorded and filed with the Lane County Department of Assessment and Taxation. Form O&M with a site plan must be recorded. Additional plans of the facility and facility-specific O&M activities will be retained at Public Works Engineering, 858 Pearl Street, Eugene, OR 97401.

Before recording the O&M plan, the applicant shall sign the form, and the signature shall be notarized. When completed accurately, this form meets the recording requirements in Lane County. The notarized O&M plan may be submitted in person or mailed, along with payment of the applicable fees, to the County Recorder's Office, Lane County Assessment and Taxation, Deeds and Records, 125 E. 8th Avenue, Eugene, OR 97401 http://www.co.lane.or.us/AT_PropRec/default.htm.

FORM O&M: OPERATIONS & MAINTENANCE PLAN

INSTRUCTIONS (PAGE 2)

1: Fill out Form O&M

Project building application number: City staff will insert this number.

Owner: Print the name of the property owner.

Phone no.: Print the area code and 7-digit phone number of the property owner.

Mailing address: Print the property owner's mailing address, including zip code. After the plan is recorded with the county recorder's office, a copy of the recorded O&M Plan will be mailed to this address. The City will also use this address if further correspondence is required.

Site address: Print the address of the property where the stormwater management facility is located.

Site legal description: Print the property's legal description. Property legal descriptions may be obtained from the county assessor's office.

Signature: Sign the O&M plan form under "filer" in the presence of a notary.

Site plan: Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), the sources of runoff entering the stormwater facility, where stormwater will be discharged to after leaving the facility, and the maintenance access location. The site plan can be inserted on Form O&M or included as a separate sheet.

Description of the financial method used to cover future operations and maintenance:
Check the appropriate box.

Party (ies) responsible for maintenance:
Provide the name, address, and phone number (both daytime and after-hours numbers) for the person or company who shall be responsible for maintaining or directly supervising the maintenance of the stormwater facilities described in the O&M Plan.

Maintenance practices and schedule for the stormwater management facility:
Provide the date the O&M Plan was prepared, the date the plan was revised (if applicable), and the month and year of the stormwater management facility installation. Provide the name, firm (if applicable), and address of the person who prepared the O&M Plan.

Spill response plan for the stormwater management facility:
Provide a spill response plan for the cleanup and disposal of spilled or discharged hazardous or environmentally damaging substances. Provide the name, firm (if applicable), and address of the person who will be responsible for responding in the event of a spill or discharge of hazardous or environmentally damaging substances.

FORM O&M: OPERATIONS & MAINTENANCE PLAN

REQUIRED IN ACCORDANCE WITH CITY CODE

Project Building Application No.	*For official county use only*
Owner's Name	
Phone No. (area code required) (______) ______ - __________	
Mailing Address (RETURN ADDRESS FOR RECORDER)	
Site Address	
Site Legal Description	

BY SIGNING BELOW, filer accepts and agrees to the terms and conditions contained in this operations & maintenance plan and in any document executed by filer and recorded with it.

____

Filer

NOTARIZATION: GIVEN under my hand and official seal

this _______ day of __________________ , __________.

Notary Public in and for the State of Oregon:

My Appointment Expires on:

O&M PLAN REQUIRED INFORMATION:

1) Site Plan. Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), sources of runoff entering the facility, and where stormwater will be discharged to after leaving the facility.

The stormwater management facility located on this site plan is a required condition of building permit approval for the identified property. The owner of the identified property is required to operate and maintain this facility in accordance with the O&M plan on file with the City. The requirement to operate and maintain this facility in accordance with the on-file O&M plan is binding on all current and future owners of the property. The O&M plan may be modified under written consent of new owners with written approval by and re-filing with the City. The O&M plan for this facility is available at the Public Works Department, located at 1820 Roosevelt, Eugene, Oregon, between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call (541) 882-4800 for assistance.

Site Plan (insert here or include separate sheet):

2) Description of the financial method used to cover future operations and maintenance. ***Check One:***

❑ Homeowner Association ❑ Property Owner Account ❑ Other (*describe*)________________________________

3) Party (ies) responsible for maintenance (only if other than owner).

Daytime Phone No. (area code required)(_____) ______ - ______	Emergency/After-Hours Contact Phone No. (_____) _____ -

Maintenance Contact & Address

4) Maintenance practices and schedule for the stormwater facility is included in the facility-specific O&M plan filed with the Public Works Department, City of Eugene. The operation and maintenance practices are based on the publication date of the City of Eugene's Stormwater Management Manual.

Preparation Date _____ / ____ / _______	Revision Date ______ / ____ / _______	Estimated Date of Installation *(month/year)* ___ / ___

Prepared By_______________________________________

FORM O&M: OPERATIONS & MAINTENANCE PLAN (Example)
REQUIRED IN ACCORDANCE WITH CITY CODE

Project Building Application No.	*For official county use only*
Owner's Name John Doe Phone No. (area code required) (541) 555 - 5555	
Mailing Address (RETURN ADDRESS FOR RECORDER) XXX NW XXX Street, XXXXX, OR XXXXX	
Site Address XXX NW XXX Street, XXXXX, OR XXXXX	
Site Legal Description Section XX, Township XX, Range XX, Tax Lot XX	

BY SIGNING BELOW, filer accepts and agrees to the terms and conditions contained in this operations & maintenance plan and in any document executed by filer and recorded with it.

John Doe ______________________

Filer

NOTARIZATION: GIVEN under my hand and official seal

this ________ day of ____________________, ___________.

Notary Public in and for the State of Oregon:

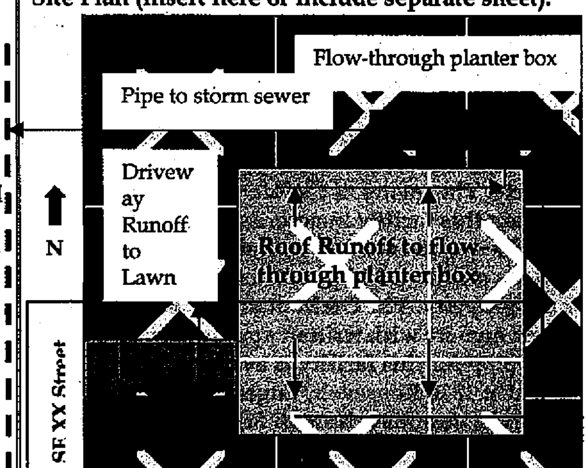
My Appointment Expires on:

O&M PLAN REQUIRED INFORMATION:

1) Site Plan. Include a site plan showing the facility location (in relation to building structures or other permanent monuments on the site), sources of runoff entering the facility, and where stormwater will be discharged to after leaving the facility.

The stormwater management facility located on this site plan is a required condition of building permit approval for the identified property. The owner of the identified property is required to operate and maintain this facility in accordance with the O&M plan on file with the City. The requirement to operate and maintain this facility in accordance with the on-file O&M plan is binding on all current and future owners of the property. The O&M plan may be modified under written consent of new owners with written approval by and re-filing with the City. The O&M plan for this facility is available at Public Works Department, located at 1820 Roosevelt, Eugene, Oregon, between the hours of 8 a.m. and 5 p.m., Monday through Friday. Call 541-682-4800 for assistance.

Site Plan (insert here or include separate sheet):



2) Description of the financial method used to cover future operations and maintenance. ***Check One:***

☐ Homeowner Association X Property Owner Account ☐ Other *(describe)*_______________

3) Party (ies) responsible for maintenance (only if other than owner). Owner Responsible

Daytime Phone No. (area code required) (541) xxx–xxxx	Emergency/After-Hours Contact Phone No. (541) xxx-xxxx

Maintenance Contact & Address Garden Guy Landscaping XXX NE XX Street XXXXXX, OR 97XXX

4) Maintenance practices and schedule for the stormwater facility is included in the facility-specific O&M plan filed with the Public Works Department, City of Eugene. The operation and maintenance practices are based on the publication date of the City of Eugene's Stormwater Management Manual.

Preparation Date XX/ XX /200X	Revision Date ______ / ____ / _______	Estimated Date of Installation *(month/year)* XX /XXXX

Prepared By John Doe ______________________

STORMWATER MANAGEMENT FACILITY
CITY OF EUGENE, OREGON
OPERATION & MAINTENANCE AGREEMENT (SAMPLE)

Sediment and other pollutants that degrade water quality will accumulate in urban stormwater facilities. The operation and maintenance of stormwater management facilities including the implementation of pollution reduction facilities is essential to the protection of the city's water quality. Removal of accumulated pollutants and sediment is important for proper operation. All property owners are expected to conduct business in a manner that promotes resource protection. This agreement contains specific provisions with respect to city maintenance of private stormwater management facilities and use of pollution reduction facilities.

Property Address:

Legal description:

Whereas, ____________________, herein referred to as Owner, has constructed improvements, including but not limited to buildings, pavement, and stormwater management facilities on the property described above. In order to further the goals of the City of Eugene to ensure the protection and enhancement of water quality, the City of Eugene and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

Recitals

1. **Owner owns the above described property within the City of Eugene, Lane County, Oregon.**
2. **Owner owns and operates stormwater management facilities approved and permitted as required by land use permit _________.**
3. **Owner has requested the city to provide the functional maintenance of the facility.**
4. **City approved construction plans dedicating the drainage system conveying runoff from the residential properties to the stormwater facility as a public drainage system are on file.**
5. **Access routes have been located within a dedicated public easement on private or commonly held property, within the public right-of-way or on city owned property.**
6. **Sufficient easement area, right-of-way width or property have been provided to accommodate the construction and maintenance of all existing and proposed utilities and public infrastructure.**

Owner shall:

1. **Implement the stormwater management program included herein as Attachment "A". (Stormwater disposal and pollution reduction construction details, and source control protection, etc.)**
2. **Implement the stormwater maintenance plan included herein as Attachment "B". (Owner responsibilities such as vegetation control, debris pickup, etc.)**
3. **Inspect the facilities monthly and after significant storm events to determine if maintenance activity is warranted.**
4. **Maintain maintenance and inspection records (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by appointment at ________________________. The log book shall catalog any action taken, who took the action, when it was taken, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected as specified in the attached instructions or more often if necessary. The Owner and Users are encouraged to photocopy the individual checklists in Attachment "A" and use them to complete its inspections. These completed checklists would then, in combination, comprise the logbook.**
5. **Submit an annual report to the City of Eugene regarding implementation programs referenced in (1) and (2) above. The report must be submitted on or before June 30 of each calendar year after execution of this agreement. At a minimum, the following items shall be included in the report:**
   - A. **Name, address, and telephone number of the businesses, persons, or firms responsible for maintenance plan implementation, and the persons completing the report.**
   - B. **Time period covered by the report.**
   - C. **A chronological summary of activities conducted to implement the program and plan referenced in (1) and (2) above. A photocopy of the applicable sections of the logbook with any additional explanations needed, shall suffice. For any activities conducted by paid parties, include a copy of the invoice for services.**
   - D. **Any outline planned activities for the upcoming year.**
6. **Allow the City of Eugene staff to inspect stormwater management facilities at the above referenced site.**

City of Eugene shall:

1. Execute the following periodic major maintenance on the subdivision's pollution reduction facilities: sediment removal from facilities, resetting orifice sizes and elevations, and adding baffles.
2. Maintain all stormwater management facility elements within the public rights of way and dedicated easements, such as catch basins, weirs, oil-water separators, and pipes.
3. Provide technical assistance to the Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and as the City of Eugene's time and resources permit.
4. Review the annual report and conduct a minimum of one (1) site visit per year to discuss performance and problems with the stormwater management facilities.
5. Review the agreement with the Owner and modify it as necessary at least once every three (3) years.

Remedies:

1. If the City of Eugene determines that maintenance that maintenance or repair work is required to be done to the stormwater management facilities located in the subdivision, the City of Eugene shall give the Owner notice of the specific maintenance and/or repair required. The City of Eugene shall set a reasonable time in which such work is to be completed the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the City of Eugene, written notice will be sent to the Owner stating the City of Eugene's intention to perform such maintenance and bill the Owner for all incurred expenses.
2. If, at any time, the City of Eugene determines that the existing facility creates any imminent threat to public health, safety, or welfare, the City of Eugene may take immediate measures to remedy said threat. No notice to the persons listed in Remedies (1), above shall be required under such circumstances. All other Owner responsibilities shall remain in effect.
3. The Owner shall grant unrestricted authority to the City of Eugene for access to any and all stormwater management facilities for the purpose of performing maintenance or repair as may become necessary under Remedies (1) and/or (2).
4. The Owner shall assume responsibility for the cost of maintenance and repairs to the stormwater management facilities, except for those maintenance actions explicitly assumed by the City of Eugene in the preceding section. Such responsibility shall include reimbursement to the City of Eugene within 90 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the City of Eugene will be borne by the parties responsible for said reimbursements.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the City of Eugene. It shall run with the land and be binding on all parties having or acquiring any right, title, or interest or any part thereof, of real property in the subdivision. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof or interest therein, and to the benefit of all citizens of the City of Eugene.

Agreed to and signed by:

Owner(s) ____ Date ____________________

On this day and year, the above Owner(s) ____________________, personally appeared before me and provided photo identification, and who executed the foregoing instrument and acknowledge that they signed the same as their free and voluntary act and deed for the uses and purposes therein mentioned.

Given under my hand and official seal this ______ day of __________________, 20______

Notary Public in and for the State of

Oregon, residing in ______________________

My commission expires ___________________

Dated in Eugene, Oregon, this ________ day of _______________, 20_______

MANAGER, CITY OF EUGENE

On this day and year, personally appearing before me, __________________________ and
_________________________, who executed the foregoing instrument and acknowledge the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute said instrument.

Given under my hand and official seal this ______ day of __________________, 20______

Notary Public in and for the State of

Oregon, residing in ______________________

My commission expires ___________________

Dated in Eugene, Oregon, this ________ day of _______________, 20_______

STORMWATER MANAGEMENT FACILITY
INSPECTION & MAINTENANCE LOG (SAMPLE)

Property Address:

Inspection Date:

Inspection Time:

Inspected By:

Approximate Date/Time of Last Rainfall:

Type of Stormwater Management Facility:

Location of Facility on Site (In relation to buildings or other permanent structures):

Water levels and observations (Oil sheen, smell, turbidity, etc.):

Sediment accumulation & record of sediment removal:

Condition of vegetation (Height, survival rates, invasive species present, etc.) & record of replacement and management (mowing, weeding, etc.):

Condition of physical properties such as inlets, outlets, piping, fences, irrigation facilities, and side slopes. Record damaged items and replacement activities:

Presence of insects or vectors. Record control activities:

Identify safety hazards present. Record resolution activities:

FACILITY-SPECIFIC OPERATIONS AND MAINTENANCE PLANS

FACILITY PAGE

Eco-Roofs and Roof Gardens

Operations & Maintenance Plan

Eco-roofs and Roof Gardens are vegetated roof systems that retain and filter stormwater and provide aesthetic and energy conservation benefits. All facility components, including soil substrate or growth medium, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure shall be inspected for proper operations, integrity of the waterproofing, and structural stability throughout the life of the eco-roof or roof garden. All elements shall be inspected once a month from April through September. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Soil Substrate/ Growing Medium shall be inspected for evidence of erosion from wind or water.

- If erosion channels are evident, they shall be stabilized with additional soil substrate/growth medium and covered with additional plants.

Eco-Roof System Structural Components shall be operated and maintained in accordance with manufacturer's requirements. Drain Inlets shall be kept unrestricted.

- Inlet pipe shall be cleared when soil substrate, vegetation, debris or other materials clog the drain inlet. Sources of sediment and debris shall be identified and corrected.
- Determine if drain inlet pipe is in good condition and correct as needed.

Debris and Litter shall be removed to prevent clogging of inlet drains and interference with plant growth.

Vegetation shall be maintained to provide 90% plant cover.

- During the Establishment Period, plants shall be replaced once per month as needed. During the long-term period, dead plants shall generally be replaced once per year in the fall months.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Nuisance and prohibited vegetation from the Eugene Plant List shall be removed when discovered.
- Dead vegetation shall be removed and replaced with new plants.
- Weeding shall be manual with no herbicides or pesticides used. Weeds shall be removed regularly and not allowed to accumulate.
- Fertilization is not necessary and fertilizers shall not be applied.
- During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss.
- Mowing of grasses shall occur as needed. Clippings shall be removed.

Irrigation can be accomplished either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, manufacturers' instructions for operations and maintenance shall be followed.

- During the Establishment Period (1-3 years), water sufficient to assure plant establishment and not to exceed ¼ inch of water once every 3 days shall be applied.
- During the long-term period (3+ years), water sufficient to maintain plant cover and not to exceed ¼ inch of water once every 14 days shall be applied.

Spill Prevention measures from mechanical systems located on roofs shall be exercised when handling substances that can contaminate stormwater.

- Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining eco-roofs shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access and Safety to the eco-roof shall be safe and efficient.

- Egress and ingress routes shall be maintained to design standards. Walkways shall be clear of obstructions and maintained to design standards.

Aesthetics of the eco-roof shall be maintained as an asset to the property owner and community.

- Evidence of damage or vandalism shall be repaired and accumulation of trash or debris shall be removed upon discovery.

Insects shall not be harbored at the eco-roof.

- Standing water creating an environment for development of insect larvae shall be eliminated by manual means. Chemical sprays shall not be used.

Contained Planters

Operations & Maintenance Plan

Contained planters are designed to intercept rainfall that would normally fall on impervious surfaces. In this respect contained planters convert impervious surfaces to pervious ones, decreasing the amount of stormwater runoff from a site. Water should drain through the planter within 3-4 hours after a storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation and 2 times per year thereafter. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Filter Media consisting of sand or topsoil shall allow stormwater to percolate uniformly through the planter.

- The planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.

Planter shall contain filter media and vegetation.

- Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.

Planter Reservoir receives and detains storm water prior to infiltration. If water does not drain from reservoir within 3-4 hours of storm event, sources of clogging shall be identified and corrected. Topsoil may need to be amended with sand or replaced all together.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished at least annually.
- Planter vegetation shall be irrigated to ensure survival.
- Vegetation, large shrubs or trees that limit access or interfere with planter operation shall be pruned or removed.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance and prohibited vegetation from the Eugene Plant List shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species (measured in a 10 x 10 foot plot) shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe, e.g., 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Training and/or written guidance information for operating and maintaining planters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored at the stormwater planter. Pest control measures shall be taken when insects/rodents are found to be present.

- Standing water creating an environment for development of insect larvae shall be eliminated.
- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    - i) Installation of predacious bird or bat nesting boxes.
    - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the stormwater planter shall be filled and compacted.

Pervious Pavement
Operations & Maintenance Plan

Pervious pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil or being collected in underlying drain pipes and being discharged off-site. There are many types of pervious pavement including plastic rings planted with grass, stone or concrete blocks with pore spaces backfilled with gravel or sand, porous asphalt, and porous concrete. Pervious pavement accepts only precipitation, not stormwater runoff. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Surface: In most pervious pavement design, the pavement itself acts as pretreatment to the stone reservoir below. The surface shall be kept clean and free of leaves, debris, and sediment. The surface shall not be overlaid with an impermeable paving surface

- Regular sweeping shall be implemented for porous asphalt or concrete systems.

Overflows or Emergency Spillways are used in the event that the facility's infiltration capacity is exceeded. Overflow devices shall be inspected for obstructions or debris, which shall be removed upon discovery Overflow or emergency spillways shall be capable of transporting high flows of stormwater to an approved stormwater receiving system.

- Sources of erosion damage shall be identified and controlled when native soil is exposed near the overflow structure.

Vegetation (where applicable) shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Vegetation, such as trees and shrubs, should not be located in or around the pervious pavement because roots from trees can penetrate the pavement, and leaves from deciduous trees and shrubs can increase the risk of clogging the surface.

- Vegetation and large shrubs/trees that limit access or interfere with porous pavement operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Poisonous, nuisance, dead or odor producing vegetation shall be removed immediately.
- Grass shall be mowed to less than four inches and grass clippings shall be bagged and removed.
- Irrigation shall be provided as needed.

Source Control measures prevent pollutants from mixing with stormwater. Typical non-structural control measures include raking and removing leaves, street sweeping, vacuum sweeping, limited and controlled application of pesticides and fertilizers, and other good house keeping practices.

Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater. A spill prevention plan shall be implemented at all non-residential sites and in areas where there is likelihood of spills from hazardous materials. However, virtually all sites, including residential and commercial, present potential danger from spills. All homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, solvents, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining pervious pavement shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the pervious pavement shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.
Obstacles preventing maintenance personnel and/or equipment access to the porous pavement shall be removed. Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present.

- Standing water creating an environment for development of insect larvae shall be eliminated.
- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the pervious pavement shall be filled and compacted.

If used at this site, the following will be applicable:

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. It may also discourage behaviors that adversely affect stormwater protection measures. For example, if debris is a problem, a sign reminding people not to litter may partially solve the problem. Broken or defaced signs shall be replaced/repaired.

Vegetated, Grassy, and Street Swales
Operations & Maintenance Plan

Swales are planted or grassed open channels that trap pollutants by filtering and slowing flows, allowing particles to settle out. The swale should drain within 48 hours of a storm event. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Swale Inlet (such as curb cuts or pipes) shall maintain a calm flow of water entering the swale.

- Source of erosion shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4" thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Rock splash pads shall be replenished to prevent erosion.

Side Slopes shall be maintained to prevent erosion that introduces sediment into the swale.

- Slopes shall be stabilized and planted using appropriate erosion control measures when native soil is exposed or erosion channels are forming.

Swale Media shall allow stormwater to percolate uniformly through the landscape swale. If the swale does not drain within 48 hours, it shall be tilled and replanted according to design specifications.

- Annual or semi-annual tilling shall be implemented if compaction or clogging continues.
- Debris in quantities that inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Swale Outlet shall maintain sheet flow of water exiting swale unless a collection drain is used. Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.

- Outlets such as drains and overland flow paths shall be cleared when 50% of the conveyance capacity is plugged.
- Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Mulch shall be replenished as needed to ensure survival of vegetation.

- Vegetation, large shrubs or trees that interfere with landscape swale operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be removed.
- Grassy swales shall be mowed to keep grass 4" to 9" in height. Clippings shall be removed to remove pollutants absorbed in grasses.
- Nuisance and prohibited vegetation from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation and woody material shall be removed to maintain less than 10% of area coverage or when swale function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining swales shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the swale shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the swale shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated, Grassy, and Street Swales Operations & Maintenance Plan
Insects & Rodents shall not be harbored in the swale. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the swale shall be filled.
If used at this site, the following will be applicable:
Check Dams shall control and distribute flow. • Causes for altered water flow shall be identified, and obstructions cleared upon discovery. • Causes for channelization shall be identified and repaired.

Vegetated Filter Strips

Operations & Maintenance Plan

Vegetated filter strips are gently sloped vegetated areas that stormwater runoff is directed to flow and filter through. Stormwater enters the filter as sheet flow from an impervious surface or is converted to sheet flow using a flow spreader. Flow control is achieved using the relatively large surface area and check dams. Pollutants are removed through infiltration and sedimentation. The vegetative filter should drain within 48 hours of storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Flow Spreader shall allow runoff to enter the vegetative filter as predominantly sheet flow.

- Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment build-up near or exceeding 2" in depth shall be removed.

Filter Inlet shall assure unrestricted stormwater flow to the vegetative filter.

- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- Inlet shall be cleared when conveyance capacity is plugged.
- Rock splash pads shall be replenished to prevent erosion.

Filter Media shall allow stormwater to percolate uniformly through the vegetative filter.

- If the vegetative filter does not drain within 48 hours, it shall be regraded and replanted according to design specifications. Established trees shall not be removed or harmed in this process.
- Debris in quantities more than 2" deep or sufficient to inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Check Dams shall direct and control flow.

- Causes for altered water flow and channelization shall be identified, and obstructions cleared upon discovery.
- Cracks, rot, and structural damage shall be repaired.

Filter Outlet shall allow water to exit the vegetative filter as sheet flow, unless a collection drainpipe is used.

- Sources of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are deeper than 2 inches.
- Outlet shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance and prohibited vegetation from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater.
Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining vegetated filters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the vegetative filter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards.
Obstacles preventing maintenance personnel and/or equipment access to the facility shall be removed.
Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated Filter Strips

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the vegetated filter. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
    i) Installation of predacious bird or bat nesting boxes.
    ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
    iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
    iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the vegetated filter shall be filled.

Infiltration and Flow-Through Planters Operations & Maintenance Plan
Planters are designed to allow runoff to filter through layers of topsoil (thus capturing pollutants) and then either infiltrate into the native soils (infiltration planter) or be collected in a pipe to be discharged off-site (flow-through planter). The planter is sized to accept runoff and temporarily store the water in a reservoir on top of the soil. The flow-through planter is designed with an impervious bottom or is placed on an impervious surface. Water should drain through the planter within 3-4 hours after a storm event. All facility components and vegetation shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:
Downspout from rooftop or sheet flow from paving allows unimpeded stormwater flow to the planter. • Debris shall be removed routinely (e.g., no less than every 6 months) and upon discovery. • Damaged pipe shall be repaired upon discovery.
Splash Blocks prevent splashing against adjacent structures and convey water without disrupting media. • Any deficiencies in structure such as cracking, rotting, and failure shall be repaired.
Planter Reservoir receives and detains storm water prior to infiltration. Water should drain from reservoir within 3-4 hours of storm event. • Sources of clogging shall be identified and corrected. • Topsoil may need to be amended with sand or replaced all together.
Filter Media consisting of sand, gravel, and topsoil shall allow stormwater to percolate uniformly through the planter. The planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates. • Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged. • Sediment accumulation shall be hand removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation. • Litter and debris shall be removed routinely (e.g., no less than quarterly) and upon discovery.
Planter shall contain filter media and vegetation. • Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.
Overflow Pipe safely conveys flow exceeding reservoir capacity to an approved stormwater receiving system. • Overflow pipe shall be cleared of sediment and debris when 50% of the conveyance capacity is plugged. • Damaged pipe shall be repaired or replaced upon discovery.
Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. • Mulch shall be replenished at least annually. • Vegetation, large shrubs or trees that limit access or interfere with planter operation shall be pruned or removed. • Fallen leaves and debris from deciduous plant foliage shall be raked and removed. • Nuisance or prohibited vegetation from the Eugene Plant List shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced. • Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within a specific timeframe, e.g., 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.
Training and/or written guidance information for operating and maintaining stormwater planters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable. • Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed. • Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Infiltration and Flow-Through Planters Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the stormwater planter.
Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  i) Installation of predacious bird or bat nesting boxes.
  ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the stormwater planter shall be filled and compacted.

Vegetated Infiltration Basins

Operations & Maintenance Plan

A **vegetated Infiltration Basin** is a vegetated depression created by excavation, berms, or small dams to provide for short-term ponding of surface water until it percolates into the soil. The basin shall infiltrate stormwater within 24 hours. All facility components and vegetation shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Basin Inlet shall assure unrestricted stormwater flow to the vegetated basin.

- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Inlet shall be cleared when conveyance capacity is plugged.
- Rock splash pads shall be replenished to prevent erosion.

Embankment, Dikes, Berms & Side Slopes retain water in the infiltration basin.

- Structural deficiencies shall be corrected upon discovery:
- Slopes shall be stabilized using appropriate erosion control measures when soil is exposed/ flow channels are forming.
- Sources of erosion damage shall be identified and controlled.

Overflow or Emergency Spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow shall be cleared when 25% of the conveyance capacity is plugged.
- Sources of erosion damage shall be identified and controlled when soil is exposed.
- Rocks or other armament shall be replaced when only one layer of rock exists.

Filter Media shall allow stormwater to percolate uniformly through the infiltration basin. If water remains 36-48 hours after storm, sources of possible clogging shall be identified and corrected.

- Basin shall be raked and, if necessary, soil shall be excavated, and cleaned or replaced.

Sediment/ Debris Management shall prevent loss of infiltration basin volume caused by sedimentation. Gauges located at the opposite ends of the basin shall be maintained to monitor sedimentation.

- Sediment and debris exceeding 4" in depth shall be removed every 2-5 years or sooner if performance is affected.
- Restricted sources of sediment and debris, such as discarded lawn clippings, shall be identified and prevented.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.

- Mulch shall be replenished as needed to ensure healthy plant growth.
- Vegetation, large shrubs or trees that limit access or interfere with basin operation shall be pruned or removed.
- Grass shall be mowed to 4"-9" high and grass clippings shall be removed no less than 2 times per year.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to control erosion.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining vegetated infiltration basins shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the infiltration basin shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the infiltration basin shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Vegetated Infiltration Basins Operations & Maintenance Plan
Insects & Rodents shall not be harbored in the infiltration basin. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the infiltration basin shall be filled.
If used at this site, the following will be applicable:
Fences shall be maintained to preserve their functionality and appearance. • Collapsed fences shall be restored to an upright position. • Jagged edges and damaged fences shall be repaired or replaced.

Sand Filters

Operations & Maintenance Plan

Sand filters consist of a layer of sand in a structural box used to trap pollutants. The water filters through the sand and then flows into the surrounding soils or an underdrain system that conveys the filtered stormwater to a discharge point. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Filter Inlet shall allow water to uniformly enter the sand filter as calm flow, in a manner that prevents erosion.

- Inlet shall be cleared of sediment and debris when 40% of the conveyance capacity is plugged.
- Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- Rock splash pads shall be replenished to prevent erosion.

Reservoir receives and detains stormwater prior to infiltration. If water does not drain within 2-3 hours of storm event, sources of clogging shall be identified and correction action taken.

- Debris in quantities more than 1 cu ft or sufficient to inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.
- Structural deficiencies in the sand filter box including rot, cracks, and failure shall be repaired upon discovery.

Filter Media shall allow to stormwater to percolate uniformly through the sand filter. If water remains 36-48 hours after storm, sources of possible clogging shall be identified and corrected.

- Sand filter shall be raked and if necessary, the sand/gravel shall be excavated, and cleaned or replaced.
- Sources of restricted sediment or debris (such as discarded lawn clippings) shall be identified and prevented.
- Debris in quantities sufficient to inhibit operation shall be removed no less than quarterly, or upon discovery.
- Holes that are not consistent with the design structure and allow water to flow directly through the sand filter to the ground shall be filled.

Underdrain Piping (where applicable) shall provide drainage from the sand filter, and **Cleanouts** (where applicable) located on laterals and manifolds shall be free of obstruction, and accessible from the surface.

- Underdrain piping shall be cleared of sediment and debris when conveyance capacity is plugged. Cleanouts may have been constructed for this purpose.
- Obstructions shall be removed from cleanouts without disturbing the filter media.

Overflow or Emergency Spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow spillway shall be cleared of sediment and debris when 50% of the conveyance capacity is plugged.
- Source of erosion damage shall be identified and controlled when erosion channels are forming.
- Rocks or other armament shall be replaced when sand is exposed and eroding from wind or rain.

Vegetation

- Vegetation, large shrubs or trees that limit access or interfere with sand filter operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining sand filters shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the sand filter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the facility shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Sand Filters

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the sand filter. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  i) Installation of predacious bird or bat nesting boxes.
  ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the infiltration basin shall be filled.

Soakage Trenches Operations & Maintenance Plan
Soakage Trenches consist of drain rock and sand, and receive stormwater from roof downspouts and/or area drains. There are various components within the system – piping, silt basin and the trench itself. The **Conveyance Piping** consists of an inlet pipe (downspout or area drain), an outlet pipe located between the silt basin and the soakage trench, and a perforated pipe, located on top of the aggregate bed of the soakage trench. The **Silt Basin** is a structure receiving runoff from an inlet pipe and conveying it to the soakage trench. The silt basin serves as the pre-treatment system for the soakage trench, removing sediments and other debris that can impact its proper functioning. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first two years from the date of installation, then two times per year afterwards, or within 48 hours after each major storm. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:
Soakage trench infiltration: If water is noticed on top of the trench within 48 hours of a major storm, the soakage trench may be clogged. • Check for debris/sediment accumulation, rake and remove and evaluate upland causes (erosion, surface or roof debris, etc • Assess the condition of the aggregate and the filter fabric in the trench. If there is sediment in the aggregate, excavate and replace. • If there is a tear in the filter fabric, repair or replace.
Conveyance Piping: If water ponds over the trench for more than 48 hours after a major storm and no other cause if identified, it may be necessary to remove the filter fabric to determine if the perforated pipe is clogged with sediment or debris. • Any debris or algae growth located on top of the soakage trench should be removed and disposed of properly. • If the piping has settled more than 1-inch, add fill material. If there are cracks or releases, replace or repair the pipe. If there are signs of erosion around the pipe, this may be an indication of water seeping due to a crack or break.
Silt Basin: If water remains in the soakage trench for 36-48 hours after storm, check for sediment accumulation in the silt basin • If less than 50% capacity remains in the basin or 6" of sediment has accumulated, remove and dispose the sediment. **Spill Prevention**: Virtually all sites, including residential and commercial, present dangers from spills. All homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect groundwater if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. • Activities that pose the chance of hazardous material spills shall not take place near soakage trenches.
A **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the soakage trench to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.
Training and/or written guidance information for operating and maintaining soakage trenches shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the soakage trench is required for efficient maintenance. Egress and ingress routes will be maintained to design standards at inspections.

Soakage Trenches

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the soakage trench. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the soakage trench shall be filled.

Wet, Extended Wet Detention, and Dry Detention Ponds Operations & Maintenance Plan
Wet Ponds are constructed ponds with a permanent pool of water. Pollutants are removed from stormwater through gravitational settling and biologic processes. **Extended Wet Ponds** are constructed ponds with a permanent pool of water and open storage space above for short-term detention of large storm events. Pollutants are removed from stormwater through gravitational settling and biologic processes. **Dry Detention Ponds** are constructed ponds with temporary storage for the detention of large storm events. The stormwater is stored and released slowly over a matter of hours. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Pond Inlet shall assure unrestricted stormwater flow to the wet pond.
• Inlet pipe shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
• Determine if pipe is in good condition:
    o If more than 1 inch of settlement, add fill material and compact soils.
    o If alignment is faulty, correct alignment.
    o If cracks or openings exist indicated by evidence of erosion at leaks, repair or replace pipe as needed.

Forebay traps coarse sediments, reduces incoming velocity, and distributes runoff evenly over the wet pond. A minimum 1-foot freeboard shall be maintained. • Sediment buildup exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected.

Embankment, Dikes, Berms & Side Slopes retain water in the wet pond.
• Slopes shall be stabilized using appropriate erosion control measures when native soil is exposed or erosion channels are forming.
• Structural deficiencies shall be corrected upon discovery:
    o If cracks exist, repair or replace structure.
    o If erosion channels deeper than 2 inches exist, stabilize surface. Sources of erosion damage shall be identified and controlled.

Control Devices (e.g., weirs, baffles, etc.) shall direct and reduce flow velocity. Structural deficiencies shall be corrected upon discovery: • If cracks exist, repair or replace structure.
Overflow Structure conveys flow exceeding reservoir capacity to an approved stormwater receiving system. • Overflow structure shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected. • Sources of erosion damage shall be identified and controlled when native soil is exposed at the top of overflow structure or erosion channels are forming. • Rocks or other armoring shall be replaced when only one layer of rock exists above native soil.
Sediment & Debris Management shall prevent loss of wet pond volume caused by sedimentation. • Wet ponds shall be dredged when 1 foot of sediment accumulates in the pond. • Gauges located at the opposite ends of the wet pond shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year. • Sources of restricted sediment or debris, such as discarded lawn clippings, shall be identified and prevented. • Debris in quantities sufficient to inhibit operation shall be removed routinely, e.g. no less than quarterly, or upon discovery.

Wet, Extended Wet Detention, and Dry Detention Ponds

Operations & Maintenance Plan

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas.

- Mulch shall be replenished at least annually.
- Vegetation, large shrubs or trees that limit access or interfere with wet pond operation shall be pruned or removed.
- Grass (where applicable) shall be mowed to 4"-9" high and grass clippings shall be removed.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when wet pond function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
- Vegetation producing foul odors shall be eliminated.

Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater Releases of pollutants shall be corrected as soon as identified.

Training and/or written guidance information for operating and maintaining ponds shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the wet pond shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the wet pond shall be removed.
- Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.

Insects & Rodents shall not be harbored in the pond. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the pond shall be filled.

If used at this site, the following will be applicable:

Signage shall clearly convey information.

- Broken or defaced signs shall be replaced or repaired.

Fences shall be maintained to preserve their functionality and appearance.

- Collapsed fences shall be restored to an upright position.
- Jagged edges and damaged fences and shall be repaired or replaced.

Constructed Treatment Wetlands

Operations & Maintenance Plan

Constructed Treatment Wetlands remove pollutants through several processes: sedimentation, filtration, and biological processes. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability. These inspections shall occur, at a minimum, quarterly for the first 2 years from the date of installation, and 2 times per year thereafter, and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Wetland Inlet shall assure unrestricted stormwater flow to the wetland.

- Inlet pipe shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Determine if pipe is in good condition:
  - If more than 1 inch of settlement, add fill material and compact soils.
  - If alignment is faulty, correct alignment.
  - If cracks or openings exist indicated by evidence of erosion at leaks, repair or replace pipe as needed.

Forebay traps coarse sediments, reduces incoming velocity, and distributes runoff evenly over the wetland. A minimum 1-foot freeboard shall be maintained.

- Sediment buildup exceeding 50% of the facility capacity shall be removed every 2-5 years, or sooner if performance is being affected.

Embankment, Dikes, Berms & Side Slopes retain water in the wetland.

- Slopes shall be stabilized using appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Structural deficiencies shall be corrected upon discovery:
  - If cracks exist, repair or replace structure.
  - If erosion channels deeper than 2 inches exist, stabilize surface. Sources of erosion damage shall be identified and controlled.

Control Devices (e.g., weirs, baffles, etc.) shall direct and reduce flow velocity.

- Structural deficiencies shall be corrected upon discovery:
- If cracks exist, repair or replace structure.

Overflow Structure conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow structure shall be cleared when 50% of the conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
- Sources of erosion damage shall be identified and controlled when native soil is exposed at the top of overflow structure or erosion channels are forming.
- Rocks or other armament shall be replaced when only one layer of rock exists above native soil.

Sediment & Debris Management shall prevent loss of wetland volume caused by sedimentation.

- Wetlands shall be dredged when 1 foot of sediment accumulates.
- Gauges located at the opposite ends of the wetland shall be maintained to monitor sedimentation. Gauges shall be checked 2 times per year.
- Sources of restricted sediment or debris, such as discarded lawn clippings, shall be identified and prevented.
- Debris in quantities sufficient to inhibit operation shall be removed routinely, e.g. no less than quarterly, or upon discovery.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion and minimizing solar exposure of open water areas.

- Mulch shall be replenished when needed.
- Vegetation, large shrubs or trees that limit access or interfere with wetland operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the Eugene Plant List (such as blackberries or English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when wetland function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.
- Vegetation producing foul odors shall be eliminated.

Constructed Treatment Wetlands Operations & Maintenance Plan
Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater Releases of pollutants shall be corrected as soon as identified.
Training and/or written guidance information for operating and maintaining treatment wetlands shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the wetland shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable. • Obstacles preventing maintenance personnel and/or equipment access to the wetland shall be removed. • Gravel or ground cover shall be added if erosion occurs, e.g., due to vehicular or pedestrian traffic.
Insects & Rodents shall not be harbored in the constructed treatment wetland. Pest control measures shall be taken when insects/rodents are found to be present. • If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following: i) Installation of predacious bird or bat nesting boxes. ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles. iii) Stocking ponds and other permanent water facilities with fish or other predatory species. iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor. • Holes in the ground located in and around the constructed treatment wetland shall be filled.
If used at this site, the following will be applicable:
Signage shall clearly convey information. • Broken or defaced signs shall be replaced or repaired.
Fences shall be maintained to preserve their functionality and appearance. • Collapsed fences shall be restored to an upright position. • Jagged edges and damaged fences and shall be repaired or replaced.

Underground Detention Tanks, Vaults, and Pipes
Operations & Maintenance Plan

Underground detention tanks, vaults, and pipes are designed to fill with stormwater during large storm events, slowly releasing it over a number of hours. There are numerous components to each system. **Drain Inlet Pipes** convey stormwater into the detention facility. The **detention Chamber** is the structure in which stormwater accumulates during a storm event. **Orifice Structure/ Outlet Drain Pipe** restricts the flow out of the detention chamber, allowing it to fill up and slowly drain out. The orifice structure is located at the downstream end of the detention chamber. Underground facilities shall be inspected quarterly and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Drain Inlet Pipes shall be inspected for clogging or leaks where it enters the vault or basin during every inspection and cleanout.

- Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Detention Chamber shall be inspected for cracks or damage during each inspection.

- The detention chamber shall be cleaned out yearly or after an inch of sediment has accumulated. If there is a valve on the outlet pipe it shall be closed otherwise the outlet shall be plugged prior to cleanout. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning.
- Water and sediment in the detention chamber shall be removed, tested, and disposed of in accordance with regulations.
- Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.

Orifice Structure/ Outlet Drain Pipe shall be inspected for clogging during unit inspections/cleanouts.

- Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.

Vegetation such as trees should not be located in or around the detention facility because roots from trees can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging the intake pipe.

- Large shrubs or trees that are likely to interfere with detention facility operation shall be identified at each inspection then removed.

Source Control measures typically include structural and non-structural controls. Non-structural controls can include street sweeping and other good house keeping practices. It is often easier to prevent pollutants from entering stormwater than to remove them.

- Source control measures shall be inspected and maintained (where applicable).

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important for everyone to exercise caution when handling substances that can contaminate stormwater.
Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.

Training and/or written guidance information for operating and maintaining detention facilities shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the detention facility is required for efficient maintenance.
Egress and ingress routes shall be open and maintained to design standards.

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signs may also discourage behavior that adversely impacts the stormwater protection measures and encourages behavior that enhances or preserves stormwater quality. If debris is a problem, a sign reminding people not to litter may partially solve the problem.
Signage (where applicable) will be maintained and repaired as needed during or shortly after inspections.

Insects & Rodents shall not be harbored in the detention facility. Pest control measures shall be taken when insects/rodents are found to be present

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the detention facility shall be filled.

Drywells

Operations & Maintenance Plan

Drywells are designed to infiltrate stormwater into the ground. Stormwater is piped to drywells from roof downspouts or pollution control facilities such as swales or planters. The pollution control facility is designed to settle out sediments and separate oils and greases from the water before releasing it through a pipe to the drywell. This prolongs the life of the drywell and helps to prevent the contamination of soils and groundwater. The drywell is a concrete or plastic manhole section with many small holes in the sides to allow stormwater to infiltrate into the surrounding soil. The drywell system shall be inspected and cleaned quarterly and within 48 hours after each major storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Stormwater Drain Pipe shall be inspected for clogging or leaks where it enters the drywell.

- Debris/sediment that is found to clog the pipe shall be removed and disposed of in accordance with applicable federal and state requirements.

Drywell shall be inspected during each cleanout. Ponding around the catch basins or sedimentation manhole or drywell lids may indicate that the drywell is failing due to siltation, or the clogging of the sediment pores surrounding the drywell. Clogged drywells must be replaced.

Vegetation such as trees should not be located in or around the drywell because roots from trees can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging the intake pipe.

- Large shrubs or trees that are likely to interfere with operation will be identified at each inspection and removed.

Source Control measures typically include structural and non-structural controls. Non-structural controls can include parking lot or street sweeping and other good house keeping practices. It is often easier to prevent pollutants from entering stormwater than to remove them.

- Source control measures shall be inspected and maintained (where applicable).

Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, solvents, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.

A **Shut-Off Valve or Flow-Blocking Mechanism** may have been required with the construction of the drywell to temporarily prevent stormwater from flowing into it, in the event of an accidental toxic material spill. This may also involve mats kept on-site that can be used to cover inlet drains in parking lots. The shut-off valve shall remain in good working order, or if mats or other flow-blocking mechanisms are used, they shall be kept in stock on-site.

Training and/or written guidance information for operating and maintaining drywell systems shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.

Access to the drywell is required for efficient maintenance. Egress and ingress routes shall be open and maintained to design standards.

Drywells

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the drywell. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the drywell shall be filled.

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signs may also discourage behavior that adversely impacts the stormwater protection measures and encourages behavior that enhances or preserves stormwater quality. If debris is a problem, a sign reminding people not to litter may partially solve the problem.
Signage (where applicable) shall be maintained and repaired as needed during or shortly after inspections.

Spill Control Manholes **Operations & Maintenance Plan**
Spill Control Manholes operate using the principal that oil and water are immiscible (do not mix) and have different densities. Oil, being less dense than water, floats to the surface. The spill control manhole shall be inspected and cleaned quarterly. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:
• **Stormwater Drain Inlet Pipe** shall be inspected for clogging or leaks where it enters the manhole during every inspection and cleanout. Debris/sediment that is found to clog the inlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.
Manhole Chamber shall be inspected for cracks or damage during each inspection. • The manhole shall be cleaned out quarterly. Cleanout shall be done in a manner to minimize the amount of trapped oil entering the outlet pipe. If there is a valve on the outlet pipe it shall be closed otherwise the outlet will be plugged prior to cleanout. • Water and oil shall be removed, tested, and disposed of in accordance with regulations. Grit and sediment that has settled to the bottom of the chamber shall be removed during each cleaning • Cleaning shall be done without use of detergents or surfactants. A pressure washer may be used if necessary.
Absorbent Pillows and Pads (where applicable) absorb oil from the separation chamber. • Replacement shall occur at least twice a year, in the spring and fall, or as necessary to retain oil-absorbing function.
Stormwater Drain Outlet Pipe shall be inspected for clogging or leaks where it exits the manhole. Particular attention shall be paid to ensure that the joint where the tee joins the outlet pipe is watertight. • Debris/sediment that is found to clog the outlet shall be removed, tested, and disposed of in accordance with applicable federal and state requirements.
Vegetation such as trees should not be located in or around the spill control manhole because roots can penetrate the unit body, and leaves from deciduous trees and shrubs can increase the risk of clogging. • Large shrubs or trees that are likely to interfere with manhole operation shall be identified at each inspection and removed.
Source Control measures typically include structural and non-structural controls. Non-structural controls can include street sweeping and other good house keeping practices. • Source control measures shall be inspected and maintained.
Spill Prevention procedures require high-risk site users to reduce the risk of spills. However, virtually all sites, including residential and commercial, present dangers from spills. Homes contain a wide variety of toxic materials including gasoline for lawn mowers, antifreeze for cars, nail polish remover, pesticides, and cleaning aids that can adversely affect storm water if spilled. It is important to exercise caution when handling substances that can contaminate stormwater. Spill prevention procedures shall be implemented in areas where there is likelihood of spills from hazardous materials.
Training and/or written guidance information for operating and maintaining spill control manholes shall be provided to all property owners and tenants. A copy of the O&M Plan shall be provided to all property owners and tenants.
Access to the spill control manhole is required for efficient maintenance. Egress and ingress routes shall be open and maintained to design standards.

Spill Control Manholes

Operations & Maintenance Plan

Insects & Rodents shall not be harbored in the spill control manhole. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the manhole shall be filled.

Signage may serve to educate people about the importance or function of the site's stormwater protection measures. Signage (where applicable) shall be maintained and repaired as needed during or shortly after inspections.

New Evergreen and Deciduous Trees

Operations & Maintenance Plan

Trees intercept rainfall and therefore provide a level of pollution reduction and flow control. They also provide shade, helping to cool stormwater runoff. Trees used to meet stormwater management requirements shall be kept on a site and maintained properly to ensure continued stormwater benefits. Trees shall be inspected 2 times a year and within 48 hours of a major wind or storm event. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Leaves and Debris from the tree shall be regularly raked and disposed of.

- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Poisonous and nuisance vegetation around the tree shall be removed when discovered.
- Dead vegetation shall be pruned from the tree on a regular basis.

Irrigation shall be implemented during the establishment period to ensure tree survival. Hand watering is preferred, but a drip-irrigation system may be used.

Protection of the tree trunk and roots shall ensure tree survival. Care should be taken when digging near tree roots.

Replacement of dead trees shall be with a comparable species if it dies or must be removed for any another reason. The replacement tree shall be a minimum of 6' tall.

Insects & Rodents shall not be harbored in or around the trees. Pest control measures shall be taken when insects/rodents are found to be present.

- If a complaint is received or an inspection reveals that a stormwater facility is significantly infested with mosquitoes or other vectors, the property owner/owners or their designee may be required to eliminate the infestation at the City inspector's discretion. Control of the infestation shall be attempted by using first non-chemical methods and secondly, only those chemical methods specifically approved by the City's inspector. Acceptable methods include but are not limited to the following:
  - i) Installation of predacious bird or bat nesting boxes.
  - ii) Alterations of pond water levels approximately every four days in order to disrupt mosquito larval development cycles.
  - iii) Stocking ponds and other permanent water facilities with fish or other predatory species.
  - iv) If non-chemical methods have proved unsuccessful, contact the City inspector prior to use of chemical methods such as the mosquito larvicides Bacillus thurengensis var. israeliensis or other approved larvacides. These materials may only be used with City inspector approval if evidence can be provided that these materials will not migrate off-site or enter the public stormwater system. Chemical larvicides shall be applied by a licensed individual or contractor.
- Holes in the ground located in and around the trees shall be filled.

Chapter 4.0
SOURCE CONTROLS

Summary of Chapter 4.0

This chapter presents storm source controls required for site uses and characteristics that generate, or have the potential to generate, specific pollutants of concern.

To Use This Chapter:
1) Determine which characteristics and/or site uses listed in **Section 4.1.1** are included in the project.
2) Follow the design methodologies to design source controls for the project.
3) The site use may require a Discharge Authorization Request **(DAR) Form** to be submitted with the permit application.

4.1 INTRODUCTION

Some site characteristics and uses may generate specific pollutants of concern or levels that are not addressed solely through implementation of the pollution reduction measures identified in Chapter 2.0. The site characteristics and uses in this chapter have been identified as potential sources for chronic loadings or acute releases of pollutants such as oil and grease, toxic hydrocarbons, heavy metals, toxic compounds, solvents, abnormal pH levels, nutrients, organics, bacteria, chemicals, and suspended solids. This chapter presents source controls for managing these pollutants at their source.

Stormwater discharge benchmarks for pollutants exist in NPDES Industrial Stormwater General Permits issued by the State of Oregon for facilities with industrial activities that are exposed to rainfall and stormwater runoff. The state also has water quality standards listed in Oregon Administrative Rules (OAR) 340 Division 041 for discharges to surface waters.

Eugene Code 6.340-6.380 lists prohibited discharges to the City's storm sewer system. The City has used these standards and benchmarks in the development of the listed source controls so stormwater discharges can better meet these criteria.

Section 4.1.1 lists the site uses and characteristics subject to the design methodologies of this chapter, and will therefore be subject to City review. Sections 4.2 through 4.9 then provide detailed information about the required source controls.

The implementation of this chapter is in addition to the applicable pollution reduction, flow control, and destination requirements.

All structural source controls require a **Discharge Authorization Request (DAR) form**, located at the end of this chapter, to be submitted as part of the development permit application packet. For more details on structural controls, please refer to the **DAR form**. Applicants may propose alternatives to the source controls identified in this chapter. To request an alternative source control the applicant must complete the Special Requests section of the **DAR form**. Proposal of an alternative source control or alternative design element will require an additional review process and may delay issuance of related building or public works permits.

4.1.1 Site Uses and Characteristics That Trigger Source Controls

Projects with the following site uses and characteristics are subject to the design methodologies of this chapter:

- Fuel Dispensing Facilities and Surrounding Traffic Areas (**Section 4.2**)
- Above-Ground Storage of Liquid Materials (**Section 4.3**)
- Solid Waste Storage Areas, Containers, and Trash Compactors (**Section 4.4**)
- Exterior Storage of Bulk Materials (**Section 4.5**)
- Material Transfer Areas/Loading Docks (**Section 4.6**)
- Equipment and/or Vehicle Washing Facilities (**Section 4.7**)
- Stormwater and Groundwater Management For Development On Land With Suspected or Known Contamination (**Section 4.8**)
- Covered Vehicle Parking Areas (**Section 4.9**)

Detailed descriptions of these site uses and characteristics can be found in each applicable section. Definitions of terms used in Sections 4.2 through 4.9 are provided in **Section 1.3**.

Applicants are required to address all of the site characteristics and uses listed in Sections 4.2 through 4.9. For example, if a development includes both a fuel dispensing area and a vehicle washing facility, the source controls in both Sections 4.2 and 4.7 will apply.

4.1.2 Source Control Goals and Objectives

The specific source control standards are based on the following goals and objectives:

1) Prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.

2) Protect soil, groundwater and surface water by capturing acute releases and reducing chronic contamination of the environment.

3) Direct wastewater discharges and areas with the potential for relatively consistent wastewater discharges (such as vehicle washing facilities) to the wastewater system.

4) Direct areas that have the potential for acute releases or accidental spills, and are not expected to regularly receive flow or require water use (such as covered fuel islands or covered containment areas), to an approved method of containment or destination.

6) Safely contain spills on-site, avoiding preventable discharges to wastewater facilities, surface water bodies, or underground injection control structures (UICs).

7) Emphasize structural controls over operational procedures. Structural controls are not operator dependent and are considered to provide more permanent and reliable source control. Any proposals for operation-based source controls need to describe the long-term viability of the maintenance program.

4.1.3 Signage

Informational signage is required for certain site uses and activities that may pollute stormwater. Signage addresses good housekeeping rules and provides emergency response measures in case of an accidental spill.

All signage shall conform to the standards described in the following box. Additional signage for specific activities are noted in applicable sections.

Signs shall be located and plainly visible from all activity areas. More than one sign may be needed to accommodate larger activity areas. Signs shall be water-resistant and shall include the following information:

- Safety precautions for self protection and spill containment.
- Immediate spill response procedures—for example: "Turn the valve located at..." or "Use absorbent materials"
- Emergency contact(s) and telephone number(s)—for example: "Call 911" and "City of Eugene Spill Response Number 541-682-4800"

Any applicable spill response supplies must be clearly marked and located where the signage is posted and near the high-risk activity area. More than one spill response kit may be necessary to accommodate larger activity areas.

Spill sign samples recommend PMS 185 red and black on white

4.1.4 Request for Alternative Design Method of Source Control

Applicants must notify the City's Public Works Department of their request in writing, specifying the reason for the request and supporting it with technical and factual data. The Discharge Authorization Request **(DAR) Form**, located at the end of this chapter, should be used when requesting an alternative design to the source control design methodologies.

Staff will check the DAR Form and supporting information submittal for completeness prior to review and decision. The applicant should expect to be contacted within five (5) working days if additional documentation is needed.

If the request cannot be satisfied with this process, the adjustment review process, as described in **Appendix A**, will be implemented.

4.2 FUEL DISPENSING FACILITIES AND SURROUNDING TRAFFIC AREAS

4.2.1 Design

1) COVER

The fuel dispensing area shall be covered with a permanent canopy, roof, or awning so precipitation cannot come in contact with the fueling activity area. Rainfall shall be directed from the cover to an approved stormwater destination.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area it is to cover.

- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated fueling activity area it is to cover.

2) PAVEMENT

A paved fueling pad shall be placed under and around the fueling activity area with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the activity area, including placement and number of the vehicles or pieces of equipment to be fueled by each pump. Fuel pumps shall be located a minimum of seven feet from the edge of the fueling pad.

3) DRAINAGE

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains. This will prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to an approved City wastewater system, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated fueling pad to a stormwater destination that meet all stormwater management practices of this manual and other applicable code requirements.

4) SIGNAGE

Signage shall be provided at the fuel dispensing area and shall be plainly visible from all fueling activity areas. Detailed information about signage is located in **Section 4.1.4**, and examples have been provided.

5) SPILL CONTROL MANHOLE

A spill control manhole shall be installed on the discharge line of the fueling pad (before the domestic waste line tie-in). The tee section shall extend 18 inches below the outlet elevation, with an additional 3 feet of dead storage volume below the tee to provide storage for oil and grease. The manhole shall be located on private property. For more information about spill control manholes, see **Exhibit 2-25**.

6) SHUT-OFF VALVES

A. Shut off valves are required to protect the City sewer systems or onsite infiltration facilities of spill risks from chemicals and other constituents that provide a danger for wide spread contamination, system damages or risk to the public health. Manual shut off valves shall not be permitted unless a "Special Request" for an adjustment is approved by the City.

Shut off valves will be required under the following situations:

- Site or activity areas are corrosives or oxidizers are used or stored (for example, concentrated acids are corrosives having a pH of less than or equal to 2.0 and bases such as sodium or ammonium hydroxide having a pH of greater than or equal to 12.5, common oxidizers are hydrogen peroxide and bleach); or
- Substances which are water soluble or float on water. These substances can spread rapidly into downstream conveyance and destination systems causing wide spread impacts, and difficult clean up situations (for example, oil and grease); or
- Substances such as solvents and petroleum products that are known to infiltrate through soils and contaminate groundwater.

B. Traffic pathways that surround the fueling pad, also designated as high-use/high-risk areas, will require a shut-off valve on the storm drainage system. Valves installed on storm drainage systems shall be installed downstream of all private pollution reduction facilities to accommodate spill containment. These valves should be left open to facilitate stormwater flows during normal conditions, and immediately closed in the event of a spill.

C. Fueling pads will require a shut-off valve downstream of the spill control manhole. Valves installed on wastewater systems shall be installed before the domestic waste line tie-in. These valves must be kept closed, and only opened to allow incidental drainage activities that do not pose to be a threat or risk to the destination system. Immediately close the valve when drainage activities are completed.

Shut-off valves shall be located on private property and downstream of the exposed area's collection system. All valves shall be installed and maintained as per manufacturers recommendations. For more information about shut-off valves and associated valve boxes, contact Building & Permit Services at 541-682-5086.

7) ADDITIONAL REQUIREMENTS

A) **Installation, alterations, or removal of above-ground fuel tanks larger than 55 gallons, and any related equipment,** are subject to additional permitting requirements by the Eugene Fire Marshall's Office. For technical questions and permitting, call the Fire Marshall's Office Permit Center at 541-682-5411, or visit them at Permit & Information Center, 99 W. 10th Avenue, Eugene, OR 97401.

B) **Bulk fuel terminals, also known as tank farms,** will require the following:

- Secondary containment equal to 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.
- A separate containment area for all valves, pumps and coupling areas with sub-bermed areas either in front of or inside the main containment areas. These sub-bermed areas are required to have rain shields and be directed to a City wastewater system for disposal. If no City wastewater facility is available, drainage shall be directed to a temporary holding facility for proper disposal and may require a DEQ permit from the Underground Injection Control (UIC) program.
- An impervious floor within all containment areas. Floors must be sealed to prevent spills from contaminating the groundwater.
- Truck loading and off-loading areas. These areas shall follow cover, pavement, drainage, spill control, and shut-off valve requirements identified for fuel dispensing facilities.
- Shut-off valves installed for the drainage of the tank yard, shall be installed downstream of the drainage system of the primary containment area, and kept closed. Valves installed for the drainage of the truck pad and sub-bermed containment areas shall be installed on the wastewater line downstream of the spill control manhole.
- A batch discharge authorization before draining a containment area. This authorization will determine appropriate disposal methods, identify pretreatment requirements (if applicable), and authorize the discharge. Pretreatment may be required for oil and grease removal, and testing may be required to establish the specific characteristics of the discharge.

Underground fuel tanks less than 4,000 gallons in size are subject to additional permitting requirements by Oregon's Department of Environmental Quality (DEQ) and tanks larger than 4,000 gallons are referred to the Federal Environmental Protection Agency (EPA). For technical questions and permitting, call DEQ's NW Region main office at 1-800-844-8467 and ask for the Underground Storage Tank Permitting Department.

4.3 ABOVE-GROUND STORAGE OF LIQUID MATERIALS

4.3.1 Design

1) CONTAINMENT

Liquid materials shall be stored and contained in such a manner that if the container(s) is ruptured, the contents will not discharge, flow, or be washed into a receiving system. A containment device and/or structure for accidental spills shall have enough capacity to capture a minimum of 110 percent of the product's largest container or 10 percent of the total volume of product stored, whichever is larger.

Containers, such as double-walled containers, with internal protection are exempt from these spill containment requirements.

2) COVER

Storage containers (other than tanks) shall be completely covered so rainfall cannot come in contact with them. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.
- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

3) PAVEMENT

A paved storage area is required. The storage area shall be paved with asphalt or concrete and shall meet all applicable building code requirements. Sizing of the paved areas shall be adequate to cover the area intended for storage.

The applicant shall clearly identify any alternative method by submitting a **DAR Form,** located at the end of this chapter.

4) DRAINAGE

All paved storage areas shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater run-on to a storage area.

Covered storage areas: Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities <u>are not required</u> for the contained area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to an approved City wastewater facility or authorized pretreatment facility.

Uncovered storage areas with containment: Water will accumulate in uncovered storage areas during and after rain. Any *contaminated* water cannot simply be drained from the area. It must be collected, inspected, and tested at the expense of the property owner before proper disposal can be determined. Some type of monitoring may also be needed to determine the characteristics and level of contamination of the stormwater.

All discharges to the wastewater system shall be considered batch discharges and shall require approval and pretreatment prior to discharge. Pretreatment requirements shall be set as part of the discharge approval process, based on the types and quantities of material to be discharged. A discharge evaluation shall be performed before connection to a wastewater facility. Testing may be required to establish characteristics of the wastewater or contaminated stormwater and to verify that local discharge limits are not exceeded. For batch discharge applications, call PW's staff at 541-682-5291.

5) SIGNAGE

Signage shall be provided at the liquid storage area and shall be plainly visible from all surrounding activity areas. Detailed information and examples are located in **Section 4.1.4.**

6) ADDITIONAL REQUIREMENTS

A) **Covered storage areas:** If the applicant elects to install drainage facilities to an approved City wastewater facility, **a shut-off valve** may be required for the covered storage area. PW will make this determination based on the type of material stored and the proposed system receiving the discharge.

Uncovered storage areas: A shut-off valve shall be installed in the storage area so excess stormwater can be drained out of the activity area and directed either to the storm drainage facilities (*if clean*) or into the City wastewater system or authorized pretreatment facility (*if contaminated*). Except when excess stormwater is being discharged, the valve shall always be kept closed so any spills within the activity area can be effectively contained.

B) **Storage of hazardous materials** located in designated groundwater resource protection areas may be subject to additional requirements.

Tank farms **shall follow the criteria established for Bulk Fuel Terminals, under** Section 4.2.

C) **Storage of reactive, ignitable, or flammable liquids** shall comply with the Uniform Fire Code as adopted by the State of Oregon. Source controls presented in this section are intended to complement, not conflict with, current fire code requirements. None of these requirements shall exclude or supersede any other requirements in this manual, other City permit requirements, or state and federal laws pertaining to water quality. Contact the Eugene Fire Marshall (541-682-5411) and/or PW staff (541-682-5291) for further information and requirements.

4.4 SOLID WASTE STORAGE AREAS, CONTAINERS, AND TRASH COMPACTORS

4.4.1 Design

For approval of solid waste storage and handling activity areas in the City of Eugene, the following design requirements will apply. See below for a clarification of each requirement.

ACTIVITY/ USE	REQUIREMENTS			
	(1) Cover	(2) Pavement	(3) Isolated	(4) Wastewater Drain
Multi-residential (with shared trash areas)	X	X	X	X*
Commercial	X	X	X	X
Industrial	X	X	X	X
Compactors (regardless of use)	X	X	X	X
Can and bottle return stations	X	X	X	X

* Multi-residential ONLY. In the event gravity service to the wastewater lines cannot be obtained, a "Special Request" can be made to direct the drainage from the hydraulically isolated activity area to the development's stormwater pollution reduction facility. For more information, refer to **Additional Requirements** below.

1) COVER

A permanent canopy, roof, or awning must be provided to cover the solid waste storage activity area and shall be constructed to cover the activity area so rainfall cannot come in contact with the waste materials being stored. The cover shall be sized relative to the perimeter of the hydraulically isolated activity area it is to cover. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

2) PAVEMENT

A paved waste storage area is required when a structural cover or trash compactor is used. The area shall be paved with asphalt or concrete and meet all applicable building code requirements. Sizing of the paved area shall adequately cover the activity area intended for refuse storage, or the trash compactor(s) and associated equipment.

3) ISOLATION

Hydraulic isolation must be provided for the solid waste storage activity areas and shall be designed to prevent uncontaminated stormwater runoff from entering the area and carrying pollutants away. Runoff occurring outside the hydraulically isolated area shall be directed to a stormwater destination that meets all applicable code requirements. This can be achieved by reverse grading at the perimeter of an activity area, perimeter curbing or berming, or by the use of area drains to collect and divert runoff.

4) DRAINAGE

Drainage must be provided for the hydraulically isolated solid waste storage area and directed to the city's wastewater facility or authorized pretreatment facility. A wastewater drain is required for those areas that may be subject to refuse or suspected pollutants that pose a risk if the structural integrity of the trash receptacle is damaged or if its contents are exposed to rainfall.

Non-gravity Option
Activity areas that do not have gravity wastewater service can install a pressurized system. These types of installations will require the following to be provided at the time of building permit application:

1) Verification or evidence that gravity service cannot be obtained; and,
2) Details of an electronic sump pump system equipped with a float switch; and,
3) A completed DAR form.

Pressurized system installations are considered "permanent equipment" and deemed the property owner's liability in the event of system failure or if the property becomes vacated.

Building & Permit Services will review all sump pump or sewage ejector installations for compliance with Uniform Plumbing Code and Oregon State Plumbing Specialty Code. The PW staff will review for compliance with this chapter of the Stormwater Management Manual.

5) ADDITIONAL REQUIREMENTS

Multi-residential developments with shared trash areas may be allowed an alternative to the wastewater drain for the hydraulically isolated solid waste storage area. This activity area can drain to the site's privately owned and operated stormwater pollution reduction facility if gravity service to the wastewater pipe of the development cannot be obtained. In order to be considered for the alternative, information showing that gravity service cannot be obtained and a completed **DAR form** that has both the General Information and Special Request sections completed must be submitted. All requirements previously outlined for multi-residential uses will apply.

4.5 EXTERIOR STORAGE OF BULK MATERIALS

4.5.1 Bulk Materials Categories

The materials are separated into three categories based on risk assessments for each material stored: high-risk, low-risk, and exempt.

High-Risk Materials	Low-Risk Materials	Exempt Materials
• Recycling materials with potential effluent • Corrosive materials (*i.e.* lead-acid batteries) • Storage and processing of food items • Chalk/gypsum products • Feedstock/grain • Material by-products with potential effluent • Asphalt • Fertilizer • Pesticides • Lime/lye/soda ash • Animal/human wastes	• Recycling materials without potential effluent • Scrap or salvage goods • Metal • Sawdust/bark chips • Sand/dirt/soil (including contaminated soil piles) • Material by-products without potential effluent • Unwashed gravel/rock • Compost	• Washed gravel/rock • Finished lumber • Rubber and plastic products (hoses, gaskets, pipe, *etc.*) • Clean concrete products (blocks, pipe, *etc.*) • Glass products (new, non-recycled) • Inert products

4.5.2 Design

1) COVER

Low-risk materials must be covered with a temporary plastic film or sheeting at a minimum.

High-risk materials are required to be permanently covered with a canopy or roof to prevent stormwater contact and minimize the quantity of rainfall entering the storage area. Runoff shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated activity area.

2) PAVEMENT

Low-risk material storage areas are not required to be paved.

High-risk material storage areas shall be paved beneath the structural cover.

3) DRAINAGE

Low-risk material storage areas are allowed in areas served by standard stormwater management systems. However, all erodible materials being stored must be protected from rainfall.

If materials are erodible, a structural containment barrier shall be placed on at least three sides of every stockpile to act as a barrier to prevent uncontaminated stormwater from running onto the storage area and carrying pollutants away. If the area under the stockpile is paved, the barrier can be constructed of asphalt berms, concrete curbing, or retaining walls. If the area under the stockpile is unpaved, sunken retaining walls or ecology blocks can be used. The applicant shall clearly identify the method of containment on the building plans, and on the **DAR form**, located at the end of this chapter.

For **high-risk** material storage areas, the paved area beneath the structural cover shall be hydraulically isolated through grading, structural containment berms or walls, or perimeter drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Significant amounts of precipitation are not expected to accumulate in covered storage areas, and drainage facilities <u>are not required</u> for the containment area beneath the cover. If the applicant elects to install drainage facilities, the drainage from the hydraulically isolated area shall be directed to the City's wastewater facility or authorized pretreatment facility.

4) ADDITIONAL REQUIREMENTS

A) **Storage of pesticides and fertilizers** may need to comply with specific regulations outlined by the Oregon Department of Environmental Quality (DEQ). For answers to technical questions, call DEQ's NW Region main office at 1-800-844-8467.

B) **A sampling manhole** or other suitable stormwater monitoring access point may be required to monitor stormwater runoff from the storage area. This may apply to certain types of storage activities and materials or if an alternative source control is proposed. This requirement complies with Eugene Code, which requires appropriate stormwater destination. PW staff will review for applicability of this requirement.

C) **Signage** shall be provided at the storage area if hazardous materials or other materials of concern are stored. Signage shall be located so it is plainly visible from all storage activity areas. More than one sign may be needed to accommodate large storage areas. Detailed information and examples are provided in Section 4.1.3.

D) If the applicant elects to install drainage facilities to the City's wastewater facility, **a shut-off valve** may be required for the structurally covered storage area. Eugene will make this determination based on the type of material stored and the proposed system receiving the discharge.

4.6 MATERIAL TRANSFER AREAS/LOADING DOCKS

4.6.1 Material Transfer Areas

Two standard types of material transfer areas associated with buildings are:

1) loading/unloading facilities with docks, and 2) large bay doors without docks. The requirements apply to all material transfer areas, including loading/unloading docks, bay doors, and any other building access point(s) with the following characteristics:

- The area is designed (size, width, *etc.*) to accommodate a truck or trailer being backed up to or into it; and,
- The area is expected to be used specifically to receive or distribute materials to and from trucks or trailers.

4.6.2 Design

1) PAVEMENT

A paved material transfer area shall be placed underneath and around the loading and unloading activity area with asphalt or concrete that meets all applicable building code requirements. This will reduce the potential for soil contamination with potential impacts on groundwater and will help control any acute or chronic release of materials present in these areas.

2) ISOLATION

Loading Docks

The first three feet of the paved area, measured from the building or dock face, shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away.

Bay Doors and Other Interior Transfer Areas

Bay doors and other interior transfer areas shall be designed so that stormwater runoff does not enter the building. This can be accomplished by grading or drains.

3) DRAINAGE

Loading Docks

Drainage from the hydraulically isolated area shall be directed to the City's wastewater facility or authorized pretreatment facility. Surrounding runoff and drainage from the access ramp shall be directed away from the hydraulically isolated area to a stormwater destination that meets all applicable requirements of this manual.

The requirement for the drainage from the hydraulically isolated area of the loading dock to be directed to the City's wastewater facility, or authorized pretreatment facility may be waived if PW determines there is no gravity wastewater service available and an appropriately sized, underground temporary storage structure (such as a catch basin with no outlet or dead-end sump) is provided. A completed DAR form will be required.

<u>Non-Gravity Option</u>

Activity areas that cannot achieve gravity wastewater service may be allowed to install a pressurized system. These types of installations will require the following to be provided at the time of building permit application:

1) Proof that gravity wastewater service cannot be obtained; and,
2) Details of an electronic sump pump system equipped with a float switch; and,
3) A completed **DAR form.**

Pressurized system installations are considered "permanent equipment" and deemed the property owner's liability in the event of system failure or if the property becomes vacated.

The Building & Permit Services will review all sump pump or sewage ejector installations for compliance with Uniform Plumbing Code and Oregon State Plumbing Specialty Code. The City will review for compliance with this chapter of the Stormwater Management Manual.

Bay Doors and Other Interior Transfer Areas

Because interior material transfer areas are not expected to accumulate precipitation, installation of floor drains is not required or recommended. It is preferable to handle these areas with a dry-mop or absorbent material. If interior floor drains are installed, they shall be plumbed to the City's wastewater facility or authorized pretreatment facility.

4) SIGNAGE

Signage shall be provided at the material transfer area and shall be plainly visible from all surrounding activity areas. Detailed information and examples are located in **Section 4.1.4.**

5) ADDITIONAL REQUIREMENTS

A) **Bay doors and other interior transfer areas** shall provide a 10-foot "no obstruction zone" beyond the entrance within the building. This will allow the transfer of materials to occur with the truck or trailer end placed at least 5 feet inside the building, with an additional staging area of 5 feet beyond that. The "no obstruction" zone shall be clearly identified on the building plan at the time of the building permit application, and identified at the facility by painting the no obstruction zone with a bright or fluorescent floor paint.

B) **<u>Shut-off valves will be required under the following situations</u>:**

1) Site activity areas are exposed to corrosives or oxidizers that can harm conveyance system components (such as battery acid).
2) Substances that do not settle or remain in one location, but are capable of being dissolved in or float on top of water (such as oil and grease). These substances can spread rapidly into downstream systems, causing widespread impacts and difficult clean-up situations.
3) Substances that are known to infiltrate through soils and contaminate groundwater.

Valves located in material transfer areas are typically left open to facilitate drainage during normal conditions, and immediately closed in the event of a spill.

Prior to transfer activities of harmful substances, the valves should be closed and only re-opened after the transfer is complete. The shut-off valves must be located on private property and downstream of the exposed area's collection system.

All valves shall be installed and maintained in accordance with manufacturer specifications. For more information about shut-off valves and associated valve boxes, contact the Building & Permit Services at 541-682-5086.

4.7 EQUIPMENT AND/OR VEHICLE WASHING FACILITIES

4.7.1 Design

1) COVER

The washing area shall be covered with a permanent canopy or roof so precipitation cannot come in contact with the washing activity area. Precipitation shall be directed from the cover to a stormwater destination that meets all applicable code requirements.

- **Covers 10 feet high or less** shall have a minimum overhang of 3 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.
- **Covers higher than 10 feet** shall have a minimum overhang of 5 feet on each side. The overhang shall be measured relative to the perimeter of the hydraulically isolated washing activity area it is to cover.

2) PAVEMENT

A paved wash pad shall be placed under and around the washing activity area with asphalt or concrete that meets all applicable building code requirements. Sizing of the paved area shall adequately cover the activity area, including the placement of the vehicle or piece of equipment to be cleaned.

3) DRAINAGE

The paved area beneath the cover shall be hydraulically isolated through grading, berms, or drains to prevent uncontaminated stormwater from running onto the area and carrying pollutants away. Drainage from the hydraulically isolated area shall be directed to the City's wastewater facility, or authorized pretreatment facility. Surrounding runoff shall be directed away from the hydraulically isolated washing pad to a stormwater destination that meets all applicable requirements of this manual.

4) OIL CONTROLS

All vehicle and equipment washing activities will be reviewed for needed oil controls to comply with the City's wastewater discharge limits. The following design criteria are established for oil/water separators discharging to a wastewater facility:

A) <u>Washing Areas Protected with a Cover or Located Inside a Structure</u>

1) Baffled oil/water separators and spill control (SC-Type) separators shall not be allowed for use with equipment and/or vehicle washing applications. *Note: Activities and processes of a washing facility change over time and the introduction of heat and surfactants may occur.*

2) Coalescing plate separators shall be designed to achieve 100 ppm non-polar oil and grease in the effluent from the peak flow generated by the washing activity. Testing information must be submitted by the manufacturer of the unit that supports the 100 ppm effluent standard at the calculated flow rate.
    a. Standard flow from a 5/8" hose is estimated to be 10 gpm.
    b. For specially designed washing units, check the vendor specifications for maximum flow rates.
3) Any pumping devices shall be installed downstream of the separator to prevent oil emulsification.
4) Separator details must be shown on the building plans submitted for permit, and shall match manufacturer specifications and details, including the unit flow rate, effluent water quality, and maximum process flow rate.

B) <u>On-site Wash Recycling Systems</u>
Wash recycling systems may be used for oil control as long as they can meet effluent discharge limits for the City's wastewater system. A detail of the wash recycling system and vendor specifications identifying effluent efficiencies shall be submitted as part of the building plans at the time of building permit application.

4.8 STORMWATER AND GROUNDWATER MANAGEMENT FOR DEVELOPMENT ON LAND WITH SUSPECTED OR KNOWN CONTAMINATION

4.8.1 Review and Permit Process

In addition to local, state and federal regulations requiring special handling and management of site soils, groundwater, and surface drainage may be necessary. As a result of these regulations, sites with suspected or known contamination will require a more detailed review process and may delay issuance of related building permits.

To research contaminant information, parties should refer to DEQ's Facility Profiler database, which can be found at: http://deq12.deq.state.or.us

If records indicate that a No Further Action (NFA) or Record of Decision (ROD) exist for your site, you must contact DEQ prior to pre and post construction activities to ensure conditions of record are not violated. For technical questions related to site contamination and clean-up, contact the Land Quality Division of DEQ.

All regulatory Divisions or Departments of DEQ, as referenced in this section, can be reached by calling DEQ's Northwest Region Office at 1-800-844-8467.

Note: Even if DEQ does not have a site included in it's tracking database, this does not mean that contamination may not be present. At a minimum, if commercial or industrial history exists, a Phase I site assessment should be performed prior to design.

Contaminants have the potential to become entrained and transported through exposure to construction activities and post-construction design elements of a development. The requirements in this section apply to excavation and stockpiling of contaminated soils, and disposal or re-use facilities related to groundwater, foundation or footing drains, interior floor drains in basements or sub-grade structures, construction dewatering, and surface stormwater treatment and conveyance systems.

4.8.2 Design

Contaminants, media, and site conditions are unique to each parcel of land, therefore sites at risk for contamination shall be reviewed on a case-by-case basis.

1) SOIL MANAGEMENT

Stockpiles of contaminated soils shall be covered with temporary plastic film or sheeting to prevent stormwater from coming into contact with them.

Stockpile perimeters shall have a containment barrier on all four sides of every stockpile to prevent stormwater run-on and material run-off. Barriers can consist of concrete curbing, silt fencing, or other berming material, depending on the activity, size, and resources available.

Areas under stockpiles of contaminated soils are not required to be paved. However, an impervious layer shall be placed beneath the stockpile to protect uncontaminated areas from potential leachate.

2) CONSTRUCTION DEWATERING

All construction dewatering discharges resulting from groundwater or precipitation (rainfall) shall be evaluated for contamination before disposal methods can be approved.

If on-site infiltration is the proposed method for disposal, authorizations must be obtained from the City and the Land Quality Division of DEQ.

Infiltration systems for private construction dewatering must be located and maintained on private property, outside the public rights-of-way.

If on-site sub-surface injection is the proposed method for disposal, authorizations must be obtained from the City and the Water Quality Division of DEQ.

Private sub-surface injection systems (a.k.a. Underground Injection Controls) must be located and maintained on private property, outside the public rights-of-way.

If a receiving stream is the proposed method for disposal, authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If an off-site City sewer system is the proposed method for disposal, authorization must be obtained from the City. Authorizations will be permitted through a discharge authorization letter. All groundwater discharge applications will go through an evaluation process before a discharge to the City sewer system will be permitted. Evaluations for discharges from sites with suspected contamination shall be based on the following:

a) Discharges to a storm sewer system will be required to meet instream water quality standards, as stated in OAR 340-41, Table 20. Table 20 can be found on the internet at **www.deq.state.or.us/wq/wqrules/340Div41Tbl20.pdf**

b) Discharges to a sump system will be required to meet safe drinking water standards, as stated in the National Safe Drinking Water Act. The safe drinking water standards can be found on the internet at: **www.epa.gov/safewater/mcl.html#mcls**

c) Discharges to a wastewater system will only be allowed if extensive pretreatment is required and the discharge is approved through the City's Wastewater

Discharge Permit process. All groundwater and surface water discharges to a wastewater system will be required to meet discharge limits of the Wastewater Discharge Permit, and will be subject to discharge volume charges. Discharges will be charged at wastewater volume rates, as stated in City Code.

d) Lab analysis reports will be required, as defined at the end of this section.

e) A temporary sampling point is required if multiple discharges are proposed. The temporary sampling point shall be agreed upon between the City staff member processing the Wastewater Discharge Permit and the applicant.

Source control requirements will be identified as part of the review process of the laboratory analysis reports and the building permit application. Source Controls, sampling points and destination shall be identified on the erosion control plan of the building permit application.

For technical assistance on obtaining a batch discharge authorization for construction dewatering activities, contact PW staff at 541-682-5291.

3) POST-CONSTRUCTION SURFACE DRAINAGE SYSTEMS

If on-site infiltration is the proposed method for disposal, authorizations must be obtained from the City and the Land Quality Division of DEQ.

Private infiltration systems must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If on-site subsurface injection is the proposed method for disposal, authorizations must be obtained from the City and the Water Quality Division of DEQ.

Private Underground Injection Controls must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If a receiving stream is the proposed method for disposal, authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If an off-site City stormwater or wastewater system is the proposed method for disposal, authorization must be obtained from the City. The determination of where you can dispose of the surface drainage shall be based on the following:

a) Surface drainage systems, that are not exposed to contaminated soils or subsurface discharges that are not expected to contain contaminants, can connect to the off-site City stormwater system..

b) Surface drainage systems, that are exposed to contaminated soils or subsurface discharges that are expected to contain contaminants, must go through the same evaluation criteria as stated under 4.8.2 2) Construction Dewatering (a-e) with the following replacement for e):
   e) A permanent monitoring point is required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

4) POST-CONSTRUCTION WATER RECLAIM OR RE-USE SYSTEMS

Water reclamation or re-use systems provide innovative ways to use natural resources and save money. However, using groundwater as a resource from sites at risk for contamination may require additional source controls and environmental compliance regulations depending on the nature of the contaminants and the extent of the remediation that has been completed

Authorizations for re-use systems will need to be obtained from the City, the Oregon Water Resource Department, and DEQ.

If surface drainage systems are the proposed resource, discharges are not expected to contain contaminants and do not pose to be a threat to City infrastructure. Review will verify that there is no interaction between groundwater and the surface.

<u>Non-potable uses</u> for plumbing fixtures and industrial equipment, *i.e.* cooling towers or boilers, will require the following:

a) A discharge meter shall be installed on the outlet of the re-use system for sewer billing purposes.

b) Industrial equipment bleed-offs or drain valves shall have discharges routed to the wastewater line of the facility.

c) Overflows from the re-use system, prior to use, are not considered wastewater and shall have discharges routed to the storm destination system of the facility.

<u>Irrigation systems</u> may encourage transportation of contaminants and should obtain authorization from the Land Quality Division of DEQ prior to installation.

If sub-surface drainage systems are the proposed resource, discharges may contain contaminants and shall be evaluated for contamination before disposal methods can be approved.

Non- potable uses for plumbing fixtures and industrial equipment, *i.e.* cooling towers or boilers, will require the following:

a) A discharge meter shall be installed on the outlet of the re-use system for sewer billing purposes.

b) Industrial equipment bleed-offs or drain valves shall have discharges routed to the wastewater line of the facility. Discharges will be required to meet local discharge limits, as stated in City Code.

c) Overflows from the re-use system, prior to use, may contain contaminants so the requirements stated under **Post-Construction Subsurface Drainage Systems** will apply.

d) A permanent monitoring point may be required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

Irrigation systems may encourage transportation of contaminants and should obtain authorization from the Land Quality Division of DEQ prior to installation.

If groundwater is proposed for commercial or industrial uses of a development, i.e. non-potable uses or irrigation, authorization or a permit should be obtained through the Oregon Water Resource Department (WRD) prior to use.

Minimum requirements that warrant a permit for industrial and commercial groundwater wells include, but are not limited to, irrigation of areas greater than ½ an acre, and use of more than 5,000 gpd of water. Unique groundwater reuse systems, anything other than a standard supply well installation, shall be reviewed on a case-by-case basis to determine permitting requirements (if applicable).

For assistance in obtaining authorization for the use of groundwater, contact Lane County Water Master at 541-682-3620. For more information on water rights and groundwater regulations the Oregon Water Resource Department website can be found on the Internet at: **www.wrd.state.or.us**

5) POST CONSTRUCTION SUB-SURFACE DRAINAGE SYSTEMS

Structures proposed below grade, in an area at risk for contamination, can greatly impact and add unexpected costs to the surface drainage systems, water reclaim or re-use systems and subsurface drainage systems of a project.

All surface, sub-surface and re-use systems shall be evaluated for contamination risks before disposal and re-use methods can be approved.

If on-site infiltration is the proposed method for disposal, authorizations will need to be obtained from the City and the Land Quality Division of DEQ.

Private infiltration systems will need to be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits will need to be obtained.

If on-site subsurface injection is the proposed method for disposal, authorizations must be obtained from the City and DEQ.

Private subsurface injection systems (or Underground Injection Controls) must be located and maintained on private property, outside the public rights-of-way. If crossings of public rights-of-way are necessary, authorizations and permits must be obtained.

If a receiving stream is the proposed method for disposal [destination], authorizations must be obtained from the City, the Army Corp of Engineers, and both Land Quality and Water Quality Divisions of DEQ.

If crossings of public rights-of-way are necessary to obtain access to an approved discharge point of a receiving stream, authorizations and permits must be obtained.

If an off-site City stormwater and wastewater system is the proposed method for disposal, authorization must be obtained from the City. Evaluations for discharges from sites with suspected contamination shall be based on the same criteria as stated under Construction Dewatering, Section 4.8.2 (2), items a) through d), with the following replacement for e):

e) A permanent monitoring point may be required to ensure compliance with local discharge regulations. Refer to 4.8.2 (7) for more information on permanent monitoring points.

6) LABORATORY ANALYSIS REPORTS

Laboratory analysis reports are required to identify the characteristics and levels of contamination in the soils and groundwater of a site.

An additional review process will be applied to these reports to determine regulatory authority and requirements. Testing and analysis are highly recommended prior to building permit applications. DEQ permitting and/or review may be required if contaminants are found, and levels of contamination appear to exceed the City's local discharge regulations. This may delay issuance of related building permits.

Lab analysis reports shall include the following information:

a) Analysis reports shall identify the elevation of the seasonal water table and identify the depth of any perched water aquifers.

b) Analysis reports shall identify the method of laboratory testing, the detection level and analytical method for detection, and the depth of any found contaminants in the soils.

c) Minimum test parameters for base line contaminants shall include: metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc), TPH (total petroleum hydrocarbons), and BTEX (benzene, toluene, ethylbenzene and xylene).

d) Test parameters may be required to include other contaminants as identified through historical data, research and environmental assessments.

e) If post-construction subsurface drainage or dewatering systems are proposed to discharge to a City separated storm sewer system, test parameters will be required to include the instream water quality standards as identified under OAR 340-41, Table 20. Table 20 can be found on the internet at: **www.deq.state.or.us/wq/wqrules/340Div41Tbl20.pdf**

f) If post-construction subsurface drainage or dewatering systems are proposed to discharge to a City sump system, test parameters will be required to include the safe drinking water standards as identified in the National Safe Drinking Water Act. These standards can be found on the internet at: **www.epa.gov/safewater/mcl.html#mcls**

7) PERMANENT MONITORING POINTS

To ensure compliance with local discharge regulations, a suitable monitoring point may be required to monitor groundwater discharges to an off-site City sewer system. Monitoring requirements will be identified as part of the review process of the laboratory analysis reports and the building permit application. If monitoring is necessary, a permanent structure (such as a sampling manhole or flow through vault) shall be installed on the discharge line of the subsurface drainage system.

Structure type and location will need to be approved by the assigned City Source Control plans examiner, complying with Eugene Code. For technical assistance on suitable monitoring points, contact PW staff at 541-682-5291.

8) ADDITIONAL REQUIREMENTS

All structural controls of this section require a Discharge Authorization Request (DAR) form, located at the end of this chapter. Typical controls needing a DAR form would be containment areas, shut-off valves, oil/water separators, etc. If you request an alternative or adjustment to any of the source controls identified in this section. These types of requests will require an additional review process and may delay issuance of related building or public works permits.

4.9 COVERED VEHICLE PARKING AREAS

4.9.1 Design

1) DRAINAGE

Top Floor Drainage of a Multi-Level Parking Structure

Stormwater runoff from the top floor shall be directed to a stormwater destination that meets all water quality requirements of this manual and any other applicable code requirements.

Lower Floor Drainage of a Multi-Level Parking Structure

Significant amounts of precipitation are not expected to accumulate in covered vehicle parking areas, and drainage facilities <u>are not required</u> for the lower floors. If the applicant elects to install drainage facilities, the drainage from the lower floors shall be directed to an approved City wastewater facility.

Adjacent, Uncovered Portions of the Site

The surrounding uncovered portions of the site shall be designed so stormwater does not enter the covered parking areas. This can be accomplished through grading or drains.

DISCHARGE AUTHORIZATION REQUEST

for

Source Control(s)

Discharge Authorizations are required for source controls in areas that have site characteristics and facility uses that have activities at risk for source point pollutant releases that are regulated or prohibited by local, state and federal regulations.

NOTE: A separate Authorization shall be filled out for each activity area, and Special Requests are available on the second page of this form.

GENERAL INFORMATION (*to be completed for all Discharge Authorization Requests*)

Applicant's Name: ______________________________ Date: __________

Facility Name: ______________ Owner/Operator Name: ________________

Facility Address: ____

Business Mailing Address: ________________________________

Phone No.: ________________ Type of business/facility: ________________

Building Permit No. (*if applicable*): ________________________________

SOURCE CONTROL INFORMATION

Installation of Source Control(s) are a result of:

- ☐ Tenant Improvements to an existing facility and/or building.
- ☐ New Development of a site or property that was unimproved.
- ☐ Re-Development of a site or property that had prior uses.
- ☐ Code Compliance in response to local, state or federal notification.
- ☐ Other: ________________________________

Proposed Source Control(s) (*check all that apply*):

- ☐ Oil/Water Separator
- ☐ Dock Leveler Pit with Retrofit
- ☐ Wall Valve for Containment Area
- ☐ Collection Device/ Structure
- ☐ Other:
- ☐ Containment Area
- ☐ Sedimentation Manhole with Retrofit
- ☐ Discharge Line Shut-Off Valve
- ☐ Cooling Towers
- ☐ Other: ________________

[NOTE: Additional City approved "Standard Maintenance" appendices will be required for each Source Control listed above, or provide a vendor's Maintenance document (if available). Contact PW at 541-682-5291 for applicable appendices.]

Describe the site activity (ies) the source control(s) apply to:

____

____

____

(DISCHARGE AUTHORIZATION REQUEST FORM CONT.)

Attach a site plan with the location of the Source Control. Be sure to identify the location in reference to a permanent structure, for assistance in field verification. *(A hand-drawn sketch, not to scale, is acceptable as long as it is legible.)*

SPECIAL REQUEST (*check only if applicable*)

- ☐ Request to *remove* or *abandon* existing source control(s).
- ☐ Request to propose *alternative* source control(s).
- ☐ Request to *ADJUST* source control requirement(s).
- ☐ Request for review of *ADJUSTMENT* qualifications.

Please provide a brief explanation (*Use additional pages if necessary.*): ____________________

____

____

____

TO BE COMPLETED BY CITY:

☐ Approved ☐ Denied

Date: ________ Signature: ______________________ Dept.: __________

Comments: ____

____

____

ORDINANCE NO. 20369

AN ORDINANCE CONCERNING STORMWATER PROVISIONS; AMENDING SECTIONS 9.0500, 9.6420, 9.8030, 9.8055, 9.8090, 9.8100, 9.8215, 9.8220, 9.8320, 9.8325, 9.8440, 9.8445, 9.8515, AND 9.8520 OF THE EUGENE CODE, 1971; REPEALING SECTION 9.6510 OF THAT CODE; AND ADDING SECTIONS 9.6790, 9.6791, 9.6792, 9.6793, 9.6794, 9.6795, 9.6796, AND 9.6797 TO THAT CODE.

THE CITY OF EUGENE DOES ORDAIN AS FOLLOWS:

Section 1. Section 9.0500 of the Eugene Code, 1971 is amended by adding the following definitions in alphabetical order to the existing definitions, to provide:

9.0500 **Definitions**. As used in this land use code, unless the context requires otherwise, the following words and phrases mean:

Destination. The ultimate discharge point for the stormwater runoff from a particular site. Destination can include on-site infiltration such as surface infiltration facilities, drywells and sumps, and soakage trenches, and off-site flow to ditches, drainage ways, rivers and streams, and off-site storm pipes.

Equivalent on-site area. An area of existing impervious surface that: (1) does not have facilities or structures to treat stormwater runoff; (2) is of equal or greater square footage to the area of proposed new impervious surface on the same site; and, (3) is of equal use.

Flood control design storm. A theoretical storm for evaluating the capacity of the storm drainage system and designing improvements for the required level of protection, in accordance with the Stormwater Management Manual.

Flow control facility. Any structure or drainage device that is designed, constructed, and maintained to collect, retain, infiltrate, or detain surface water runoff during and after a storm event for the purpose of controlling post-development water quantity leaving the development site.

Headwaters Area. The area within Eugene city limits that is above 500 feet.

Headwater streams. Streams that: (1) are identified on the Headwater Streams Map (an Appendix to the Stormwater Management Manual) as having all or a portion of their length located on slopes greater than 10%; (2) are identified on the Sensitive Areas Map as having all or a portion of their length located in areas with highly erodible soils; (3) are at least 500 feet or longer; and, (4) drain at least 10 acres.

Impervious surface/area. Any surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from conditions pre-existing to development. Types of impervious surface include, but are not limited to, rooftops, asphalt and concrete parking lots, driveways, roads, sidewalks, and pedestrian plazas. *Note:* Slatted decks are considered pervious. Gravel surfaces are considered pervious unless they cover impervious surfaces or are compacted to a degree that causes their runoff coefficient to exceed 0.8.

Oil control facility. Any structure or drainage device that is designed, constructed, and maintained to remove oil and grease from storm runoff.

Pollution reduction facility. Any structure or drainage device that is designed, constructed, and maintained to collect and filter, retain, or detain surface water runoff during and after a storm event for the purpose of maintaining or improving surface and/or groundwater quality.

Property suspected or known to contain contaminants in the soil or groundwater. Any real property where the presence of any hazardous substance or petroleum product indicates an existing release, past release, or threatened release of a hazardous substance or petroleum product into the ground, ground water, or surface water of the property.

Source control. Any structure, device, or design that is used to eliminate or reduce pollution from a source.

Stormwater Management Manual. The City of Eugene Stormwater Management Manual adopted by the city in the manner set forth in EC 2.019, <u>City Manager – Administrative and Rulemaking Authority and Procedures</u>.

Stormwater Management Facility. Any structure or configuration of the ground that is used or, by its location, becomes a place where stormwater flows or is accumulated, including but not limited to, pipes, sewers, curbs, gutters, manholes, catch basins, ponds, open drainage ways, runoff control facilities, wetlands, and their accessories.

Water Quality Design Storm. A theoretical storm for estimating the amount of stormwater runoff to be treated. Facilities designed to store and treat a volume of stormwater shall be sized in accordance with the Stormwater Management Manual.

<u>Section 2</u>. Subsection (2) of Section 9.6420 of the Eugene Code, 1971, is amended as follows.

9.6420 Parking Area Standards.

(2) **Drainage.** All parking areas, except those in conjunction with a single family or two family dwelling, shall be graded so as not to drain storm water over the public sidewalk or onto any abutting property. Drainage improvements shall be provided as required by the stormwater provisions of EC 9.6790 to 9.6797.

Section 3. Section 9.6510 of the Eugene Code, 1971, is repealed.

Section 4. Sections 9.6790, 9.6791, 9.6792, 9.6793, 9.6794, 9.6795, 9.6796, and 9.6797 are added to the Eugene Code, 1971, to provide:

9.6790 Stormwater Management Manual. In order to implement Section 9.6791 through 9.6797 of this code, the City Manager shall adopt in accordance with EC 2.019, City Manager – Administrative and Rulemaking Authority and Procedures, a Stormwater Management Manual. The Stormwater Management Manual may contain forms, maps and facility agreements and shall include requirements that are consistent with the following goals:

(1) Reduce runoff pollution from development by reducing impervious surfaces and capturing and treating approximately 80% of the average annual rainfall.

(2) Control and minimize flows from development in the Headwater Areas using a variety of techniques to release water to downstream conveyance systems at a slower rate and lower volume, thereby reducing the potential for further aggravation of instream erosion problems.

(3) Emphasize stormwater management facilities that incorporate vegetation as a key element, and include design and construction requirements that ensure landscape plant survival and overall stormwater facility functional success.

(4) Operate and maintain stormwater management facilities in accordance with facility-specific O & M Plans.

(5) Reduce pollutants of concern that are generated by identified site uses and site characteristics that are not addressed solely through the pollution reduction measures by implementing additional specific source control methods including reducing or eliminating pathways that may introduce pollutants into stormwater, capturing acute releases, directing wastewater discharges and areas with the potential for relatively consistent wastewater discharges to the wastewater system, containing spills on site, and avoiding preventable discharges to wastewater facilities, surface waters or ground waters.

9.6791 Stormwater Destination.

(1) **Purpose.** The purpose of EC 9.6791 is to protect life and property from flood and drainage hazards by maintaining the capacity of the city's stormwater conveyance system through the establishment of destination regulations for stormwater runoff from development.

(2) **Applicability.** Destination standards apply to all development.

(3) **Standards.** Stormwater drainage facilities shall be designed and constructed

according to adopted plans and policies, and in accordance with standards in EC Chapters 6 and 7, and the stormwater destination provisions and the facility design requirements set forth in the Stormwater Management Manual. An applicant proposing a new development must submit documentation to the city showing the stormwater destination into which the proposed development will be disposed. The documentation must establish that the new development will be disposed of into existing stormwater drainage facilities that, considering all developments that have received tentative or final plan approval as of the date the developer submits a complete application, have the capacity to handle the stormwater runoff that will be generated by the proposed new development for the flood control design storm, or, if the applicant cannot establish that existing stormwater drainage facilities have such capacity, the applicant must construct storm drainage facilities to accommodate the stormwater draining from the proposed development.

(4) **Underground Injection Control Systems.** Stormwater runoff disposed of in underground systems is also regulated through the federal Underground Injection Control (UIC) program under Part C of the Safe Drinking Water Act (42 U.S.C. § 300, Chapter 6A, Subchapter XII) and Oregon Administrative Rule Chapter 340, Section 044.

9.6792 **<u>Stormwater Pollution Reduction.</u>**

(1) **Purpose.** The purpose of EC 9.6792 is to reduce the impacts that urbanization is having on the city's water quality by providing standards for the capture and treatment of stormwater runoff from development.

(2) **Applicability and Exemptions.**

(a) Except as exempt under EC 9.6792(2)(c), the standards in EC 9.6792(3) apply to all land use applications submitted after July 14, 2006 requesting approval of one or more of the following:

1. A cluster subdivision - tentative plan (EC 9.8055);
2. A conditional use (EC 9.8090 or 9.8100);
3. A partition - tentative plan (EC 9.8215 or 9.8220);
4. A planned unit development - tentative plan (EC 9.8320 or 9.8325);
5. Site review (EC 9.8440 or 9.8445);
6. A subdivision tentative plan (EC 9.8515 or 9.8520).

(b) Except as exempt under EC 9.6792(2)(c), the standards in EC 9.6792(3) apply to all applications for development permits submitted after July 14, 2006.

(c) The standards in EC 9.6792(3) do not apply to:

1. A land use application that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development.
2. A development permit application for any of the following:

a. Development of a lot or parcel included in a land use application that was determined by the city to comply with the standards in EC 9.6792(3). For such a development permit, the approved land use plan shall control.

b. Development of a lot or parcel that was not included in a land use application that was determined by the city to comply with the standards in EC 9.6792(3) and:

(1) Will result in less than 1,000 square feet of new or replaced impervious surface within a 12 month period; or

(2) Is to construct or alter a one or two family dwelling; or

(3) The replacement of more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site.

(3) **Standards.**

(a) Applications shall include pollution reduction facilities selected from the Stormwater Management Manual as follows:

1. For land use applications listed in EC 9.6792(2)(a) for undeveloped land, the selected pollution reduction facilities shall treat all the stormwater runoff from the development site that will result from the water quality design storm;
2. For land use applications listed in EC 9.6792(2)(a) that change or add development to an already developed site, the selected pollution reduction facilities shall treat the stormwater runoff from all added and replaced impervious surface that will result from the water quality design storm;
3. For development permit applications, the selected pollution reduction facilities shall treat all stormwater runoff from all new or replaced impervious surface, or an equivalent on-site area, that will result from the water quality design storm;

(b) All pollution reduction facilities shall be sited, designed and constructed according to the pollution reduction provisions and the facility design requirements set forth in the Stormwater Management Manual. Pollution reduction facilities must be designed using one of the three methodologies outlined in the Stormwater Management Manual.

(c) The standards in EC 9.6792(3) may be adjusted pursuant to EC 9.8030(24).

9.6793 <u>Stormwater Flow Control (Headwaters)</u>.

(1) **Purpose.** The purpose of EC 9.6793 is to protect waterways in the headwaters area from the erosive affects of increases in stormwater runoff peak flow rates and volumes resulting from development.

(2) **Applicability and Exemptions.**

(a) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all land use applications for development sites in the headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006 requesting approval of one or more of the following:

1. A cluster subdivision - tentative plan (EC 9.8055);

2. A conditional use (EC 9.8090 or 9.8100);
3. A partition - tentative plan (EC 9.8215 or 9.8220);
4. A planned unit development - tentative plan (EC 9.8320 or 9.8325);
5. Site review (EC 9.8440 or 9.8445);
6. A subdivision tentative plan (EC 9.8515 or 9.8520).

(b) Except as exempt under EC 9.6793(2)(c), the standards in EC 9.6793(3) apply to all applications for development permits for development sites in a headwaters area that drain directly into a headwater stream or drain into a pipe that discharges into a headwater stream that are submitted after July 14, 2006.

(c) The standards in EC 9.6793(3) do not apply to:

1. A land use application that will result in the construction or creation of less than 1,000 square feet of new or replaced impervious surface at full buildout of the development.
2. A development permit application for any of the following:
    a. Development of a lot or parcel included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3). For such a development permit, the approved land use plan shall control.
    b. Development of a lot or parcel that was not included in a land use application that was determined by the city to comply with the standards in EC 9.6793(3) and:
        (1) Will result in less than 1,000 square feet of new or replaced impervious surface within a 12 month period; or
        (2) Is to construct or alter a one or two family dwelling; or
        (3) Is for the replacement of more than 1,000 square feet of impervious surface for purposes of maintenance or repair for the continuance of the current function, providing that as part of such maintenance and repair the applicant is replacing less than 50% of the length of the stormwater drainage system (including pipes, drainageway catch basins and drywells) on the development site.
3. Development sites within a drainage basin for which the city has constructed or approved a project to restore the receiving waterway, and the entire downstream system has been designed to accommodate full build-out conditions within the drainage basin.

(3) Standards.

(a) Applications shall demonstrate, using methodology in the Stormwater Management Manual, that peak rates of flow delivered to an existing open waterway at a point above 500 feet in elevation will not increase during storms larger than the water quality design storm and smaller than the flood control design storm as a result of the development that is the subject of the application;

(b) For purposes of designing the system as required by the standards in this section, the amount of impervious surface per lot is assumed to be the maximum lot coverage allowed for the use in the zone in which it is located, unless the applicant demonstrates otherwise.

(c) All facilities to control the rate of stormwater runoff shall be sited, designed and constructed according to the flow control provisions and the facility design requirements set forth in the Stormwater Management Manual. Flow control facilities must be designed using one of the methodologies outlined in the Stormwater Management Manual.

(d) The standards in EC 9.6793(3) may be adjusted pursuant to EC 9.8030(24).

9.6794 **Stormwater Oil Control.**

(1) **Purpose.** The purpose of EC 9.6794 is to protect the city's stormwater system from oil and grease from stormwater runoff of impervious surface areas on properties that produce high concentrations of these pollutants.

(2) **Applicability.** Oil control standards set forth in EC 9.6794(3) apply to:

(a) All new commercial and industrial development with parking lots that store wrecked or impounded vehicles; or

(b) Any development that would result in an expected daily traffic count greater than one hundred vehicles per 1,000 square feet of gross building area, based on the most recent version of The Institute of Transportation Engineers' Trip Generation Manual; or

(c) Any development that would result in 100 or more off-street parking spaces; or

(d) Any commercial or industrial development that receives an adjustment approving the installation of 125 percent or more of the minimum off-street parking spaces required by EC 9.6410(3), Minimum Number of Required Off-Street Parking Spaces and that adjustment will result in, at least, a total of 10 parking spaces.

(3) **Standards.** Unless adjusted pursuant to EC 9.8030(24), all oil control facilities shall be sited, designed and constructed according to the oil control provisions and the facility design requirements set forth in the Stormwater Management Manual.

9.6795 **Stormwater Source Controls.**

(1) **Purpose.** The purpose of EC 9.6795 is to prevent stormwater pollution by eliminating pathways that may introduce pollutants into stormwater.

(2) **Applicability and Exemptions.** Except as exempted below and except when the source control would duplicate source controls required by a state or federal permit obtained by the applicant, source control standards set forth in EC 9.6795(3), apply to all land use applications, development permits and tenant improvements that result in any of the defined site uses or characteristics listed in EC 9.6795(2)(a)–(h).

(a) Fuel dispensing facilities and surrounding traffic areas where vehicles, equipment, or tanks are refueled on the premises. A fuel dispensing facility is the area where fuel is transferred from bulk storage tanks to vehicles, equipment, and/or mobile containers. Exempt from this subsection are:

1. Propane tanks.
2. Fuel dispensing areas generally used to service oversized equipment, for example cranes, that cannot maneuver under a roof or canopy.

3. Existing fueling areas where scope of work is limited to a new canopy installation over an existing fuel pad that is not being upgraded, an underground tank replacement for compliance with state regulations, or the replacement of a fuel pump on an existing fuel pad that is not being upgraded.

(b) Exterior storage of liquid materials, for example chemicals, food products, waste oils, solvents, process wastewaters, or petroleum products in aboveground containers, in quantities of 50 gallons or more, including permanent and temporary storage areas. Exempt from this subsection are underground storage tanks or installations requiring a Water Pollution Control Facility (WPCF) permit and containers with internal protections (such as double-walled containers).

(c) All facilities that store solid waste. A solid waste storage area is a place where solid waste containers, including compactors, dumpsters, and garbage cans, are collectively stored. Solid waste storage areas include, areas used to collect and store refuse or recyclable materials collection areas. Exempt from this subsection are solid waste storage areas for one and two family dwelling and areas used for the temporary storage of wood pallets or cardboard.

(d) Developments that stockpile or store high-risk or low-risk bulk materials in outdoor containers, as the terms "high risk" and "low risk" are in the Stormwater Management Manual. Exempt from this subsection are:

1. Materials which have no measurable solubility or mobility in water and no hazardous, toxic or flammable properties.
2. Materials which exist in a gaseous form at ambient temperature.
3. Materials, except for pesticides and fertilizers, that are contained in a manner that prevents contact with stormwater.

(e) Developments proposing the installation of new material transfer areas as defined in the Stormwater Management Manual, or structural alterations to existing material transfer areas, such as access ramp re-grading and leveler installations. Exempt from this subsection are areas used only for mid-sized to small-sized passenger vehicles and restricted by lease agreements or other regulatory requirements to storing, transporting or using materials that are classified as domestic use, for example, primary educational facilities (elementary, middle or high schools), buildings used for temporary storage and churches.

(f) All development with a designated equipment or vehicle washing or steam cleaning area, including smaller activity areas such as wheel-washing stations. Exempt from this subsection are:

1. Washing activity areas generally used to service oversized equipment than cannot maneuver under a roof or canopy, for example cranes and sail boats.
2. Evaporation unit installed as part of a wash recycling system are exempt from the wastewater connection requirement.
3. One and two family dwelling sites.

Development that is intended for the storage of 10 or more fleet vehicles shall include a designated vehicle washing area.

(g) All development projects that disturb property suspected or known to contain contaminants in the soil or groundwater.

(h) All development with new covered vehicle parking areas, or existing parking structures that are being developed. Exempt from this subsection are single-level canopies, overhangs and carports.

(3) **Standards.** Unless adjusted pursuant to EC 9.8030(24), all source controls shall be designed and constructed according to the source control provisions set forth in the Stormwater Management Manual.

(4) **Enforcement.** Failure to construct, operate and maintain source controls when a land use application, development permit or tenant improvement has resulted in a defined site use or characteristic listed in EC 9.6795(1)(a)-(h) is subject to enforcement in accordance with EC Chapter 6.

9.6796 <u>**Dedication of Stormwater Easements.**</u>

(1) **Purpose.** The purpose of EC 9.6796 is to ensure that city maintained stormwater management facilities designed and constructed in accordance with EC 9.6791-9.6795 and the Stormwater Management Manual can be accessed by the city for routine and/or emergency maintenance to protect life and property from flood and drainage hazards, ensure that water quality is protected, and to ensure that waterways in the headwaters area are protected from the erosive effects of runoff.

(2) **Applicability.** Stormwater easement standards set forth in EC 9.6791 apply to all land use applications and development permits that result in the construction of a city maintained stormwater management facility.

(3) **Standards.** The applicant must dedicate public easements approved by the city over city maintained stormwater management facilities provided the city makes findings to demonstrate consistency with constitutional requirements. The conveyance of ownership or dedication of easements may be required in any of the following circumstances:

(a) Except for areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any open drainage way, headwater, stream, creek, wetland, spring, or pond, including those not maintained by the city which drain onto or from city-owned property or into city maintained facilities.

(b) For areas on the city's acknowledged Goal 5 inventory, where the subject property in the proposed development is or will be periodically subject to accumulations of surface water or is traversed by any water course or channel.

(c) Where necessary to extend public drainage facilities and services to adjoining undeveloped property.

(d) To provide necessary drainage from the public right-of-way.

(e) Where the City has accepted functional maintenance responsibility for pollution reduction and/or flow control facilities in accordance with EC 9.6797(4)(b).

9.6797 <u>**Stormwater Operation and Maintenance.**</u>

(1) **Purpose.** The purpose of EC 9.6797 is to ensure that stormwater management facilities designed and constructed in accordance with EC 9.6791-9.6796 and the Stormwater Management Manual are operated and maintained in a manner that protects life and property from flood and drainage hazards, protects water quality, and protects the waterways in the headwaters area from the erosive effects of runoff.

(2) **Applicability.** Operation and maintenance standards apply to all facilities designed and constructed in accordance with EC 9.6792 through EC 9.6795 and the Stormwater Management Manual.

(3) **Standards.**

(a) Unless the city accepts the responsibility to operate and maintain a stormwater facility, all stormwater management facilities shall be privately operated and maintained.

(b) All stormwater facilities shall be operated and maintained in accordance with EC Chapters 6 and 7, and the Stormwater Management Manual.

(c) Privately maintained facilities. Applications proposing private operation and maintenance of all or part of the stormwater facility shall include an Operations and Maintenance Plan in accordance with the forms adopted as a part of the Stormwater Management Manual.

(d) Publicly maintained facilities. Applications proposing city operation and maintenance of all or part of the stormwater facility shall include an Operations and Maintenance Agreement in accordance with the facility agreements adopted as a part of the Stormwater Management Manual.

(4) **City Maintenance.**

(a) If the conditions of EC 9.6797(4)(b) are satisfied, the city will accept functional maintenance responsibility of the following facilities:

1. A facility designed and constructed to provide treatment solely for runoff from the public right-of-way;
2. A facility designed and constructed to provide treatment solely for runoff from 4 or more one and two family residential properties that are not under common ownership;
3. A facility designed and constructed to provide treatment solely for runoff that is a combination of one and two family residential properties not under common ownership and the public right-of-way.

(b) The city will accept functional maintenance responsibility of a facility listed in EC 9.6797(4)(a) if all of the following conditions are met:

1. The city has approved the dedication of the easement or public way to the city the property on which the facility is located or the city has approved plans allowing the facility to be placed within the public right-of-way; and
2. The city has approved plans dedicating the drainage system conveying runoff from the residential properties to the stormwater facility as a public drainage system; and
3. The stormwater facility access routes have been located within a dedicated public easement on private or commonly held property, within the public right-of-way or on city owned property; and
4. Sufficient easement area, right-of-way width or property have been provided to accommodate the construction and maintenance of all existing and proposed utilities and public infrastructure; and
5. The facility is designed and constructed in accordance with the city's Stormwater Management Manual; and
6. Access to the proposed facility allows maintenance to be performed using city owned maintenance equipment; and
7. As-construct plans of the drainage system shall be submitted designating all facilities that are proposed for public maintenance within 30 days of the city accepting maintenance responsibilities; and

8. The facility is designed and constructed in compliance with the city's Public Improvement Design Standards Manual.

(c) Notwithstanding EC 9.6797(4)(a) and (b), the city will not accept operation and maintenance responsibility of eco-roofs, roof gardens, pervious pavement, contained planters, tree credits, rainwater harvesting or private drywells.

(5) Private Operation and Maintenance. All privately operated and maintained stormwater management facilities shall be operated and maintained in accordance with EC Chapter 6.

Section 5. Subsection (24) is added to Section 9.8030 of the Eugene Code, 1971, to provide:

9.8030 **Adjustment Review - Approval Criteria.** The planning director shall approve, conditionally approve, or deny an adjustment review application. Approval or conditional approval shall be based on compliance with the following applicable criteria.

(24) Stormwater Pollution Reduction, Flow Control, Oil Control and Source Control Standards Adjustment.

(a) The requirement in EC 9.6792(3)(a)1 and EC 9.6792(3)(a)3 that selected pollution reduction facilities shall treat all the stormwater runoff that will result from the water quality design storm may be adjusted upon a finding that the selected pollution reduction facility will treat as much of the runoff as possible and one of the following applies:

1. The area generating untreated runoff is less than 500 square feet of impervious surface and is isolated from the pollution reduction facility;
2. The area generating untreated runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the pollution reduction facility;
3. Constructing pollution reduction facilities to treat the runoff from the area at issue would require removal of trees or damage to other natural resources; or
4. The area generating untreated runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the pollution reduction facility.

(b) The requirement in EC 9.6792(3)(b) that all pollution reduction facilities be selected from and sited, designed, and constructed according to the pollution reduction provisions and the facility design requirements set forth in the Stormwater Management Manual and that pollution reduction facilities must be designed using one of the methodologies outlined in the Stormwater Management Manual may be adjusted upon finding that all of the following requirements are met:

1. The proposed alternative design will achieve equal, or superior, results for function (reducing pollution), maintainability and safety, and the proposed siting does not adversely affect structures or other properties.
2. The applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer.

The description of the proposed design submitted for review must include all of the following information for each component of the proposed alternative design:

a. Size, technical description, capacity, capital cost, design life, construction process and costs, consequences of improper construction, operation and maintenance requirements and costs;

b. Data on the effectiveness of proposed alternative technologies, if available, including data from laboratory testing and pilot/full-scale operations, and information regarding the operations of any full-scale installations;

c. Any other available information about the proposed design, including peer review articles, scientific or engineering journals, and approvals from other jurisdictions.

3. The applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design once constructed, and a schedule for its maintenance.

4. The applicant has submitted a signed statement that the applicant will replace the alternative pollution reduction facility if the facility does not function as proposed.

(c) The requirement in EC 9.6793(3)(a) and EC 9.6793(3)(b) may be adjusted upon a finding that the flow control facility will control flow rates as much as possible and one of the following applies:

1. The area at issue generating runoff is less than 500 square feet of impervious surface and is isolated from the flow control facility;

2. The area at issue generating runoff is less than 500 square feet of impervious surface and it is not technically feasible to drain the untreated runoff to the flow control facility;

3. Constructing facilities to control the flow of runoff from the area at issue would require removal of trees or damage to other natural resources;

4. The area at issue generating runoff is less than 500 square feet of impervious surface and limited access to the area would prevent regular maintenance of the flow control facility.

(d) The requirements in EC 9.6793(3)(d) that all flow control facilities be selected from and sited, designed, and constructed according to the flow control provisions and the facility design requirements set forth in the Stormwater Management Manual may be adjusted upon finding that all of the following requirements are met:

1. The proposed alternative design will achieve equal, or superior, results for function (maintaining flow or restricting flow or both), maintainability and safety, and the proposed siting does not adversely affect structures or other properties;

2. The applicant's written description of the proposed alternative design has been reviewed and approved by the City Engineer. The description of the proposed design submitted for review must include all of the following information for each component of the proposed alternative design:

a. Size, technical description, capacity, capital cost, design life, construction process and costs, consequences of improper construction, operation and maintenance requirements and costs;

b. Data on the effectiveness of proposed alternative design, if available, including data from laboratory testing and pilot/full-scale operations, and information regarding the operations of any full-scale installations;

c. Any other available information about the proposed design, including peer review articles, scientific or engineering journals, and approvals from other jurisdictions.

3. The applicant has submitted a method and schedule for monitoring the effectiveness of the proposed design once constructed, and a schedule for its maintenance;

4. The applicant has submitted a signed statement that the applicant will replace the alternative flow control facility if the facility does not function as proposed.

(e) The requirement in EC 9.6795(3) that oil control facilities be sited, designed and constructed according to the oil control provisions and the facility design requirements set forth in the Stormwater Management Manual may be adjusted if the applicant can demonstrate that the selected oil control facility will achieve the same result as those listed in the Stormwater Management Manual.

(f) The requirement in EC 9.6796(3) that source controls be sited, designed and constructed according to source control provisions set forth in the Stormwater Management Manual may be adjusted if the applicant can demonstrate that the selected source control will achieve the same result as those listed in the Stormwater Management Manual. Applicants seeking an adjustment to EC 9.6796(3) must submit a completed authorization request form adopted as part of the Stormwater Management Manual.

<u>**Section 6**</u>. Subsection (1) of Section 9.8055 of the Eugene Code, 1971 is amended as follows:

9.8055 <u>**Cluster Subdivision- Approval Criteria - General**</u>. The planning director shall approve, approve with conditions, or deny a proposed cluster subdivision. Approval or approval with conditions shall be based on the following:

(1) The proposed subdivision complies with:

(a) EC 9.8515 <u>Subdivision, Tentative Plan Approval Criteria- General</u> except for the standards related to EC 9.2760 <u>Residential Zone Lot Standards</u>;

(b) EC 9.2750 <u>Residential Zone Development Standards</u>;

(c) EC 9.2000 through 9.3915 regarding lot dimensions, solar standards, and density requirements for the subject zone;

(d) EC 9.6500 through EC 9.6505 Public Improvement Standards;

(e) EC 9.6800 through EC 9.6875 Streets, Alleys, and Other Public Ways Standards; and

(f) EC 9.6791 through 9.6797 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

The residential lot and development standards may be relaxed based on compliance with the remainder of the cluster subdivision criteria. An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 7. Subsection (8) of Section 9.8090 of the Eugene Code, 1971, is amended as follows:

9.8090 **Conditional Use Permit Approval Criteria - General.** A conditional use permit shall be granted only if the proposal conforms to all of the following criteria:

(8) The proposal complies with all applicable standards, including but not limited to:

(a) EC 9.2000 through 9.3915 regarding lot dimensions, solar standards, and density requirements for the subject zone;

(b) EC 9.6500 through EC 9.6505 Public Improvement Standards;

(c) EC 9.6791 through 9.6797 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance; and

(d) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and other Public Ways;

(e) Where the proposal is to establish non-residential uses subject to residential density requirements on development sites in the residential zone category, it shall achieve the minimum and maximum density requirements in accordance with Table 9.2750 Residential Zone Development Standards, unless specifically exempted elsewhere in this code or granted a modification through an approved conditional use permit. For purposes of calculating "net density," the acreage of land considered shall include the entire development site and exclude public property, such as public streets, parks, and other public facilities. In considering whether to grant a modification to the density requirements, the hearings official shall evaluate the following factors:

1. The availability of the development site for residential use on August 1, 2001. The term "availability" in this section shall include consideration of whether the site was already developed with non-residential uses or had other site constraints impacting its suitability for residential use.
2. The necessity of the development site to be developed with residential uses to be able to achieve the minimum residential density for the area designated on the Metro Plan Land Use Diagram for either medium- or high-density residential use.
3. Adopted plan policies indicate the suitability and appropriateness of the site for non-residential use.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard. Additional criteria may also be required based on the applicability of other sections of this land use code.

Section 8. Subsection (4) of Section 9.8100 of the Eugene Code, 1971 is amended as follows:

9.8100 **<u>Conditional Use Permit Approval Criteria- Needed Housing</u>.** The hearings official shall approve, conditionally approve, or deny the conditional use permit application. Unless the applicant elects to use the general criteria contained in EC 9.8090 <u>Conditional Use Permit Approval Criteria - General</u>, where the applicant proposes needed housing, as defined by the State statutes, the hearings official shall approve or approve with conditions a conditional use based on compliance with the following criteria:

(4) The proposal complies with all applicable standards, including, but not limited to:
- (a) EC 9.6706 <u>Development in Flood Plains</u> through EC 9.6709 <u>Special Flood Hazard Areas - Standards</u>.
- (b) EC 9.6710(6) <u>Geological and Geotechnical Analysis</u>.
- (c) EC 9.6730 <u>Pedestrian Circulation On-Site</u>.
- (d) EC 9.6735 <u>Public Access Required</u>.
- (e) EC 9.6750 <u>Special Setback Standards</u>.
- (f) EC 9.6775 <u>Underground Utilities</u>.
- (g) EC 9.6780 <u>Vision Clearance Area</u>.
- (h) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
- (i) An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

<u>Section 9</u>. Subsection (1) of Section 9.8215 of the Eugene Code, 1971 is amended as follows:

9.8215 **<u>Partition, Tentative Plan Approval Criteria- General</u>.** The planning director shall approve, approve with conditions, or deny a partition, with findings and conclusions. Approval, or approval with conditions, shall be based on compliance with the following criteria:

(1) The proposed partition complies with all of the following:
- (a) Lot standards of EC 9.2000 through 9.3915 regarding applicable parcel dimensions and density requirements.
- (b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.
- (c) EC 9.6500 through EC 9.6505 Public Improvement Standards.
- (d) EC 9.6706 <u>Development in Flood Plains</u> through EC 9.6709 <u>Special Flood Hazard Areas - Standards</u>.
- (e) EC 9.6710 <u>Geological and Geotechnical Analysis</u>.
- (f) EC 9.6735 <u>Public Access Required</u>.
- (g) EC 9.6750 <u>Special Setback Standards</u>.
- (h) EC 9.6775 <u>Underground Utilities</u>.
- (i) EC 9.6780 <u>Vision Clearance Area</u>.
- (j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control,

easements, and operation and maintenance.

(k) All other applicable development standards for features explicitly included in the application.

(l) The applicable adopted plan policies beginning at EC 9.9500.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 10. Subsection (2) of Section 9.8220 of the Eugene Code, 1971 is amended as follows:

9.8220 **Partition, Tentative Plan Approval Criteria- Needed Housing.** The planning director shall approve, conditionally approve, or deny the partition application. Unless the applicant elects to use the general criteria contained in EC 9.8215 Partition, Tentative Plan Approval Criteria- General, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a partition based on compliance with the following criteria:

(2) The proposed partition complies with all of the following:

(a) Lot standards of EC 9.2000 through 9.3915 regarding applicable parcel dimensions and density requirements.

(b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.

(c) EC 9.6500 through EC 9.6505 Public Improvement Standards.

(d) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.

(e) EC 9.6710(6) Geological and Geotechnical Analysis.

(f) EC 9.6735 Public Access Required.

(g) EC 9.6750 Special Setback Standards.

(h) EC 9.6775 Underground Utilities.

(i) EC 9.6780 Vision Clearance Area.

(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

(k) EC 9.6880 through EC 9.6885 Tree Preservation and Removal Standards.

(l) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 11. Subsection (11) of Section 9.8320 of the Eugene Code, 1971 is amended as follows:

9.8320 **Tentative Planned Unit Development Approval Criteria- General**. The hearings official shall approve, approve with conditions, or deny a tentative PUD application with findings and conclusions. Decisions approving an application, or approving with conditions shall be based on compliance with the following criteria:

(11) The PUD complies with all of the following:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through EC 9.6505 Public Improvement Standards.
- (c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (d) EC 9.6710 Geological and Geotechnical Analysis.
- (e) EC 9.6730 Pedestrian Circulation On-Site.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.
- (j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
- (k) All other applicable development standards for features explicitly included in the application except where the applicant has shown that a proposed noncompliance is consistent with the purposes set out in EC 9.8300 Purpose of Planned Unit Development.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 12. Subsection (7) of Section 9.8325 of the Eugene Code, 1971 is amended as follows:

9.8325 **Tentative Planned Unit Development Approval Criteria - Needed Housing**. The hearings official shall approve, conditionally approve, or deny the PUD application with findings and conclusions. Unless the applicant elects to use the general criteria contained in EC 9.8320 Tentative Planned Unit Development Approval Criteria - General, where the applicant proposes needed housing, as defined by the State statutes, the hearings official shall approve or approve with conditions a PUD based on compliance with the following criteria:

(7) The PUD complies with all of the following:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6500 through 9.6505 Public Improvement Standards.
- (c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
- (d) EC 9.6710(6) Geological and Geotechnical Analysis.
- (e) EC 9.6730 Pedestrian Circulation On-Site.
- (f) EC 9.6735 Public Access Required.
- (g) EC 9.6750 Special Setback Standards.
- (h) EC 9.6775 Underground Utilities.
- (i) EC 9.6780 Vision Clearance Area.

(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 13. Subsection (5) of Section 9.8440 of the Eugene Code, 1971 is amended as follows:

9.8440 **Site Review Approval Criteria-General**. The planning director shall approve, conditionally approve, or deny the site review application. Approval or conditional approval shall be based on compliance with the following criteria:

(5) The proposal complies with all of the following standards:

(a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
(b) EC 9.6500 through 9.6505 Public Improvement Standards.
(c) EC 9.6706 Development in Flood Plains through EC 9.6709 Special Flood Hazard Areas - Standards.
(d) EC 9.6710 Geological and Geotechnical Analysis.
(e) EC 9.6730 Pedestrian Circulation On-Site.
(f) EC 9.6735 Public Access Required.
(g) EC 9.6750 Special Setback Standards.
(h) EC 9.6775 Underground Utilities.
(i) EC 9.6780 Vision Clearance Area.
(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
(k) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

Section 14. Subsection (4) of Section 9.8445 of the Eugene Code, 1971 is amended as follows:

9.8445 **Site Review Approval Criteria- Needed Housing**. The planning director shall approve, conditionally approve, or deny the site review application. Unless the applicant elects to use the general criteria contained in EC 9.8440 Site Review Approval Criteria - General, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a site review based on compliance with the following criteria:

(4) The proposal complies with all of the following standards:

(a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
(b) EC 9.6500 through 9.6505 Public Improvement Standards.

(c) EC 9.6706 <u>Development in Flood Plains</u> through EC 9.6709 <u>Special Flood Hazard Areas - Standards</u>.
(d) EC 9.6710 (6) <u>Geological and Geotechnical Analysis</u>.
(e) EC 9.6730 <u>Pedestrian Circulation On-Site.</u>
(f) EC 9.6735 <u>Public Access Required</u>.
(g) EC 9.6750 <u>Special Setback Standards</u>.
(h) EC 9.6775 <u>Underground Utilities</u>.
(i) EC 9.6780 <u>Vision Clearance Area</u>.
(j) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
(k) All other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

<u>Section 15</u>. Subsections (1) and (10) of Section 9.8515 of the Eugene Code, 1971 are amended as follows:

9.8515 **<u>Subdivision, Tentative Plan Approval Criteria - General</u>.** The planning director shall approve, approve with conditions, or deny a proposed subdivision. Approval, or approval with conditions shall be based on compliance with the following criteria:

(1) The proposed subdivision complies with the following:
(a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone;
(b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways; and
(c) EC 9.6500 through EC 9.6505 Public Improvement Standards.

(10) The proposed subdivision complies with all of the following:
(a) EC 9.6706 <u>Development in Flood Plains</u> through EC 9.6709 <u>Special Flood Hazard Areas - Standards</u>.
(b) EC 9.6710 <u>Geological and Geotechnical Analysis</u>.
(c) EC 9.6730 <u>Pedestrian Circulation On-Site</u>.
(d) EC 9.6735 <u>Public Access Required</u>.
(e) EC 9.6750 <u>Special Setback Standards</u>.
(f) EC 9.6775 <u>Underground Utilities</u>.
(g) EC 9.6780 <u>Vision Clearance Area</u>.
(h) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.
(i) The proposed subdivision complies with other applicable development standards for features explicitly included in the application.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

<u>Section 16</u>. Subsection (3) of Section 9. 8520 of the Eugene Code, 1971 is amended as follows:

9.8520 **<u>Subdivision, Tentative Plan Approval Criteria- Needed Housing</u>.** The planning director shall approve, conditionally approve, or deny the subdivision application. Unless the applicant elects to use the general criteria contained in EC 9.8515 <u>Subdivision, Tentative Plan Approval Criteria- General</u>, where the applicant proposes needed housing, as defined by the State statutes, the planning director shall approve or approve with conditions a subdivision based on compliance with the following criteria:

(3) The proposed subdivision complies with all of the following:
- (a) EC 9.2000 through 9.3915 regarding lot dimensions and density requirements for the subject zone.
- (b) EC 9.6800 through EC 9.6870 Standards for Streets, Alleys, and Other Public Ways.
- (c) EC 9.6500 through EC 9.6505 Public Improvement Standards.
- (d) EC 9.6706 <u>Development in Flood Plains</u> through EC 9.6709 <u>Special Flood Hazard Areas - Standards</u>.
- (e) EC 9.6710(6) <u>Geological and Geotechnical Analysis</u>.
- (f) EC 9.6730 <u>Pedestrian Circulation On-Site</u>.
- (g) EC 9.6735 <u>Public Access Required</u>.
- (h) EC 9.6750 <u>Special Setback Standards</u>.
- (i) EC 9.6775 <u>Underground Utilities</u>.
- (j) EC 9.6780 <u>Vision Clearance Area</u>.
- (k) EC 9.6791 through 9.6796 regarding stormwater destination, pollution reduction, flow control for headwaters area, oil control, source control, easements, and operation and maintenance.

An approved adjustment to a standard pursuant to the provisions beginning at EC 9.8015 of this land use code constitutes compliance with the standard.

<u>Section 17</u>. The City Recorder, at the request of, or with the concurrence of the City Attorney, is authorized to administratively correct any reference errors contained herein or in other provisions of the Eugene Code, 1971, to the provisions added, amended, or repealed herein.

<u>Section 18</u>. The findings set forth in Exhibit A attached hereto are adopted in support of this Ordinance.

Passed by the City Council this	**Approved by the Mayor this**
12th day of June, 2006.	**14th day of June, 2006.**
Mary Feldman	Kitty Piercy
City Recorder	**Mayor**

Appendix B

CITY OF PORTLAND, OREGON
BUREAU OF ENVIRONMENTAL SERVICES

VENDOR SUBMISSION GUIDANCE

FOR

EVALUATING STORMWATER TREATMENT TECHNOLOGIES

February 2001

INDEX

VENDOR SUBMISSION GUIDANCE FOR EVALUATING STORMWATER TREATMENT TECHNOLOGIES

February 20, 2001

I. Introduction

The City of Portland's Bureau of Environmental Services recently completed a Stormwater Manual update in September of 2000, and expects to complete the next revision by September of 2002. This manual provides storm water treatment requirements and guidance. BES specifies design criteria, such as storm events and facility performance goals. Facilities need to be designed to satisfy those criteria as stand-alone systems or as parts of treatment train approaches. The Stormwater Manual can be found online at www.cleanrivers-pdx.org.

Chapter 5.0 deals with storm water quality and includes a section on manufactured storm water treatment technologies. The facilities currently included in the manual are CSR Hydro Conduit™ Stormceptor®, Vortechnics™ Stormwater Treatment System™, H.I.L. Technology Inc.™ Downstream Defender™, CDS Technologies™, and Stormwater Management™ Stormfilter™. Storm water technologies and the knowledge base around them is rapidly evolving, and as such these facilities were included with a limited foundation of consistent test data to back their claims of performance to Portland's design standards.

This guidance is designed to gather the information needed to address these needs, and to provide a process for designating approval levels of manufactured treatment technologies. It is understood that vendors' initial submittals may not be fully compliant with the assessment protocol (see Technology Assessment Protocol section, Page 3), just as the data submitted by the vendors of the manufactured technologies currently included in the Stormwater Manual is not. However, to be included in the September 2002 revision of BES's Stormwater Manual, new or previously approved vendors must submit test data that meets the requirements set forth in this protocol by July 1, 2002. Results must indicate that the facility performs to Portland's design standards (see Performance Criteria section below, and Data Evaluation section, Page 11).

This guidance will also define "TSS (Total Suspended Solids) removal", and provide the equations necessary to calculate it. Portland's method for evaluating test results, which includes provisions for influent concentration, is also included (See Data Evaluation section, Page 11).

II. Performance Criteria

DESIGN STORM

Treatment facilities shall be sized to treat runoff from the water quality design storm, defined as 0.83 inches of rainfall in a 24-hour period (SCS Type 1A rainfall distribution), which is also one-third of Portland's 2-year event of 2.5 inches over 24 hours. Approved hydrology methods, as outlined in chapter 6.0 of BES's Stormwater Manual, shall be used to identify runoff volumes and peak flow rates for design purposes. By treating this storm event, roughly 95% of storm events in Portland are effectively treated.

REQUIRED TREATMENT PERFORMANCE GOALS

Basic Water Quality Performance Goal

The basic treatment performance goal for the entire city is 70% TSS (Total Suspended Solids) removal from post-developed runoff from the design storm (See Treatment Efficiency section, Page 6 and 7). TSS is defined as "matter suspended in storm water excluding litter, debris, and other gross solids exceeding 1 millimeter in diameter (larger than coarse sand, also see Distribution of Sediment Sizes Table, Page 6). Influent concentration of TSS is known to greatly impact the ability of a facility to remove 70% TSS, so it is important to specify limits to be used in performance tests. BES will use the "Line of Comparative Performance©" method, developed by Dr. Gary Minton of Resource Planning Associates (See Charts 1 through 3 in the Data Evaluation section, Pages 11 and 12) to determine whether or not a facility meets this requirement. These lines were generated from test data on the TSS removal efficiencies of grassy swales and sand filters and modified to account for Portland's 70% TSS removal standard. The premise behind using these lines of performance is that grassy swales and sand filters have been widely accepted as adequate-performing treatment facilities. These, as well as other treatment BMPs, remove a higher percentage of TSS with higher TSS influent concentrations. It is not fair or practical to require 70% TSS removal from clean storm water. This method of evaluation, however, accounts for this dilemma. Manufactured technologies will not be expected to outperform grassy swales and sand filters, but data points must be comparable, with a certain percentage falling above the "Line of Comparative Performance©" for the facility to be accepted as a "Presumptive Approach" in the Stormwater Manual. As a low-level baseline, a facility must also achieve an effluent goal of no more than 20 mg/l TSS for low influent concentrations (≤ 70 mg/l).

TMDL Enhanced Performance Goal

Certain watersheds within the City of Portland have established TMDLs (Total Maximum Daily Loads). The TMDLs apply specific pollution control requirements to designated pollutants of concern. To ensure that new development does not contribute pollutants of concern to a TMDL watershed, pollution reduction facilities are required to demonstrate specific removal rates for those specific pollutants. For example, the Tualatin Basin Watershed currently has Phosphorus as a listed pollutant of concern. The City's policy in the Tualatin Basin, therefore, is to construct storm water facilities that are capable of removing 65% of the post-developed Phosphorus from the storm water.

To be considered for use as a stand-alone facility in a TMDL watershed, a manufactured technology must demonstrate removal efficiencies for specific pollutants of concern, as well as TSS. Contact BES for a current list of TMDL watersheds with corresponding pollutant parameters.

Oil and Grease Performance Goal

Certain site uses within the City of Portland, such as high-use or high-risk parking lots, require additional treatment for oil and grease. The Stormwater Manual currently only recognizes oil/water separators for the pretreatment of oil and grease. To be considered for use as an oil/water separator, a manufactured technology must demonstrate adequate performance. Adequate performance needs to include: the removal of oil droplets from 50 to 60 microns in size, and the ability to achieve effluent efficiencies of 10 ppm or mg/L for influent concentrations exceeding 50 ppm or mg/L. The Stormwater Manual's Chapter 9.0, Section 9.8, identifies conditions under which a high-use or high-risk assessment is made.

Pretreatment Performance Goal

A facility may be approved for pretreatment use only. In this case, the facility would be constructed in conjunction with another water quality facility as a "treatment train" to accomplish the basic or enhanced performance goal. To be approved as a pretreatment facility only, data pertaining to the assessment protocol should be submitted. However, the level of performance will not need to meet basic water quality performance goals. The facility will need to demonstrate the ability to remove large debris and the larger range of TSS particle sizes (see Distribution of Sediment Sizes Chart on page 6), as approved by BES.

REQUIRED PERFORMANCE

Manufactured technologies claiming effectiveness for the listed pollutants must demonstrate (based on data provided per the Technology Assessment Protocol described below) that the above treatment performance goals will be generally achieved. Facilities shall be designed to perform without maintenance for one full year. In addition, factors other than treatment performance are important and will be evaluated to determine appropriate use of the emerging technology. Technologies may be approved as "Presumptive Approaches", which are then presumed to comply with the City's basic water quality performance goal, or as pre-treatment facilities, only accepted in combination with other facilities. Facilities demonstrating compliance with enhanced or oil and grease performance goals may be added to applicable Stormwater Manual sections in future revisions. Facilities that don't demonstrate adequate maintainability (See Section E, page 8) will not be included in the Stormwater Manual and will not be accepted for use within the City.

III. Technology Assessment Protocol

This testing protocol is based on protocols developed by other jurisdictions in the northwest. The Washington Chapter of the American Public Works Association (APWA), the Washington Department of Ecology, the City of Olympia, and the City of Sacramento/ Sacramento County have all developed very similar protocols, and were all instrumental in the development of this one. In this document, BES has tailored various sections of these protocols to fit Portland's design standards. BES reserves the right to change or update this document at any time. As design standards change, compliance with this protocol does not "grandfather" any manufactured facilities into the Stormwater Manual. BES reserves the right to request additional information at any time, and may remove technologies from accepted status after gaining further experience with them, or as new data becomes available. If a vendor wishes to use a different protocol, it is highly recommended to submit protocol details to BES for review prior to initiating tests.

REQUIRED NUMBER AND TYPES OF STUDIES

For BES to adequately evaluate the performance of a facility, a sufficient number of data points, or tests, must be submitted by the manufacturer. The submission of at least 30 tests will be deemed adequate for review. A "test" is defined as a controlled study that meets the requirements set forth in this protocol and results in a single data point which can be plotted on an Influent TSS (mg/L) vs. Removal Efficiency (%) curve (see Chart 3, Page 12). Removal efficiency shall be calculated using methods specified on page 7 of this report. At least half of the tests must come from field installations; either field performance studies with real storms or field performance studies with artificial storms.

Testing by "Independent Entities"

Testing of technologies may be conducted by qualified "independent entities" such as consultants, universities, local, state, or federal agencies. Testing may also be sponsored by the manufacturers themselves, but actual sampling, testing, and laboratory reporting must come from a qualified laboratory.

A. FIELD PERFORMANCE STUDIES WITH REAL STORMS

For inclusion in the Stormwater Manual as a stand-alone "Presumptive Approach", at least 15 data points must be obtained from actual field installations. These can come from field studies with real or artificial storms. At least two different land-uses must be represented, including medium density residential, retail commercial, non-retail commercial, or industrial. Testing within transportation corridors, including public or private streets within these land-uses, is encouraged. The purpose of this is to obtain a range of influent concentrations representative of typical storm water runoff. While it is acknowledged to be more difficult and expensive than laboratory testing, field testing will ensure that situations existing in "real-life" will be mimicked to the maximum extent practicable.

The following storm characteristic requirements must be met for field tests with real storm events, and must be documented and submitted to BES for acceptance.

NUMBER AND CHARACTERISTICS OF SAMPLED STORMS

Minimum Number of Sampled Storms

For inclusion in the Stormwater Manual as a stand-alone "Presumptive Approach", 5 storm events from three different sites must be submitted for a total of 15 storms. Real or artificial storm events can be used. At least two different land-uses must be represented, from either medium density residential, retail commercial, non-retail commercial, or industrial. Testing within transportation corridors, including public or private streets within these land-uses, is encouraged. The purpose of this is to obtain a range of influent concentrations representative of typical storm water runoff. For possible acceptance as a pretreatment device, at least 5 storm events must be submitted. To represent seasonal differences if only real storms are used, the tests shall occur throughout the calendar year. No more than 70% of the real storms may be sampled during the dry season (May through September) or during the wet season (October through April).

Minimum Storm Depth

The minimum total storm depth shall be 0.12 inches. As a guideline, at least 50% of the sampled storms should exceed 0.42 inches, and at least 10% of the sampled storms should exceed 0.83 inches.

Minimum Facility Flow Rate

Obtain data for a range of flows, from 10 to 100% of the design flow for off-line facilities, and from 10 to 125% for facilities designed to be flow-through, on-line facilities. Exceeding the design flow will demonstrate the facility's ability to retain previously trapped pollutants during high-flow periods. This requirement will most likely be accomplished through field testing with artificial storms.

Start/ End of Storm Event: A storm event is preceded and followed by at least six hours of dry weather.

Minimum Runoff Duration: 6 Hours.

Minimum Average Rainfall Intensity

Minimum average rainfall intensity shall be 0.02 inches/ hour. As a guideline, at least 50% of the storms should exceed 0.03 inches/ hour, and at least 10% should exceed 0.05 inches/ hour.

Maximum Average Rainfall Intensity: Maximum average rainfall intensity shall be 0.1 inches/ hour.

SAMPLING SPECIFICATIONS

Type of Samples

Flow-weighted composite samples (Event Mean Concentration or EMC), except pollutants or technologies for which grab sampling is mandated by sampling protocols. Document all sample types for BES review.

Sampling Procedure

To the maximum extent practicable, sample the entire runoff period. As a guideline, sample at least 75% of the total volume of each storm. The final composite sample shall comprise at least 10 influent and 10 effluent sub-samples collected throughout the storm. Plot sampling times on a copy of the runoff hydrograph.

Sampling Locations

If Method #1, 2, or 3 (Page 7) is used to calculate Removal Efficiency: Collect influent samples and measurements of flow rates and volumes at a point upstream of the treatment system, before any flow bypasses. Collect effluent samples and measurements of flow rates and volumes at a point downstream of the treatment system after bypassed and treated flows are rejoined.

If Method #4 (Page 7) is used to calculate Removal Efficiency: Ensure that the unit has been thoroughly cleaned and all sediment removed prior to start of test. Collect influent samples and measurements of flow rates and volumes at a point upstream of the treatment system. Immediately after test, block incoming flows and remove collected pollution for analysis.

Document all sampling locations for BES review.

Parameters of Interest

Parameters of interest include: total suspended solids (TSS), total dissolved solids, BOD, temperature, pH, hardness, total recoverable and dissolved metals including zinc, copper, lead, and cadmium, total and ortho-phosphate, total nitrogen, total petroleum hydrocarbons (NWTPH-Dx and –Gx, silica gel), visible sheen, bacteria (E. coli), nitrate-N, and ammonia-N. The vendor may submit any additional parameters that are deemed to be relevant to facility performance.

The vendor should tailor its sampling procedure to support the treatment goal. To be included in the Stormwater Manual as a general "Presumptive Approach", TSS needs to be sampled. To be considered as an oil/ water separator, Total petroleum hydrocarbons (NWTPH-Dx and –Gx, silica gel) and visible sheen needs to be tested. To be considered for use in TMDL watersheds, other pollutants of concern must be addressed. Because pollution removal parameter requirements tend to change over time, it is in the vendor's best interest to evaluate as many pollutants as possible. Testing methods and procedures are not included in this document for all pollutants of interest, and therefore must be submitted to BES with any testing data.

Sample Handling and Reporting

The methods of sample preservation and analysis are to be documented and submitted with test results. A qualified laboratory shall analyze samples. Results shall be analyzed and reported by entities independent of the vendor. The report shall discuss any discarded samples, QA/QC, duplicates, and ignored data. Analyzation techniques should not employ very minute samples, such as the "10 ml technique".

ACCUMULATED SEDIMENT TESTING

At the end of the test period, remove, weigh, and analyze accumulated sediment. Evaluate the sediment for the following: total dry weight, moisture content, particle size distribution, organic content, TPH, total phosphorus, and total zinc, copper, cadmium, and lead. Analyze particle size distribution using both wet and dry sieve test procedures following ASTM methods. Analyzing particle size distribution is very important in determining a facility's ability to remove the full range of sediment sizes (see table on page 6). Quantify or otherwise document gross solids (debris, litter, and other particles exceeding 1 mm in diameter) and oil accumulations.

GROSS SOLIDS TESTING

At the end of the test period, remove, weigh, and describe accumulated gross solids. Compare gross solids collected in the facility with gross solids bypassed downstream, measured through collection in mesh bags with one-millimeter openings.

RAINFALL MONITORING

Rainfall shall be measured at a representative site. Document site location and distance from facility.

GEOGRAPHIC SETTING

Sites in the Pacific Northwest (SCS Type 1A Rainfall Distribution) are preferred, but not required, as long as rainfall and runoff measurements are within tolerances specified on page 4.

B. FIELD PERFORMANCE STUDIES WITH ARTIFICIAL STORMS

Field performance studies with artificial storms may be submitted by vendors. The procedures described above for "real" storms must be followed, and additional data on the methods used to calculate and field-distribute the artificial storms must be documented and submitted. An artificial hydrograph or series of constant flow rates must be formulated and followed during the field test. It is highly recommended that the vendor submit this artificial hydrograph to BES for review prior to field testing.

C. LABORATORY PERFORMANCE STUDIES

BES recognizes that laboratory testing provides useful information under controlled conditions. Vendors may submit laboratory performance studies for consideration. Up to one-half (15) of the performance studies may be performed in the laboratory.

Removal rates for tests using potable water, spiked with pollutants, have generally been shown to be higher than tests using "real" storm water. Real storm water is therefore preferred when laboratory testing is employed, and should be used for at least half of the tests. When real storm water is used, one performance study shall be comprised of at least 10 influent and 10 effluent samples collected throughout the testing period (treatment efficiency calculation method #1, Page 7), or 10 influent samples collected throughout the testing period and one final captured load mass (treatment efficiency calculation method #4, Page 7). Documentation of the method of acquisition of test water must be submitted to BES for approval.

Spiked test water may be used for up to seven studies. When spiked test water is used, one study shall consist of either; 1) a test performed on water loaded with the full range of particle sizes, or 2) a series of tests on each separate particle size. Treatment efficiency calculation method #4 on page 7 shall be used in either case. TSS added to laboratory water shall conform to the particle size distribution shown in the table below. Documentation of the composition of test water must be submitted to BES for approval.

TABLE: DISTRIBUTION OF SEDIMENT SIZES (STANDARD SIEVE)

PARTICLE DIAMETER	% LESS THAN (WEIGHT)
< 1,000 micron	100%
< 707 micron (coarse sand)	95 to 100%
< 595 micron	90 to 95%
< 420 micron (medium sand)	85 to 90%
< 297 micron	80 to 85%
< 177 micron (fine sand)	75 to 80%
< 88 micron (very fine sand)	50 to 75%
< 44 micron (coarse silt)	25 to 50%
< 16 micron (medium silt)	0 to 25%
<8 micron (fine silt)	0%

D. TREATMENT EFFICIENCY

There are many different methods used to calculate treatment efficiency, four of which are shown below. Method #1 and #4 calculate efficiencies for individual storms, while method #2 and #3 calculate average efficiencies over a number of storms. While any of these described methods are acceptable for use, methods 1 and 4 require fewer storm events to be sampled and are therefore easier to perform. Describe which treatment efficiency methods below were used and include calculations. All are expressed as percentages. Any samples analyzed below detection limits may either be included at the detection limit, or be excluded (with a notation to that effect).

Method #1: Removal in each storm calculated as:

100(flow-weighted influent concentration – flow-weighted effluent concentration) / flow-weighted influent concentration

Where: All concentrations are averages of the 10 flow-weighted sub-samples.

Method #2: Aggregate removal of the storms sampled as:

100(A-B) / A

Where: A = (influent concentration Storm 1)(flow of Storm 1) + (influent concentration of Storm 2)(flow of Storm 2) +...(influent concentration of Storm N)(flow of Storm N)

B = (effluent concentration of Storm 1)(flow of Storm 1) + (effluent concentration of Storm 2)(flow of Storm 2) +...(effluent concentration of Storm N)(flow of Storm N)

Where concentrations are flow-weighted, and flow = average storm flow or total storm volume (vendor's choice).

Method #3: Efficiency based on geometric mean:

100(A-B) / A

Where: A = Geometric mean of all products of flow-weighted influent concentration times average storm flow or total storm volume.

B = Geometric mean of all products of flow-weighted effluent concentration times average storm flow or total storm volume.

Method #4: Removal in each storm calculated as:

Efficiency = 100(Captured load mass) / (Influent load mass over entire storm)

Where: Captured load mass = Mass of accumulated TSS in the treatment facility during testing period

Influent load mass over entire storm = Flow-weighted influent concentration times total storm volume through facility, or for laboratory tests with spiked water, total mass of added TSS. Note: TSS gradation must comply with table on page 6.

E. FACTORS OTHER THAN TREATMENT PERFORMANCE

BES staff must make reasoned decisions about storm water treatment technologies. To do so, all relevant factors need to be evaluated, while recognizing the critical importance of the technology's verified treatment performance for a target group of pollutants. Given the limited experience with emerging technologies, this is an arena where "best professional judgement" based on the weight of evidence is appropriate. To be accepted as a publicly owned and maintained facility, the vendor must present the following data to BES's *Standards and Practices Committee*, and receive their official consent. To be accepted for use as private facilities, the vendor must submit the following data to the BES address on page 10.

Applications

1) How does the facility work? How does it remove pollutants?
2) For which applications (e.g. land uses, pollutants) does the vendor recommend this technology? Why?
3) How many systems are installed in the United States? Provide at least three references with names and telephone numbers. Provide specific model numbers.
4) Provide information on at least three units owned and maintained by public municipalities and information on the oldest units installed to date. Provide specific model numbers.

Site Characteristics

5) Do any of these site characteristics or safety considerations favor or limit the technology's use: steep slopes, high groundwater, baseflows, soils, proximity to wells, septic systems and buildings, facility depth limits for access and safety, risk of hazardous materials spills, and driving head requirements? How?

Design Criteria

6) Pollutant removal at design flow and for representative storm water characteristics (e.g. TSS particle size distribution)
7) Storm water constituent limitations, pollutants and other constituents, including fouling factors
8) Design hydraulics (treatment and hydraulic design flows, by-pass flow, hydraulic grade line, scour velocities, etc.)
9) Design residence time, vertical/ horizontal velocities, etc.
10) Specific flow rate for media
11) Head loss curves for media
12) Minimum contact time and minimum thickness for media
13) Design life of system or components of the system before major overhaul is projected; describe fully
14) Media specifications to ensure that adequate quality of each medium is supplied to the user at all times. A list of all the physical/ chemical and impurity specifications should be provided
15) Structural, water tightness, buoyancy, and constructability
16) Design sizing and cost information for units designed to perform without maintenance for one full-year, and over-designed to last three years before the first cleaning.
17) Pretreatment requirements if any
18) Materials used to construct facility

Construction

19) What role does the vendor take in design and construction? Will a vendor representative be available to the contractor in the field? A letter from the vendor is required with every facility accepted to be publicly owned and maintained. This letter must confirm that the facility is being designed per manufacturer specifications to meet City of Portland requirements.
20) List the steps taken to install the technology. How long does it take?
21) How are factors such as structural integrity, water tightness, and buoyancy addressed?
22) What types of problems can occur in designing and installing the technology?

23) How are potential problems diagnosed and corrected, and by whom?
24) If problems go uncorrected, how does this affect the technology's effectiveness? What will cause complete facility failure?
25) How available is the technology (e.g. where do the major components come from and how much lead-time is needed?)

Costs

26) Provide materials (capital) and installation costs for complete system(s), indicating total costs and costs per cfs treated (not per cfs hydraulic capacity)
27) What is estimated useful facility life before replacement is needed?

Operation and Maintenance: For a typical installation with typical storm water, discuss each of the following:

28) How are inspections performed and how often?
29) How do you tell or forecast when maintenance will be needed, i.e., what is the "trigger" for determining when maintenance is needed and why?
30) How is maintenance performed? Specify equipment, materials, and man-hours necessary
31) Are all maintenance areas accessible by people and equipment? Are special equipment or methods needed for access? Any confined space entry areas?
32) What is the estimated maintenance frequency and on what information/ tests do you base this estimate?
33) What role does the vendor take in maintenance/ How much does the vendor charge for maintenance service?
34) Can the technology be damaged due to delayed maintenance, and if so, how is it restored?
35) How many years have you been in business? If vendor goes out of business or product model changes, how/ where will facility owner find needed parts, materials, and service?
36) Provide information on how other public jurisdictions clean and maintain their units.
37) Is there a standardized Operations and Maintenance plan available? If so, please provide a copy.

Reliability

38) Assuming the technology is designed and installed correctly, what factors can cause it not to perform as designed?
39) Can the technology add, transform, or release accumulated pollutants?
40) Does the filter medium decompose or is it subject to slime/ bacteria growth/
41) Is the technology sensitive to heavy or fine sediment loadings- is pretreatment required?
42) How is under-performance diagnosed and treated?
43) What is the warranty?
44) What initial/ ongoing user support is provided? Does the vendor charge for support?

Other Factors

45) Does the technology provide benefits or present challenges in other potentially relevant areas, such as groundwater recharge, thermal effects on surface waters, habitat creation, aesthetics, vectors, safety, community acceptance, and recreational use?

IV. REPORTING

Vendors seeking BES approval of manufactured storm water treatment facilities must submit the specified test data in report format, and must include answers to the "Factors Other than Treatment Performance" section above. While treatment performance is the most obvious factor in determining facility acceptance, others such as maintainability and reliability are equally important.

All relevant data should be included in the report, including but not limited to: test site locations with maps, dates and times of sampling, topography maps outlining drainage basins, system plans showing all relevant storm water piping and water quality facilities, expected flow calculations for various storm events, beginning and end times of all storm events and samplings, rainfall data from specified rain gage, measured flows through the system at various times (submit calculated hydrographs), and history of the facility (when constructed, when last maintenance/ cleaning occurred, etc.). All data pertaining to characteristics of storms and sampling procedures must be submitted to show conformance with previous specifications.

All reports should be submitted to ATTN: Steve Fancher, PE
Bureau of Environmental Services, C.O.P.
1120 SW 5th Ave. Room 1100
Portland, OR 97204-1972

BES will evaluate the data and report findings to the vendor within 60 days of the submittal.

V. DATA EVALUATION

BES will evaluate the data submitted by the vendors, and group each technology into one or more of the following classifications:

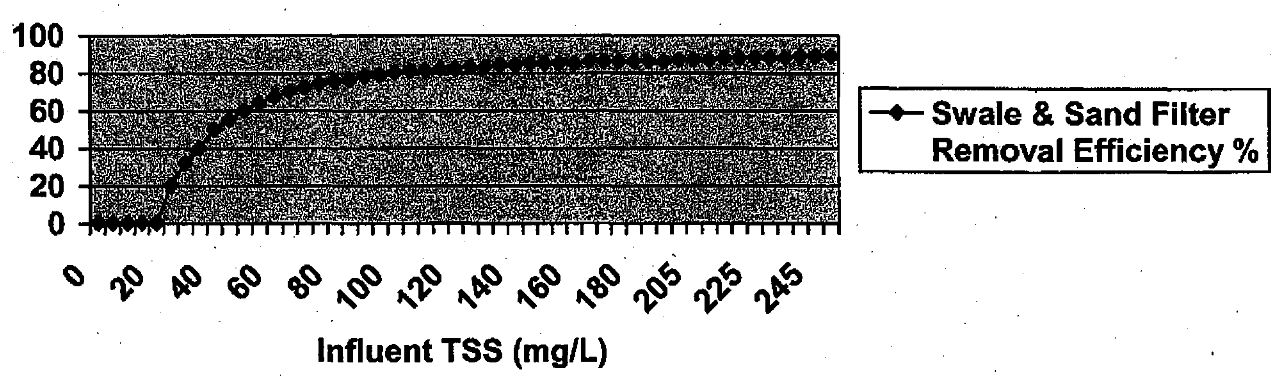
- Presumptive Approach (TSS)
- Pretreatment Only
- Oil/ Water Separation
- Specific Pollutants of Concern (TMDL pollutants)
- Acceptable as Public Facility
- Private Facility Only
- Not Approved for Any Application
- Insufficient Information, Provide Additional Data

LINES OF COMPARABLE PERFORMANCE

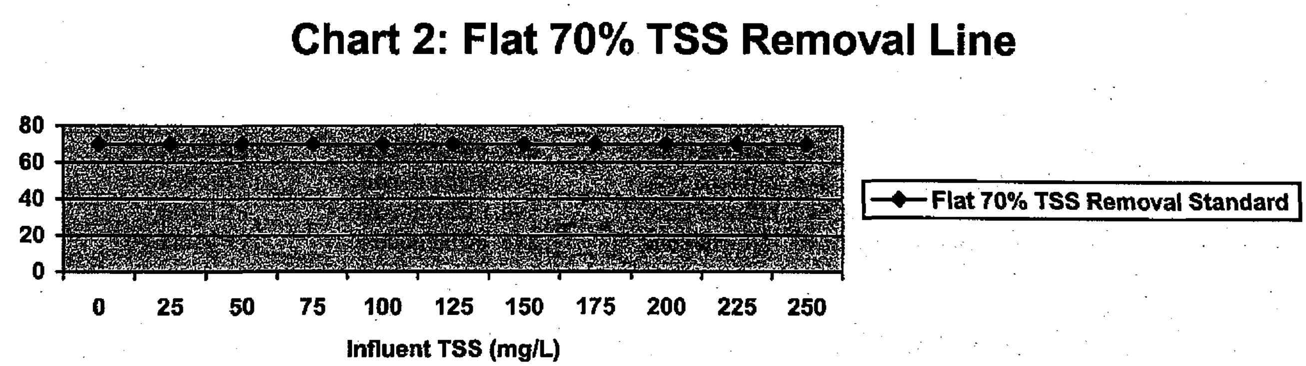
As mentioned earlier, BES will use the "Line of Comparative Performance©" method to evaluate a treatment technology's ability to remove TSS. The following table describes the data points that form the approximate grassy swale/ sand filter comparison line:

INFLUENT TSS (mg/L)	REMOVAL EFFICIENCY
20	0 %
25	20 %
50	60 %
75	74 %
100	80 %
125	83 %
150	85 %
175	87 %
200	88 %
250	89 %

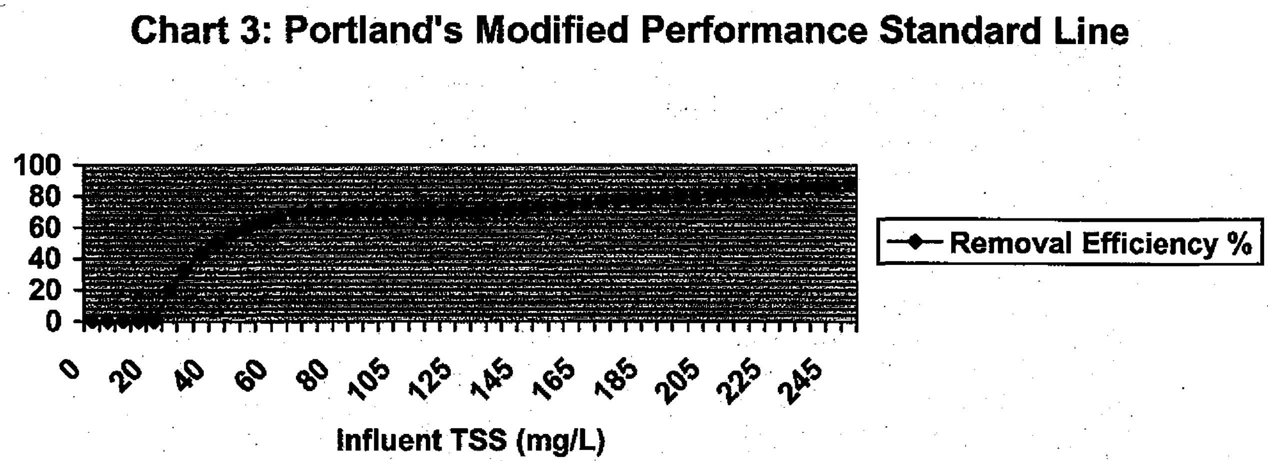
Chart 1: Grassy Swale/ Sand Filter Line of Performance



The following chart represents a flat "70% TSS Removal" standard:



The following performance line is consistent with the City of Portland's 70% TSS removal standard and takes into account influent TSS concentrations:



According to Section 403 Report to Congress, U.S. EPA, 1995, "Typical" storm water contains about 100 mg/L TSS. This line specifies 70% TSS removal for a range 30% below and 30% above 100 mg/L. For every point with less than 70 mg/L influent TSS, it is assumed that the effluent will be the minimum allowed 20 mg/L. For influent concentrations greater than 130 mg/L, the points rise linearly to 88% removal at 250 mg/L, which is a point shared with the swale/ sand filter comparison line.

To meet the City of Portland's basic water quality standard, at least 50% of a technology's data points should fall above this line of performance, as approved by BES. Efficiency calculation methods on page 6 and 7 shall be used to plot points on the chart. Facilities will be required to remove more than 70% for high (<130 mg/L) influent concentrations, while being allowed to remove less than 70% for low (<70 mg/L) influent concentrations. This will result in facilities being evaluated as they actually perform in the field, with those that average 70% TSS removal during the design storm of 0.83 inches over 24 hours receiving acceptable performance evaluations.

SAMPLE DATA COLLECTION SHEET

FIELD SITE #1

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

FIELD SITE #2

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

FIELD SITE #3

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

LABORATORY STUDIES WITH "REAL" STORM WATER

TEST 1= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 2= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 3= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 4= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 5= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 6= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 7= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____
TEST 8= 10 sub-samples: ave. influent conc.=_____; ave. effluent conc.=_____; efficiency=_____

LABORATORY STUDIES WITH SPIKED WATER

TEST 1: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 2: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 3: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 4: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 5: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 6: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____
TEST 7: influent load mass over entire storm=_____; captured load mass=_____; efficiency=_____

VI. REFERENCES

Washington Department of Ecology, "Draft 4: Vendor Submission Guidance for Evaluating Emerging Stormwater Treatment Technologies", October 2000

Puget Sound Watershed, "Final Draft: Protocol for the Acceptance of Unapproved Stormwater Treatment Technologies for Use in the Puget Sound Watershed", APWA Task Committee, November 1999

The County of Sacramento and Cities of Citrus Heights, Folsom, Galt, and Sacramento, "Investigation of Structural Control Measures for New Development", November 1999

Boyd, Gail, URS Corporation, personal communication

Technical Update #1

Subject: **Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies: Clarification Regarding "TSS" versus "SSC" Testing Methods**

Date: **July 5, 2001**

The recently released USGS policy regarding the collection and use of total suspended solids data in determining the suspended sediment load in storm water runoff was recently brought to our attention. We have been reviewing the USGS "Comparability of Suspended-Sediment Concentration and Total Suspended Solids Data" document dated August of 2000, and would like to clarify our sampling specifications, as listed in the above mentioned "Vendor Submission Guidance for Evaluating Stormwater Treatment Technologies".

By using "Total Suspended Solids" or "TSS" terminology, we may have implied that the *Total Suspended Solids Analytical Method*, as described by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation should be used to analyze test samples. According to the USGS study (Water-Resources Investigations Report 00-4191 by John R. Gray, G. Douglas Glysson, Lisa M. Turcios, and Gregory E. Schwarz) this method, which uses predetermined sub-sample volumes from an original water sample obtained while the sample is being mixed, is fundamentally unreliable for the analysis of natural-water samples. Methods used in the withdrawal of an aliquot of the original sample are inconsistent and often non-representative of the sample.

The *Suspended-Sediment Concentration Analytical Method*, however, measures all sediment and the mass of the entire water-sediment mixture. ASTM Standard Test Method D 3977-97 lists three methods that result in a determination of SSC values in water and wastewater samples: Test Method A- Evaporation, Test Method B- Filtration, and Test Method C- Wet-sieving filtration. The percentage of sand-size and finer material can be determined as part of the SSC method, but not as part of the TSS method. Overall, the SSC method "produces relatively reliable results for samples of natural water, regardless of the amount or percentage of sand-size material in the samples".

We would like to see the *Suspended-Sediment Concentration Analytical Method* used, as described in ASTM D 3977-97 for analysis of suspended sediment load in storm water runoff.

Appendix C
SANTA BARBARA URBAN HYDROGRAPH METHOD

INTRODUCTION

The Santa Barbara Urban Hydrograph (SBUH) method was developed by the Santa Barbara County Flood Control and Water Conservation District to determine a runoff hydrograph for an urbanized area. It is a simpler method than some other approaches, as it computes a hydrograph directly without going through intermediate steps (i.e., a unit hydrograph) to determine the runoff hydrograph.

The SBUH method is a popular method for calculating runoff, since it can be done with a spreadsheet or by hand relatively easily. The SBUH method is the method approved by the City of Eugene for determining runoff when doing flow control calculations.

ELEMENTS OF THE SBUH METHOD

The SBUH method depends on several variables:

- Pervious (A_p) and impervious (A_{imp}) land areas
- Time of concentration (T_c) calculations
- Runoff curve numbers (CN) applicable to the site
- Design storm

These elements shall all be presented as part of the submittal process for review by staff. In addition, maps showing the pre-development and post-development conditions shall be presented to help in the review.

Land Area

The total area, including the pervious and impervious areas within a drainage basin, shall be quantified in order to evaluate critical contributing areas and the resulting site runoff. Each area within a basin shall be analyzed separately and their hydrographs combined to determine the total basin hydrograph. Areas shall be selected to represent homogenous land use/development units.

Time of Concentration

Time of concentration, T_c, is the time for a theoretical drop of water to travel from the furthest point in the drainage basin to the facility being designed. (In this case, T_c is derived by calculating the overland flow time of concentration and the channelized flow time of concentration.) T_c depends on several factors, including ground slope, ground roughness, and distance of flow. The following formula for determining T_c is:

Formulas

$T_c = T_{t1} + T_{c2} + T_{c3} + \ldots + T_{cn}$

$T_t = L/60V$ (Conversion of velocity to travel time)

$T_t = \frac{0.42\,(nL)^{0.8}}{1.58(s)^{0.4}}$ (Manning's kinematic solution for sheet flow less than 300 feet)

(Shallow concentrated flow for slopes less than 0.005 ft/ft.):

$V = 16.1345(s)^{0.5}$ (Unpaved surfaces)

$V = 20.3282(s)^{0.5}$ (Paved surfaces)

Where,

T_t = travel time, minutes
T_c = total time of concentration, minutes (minimum T_c = 5 minutes)
L = flow length, feet
V = average velocity of flow, feet per second
n = Manning's roughness coefficient for various surfaces
s = slope of the hydraulic grade line (land or watercourse slope), feet per foot

When calculating T_c, the following limitations apply:

- Overland sheet flow (flow across flat areas that does not form into channels or rivulets) shall not extend for more than 300 feet.

- For flow paths through closed conveyance facilities such as pipes and culverts, standard hydraulic formulas shall be used for establishing velocity and travel time.
- Flow paths through lakes or wetlands may be assumed to be zero (i.e. $T_c = 0$).

Runoff Curve Numbers

Runoff curve numbers were developed by the Natural Resources Conservation Service (NRCS) after studying the runoff characteristics of various types of land. Curve numbers (CN) were developed to reduce diverse characteristics such as soil type, land usage, and vegetation into a single variable for doing runoff calculations. The runoff curve numbers approved for water quantity/quality calculations are included as Table C-2 of this appendix.

The curve numbers presented in Table C-2 are for *wet* antecedent moisture conditions. Wet conditions assume previous rainstorms have reduced the capacity of soil to absorb water. Given the frequency of rainstorms in this area, wet conditions are most likely, and give conservative hydrographic values.

Design Storm

The SBUH method also requires a design storm to perform the runoff calculations. For flow control calculations, use NRCS Type 1A 24-hour storm distribution. This storm is shown in Figure C-1 and Table C-4. The depth of rainfall for the 2 through 100-year storm events is shown below in Table C-1.

Table C-1
24-HOUR RAINFALL DEPTHS

Recurrence Interval, Years	2	5	10	25	100
Flood Control, Destination: 24-Hour Depths, Inches	3.12	3.6	4.46	5.18	6.48

Pollution Reduction: 24-Hour Depths, 1.4 Inches

Table C-2
RUNOFF CURVE NUMBERS

Runoff curve numbers for urban areas*

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover <50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

Runoff curve numbers for other agricultural lands*

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing					
<50% ground cover or heavily grazed with no mulch	Poor	68	79	86	89
50 to 75% ground cover and not heavily grazed	Fair	49	69	79	84
>75% ground cover and lightly or only occasionally grazed	Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay	-	30	58	71	78
Brush--weed-grass mixture with brush as the major element					
<50% ground cover	Poor	48	67	77	83
50 to 75% ground cover	Fair	35	56	70	77
>75% ground cover	Good	30	48	65	73
Woods-grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79

Runoff curve numbers for other agricultural lands*

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Woods					
Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.	Poor	45	66	77	83
Woods are grazed but not burned, and some forest litter covers the soil.	Fair	36	60	73	79
Woods are protected from grazing, and litter and brush adequately cover the soil.	Good	30	55	70	77

Runoff curve numbers for Simplified Approaches**

Cover description		Curve numbers for hydrologic soil group			
Simplified Approaches	Hydrologic condition	A	B	C	D
Eco-roof	Good	n/a	61	n/a	n/a
Roof Garden	Good	n/a	48	n/a	n/a
Contained Planter Box	Good	n/a	48	n/a	n/a
Infiltration & Flow-Through Planter Box	Good	n/a	48	n/a	n/a
Pervious Pavement	-	76	85	89	n/a
Trees					
New and/or Existing Evergreen	-	36	60	73	79
New and/or Existing Deciduous	-	36	60	73	79

n/a - Does not apply, as design criteria for the relevant mitigation measures do not include the use of this soil type.
*Soil Conservation Service, *Urban Hydrology for Small Watersheds*, Technical Release 55, pp. 2.5-2.8, June 1986.
**CNs of various cover types were assigned to the Proposed Simplified Approaches with similar cover types as follows:

Eco-roof – assumed grass in good condition with soil type B.
Roof Garden – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Contained Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Infiltration & Flow-Through Planter Box – assumed brush-weed-grass mixture with >75% ground cover and soil type B.
Pervious Pavement – assumed gravel.
Trees – assumed woods with fair hydrologic conditions.

Note: To determine hydrologic soil type, consult local USDA Soil Conservation Service Soil Survey.

TABLE C-3
NRCS HYDROLOGIC SOIL GROUP DESCRIPTIONS

NRCS Hydrologic Soil Group	Description
Group A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.
Group B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
Group C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.
Group D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a fragipan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Figure C-1 - NRCS 24-Hour Type 1A Hyetograph

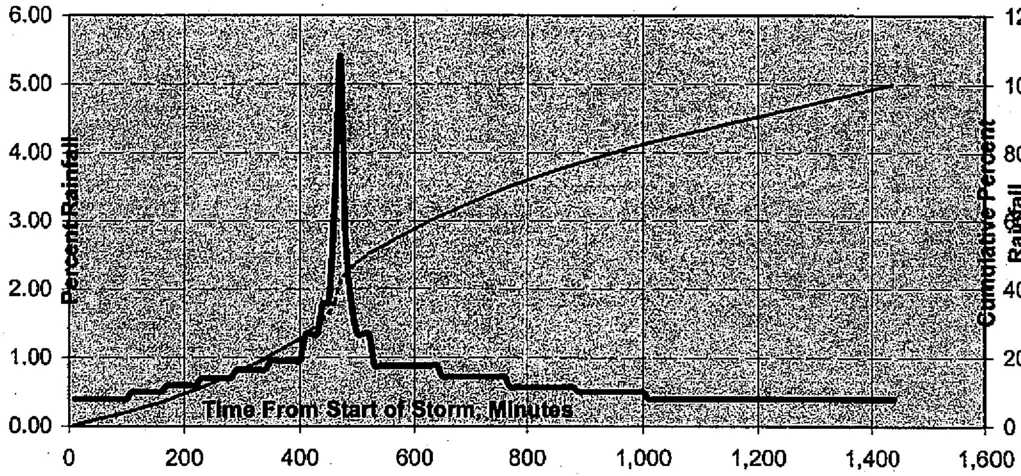


Table C-3 - NRCS Type 1A Hyetographic Distrubution - For Use In Water Quality/Quantity Design

Time From Start of Storm Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm Minutes	% Rainfall	Cumulative % Rainfall
0 - 10	0.40	0.40	360 - 370	0.95	22.67	720 - 730	0.72	67.40	1080 - 1090	0.40	86.00
10 - 20	0.40	0.80	370 - 380	0.95	23.62	730 - 740	0.72	68.12	1090 - 1100	0.40	86.40
20 - 30	0.40	1.20	380 - 390	0.95	24.57	740 - 750	0.72	68.84	1100 - 1110	0.40	86.80
30 - 40	0.40	1.60	390 - 400	0.95	25.42	750 - 760	0.72	69.56	1110 - 1120	0.40	87.20
40 - 50	0.40	2.00	400 - 410	1.34	26.76	760 - 770	0.57	70.13	1120 - 1130	0.40	87.60
50 - 60	0.40	2.40	410 - 420	1.34	28.10	770 - 780	0.57	70.70	1130 - 1140	0.40	88.00
60 - 70	0.40	2.80	420 - 430	1.34	29.44	780 - 790	0.57	71.27	1140 - 1150	0.40	88.40
70 - 80	0.40	3.20	430 - 440	1.80	31.24	790 - 800	0.57	71.84	1150 - 1160	0.40	88.80
80 - 90	0.40	3.60	440 - 450	1.80	33.04	800 - 810	0.57	72.41	1160 - 1170	0.40	89.20
90 - 100	0.40	4.00	450 - 460	3.40	36.44	810 - 820	0.57	72.98	1170 - 1180	0.40	89.60
100 - 110	0.50	4.50	460 - 470	5.40	41.84	820 - 830	0.57	73.55	1180 - 1190	0.40	90.00
110 - 120	0.50	5.00	470 - 480	2.70	44.54	830 - 840	0.57	74.12	1190 - 1200	0.40	90.40
120 - 130	0.50	5.50	480 - 490	1.80	46.34	840 - 850	0.57	74.69	1200 - 1210	0.40	90.80
130 - 140	0.50	6.00	490 - 500	1.34	47.68	850 - 860	0.57	75.26	1210 - 1220	0.40	91.20
140 - 150	0.50	6.50	500 - 510	1.34	49.02	860 - 870	0.57	75.83	1220 - 1230	0.40	91.60
150 - 160	0.50	7.00	510 - 520	1.34	50.36	870 - 880	0.57	76.40	1230 - 1240	0.40	92.00
160 - 170	0.60	7.60	520 - 530	0.88	51.24	880 - 890	0.50	76.90	1240 - 1250	0.40	92.40
170 - 180	0.60	8.20	530 - 540	0.88	52.12	890 - 900	0.50	77.40	1250 - 1260	0.40	92.80
180 - 190	0.60	8.80	540 - 550	0.88	53.00	900 - 910	0.50	77.90	1260 - 1270	0.40	93.20
190 - 200	0.60	9.40	550 - 560	0.88	53.88	910 - 920	0.50	78.40	1270 - 1280	0.40	93.60
200 - 210	0.60	10.00	560 - 570	0.88	54.76	920 - 930	0.50	78.90	1280 - 1290	0.40	94.00
210 - 220	0.60	10.60	570 - 580	0.88	55.64	930 - 940	0.50	79.40	1290 - 1300	0.40	94.40
220 - 230	0.70	11.30	580 - 590	0.88	56.52	940 - 950	0.50	79.90	1300 - 1310	0.40	94.80
230 - 240	0.70	12.00	590 - 600	0.88	57.40	950 - 960	0.50	80.40	1310 - 1320	0.40	95.20
240 - 250	0.70	12.70	600 - 610	0.88	58.28	960 - 970	0.50	80.90	1320 - 1330	0.40	95.60
250 - 260	0.70	13.40	610 - 620	0.88	59.16	970 - 980	0.50	81.40	1330 - 1340	0.40	96.00
260 - 270	0.70	14.10	620 - 630	0.88	60.04	980 - 990	0.50	81.90	1340 - 1350	0.40	96.40
270 - 280	0.70	14.80	630 - 640	0.88	60.92	990 - 1000	0.50	82.40	1350 - 1360	0.40	96.80
280 - 290	0.82	15.62	640 - 650	0.72	61.64	1000 - 1010	0.40	82.80	1360 - 1370	0.40	97.20
290 - 300	0.82	16.44	650 - 660	0.72	62.36	1010 - 1020	0.40	83.20	1370 - 1380	0.40	97.60
300 - 310	0.82	17.26	660 - 670	0.72	63.08	1020 - 1030	0.40	83.60	1380 - 1390	0.40	98.00
310 - 320	0.82	18.08	670 - 680	0.72	63.80	1030 - 1040	0.40	84.00	1390 - 1400	0.40	98.40
320 - 330	0.82	18.90	680 - 690	0.72	64.52	1040 - 1050	0.40	84.40	1400 - 1410	0.40	98.80
330 - 340	0.82	19.72	690 - 700	0.72	65.24	1050 - 1060	0.40	84.80	1410 - 1420	0.40	99.20
340 - 350	0.95	20.67	700 - 710	0.72	65.96	1060 - 1070	0.40	85.20	1420 - 1430	0.40	99.60
350 - 360	0.95	21.62	710 - 720	0.72	66.68	1070 - 1080	0.40	85.60	1430 - 1440	0.40	100.00

Appendix D
SIMPLIFIED APPROACH SIZING CALCULATIONS

The spreadsheet columns are described below:

Column (1)	Time in Minutes
Column (2)	Inflow for Storm Event (25-Year Detention Storm 3.9"/24 hours) and Contributing Impervious Area (1 acre)
Column (3)	Inflow (cf) = Inflow (cfs) x 60 x 10
Column (4)	Inflow (in) = Inflow (cf) x 12 / 43,560
Column (5)	Cumulative Inflow (in) = inflow (in) + Cumulative inflow (in) of previous step
Column (6)	Max Outflow (cfs) = Facility Area (sf) x Infiltration Rate (ft/s) **Note: Infiltration rate is assumed to be 2.5"/hr in this case. Also, for simplicity head is not taken into account.**
Column (7)	Cumulative Outflow (cf) = outflow (cfs) x 10 x 60 + cumulative outflow (cf) of previous step
Column (8)	Inflow – Outflow (cfs) = Column 2 inflow (cfs) – Column 6 outflow (cfs)
Column (9)	Incremental inflow – outflow (cf) = inflow – outflow (cfs) x 10 x 60
Column (10)	Cumulative inflow – outflow (cf) = If incremental inflow – outflow (cf) + cumulative inflow – outflow (cf) of previous step is less than 0, 0; else = incremental inflow – outflow (cf) + cumulative inflow – outflow (cf) of previous time step
Column (11)	Cumulative depth (in) = cumulative inflow – outflow (cf) x 12 / Facility Area (sf) **Note that cumulative depth does not exceed 6 inches in this case, which would result in an overflow condition. When modeling for detention purposes, overflow is allowed, but only at pre-developed peak rates. When modeling for pollution reduction, the entire post-developed runoff rate from the pollution reduction storm must be infiltrated without overflow.** **Resulting swale square-footage is 3,940, which when divided by the 43,560 square-foot impervious surface equals the 0.09 sizing factor.**

Spreadsheet Illustrating Vegetated Swale Sizing: 43,560 sq-ft imp. 25 yr storm Swale Square Footage= **3940**
B Soil Infiltration Rate=2.5"/hr= .21 ft/hr= 0.00006 ft/s

(1) Time (min)	(2) Inflow (cfs)	(3) Inflow Volume (cf)	(4) Inflow Volume (in)	(5) Cumulative Inflow (in)	(6) Max Outflow (cfs)	(7) Cumulative Outflow Vol. (cf)	(8) Inflow - Outflow (cfs)	(9) Incremental Inflow - Outflow (cf)	(10) Cumulative Inflow - Outflow (cf)	(11) Cumulative Depth (in)
0	0	0	0.00	0.00	0.2364	0	-0.2364	-141.84	0	0
10	0	0	0.00	0.00	0.2364	141.84	-0.2364	-141.84	0	0
20	0	0	0.00	0.00	0.2364	283.68	-0.2364	-141.84	0	0
30	0	0	0.00	0.00	0.2364	425.52	-0.2364	-141.84	0	0
40	0.01	6	0.00	0.00	0.2364	567.36	-0.2264	-135.84	0	0
50	0.02	12	0.00	0.00	0.2364	709.2	-0.2164	-129.84	0	0
60	0.03	18	0.00	0.01	0.2364	851.04	-0.2064	-123.84	0	0
70	0.03	18	0.00	0.01	0.2364	992.88	-0.2064	-123.84	0	0
80	0.04	24	0.01	0.02	0.2364	1134.72	-0.1964	-117.84	0	0
90	0.05	30	0.01	0.03	0.2364	1276.56	-0.1864	-111.84	0	0
100	0.05	30	0.01	0.04	0.2364	1418.4	-0.1864	-111.84	0	0
110	0.06	36	0.01	0.05	0.2364	1560.24	-0.1764	-105.84	0	0
120	0.08	48	0.01	0.06	0.2364	1702.08	-0.1564	-93.84	0	0
130	0.08	48	0.01	0.07	0.2364	1843.92	-0.1564	-93.84	0	0
140	0.08	48	0.01	0.09	0.2364	1985.76	-0.1564	-93.84	0	0

150	0.09	54	0.01	0.10	0.2364	2127.6	-0.1464	-87.84	0	
160	0.09	54	0.01	0.12	0.2364	2269.44	-0.1464	-87.84	0	
170	0.1	60	0.02	0.13	0.2364	2411.28	-0.1364	-81.84	0	
180	0.11	66	0.02	0.15	0.2364	2553.12	-0.1264	-75.84	0	0
190	0.12	72	0.02	0.17	0.2364	2694.96	-0.1164	-69.84	0	0
200	0.12	72	0.02	0.19	0.2364	2836.8	-0.1164	-69.84	0	0
210	0.12	72	0.02	0.21	0.2364	2978.64	-0.1164	-69.84	0	0
220	0.12	72	0.02	0.23	0.2364	3120.48	-0.1164	-69.84	0	0
230	0.13	78	0.02	0.25	0.2364	3262.32	-0.1064	-63.84	0	0
240	0.15	90	0.02	0.28	0.2364	3404.16	-0.0864	-51.84	0	0
250	0.15	90	0.02	0.30	0.2364	3546	-0.0864	-51.84	0	0
260	0.15	90	0.02	0.33	0.2364	3687.84	-0.0864	-51.84	0	0
270	0.15	90	0.02	0.35	0.2364	3829.68	-0.0864	-51.84	0	0
280	0.15	90	0.02	0.38	0.2364	3971.52	-0.0864	-51.84	0	0
290	0.17	102	0.03	0.40	0.2364	4113.36	-0.0664	-39.84	0	0
300	0.18	108	0.03	0.43	0.2364	4255.2	-0.0564	-33.84	0	0
310	0.18	108	0.03	0.46	0.2364	4397.04	-0.0564	-33.84	0	0
320	0.18	108	0.03	0.49	0.2364	4538.88	-0.0564	-33.84	0	0
330	0.18	108	0.03	0.52	0.2364	4680.72	-0.0564	-33.84	0	0
340	0.18	108	0.03	0.55	0.2364	4822.56	-0.0564	-33.84	0	0
350	0.2	120	0.03	0.59	0.2364	4964.4	-0.0364	-21.84	0	0
360	0.21	126	0.03	0.62	0.2364	5106.24	-0.0264	-15.84	0	0
370	0.21	126	0.03	0.66	0.2364	5248.08	-0.0264	-15.84	0	0
380	0.22	132	0.04	0.69	0.2364	5389.92	-0.0164	-9.84	0	0
390	0.22	132	0.04	0.73	0.2364	5531.76	-0.0164	-9.84	0	0
400	0.22	132	0.04	0.77	0.2364	5673.6	-0.0164	-9.84	0	0
410	0.26	156	0.04	0.81	0.2364	5815.44	0.0236	14.16	14.16	0.04830213
420	0.31	186	0.05	0.86	0.2364	5957.28	0.0736	44.16	58.32	0.19893928
430	0.31	186	0.05	0.91	0.2364	6099.12	0.0736	44.16	102.48	0.34957644
440	0.36	216	0.06	0.97	0.2364	6240.96	0.1236	74.16	176.64	0.60254862
450	0.42	252	0.07	1.04	0.2364	6382.8	0.1836	110.16	286.8	0.97832284
460	0.6	360	0.10	1.14	0.2364	6524.64	0.3636	218.16	504.96	1.72250314
470	1.02	612	0.17	1.31	0.2364	6666.48	0.7836	470.16	975.12	3.32629766
480	0.94	564	0.16	1.46	0.2364	6808.32	0.7036	422.16	1397.28	4.76635
490	0.52	312	0.09	1.55	0.2364	6950.16	0.2836	170.16	1567.44	5.3468
500	0.37	222	0.06	1.61	0.2364	7092	0.1336	80.16	1647.6	5.6202
510	0.31	186	0.05	1.66	0.2364	7233.84	0.0736	44.16	1691.76	5.77087
520	0.31	186	0.05	1.71	0.2364	7375.68	0.0736	44.16	1735.92	5.92151390
530	0.26	156	0.04	1.76	0.2364	7517.52	0.0236	14.16	1750.08	5.96981604
540	0.21	126	0.03	1.79	0.2364	7659.36	-0.0264	-15.84	1734.24	5.91578314
550	0.21	126	0.03	1.82	0.2364	7801.2	-0.0264	-15.84	1718.4	5.86175025
560	0.21	126	0.03	1.86	0.2364	7943.04	-0.0264	-15.84	1702.56	5.80771736
570	0.21	126	0.03	1.89	0.2364	8084.88	-0.0264	-15.84	1686.72	5.75368446
580	0.21	126	0.03	1.93	0.2364	8226.72	-0.0264	-15.84	1670.88	5.69965157
590	0.21	126	0.03	1.96	0.2364	8368.56	-0.0264	-15.84	1655.04	5.64561868
600	0.21	126	0.03	2.00	0.2364	8510.4	-0.0264	-15.84	1639.2	5.59158578
610	0.21	126	0.03	2.03	0.2364	8652.24	-0.0264	-15.84	1623.36	5.53755289
620	0.21	126	0.03	2.07	0.2364	8794.08	-0.0264	-15.84	1607.52	5.48352
630	0.21	126	0.03	2.10	0.2364	8935.92	-0.0264	-15.84	1591.68	5.42948710
640	0.21	126	0.03	2.14	0.2364	9077.76	-0.0264	-15.84	1575.84	5.37545421
650	0.19	114	0.03	2.17	0.2364	9219.6	-0.0464	-27.84	1548	5.28048731
660	0.17	102	0.03	2.20	0.2364	9361.44	-0.0664	-39.84	1508.16	5.14458639
670	0.17	102	0.03	2.22	0.2364	9503.28	-0.0664	-39.84	1468.32	5.00868548
680	0.17	102	0.03	2.25	0.2364	9645.12	-0.0664	-39.84	1428.48	4.87278456
690	0.17	102	0.03	2.28	0.2364	9786.96	-0.0664	-39.84	1388.64	4.73688365
700	0.17	102	0.03	2.31	0.2364	9928.8	-0.0664	-39.84	1348.8	4.60098274
710	0.17	102	0.03	2.34	0.2364	10070.64	-0.0664	-39.84	1308.96	4.46508182
720	0.17	102	0.03	2.37	0.2364	10212.48	-0.0664	-39.84	1269.12	4.32918091
730	0.17	102	0.03	2.39	0.2364	10354.32	-0.0664	-39.84	1229.28	4.19328
740	0.17	102	0.03	2.42	0.2364	10496.16	-0.0664	-39.84	1189.44	4.05737908
750	0.17	102	0.03	2.45	0.2364	10638	-0.0664	-39.84	1149.6	3.92147817
760	0.17	102	0.03	2.48	0.2364	10779.84	-0.0664	-39.84	1109.76	3.78557725
770	0.15	90	0.02	2.50	0.2364	10921.68	-0.0864	-51.84	1057.92	3.60874233
780	0.13	78	0.02	2.52	0.2364	11063.52	-0.1064	-63.84	994.08	3.39097340
790	0.13	78	0.02	2.55	0.2364	11205.36	-0.1064	-63.84	930.24	3.17320446
800	0.13	78	0.02	2.57	0.2364	11347.2	-0.1064	-63.84	866.4	2.95543553
810	0.13	78	0.02	2.59	0.2364	11489.04	-0.1064	-63.84	802.56	2.73766659
820	0.13	78	0.02	2.61	0.2364	11630.88	-0.1064	-63.84	738.72	2.5198
830	0.13	78	0.02	2.63	0.2364	11772.72	-0.1064	-63.84	674.88	2.3021
840	0.13	78	0.02	2.65	0.2364	11914.56	-0.1064	-63.84	611.04	2.0843

850	0.13	78	0.02	2.67	0.2364	12056.4	-0.1064	-63.84	547.2	1.86659086
860	0.13	78	0.02	2.70	0.2364	12198.24	-0.1064	-63.84	483.36	1.64882192
870	0.13	78	0.02	2.72	0.2364	12340.08	-0.1064	-63.84	419.52	1.43105299
880	0.13	78	0.02	2.74	0.2364	12481.92	-0.1064	-63.84	355.68	1.21328406
890	0.13	78	0.02	2.76	0.2364	12623.76	-0.1064	-63.84	291.84	0.99551512
900	0.12	72	0.02	2.78	0.2364	12765.6	-0.1164	-69.84	222	0.75727918
910	0.12	72	0.02	2.80	0.2364	12907.44	-0.1164	-69.84	152.16	0.51904324
920	0.12	72	0.02	2.82	0.2364	13049.28	-0.1164	-69.84	82.32	0.28080731
930	0.12	72	0.02	2.84	0.2364	13191.12	-0.1164	-69.84	12.48	0.04257137
940	0.12	72	0.02	2.86	0.2364	13332.96	-0.1164	-69.84	0	0
950	0.12	72	0.02	2.88	0.2364	13474.8	-0.1164	-69.84	0	0
960	0.12	72	0.02	2.90	0.2364	13616.64	-0.1164	-69.84	0	0
970	0.12	72	0.02	2.92	0.2364	13758.48	-0.1164	-69.84	0	0
980	0.12	72	0.02	2.94	0.2364	13900.32	-0.1164	-69.84	0	0
990	0.12	72	0.02	2.96	0.2364	14042.16	-0.1164	-69.84	0	0
1000	0.12	72	0.02	2.98	0.2364	14184	-0.1164	-69.84	0	0
1010	0.11	66	0.02	3.00	0.2364	14325.84	-0.1264	-75.84	0	0
1020	0.09	54	0.01	3.01	0.2364	14467.68	-0.1464	-87.84	0	0
1030	0.09	54	0.01	3.03	0.2364	14609.52	-0.1464	-87.84	0	0
1040	0.09	54	0.01	3.04	0.2364	14751.36	-0.1464	-87.84	0	0
1050	0.09	54	0.01	3.06	0.2364	14893.2	-0.1464	-87.84	0	0
1060	0.09	54	0.01	3.07	0.2364	15035.04	-0.1464	-87.84	0	0
1070	0.09	54	0.01	3.09	0.2364	15176.88	-0.1464	-87.84	0	0
1080	0.09	54	0.01	3.10	0.2364	15318.72	-0.1464	-87.84	0	0
1090	0.09	54	0.01	3.12	0.2364	15460.56	-0.1464	-87.84	0	0
1100	0.09	54	0.01	3.13	0.2364	15602.4	-0.1464	-87.84	0	0
1110	0.09	54	0.01	3.15	0.2364	15744.24	-0.1464	-87.84	0	0
1120	0.09	54	0.01	3.16	0.2364	15886.08	-0.1464	-87.84	0	0
1130	0.09	54	0.01	3.18	0.2364	16027.92	-0.1464	-87.84	0	0
1140	0.09	54	0.01	3.19	0.2364	16169.76	-0.1464	-87.84	0	0
1150	0.09	54	0.01	3.20	0.2364	16311.6	-0.1464	-87.84	0	0
1160	0.09	54	0.01	3.22	0.2364	16453.44	-0.1464	-87.84	0	0
1170	0.09	54	0.01	3.23	0.2364	16595.28	-0.1464	-87.84	0	0
1180	0.09	54	0.01	3.25	0.2364	16737.12	-0.1464	-87.84	0	0
1190	0.09	54	0.01	3.26	0.2364	16878.96	-0.1464	-87.84	0	0
1200	0.09	54	0.01	3.28	0.2364	17020.8	-0.1464	-87.84	0	0
1210	0.09	54	0.01	3.29	0.2364	17162.64	-0.1464	-87.84	0	0
1220	0.09	54	0.01	3.31	0.2364	17304.48	-0.1464	-87.84	0	0
1230	0.09	54	0.01	3.32	0.2364	17446.32	-0.1464	-87.84	0	0
1240	0.09	54	0.01	3.34	0.2364	17588.16	-0.1464	-87.84	0	0
1250	0.09	54	0.01	3.35	0.2364	17730	-0.1464	-87.84	0	0
1260	0.09	54	0.01	3.37	0.2364	17871.84	-0.1464	-87.84	0	0
1270	0.09	54	0.01	3.38	0.2364	18013.68	-0.1464	-87.84	0	0
1280	0.09	54	0.01	3.40	0.2364	18155.52	-0.1464	-87.84	0	0
1290	0.09	54	0.01	3.41	0.2364	18297.36	-0.1464	-87.84	0	0
1300	0.09	54	0.01	3.43	0.2364	18439.2	-0.1464	-87.84	0	0
1310	0.09	54	0.01	3.44	0.2364	18581.04	-0.1464	-87.84	0	0
1320	0.09	54	0.01	3.46	0.2364	18722.88	-0.1464	-87.84	0	0
1330	0.09	54	0.01	3.47	0.2364	18864.72	-0.1464	-87.84	0	0
1340	0.09	54	0.01	3.49	0.2364	19006.56	-0.1464	-87.84	0	0
1350	0.09	54	0.01	3.50	0.2364	19148.4	-0.1464	-87.84	0	0
1360	0.09	54	0.01	3.52	0.2364	19290.24	-0.1464	-87.84	0	0
1370	0.09	54	0.01	3.53	0.2364	19432.08	-0.1464	-87.84	0	0
1380	0.09	54	0.01	3.55	0.2364	19573.92	-0.1464	-87.84	0	0
1390	0.09	54	0.01	3.56	0.2364	19715.76	-0.1464	-87.84	0	0
1400	0.09	54	0.01	3.58	0.2364	19857.6	-0.1464	-87.84	0	0
1410	0.09	54	0.01	3.59	0.2364	19999.44	-0.1464	-87.84	0	0
1420	0.09	54	0.01	3.61	0.2364	20141.28	-0.1464	-87.84	0	0
1430	0.09	54	0.01	3.62	0.2364	20283.12	-0.1464	-87.84	0	0
1440	0.09	54	0.01	3.64	0.2364	20424.96	-0.1464	-87.84	0	0
1450	0.05	30	0.01	3.64	0.2364	20566.8	-0.1864	-111.84	0	0
1460	0	0	0.00	3.64	0.2364	20566.8	-0.2364	-141.84	0	0

APPENDIX E

WATER QUALITY DESIGN STORM DEVELOPMENT

REVISED DRAFT

CITY OF EUGENE
DEVELOPMENT STANDARDS MEMORANDUM #4
WATER QUALITY DESIGN STORM SELECTION

INTRODUCTION

In Development Standards Memorandum #2, the following four approaches for implementing stormwater quality requirements were considered:

1. Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified amount of rainfall, or "water quality design storm"
2. Stormwater quality facilities are required to meet a specified performance threshold (e.g., 80% removal of TSS)
3. Specific stormwater quality facilities are required for specific land uses
4. In-lieu-of fees are allowed

Based on the advantages and disadvantages described for each of the four approaches, we decided to further evaluate Approach #1 – Stormwater quality facilities are required to reduce pollutants in the stormwater runoff resulting from a specified water quality design storm.

Structural stormwater quality facilities (i.e., not site planning) can generally be divided into two groups based on different design requirements: detention facilities and flow-through facilities. Detention type facilities include dry ponds, wet ponds, and stormwater marshes. These facilities are designed to allow for the settling of particulates and other pollutants in stormwater by storing the stormwater runoff for a certain period. Therefore, the total rainfall (depth in inches) of the water quality design storm needs to be specified to determine the appropriate size of a detention type facility.

Flow-through facilities include vegetated swales and/or structural facilities with filter media such as sand or compost. These facilities remove particulates and other pollutants by mechanical means (e.g., baffles) or by passing the stormwater through a filtration media (e.g., vegetation, sand or compost). Since flow-through type facilities operate with little or no detention, these types of facilities are designed to treat a maximum flow rate rather than a total runoff volume. Therefore, the rainfall intensity (inches/hour) of the water quality design storm needs to be specified to determine the appropriate size of a flow-through based facility.

The purpose of this memorandum is to describe the methods used to select the water quality design storm parameters for detention type and flow-through type stormwater quality facilities. This memo contains the following information:

- Description of measured rainfall data sources
- Description of the rainfall analysis procedures
- A discussion of the conceptual design procedure for the preliminary capital projects
- Summary of the results of the water quality design storm analysis

- Comparison to other jurisdictions
- Recommendation for further evaluation

LONG-TERM RAINFALL DATA SOURCES

The parameters of the water quality design storm (i.e., total rainfall and rainfall intensity) are based on a statistical analysis of local long-term rainfall data. Hourly rainfall measurements are needed to determine the total rainfall volume for designing detention type facilities. For Eugene, long-term hourly precipitation data are available from a rain gage operated by the National Weather Service (NWS) at the Eugene Airport. Hourly precipitation data is available for this gauge location from 1948 to the present.

Shorter increment rainfall measurements (i.e., 5 to 15 minutes) are more appropriate for determining the rainfall intensity for designing flow-through type facilities. The City has operated several rain gauges within Eugene for the past six years that measure rainfall at 15-minute increments. The rainfall data collected at City gauge I1 (located in west Eugene on the Bertlesen Slough) and City gauge M2 (located in Amazon Park) were used in this analysis.

RAINFALL ANALYSIS PROCEDURES

The statistical analyses of the long-term hourly rainfall measurements collected by the NWS at the Eugene Airport were completed using the Synoptic Rainfall Data Analysis Program (SYNOP). SYNOP provides a summary and statistical analysis of storm event parameters (e.g., rainfall depths, storm intensity, storm duration) and of annual and monthly rainfall totals. The two key input variables in SYNOP are the inter-event time and minimum storm depth. The inter-event time represents the minimum length of dry period, in hours, beyond which additional rainfall measurements are considered to be separate storm events. It is used to separate a long-term continuous rainfall record into discrete, independent storm events. The minimum storm depth is applied to eliminate small storm events from the long-term record that are unlikely to produce measurable stormwater runoff. Storm events with a depth of 0.01 inches or less were eliminated from the long-term record as they are unlikely to produce measurable stormwater runoff. Additional analyses of the results from SYNOP were completed using Microsoft Excel.

CONCEPTUAL DESIGN OF PRELIMINARY CAPITAL PROJECTS

In order to develop conceptual designs for the preliminary capital projects identified during the basin planning process, a preliminary water quality design storm was needed. A SYNOP analysis was completed on the long-term hourly precipitation data from the NWS gage at the Eugene airport using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. The results of the SYNOP and spreadsheet analyses are presented in Figure 1.

The plot in Figure 1 presents the average annual percentage of storm events (y axis) that are equal to or less than a specific design storm rainfall depth (x axis). For example, approximately 80% of the storm events have a rainfall depth of 1.4 inches or less. Therefore, if a detention type stormwater quality facility were designed to capture and treat the stormwater runoff from a site resulting from a 1.4 inch storm event, approximately 80% of the annual stormwater runoff from the site would be treated. This storm depth, 1.4 inches, was selected as the preliminary water quality design storm for completing the conceptual designs for the detention type stormwater quality capital projects.

WATER QUALITY DESIGN STORM ANALYSIS

Based on recent Department Advisory Committee meetings, it seems apparent that development standards for stormwater quality are recommended for portions of Eugene. Therefore, we completed a more detailed analysis of the NWS and City rainfall records to develop the specific parameters of the water quality design storm for implementing development standards. The total rainfall and rainfall distribution is required to design detention type stormwater quality facilities. The rainfall intensity is required to design flow-through type facilities (both off-line and on-line). The procedures used to obtain these water quality design storm parameters are described below.

Detention Type Water Quality Facilities

Long-term hourly precipitation data at the Eugene airport were analyzed to select the water quality design storm parameters for designing detention type stormwater quality facilities. The SYNOP analysis was conducted using an inter-event time of 6 hours and a minimum storm depth of 0.01 inches. Based on the results presented in Figure 1, a design storm rainfall depth of 1.4 inches is required to capture approximately 80% of the average annual runoff from a site. A design storm rainfall depth of 0.95 inches is required to capture approximately 70% of the average annual runoff from a site. A design storm rainfall depth of 2.4 inches is required to capture 90% of the average annual runoff from a site.

The rainfall distribution describes the temporal distribution for the total rainfall. The U.S. Soil Conservation Service (SCS) developed a rainfall distribution for western Oregon and Washington referred to as SCS Type 1A. The duration of the SCS Type 1A storm event is typically specified as 24 hours. Based on our SYNOP analysis, the average storm durations for a 6-hr, 12-hr, and 24-hr inter-event time were 16 hours, 26 hours, and 46 hours, respectively. Therefore, a 24-hour rainfall distribution appears to be appropriate.

Flow-through Type Water Quality Facilities

Flow-through type facilities can be installed as off-line or on-line structures. With off-line facilities, an inlet control structure (e.g., flow control manhole) is installed to limit the maximum allowable flow rate that can be treated by the stormwater quality facility. Stormwater flows that exceed the maximum allowable flow rate are bypassed around the facility. The off-line configuration minimizes the possibility that particulates and other pollutants previously trapped by the facility will be resuspended and transported downstream during higher flows.

For on-line facilities, the high flows are not bypassed around the stormwater quality facility. A typical example of this type of facility is a vegetated swale. Most vegetated swales are designed to treat the peak flow rate resulting from the water quality design storm but also convey the peak flow rate resulting from the flood control design storm. During high flows, the treatment effectiveness of an on-line facility is eliminated or greatly reduced. Furthermore, there is a risk that a portion of the particulates and other pollutants that were previously trapped by the on-line facility could be resuspended and transported downstream. Due to these concerns, for an equivalent drainage area, an on-line facility typically must be significantly larger than an off-line facility to provide an equivalent degree of water quality treatment. Therefore, two rainfall intensities need to be specified for designing these facilities: one for the design of on-line facilities and one for the design of off-line facilities.

QA/QC for the 15-Minute Rainfall Data Collected at City Gauges I1 and M2

The 15-minute rainfall data collected at City gauges I1 and M2 were used to determine the rainfall intensity for designing flow-through type facilities. The rainfall data were available from I1 and M2 from January 1995 to December 1999. A comparison of the rainfall data from the two gauges indicated that significant differences exist in the two data sets for some periods of record. Therefore, the 15-minute rainfall data collected at I1 and M2 were studied and analyzed for quality assurance and control purposes. The daily precipitation data collected from the NWS Rain Gauge at the Eugene Airport were also used in the data QA/QC process. The steps involved in data QA/QC are summarized below.

First we calculated daily precipitation at I1 and M2 from 1995 to 1999 by summing all the 15-minute rainfall data collected on each individual day. The daily precipitation at I1 and M2 were then compared with the daily precipitation data collected from the National Weather Service Rain Gauge at the Eugene Airport. One rainfall data file was developed from the two city data sets (i.e., the I1 and M2 rain gages) based on the following criteria:

- If the daily precipitation data for specific dates at one city gauge were significantly different from the daily rainfall data from the NWS gauge and the other city gauge, the data collected at this city gauge were excluded for those dates;
- If the daily precipitation data collected at the two city gauges were similar for a storm event but were quite different from the data collected from NWS, the city gauge that had the closer daily rainfall values to the NWS data were included in the combined data set;
- For certain days in a month that the daily rainfall data were different at all three rain gauges, data from the city gauge that was excluded the least frequently in that month was included in the combined data set.

The following periods of precipitation data were excluded altogether from the records due to the malfunctioning of both the I1 and M2 rain gages:

1. March 6, 1995 through March 31, 1995
2. September 1, 1999 through December 31, 1999.

The QA/QC results can be found in the spreadsheet files titled 1995.xls, 1996.xls, 1997.xls, 1998.xls and 1999.xls. The shaded areas in the spreadsheet represent the periods of record that were excluded. A new set of 15-minute rainfall data was developed by combining the 15-minute rainfall data collected at I1 and M2 from 1995 to 1999 as described above. A spreadsheet analysis was then performed on the combined data set to develop a frequency distribution of rainfall intensities for on-line and off-line flow-through water quality facilities. Descriptions of the spreadsheet analysis for both off-line and on-line flow-through facilities are provided in the following sections.

Off-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was completed to summarize the occurrence of rainfall intensities for off-line facilities. The results are presented in Figure 2. The results are based on the assumption that all stormwater runoff would be treated if the measured rainfall intensity was equal to or less than the design storm intensity. If the measured rainfall intensity exceeded the design storm intensity, then the percentage of the storm that could be treated was set equal to the ratio of the design storm intensity to the actual storm intensity. For example, if the facility is designed to treat storm events with a maximum intensity of 0.2 in/hr, then all the runoff from storm events with intensities less than or equal to 0.2 in/hr can be treated. However, if the rainfall intensity is 0.3 in/hr, then only 2/3 (or 66%) of the runoff generated this storm event would get treated.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.13 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.08 in/hr, and 90% would be treated using a rainfall intensity of 0.19 in/hr.

On-line Flow-through Type Facilities

A spreadsheet analysis of the combined 15-minute rainfall data collected at City gauges I1 and M2 was also completed to summarize the occurrence of rainfall intensities for on-line facilities. The results are presented in Figure 2. The results for on-line facilities are based on a different set of assumptions than for off-line facilities. Similar to off-line facilities, if the measured rainfall intensity was less than or equal to the design storm intensity, then all of the stormwater runoff would be treated. However, if the measured rainfall intensity exceeded the design storm intensity, the results are based on the assumption that all of the stormwater runoff from that event would not receive treatment.

Based on these assumptions, 80% of the average annual runoff volume would be treated if the off-line facility is designed using a rainfall intensity of 0.22 in/hr. Approximately 70% of the average annual runoff volume would be treated using a rainfall intensity of 0.17 in/hr, and 90% would be treated using a rainfall intensity of 0.34 in/hr.

COMPARISON WITH OTHER JURISDICTIONS

Several other regional jurisdictions have recently adopted development standards for water quality. The following table presents the water quality requirements for Portland, Gresham, and the Unified Sewerage Agency with proposed requirements in Eugene.

Jurisdiction	Average Annual Rainfall (in)	Water Quality Design Storm			
		Detention Type Facilities		Flow-through Type Facilities	
		Total Rainfall (in)	Storm Duration	Off-Line Facilities	On-Line Facilities
Portland	34	0.83	24-hr duration	Not Specified	Not Specified
Gresham	34	1.2	12-hr duration	0.11 in/hr	0.20 in/hr
USA	40	0.36	4-hr duration	Not Specified	Not Specified
Eugene	45	1.4	24-hr duration	0.13 in/hr	0.22 in/hr

RECOMMENDATION

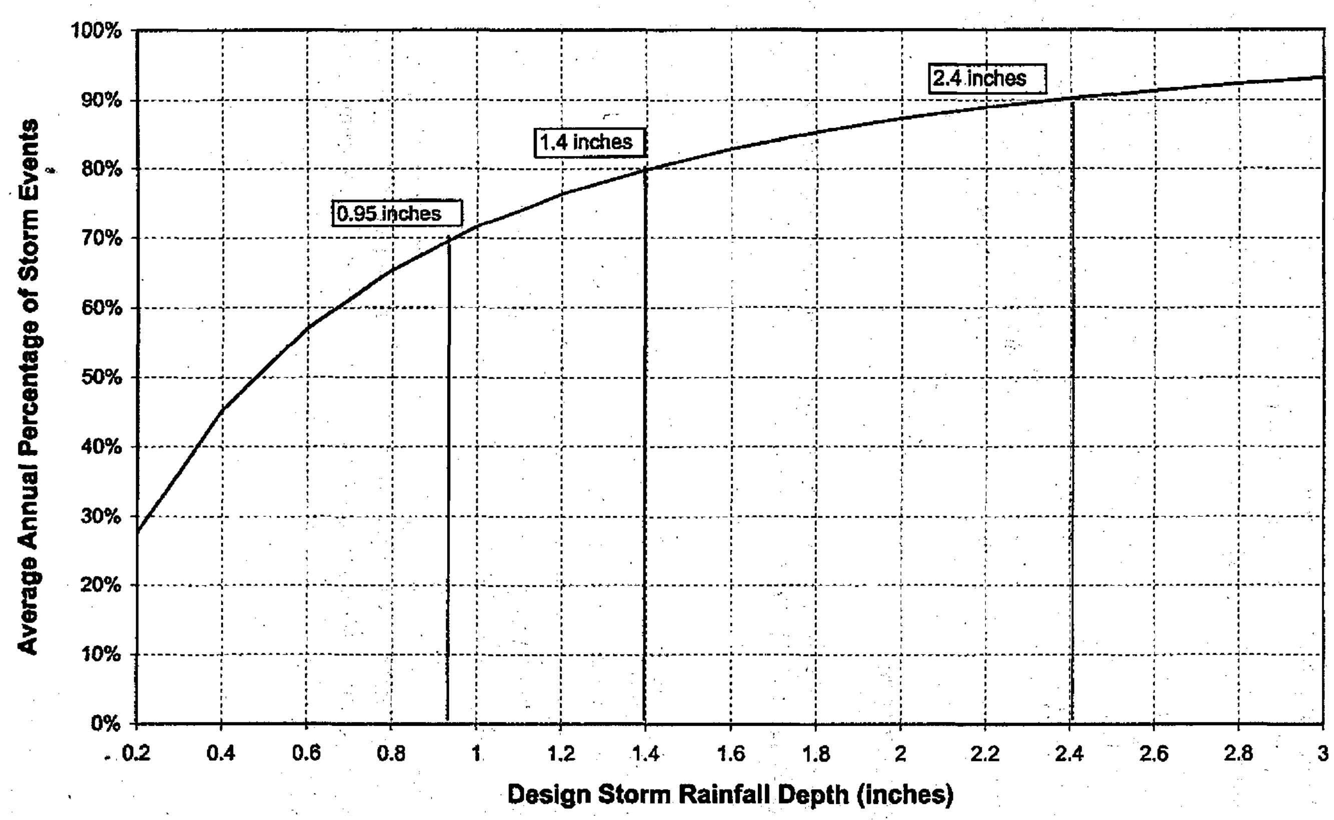
Based on the above analysis, we recommend that preliminary capital project designs and example site designs (for the DAC) incorporate the use of the following design storm specifications:

- For detention type facilities: required storage volume is equal to the stormwater runoff resulting from a 1.4 inch, 24-hour duration design storm
- For off-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.13 in/hr
- For on-line flow-through type facilities: treat the peak flow rate resulting from a design storm with a rainfall intensity of 0.22 in/hr

For the development of design tools (Task 400B1) and development of the BMP manual (Task 400B3), we recommend further analysis of the proposed design storms. Specifically, we recommend designing some example facilities to meet these requirements and running the long-term rainfall record through the facilities to ensure 80% capture of runoff.

Figure 1

Occurrence of Storm Events Based on an Analysis of the 50-year NWS Rainfall Record from the Eugene Airport (inter-event time = 6 hrs, minimum storm volume = 0.01 in)



I:\945042na\task300\precip\wqdesign\volume.xls 7/5/02

Figure 2

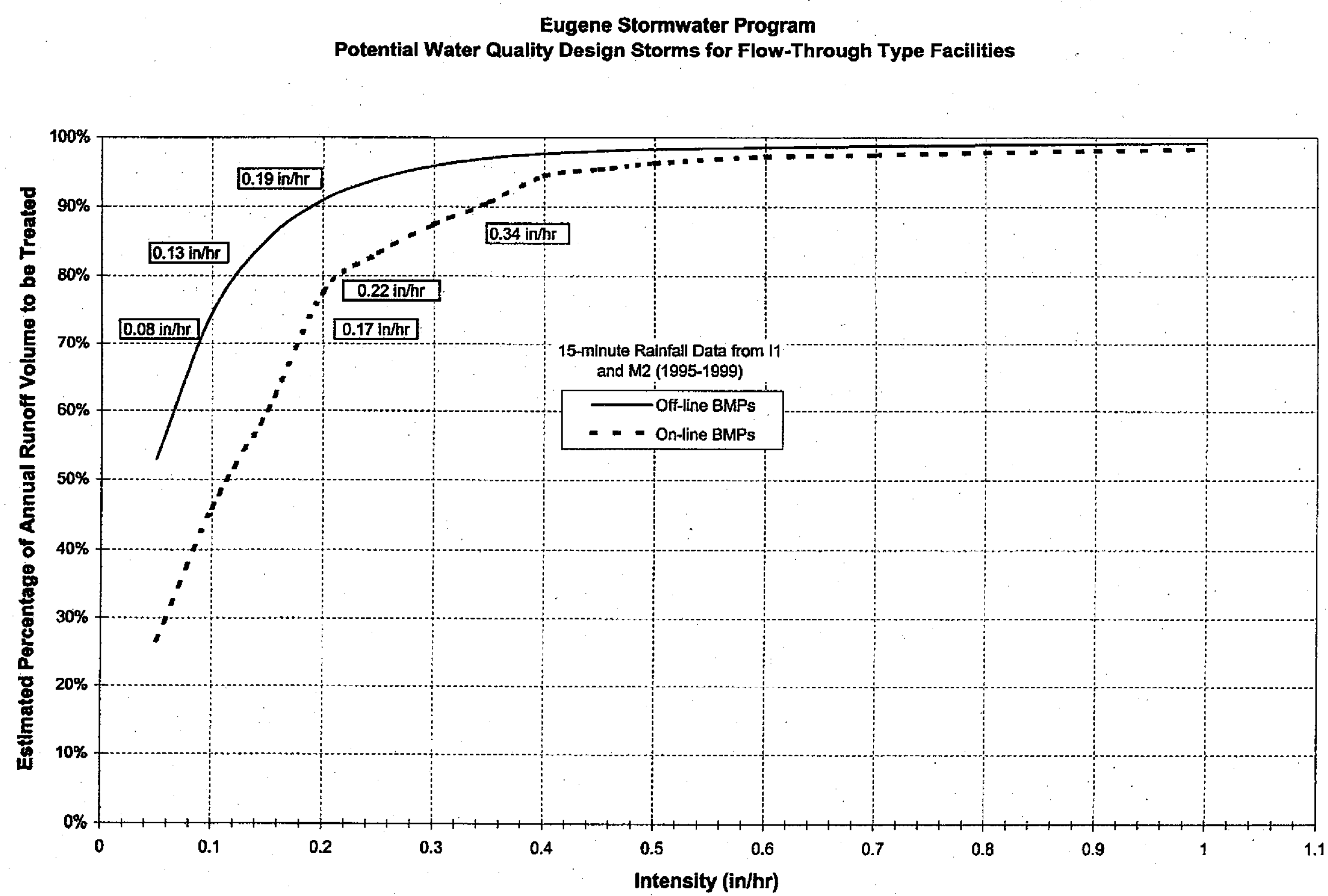


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FIGURE 1

APPENDIX F

FLOOD CONTROL DESIGN STORMS

Storm Recurrence Intervals
(Tables 3-1, 3-2, and 3-3, Section 3, 2002 Basin Plans)

OTAK Rainfall Intensity Curves

Table 3-1
Storm Recurrence Intervals for Planning and Design of Drainage Improvements

Drainage Area (acres)			Type of Drainage Improvement		Culverts and Bridges - Type of Roadway		Design Storm Recurrence Interval in Years
			Open Channel	Closed Pipe	Major Collectors and Neighborhood Collectors	Major Arterials and Minor Arterials	
<40	40 TO 640	>640	(a)	(b)	(c)	(d)	(e)
X				X			5/10 (h)
X			X		X	X	10 (f)
	X			X			10 (f)
	X		X		X		10 (f)
	X					X	25
		X	X	X(g)	X		25
		X				X	50
All improvements on waterways with FEMA 100-year floodplains							100

(a) Includes roadside ditches and drainage swales
(b) Storm sewer systems or a closed conduit whose length exceeds that of a normal culverted crossing of a single roadway
(c) Includes local or residential streets, local collectors, and any other roadways up to a major arterial
(d) Major arterial or better within the City's right-of-way maintenance
(e) Assuming ultimately planned development conditions (i.e., impervious cover) within the City's Urban Growth Boundary (UGB) and existing development conditions outside of the City's UGB
(f) The 5-year recurrence interval can be used in unusual situations involving sufficient topographical conditions that result in an exceptionally high cost differential between the 10-year and 5-year improvement design (e.g., 40%)
(g) Closed pipe systems should not be used on waterways draining more than 640 acres (i.e., 1 square mile)
(h) The 5-year storm may be used when the Rational Method is applied to calculate the design flow rate. The 10-year storm should be used for closed pipes with <40 acre drainage areas when using the City's SWMM modeling results or when extending the City's SWMM model using consistent methods and assumptions as used for the City's SWMM modeling work.

Table 3-2
Selected Design Events for Each Basin

Design Event	Amazon Creek	Willow Creek	Bethel Danebo	Laurel Hill	Willakenzie	Willamette River
10-Year	11/25/77	11/23/60	11/23/60	11/25/77	11/25/77	8/16/68 2/5/96
25-Year Summer	8/16/68	**	8/16/68	8/16/72	8/21/79	*
25-Year Winter	2/5/96	2/5/96	10/31/94	10/31/94	10/31/94	*
50-Year	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	5.76" SCS Type 1A	*
100-Year	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	6.48" SCS Type 1A	*

*For the Willamette basin, only the 10-year storm was needed for the evaluation because only selected portions of the basin were modeled.

**For the Willow Creek basin, an August storm was not evaluated as the short, high-intensity events were not as critical in this basin as the long duration, high-volume events.

Table 3-3
Design Events Characteristics

Design Event	Rainfall Volume (inches)	Maximum Intensity (in/hour)	Approximate Duration (hours)
11/23/60	7.36	0.67	114
8/16/68	1.36	1.14	10
8/16/72	1.38	0.92	5
11/25/77	2.09	0.66	7
8/21/79	1.82	1.11	3
10/31/94	4.05	0.70	32
2/5/96	7.24	0.66	51
50-Year SCS Type 1A	5.76	0.95	24
100-Year SCS Type 1A	6.48	1.06	24

The above information is based on NWS rain gage data.

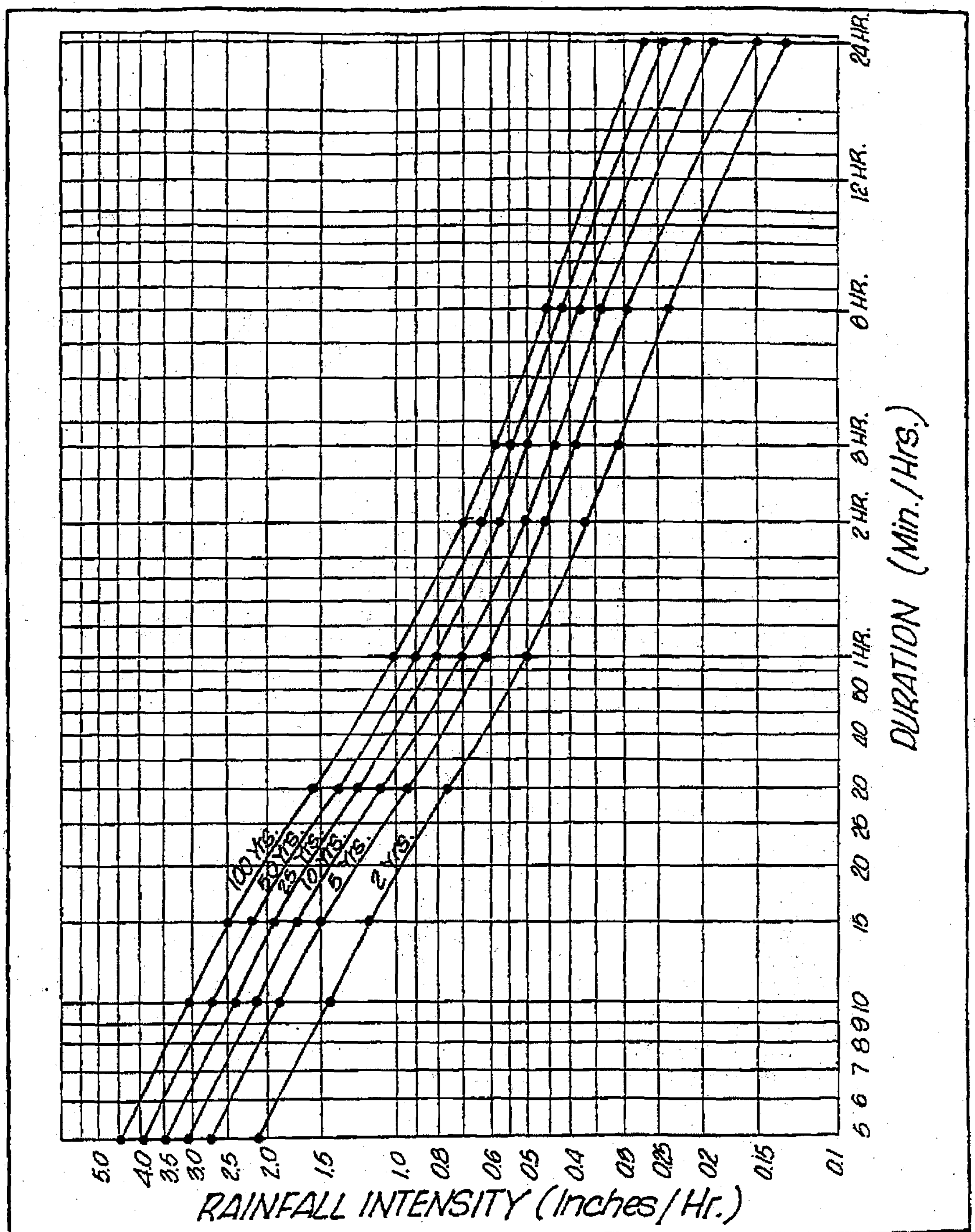


FIGURE 4.1
Rainfall Intensity, Duration and Frequency Curves for Eugene, Oregon

otak incorporated
INC. ARCHITECTS, P.C.

Appendix G
FACILITY PLANTING & SOIL RECOMMENDATIONS

G.1 RECOMMENDED PLANT LISTS

Eco-Roof Recommended Plants:

Note: For Roof Garden plants, the City of Eugene recommends using drought tolerant, self-sustaining native trees, shrubs and ecoroof plants.

Sedums and Succulents

Delosperma cooperi,	Ice plant
Delosperma nubegenum,	Ice plant
Sedum acre	Stonecrop
**Sedum album*	White Stonecrop
**Sedum telephium* varieties including 'Autumn Joy' and 'Variegatum'	Stonecrop
Sedum divergens	Stonecrop
Sedum hispanicum	Stonecrop
Sedum kamtschaticum	Stonecrop
**Sedum oreganum*	Oregon Stonecrop
Sedum sexangular	Stonecrop
**Sedum spathilifolium*	Stonecrop
**Sedum spurium* varieties	Stonecrop
**Sempervivum tectorum,*	Hens and Chicks

Herbaceous

Achillea millefolium,	Common Yarrow
Achillea ageratifolia,	Greek Yarrow
Achillea tomentosum,	Wooly Yarrow
Allium acuminatum	Hooker's Onion
Allium amplectens	Slim Leaf Onion
Arenaria montana,	Sandwort
Artemesia 'Silver mound',	Artemesia
Aurinia saxatilis,	Alyssum saxatile
Brodiaea congesta	Harvest Brodiaea
**Cerastium,*	Snow-in-Summer
Clarkia amoena	Summer's Darling
Clarkia purpurea	Four Spot Godetia
Dianthus alwoodii,	Pink
Dianthus deltoides,	Maiden Pink
Dichelostemma congestum	Ookow

Erigeron discoideus,	Fleabane
Festuca glauca,	Blue Fescue
Fragaria vesca,	Woodland Strawberry
Gazania linearis var. 'CO gold',	Gazania
**Gilia capitata,*	Globe gilia
Koeleria macrantha	Junegrass*
Lobularia maritima,	Sweet alyssum
Nierembergia repens,	Cup Flower
**Polypodium glycrrhiza,*	Licorice Fern
**Polystichum munitum,*	Sword Fern
Potentilla nepalensis,	Nepal Cinquefoil
Potentilla nuemaniana,	Cinquefoil
Thymus serphyllum,	Mother of Thyme
Thymus vulgaris,	Common Thyme
Veronica liwanensis,	Speedwell

* Indicates that Portland's Bureau of Environmental Services has observed these plants generally survive in ecoroof areas that do not receive summer irrigation. Most of these locations have moderate to deep shade. To date these plants appear very stressed by the end of summer, but they have comeback each year. It is likely that many of the other plants listed above could survive in such conditions without irrigation.

Contained Planter Box, Infiltration Planter Box, and Flow-Through Planter Box Recommended Plants:

Note: Generally, plants requiring **moist-wet** conditions are preferred for flow-through facilities; plants requiring **moist to dry** conditions are preferred for infiltration facilities.

Shrubs

Ceanothus velutinus,	Snowbrush- moist-dry
Cornus sericea,	Redtwig Dogwood- moist-wet
Gaultheria shallon,	Salal- moist-dry
Mahonia (or Berberis) aquifolium,	Tall Oregon Grape-moist-dry
Mahonia nervosa,	Dull Oregon Grape– moist-dry
Physocarpus capitatus,	Pacific Ninebark- moist-wet
Ribes sanguineum,	Red-flowering Current- moist-dry
Rosa gymnocarpa,	Baldhip Rose– moist-dry
Rosa nutkana,	Nootka Rose– moist-dry
Rosa pisocarpa,	Swamp Rose– moist-dry
Rubus parviflorus,	Thimbleberry– moist-dry
Symphoricarpos alba,	Common Snowberry- moist-dry
Viburnum edule,	Highbush Cranberry; Squashberry- moist

Large Shrubs/ Small Trees

Acer circinatum,	Vine Maple– moist-wet
Amelanchier alnifolia,	Western Saskatoon Serviceberry-dry
Crataegus douglasii (or *C. suksdorfii*),	Douglas' Black Hawthorn– moist-wet
Malus fusca,	Pacific Crab Apple– moist-wet
Oemleria cerasiformis,	Indian Plum– moist-dry
Philadelphus lewisii,	Mock Orange– moist-dry
Prunus emarginata (or *P. virginiana*),	Bitter Cherry- moist
Rhamnus purshiana,	Cascara– dry-wet
Salix hookeriana,	Piper's Willow– moist-wet
Salix scouleriana,	Scoulers Willow- moist-wet
Salix sessilifolia,	Soft leafed Willow– moist-wet
Salix sitchensis,	Sitka Willow– moist-wet
Spiraea douglasii,	Douglas Spiraea– moist-wet

Grass and Grass-Like Plants

Agrostis exarata	Spike Bentgrass - wet -dry
Allium amplectens	Slim Leaf Onion- moist-dry
Allium acuminatum	Hooker's Onion- moist-dry
Beckmannia syzigachne,	American Slough Grass– moist-wet
Brodiaea congesta	Harvest Brodiaea- moist-dry
Bromus carinatus,	California Brome Grass- moist-dry

Bromus sitchensis,	Alaska Brome– moist-dry
Bromus vulgaris,	Columbia Brome Grass– moist-dry
Camassia quamash,	Common Camas- moist-dry
Carex densa	Dense Sedge– moist-wet
Carex deweyanna,	Dewey Sedge– moist-wet
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge– moist-wet
Carex tumulicola	Foothill Sedge- moist-dry
Dichelostemma congestum	Ookow- moist-dry
Deschampsia cespitosa,	Tufted Hairgrass- moist-dry
Deschampsia elongata	Slender Hairgrass- moist-dry
Eleocharis acicularis,	Needle Spike-Rush- moist-wet
Eleocharis ovata,	Ovate Spike-Rush- moist-wet
Eleocharis palustris,	Creeping Spike-Rush- moist-wet
Elymus glaucus,	Blue Wildrye– moist-dry
Elymus trachycaulus	Slender Wheatgrass- - moist-dry
Festuca occidentalis,	Western Fescue Grass– moist-dry
Festuca rubra var. commutata,	Western Red Fescue– moist-dry
Festuca roemeri var. *roemeri*	Roemer's Fescue - dry
Glycera occidentalis,	Western Mannagrass– moist-wet
Iris tenax,	Oregon Iris– moist-dry
Juncus acuminatus	Tapertip Rush– moist-wet
Juncus effusus var. pacificus	Common Rush– moist-wet
Juncus effufus var. gracilis	Common Rush– moist-wet
Juncus ensifolius,	Dagger-leaf Rush- moist-wet
Juncus patens,	Grooved Rush, Spreading Rush, - moist-wet
Juncus tenuis,	Slender Rush– moist-wet
Juncus unilateralis	One-sided Rush- moist-wet
Koeleria macrantha	Junegrass- moist-dry
Scirpus acutus,	Hardstem Bulrush- moist-wet
Scirpus microcarpus,	Small Fruited Bulrush- moist-wet
Sedum oreganum,	Oregon Sedum- dry
Sisyrinchium idahoense (or *S.angustifolium; S. bellum*),	Blue-eyed Grass– moist
Sisyrinchium douglasii,	Purple-Eyed Grass-moist

Ferns: Moist Shade

Athyrium felix-femina,	Lady Fern
Blechnum spicant,	Deer Fern
Polypodium glycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern
Pteridium aquilinum,	Bracken Fern

Vegetated Swale and Vegetated Filter Strip Recommended Plants:

Planting zones
Swale bottom to 1.5 ft. up the side slope = wet to moist
Side slopes from 1.5 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Grasses and Groundcovers - Wet to Moist

Agrostis exarata	Spike Bentgrass
Carex obnupta,	Slough Sedge
Eleocharis ovata,	Ovate Spike-Rush- moist-wet
Eleocharis acicularis,	Needle Spike-Rush- moist-wet
Eleocharis palustris,	Creeping Spike-Rush- moist-wet
Downingia elegans	Calico Flower
Glyceria occidentalis,	Manna Grass
Hordeum brachyantherum,	Meadow Barley
Juncus acuminatus	Tapertip Rush- moist-wet
Juncus effusus var. pacificus	Common Rush
Juncus effufus var. gracilis	Common Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus oxymeris,	Pointed Rush
Juncus tenuis,	Slender Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus unilateralis	One-sided Rush- moist-wet
Plagiobothrys figuratus	Popcorn Flower
Scirpus microcarpus,	Small flowered (or fruited) Bulrush

Ferns: Moist shade

Blechnum spicant,	Deer Fern
Polypodium gycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern

Moist to dry

Arctostaphyllos uva-ursi,	Kinnick-innick Aster
Aster suspicatus,	Douglas' Aster
Aster hallii	Hall's Aster
Bromus carinatus,	California Brome Grass
Bromus sitchensis,	Alaska Brome
Bromus vulgaris,	Columbia Brome Grass
Clarkia amoena	Summer's Darling
Clarkia purpurea	Four Spot Godetia
Collomia grandiflora	Large Leaf Collomia
Danthonia californica	California Oatgrass

Epilobium densiflora	Dense Spike Primrose
Eriophyllum lanatum	Oregon Sunshine
Festuca roemeri var. *roemeri*	Roemer's Fescue
Grindelia integrifolia	Gumweed
Iris tenax	Oregon Iris
Koeleria macrantha	Junegrass
Lupinus micranthus,	Small Flowered Lupine
Lupinus polyphyllus	Large Leaf Lupine
Lupinus rivularis	Riverbank Lupine
Madia elegans	Showy Tarweed
Potentilla gracilis var. gracilis	Graceful Cinquefoil
Prunella vulgaris var. *vulgaris*	Heal All
Ranunculus occidentalis	Western buttercup
Sisyrinchium idahoense,	Blue-eyed Grass
Camassia quamash,	Common Camas
Festuca occidentalis,	Western Fescue Grass
Deschampsia caespitosa,	Tufted Hairgrass
Elymus glaucus,	Blue Wildrye
Fragaria vesca or *F. virginiana,*	Woodland strawberry or Wild strawberry
Sisyrinchium idahoense,	Blue-eyed Grass

Shrubs- varying zones

Cornus sericea,	Redtwig Dogwood- moist-wet
Gaultheria shallon,	Salal- dry
Mahonia aquifolium,	Tall Oregon Grape- moist -dry
Mahonia nervosa,	Dull Oregon Grape- moist-dry
Physocarpus capitatus,	Pacific Ninebark- moist-wet
Ribes sanguineum,	Red-flowering Current-dry
Rosa gymnocarpa,	Baldhip Rose- moist -dry
Rosa nutkana,	Nootka Rose- moist-dry
Rosa pisocarpa,	Swamp Rose- moist-dry
Spiraea douglasii	Douglas Spiraea – moist-dry
Symphoricarpos alba,	Common Snowberry- moist-dry
Viburnum edule,	Highbush Cranberry; Squashberry- moist -dry

Large Shrub/Small Tree- varying zones

Acer circinatum,	Vine Maple- moist-wet
Amelanchier alnifolia,	Western Saskatoon Serviceberry- dry
Ceanothus cuneatus	Buckbrush- dry
Ceanothus integerrimus	Deerbrush- dry
Ceanothus sanguineus,	Oregon Redstem Ceanothus- dry
Corylus cornuta,	Western Beaked Hazelnut- moist-dry
Crataegus douglasii,	Douglas' Black Hawthorn- moist

Holodiscus discolor,	Oceanspray- moist-dry
Malus fusca,	Pacific Crab Apple- moist-wet
Oemleria cerasiformis,	Indian Plum; Osoberry- moist-wet
Philadelphis lewesii,	Mock Orange- moist-dry
Prunus emarginata or *P.Virginiana*	Bitter or Choke Cherry- moist
Rhamnus purshiana,	Cascara- dry-wet
Rosa nutkana,	Nootka Rose- moist-dry
Rubus parviflorus,	Thimbleberry- moist-dry
Salix fluviatalis,	Columbia Willow- moist-wet
Salix hookeriana,	Piper's Willow- moist-wet
Salix lucida (or S. *lasiandra*),	Pacific Willow- moist-wet
Salix scouleriana,	Scoulers Willow-moist-wet
Salix sessilifolia,	Soft leafed Willow- moist-wet
Salix sitchensis,	Sitka Willow- moist-wet
Sambucus cerulea,	Blue Elderberry- moist- dry
Sambucus racemosa,	Red Elderberry- moist- dry

Conifer and Evergreen Trees- varying zones

Abies grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense cedar – moist-dry
Pinus monticola,	Western White Pine- moist-dry
Pinus ponderaosa,	Ponderosa Pine- dry
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Thuja plicata,	Western Red Cedar- moist-wet

Deciduous Trees- varying zones

Acer macrophyllum,	Big leaf Maple- moist-dry
Alnus rhombifolia	White Alder – moist-wet
Alnus rubra,	Red Alder - moist-wet
Amelanchier alnifolia,	Serviceberry - dry
Cornus nuttallii,	Western Flowering Dogwood– moist-dry
Fraxinus latifolia,	Oregon Ash - moist-wet
Populus balsamifera,	Black Cottonwood – moist-wet
Quercus garryana,	Oregon White Oak – dry
Quercus kelloggii	California Black Oak - dry

Grassy Swale Recommended Seed Mixes:

See **Exhibit G-1** for grass seed recommendations and specifications.

Vegetated Infiltration Basin and Dry Detention Pond Recommended Plants:

Planting zones
Basin bottom to 1.5 ft. up the side slope = moist
Side slopes from 1.5 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Note: These plants are recommended based on experience and/or literature review. For soils with slow infiltration rates (< 2 inches per hour) moist to wet plants are preferable; for soils with higher infiltration rates moist to dry plants are preferable.

Grasses and groundcovers: See **Exhibit G-1** for grass seed recommendations and specifications.

Moist

Agrostis exarata	Spike Bentgrass
Beckmannia syzigachne,	American Slough Grass
Carex densa	Dense Sedge- moist-wet
Carex deweyanna,	Dewey Sedge- moist-wet
Carex hendersonii,	Henderson Sedge
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge- moist-wet
Carex tumulicola	Foothill Sedge- moist-dry
Eleocharis acicularis,	Needle Spike-rush
Eleocharis ovata,	Ovate Spike-rush
Eleocharis palustris,	Creeping Spike-rush
Juncus effusus,	Common/Soft Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus tenuis,	Slender Rush
Scirpus acutus,	Hardstem Bulrush
Scirpus americanus,	Three-square or American Bulrush
Scirpus microcarpus,	Small Fruited Bulrush

Moist to Dry

Aster hallii	Hall's Aster
Aster suspicatus,	Douglas' Aster
Bromus carinatus,	California Brome Grass

Bromus sitchensis,	Alaska Brome
Bromus vulgaris,	Columbia Brome Grass
Camassia quamash,	Common Camas
Festuca occidentalis,	Western Fescue Grass
Deschampsia caespitosa,	Tufted Hairgrass
Elymus glaucus,	Blue Wildrye
Fragaria vesca or F. virginiana,	Woodland strawberry or Wild strawberry
Hordeum brachyantherum,	Meadow Barley
Iris tenax,	Oregon Iris
Lupinus micranthus,	Small Flowered Lupine
Lupinus rivularis	Riverbank Lupine
Sisyrinchium idahoense,	Blue-eyed Grass

Ferns: Moist shade

Blechnum spicant,	Deer Fern
Polypodium gycrrhiza,	Licorice Fern
Polystichum munitum,	Sword Fern
Athyrium felix-femina,	Lady Fern

Shrubs: moist

Cornus sericea,	Red-stemmed or Red-osier Dogwood
Salix hookeriana,	Hookers Willow
Salix lucida var. 'lasiandra',	Pacific Willow
Salix sitchensis,	Sitka Willow
Salix scouleriana,	Scouler's Willow
Salix fluviatalis,	Columbia Willow
Sambucus racemosa,	Red Elderberry
Physocarpis capitatus,	Pacific Ninebark
Spiraea douglasii,	Douglas Spirea
Crataegus douglasii,	Black Hawthorn
Rhamnus purshiana,	Cascara
Rubus spectabilis,	Salmonberry
Rosa pisocarpa,	Swamp Rose

Shrubs: (moist-dry)

Acer circinatum,	Vine maple
Ceanothus cuneatus	Buckbrush- dry
Ceanothus integerrimus	Deerbrush- dry
Ceanothus sanguineous,	Oregon Redstem Ceanothus
Ceanothus velutinus,	Snowbrush
Corylus cornuta,	Western Beaked Hazelnut
Gautheria shallon,	Salal
Holodiscus discolor,	Oceanspray

Mahonia aquifolium,	Tall Oregon Grape
Mahonia nervosa,	Dull Oregon Grape
Philadelphus lewisii,	Mock Orange
Ribes sanguineum,	Red Flowering Currant
Rosa gymnocarpa,	Baldhip Rose
Rosa nutkana,	Nootka Rose
Rubus parviflorus,	Thimbleberry
Spiraea douglasii,	Douglas' Spiraea
Symphoricarpus albus,	Snowberry
Viburnum edule,	Highbush Cranberry

Trees

Conifer and Evergreen Trees- varying zones

Abies Grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense Cedar
Castanopsis chrysopylla,	Chinquapin- dry
Pinus monticola,	Western White Pine- moist-dry
Pinus Ponderaosa,	Ponderosa Pine- dry
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Thuja plicata,	Western Red Cedar- moist-wet (prefers shade)

Deciduous Trees- varying zones

Acer macrophyllum,	Big leaf Maple – moist-dry
Alnus rhombifolia	White Alder- moist-wet
Alnus rubra,	Red Alder - moist-wet
Amelanchier alnifolia,	Serviceberry - dry
Cornus nuttalii,	Western Flowering Dogwood – moist-dry
Fraxinus latifolia,	Oregon Ash - moist-wet
Malus fusca,	Pacific crabapple - moist-wet
Oemleria cerasiformis,	Indian Plum - moist-dry
Populus balsamifera,	Black Cottonwood – moist-wet
Quercus garryana,	Oregon White Oak – moist-dry
Quercus kelloggii	California Black Oak - dry

Wet and Extended Wet Pond Recommended Plants:

Planting zones
Shallow water to 1 ft. up the side slope = wet to saturated
Side slopes from 1 - 3 ft. = moist to dry
Side slopes above 3 ft. and upland = dry

Wetland herbaceous plants (aquatic and emergent)
Emergent wet to saturated zone

Alisma plantago-aquatica,	Water Plantain
Carex obnupta,	Slough Sedge
Eleocharis ovata,	Ovate Spike rush
Eleocharis palustris,	Creeping Spike rush
**Lemna minor,*	Common Lesser Duckweed*
Myosotis laxa,	Small-flowered Forget-me-not
**Potamogeton natans,*	Floating-leafed Pondweed
**Sagittaria latifolia,*	Broadleaf Arrowhead; Wapato
Scirpus acutus,	Hardstem Bulrush
Sparganium emersum,	Narrowleaf Bureed
Veronica americana	American Speedwell

Moist to wet zone

Alopecurus geniculatus,	Water foxtail
Beckmannia syzigachne,	American Slough Grass
Carex densa	Dense Sedge- moist-wet
Carex deweyanna,	Dewey Sedge- moist-wet
Carex hendersonii,	Henderson Sedge
Carex obnupta,	Slough Sedge- moist-wet
Carex stipata,	Sawbeak Sedge- moist-wet
Juncus acuminatus	Tapertip Rush- moist-wet
Juncus effusus var. pacificus	Common Rush
Juncus effufus var. gracilis	Common Rush
Juncus ensifolius,	Dagger-leaf Rush
Juncus oxymeris,	Pointed Rush
Juncus tenuis,	Slender Rush
Juncus patens,	Grooved Rush; Spreading Rush
Juncus unilateralis	One-sided Rush- moist-wet
Lupinus polyphyllus,	Large-leaved Lupine
Scirpus microcarpus,	Small flowered (or fruited) Bulrush

Grasses and Groundcovers: varying zones, see **Exhibit G-1** for grass seed recommendations and specifications.

Arctostaphyllos uva-ursi,	Kinnick-Kinnick - dry
Aster suspicatus,	Douglas' Aster - moist-dry
Aster hallii	Hall's Aster– moist-dry
Bidens cernua,	Nodding Beggarticks- moist -wet
Bromus carinatus,	California Brome Grass - moist-dry
Bromus sitchensis,	Alaska Brome - moist-dry
Bromus vulgaris,	Columbia Brome Grass– moist-dry
Clarkia amoena	Summer's Darling– moist-dry
Clarkia purpurea	Four Spot Godetia– moist-dry
Collomia grandiflora	Large Leaf Collomia - moist-dry
Danthonia californica	California Oatgrass– moist-dry
Epilobium densiflora	Dense Spike Primrose– moist-dry
Eriophyllum lanatum	Oregon Sunshine– moist-dry
Festuca roemeri var. *roemeri*	Roemer's Fescue - dry
Glyceria occidentalis,	Western Mannagrass- moist-wet
Grindelia integrifolia	Gumweed– moist-dry
Iris tenax	Oregon Iris– moist-dry
Koeleria macrantha	Junegrass– moist-dry
Lupinus micranthus,	Small Flowered Lupine - moist-dry
Lupinus polyphyllus	Large Leaf Lupine– moist-dry
Lupinus rivularis	Riverbank Lupine– moist-dry
Madia elegans	Showy Tarweed– moist-dry
Potentilla gracilis var. gracilis	Graceful Cinquefoil– moist-dry
Prunella vulgaris var. *vulgaris*	Heal All– moist-dry
Ranunculus occidentalis	Western buttercup– moist-dry
Sisyrinchium idahoense,	Blue-eyed Grass - moist-dry

Shrub: moist to saturated zones

Acer circinatum,	Vine Maple
Blechnum spicant,	Deer Fern
Cornus sericea,	Red-stemmed dogwood
Crateagus douglasii,	Black Hawthorn
Rhamnus purshiana,	Cascara
Rubus spectabilis,	Salmonberry
Rosa gymnocarpa,	Baldhip Rose
Rosa pisocarpa,	Swamp Rose
Oemlaria cerasiformis,	Indian Plum
Physocarpis capitatus,	Pacific Ninebark
Polystichum munitum,	Sword fern
Prunus emarginata,	Bitter Cherry

Salix fluviatalis,	Columbia Willow
Salix hookeriana,	Hookers Willow
Salix sitchensis,	Sitka Willow

Shrub: moist to dry zones

Mahonia aquifolium,	Tall Oregon Grape
Mahonia nervosa,	Dull Oregon Grape
Rosa nutkana,	Nootka Rose
Rubus parviflorus,	Thimbleberry
Spiraea betulifolia,	Shiny-leaf Spiraea
Symphoricarpus alba,	Snowberry
Sambucus racemosa,	Red Elderberry
Spiraea douglasii,	Douglas Spiraea
Viburnum edule,	Highbush Cranberry; Squashberry

Shrub dry zones

Ceanothus cuneatus	Buckbrush
Ceanothus integerrimus	Deerbrush
Corylus cornuta,	Western Beaked Hazelnut
Holodiscus discolor,	Oceanspray
Lonicera involucrata,	Black twinberry
Mahonia aquifolium,	Tall Oregon Grape
Philadelphis lewesii,	Mock Orange
Ribes sanguineum,	Red Flowering Currant
Salix scouleriana,	Scouler's Willow

Conifer and Evergreen Trees - varying zones

Abies grandis,	Grand Fir- moist-dry
Arbutus menziesii,	Madrone- dry
Calocedrus decurrens	Incense Cedar
Castinopsis chrysophylla,	Chinquapin- dry
Pinus ponderosa,	Ponderosa Pine- dry
Pinus monticola,	Western White Pine- dry-moist
Pseudotsuga menziesii,	Douglas Fir- moist-dry
Sequoia sempervirons,	Coast Redwood- moist
Thuja plicata,	Western Red Cedar- moist-wet

Deciduous Trees - varying zones

Acer macrophyllum,	Big leaf Maple- moist- dry
Alnus rhombifolia	White Alder- moist-wet
Alnus rubra,	Red Alder- moist-wet
Amelanchier alnifolia,	Serviceberry- dry
Cornus nuttalii,	Western Flowering Dogwood- moist-dry

Fraxinus latifolia,	Oregon Ash- moist-wet
Malus fusca,	Pacific crabapple- moist-wet
Oemleria cerasiformis,	Indian Plum- moist-dry
Populus balsamifera,	Black Cottonwood- moist-wet
Salix lucida var.' lasiandra',	Pacific Willow- moist-wet
Quercus garryana,	Oregon White Oak- moist-dry
Quercus kelloggii	California Black Oak - dry

Exhibit G-1

SEED SPECIFICATIONS FOR STORMWATER MANAGEMENT MANUAL

Species listed below should only be used in the listed moisture regime for optimal success. *Sow rates for **small seeded mixes** shall contain a **minimum of 20 lbs/per acre in combination** for stormwater management facilities and **30 lbs/acre for erosion control** purposes. **Sow rates for large/medium seeded** mixes should contain a **minimum of 25 lbs per acre** in combination for stormwater management facilities and 40 pounds per acre **for erosion control** purposes.*

Common name	Scientific Name	Optimal Sow Season	Natrl or to add diversity?	Swale or Pond Sow Rate (Hand)	Erosion Control Sow Rate	Moisture	Exposure	Seed size	Commercial accessibility of local eco-type
Grasses									
American sloughgrass	Beckmannia syzigachne	fall/spring	D	2 lbs/ac	NR	inundated to wet	sun	medium	easy to medium, Willamette Valley
Blue wildrye	Elymus glaucus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun to shade	large	easy, Portland Metro
California brome	Bromus carinatus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun	large	easy, Portland Metro
California oatgrass	Danthonia californica	fall/spring	M	**30 lbs/ac**	NR		sun	large	easy to medium, Willamette Valley
Columbia brome	Bromus vulgaris	fall/spring	D	5 lbs/ac	NR	xeric to mesic	shade	large	medium, Portland Metro
Junegrass	Koeleria macrantha	fall/spring	M	**20 lbs/ac**	NR	xeric to mesic	sun	small	easy to medium, PDX or Willamette Valley
Meadow barley	Hordeum brachyantheru	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	wet to mesic	sun	large	easy to medium, Willamette Valley
Pine bluegrass	Poa secunda								
Rice cutgrass	Leersia oryzoides	fall/spring	D	5 lbs/ac	NR	inundated to wet	sun	medium	medium to difficult, Portland Metro
Roemer's fescue	Festuca roemeri	fall/spring	D	2 lbs/ac	NR	xeric to mesic	sun	small	difficult, Willamette Valley
Sitka brome	Bromus sitchensis	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	wet to mesic	sun/shade	large	easy, Willamette Valley
Slender hairgrass	Deschampsia elongata	early fall/spring	M	**20 lbs/ac**	30 lbs/acre	wet to xeric	sun	small	easy, Portland Metro
Slender wheatgrass	Elymus trachycaulus	early fall/spring	M	**25 lbs/ac**	40 lbs/acre	xeric to mesic	sun	large	medium to difficult, Willamette Valley
Spike bentgrass	Agrostis exarata	early fall/spring	D	5 lbs/ac	30 lbs/acre	saturated to wet	sun	small	easy to medium, Portland Metro
Tall mannagrass	Glyceria elata	fall/spring	D	2 lbs/ac	NR	saturated to mesic	shade	small	medium to difficult, Portland Metro
Tufted hairgrass	Deschampsia cespitose	fall/spring	D	2 lbs/ac	NR	saturated to wet	sun	small	easy, Willamette Valley
Water foxtail	Alopecuris geniculatus	fall/spring	M	**25 lbs/ac**	NR	inundated to wet	sun	medium	easy, PDX or Willamette Valley
Western fescue	Festuca occidentalis	fall/spring	M	**20 lbs/ac**	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Western mannagrass	Glyceria occidentalis	fall/spring	M	**25 lbs/ac**	NR	saturated to wet	sun	medium	easy to medium, Willamette Valley
Sedges, Rushes - soil moisture as indicated into summer months									
Carex obnupta	Slough sedge	fall/spring	D	2 lbs/ac	NR	inundated to mesic	sun/shade	medium	medium to difficult, PDX
Carex scoparia	Pointed broom sedge	fall/spring	D	2 lbs/ac	NR	wet to mesic	sun	medium	medium to difficult, PDX
Carex stipata	Sawbeak sedge	fall/spring	D	2 lbs/ac	NR	inundated to mesic	sun	medium	medium, Willamette Valley
Eleocharis ovata	Ovate spikerush	fall/spring	D	1 lb/ac	NR	inundated to wet	sun	small	easy, PDX or Willamette Valley
Eleocharis palustris	Creeping spikerush	fall/spring	D	2 lbs/ac	NR	inundated to wet	sun	small	easy to medium, Willamette Valley
Juncus acuminatus	Tapertip rush	fall/spring	D	0.25 lbs/ac	NR	inundated to wet	sun	small	medium, Willamette Valley, PDX
Juncus bufonius	Toad rush	fall/spring	D	0.25 lbs/ac	NR	wet to mesic	sun	small	medium, Willamette Valley
Juncus patens	Spreading rush	fall/spring	D	0.50 lb/ac	NR	wet to mesic	sun/shade	small	easy, PDX
Forbs									
Achillea millefolium	Western Yarrow	fall	D	0.25 lbs/ac	NR	wet to mesic	sun	medium	easy, PDX or Willamette Valley
Aquilegia formosa	Western Columbine	fall	D	1.0 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Alisma media	Water plantain	fall/spring	D	1.0 lb/ac	NR	inundated to wet	sun	medium	easy to medium, Willamette Valley
Collomia grandiflora	Large flowered collomia	fall/spring	D	.50 lbs/ac	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Collinsia rattanii	Blue eyed mary	fall/spring	D	.25 lbs/ac	NR	xeric to mesic	sun	small	medium to difficult, Willamette Valley
Epilobium densiflora	Dense spike primrose	fall	D	1.0 lb/ac	NR	wet to mesic	sun	small	medium, Willamette Valley
Eriophyllum lanatum	Wooly sunshine	fall	D	1.0 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Gilia capitata	Blue gilia	fall/spring	D	2 lbs/acre	1 lb/ac (w/	xeric to mesic	sun	medium	medium, Willamette Valley
Lotus purshianus	Spanish clover	fall	D	2 lbs/acre	1 lb/ac (w/	xeric to mesic	sun	medium	medium, Willamette Valley
Lupinus albicaulis	*Sickle keel lupine*	*fall*	*D*	*1 lb/ac*	*1 lb/ac (w/*	*xeric to mesic*	*sun*	*large*	*medium, Willamette Valley*
Iris tenax	Oregon Iris	fall	D	2 lbs/ac	NR	xeric to mesic	sun	large	easy to medium, Willamette Valley
Camassia quamash	Common camas	fall	D	1 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Camassia quamash va	Great camas	fall	D	1 lb/ac	NR	wet to mesic	sun	medium	easy to medium, Willamette Valley
Lupinus micranthus	Small flowered lupine	fall	D	1 lb/ac	NR	xeric to mesic	sun	medium	medium to difficult, Willamette Valley
Ranunculus occidental	Western buttercup	fall	D	1 lb/ac	NR	xeric to mesic	sun	medium	medium to difficult, Willamette Valley
Sidalcea campestris	Checker mallow	fall	D	1 lb/ac	NR	xeric to mesic	sun	large	medium to difficult, Willamette Valley
Lupinus rivularis	Stream lupine	fall	D	1 lb/ac	1 lb/ac (w/	xeric to mesic	sun	large	medium, Willamette Valley
Plagiobothrys figuratus	Popcorn flower	fall/spring	D	1.0 lb/ac	NR	inundated to wet	sun	small	medium to difficult, Willamette Valley
Prunella vulgaris var. la	Self heal	fall/spring	D	2 lbs/ac	1 lb/ac (w/	wet to mesic	sun/shade	medium	easy to medium, PDX or Willamette Valley
Solidago canadensis	Goldenrod	fall	D	0.50 lbs/ac	NR	xeric to mesic	sun	small	easy to medium, PDX or Willamette Valley
Recommended Non-Native Cover Crop Species									
Festuca rubra var. com	Chewings fescue	year round	M	20 lbs/ac	30-40				n/a
Triticum spp.	Wheat	year round	M	50 lbs/ac	80				n/a
Avena spp.	Oats	year round	M	50 lbs/ac	80				n/a
Regreen	Sterile wheat hybrid	year round	M	40 lbs/ac	50				n/a
Agropyron spp.	Wheatgrass	year round	M	30 lbs/acre	40				A. trachycaulus (W.V. source)
Nuisance Grass Species not recommended for use on Erosion Control or Stormwater Projects									
Species	***Common name***		***State Listed Noxious Weed?***			***City***			
Agropyron repens	Quackgrass		yes (B-list)	[redacted]		Nuisance List Portland Plant List			
Alopecuris pratensis	Meadow foxtail		no			Nuisance List Portland Plant List			
Anthoxanthum odoratu	Sweet vernal grass		no			Nuisance List Portland Plant List			
Arrhenatherum elatius	Tall oatgrass		no			Nuisance List Portland Plant List			
Brachypodium sylvatic	False brome		yes (B-list)			Nuisance List Portland Plant List			
Bromus diandrus	Ripgut		no			Nuisance List Portland Plant List			
Bromus hordaceus	Smooth brome		no			Nuisance List Portland Plant List			
Bromus inermis	Smooth brome		no			Nuisance List Portland Plant List			
Bromus japonicus	Japanese brome		no			Nuisance List Portland Plant List			
Bromus sterilis	Poverty grass		no			Nuisance List Portland Plant List			
Bromus tectorum	Cheatgrass		no			Nuisance List Portland Plant List			
Festuca arundinacea	Tall fescue		no			Nuisance List Portland Plant List			
Holcus lanatus	Velvet grass		no			Nuisance List Portland Plant List			
Lolium multiflorum	Annual ryegrass		no			Nuisance List Portland Plant List			
Phalaris arundinacea	Reed canary grass		no			Nuisance List Portland Plant List			
Phalaris aquatica	Harding grass		no			Nuisance List Portland Plant List			
Phleum pratensis	Timothy		no			Nuisance List Portland Plant List			
Phragmites australis	Common reed		no			Nuisance List Portland Plant List			
Vulpia myuros	Rat-tailed fescue		no			Nuisance List Portland Plant List			

G.2 DESIGN CONCEPTS AND PRINCIPLES

The City of Eugene requires developers to design stormwater facilities in project landscape areas, using surface retention facilities such as those shown in the simplified approach. The resulting integrated stormwater landscape can meet many, if not all, of landscape requirements. The benefits of integrated designs include construction cost savings, combined maintenance, aesthetic benefits, and the greater likelihood of maintaining long-term functionality. A well-designed and established landscape will also prevent post-construction soil erosion. These approaches can also help reduce urban heat island effects and contribute to other sustainable principles.

An integrated design may require changing the size of some site elements, such as the parking lot layout. Also see Parking lot Design Tips in Chapter 2 of this document.

In order to integrate stormwater management with the project landscape areas, it is essential that impervious surface grading be directed toward the stormwater facility areas. Surface stormwater facilities also must be depressed to allow sheet flow into the area. Since these design approaches are still new to many construction contractors it is advisable to clearly show these details in cross section and plan view drawings.

Pollution Prevention

Stormwater pollution prevention practices related to landscaping can be categorized into two broad categories:

- Toxic Substance Use Reduction
- Pollutant Source Reduction

Toxic Substance Use Reduction

Projects shall be designed to minimize the need for toxic or potentially polluting materials such as herbicides, pesticides, fertilizers, or petroleum based fuels within the facility area before, during, and after construction. Use of these materials creates the risk of spills, misuse, and future draining or leaching of pollutants into facilities or the surrounding area.

Pollutant Source Reduction

Materials that could leach pollutants or pose a hazard to people and wildlife shall not be used as components of a stormwater facility. Some examples of these materials are chemically treated railroad ties and lumber and galvanized metals. Many alternatives to these materials are available.

Soils

Soil analysis shall be conducted **within the stormwater facility area** to determine the viability of soils to assure healthy tree and vegetation growth and to provide adequate infiltration rates through the topsoil, or soil in these areas shall be amended. These tests can help the designer specify appropriate levels and types of soil amendments.

Projects should stockpile existing topsoil for re-use on the site to minimize the need to import topsoil. Appropriate erosion control measures, as required by the City, shall be used. Soil analysis tests shall be performed on stockpiled soil if it will be used within the facility area.

Topsoil is not required to be placed in the bottom of wet ponds or constructed wetland areas having a permanent pool depth of 6" or more. At the time of final inspection all surface area soils shall be covered with plants and/or mulch sufficient to prevent erosion.

Site Preparation and Grading

Unwanted vegetation in the facility area shall be removed during site preparation with equipment appropriate for the type of material encountered and site conditions. It is recommended that the maximum amount of pre-existing native vegetation be retained and protected.

No material storage or heavy equipment is allowed within the stormwater facility area after site clearing and grading has been completed, except to excavate and grade as needed to build the facility.

After the facility area is cleared and graded, all disturbed subsoil shall be tilled before capping with 18 inches of topsoil. If existing areas surrounding the stormwater facility are disturbed by construction, the top 18 inches of soil shall be tilled. No tilling shall occur within the drip line of existing trees. After tilling is completed, no other construction traffic shall be allowed in the area, except for planting and related work.

All construction and other debris shall be removed before topsoil is placed. Unless otherwise specified, the City will expect the landscape contractor to be responsible for final grading and for ensuring that surface and stormwater runoff flows are functioning as designed.

Mulch

Approved mulching materials and practices include organic materials such as compost, bark mulch, leaves, sawdust, straw, or wood shavings, as well as small river gravel, pumice, or other inert materials, applied in a 1-foot radius (measured from the center of the plant) around specific trees or shrubs. For ground cover plantings, the mulch shall be applied to cover all soil between plants. Care should be exercised to use the appropriate amount of mulch. Over-use can cause excessive nutrients to leach into the facility. Mulch shall be weed-free. Manure mulching and high-fertilizer hydroseeding are prohibited in a facility area during and after construction.

Irrigation

Permanent irrigation systems are not allowed for city-maintained facilities, unless approved by PW. Temporary irrigation systems or alternative methods of irrigation for landscape establishment shall be specified. Permanent irrigation systems are required for private facilities, but designers are encouraged to minimize the need for permanent irrigation. Innovative methods for watering vegetation are encouraged, such as the use of cisterns and air conditioning condensate.

Facility Screening

Facility elements such as chain link fences, concrete bulkheads, outfalls, rip-rap, gabions, large steel grates, steep side slopes, manhole covers/vault lids, berm embankments planted only with grasses, exposed pipe, blank retaining walls greater than 2 feet high, and access roads are generally not aesthetic. When these elements are part of City-maintained facilities or private facilities that face public right-of-way or other private property, PW requires them to be screened with plant materials. The quantities of landscape materials that are required by this chapter have been estimated to provide sufficient screening in most of the stormwater facilities. Attention will need to be paid to site conditions that may require adjustments in planting layout and/or the need for additional trees and shrubs. It is not the intent of this screening requirement to dictate a specific solution such as a linear hedge. Designers are encouraged to integrate the facility landscaping with the screening objective.

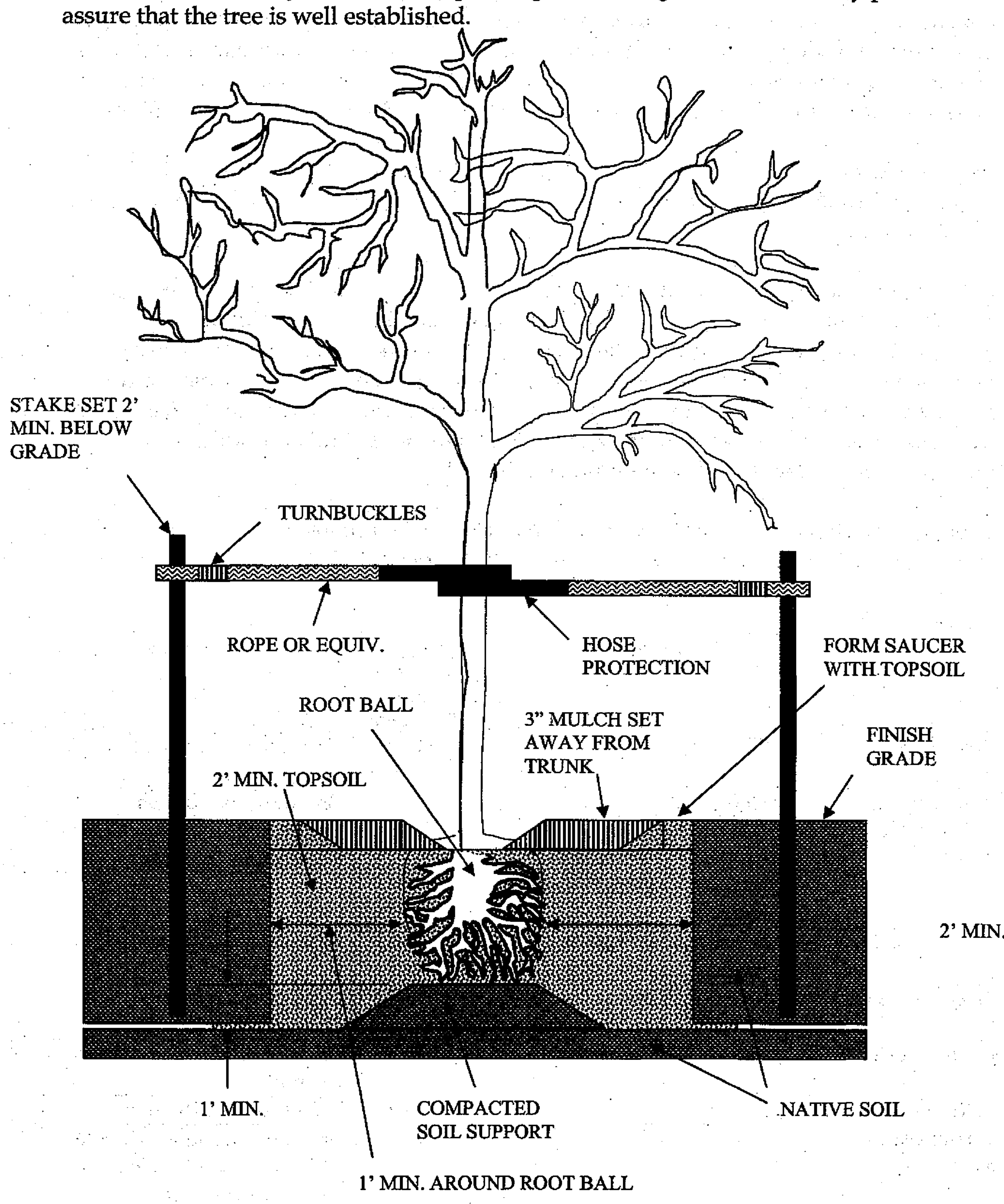
Commercial Sources for Native Plant Material:

Bareroot (Seedling) Trees/ Shrubs	
Aprovecho Research Center	541-942-8198
Balance Restoration Nursery	541-942-5530
Bloomers Nursery	541-687-5919
Buggy Crazy	541-258-5590
Doak Creek Native Plants	541-484-9206
Down to Earth	541-342-6820
Duckworth's Nursery	541-345-5408
Gray's Garden Center	541-345-1569
Hansen Nursery	541-756-1156
Log House Plants	541-942-2288
Lorane Hills Farm & Nursery	541-344-8943
Native Grounds Nursery	541-466-3561
Northwest Native Trees	541-736-0232
Pleasant Hill Nursery	541-746-7178
Sevenoaks Native Nursery	541-757-6520
Trillium Gardens	541-937-3073
Understory Plants	541-683-2612
Wild Garden Seed	541-929-4068
Wild Goose Nursery	541-607-6183
Willamette Gardens	541-754-0893

Native Seed	
Pacific Northwest Natives	541-928-8239
Mid-Valley Farms	541-936-6061
North American Revegetation	541-928-9095
Triangle Farms	503-873-5190

Note: The Nursery list is adapted from the Emerald Chapter of the Native Plant Society of Oregon's "Local Native Nurseries" handout. More information is available at http://www.emeraldnpso.org/nurseries.html. This list is not all-inclusive and is only up-to-date at the time of this manual's release. For a more inclusive list of nurseries that supply native plants, contact: www.tardigrade.org/natives/nurseries.html. The City of Eugene does not endorse any of these nurseries and provides this list for information purposes only.

Tree Planting Detail for Trees of 3" Caliper or Larger, usually used for street trees applications. This detail is not required for smaller trees. However, all trees must be secured sufficiently at the time of planting and throughout the warranty period to assure that the tree is well established.



Parking Lot Trees

COE has included the parking lot tree list to assist designers in selection of trees most appropriate for the potentially numerous micro-climates that might exist in parking lots and often associated proximity to building walls. It is likely that most parking lots will be hot in summer months until the trees become established. COE has attempted to point out native species in the list and provide their suitability to various conditions.

Trees are listed by the scientific name of the species first, then the common name. Where applicable, names of cultivars are presented in single quote marks with the common name.

The recommended minimum clearance from the pavement provides guidance on the amount of planting space each tree needs. It is expressed as the distance from the center of the planted tree trunk to the nearest paved surface. Comments provide guidance as to best applications of the different trees and additional information that may help in tree selection. For example, some trees are well suited to landscaped areas that will receive stormwater runoff, while others may not tolerate the additional moisture from runoff, largely depending on the soil.

There are two tables. The first consists of trees that are not native to the Portland area and the second consists of native trees listed on the Portland Plant List.

Non-native trees

Species name	Common Name	Min. Distance from Pavement	Comments
Abies amabilis	Silver Fir	4 feet	Conifer, evergreen. Native to Oregon Cascades.
Acer campestre	Hedge maple	2 feet	Broadleaf, deciduous.
Acer rubrum	Red maple 'Embers Red,' 'October Glory,' 'Red Sunset,' 'Gerling,' 'Autumn Flame'	3 feet	Broadleaf, deciduous. Good for stormwater facilities
Acer saccharum	Sugar Maple (Except 'Legacy')	3 feet	Broadleaf, deciduous.
Calocedrus decurrens	Incense Cedar	3 feet	Conifer, evergreen Drought tolerant
Carpinus betulus	European Hornbeam	2 feet	Broadleaf, deciduous. Shade tolerant.
Celtis occidentalis	Hackberry	3 feet	Broadleaf, deciduous.
Cercidiphyllum japonicum	Katsura Tree	3 feet	Broadleaf, deciduous. Prefers well-drained soils Needs summer irrigation

Species name	Common Name	Min. Distance from Pavement	Comments
Cladrastis kentuckea	Yellowwood	3 feet	Broadleaf, deciduous. Prefers summer irrigation and well-drained soil.
Cornus kousa var. *chinensis*	Chinese Dogwood	3 feet	Broadleaf, deciduous. Small tree. Fruits, but is not messy. Needs summer water.
Crataegus x *lavallei*	Lavalle Hawthorn	2 feet	Broadleaf, deciduous. Fruit can be messy.
Fagus grandifolia	American Beech	4 feet	Broadleaf, deciduous.
Fagus sylvatica	European Beech	4 feet	Broadleaf, deciduous.
Fagus sylvatica	European Beech 'Roseo-marginata,' 'Tricolor'	3 feet	Broadleaf, deciduous.
Fraxinus americana	White Ash	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Fraxinus excelsior	European Ash	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Fraxinus pennsylvanica	Green Ash 'Marshall,' 'Patmore,' 'Summit,' 'Urbanite'	3 feet	Broadleaf, deciduous. Needs plenty of water until established
Ginkgo biloba	Ginkgo 'Shangri-la,' 'Saratoga'	3 feet	Measured as a broadleaf; deciduous. Use the male only. Female produces messy, smelly fruit.
Liquidambar styraciflua	Sweetgum	4 feet	Broadleaf, deciduous.
Liriodendron tulipifera	Tulip Tree or Tulip Poplar	4 feet	Broadleaf, deciduous.
Magnolia grandiflora	Southern Magnolia	4 feet	Broadleaf, evergreen.
Magnolia kobus	Kobus Magnolia	2 feet	Broadleaf, deciduous.
Metasequoia glyptostroboides	Dawn Redwood	4 feet	Conifer, deciduous.
Nothofagus dombeyi	South American Beech or Southern Beech	3 feet	Broadleaf, evergreen.
Nothofagus obliqua	Roble Beech	3 feet	Broadleaf, deciduous.
Nyssa sylvatica	Black Gum or Black Tupelo	3 feet	Broadleaf, deciduous. Good for stormwater facilities.
Ostrya virginiana	American Hornbeam	2 feet	Broadleaf, deciduous.
Pinus contorta	Shore Pine	3 feet	Conifer, evergreen. A smaller tree.
Pinus monticola	Western White Pine	3 feet	Conifer, evergreen.
Quercus bicolor	Swamp White Oak	3 feet	Broadleaf, deciduous. Tolerates wet soil.
Quercus coccinea	Scarlet Oak	3 feet	Broadleaf, deciduous. Intolerant of wet soil.

Species name	Common Name	Min. Distance from Pavement	Comments
Quercus frainetto	Hungarian Oak 'Forest Green'	3 feet	Broadleaf, deciduous.
Quercus nigra	Water Oak	3 feet	Broadleaf, evergreen. Tolerates wet conditions.
Quercus phellos	Willow Oak	3 feet	Broadleaf, deciduous.
Quercus robur	English Oak	3 feet	Broadleaf, deciduous.
Quercus rubra	Northern Red Oak	4 feet	Broadleaf, deciduous.
Quercus velutina	Black Oak	4 feet	Broadleaf, deciduous.
Sequoia sempervirens	Coast Redwood	6 feet	Conifer, evergreen. Grows very tall.
Sequoiadendron giganteum	Giant Sequoia	8 feet	Conifer, evergreen. Trunk quickly becomes massive, needs ample space.
Sophora japonica	Japanese Pagoda Tree	3 feet	Broadleaf, deciduous.
Taxodium distichum	Bald Cypress	4 feet	Conifer, deciduous. Tolerates extremely wet conditions, but does not require it.
Umbellularia californica	California Laurel, Oregon Myrtle, Bay	4 feet	Broadleaf, evergreen. Drought tolerant.
Zelkova serrata	Sawleaf Zelkova 'Green Vase,' 'Halka,' 'Village Green'	3 feet	Broadleaf, deciduous.

Native Parking Lot Trees

Species Name	Common Name	Min. Distance from Pavement	Comments
Abies grandis	Grand Fir	4 feet	Conifer, evergreen. Can grow very tall.
Acer macrophyllum	Big Leaf Maple	4 feet	Broadleaf, deciduous.
Alnus rhombifolia	White Alder	3 feet	Broadleaf, deciduous. Moisture loving. ***Short live species.*** *
Alnus rubra	Red Alder	3 feet	Broadleaf, deciduous. Moisture loving. ***Short live species.*** *
Calocedrus decurrens	Incense Cedar	4 feet	Conifer, evergreen. Prefers moist conditions and some shade.
Crataegus douglasii, var. douglasii	Black Hawthorn, wetland form	3 feet	Broadleaf, deciduous. A smaller tree. Wetland form tolerates wet areas.
Fraxinus latifolia	Oregon Ash	3 feet	Broadleaf, deciduous. Tolerates wet conditions.

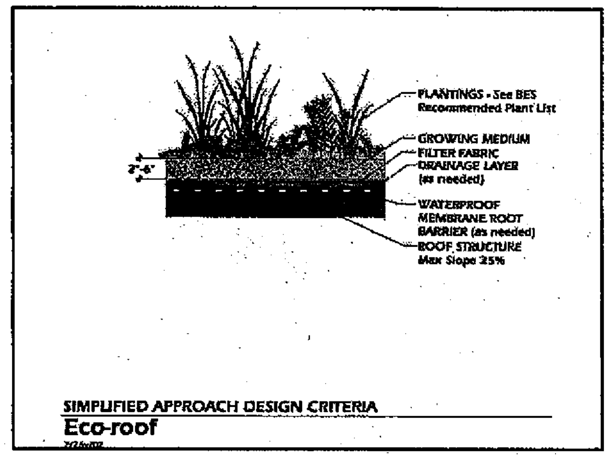
Pinus ponderosa, ssp. Valley	Ponderosa Pine, Valley subspecies	4 feet	Conifer, evergreen. Prefers drier conditions, but Valley subspecies is adapted to Willamette Valley climate.
Pseudotsuga menziesii	Douglas Fir	4 feet	Conifer, evergreen. Can grow very tall.
Quercus garryana	Oregon White Oak	4 feet	Broadleaf, deciduous. Drought tolerant.
Quercus kelloggii	Californai Black Oak	4 feet	Broadleaf, deciduous. Drought tolerant.
Rhamnus purshiana	Cascara	3 feet	Broadleaf, deciduous. A smaller tree.
Thuja plicata	Western Red Cedar	4 feet	Conifer, evergreen. Prefers moist conditions and some shade. **Does not do well in direct sunlight, Shade tolerant**
Thuja plicata	Western Red Cedar 'Hogan'	4 feet	Conifer, evergreen. Prefers moist conditions and some shade. 'Hogan' is a narrow-growing variety.

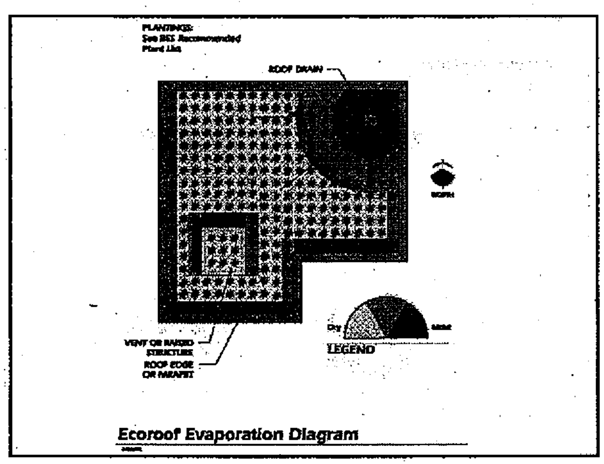
* According to the "Western Tree Book" maximum age of a Red Alder is thought to be 100 years. Relatively speaking these trees have a life span sufficient for urban parking lot swales. A report by the Portland Planning Bureau in 1997 indicated that the life expectancy of most trees in non-residential areas was 20-40 years.

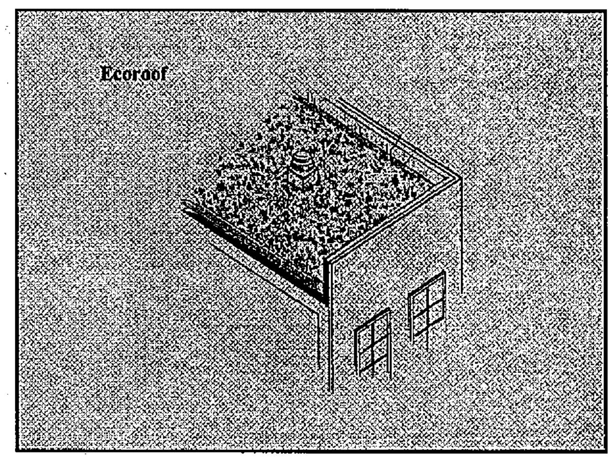
Appendix H

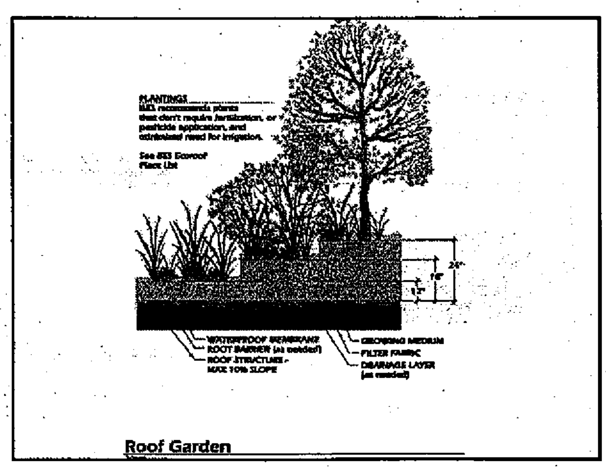
Supplemental Drawings and Example Landscaping Plans

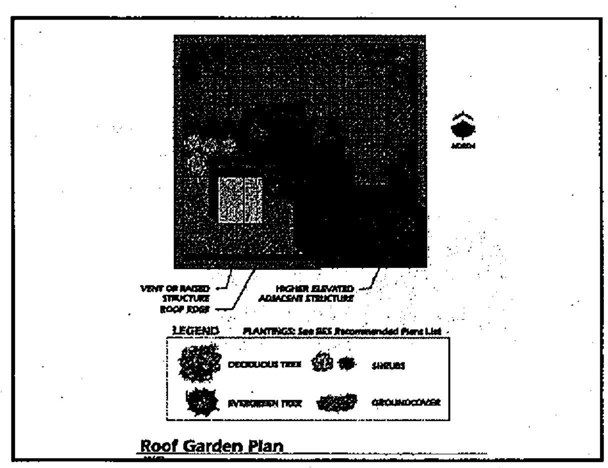
Stormwater Management Manual

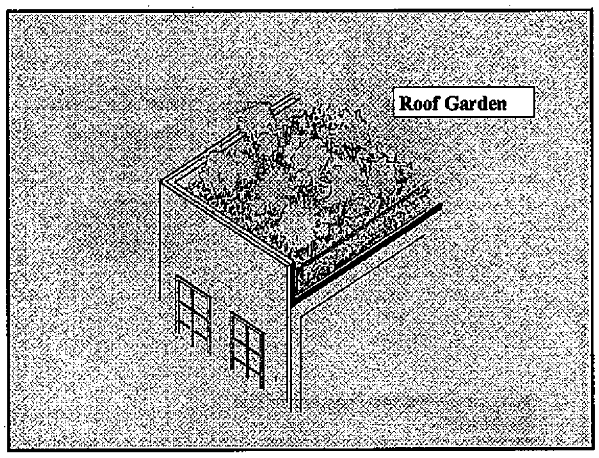


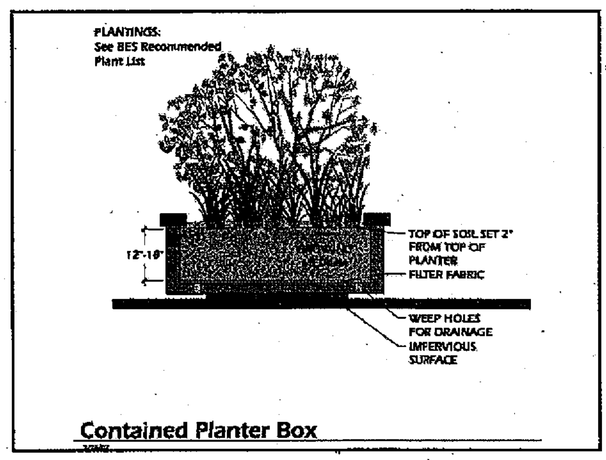


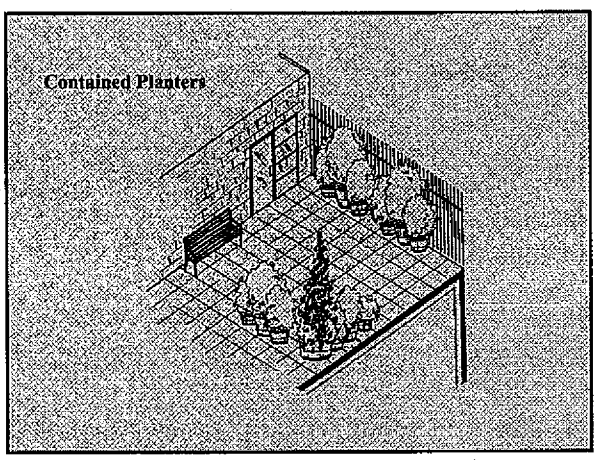


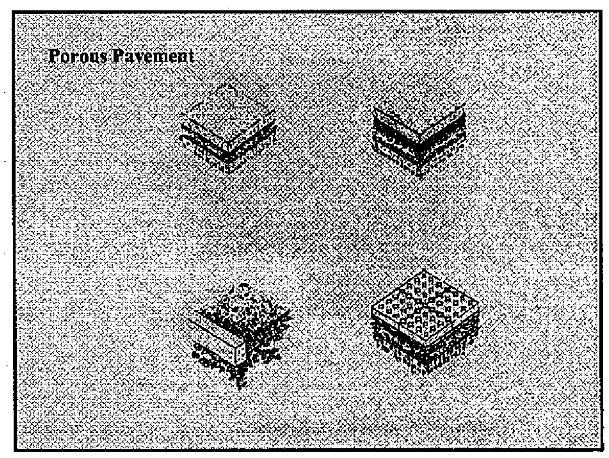


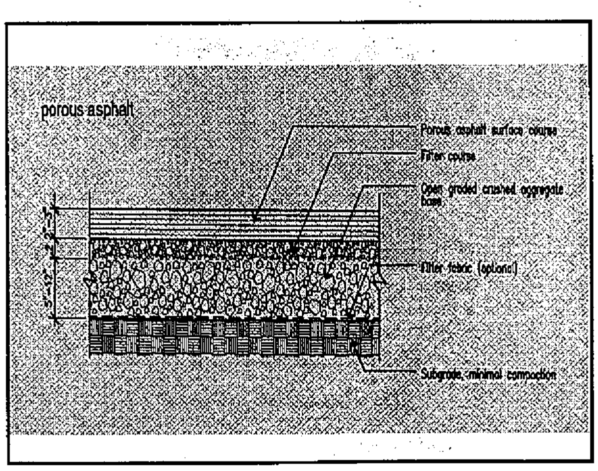


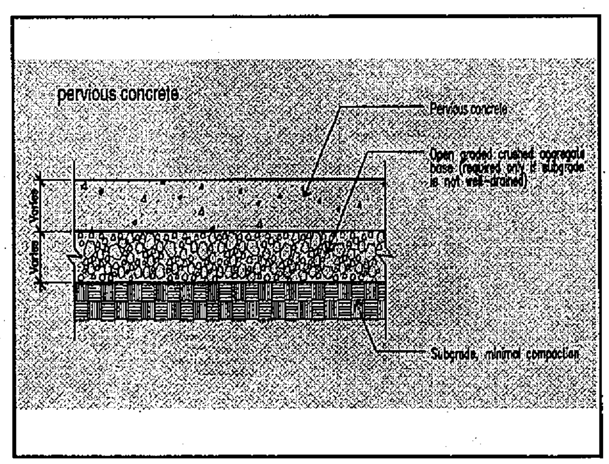

Roof Garden

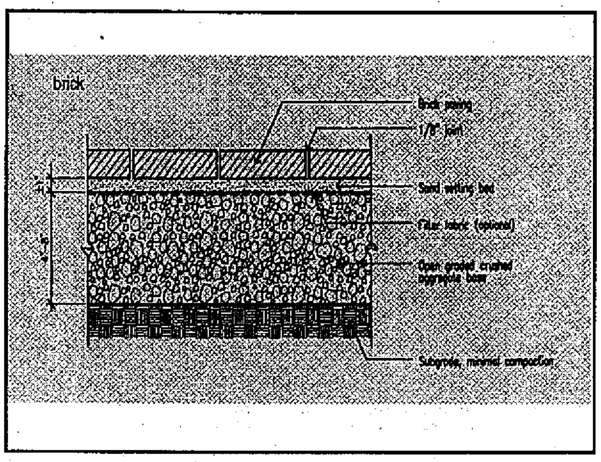

PLANTINGS:
See BES Recommended
Plant List
12"-18"
TOP OF SOIL SET 2"
FROM TOP OF
PLANTER
FILTER FABRIC
WEEP HOLES
FOR DRAINAGE
IMPERVIOUS
SURFACE
Contained Planter Box

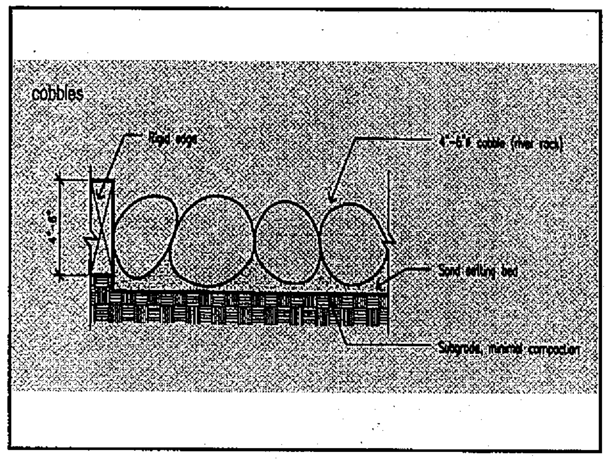

Contained Planters

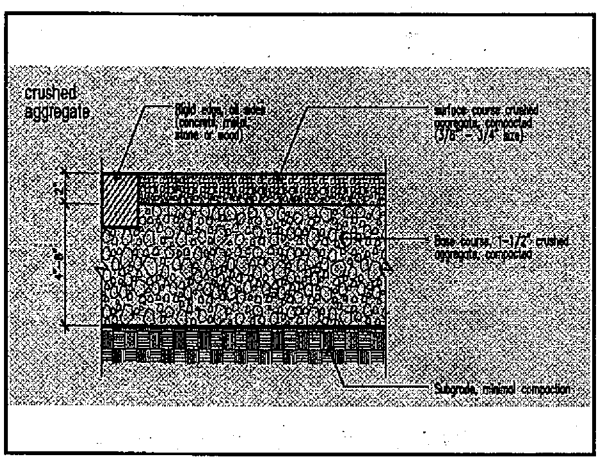

Porous Pavement

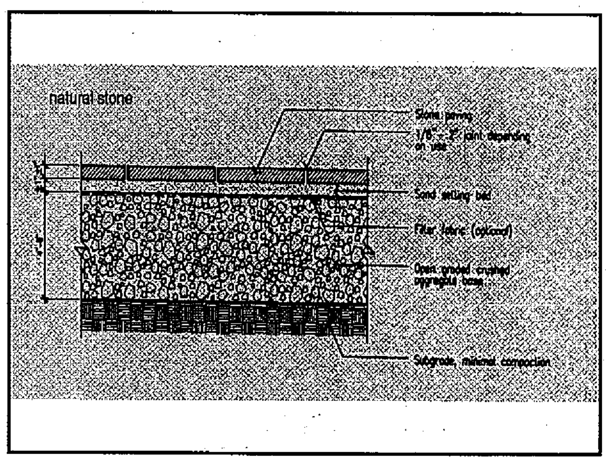

porous asphalt
Porous asphalt surface course
Filter course
Open graded crushed aggregate base
Filter fabric (optional)
Subgrade, minimal compaction

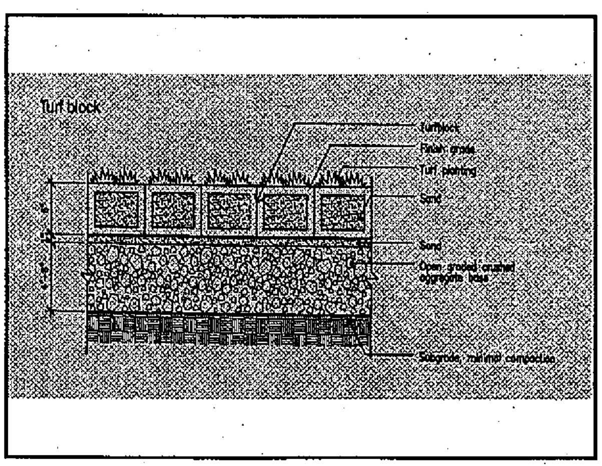

pervious concrete
Pervious concrete
Open graded crushed aggregate base (required only if subgrade is not well-drained)
Varies
Varies
Subgrade, minimal compaction

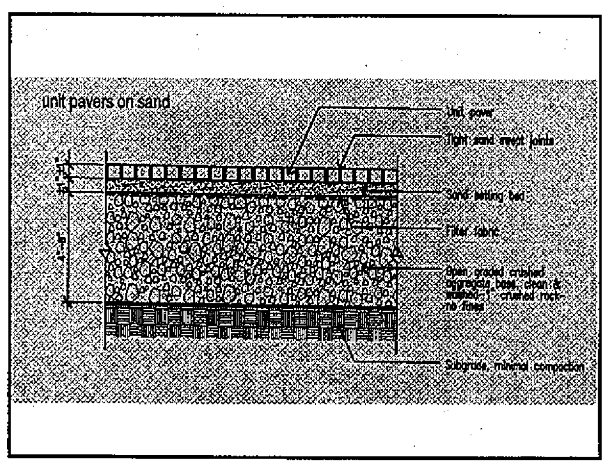

brick
Brick paving
1/8" joint
Sand setting bed
Filter fabric (optional)
Open graded crushed aggregate base
Subgrade, minimal compaction


cobbles
Rigid edge
4"-6" cobble (river rock)
Sand setting bed
Subgrade, minimal compaction

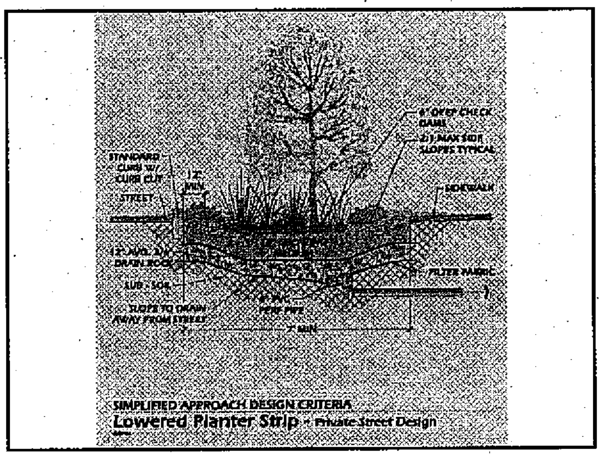

crushed aggregate
Rigid edge, all sides (concrete, metal, stone or wood)
surface course crushed aggregate, compacted
Base course, 1-1/2" crushed aggregate, compacted
Subgrade, minimal compaction

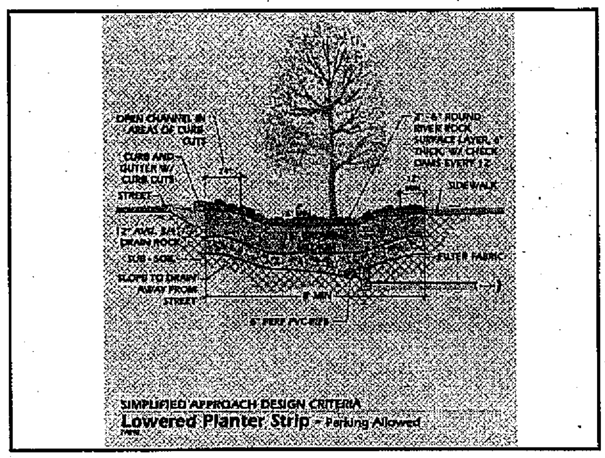

natural stone
Stone paving
Sand setting bed
Filter fabric (optional)
Open graded crushed aggregate base
Subgrade, minimal compaction

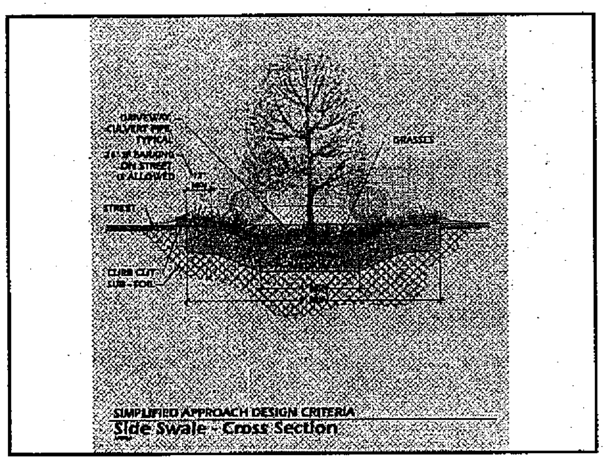

Turf block
Turfblock
Finish grade
Turf planting
Sand
Sand
Open graded crushed aggregate base
Subgrade, minimal compaction

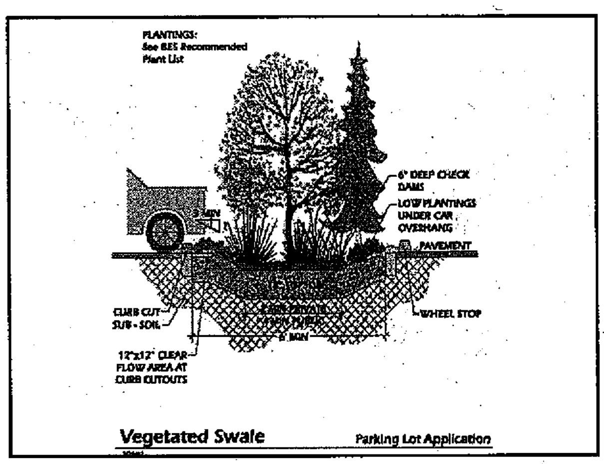

unit pavers on sand
Unit paver
Tight sand swept joints
Sand setting bed
Filter fabric
Subgrade, minimal compaction

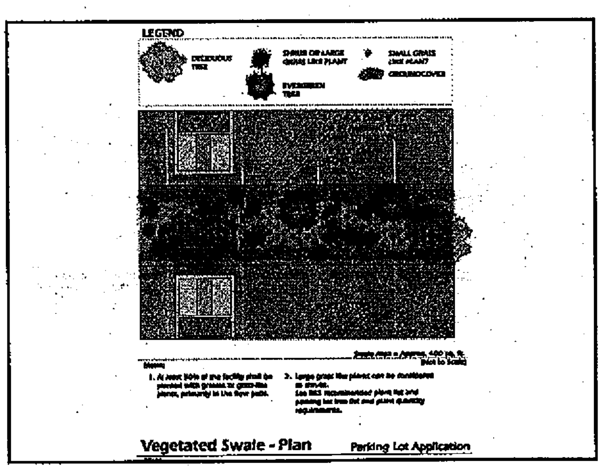
Appendix H

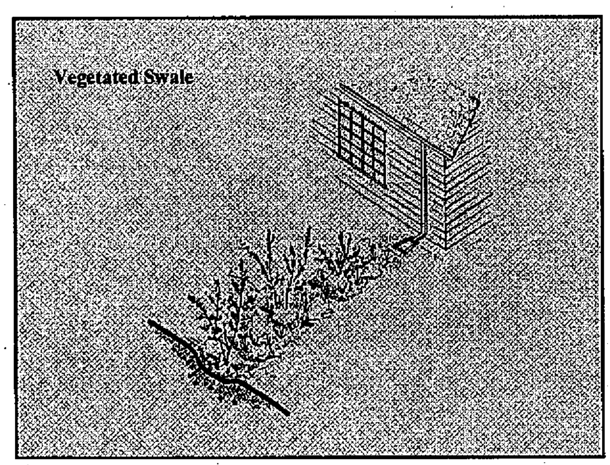

SIMPLIFIED APPROACH DESIGN CRITERIA
Lowered Planter Strip - Private Street Design

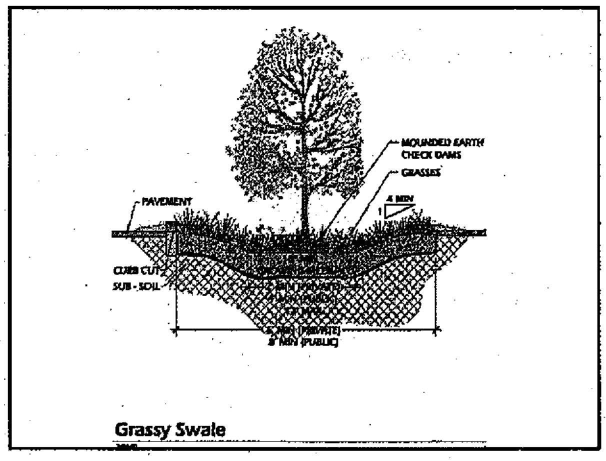

SIMPLIFIED APPROACH DESIGN CRITERIA
Lowered Planter Strip - Parking Allowed

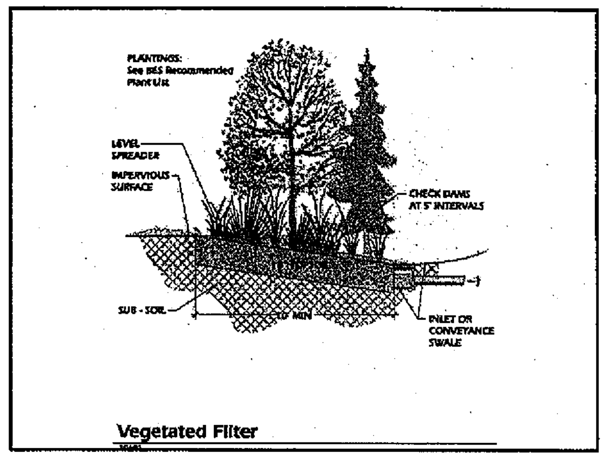

SIMPLIFIED APPROACH DESIGN CRITERIA
Side Swale - Cross Section

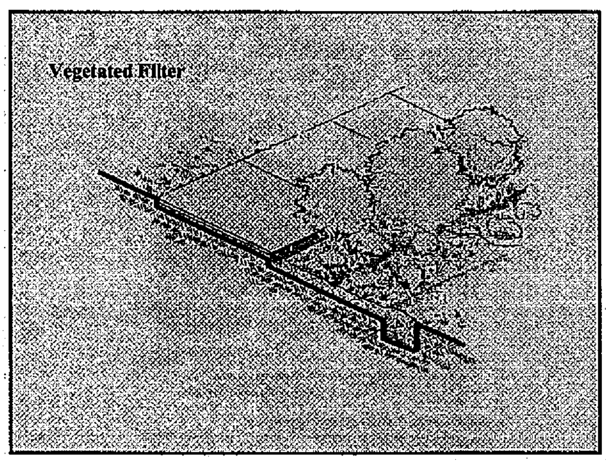

PLANTINGS:
6" DEEP CHECK DAMS
LOW PLANTINGS UNDER CAR OVERHANG
PAVEMENT
CURB CUT
SUB-SOIL
WHEEL STOP
Vegetated Swale
Parking Lot Application

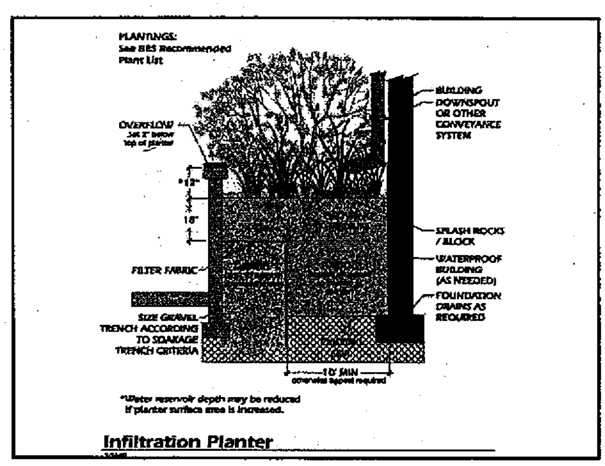

LEGEND
Vegetated Swale - Plan
Parking Lot Application

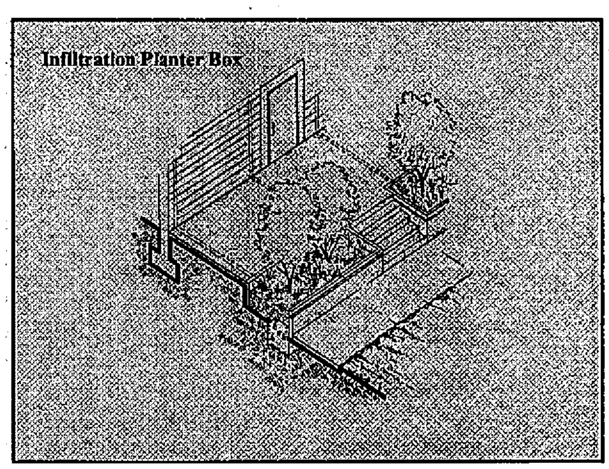

Vegetated Swale

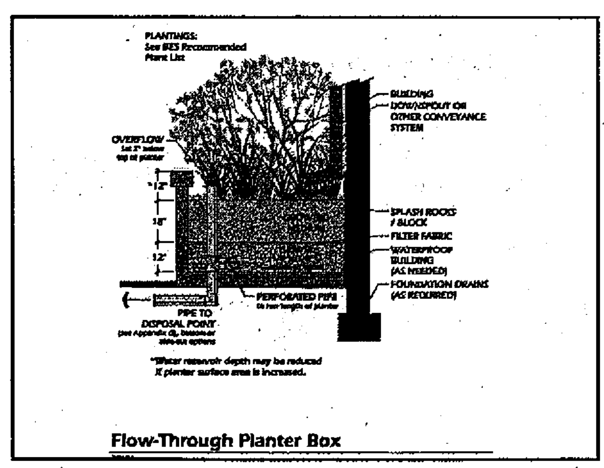

MOUNDED EARTH CHECK DAMS
GRASSES
PAVEMENT
CURB CUT
SUB - SOIL
Grassy Swale

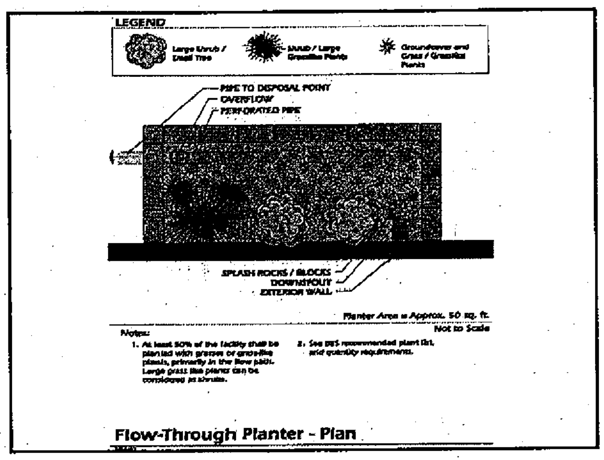

PLANTINGS:
See BES Recommended Plant List
LEVEL SPREADER
IMPERVIOUS SURFACE
CHECK DAMS AT 5' INTERVALS
SUB - SOIL
INLET OR CONVEYANCE SWALE
Vegetated Filter

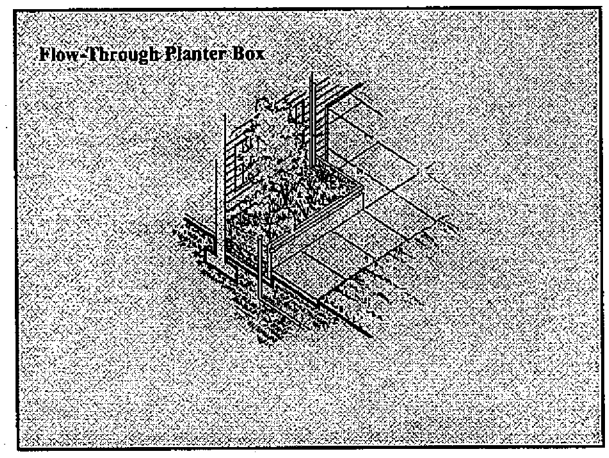

Vegetated Filter

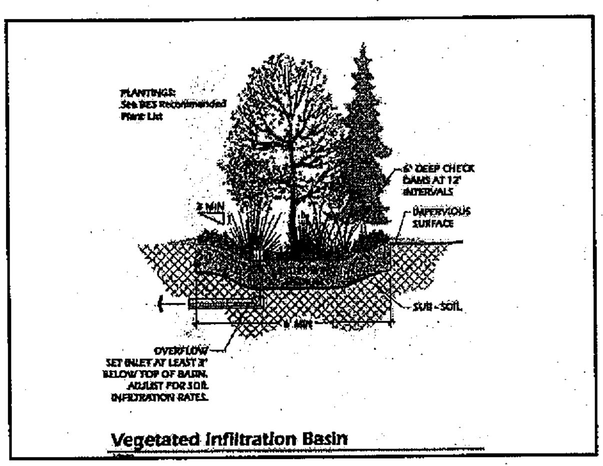

PLANTINGS:
See BES Recommended Plant List
OVERFLOW
BUILDING
DOWNSPOUT OR OTHER CONVEYANCE SYSTEM
SPLASH ROCKS / BLOCK
WATERPROOF BUILDING (AS NEEDED)
FOUNDATION DRAINS AS REQUIRED
FILTER FABRIC
SIZE GRAVEL TRENCH ACCORDING TO SOAKAGE TRENCH CRITERIA
Infiltration Planter

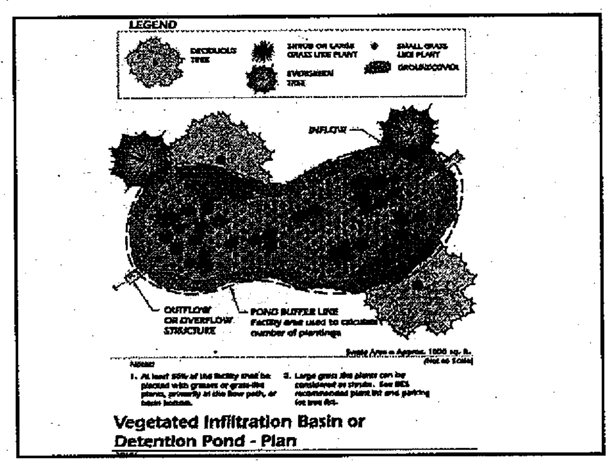

Infiltration Planter Box

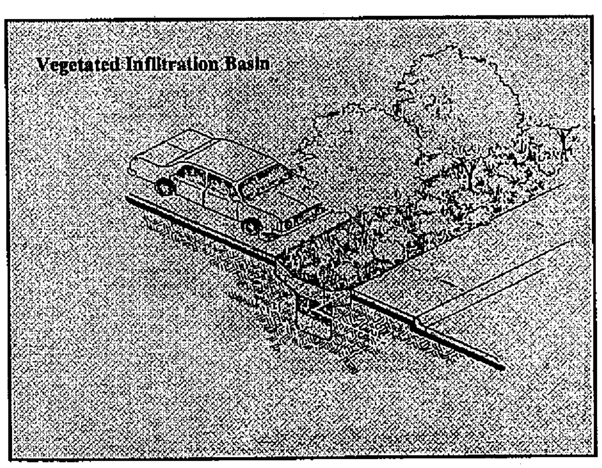

PLANTINGS:
See BES Recommended Plant List
OVERFLOW
BUILDING
DOWNSPOUT OR OTHER CONVEYANCE SYSTEM
SPLASH ROCKS / BLOCK
FILTER FABRIC
WATERPROOF BUILDING (AS NEEDED)
FOUNDATION DRAINS (AS REQUIRED)
PERFORATED PIPE
PIPE TO DISPOSAL POINT
Flow-Through Planter Box

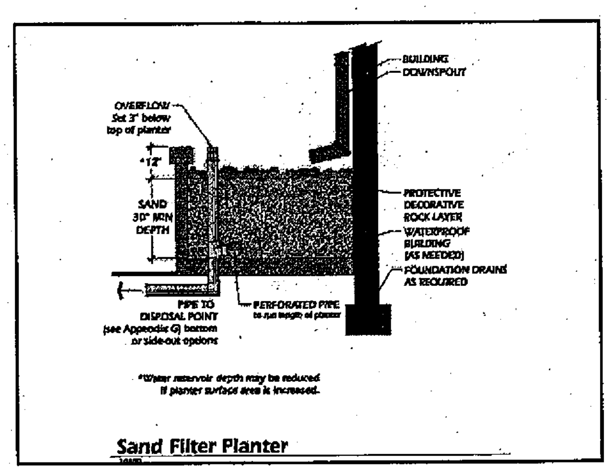

LEGEND
Flow-Through Planter - Plan

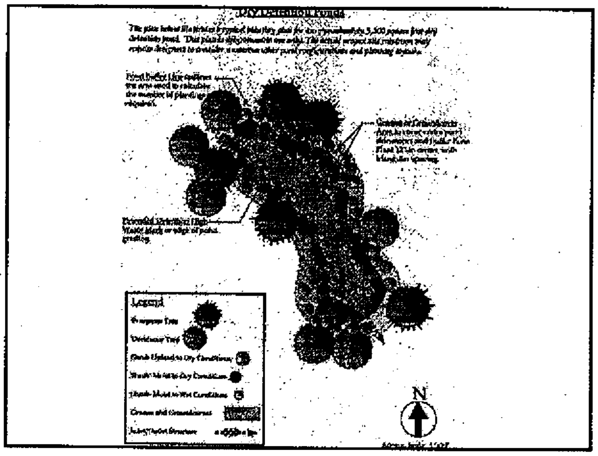

Flow-Through Planter Box

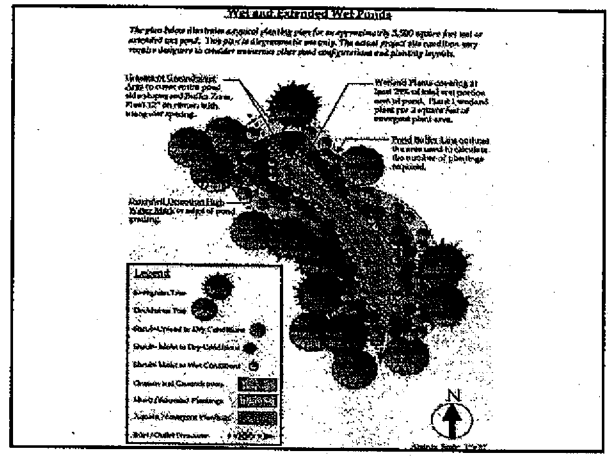

Vegetated Infiltration Basin


LEGEND
Vegetated Infiltration Basin or
Detention Pond - Plan


Vegetated Infiltration Basin


Sand Filter Planter


Legend
N

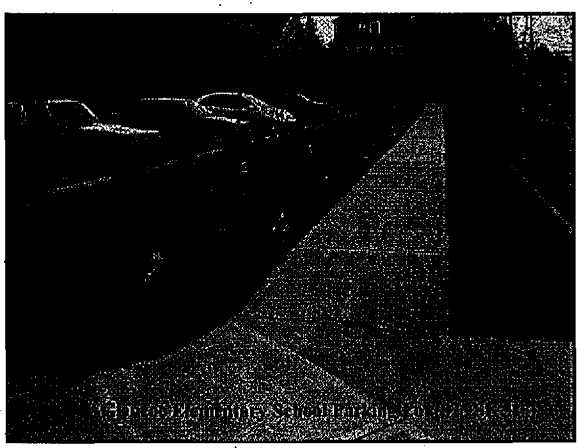

Wet and Extended Wet Ponds
Legend
N

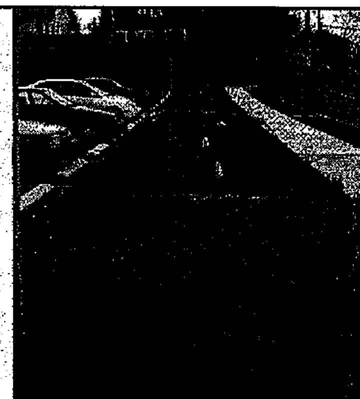
Appendix I

Stormwater Management Facility Photos

Stormwater
Management Manual

Parking Lot Examples

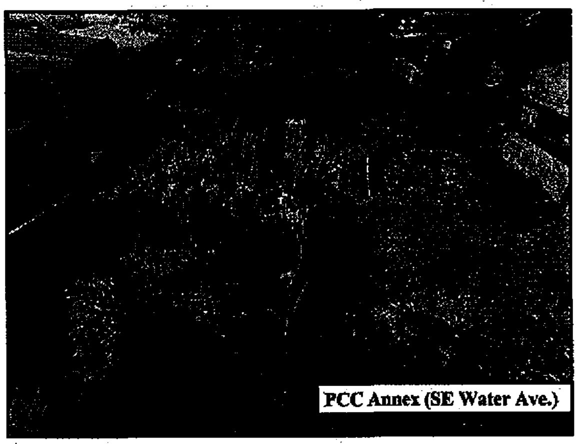




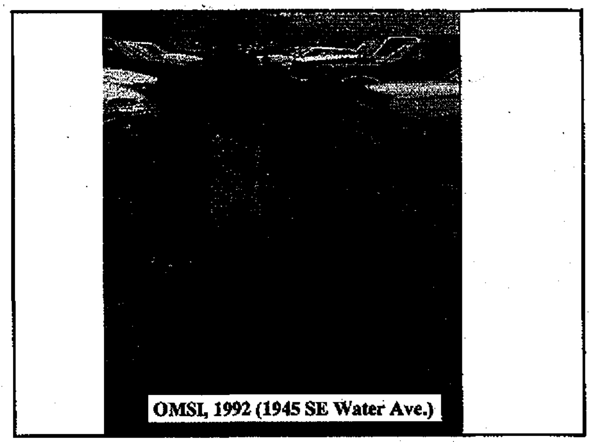
Glencoe Elementary School Parking Lot (825 SE 51st)

Glencoe Elementary School Parking Lot (825 SE 51st)

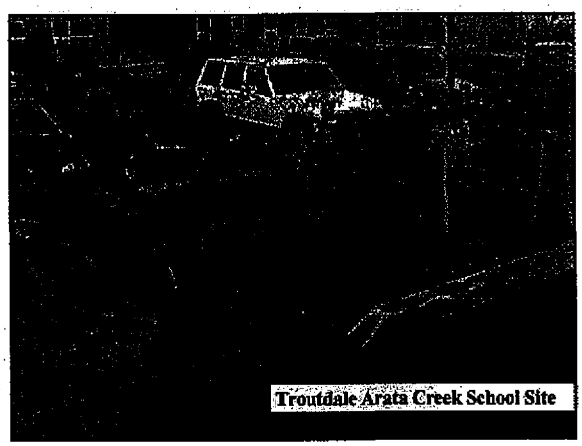
Glencoe Elementary School Parking Lot (825 SE 51st)



PCC Annex (SE Water Ave.)



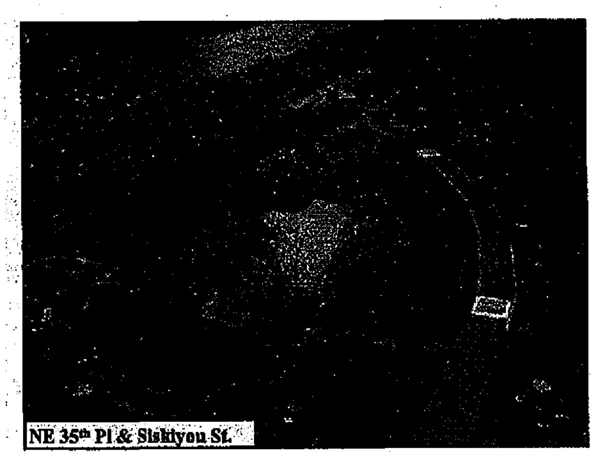
OMSI, 1992 (1945 SE Water Ave.)



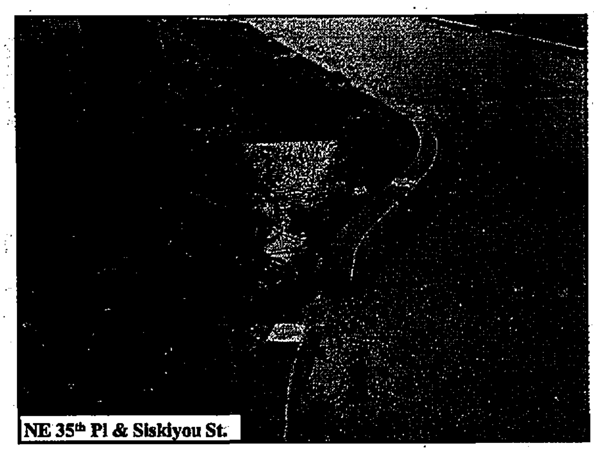
Troutdale Arata Creek School Site

Street Examples

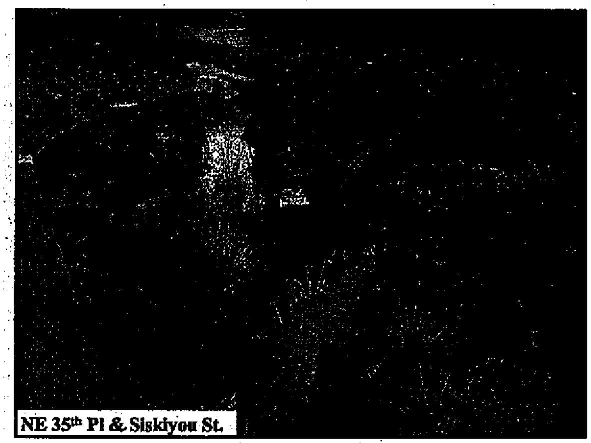
Site Location	Page/ Slide
NE 35th Pl. & Siskiyou	11-16
SE 56th & Ankeny	17-19
N Leadbetter Road	20,21
SW Lodi Lane (& Shattuck) Subdivision	22
Seattle Street Edge Alternative Project	23-25
Seattle- Cascade & Broadview	26

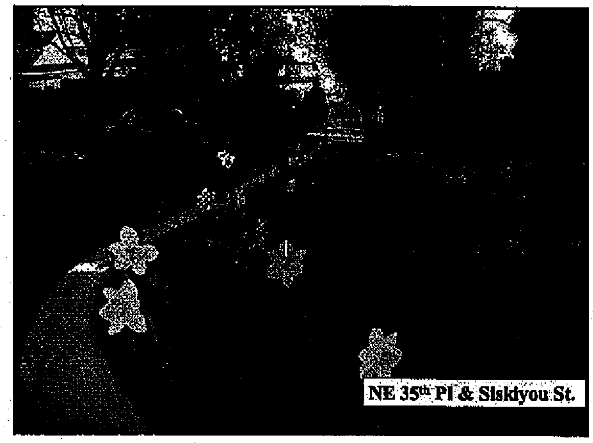


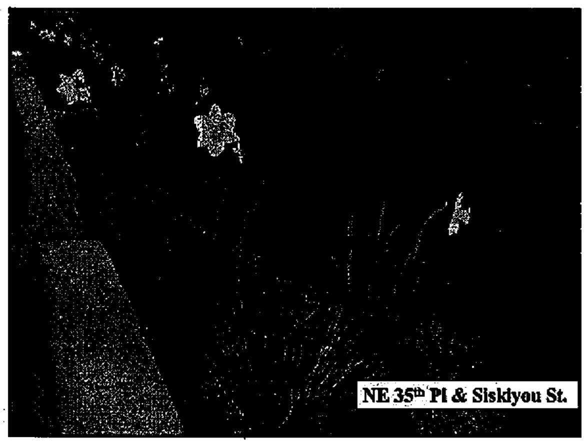
NE 35th Pl & Siskiyou St.

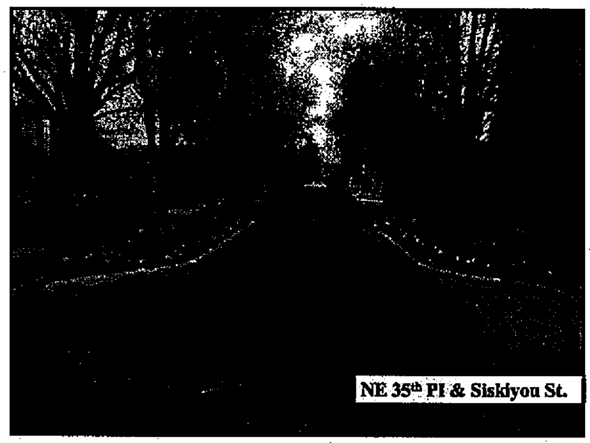


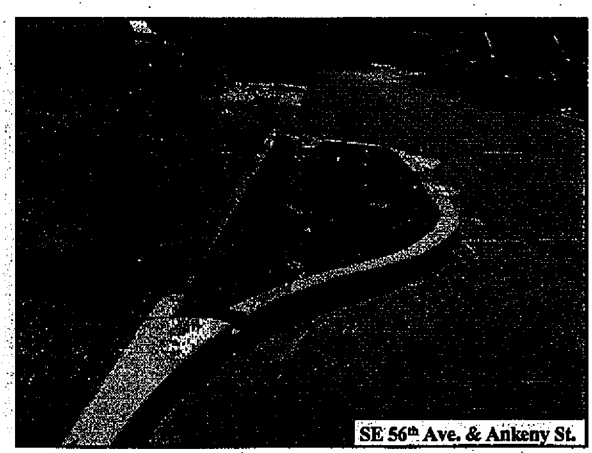
NE 35th Pl & Siskiyou St.

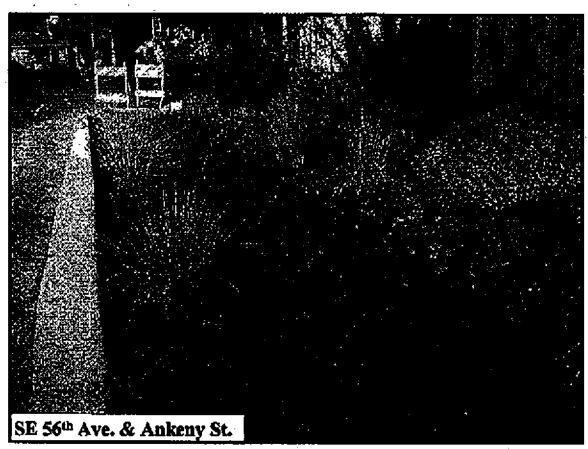

NE 35th Pl & Siskiyou St.

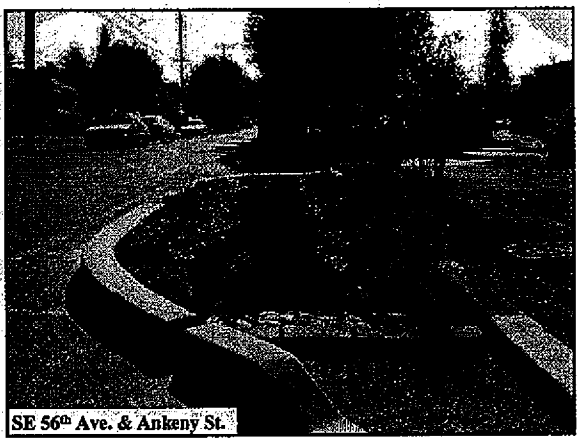

NE 35th Pl & Siskiyou St.


NE 35th Pl & Siskiyou St.

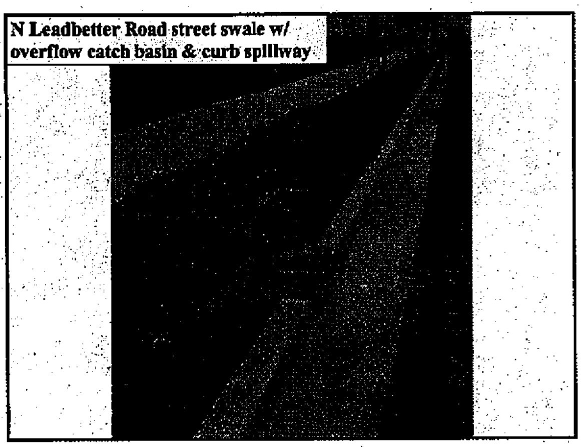

NE 35th Pl & Siskiyou St.


SE 56th Ave. & Ankeny St.

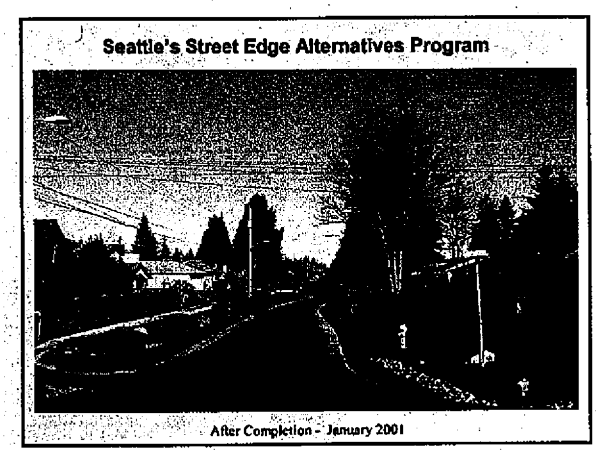

SE 56th Ave. & Ankeny St.


SE 56th Ave. & Ankeny St.

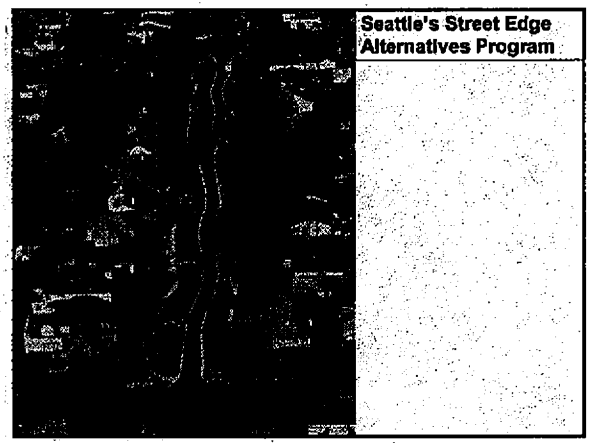

N Leadbetter Road street swale w/ overflow catch basin & curb slots

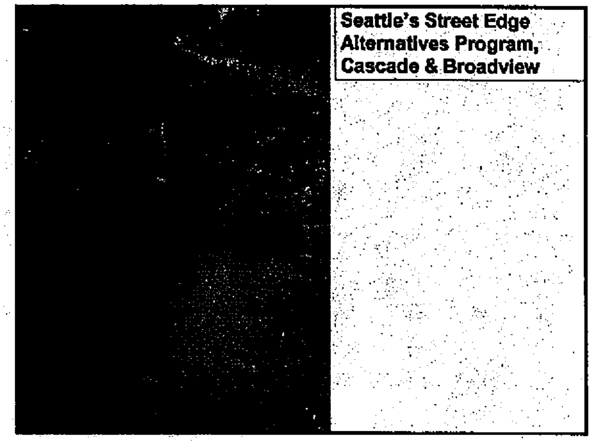

N Leadbetter Road street swale w/ overflow catch basin & curb spillway


North side of SW Lodi Lane (& Shattuck), sand filter/ street swale



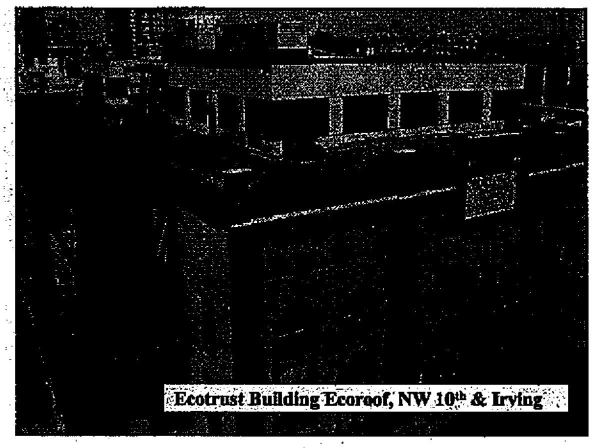

Seattle's Street Edge Alternatives Program

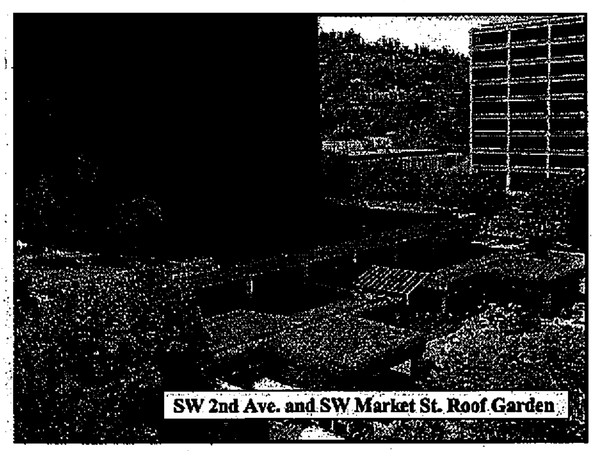


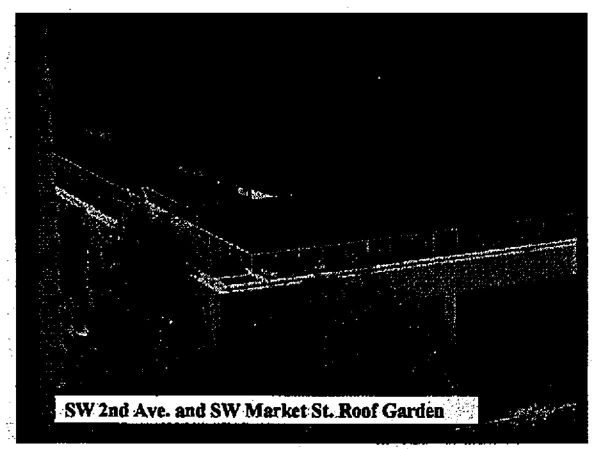


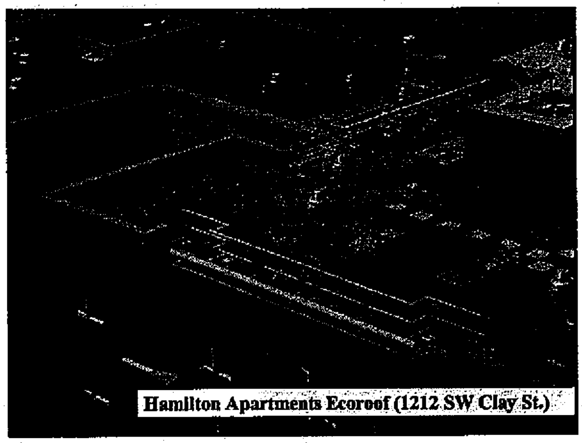
Ecoroofs and Roof Gardens

Site Location	Page/ Slide
Ecotrust Building (NW 10th & Irving)	28
SW 2nd Ave. & Market St.	29, 30
Hamilton Apartments (1212 SW Clay St.)	31, 32
Multnomah County (501 SE Hawthorne)	33
2021 SE Clinton St.	34
Buckman Terrace Apartments (303 NE 16th Ave.)	35, 36

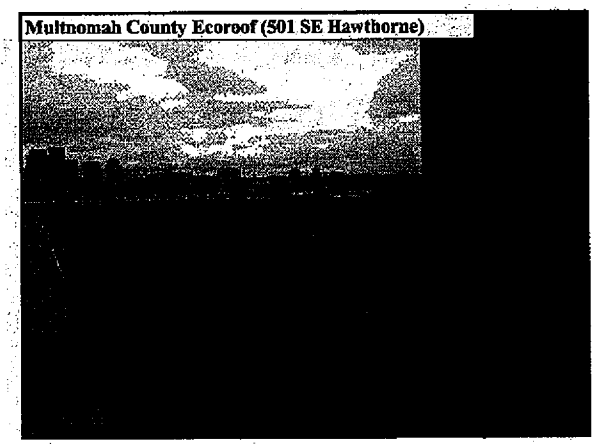


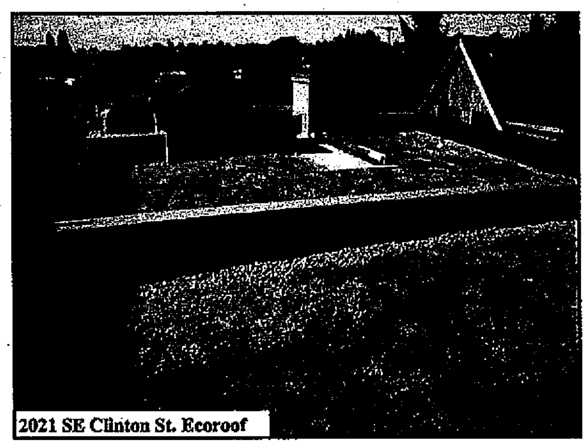


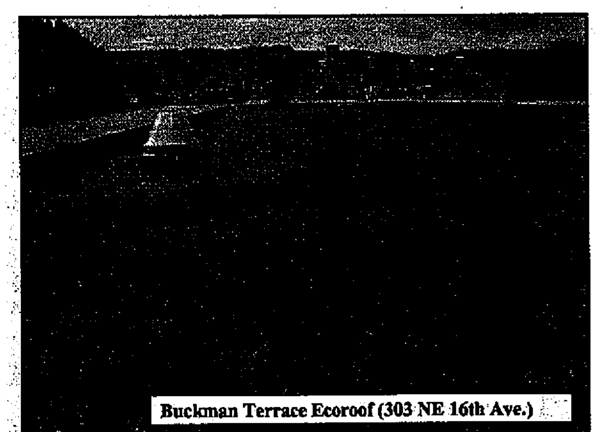


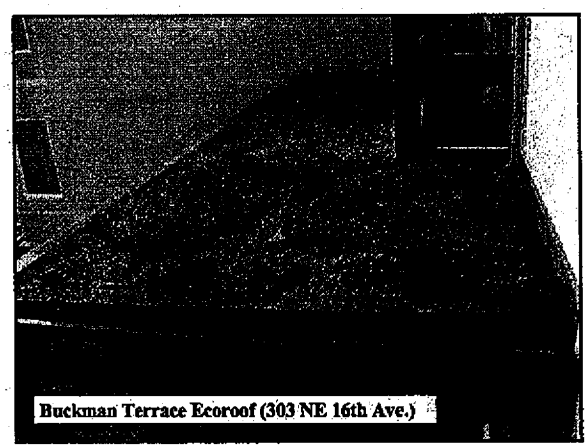

Hamilton Apartments Ecoroof (1212 SW Clay St.)


Hamilton Apartments Ecoroof (1212 SW Clay St.)


Multnomah County Ecoroof (501 SE Hawthorne)

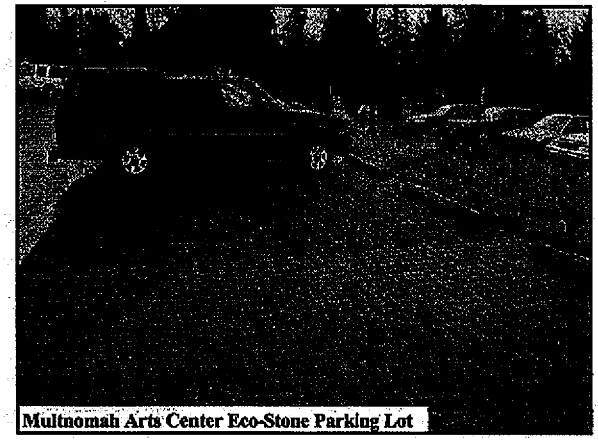

2021 SE Clinton St. Ecoroof


Buckman Terrace Ecoroof (303 NE 16th Ave.)


Buckman Terrace Ecoroof (303 NE 16th Ave.)

Pervious Pavement

Site Location	Page/ Slide
Multnomah Arts Center Eco-Stone	38, 39
Eco-Lock Pavers in Lacey, Washington	40, 41
ONRC (5825 N Greeley)	42, 43
Pervious Concrete Core Sample	44
NE 94th & Broadway Pump Station	45
Clean Water Services Pervious Concrete	46, 47
SE 162nd & Foster Pervious Asphalt	48
Unknown Location	49

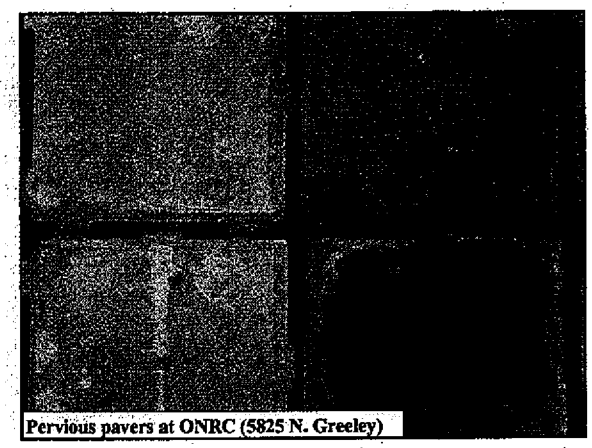

Multnomah Arts Center Eco-Stone Parking Lot


Multnomah Arts Center Eco-Stone Parking Lot

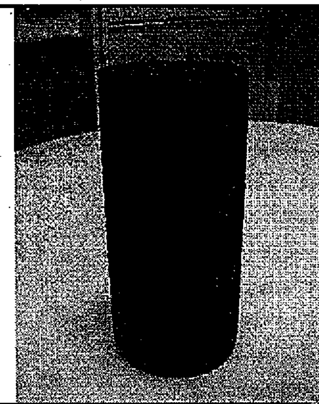

Installation of Eco-Loc Paver Parking Lot in Washington


Installation of Eco-Loc Paver Parking Lot in Washington


Pervious pavers at ONRC (5825 N. Greeley)



Pervious pavers at ONRC (5825 N. Greeley)

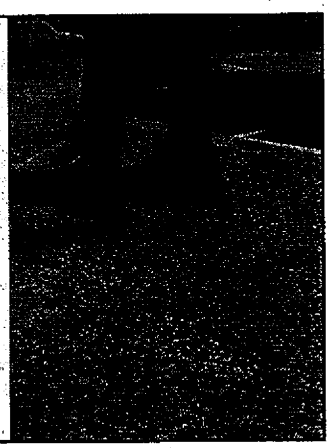


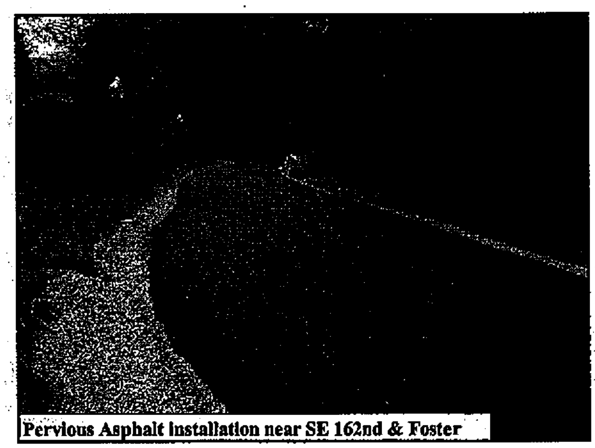
Core-Sample of Pervious Concrete, Dyed Brown

Pervious concrete installation at NE 94th & Broadway pump station site

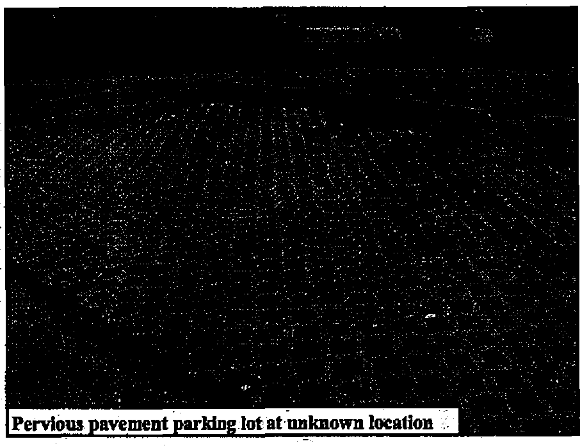
Clean Water Services' pervious concrete parking lot in Beaverton

Clean Water Services Pervious Concrete Parking Lot





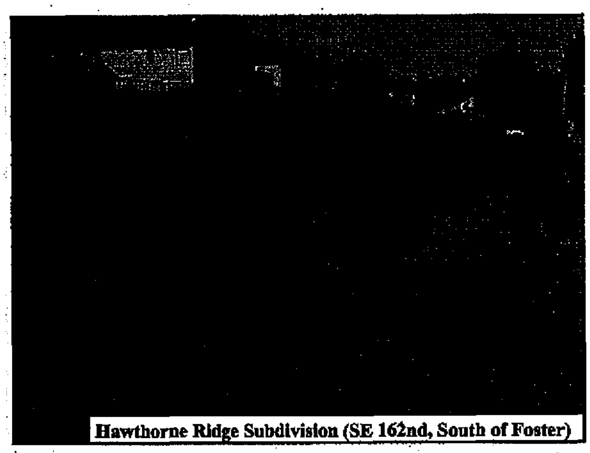
Pervious Asphalt installation near SE 162nd & Foster



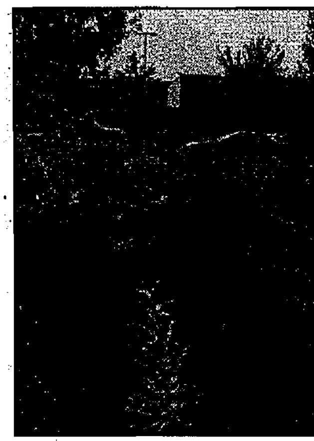
Pervious pavement parking lot at unknown location

Vegetated Swales

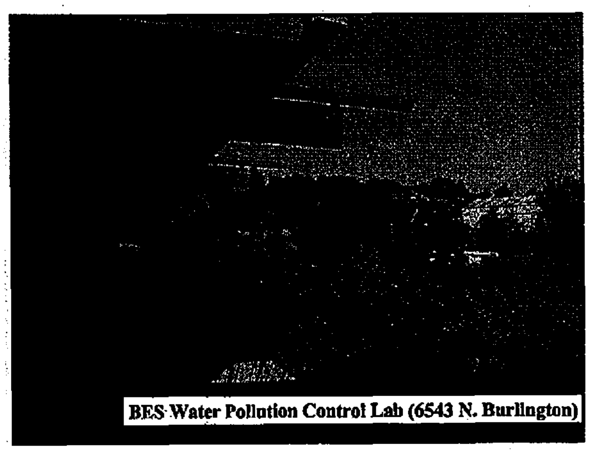
Site Location	Page/ Slide
Hawthorne Ridge Subdivision (SE 162 S. of Foster)	51
OMSI (1945 SE Water Ave.)	52
BES Water Pollution Control Lab (6543 N. Burlington)	53



Hawthorne Ridge Subdivision (SE 162nd, South of Foster)



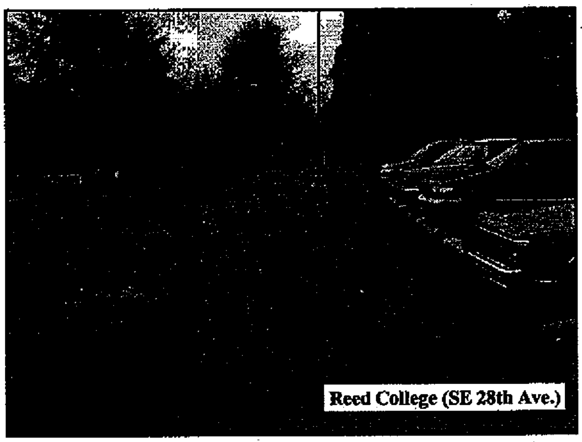
OMSI Vegetated Swale
(1945 SE Water Ave.)



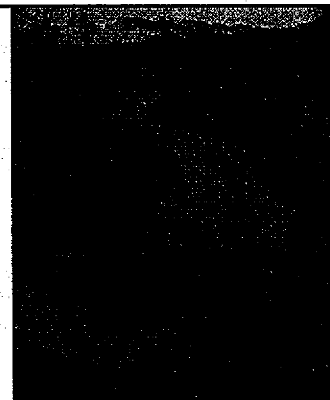
BES Water Pollution Control Lab (6543 N. Burlington)

Grassy Swales

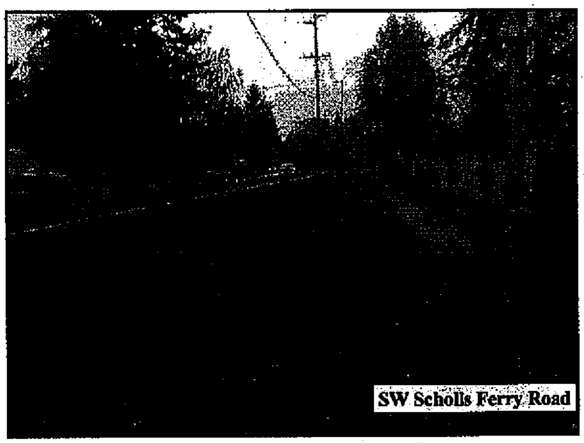
Site Location	Page/ Slide
Reed College (SE 28th Ave.)	55
Russell Pond Site (NE 88th Ave. & Freemont Dr.)	56
SW Scholls Ferry Road	57



Reed College (SE 28th Ave.)



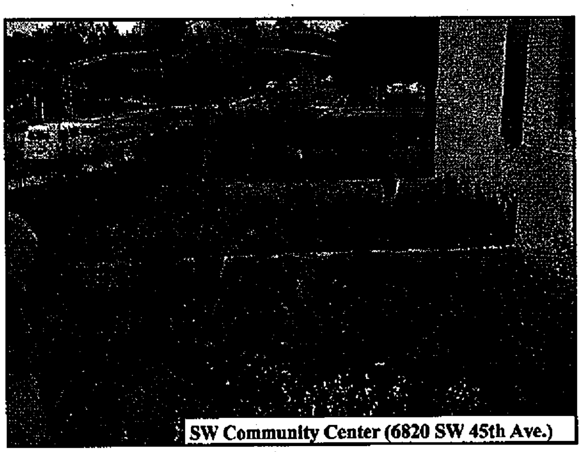
Russell Pond Site (NE 88th Ave. and Freemont Dr.)



SW Scholls Ferry Road

Vegetated Filters

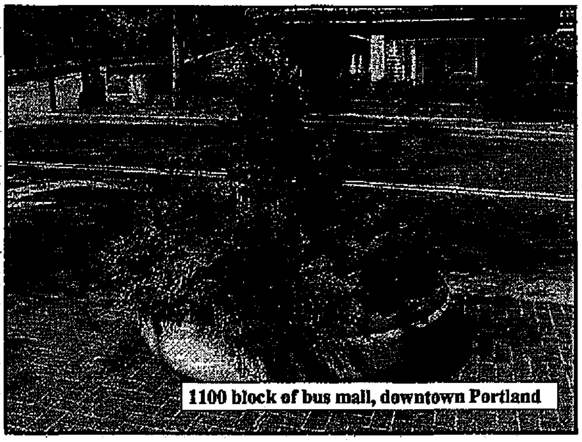
Site Location	Page/ Slide
SW Community Center (6820 SW 45th Ave.)	59

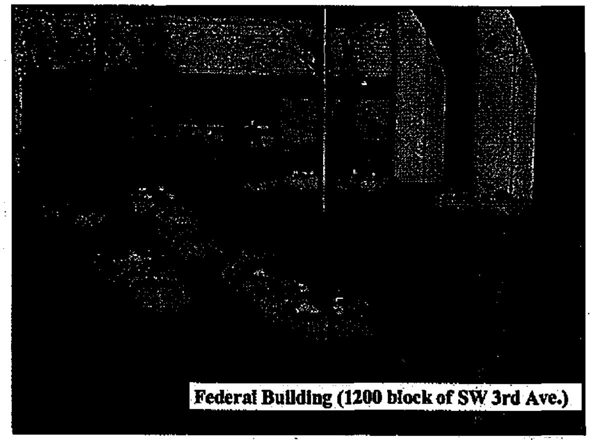


SW Community Center (6820 SW 45th Ave.)

Contained Planters

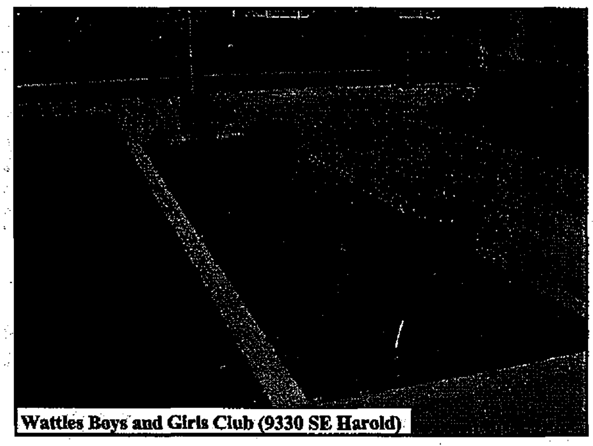
Site Location	Page/ Slide
1100 block of bus mall, downtown Portland	61
Federal Building (1200 block of SW 3rd Ave.)	62


1100 block of bus mall, downtown Portland

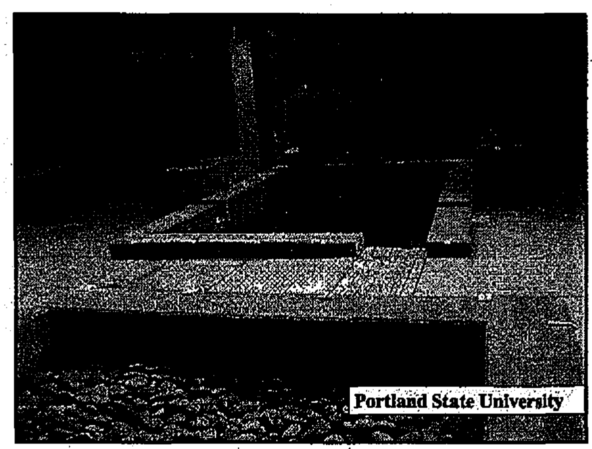

Federal Building (1200 block of SW 3rd Ave.)

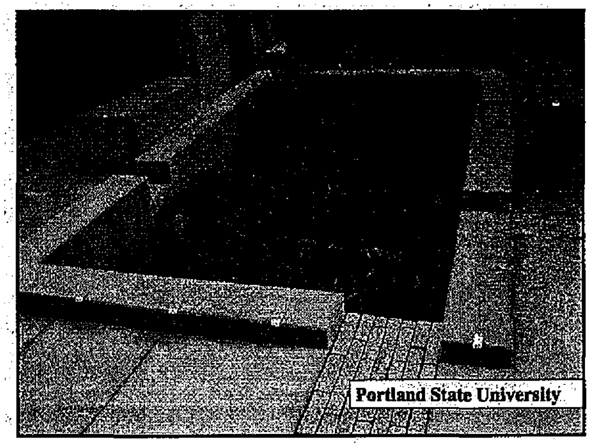
Infiltration Planters

Site Location	Page/ Slide
Wattles Boys and Girls Club (9330 SE Harold	64
Portland State University	65-67


Wattles Boys and Girls Club (9330 SE Harold)

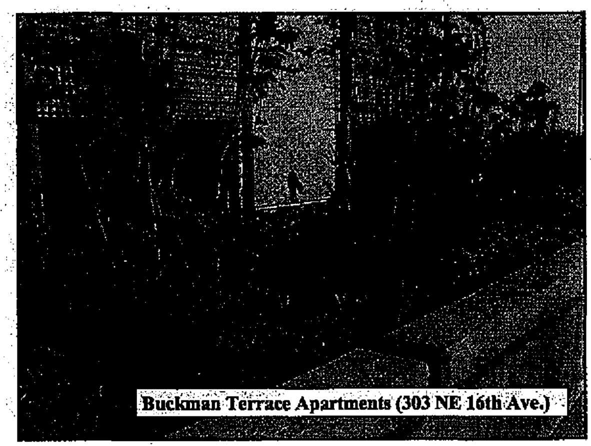

Portland State University

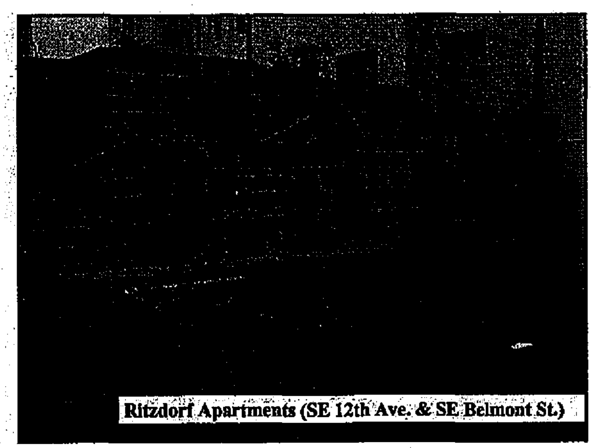

Portland State University

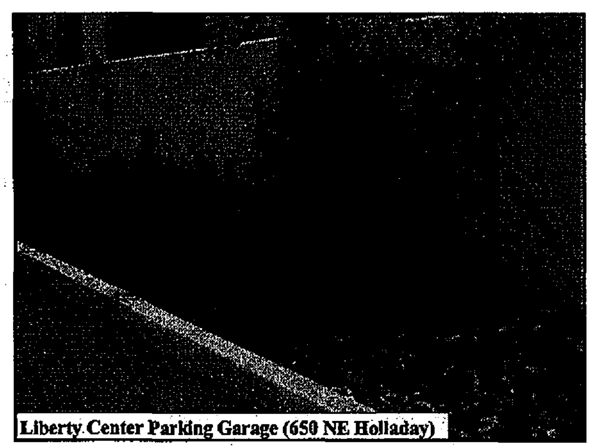


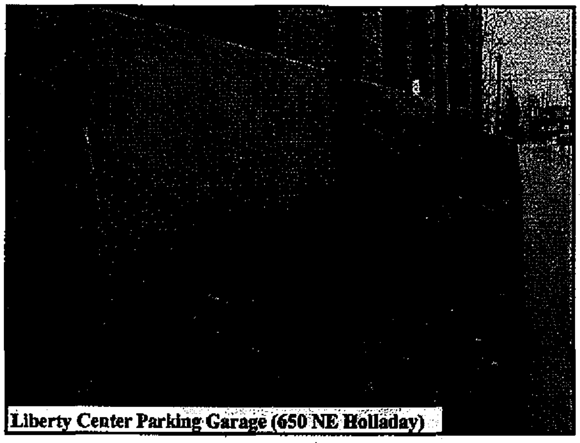
Flow-Through Planters

Site Location	Page/ Slide
Buckman Terrace Apartments (303 NE 16th Ave.)	69, 70
Ritzdorf Apartments (SE 12th Ave. & Belmont)	71
Liberty Center Parking Garage (650 NE Holladay)	72-74
Flow-Through Planter Test in New Zealand	75, 76

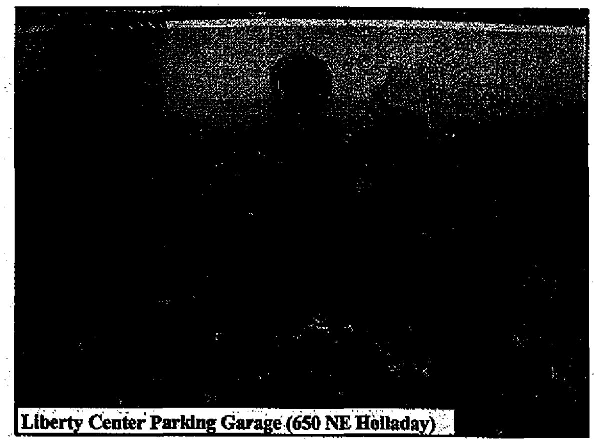






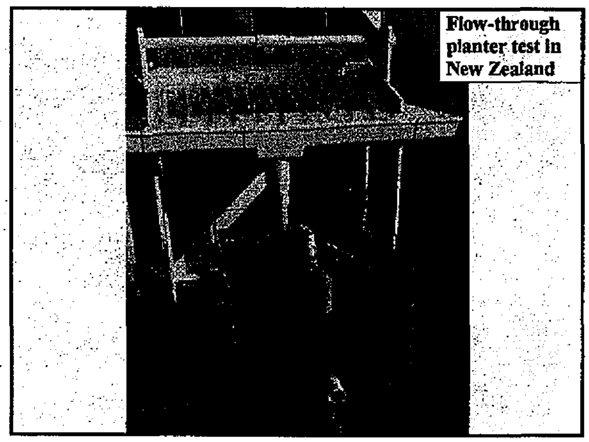


Liberty Center Parking Garage (650 NE Holladay)



Liberty Center Parking Garage (650 NE Holladay)

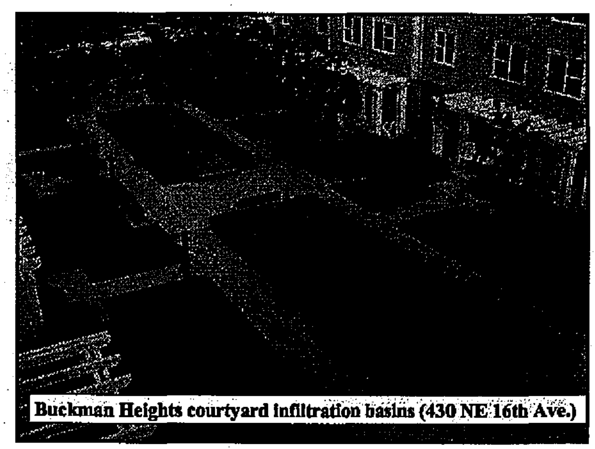
Flow-through planter test in New Zealand



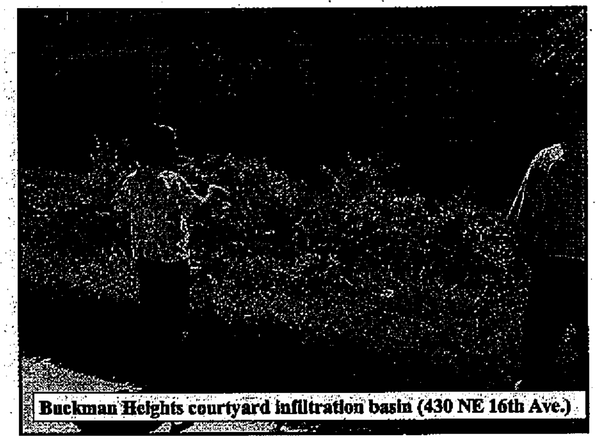
Flow-through planter test in New Zealand

Vegetated Infiltration Basins

Site Location	Page/ Slide
Buckman Heights Apartments (430 NE 16th Ave.)	78-80
Glencoe Elementary School (825 SE 51^{st})	81, 82
Macintyre Estates Subdivision (SE 139^{th} & Steele)	83, 84
Wattles Boys and Girls Club (9330 SE Harold)	85

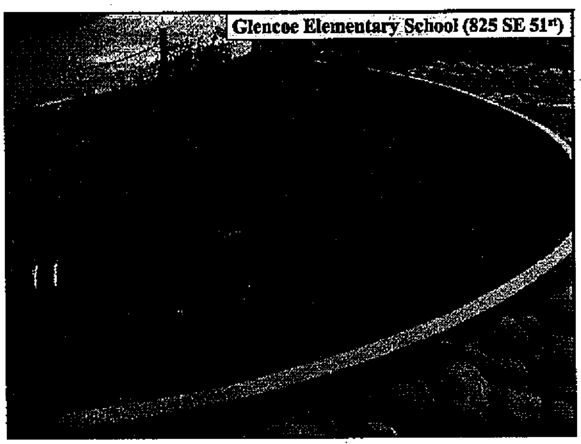


Buckman Heights courtyard infiltration basins (430 NE 16th Ave.)



Buckman Heights courtyard infiltration basin (430 NE 16th Ave.)

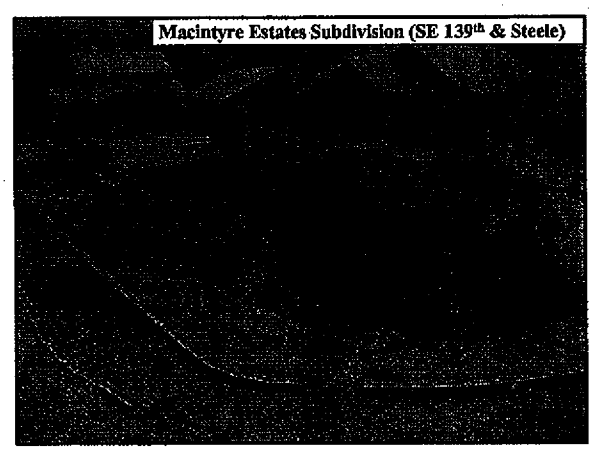
Buckman Heights courtyard planter overflow (430 NE 16th Ave.)



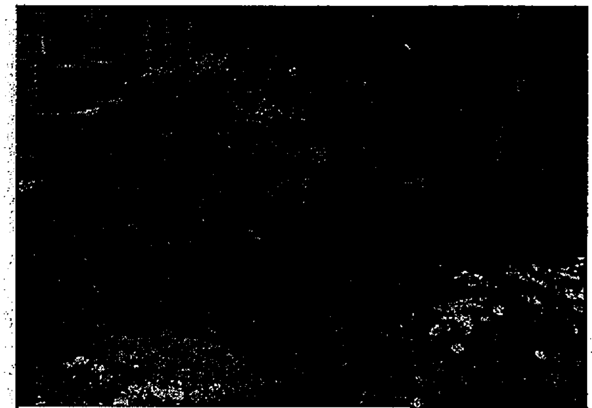
Glencoe Elementary School (825 SE 51st)

Glencoe Elementary School (825 SE 51st)

Macintyre Estates Subdivision (SE 139th & Steele)



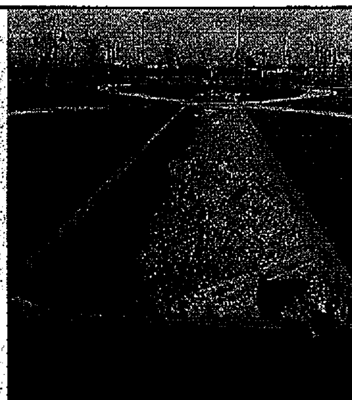
Macintyre Estates Subdivision (SE 139th & Steele)



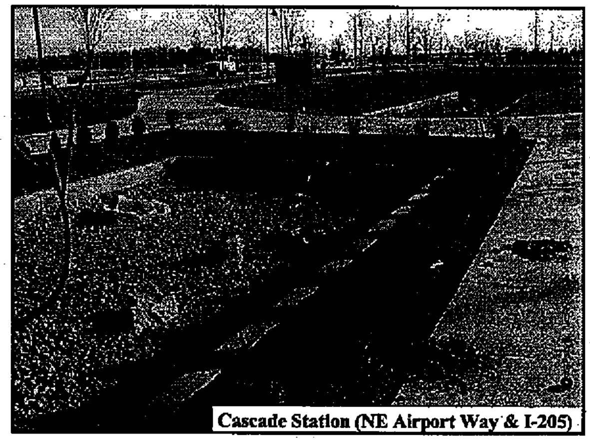
Wattles Boys and Girls Club (9330 SE Harold)

Sand Filters

Site Location	Page/ Slide
Cascade Station (NE Airport Way & I-205)	87, 88



Cascade Station (NE Airport Way & I-205)

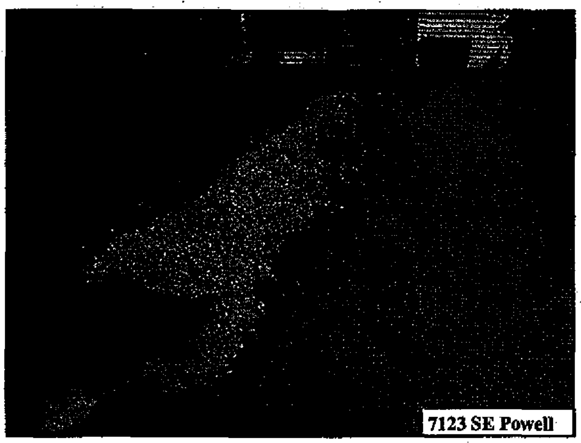


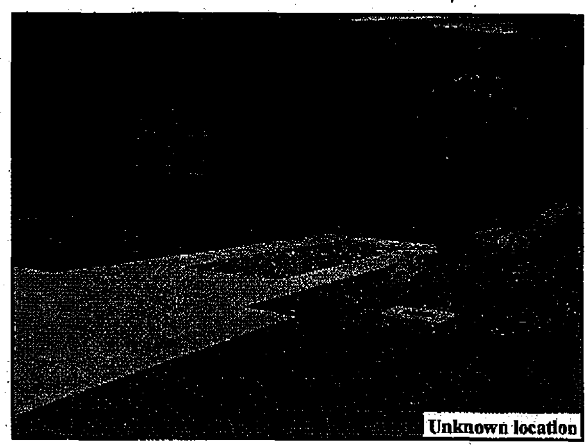
Cascade Station (NE Airport Way & I-205)

Soakage Trenches

Site Location	Page/ Slide
7123 SE Powell	90, 91
Unknown location	92

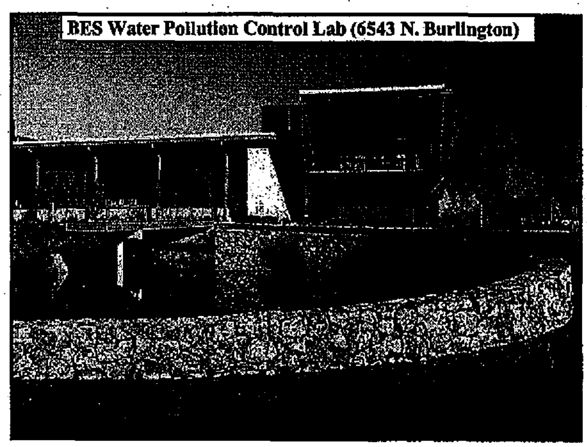
7123 SE Powell

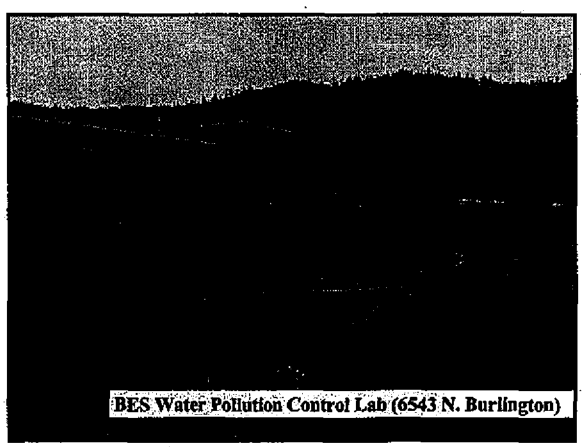

7123 SE Powell

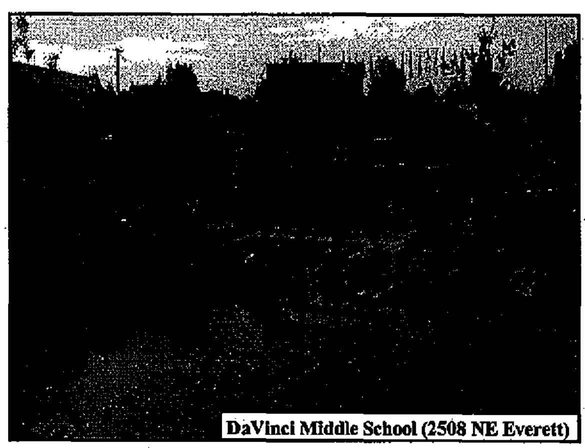

Unknown location

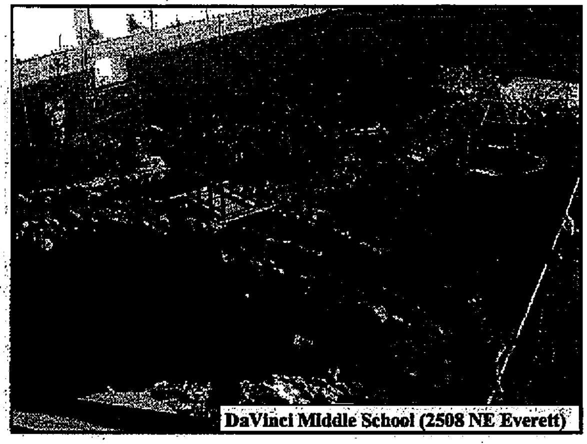
Wet & Extended Wet Detention Ponds

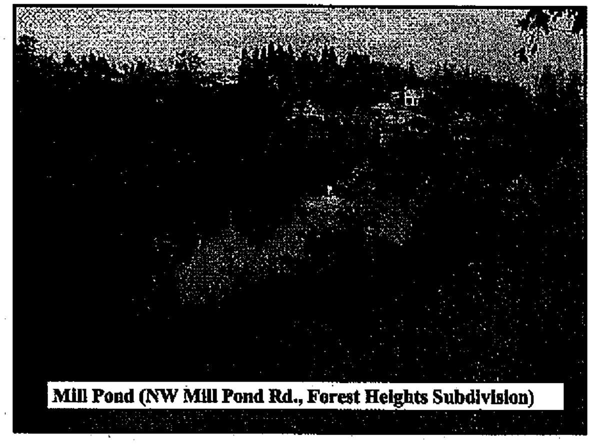
Site Location	Page/ Slide
BES Water Pollution Control Lab (6543 N. Burlington)	94, 95
DaVinci Middle School (2508 NE Everett)	96, 97
Mill Pond (NW Mill Pond Road, Forest Heights)	98
Arata Creek School Site in Troutdale	99
Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)	100

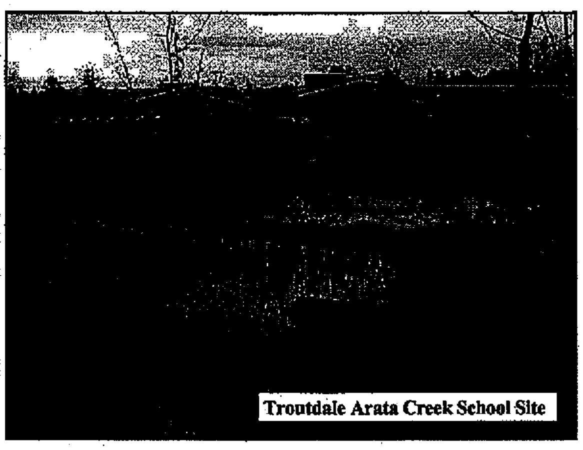

BES Water Pollution Control Lab (6543 N. Burlington)

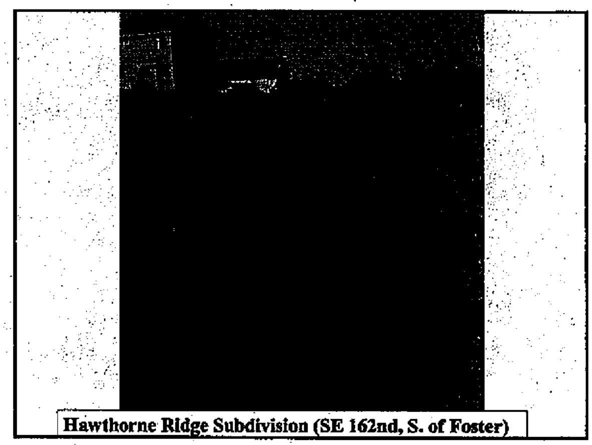

BES Water Pollution Control Lab (6543 N. Burlington)


DaVinci Middle School (2508 NE Everett)


DaVinci Middle School (2508 NE Everett)

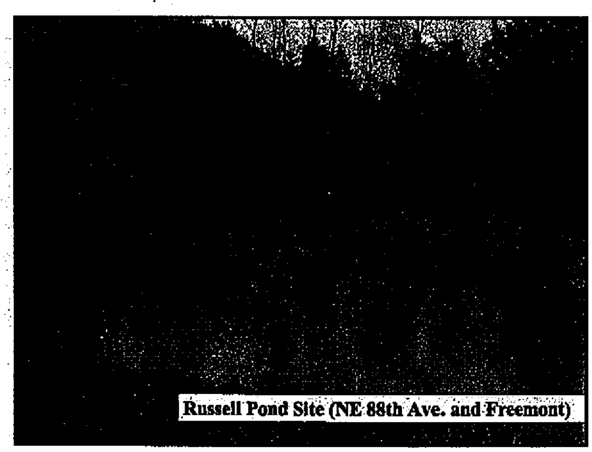

Mill Pond (NW Mill Pond Rd., Forest Heights Subdivision)


Troutdale Arata Creek School Site


Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)

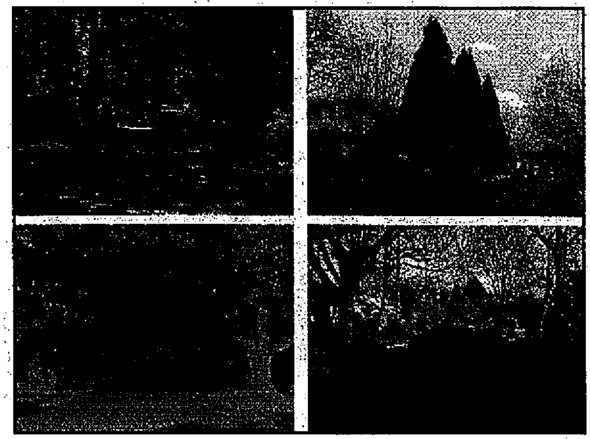
Constructed Treatment Wetlands

Site Location	Page/ Slide
Russell Pond Site (NE 88th & Freemont)	102


Russell Pond Site (NE 88th Ave. and Freemont)

Tree Credit Examples

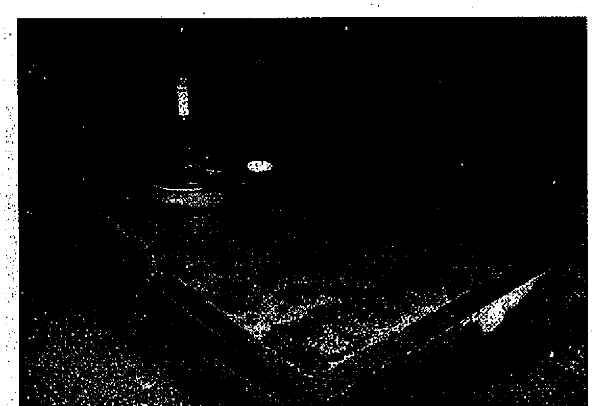
Site Location	Page/ Slide
Miscellaneous	104
Buckman Terrace Apartments (303 NE 16th Ave.)	105



Buckman Terrace tree preservation and at grade infiltration plante (303 NE 16th Ave.)

Rainwater Harvesting

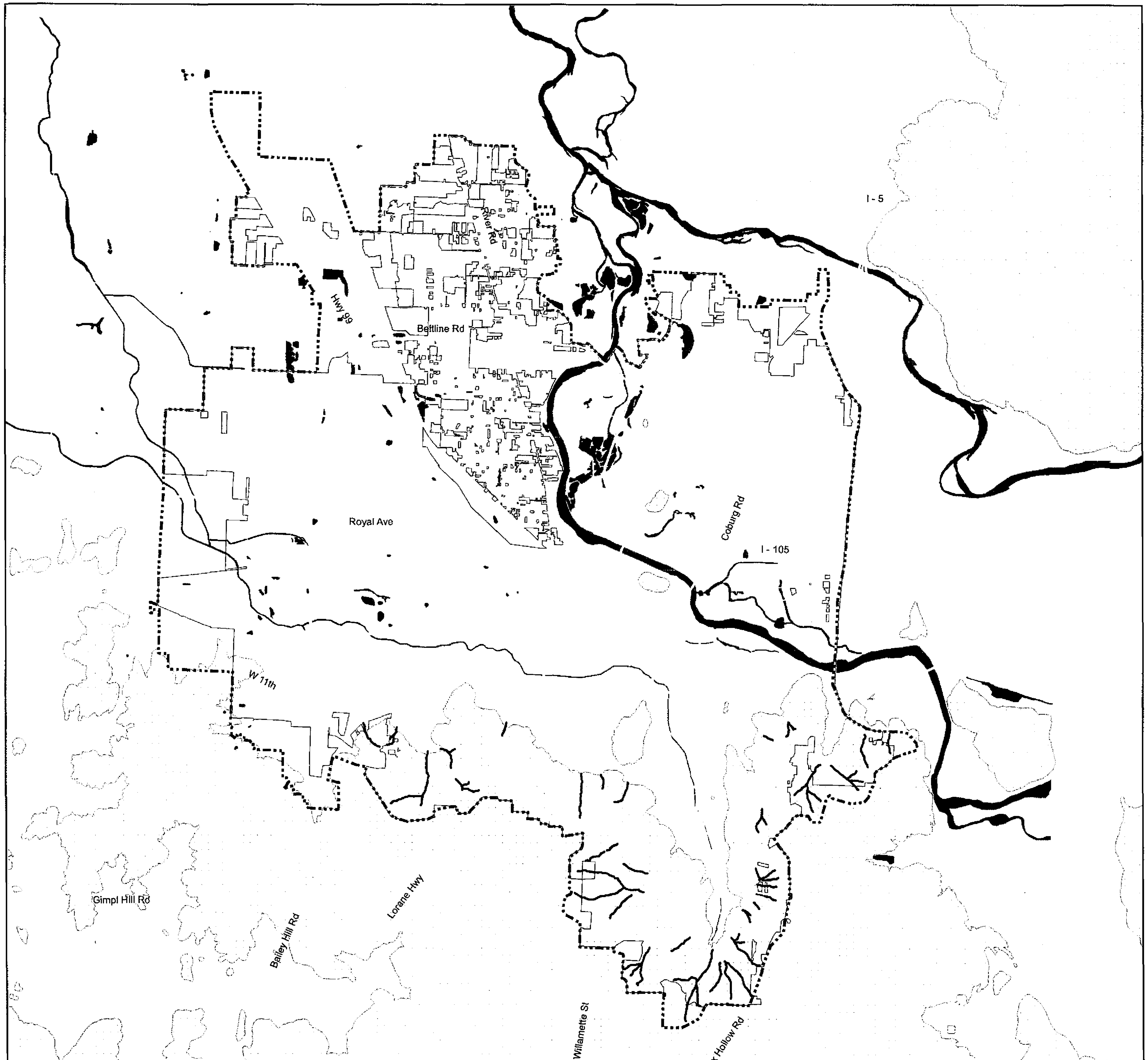
Site Location	Page/ Slide
Oregon Natural Resources Council Office	107



Cistern at ONRC (5825 N. Greeley)

APPENDIX J

HEADWATERS STREAMS MAP



Headwaters Streams Map

LEGEND

Headwater Stream*

Eugene Urban Growth Boundary

City Limits

500 ft Elevation Line

Rivers and Streams

Definition:

* Headwater Streams: a waterbody having a minimum length of 500 feet and provides a drainage area of 10 acres or more, and is identified on the City of Eugene's Sensitive Areas Map having all or a portion of its length greater than 10% slope and affected by highly erodible soils

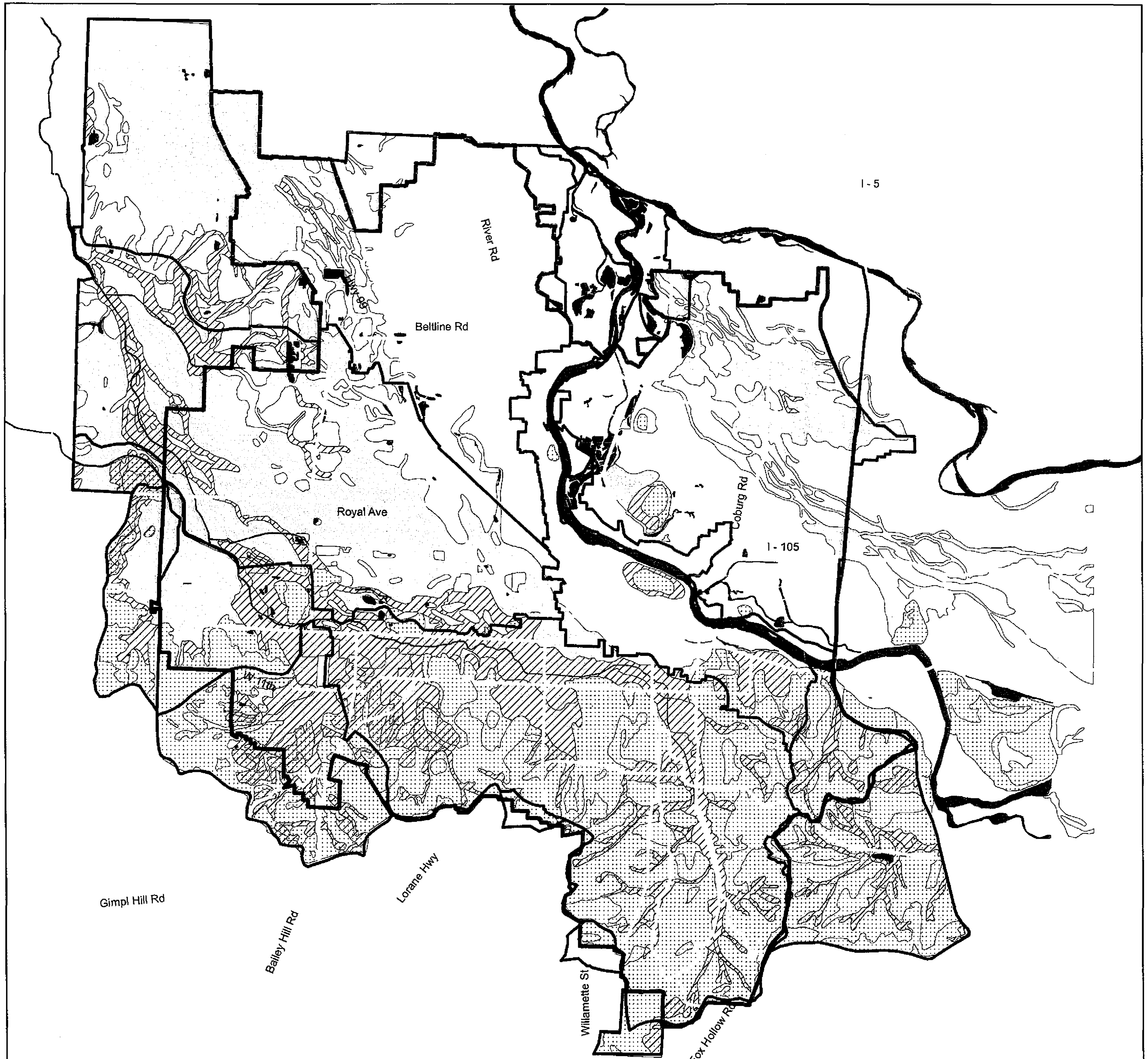
1 0.5 0 1 2 3 Miles

Map produced by City of Eugene PW Eng Info Team, June 02 2006 (ref# 0605-1467)

Map based on imprecise source data, subject to change

APPENDIX K

INFILTRATION LIMITED AREAS MAP



Infiltration Limited Areas

LEGEND

Eugene Urban Growth Boundary

Storm Water Basins

Rivers and Streams

Infiltration Limiting Criteria

Depth to Bedrock less than 5 feet*

Permeability less than 0.6 inches/hour*

Depth to Groundwater less than 6 feet*

Slopes greater than 15 percent

This map displays areas that are not likely to meet the City's proposed subsurface infiltration design requirements. Detailed site-specific information will be required for all proposed infiltration facilities whether required by the City or initiated by the property owner.

** from USDA Natural Resources Conservation Services*

Figure 1. Infiltration limited areas in Eugene

1 0.5 0 1 2 3 Miles

Map produced by City of Eugene PW Eng Info Team, May 25 2006 (ref# 0605-1467)

N

Map based on imprecise source data, subject to change