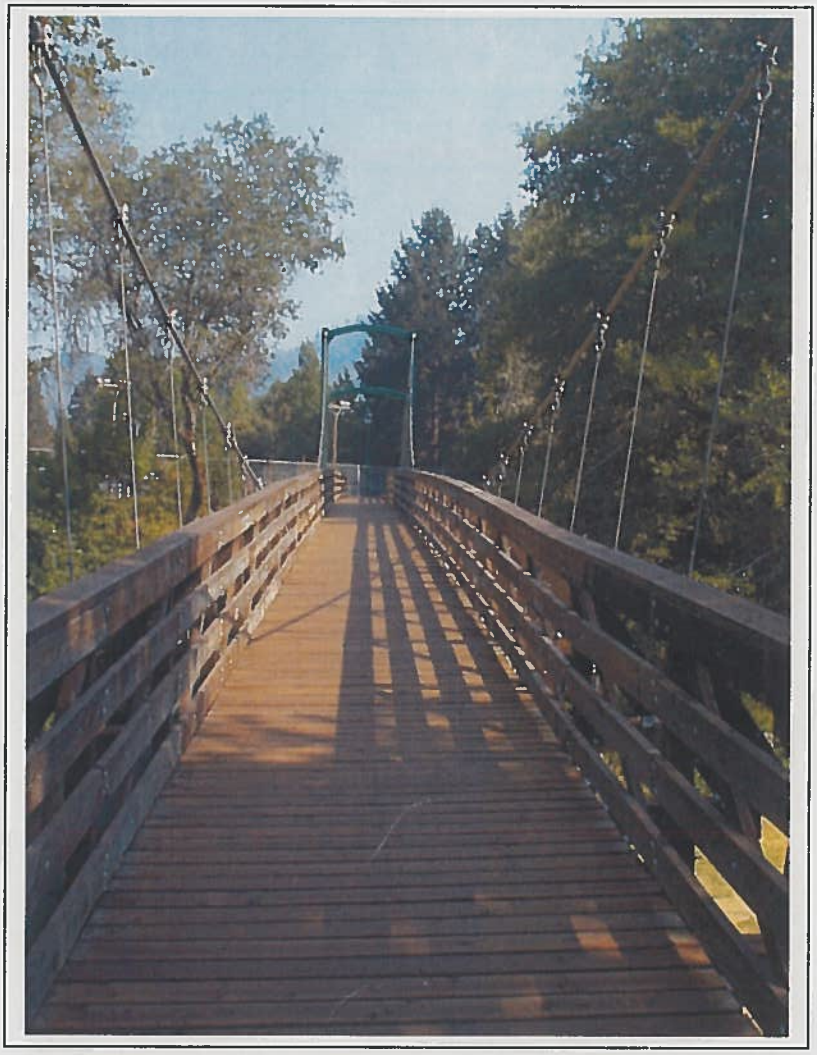
City of Rogue River:
Stormwater Management Plan Volume 1



August 2003

Rogue Valley Council of Governments
Water Resources Department
155 North First Street
Central Point, Oregon. 97502
www.rvcog.org

"Preparation of this document was funded in part from Oregon Lottery proceeds with a technical assistance award from the Special Public Works Fund administered by the State of Oregon Economic and Community Development Department."

Abstract

The objective of the Stormwater Management Plan Volume 1 is to provide a stormwater management plan that utilizes and integrates natural areas, streams, open space and park areas, while providing multiple benefits to the citizens of Rogue River, and meeting regulatory challenges in the region. The Stormwater Management Plan provides the framework and guidance necessary for establishing a comprehensive stormwater program in the City. The final program will consist of several elements in addition to this document, including development code and ordinance revisions, public education and involvement, and basin master planning. Final recommendations and selection criteria regarding program development will be completed by the City of Rogue River.

The Stormwater Master Plan Volume 2 provides an updated Stormwater Master Plan for the City. Engineering recommendations and sizing information including pipe improvements, detention facilities, culvert sizing, anticipated flooding areas, modeling scenarios, and other data concerning the storm drainage system are summarized.

The overall project was completed by the Rogue Valley Council of Governments in Partnership with the Dyer Partnership and the City of Rogue River. Project funding was provided by the Southern Oregon Regional Economic Development Inc. (SOREDI) Regional Investment Fund and the Oregon Economic Development Department (OECDD).

Note: The term Stormwater is used throughout Volume 1 and Storm Water is used in Volume 2. Both of these conventions are considered to be correct and can be used interchangeably.

Components of a Comprehensive Stormwater Management Program for the City of Rogue River

General Stormwater Management

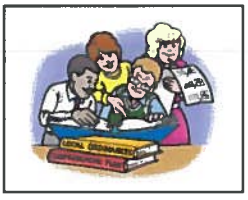
1. Define goals and objectives of the program.

2. Designate personnel or establish a municipal program in the City that will be responsible for stormwater management.

3. Identify stakeholders and other interested parties.

4. Develop communication, coordination, and cooperation both within City Departments and with local, state, and federal agencies.

5. Research funding options and decide on a method to fund the program.



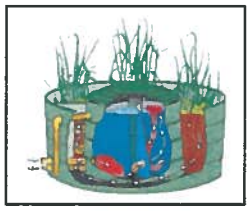
6. Amend existing regulations and administrative policies to be consistent with the recommendations of the Stormwater Program.

7. Establish procedures for program implementation including requirements and procedures for permit issuance, approval, administration, and enforcement of the program.

8. Develop basin plans for local watersheds (Evans Creek, Wards Creek, and the Rogue River) that incorporate the multiple objectives of the stormwater management plan. Plans for the watersheds should include consideration of areas outside of City Limits.

9. Adopt or develop a Stormwater Design Manual.

10. Seek public involvement and input as primary management objectives.

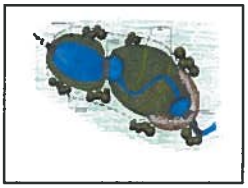


11. Research and evaluate the best available technology designed to improve water quality and control flooding.

12. Provide incentives and flexibility to encourage impervious surface area reduction, promote the conservation of riparian corridors, forests, meadows, and other areas of environmental or cultural significance.

13. Preserve natural infiltration and the recharge of groundwater to maintain subsurface flows, which replenish lakes, streams, and wetlands.

14. Encourage the design and construction of stormwater control systems that serve multiple purposes, including but not limited to flood prevention, water quality protection, wildlife habitat preservation, education, recreation, and protection of wetlands.



15. Assure that all stormwater and runoff control measures are properly designed, constructed, and maintained.

16. Provide for adequate enforcement of regulations.

17. Limit clearing and grading of forests and native vegetation at construction sites to the minimum amount needed to build lots, allow access, and provide fire protection.

18. Promote more flexible design standards for sidewalks, parking lots, driveways, street widths, and cul-de-sacs.

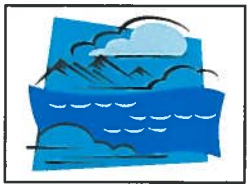
19. Conduct public education programs, and provide information on stormwater impacts and solutions.

20. Implement a cost effective operations and maintenance program for municipal operations.

21. Provide training programs for city staff, the development community, and other interested parties.

22. Establish protocols for detecting and eliminating illicit discharges to area waters.

23. Define measurable goals for the success of the program.



24. Revise the stormwater program and use adaptive management as needed.

Erosion Prevention and Sediment Control

25. **Prevent** erosion from construction sites and capture sediment before it enters waterbodies, wetlands, and storm drains. Erosion prevention and sediment control is more cost effective and practical when erosion is **prevented**.

26. Control accelerated stormwater runoff onto and from construction sites both during and after construction.

27. Assure that erosion prevention and sediment control measures and stormwater runoff control systems are incorporated into site planning at an early stage in the planning and design process.

28. Provide for inspection and enforcement of erosion prevention and sediment control measures.

29. Adopt or design an Erosion Prevention and Sediment Control Manual.

Open Space Conservation

30. Maximize public benefits by integrating open space and wildlife habitat conservation with stormwater management to achieve multiple objectives.

31. Develop and implement a management and acquisition program for open space conservation and natural resources protection.

32. Promote open space development and conservation designs incorporating smaller lot sizes to minimize total impervious area, reduce total construction costs, conserve natural areas, provide community recreational space, and promote watershed protection.

33. Clearly specify how community open space will be managed, and provide resources and the authority to manage both natural and recreational open space.

Riparian Corridor Management

34. Evaluate the adequacy of current riparian regulations and analyze the costs and benefits of increasing corridor widths and riparian protection.

35. Protect and plant native vegetation in riparian corridors, wetlands, steep slopes, and other sensitive areas, and prevent encroachment by invasive plant species.

36. Establish a system of incentives or credits for preserving riparian corridors.

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Section 1.0: City of Rogue River Stormwater Management Plan (SWMP)

1.1 Introduction

Stormwater management in Rogue River has been based on traditional methods focusing primarily on flooding and drainage management through engineered solutions (Figure 1-1(a)). Pipes convey flow efficiently to receiving waters to minimize impacts to property and city residents. As communities continue to grow, these systems become overloaded resulting in the need for upgrades and repair. In addition, stormwater management has moved far beyond dealing with water quantity issues alone. Urban stormwater has been found to impact stream hydrology, geomorphology, and water quality (Figure 1-1 (b)). Degraded fish and aquatic habitat, diminished recreational opportunities, channel erosion, increased flooding, property damage and loss, and impact to endangered species are among the problems documented from stormwater that cities are struggling to manage. In addition there are a number of regulations affecting the region that deal with stormwater both directly and indirectly.

Figure 1-1(a): Example of typical storm drainage inlet (RVCOG 2002)

Figure 1-1(b): Stream downcutting resulting from stormwater runoff (Center for Watershed Protection 1999).

1.2 Project Scope

In the winter of 2002, the City entered into an agreement with the Rogue Valley Council of Governments (RVCOG) and the Dyer Partnership to assist the City of Rogue River in the development of a Stormwater Management Plan. The Management Plan is designed to serve as a guide for the City in the development of a ***comprehensive stormwater management program***, which will provide multiple benefits to the city and its residents.

The City was concerned about meeting NPDES Phase II requirements, water quality issues, and other concerns affecting the region as part of their management program. ***The plan outlined in this document is only one component of the comprehensive stormwater management program for the city.*** Revised ordinance language, a Capital Improvement Plan, educational information, integration of other plans, training, and other supporting information will be included as part of the overall program (see Figure 1-1). It is recommended that this program be reviewed at a minimum of every three years, and revised as needed every 5-10 years.

1.3 Development of the Stormwater Management Plan

The City of Rogue River is not currently mandated to comply with the NPDES Phase II stormwater regulations since it does not have a population of 10,000 persons or more, and it was not designated as an urbanized area as defined by the 2000 census. However, the City recognizes that it can be listed as a Phase II community in the near future. Sections of the Rogue River and Evans Creek are on the water quality impaired 303(d) list for temperature and bacteria, and both flow modification and habitat modification continue to be a concern in the region. These factors combined with high growth rates in the region, the pending completion of the Rogue River total maximum daily load allocations (TMDL), and the presence of anadromous fish species (particular the threatened coho salmon) indicate the likelihood of the City being required to meet Phase II, TMDL, Statewide Planning Goal 5, and ESA regulations in the next 20 years.

In addition, the requirements for DEQ's 1200-C permit for new construction have been changed. Prior to December 2002, projects disturbing five acres or more were required to obtain a permit. The limits were lowered after December requiring projects that disturb over 1 acre to apply for a 1200-C permit from DEQ. 1200-C permits provide guidance and requirements concerning methods that are to be used to minimize erosion and control sedimentation and other pollutants in runoff from construction sites. Many jurisdictions are adding increased erosion control requirements to smaller projects (500 square feet or larger) to protect sensitive areas, including wetlands and hillslopes, and stormwater systems from clogging with sediment generated from construction sites.

The Stormwater Management Plan marks a change in the way the City of Rogue River understands and manages its stormwater runoff. The impetus for preparing the Stormwater Plan grew out of the need to update the existing Storm Drain Capital Improvement Plan to address community growth, resource needs, water quality, and regulatory concerns. Local officials recognized at the outset of the project that an opportunity existed to manage a broader range of issues beyond what is required by pending mandates. Through an integrated stormwater

management approach , the City can efficiently manage resources and programs to provide multiple public benefits for the community.

Effectively meeting the requirements of Phase II will also help the City address other water quality and regulatory concerns in the region, including the impending TMDLs to be completed for the Rogue in 2004. Utilizing elements of the Phase II program also provides for awareness and proper stewardship of the city's natural resources. This will ensure that the community retains the character and quality of life that attracts people to the city, while maintaining a balance between growth and conservation of resources.

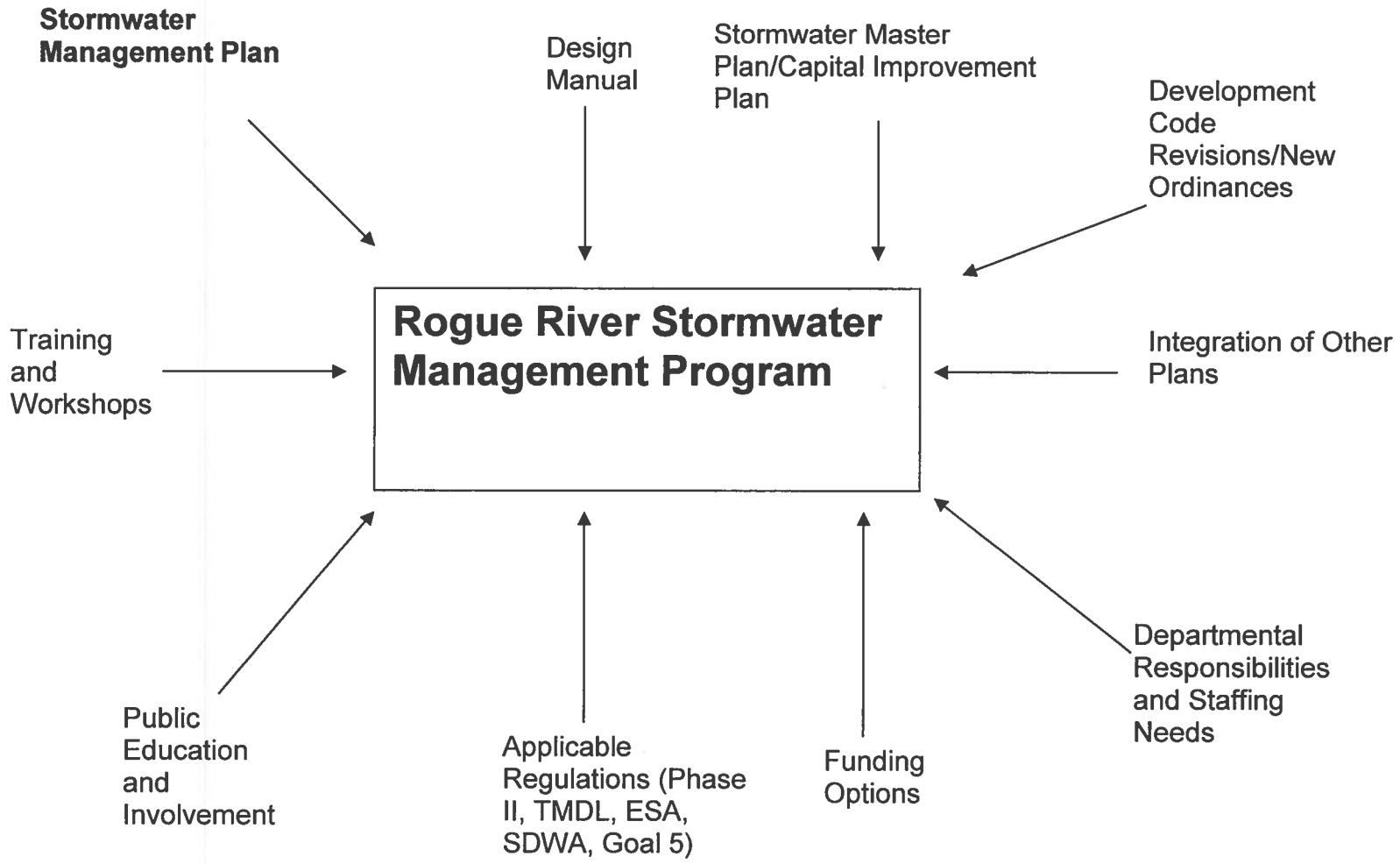
Most of the areas encompassed by the plan refer to the areas encompassed by the Urban Growth Boundary and within City Limits. Rogue River recognizes the interconnectedness of the headwater areas, and the need to work with other groups to manage these areas. However, due to jurisdictional authority and the desire to focus more on growth within the City, this plan focuses primarily on the areas encompassed by the UGB.

1.4 Establishing a Stormwater Planning Team

A key first step in establishing a stormwater management program is to assemble a multi-disciplinary planning team, designate a team coordinator, and define the scope of the stormwater planning effort.

The initial planning team for the design of the Rogue River Stormwater project consisted of Mark Reagles – City Administrator, Ken Johnson – Public Works Director, Jeannell Wyntergreen – Planning Department, and staff from the Rogue Valley Council of Governments and the Dyer Partnership. Primary responsibility for program implementation will be the Public Works department.

Figure 1-2: Stormwater Management Program for the City of Rogue River



Section 2.0: Regulations

This section describes stormwater regulations including the Clean Water Act (CWA), the Endangered Species Act (ESA), the Safe Drinking Water Act (SDWA), and Oregon Statewide Planning Goals (primarily Goals 5 and 6).

2.1 Clean Water Act

2.1.1 Section 402 (NPDES Phase I and Phase II)

Regulatory Requirement

Phase I of the U.S. Environmental Protection Agency's (EPA) municipal stormwater program was promulgated in 1990 under the authority of the Clean Water Act (CWA). Phase I relied on the National Pollutant Discharge Elimination System (NPDES) permit coverage to address stormwater runoff from medium and large municipal separate storm sewer systems (MS4s), serving populations of 100,000 or greater.

The Stormwater Phase II Final Rule (promulgated December 8, 1999) was the next step in the EPA's efforts to preserve, protect, and improve the nation's water resources from polluted stormwater runoff. The Phase II program requires additional operators (regulated small MS4s) to implement programs and practices to control polluted stormwater runoff, through the NPDES permit program. The program requires Phase II municipalities to develop a Stormwater Management Program.

A "regulated small MS4" is defined as a small MS4 that discharges to a water of the U.S. or to another MS4 regulated by a NPDES permit, and which is designated in one of the following ways (DEQ 2002):

1. Automatically designated by U.S. EPA pursuant to 40 CFR 122.32(a) because it is located within in urbanized area defined by the Bureau of the Census; or
2. Traditional Small MS4s that serve cities, counties and unincorporated areas that are designated by DEQ after the consideration of the following factors:
    a. High population density- High population density means an area with greater than 1,000 residents per square mile. Also to be considered in this definition is a high density created by a non-residential population, such as tourists or commuters.
    b. High Growth or growth potential- If an area grew by more than 25% between 1990 and 2000, it is a high growth area. If an area anticipates a growth rate of more than 25% over a 10-year period ending prior to the end of the first permit terms, it has a high growth potential.
    c. Significant contributor of pollutants to an interconnected MS4- A small MS4 is interconnected with a separately permitted MS4. Stormwater that has entered the small MS4 is allowed to flow directly into a permitted MS4.
3. Discharge to sensitive waterbodies – Sensitive waterbodies are receiving waters, which are a priority to protect. They include the following:

a. Those listed as providing or known to provide habitat for threatened or endangered species.
b. Those used for recreation that are subject to beach closings or health warnings; or
c. Those listed as impaired pursuant to CWA section 303(d).

4. Significant contributor of pollutants to waters of the United States – Specific conditions presented by the MS4 may lead to the significant pollutant loadings to waters of the U.S. that are otherwise unregulated or inadequately regulated.

The City of Rogue River has not been designated as a regulated small MS4, and therefore is not currently mandated to comply with Phase II requirements. However, given the rate of growth in region, resource sensitivity, water quality concerns, and desire to maintain the quality of life in the City, the management plan incorporates recommendations to meet the six minimum control measures.

Compliance with the NPDES Phase II guidelines requires affected municipalities to meet six minimum control measures as part of a stormwater management program:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Stormwater Management
6. Pollution Prevention/Good Housekeeping

The following text discusses why these elements are considered to be necessary components in stormwater management.

Control Measure #1: Public Education and Outreach

An active and involved community allows for:

1. Broader public support since citizens who participate in the development and decision making process are partially responsible for the program and, therefore, may be less likely to raise legal challenges to the program and more likely to take an active role in its implementation;

2. Shorter implementation schedules due to fewer obstacles in the form of public and legal challenges and increased sources in the form of citizen volunteers;

3. A broader base of expertise and economic benefits since the community can be a valuable, and free, intellectual resource; and

4. A conduit to other programs as citizens involved in the stormwater program development process provide important cross-connections and relationships with other community and government programs. This benefit is particularly valuable when trying to implement a stormwater program on a watershed basis.

Control Measure #2: Public Involvement and Participation

An informed and knowledgeable community helps to ensure the following:

1. Greater support for the program as the public gains a greater understanding of the reasons why it is necessary and important. Public support is particularly beneficial when attempting to institute new funding initiatives for the program or seek volunteers to help implement the program; and

2. Greater compliance with the program as the public becomes aware of the personal responsibilities expected of them and others in the community, including the individual actions they can take to protect or improve the quality of area waters.

Control Measure #3: Illicit Discharge Detection and Elimination

Discharges from storm drains often include wastes and wastewater from non-stormwater sources. A study conducted in 1987 in Sacramento, California found that almost one-half of the water discharged from local storm drains was not directly attributable to precipitation runoff. Significant portions of these dry weather flows were from illicit and/or inappropriate discharges and connections to the system. Illicit discharges enter the system through either direct connections (e.g., wastewater piping either mistakenly or deliberately connected to the storm drains) or indirect connections (e.g., infiltration into the system from cracked sanitary systems, spills collected by drain outlets, or paint or used oil dumped directly into a drain). The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies. Pollutant levels from these illicit discharges have been shown in studies to be high enough to significantly degrade receiving water quality and threaten aquatic, wildlife, and human health.

Control Measure #4: Construction Site Runoff Control

Polluted stormwater runoff from construction sites often flows to storm drainage systems and ultimately is discharged into local rivers and streams. Sediment is usually a main pollutant of concern from these sites. Sediment runoff rates from construction sites are typically 10 to 20 times greater than those of agricultural lands, and 1,000 to 2,000 times greater than those of forest lands. During a short period of time, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation, and the contribution of other pollutants from construction sites, can cause physical, chemical, and biological harm to local streams and the Rogue River. For example, excess sediment can quickly fill rivers and lakes destroying aquatic habitats and fish spawning areas.

Control Measure #5: Post-Construction Stormwater Management

Post-construction stormwater management in areas undergoing new development or redevelopment is necessary because runoff from these areas has been shown to significantly effect receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management.

There are generally two forms of substantial impacts of post-construction runoff. The first is caused by an increase in the type and quantity of pollutants in stormwater runoff. As runoff flows over areas altered by development, it picks up harmful sediment and chemicals such as oil and grease, pesticides, heavy metals, and nutrients (e.g., nitrogen and phosphorus). These

pollutants often become suspended in runoff and are carried to receiving waters, such as lakes, ponds, and streams. Once deposited, these pollutants can enter the food chain through small aquatic life, eventually entering the tissues of fish and humans. The second kind of post-construction runoff impact occurs by increasing the quantity of water delivered to the waterbody during storms. Increased impervious surfaces interrupt the natural cycle of gradual percolation of water through vegetation and soil. Instead, water is collected from surfaces such as asphalt and concrete and routed to drainage systems where large volumes of runoff quickly flow to the nearest receiving water. The effects of this process include streambank scouring and downstream flooding, which often lead to a loss of aquatic life and damage to property.

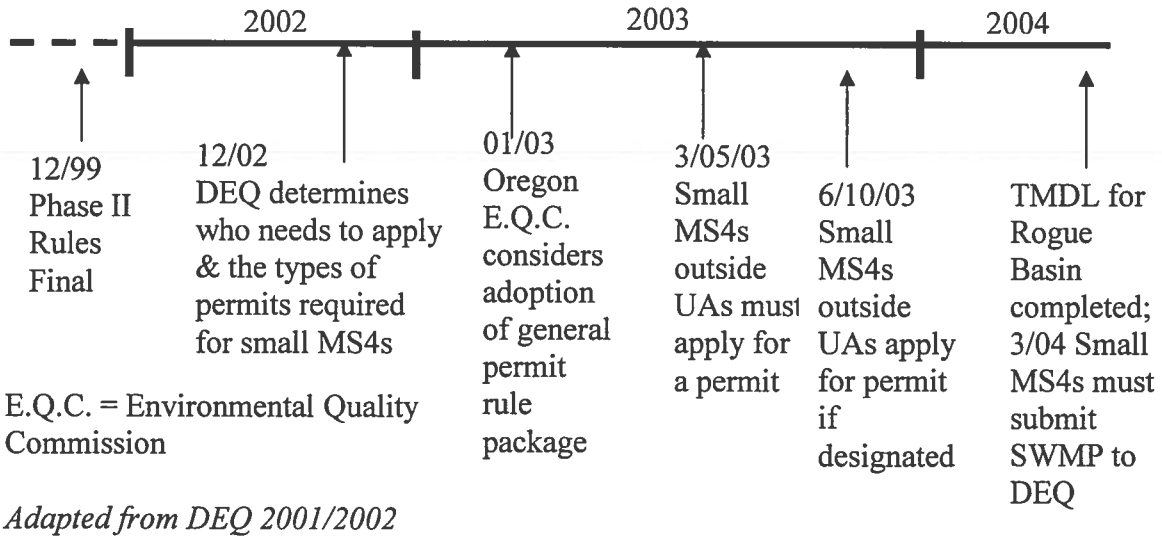
Control Measure #6: Pollution Prevention/Good Housekeeping

The Pollution Prevention/Good Housekeeping for municipal operations minimum control measure is a key element of the stormwater management program. This measure requires the small operators (City of Rogue River) to examine and subsequently alter their own actions to help ensure a reduction in the amount and type of pollution that: (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. While this measure is meant primarily to improve or protect receiving water quality by altering municipal or facility operations, it also can result in a cost savings for the small operator, since proper and timely maintenance of storm sewer systems can help avoid repair costs from damage caused by age and neglect.

NPDES Phase II Timeline for the Rogue Valley

The timeline for Phase II permits in the Rogue Valley will require designated cities to obtain permits beginning in spring 2003 (DEQ 2001). Figure 1-3 shows a flowchart of tentative dates from DEQ.

Figure 2-1: NPDES Phase II Deadlines for the Middle Rogue



E.Q.C. = Environmental Quality Commission

Adapted from DEQ 2001/2002

2.1.2 303(d) List and Total Maximum Daily Loads (TMDLS)

The Oregon Department of Environmental Quality determines beneficial uses for waterbodies and establishes water quality standards necessary to protect and maintain these uses. If a waterbody exceeds the established standards, it is placed on a list of impaired waters (303 (d) list). Once a waterbody is listed, a TMDL must be calculated for that stream. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant sources. Sources of pollution are allocated between point sources (waste load allocation), nonpoint sources (load allocation), and natural (background) levels. Stormwater discharge is allocated as part of the TMDL, and therefore may need to meet strict limitations on both quality and quality before it can be discharged into a stream. Table 1-1 shows 303(d) listed streams and areas of concern in Rogue River.

Table 2-1: Water Quality Limited Streams (303(d) Listings)

Stream/River	Parameters of concern	Comments
Rogue River*	Temperature, bacteria, flow modification, and habitat modification	** See Below
Evans Creek*	Temperature, bacteria	

* 303(d) listings indicate that the Rogue River and Evans Creek are impaired for the parameters of concern during portions of (seasonally) or throughout the year.
* *Flow modification and habitat modification have been identified as major concerns for the Rogue. Revisions to the 303(d) listing rules as of 2002 have changed the status of these parameters. They are acknowledged as pollution, but not pollutants. Therefore, development of TMDLs and subsequent load allocations are no longer required.

2.2 Endangered Species Act (ESA)

The NOAA Fisheries National Marine Fisheries Service (NMFS) is currently working with state and local agencies to review stormwater programs, and evaluate their impacts to threatened anadromous fish species. The U.S. Fish and Wildlife Service regulates the effects of stormwater on other aquatic and terrestrial species, including resident trout. NMFS's technical concern is that listed aquatic species may be affected by changes in water quality and hydrology (Munn 2002). Changes in water quality may impact biota and changes in hydrology result in changes in stream habitat. A list of potential concerns is summarized in Table 1-2.

Table 2-2: Selected List of Potential NMFS Concerns (Draft Munn 2002)

Category
Hydrology • Increases in impervious surface cover (ISC) alters the hydrology of the watershed by decreasing infiltration and increasing surface runoff • Floods peak more rapidly with flood discharge increasing in proportion to percent ISC. • Groundwater recharge is reduced.
Changes in Stream Habitat • Changes in hydrology result in predictable changes in stream habitat. • Channel enlargement increases with increasing (ISC) (2-6%). Incision, bank erosion and channel widening are evident. • Channels become unstable above 10% ISC. • Increase in pool to riffle ratio. • Changes in sediment texture. • Less large wood. • Changes in velocity.
Changes to Water Quality and Biota • Increased loading of nutrients, metals, pesticides, and other contaminants. • Water temperature increases with impervious surface cover. • Reduced diversity of invertebrates and fish.

Procedures for meeting ESA requirements and consultation priorities are currently under review within NMFS. Sample terms and conditions that Rogue River could have to meet for NMFS's project approval are summarized below. It should be noted that these requirements are currently draft terms under consideration and may change before final adoption.

Sample Terms and Conditions

- Project applicants should take a watershed approach, maintaining existing trees or planting new ones should be a priority.
- Stormwater must be infiltrated or dispersed onsite to the maximum extent possible without causing flooding or erosion impacts.
- Permeable surfaces must be used where appropriate.
- Treatment must be provided to remove debris, nutrients, sediment, petroleum hydrocarbons, metals, and other pollutants.
- Protect the predevelopment timing, magnitude, and duration of instream peak flows and base flows.
- Locate water quality/quantity treatment structures outside of riparian, shoreline and wetland buffer areas.
- Add 30% compost by volume to topsoil to enhance soil porosity.
- NMFS supports changes in local regulations that modify land use practices to improve water quality/quantity such as tax incentives, increased use of alternate transportation modes, redevelopment, increased density, etc.

2.3 Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act regulates injection of water below ground to sources of drinking water. All groundwater aquifers in Oregon are considered suitable as sources of drinking water, and as a result selected wells and infiltration practices used in stormwater management may fall under the Underground Injection Control (UIC) Program (Reininga 2002).

Regulated injection systems fall into one of five classes. Class V systems include a subcategory for stormwater injection systems injecting only stormwater runoff from residential, commercial, or industrial facilities, and roadways. A stormwater injection system includes facilities that have a subsurface fluid distribution system intended to distribute fluids below the surface of the ground. Examples of typical stormwater injection systems include: dry wells, sumps, perforated pipes, drain tiles, and infiltration trenches (Reininga 2002).

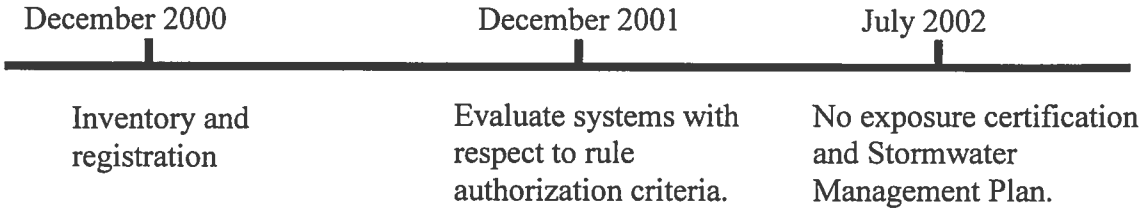
Class V stormwater injection systems are prohibited unless they are (1) exempt, (2) authorized by Rule, or (3) authorized by a Permit (WPCF). Class V wells are exempt if they inject stormwater runoff from rooftops only. DEQ is also likely to exempt (1) systems designed for conveyance to a surface water discharge point (e.g. swales), even when some ancillary infiltration occurs, and (2) porous pavement (Reininga 2002).

Class V systems are considered rule authorized when they are inventoried and registered, and meet rule authorization criteria. Rule authorization criteria include (1) ensuring that no other waste is mixed with stormwater, (2) implementing development practices to minimize stormwater through the creation of a stormwater management plan, (3) ensuring that no other

method of disposal is appropriate, (4) ensuring that no domestic drinking wells or public supply water wells are within 500 feet or a 2 year time-of-travel (public water supply), (5) no existing groundwater contamination will be affected, (6) no discharge is below the seasonal high groundwater table, (7) a confinement barrier or engineered filtration media is present or BMPs have been implemented, and (8) spill control is present.

Class V wells are authorized by a permit when a Water Pollution Control Facility (WPCF) is obtained for wells that cannot be rule authorized. The system requires a land use compatibility statement, a stormwater management plan, and monitoring to be authorized under this option.

The timeline for rule authorization is shown below:



2.4 Oregon Statewide Planning Goals

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 statewide planning goals. The goals express the state's policies on land use and on related topics, such as citizen involvement, housing, and natural resources. Several of the Goals have potential implications for stormwater management. A brief summary of selected goals is presented below. Detailed descriptions of the Goals can be accessed on the Department of Land Conservation and Development's website http://www.lcd.state.or.us/goalhtml/goals.html (DLCD 2002)

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces. Local governments shall adopt programs that will protect natural resources and conserve scenic, historic, and open space resources for present and future generations.

Goal 6: Air, Water, and Land Resources Quality. All waste and process discharges from future development, when combined with such discharges from existing developments shall not threaten to violate, or violate applicable state or federal environmental quality statutes, rules, and standards.

Goal 7: Areas Subject to Natural Disasters and Hazards. Developments subject to damage or that could result in loss of life shall not be planned nor located in known areas of natural disasters and hazards without appropriate safeguards.

Goal 9: Economic Development. Comprehensive plans and policies shall contribute to a stable and healthy economy in all regions of the state. Such plans shall be based on inventories of areas suitable for increased economic growth and activity after taking into consideration the health of

the current economic base; materials and energy availability and cost; labor market factors; educational and technical training programs; availability of key public facilities; necessary support facilities; current market forces; location relative to markets; availability of renewable and non-renewable resources; availability of land; and pollution control requirements.

2.5 References

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Section 3.0: General Stormwater Management Policy

3.1 Scope Section 3 establishes the basic policy recommendations for developing a Stormwater Management Program for the City of Rogue River. Information contained in this section, sections 4-10, and the additional elements highlighted on Figure 1-1 provide the framework for the management program.

3.2 Purpose Manage stormwater in the City of Rogue River to provide 1) flood protection, 2) water quality protection, 3) erosion prevention and sediment control, 4) regulatory compliance , and 5) conservation of natural resources and open space.

3.3 Policy Establish a stormwater management program for the City of Rogue River.

3.3.1 Implementation Actions

(1) Define goals and objectives of the program.
(2) Designate personnel or a municipal program in the City that will be responsible for Stormwater Management.
(3) Identify Stakeholders and other interested parties.
(4) Develop communication, coordination, and cooperation within City Departments and with local, state, and federal agencies.
(5) Research funding options and decide on a method to fund the program.
(6) Amend existing regulations and administrative policies to be consistent with the recommendations of the Stormwater Program.
(7) Establish procedures for program implementation including requirements and procedures for permit issuance, approval, administration, and enforcement of the program.
(8) Develop basin plans for local watersheds (Evans Creek, Wards Creek, and the Rogue River) that incorporate the multiple objectives of the stormwater management plan.
(9) Adopt or design a Stormwater Design Manual.
(10) Seek public involvement and input as primary management objectives.
(11) Research and evaluate the best available technology designed to improve water quality and control flooding.
(12) Provide incentives to minimize the amount and extent of impervious surfaces, vegetative removal, and to conserve open space and riparian corridors.
(13) Conduct public education programs, and provide information on stormwater impacts and solutions.
(14) Implement a cost effective operations and maintenance programs for municipal operations.
(15) Provide for adequate enforcement of regulations.
(16) Provide training programs for city staff, the development community, and other interested parties.
(17) Establish protocols for detecting and eliminating illicit discharges to area waters.
(18) Develop measurable goals for the success of the program.
(19) Incorporate adaptive management as needed to revise the program as needed.

3.4 Policy Ensure that Rogue River complying with existing regulations and being proactive in its management approach for pending regulations and maintaining overall livability in the region.

3.5 Policy Establish procedures to evaluate the effectiveness of stormwater management measures, and revise the plan as needed.

3.5.1 Implementation Actions.

(1) Define measurable goals for BMPs and program objectives.
(2) Establish timelines and milestones for achieving program goals.
(3) Designate personnel responsible for implementing program tasks.

3.6 Policy Focus on public participation and involvement, public education and outreach, illicit discharge detection and elimination, pollution prevention/good housekeeping, erosion prevention and sediment control, post-construction runoff control, open space conservation, and riparian corridor protection as integrated key elements of the stormwater management program.

Section 4.0: Public Education and Outreach

4.1 What is Required to meet Phase II Regulations?

To satisfy this minimum control measure, the operator of a small MS4 should:

1. Implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on local waterbodies and the steps that can be taken to reduce stormwater pollution; and

2. Determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

4.2 Why is it Necessary?

An informed and knowledgeable community is crucial to the success of a stormwater management program since it helps to ensure the following:

1. Greater support for the program as the public gains a greater understanding of the reasons why it is necessary and important. Public support is particularly beneficial when operators of small MS4s attempt to institute new funding initiatives for the program or seek volunteers to help implement the program; and

2. Greater compliance with the program as the public becomes aware of the personal responsibilities expected of them and others in the community, including the individual actions they can take to protect or improve the quality of area waters.

4.3 Goals for Public Education and Outreach:

1. Develop educational resources.
2. Hold open houses and workshops on stormwater management and erosion prevention and sediment control.
3. Stencil all city storm drains discharging to Evans Creek, Wards Creek, and the Rogue River.

4.4 Goal Description and implementation actions

Goal #1: Develop Educational Resources

Description: Develop an infrastructure resource to support the public education and outreach program including designating personnel responsible for developing these resources.

Action Items:

1. Work with the Seven Basins Watershed Council, the Regional Stormwater Project, RVCOG, and other interested parties to develop educational and outreach materials including brochures, articles in newsletters, bulletins on grocery bags, and information

accessible via the web.

2. Identify and train volunteers.
3. Create or link to an informational web site describing stormwater management.
4. Make information (pamphlets) available at City Hall, the library, and/or another designated spot in the community.

Goal #2: Hold open houses and workshops on stormwater management and erosion prevention and sediment control (EPSC)

Action Items:

1. Hold at a minimum of one workshop or work session on stormwater management per year.
2. Vary the audience of the presentations. Include the City Council, general public, and the development community.

Goal #3: Stencil all city storm drains discharging to Evans Creek, Wards Creek, and the Rogue River.

Description: Stencil and/or re-stencil storm drains in the City.

Section 5.0: Public Involvement and Participation

5.1 What is Required to meet Phase II Regulations?

To satisfy this minimum control measure, Rogue River should:

1. Comply with applicable State, Tribal, and local public notice requirements; and

2. Determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

5.2 Why is it Necessary?

The public can provide valuable input and assistance to a small MS4's municipal stormwater management program. Therefore, the public should be given opportunities to play an active role in both the development and implementation of the program. An active and involved community is crucial to the success of a stormwater management program because it allows for:

1. Broader public support since citizens who participate in the development and decision making process are partially responsible for the program and, therefore, may be less likely to raise legal challenges to the program and more likely to take an active role in its implementation;

2. Shorter implementation schedules due to fewer obstacles in the form of public and legal challenges and increased sources in the form of citizen volunteers;

3. A broader base of expertise and economic benefits since the community can be a valuable, and free, intellectual resource; and

4. A conduit to other programs as citizens involved in the stormwater program development process provide important cross-connections and relationships with other community and government programs. This benefit is particularly valuable when trying to implement a stormwater program on a watershed basis.

5.3 Goals for Public Involvement and Participation:

1. Establish a Stakeholder Advisory Group
2. Hold Public Meetings
3. Create newspaper ads, brochures, radio spots, and other media for public meetings
4. Hold Community Clean-ups
5. Establish a Point of Contact for Stormwater Issues

5.4 Goal Description and implementation actions.

Goal #1: Establish a stakeholder advisory group.

Description: Create a stakeholder advisory committee to provide an active role in both program development and implementation.

Action Items:

1. Identify potential stakeholder groups and determine their respective responsibilities and concerns to both planning and implementing the program.
2. Contact selected groups.
3. Interview and select groups to serve on the advisory committee and citizen panels.
4. Establish goals and objectives for the advisory committee.
5. Determine a meeting frequency and schedule for the committee.

Supplemental Information/Examples from Other Communities/Recommendations:

Stakeholders can be thought of as parties (e.g., individuals, groups, agencies) who have a "stake" in how the stormwater management program functions. Stakeholders have some interest in the program. The term "stakeholder" includes all of the following:

- Interested parties: These are parties who stand to gain or lose or otherwise be affected by some aspect of the stormwater program (e.g., its policies, requirements, activities, facilities, results). Most of these stakeholders are likely to be interested individuals, landowners, neighborhood associations, businesses, environmental and conservation organizations, and a variety of citizens groups.
- Program partners: These are the parties who will be providing personnel, funds, facilities, and/or other resources to help support the community's stormwater planning team and/or implementation program. Most of these "program partners" will be individuals, companies, non-profit organizations, service clubs, and/or public agencies or departments that do not have direct regulatory obligations to support the program.
- Funding sources: These include federal, state, or county-level agencies that will (or may be able to) provide public funds to support aspects of the community's stormwater planning process and/or implementation program (through grants, for example).
- Resource management and oversight: Included here would be public agencies that are responsible primarily for managing natural resources. U.S. Forest Service (USFS), Bureau of Land Management (BLM), Natural Resource Conservation Service (NRCS), and Oregon Division of State Lands (DSL) are examples of resource management agencies.

- Regulatory oversight: Included here would be public agencies that are responsible primarily for implementing and enforcing federal, state, and county laws (and related regulations, policies, and programs). Presumably they would be interested in the ways local municipal stormwater systems might affect local streams, water bodies, wetlands, and associated habitat areas. U.S. Environmental Protection Agency (USEPA), Oregon Department of Environmental Quality (DEQ), and Oregon Department of Fish and Wildlife (ODFW) would be examples of regulatory agencies.

Table 5-1 Stakeholders and Their Respective Roles with Examples

	Interested Parties	*Program Partners*	***Funding Sources***	*Resource Management Oversight*	*Regulatory Oversight and Enforcement*
Local Agencies and Departments: - - -		**-RVCOG** **-Josephine County** **-Grants Pass** **-Jackson County** **-City of Medford**	**-SOREDI**		
State-level Agencies: - - - -			**-DEQ** **-OWEB** **-OECDD**		**-DEQ** **-DSL** **-ODFW** **-DLCD**
Federal-level Agencies: - - - - -			**-RUS**	**-BLM** **-USFS** **-DSL**	**-NOAA Fisheries**
Non-Governmental Organizations: - - -	- Seven Basins Watershed Council				
Individuals: - - -					
Private Companies: - - -					

Documentation Worksheet for Stakeholders

Identify the major stakeholders and determine their respective responsibilities and concerns relative to both planning and implementing your community's stormwater management program.

Potential Stakeholders
1.
3.
4.
5.
6.
7.
8.

Selected Stakeholders
1.
Rationale (why selected):
2.
Rationale:
3.
Rationale:
4.
Rationale:
5.
Rationale:

Goal #2: **Hold Public Meetings**

Description: Hold several public meetings and workshops introducing the concept of stormwater management, project activity, and other relevant information.

Action Items:

1. Hold initial open house introducing the concept of stormwater management.
2. Determine the schedule and topics for future open houses.

Goal #3: **Create newspaper ads, brochures, radio spots, and other media for Public Meetings**

Description: Prepare multi-media materials promoting stormwater program participation.

Goal #4: **Hold Community Clean-ups**

Description: Organize community cleanups of streams, open ditches, and storm drain outfalls. Using volunteers for clean-up activities will help citizens identify with and take an active role.

Action Items:

1. Involve a certain percentage or a designated number of citizens to help in community clean-ups.

Goal #5: **Establish a point of contact for stormwater issues.**

Description: Create a stormwater hotline for information and for citizen reports on stormwater concerns.

Section 6.0: Illicit Discharge Detection and Elimination

6.1 What is Required to meet Phase II Regulations?

Recognizing the adverse effects illicit discharges can have on receiving waters, operators of MS4s should develop, implement and enforce an illicit discharge detection and elimination program. This program should include the following:

1. A storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;

2. Appropriate enforcement procedures and actions to prevent non-stormwater discharges into the MS4 through an ordinance, or other regulatory mechanism;

3. A plan to detect and address non-stormwater discharges, including illegal dumping, into the MS4;

4. The education of public employees, businesses, and the general public about the hazards associated with illegal discharges and improper disposal of waste; and

5. The determination of appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

6.2 Why is it Necessary?

Discharges from MS4s often include wastes and wastewater from non-stormwater sources. A study conducted in 1987 in Sacramento, California, found that almost one-half of the water discharged from a local MS4 was not directly attributable to precipitation runoff. Significant portions of these dry weather flows were from illicit and/or inappropriate discharges and connections to the MS4. Illicit discharges enter the system through either direct connections (e.g., wastewater piping either mistakenly or deliberately connected to the storm drains) or indirect connections (e.g., infiltration into the MS4 from cracked sanitary systems, spills collected by drain outlets, or paint or used oil dumped directly into a drain). The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies. Pollutant levels from these illicit discharges have been shown in studies to be high enough to significantly degrade receiving water quality and threaten aquatic, wildlife, and human health.

6.3 Goals for Illicit Discharge Detection and Elimination

1. Develop a Procedure for Tracking Illicit Discharges
2. Initiate a Household Waste Recycling Program
3. Create a Drainage System Map
4. Initial Identification of Illicit Discharge Sources

5. Develop a Stormwater Ordinance Prohibiting Non-Stormwater Discharges to the Storm Drain System

6. Train Employees

7. Revisit and Revise Program

6.4 Goal Description and Implementation Items

Goal #1: Develop a Procedure for Tracking Illicit Discharges

Description: Develop a protocol for identifying and documenting illicit discharges including actions taken.

Action Items:

1. Develop a survey/submittal form for documenting illicit discharge reports.

2. Develop a spreadsheet or database program to track illicit discharge locations, and actions taken.

3. Document the number of illicit discharges discovered during outfall screening, and the number of illicit discharges discovered as a result of citizen complaints.

Goal #2: Initiate a Household Waste Recycling Program

Description: Initiate a recycling program for commonly dumped household wastes such as motor oil, antifreeze, paint, pesticides, etc.

Action Items:

1. Investigate similar recycling programs occurring in the area.

2. Establish a program for collecting commonly dumped household wastes. The program may consist of collection points in Rogue River coinciding with other efforts in the region.

3. Collect waste materials a minimum of once per year.

Goal #3: Create a Drainage System Map

Description: The storm drainage system map is meant to demonstrate a basic awareness of the intake and discharge areas of the system. It is needed to help determine the extent of discharged dry weather flows, the possible sources of the dry weather flows, and the particular waterbodies these flows may be affecting.

The maps should contain all existing information on outfall locations, open channels, closed conduits, and other features impacting storm drainage systems (canals, springs).

Action Items:

1. Compile all existing information on the storm drainage network.

2. Conduct field surveys to verify locations of outfalls and other features.

3. Revise map based on field surveys.

4. Establish protocol for updating and revising the system map.

Goal #4: Initial Identification of Illicit Discharge Sources

Description: Begin process of identifying potential sources of illicit discharges.

Action Items:

1. Examine maps, aerial photographs, land uses, septic system records, and other documents to identify potential source areas. Areas to look for include:

    a. Industrial parks or areas with large concentrations of industrial business (manufacturing, warehousing, trucking, etc.).

    b. Areas where there are large concentrations of septic systems.

    c. Areas with older sanitary sewer lines.

2. Conduct visual surveys of identified stormwater outfalls following map completion (Goal #2) to verify that no unusual discharges are noted. Surveys will be documented on an established form, and entered into the database. The frequency of surveys should be at least once a year, dependent upon time and personnel availability.

3. Collect water quality samples as needed to trace and verify suspected source areas.

Goal #5: Develop a Stormwater Ordinance Prohibiting Non-Stormwater Discharges to the Storm Drain System

Description: Develop an ordinance or other regulatory mechanism that will prohibit all non-stormwater discharges into the storm drainage network. This ordinance will include appropriate enforcement procedures and actions such as:

1. Fines
2. Civil penalties
3. Defining exempt activities

Action Items:

1. Determine those activities that are exempt and those activities requiring coverage under the ordinance.

2. Establish enforcement provisions and level of enforcement.
3. Draft Ordinance.
4. Revise and adopt ordinance.

Goal #6: Train Employees

Description: Provide training to employees that will help them to identify illicit discharges. Training may include local workshops and programs, and/or participation in regional programs.

Goal #7: Revisit and revise program

Description: Building on experience learned through the program, adapt the procedures as needed to increase the program efficiency and work towards eliminating illicit discharge.

Section 7.0: Erosion Prevention and Sediment Control

7.1 What is Required to meet Phase II Regulations?

Operators of MS4s should develop, implement, and enforce a program to reduce pollutants in stormwater runoff from construction activities that result in a land disturbance of greater than or equal to one acre.

The small MS4 operator should:

1. Have an ordinance or other regulatory mechanism requiring the implementation of proper erosion prevention and sediment controls, and controls for other wastes, on applicable construction sites;

2. Have procedures for site plan review of construction plans that consider potential water quality impacts;

3. Have procedures for site inspection and enforcement of control measures;

4. Have sanctions to ensure compliance (established in the ordinance or other regulatory mechanism);

5. Establish procedures for the receipt and consideration of information submitted by the public; and

6. Determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

7.2 Why is it Necessary?

Polluted stormwater runoff from construction sites often flows to MS4s and ultimately is discharged into local rivers and streams. Of the pollutants listed in Table 7-1, sediment is usually the main pollutant of concern. Sediment runoff rates from construction sites are typically 10 to 20 times greater than those of agricultural lands, and 1,000 to 2,000 times greater than those of forest lands. During a short period of time, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation, and the contribution of other pollutants from construction sites, can cause physical, chemical, and biological harm to local waterbodies. For example, excess sediment can quickly fill creeks and lakes, requiring dredging and destroying aquatic habitats.

Table 7-1: Pollutants Commonly Discharged From Construction Sites

Sediment
Solid and sanitary wastes
Phosphorus (fertilizer)
Nitrogen (fertilizer)

Pesticides
Oil and grease
Concrete truck washout

7.3 Goal Summary for Erosion Prevention and Sediment Control (EPSC)

1. Develop an Erosion Prevention and Sediment Control Ordinance
2. Adopt or Develop and Erosion Prevention and Sediment Control Manual
3. Begin Inspection Program
4. Staff Training
5. Developer and public training

7.4 Goal Description and Implementation Items

Goal #1: EPSC Ordinance

Description: Develop an ordinance or other regulatory mechanism will be put in place that will provide the ability to regulate polluted runoff that emanates from construction sites.

Action Items:

1. Designate the size of disturbance activities that need to meet the EPSC requirements.

2. Establish EPSC requirements for different levels of disturbance. EPSC requirements will be outlined in the procedures for an EPSC Plan that will be submitted as part of the permit application. Additional material including best management practices, design storm information, and other information can be referenced from the Erosion Prevention and Sediment Control Manual (Goal #2) and the Stormwater Master Plan (see Volume 2).

3. Designate exempt activities and define sensitive areas (e.g. hillsides, wetlands, riparian corridors) where additional requirements may be necessary.

4. Outline permit application and submittal procedures.

5. Establish inspection and enforcement provisions.

Recommendations:

Establish EPSC regulations using a multi-tiered approach varying according to the size of the disturbance activity. Requirements would increase with the size of the development activity (Table 7-2, and Figure 7-1).

Table 7-2: EPSC Requirements

Tier/ Management	Size of disturbed area (square feet)	Requirements

Level		
0	*< 500*	None
1	*≥ 500 to ≤ 2,000*	Simple permit application. City provides information only unless project is located in a designated sensitive area.
2	*2,000 to ≤ 5,000*	Submittal of a simple plan (see figure 7-2).
3	*> 5,000*	Submittal of an engineered approved plan.

Figure 7-1: EPSC Regulation Overview

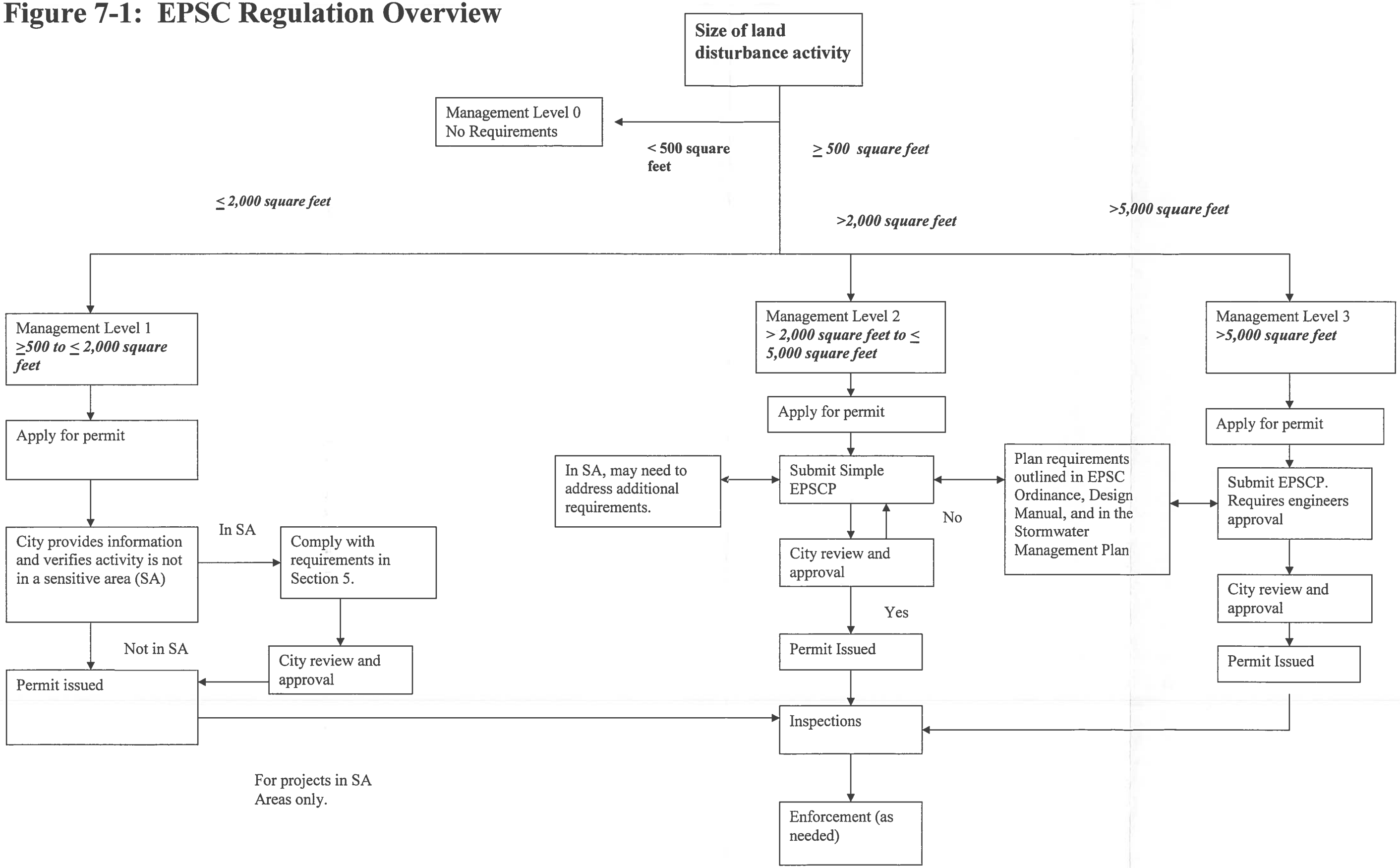
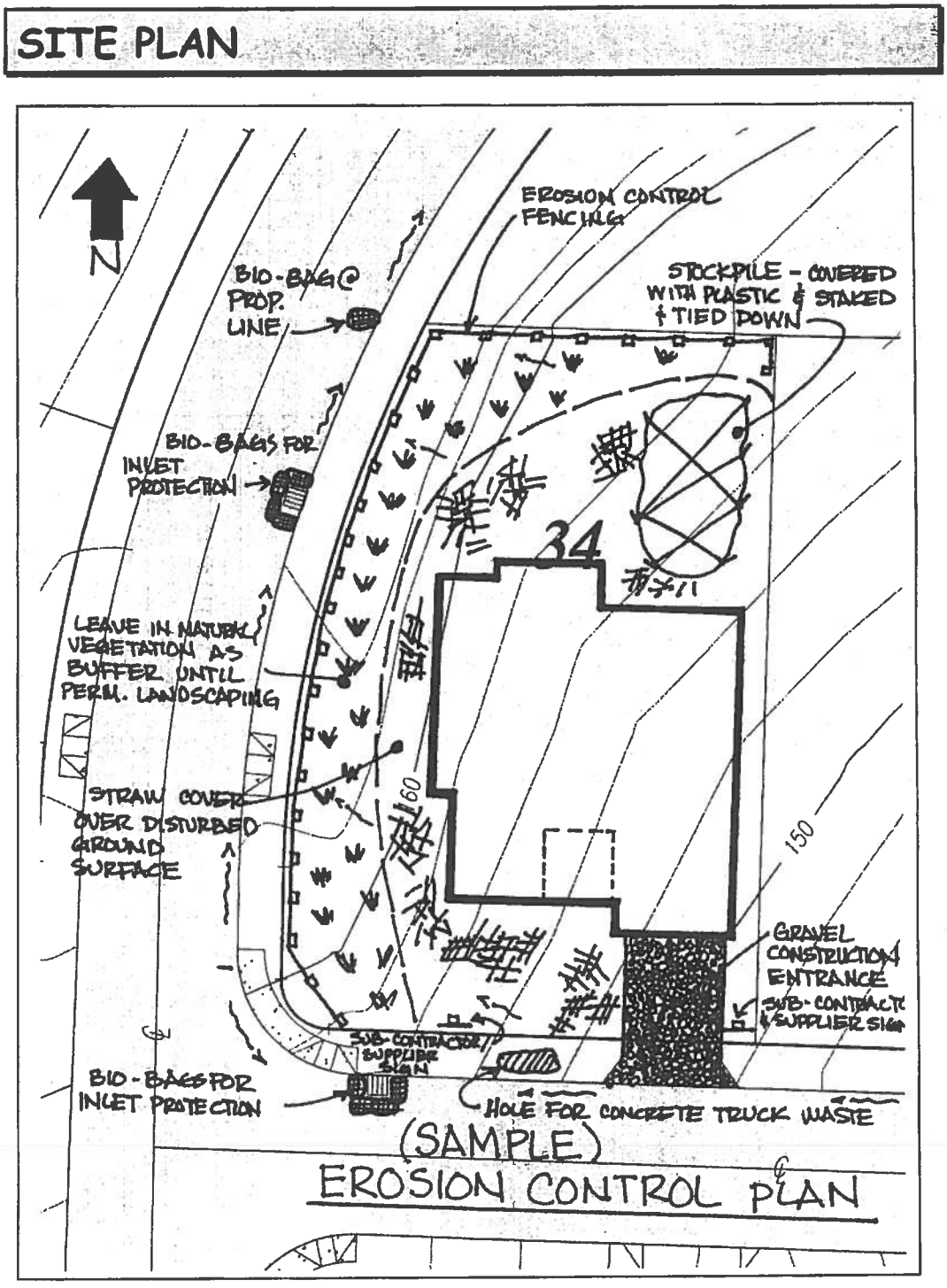


Figure 7-2: Example of a Simple EPSC Plan (Management Level 2)



Excerpted from: *A Builders Guide to Erosion Prevention and Sediment Control*. Clark County Home Builders Association, Vancouver, Washington.

Requirements of an EPSC Plan (Management Level 3)

The Erosion Prevention and Sediment Control Plan shall include at a minimum:

1. A vicinity map showing the location of the site in relationship to the surrounding watercourses, waterbodies and other significant geographic features, and roads, and other significant structures.

2. Suitable contours for the existing and proposed topography.

3. A clear and definite delineation of any areas of vegetation or trees to be saved.

4. A clear and definite delineation of any wetlands, natural or artificial water storage detention areas, and drainage ditches on the site.

5. The proposed grading or land disturbance activity including: the surface area involved, excess spoil material, use of borrow material, and specific limits of disturbance.

6. A clear and definite delineation of any one hundred (100) year floodplain on or near the site.

7. Storm drainage system, including quantities of flow and site conditions around all points of surface water discharge from the site.

8. Erosion prevention and sediment control provisions to minimize on-site erosion and prevent off-site sedimentation, including provisions to preserve topsoil and limit disturbance.

9. Design details for both temporary and permanent erosion prevention and sediment control structures.

10. Details of temporary and permanent stabilization.

11. A chronological construction schedule and time frame including, as a minimum, the following activities:

    - Clearing and grubbing for those areas necessary for installation of perimeter erosion control devices.

    - Construction of perimeter erosion and sediment control devices.

    - Remaining interior site clearing and grubbing.

    - Installation of permanent and temporary stabilization measures.

- Road grading.
- Grading for the remainder of the site.
- Utility installation and whether storm drains will be used or blocked after construction.
- Building, parking lot, and site construction.
- Final grading, landscaping or stabilization.
- Implementation and maintenance of final erosion and sediment control structures.
- Removal of temporary erosion prevention and sediment control devices.

12. A statement noting that the contractor, developer, and owner shall request the Erosion Control Inspector to inspect and approve work completed in accordance with the approved Erosion Prevention and Sediment Control Plan, and in accordance with the ordinance.

13. A signed statement on the plan by the owner, developer, and contractor that any clearing, grading, construction, or development, or all of these, will be done pursuant to the plan.

14. A description of, and specifications for, sediment retention structures.

15. A description of, and specifications for, surface runoff and erosion control devices.

16. A description of vegetative measures.

Goal #2: Develop or Adopt an Erosion Prevention and Sediment Control Manual

Recommendations:

Two design manuals recommended for adoption are:

2000 Erosion Prevention and Sediment Control Manual: Planning and Design Manual developed by the Unified Sewerage Agency (Clean Water Services), Water Environment Service of Clackamas County, and the City of West Linn.

Oregon Department of Transportation (ODOT) Erosion and Sediment Control Manual

Goal #3: Begin Inspection Program

Description: Perform inspections of construction sites to determine the overall compliance rate that is being achieved by construction operators.

Action Items:

1. Develop an inspection checklist and monitoring form to ensure compliance with EPSC requirements. Examples from Clean Water Services (formerly the Unified Sewerage Agency) *2000 Erosion Prevention and Sediment Control Manual: Planning and Design Manual* are attached.

2. Train staff in conducting inspections.

3. Conduct inspections of construction sites. The frequency should be consistent with the City's permitting process and other inspections (e.g., footing inspections), and be conducted shortly following precipitation events.

INSPECTOR CHECKLIST FOR EROSION CONTROL

- **SCHEDULE**

  Have you looked at the Contractors Schedule and determined any conflicts?
  - ✓ Install necessary Best Management Practices (BMP's) prior to any earthwork beginning.
  - ✓ Are earthwork operations being performed in October with soils that are highly erosive?
  - ✓ Grubbing of areas that will be worked on much later should be delayed
  - ✓ Staging of project may require staging of erosion control measures
  - ✓ Is seeding scheduled before the end of the seed dates?
  - ✓ Are there "In-Stream work areas that may alter contractor's schedule?
  - ✓ When will the contractor remove BMP's? Don't remove until seeded slopes are established

- **EROSION AND SEDIMENT CONTROL PLAN (ESCP)**
  - ✓ Walk project during preliminary or advanced plan review and look for potential erosion problems
  - ✓ Have you reviewed the Contractor's Erosion Control Plan to determine if it is adequate or makes sense? The ESCP included in the bid package may need modifications to address site conditions or staging
  - ✓ Walk project with ESCM prior to any earthwork looking for needed modifications of ESCP
  - ✓ Is the ESCP being kept up-to-date?
  - ✓ Is the ESCP kept on-site? Where?
  - ✓ What is contractor's erosion control plan for offsite borrow sources and waste areas?

- **EROSION AND SEDIMENT CONTROL MANAGER (ESCM)**

  Have you met and talked with the person identified as the ESCM?
  - ✓ Do you believe this person has adequate knowledge to perform this work?
  - ✓ Does this person understand all the required duties of the ESCM?
  - ✓ Does this person have the authority to direct resources and make changes in an emergency situation?

- **SENSITIVE AREAS**

  Are there sensitive areas, which require "extra" attention?
  - ✓ Have they been adequately addressed on the ESCP?
  - ✓ Will these sensitive areas require more monitoring?

- **CONTINGENCY PLAN**
  - ✓ Is there a contingency plan for unexpected events?
  - ✓ What is the plan for stabilization of earthwork performed after seeding dates?

- **MATERIALS ON-HAND**

  It may be difficult to get Erosion Control materials in the middle of the wet season. It is easier to deal with erosion before it happens rather than after.
  - ✓ Does the Contractor have adequate materials on hand to cover each phase of work they plan on performing?

- **MAINTENANCE**
  - ✓ Consider access for maintenance of BMP's. Place where they are easy to maintain if you have a choice
  - ✓ Are installed erosion and sediment controls in good working order?
  - ✓ Are catch basins cleaned out when more than 6 inches of sediment depth accumulates?
  - ✓ At sediment fences, barriers, check dams, inlet protection cleaned out when sediment reaches 1/3 of the storage depth?
  - ✓ Are construction entrances maintained with fresh rock to prevent tracking of sediment onto pavement?

- **MONITORING FORMS**
  - ✓ Are you getting Erosion Control Weekly reports as often as they should be filed from the ESCM?
  - ✓ Are the forms complete and adequately represent site conditions and work performed?
  - ✓ Are forms on-site with the "Up-to-Date Plan"?

- **SLOPE PROTECTION & STABILIZATION**
  - ✓ All highly sensitive areas
  - ✓ Permanently finish slopes from top down and seed as you go!
  - ✓ Track walk slopes to provide loosened soil and hold seed
  - ✓ Temporarily stabilize unfinished earthwork scheduled for re-disturbance at a later date (i.e. straw mulch, chemical soil stabilizers, plastic sheeting, matting, etc.)

- **PLANS ARE ONLY A GUIDE**
  What's best for your project is what works on your project. No designer can sit in an office and determine what works on your project. It may require trial and error. The plans are a toolbox with available tools. You may have to create and modify these tools to satisfy the conditions

- **IT'S NOT WORKING!!!**
  Are the BMP's working? If not, are the facilities attempting to prevent erosion before it starts?

- **ADDITIONAL ITEMS**
  - ✓ Go back to newly installed BMP's to check their performance
  - ✓ How will contractor handle dust control or wind erosion?
  - ✓ Will snow melt change runoff and drainage patterns?

EROSION CONTROL MONITORING FORM

PROJECT NAME:	PROJECT #
LOCATION:	RECEIVING WATER:
CONTRACTOR:	

EROSION CONTROL FACILITIES

LOCATION	DESCRIPTION	EFFECTIVENESS	DATE

VISIBLE OR MEASURABLE EROSION LEAVING SITE

LOCATION	CORRECTIVE & CLEAN-UP MEASURES	EFFECTIVENESS	DATE

COMMENTS AND GENERAL SITE CONDITIONS:

PREPARED BY:	PERIOD:

Minimum Monitoring and Reporting Requirements: Inspect all erosion control facilities a minimum of once per week on active projects. Inspect within 24 hours following a .5 inch rain event. Inspect daily during stormy periods or periods of snow melt when runoff occurs daily. Furnish copy to DEQ upon their request.

Goal #4: Staff Training

Description: Train staff in inspection procedures and in Erosion Prevention and Sediment Control Methodology.

Goal #5: Developer and Public Training.

Description: Conduct workshops, public meetings, and media outreach on EPSC needs and methods. Individual discussions with developers and construction contractors have been found to be an effective means of outreach.

Section 8.0: Post-Construction Runoff Control

8.1 What is Required to meet Phase II Regulations?

Operators of small MS4s should develop, implement, and enforce a program to reduce pollutants in post-construction runoff from new development and redevelopment projects that result in the land disturbance of greater than or equal to 1 acre.

The small MS4 operator should:

1. Develop and implement strategies that include a combination of structural and/or non-structural best management practices (BMPs).

2. Have an ordinance or other regulatory mechanism requiring the implementation of post-construction runoff controls to the extent allowable under State, Tribal or local law.

3. Ensure adequate long-term operation and maintenance of controls.

4. Determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

8.2 Why is it Necessary?

Post-construction stormwater management in areas undergoing new development or redevelopment is necessary because runoff from these areas has been shown to significantly effect receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management.

There are generally two forms of substantial impacts of post-construction runoff. The first is caused by an increase in the type and quantity of pollutants in stormwater runoff. As runoff flows over areas altered by development, it picks up harmful sediment and chemicals such as oil and grease, pesticides, heavy metals, and nutrients (e.g., nitrogen and phosphorus). These pollutants often become suspended in runoff and are carried to receiving waters, such as lakes, ponds, and streams. Once deposited, these pollutants can enter the food chain through small aquatic life, eventually entering the tissues of fish and humans. The second kind of post-construction runoff impact occurs by increasing the quantity of water delivered to the waterbody during storms. Increased impervious surfaces interrupt the natural cycle of gradual percolation of water through vegetation and soil. Instead, water is collected from surfaces such as asphalt and concrete and routed to drainage systems where large volumes of runoff quickly flow to the nearest receiving water. The effects of this process include streambank scouring and downstream flooding, which often lead to a loss of aquatic life and damage to property.

8.3 Goal Summary for Post-Construction Stormwater Runoff

1. Develop a Stormwater Ordinance

2. Identification of BMPs recommended for addressing water quality and water quantity concerns.

3. Maintain Natural Drainage Characteristics and Minimize increases in Impervious Surface Areas

4. Adopt or develop a Stormwater Design Manual.

8.4 Goal Description and Implementation Items

Goal #1: Develop a Stormwater Ordinance

Description: Develop stormwater ordinance language pertaining to post-construction stormwater management. The ordinance should include requirements for stormwater management plans, definition of activities covered under this program, enforcement, and maintenance guidelines.

Implementation Actions:

1. Designate the size of impervious surface area (ISA) created by a project that need to meet the stormwater requirements.

2. Establish stormwater requirements for different amounts of ISA. Develop procedures and guidelines for individual site stormwater management plans (SWMP) including basic requirements of the plan, applicability, review procedures, maintenance requirements, and penalties for noncompliance.

3. Designate exempt activities and define sensitive areas (e.g., hillsides, wetlands, riparian corridors) where additional requirements may be necessary.

4. Outline permit application and submittal procedures.

5. Establish inspection and enforcement provisions.

Recommendations:

Establish minimum control requirements using the similar thresholds as the EPSC thresholds substituting ISA in place of disturbed area.

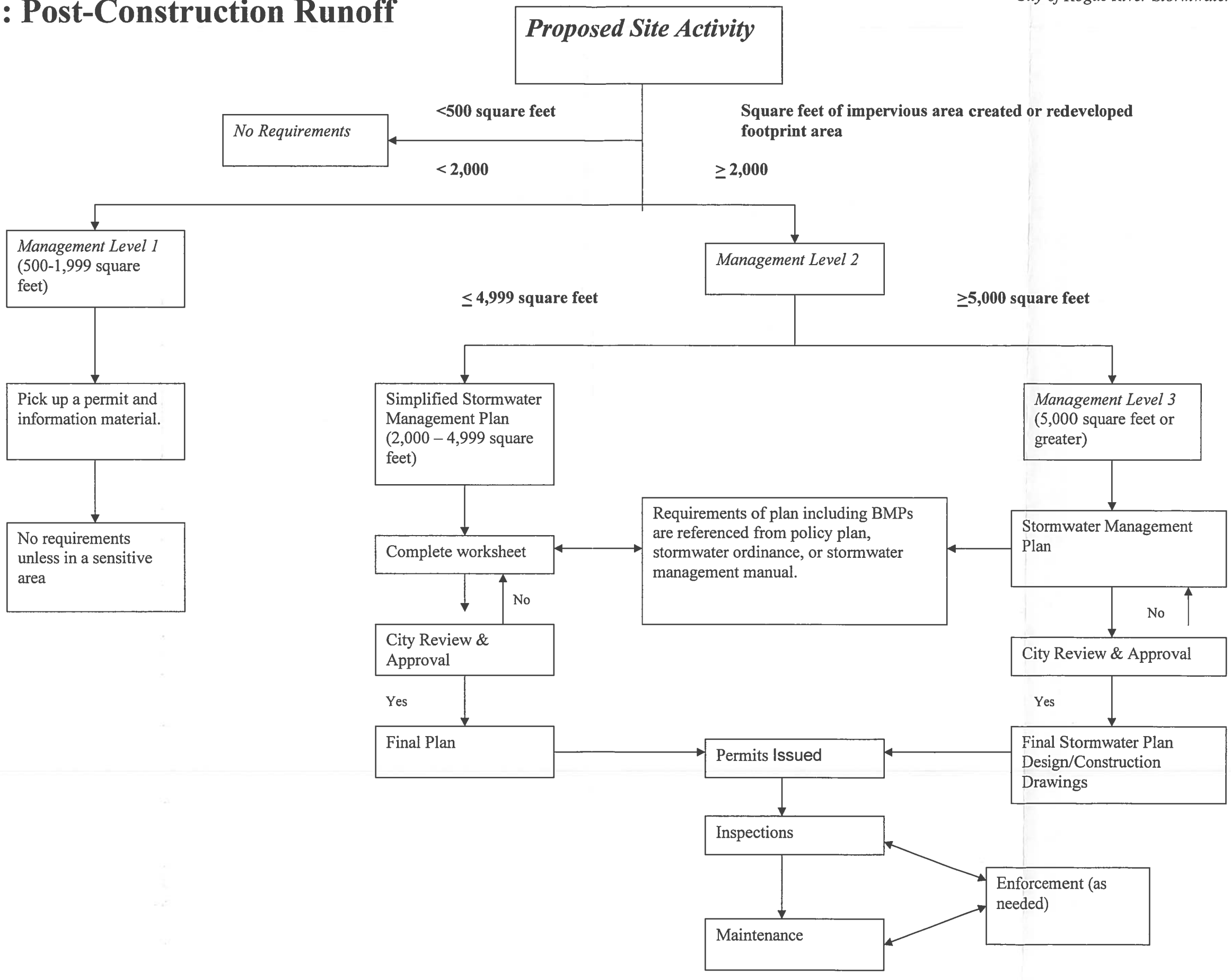
<u>Minimum Control Requirements</u>

All new development projects and redevelopment projects need to meet minimum control requirements based on the amount of impervious area resulting from the project. Proposed developments fall under one of three management levels based on the amount of impervious area or redevelopment footprint area (See Figure 8-1). Management Level

I requirements apply to projects ranging from 500 square feet to 2,000 square feet of impervious area or redevelopment footprint area, Management Level II requirements apply to projects ranging from 2,000 to 5,000 square feet, and Management Level III requirements apply to projects greater than 5,000 square feet. Additional requirements for erosion prevention and sediment control based on size are found in Section 7.

All stormwater management practices will be designed so that the specific storm frequency storage volumes as identified by the City are met. In addition, if hydrologic or topographic conditions warrant greater control than that provided by the minimum control requirements, Rogue River reserves the right to impose any and all additional requirements deemed necessary to control the volume, timing, and rate of runoff. Special conditions include, but are not limited to, slope hazard areas, flood prone areas, and significant natural resources.

Figure 8-1: Post-Construction Runoff Control



Stormwater Management Plan Requirements

Management Level I

Developments creating from 500 square feet to 2,000 square feet of impervious surface area or redevelopment footprint area are required to pick up informational material and verify that the project is not in a designated sensitive area. Developments located in a sensitive area may be required to submit additional information with the permit application. There are no additional requirements for areas not located in a sensitive area.

Stormwater Plans (Management Levels II and III)

A stormwater management conceptual plan shall be required with all permit applications and will include sufficient information (e.g., maps, hydrologic calculations, etc.) to evaluate the environmental characteristics of the project site, the potential impacts of all proposed development of the site, both present and future, on the water resources, and the effectiveness and acceptability of the measures proposed for managing stormwater generated at the project site. The intent of this conceptual planning process is to determine the type of stormwater management measures necessary for the proposed project, and ensure adequate planning for management of stormwater runoff from future development. To accomplish this goal the following information is recommended to be included in the concept plan:

Management Levels II and III:

1. A map (or maps) indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural stormwater management and sediment control facilities. The map(s) will also clearly show proposed land use with tabulation of the percentage of surface area to be adapted to various uses; drainage patterns; locations of utilities, roads and easements; and the limits of clearing and grading. A written description of the site plan and justification of proposed changes in natural conditions may also be required.

Management Level II (Items listed above plus the following)

2. Completed simple plan consisting of a worksheet and plan drawing. An example of a completed simplified worksheet and drawing from the *September 2002 City of Portland Stormwater Management Manual* is provided at the end of this section.

Management Level III (Item #1 plus the items listed below)

3. Sufficient engineering analysis to show that the proposed stormwater management measures are capable of controlling runoff from the site in compliance with this plan, applicable ordinances, and the specifications of the Stormwater Design Manual.

4. A written or graphic inventory of the natural resources at the site and surrounding area as it exists prior to the commencement of the project and a description of the watershed and its relation to the project site. This description should include a discussion of soil conditions, forest cover, topography, wetlands, and other native vegetative areas on the site. Particular attention should be paid to environmentally sensitive features that provide particular opportunities or constraints for development.
5. A written description of the required maintenance burden for any proposed stormwater management facility.
6. The City may also require a concept plan to consider the maximum development potential of a site under existing zoning, regardless of whether the applicant presently intends to develop the site to its maximum potential.

Final Stormwater Management Plan Requirements (Management Level II)

1. *Contact Information*
   The name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected.
2. *Topographic Base Map*
   A 1" = 200' topographic base map of the site which extends a minimum of 60 feet beyond the limits of the proposed development and indicates existing surface water drainage including streams, ponds, culverts, ditches, and wetlands; current land use including all existing structures; locations of utilities, roads, and easements; and significant natural and manmade features not otherwise shown.
3. *Building Plans*
   Submit building plans to the City showing stormwater management methods including facility locations, sizes, design details, and planting plans.
4. *Maintenance and Repair Plan*
   The design and planning of all stormwater management facilities shall include maintenance and repair procedures to ensure their continued function.
5. *Landscaping plan*
   The applicant must present a plan for management of vegetation at the site after construction is finished.

Final Stormwater Management Plan Requirements (Management Level III)

After review of the stormwater management plan, and modifications to that plan as deemed necessary by the City, a final stormwater management plan must be submitted for approval. The final stormwater management plan, in addition to the information from the concept plan, shall include all of the information required in the Final Stormwater Management Plan checklist found in the Stormwater Design Manual. This includes:

1. *Contact Information*

The name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected.

2. *Topographic Base Map*
   A 1" = 200' topographic base map of the site which extends a minimum of 60 feet beyond the limits of the proposed development and indicates existing surface water drainage including streams, ponds, culverts, ditches, and wetlands; current land use including all existing structures; locations of utilities, roads, and easements; and significant natural and manmade features not otherwise shown.
3. *Calculations*
   Hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified. Such calculations shall include (i) description of the design storm frequency, intensity and duration, (ii) time of concentration, (iii) Soil Curve Numbers or runoff coefficients, (iv) peak runoff rates and total runoff volumes for each watershed area, (v) infiltration rates, where applicable, (vi) culvert capacities, (vii) flow velocities, (viii) data on the increase in rate and volume of runoff for the design storms referenced in the Stormwater Design Manual, and (ix) documentation of sources for all computation methods and field test results.
4. *Soils Information*
   If a stormwater management control measure depends on the hydrologic properties of soils (e.g., infiltration basins), then a soils report shall be submitted. The soils report shall be based on on-site boring logs or soil pit profiles. The number and location of required soil borings or soil sits shall be determined based on what is needed to determine the suitability and distribution of soil types present at the location of the control measure.
5. *Maintenance and Repair Plan*
   The design and planning of all stormwater management facilities shall include detailed maintenance and repair procedures to ensure their continued function. These plans will identify the parts or components of a stormwater management facility that need to be maintained and the equipment and skills or training necessary. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan.
6. *Landscaping plan*
   The applicant must present a detailed plan for management of vegetation at the site after construction is finished, including who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved. This plan must be prepared by a registered landscape architect or by the soil conservation district.
7. *Maintenance Easements*
   The applicant must ensure access to all stormwater treatment practices at the site for the purpose of inspection and repair by securing all the maintenance easements needed on a permanent basis. These easements will be recorded with the plan and will remain in effect even with transfer of title to the property.
8. *Maintenance Agreement*

The applicant must execute an easement and an inspection and maintenance agreement binding on all subsequent owners of land served by an on-site stormwater management measure in accordance with the specifications of this ordinance.

9. *Erosion Prevention and Sediment Control Plans for Construction of Stormwater Management Measures*
   The applicant must prepare an erosion and sediment control plan for all construction activities related to implementing any on-site stormwater management practices.
10. *Other Environmental Permits*
    The applicant shall assure that all other applicable environmental permits have been acquired for the site prior to approval of the final stormwater design plan.

Goal #2: Identification of BMPs recommended for addressing water quality and water quantity concerns.

Description: Identify and develop a mix of Structural and Non-Structural BMPs that are appropriate for this geographic area. This BMP list will include BMPs suited for both redevelopment and new development.

Goal #3: Maintain Natural Drainage Characteristics and Minimize increases in Impervious Surface Areas

Action Items:
1. Provide incentives to encourage conservation design incorporating open space, passive stormwater management structures, and other mechanisms to reduce effective impervious surface.
2. Establish target goals (% impervious) for watersheds and subwatersheds in the city.
3. Preserve open space, riparian corridors, wetlands, and other areas in the city

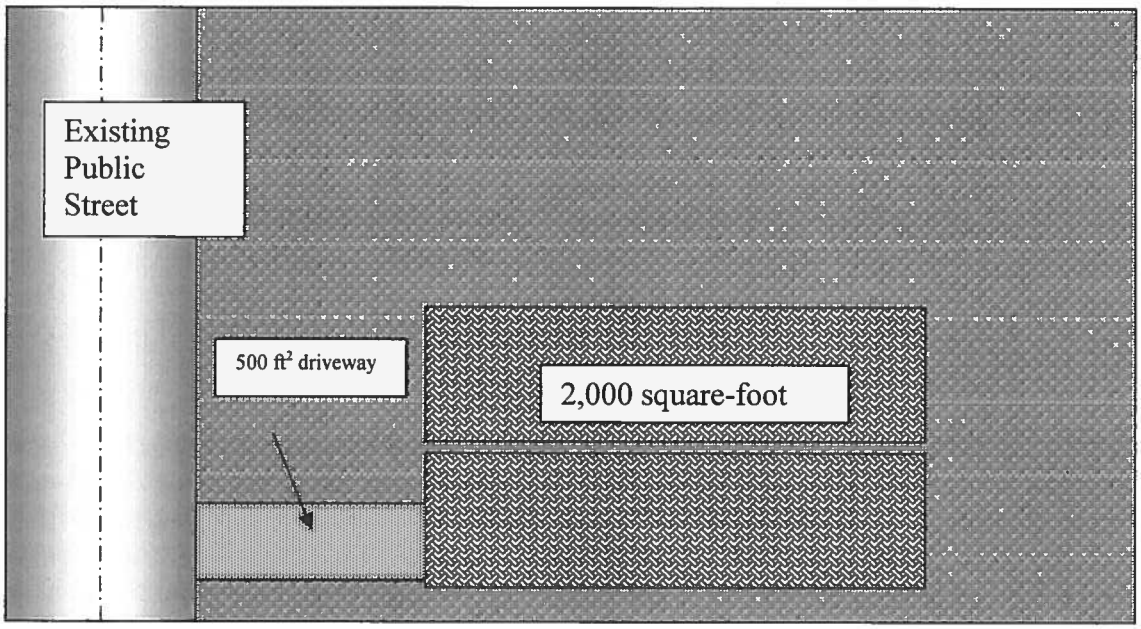
Goal #4: Adopt or Develop a Stormwater Design Manual.

Description: Develop a stormwater design manual outlining procedures for complying with stormwater management guidelines. The design manual should contain detailed information to support the ordinance developed in Goal #1. Specific design requirements and examples, rationale for components of the plans, checklists, example plans, and other materials should be contained in this document.

Action Items:
1. Adopt the City of Eugene Stormwater Design Manual until a local manual is developed for the City or another local community. Other manuals to consider include Portland (OR), Maryland, New York State, and Phoenix (OR).

PORTLAND SIMPLIFIED WORKSHEET DESIGN EXAMPLES

Design Example #1: Single family home to be constructed on a fairly flat site (<5% slopes). Soil type indicates high infiltration potential.



Preliminary information to think about:

Q: Where does stormwater runoff from this site flow prior to development?

A: Because of the high soil infiltration rate and flatness of the site, very little stormwater leaves as runoff. Rainfall percolates into the ground, where it makes its way into the groundwater.

Site Impervious Surface Calculation: Total new impervious surface = 2,500 ft².

Form SIM: Simplified Approach for Stormwater Management Facilities

The city has produced this form to assist with a quick and simple approach to manage stormwater quality, flow rate, and volume on projects. Facilities using this form are presumed to comply with stormwater quality, flow rate, and volume requirements.

New or Redeveloped Impervious Site Area 2500 **Box 1**

INSTRUCTIONS

1. Enter square footage of new or redeveloped impervious site area in Box 1 at the top of this form.
2. Select the desired management measure(s). In Column 1, enter the square footage of impervious surface that each facility will manage.
3. Multiply each impervious surface 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 surface.
4. Total Column 1 and enter the resulting "Impervious Surface Area Managed" in Box 2.
5. Subtract Box 2 from Box 1 and enter the result in Box 3. If this number is less than 500 square feet, stormwater quality and quantity requirements have been met. Submit this form with the application for permit.
6. If Box 3 is greater than 500 square feet, add square footage or facilities to Column 1 and recalculate, or use additional facilities shown in Chapter 3.0 of the Stormwater Manual to manage stormwater from these remaining surfaces.

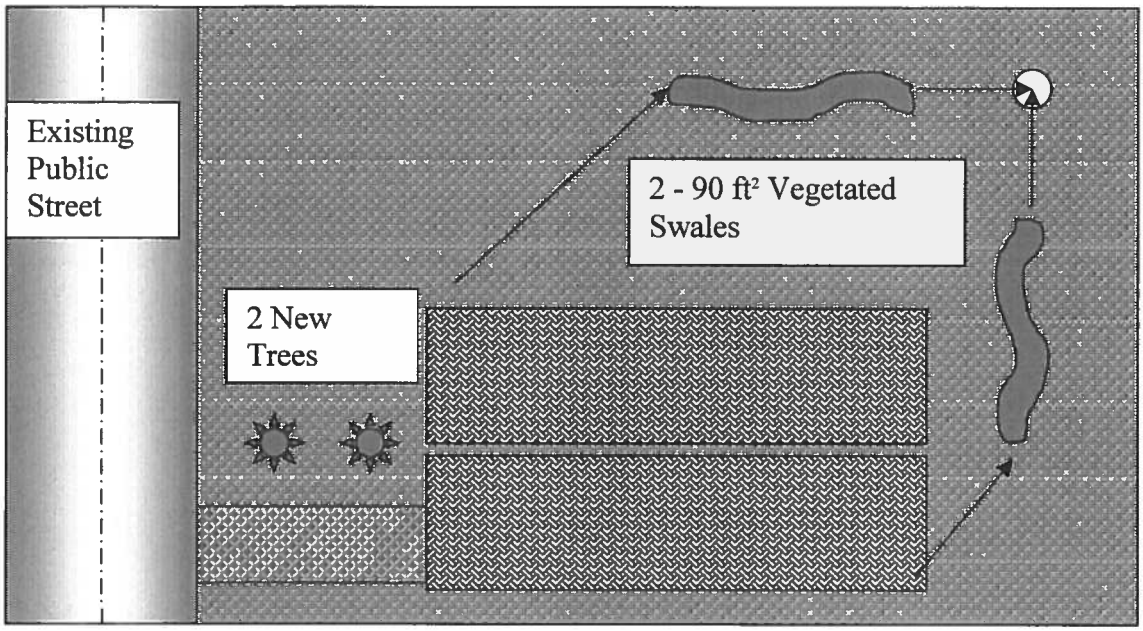
Facility	Column 1 Impervious Surface Area Managed	Unit		Column 2 Sizing Factor		Column 3 Facility Surface Area	Unit
1) Eco-Roof		sf	x	1	=		sf
2) Roof Garden		sf	x	1	=		sf
3) Contained Planter Box		sf	x	1	=		sf
4) Porous Pavement	200	sf	x	1	=	200	sf
5) Vegetated Swale	2000	sf	x	0.09	=	180	sf
6) Grassy Swale		sf	x	0.1	=		sf
7) Vegetated Filter		sf	x	0.2	=		sf
8) Infiltration Planter Box		sf	x	0.06	=		sf
9) Flow-Through Planter Box		sf	x	0.06	=		sf
10) Vegetated Infil. Basin		sf	x	0.09	=		sf
11) Sand Filter		sf	x	0.06	=		sf
12) East Side Soakage Trench		sf	x	0.06	=		sf
13) West Side Soakage Trench		sf	x	0.08	=		sf
14) New Deciduous Trees	200	sf	x	0.01	=	2	trees
15) New Evergreen Trees		sf	x	0.005	=		trees
* 16) Existing Tree Canopy		sf	x	1	=		sf canopy

* Note: To claim credit for new trees, trees must be planted within 10 feet of impervious surface. To claim credit for existing tree canopy, canopy must border or cover impervous surface.

Total Impervious Surface Area Managed 2400 **Box 2**

Box 1 - Box 2 100 **Box 3**

Developed Site Plan:



= *Downspout piping or overland swales.*

The original 2,500 square-feet of impervious surface from this site is now managed. Overflows from the landscape swales will be plumbed into a drywell (see Appendix G for drywell sizing chart) for disposal.

Design examples taken from The City of Portland Stormwater Management Manual September 2002 Draft. Bureau of Environmental Services. Portland, OR.

Section 9.0: Pollution Prevention/Good Housekeeping

9.1 What is Required to meet Phase II Regulations?

Recognizing the benefits of pollution prevention practices, operators of small MS4s should:

1. Develop and implement an operation and maintenance program with the ultimate goal of preventing or reducing pollutant runoff from municipal operations into the storm drainage system.

2. Include employee training on how to incorporate pollution prevention/good housekeeping techniques into municipal operations such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance. To minimize duplication of effort and conserve resources, the MS4 operator can use available training materials.

3. Determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

9.2 Why is it Necessary?

The Pollution Prevention/Good Housekeeping for municipal operations minimum control measure is a key element of the small MS4 stormwater management program. This measure requires the small MS4 operator to examine and subsequently alter their own actions to help ensure a reduction in the amount and type of pollution that: (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. While this measure is meant primarily to improve or protect receiving water quality by altering municipal or facility operations, it also can result in a cost savings for the small MS4 operator, since proper and timely maintenance of storm sewer systems can help avoid repair costs from damage caused by age and neglect.

9.3 Goals for Pollution Prevention/Good Housekeeping

1. Develop a Pollution Prevention Plan

2. Provide Employee Training Materials

3. Train Employees

4. Incorporate BMPs into the Stormwater Management Program

5. Establish a Maintenance Schedule

6. Evaluate Maintenance Program Effectiveness.

9.4 Goal Summary and Implementation Items.

Goal #1: Develop a Pollution Prevention Plan

Description: Develop a comprehensive Pollution Prevention Plan that identifies:

1. Items the City is currently doing to meet regulatory concerns. Examples include maintenance activities including street sweeping.
2. BMPs
3. Management Practices and Maintenance Schedules
4. Recycling Efforts
5. Waste Disposal Guidelines
6. Areas of Concern

The Municipal Stormwater Toolbox for Maintenance Practices (ORACWA 1998) provides an excellent guideline for maintenance activities from municipal operations. Topics covered include 1) Developing a Water Quality-Friendly Maintenance Program, 2) Maintaining Storm Drainage Systems, 3) Maintaining and Repairing Roadways, 4) Maintaining Roadside Areas, 5) Keeping a Clean Maintenance Yard, 6) Storing and Disposing of Waste Materials, 7) Educating both the Maintenance Staff and the Public About Stormwater Quality, and 8) Where to go for more information.

Goal #2: Provide Employee Training Materials

Description: Develop a collection of training materials that will be used to educate staff about pollution prevention and good housekeeping.

Goal #3: Train Employees

Description: Train staff on pollution prevention and good housekeeping using the materials collected.

Goal #4: Incorporate BMPs into the Stormwater Management Program

Description: Identify, from the list of BMPs outlined in Goal #1 (Develop a Pollution Prevention Plan), the BMPs that have been incorporated into the Stormwater Management Program.

Goal #5: Establish a Maintenance Schedule

Description: Finalize the maintenance plan and schedule that will be put in place for management of BMPs.

Goal #6: Evaluate Maintenance Program Effectiveness

Description: Identify the number of facilities and controls that have received maintenance. Document the overall compliance with the schedule and explain any discrepancies.

Section 10.0: Riparian Corridors

10.1 Purpose The purpose of Section 10.0 is to provide recommendations for preserving and protecting riparian corridors in Rogue River.

10.2 Scope Section 10.0 refers to all riparian areas along all named drainages in the Rogue River Urban Area including, but not limited to, Evans Creek, Wards Creek, and the Rogue River.

10.3 Policy Preserve and restore the functions and characteristics of Rogue River's riparian corridors to provide floodwater storage, water quality benefits, open space benefits, wildlife habitat, connectivity, and enhance the capacity of streams to provide habitat for fish and other aquatic organisms.

(1) Riparian vegetation especially canopy forming vegetation should be preserved or replaced around streams, wetlands, and other sensitive areas.
(2) Incorporate riparian corridor conservation with stormwater management and open space conservation goals.
(3) Ensure compliance with Statewide Planning Goals, Endangered Species Act requirements, and other relevant regulations.
(4) Protect sensitive hydrologic features including, but not limited to, wetlands, floodplains, and aquifer recharge areas.

10.4 Implementation Actions:

i. Conduct and maintain an inventory of waterway corridors, including related headwater streams, riparian zones, and wetland areas.

ii. Develop and implement a proactive acquisition program for areas along channels, wetlands, and waterways.

iii. Enforce existing riparian corridor width, and regulations regarding use in the city.

iv. Evaluate the adequacy of current riparian regulations with the costs and benefits of increasing corridor width or otherwise changing existing riparian policy.

v. Review and develop riparian protection ordinances as needed.

vi. Redefine uses allowable within riparian corridors, and evaluate the use of a multi-zone approach for protection.

vii. Establish a system of incentives or a credit system for preservation of riparian corridors in development projects.

viii. Establish guidelines for protecting wetlands, and other sensitive hydrologic features as needed.

ix. Maintain and enhance riparian areas with native vegetation, bank stabilization, and other projects to benefit watershed health.

(10) Conduct educational outreach to inform the public, city staff, and other agencies regarding the importance and functions of riparian corridors.

10.5 Corridor Description

A riparian corridor is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of riparian corridors is to physically protect and separate a stream, lake, wetland, or other sensitive area from disturbance or encroachment. If properly designed, a corridor can provide storm water management, and act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats. Additionally, riparian corridors are one type of conservation area that can function as an integral part of the riparian ecosystem and as part of an urban forest.

Riparian corridors can provide a number of functions and benefits including shade and temperature regulation, large woody debris recruitment, providing a source of organic matter, streambank stabilization, flood storage, nutrient and nonpoint source pollution filtration, wildlife habitat, aesthetics, and recreational opportunities.

10.6 Applicability

Corridors can be applied to new development by establishing specific preservation areas and sustaining management through easements or community associations. For existing developed areas, an easement may be needed from adjoining landowners. A local ordinance can help set specific criteria for corridors to achieve stormwater management goals.

In many regions of the country, the benefits of corridors are amplified if they are managed in a forested condition. In some settings, corridors can remove pollutants traveling in stormwater or ground water. Shoreline and stream corridors situated in flat soils have been found to be effective in removing sediment, nutrients, and bacteria from stormwater runoff and septic system effluent in a wide variety of rural and agricultural settings along the East Coast and with some limited capability in urban settings. Corridors can also provide wildlife habitat and recreation, and can be reestablished in urban areas as part of an urban forest.

Three general types of corridors are water pollution hazard setbacks, vegetated corridors, and engineered corridors. Water pollution hazard setbacks are areas that separate a potential pollution hazard from a waterway. By providing setbacks from these areas in the form of a corridor, the potential for pollution can be reduced. Vegetated corridors are natural areas that exist to divide land uses or provide landscape relief. Engineered corridors are areas specifically designed to treat stormwater before it enters into a stream, lake, or wetland.

10.7 Siting and Design Considerations

10.7.1 Key Criteria

There are ten key criteria to consider when establishing a stream corridor:

(1) Minimum total corridor width

(2) Uses within the corridor system (multi-zone corridor system)

(3) Vegetative target species

(4) Conditions for corridor expansion or contraction

(5) Physical delineation requirements

(6) Conditions where corridor can be crossed

(7) Integrating stormwater and open space management within the corridor

(8) Corridor limit review

(9) Corridor education, inspection, and enforcement

(10) Corridor flexibility

10.7.2 Basic Design Recommendations

In general, a minimum base width of at least 100 feet is recommended to provide adequate stream protection. The three-zone corridor system, consisting of inner, middle, and outer zones, is an effective technique for establishing a corridor. The zones are distinguished by function, width, vegetative target, and allowable uses. The inner zone protects physical and ecological integrity and is a minimum of 25 feet plus wetland and critical habitats. The vegetative target consists of mature forest, and allowable uses are very restricted (flood controls, utility right-of-ways, footpaths, etc.).

The middle zone provides distance between upland development and the inner zone and is typically 50 to 100 feet, depending on stream order, slope, and 100-year floodplain. The vegetative target for this zone is managed forest, and usage is restricted to some recreational uses, some stormwater BMPs, and bike paths. The outer zone functions to prevent encroachment and filter backyard runoff. The width is at least 25 feet and, while forest is encouraged, turfgrass can be a vegetative target. Uses for the outer zone are unrestricted and can include lawn, garden, compost, yard wastes, and most stormwater BMPs.

For optimal stormwater treatment, the following corridor designs are recommended. The corridor should be composed of three lateral zones: a stormwater depression area that leads to a grass filter strip that in turn leads to a forested corridor. The stormwater depression is designed to capture and store stormwater during smaller storm events and bypass larger stormflows directly into a channel. The captured runoff within the stormwater depression can then be spread across a grass filter designed for sheetflow conditions for the water quality storm. The grass filter then discharges into a wider forest corridor designed to have zero discharge of surface runoff to the stream (i.e., full infiltration of sheet flow).

Stream corridors must be highly engineered in order to satisfy these demanding hydrologic and hydraulic conditions. In particular, simple structures are needed to store, split, and spread surface runoff within the stormwater depression area. Although past efforts to engineer urban stream corridors were plagued by hydraulic failures and maintenance problems, recent experience with similar bioretention areas has been much more positive (Claytor and Schueler, 1996). Consequently, it may be useful to consider elements of bioretention design for the first zone of an urban stream corridor (shallow ponding depths, partial underdrains, drop inlet bypass, etc).

10.7.3 Limitations

Only a handful of studies have measured the ability of stream corridors to remove pollutants from storm water. One limitation is that urban runoff concentrates rapidly on paved and hard-packed turf surfaces and often crosses the corridor as channel flow, effectively shortcutting through the corridor. To achieve optimal pollutant removal, the engineered corridor should be carefully designed with a stormwater depression area, grass filter, and forested strip.

10.7.4 Maintenance Considerations

An effective corridor management plan should include establishment, management, and distinctions of allowable and unallowable uses in the corridor zones. Corridor boundaries should be well defined and visible before, during, and after construction. Without clear signs or markers defining the corridor, boundaries become invisible to local governments, contractors, and residents. Corridors designed to capture stormwater runoff from urban areas will require more maintenance if the first zone is designated as a bioretention or other engineered depression area.

10.7.5 Effectiveness

The pollutant removal effectiveness of corridors depends on the design of the corridor; while water pollution hazard setbacks are designed to prevent possible contamination from neighboring land uses, they are not designed for pollutant removal during a storm. With vegetated corridors, some pollutant removal studies have shown that they range widely in effectiveness (Table10-1). Proper design of corridors can help increase the pollutant removal from stormwater runoff (Table 10-2).

Table 10-1: Pollutant Removal Rates in Corridor Zones

Reference	Corridor Vegetation	Corridor Width (feet)	Total % TSS Removal	Total % Phosphorus Removal	Total % Nitrogen Removal
Dillaha et al., 1989	Grass	15-30	63–78	57–74	50–67

Magette et al., 1987	Grass	15-30	72–86	41–53	17–51
Schwer and Clausen, 1989	Grass	85	89	78	76
Lowrance et al., 1983	Native hardwood forest	65-130	–	23	–
Doyle et al., 1977	Grass	5	–	8	57
Barker and Young, 1984	Grass	259	–	–	99
Lowrance et al., 1984	Forested	–	–	30–42	85
Overman and Schanze, 1985	Grass	–	81	39	67

Table 10-2: Factors that enhance/reduce corridor pollutant removal performance

Factors that Enhance Performance	Factors that Reduce Performance
Slopes less than 5%	Slopes greater than 5%
Contributing flow lengths <150 feet.	Overland flow paths over 300 feet
Water table close to surface	Ground water far below surface
Check dams/level spreaders	Contact times less than 5 minutes
Permeable but not sandy soils	Compacted soils
Growing season	Nongrowing season
Long length of corridor or swale	Corridors less than 10 feet
Organic matter, humus, or mulch layer	Snowmelt conditions, ice cover

Small runoff events	Runoff events >2 year event.
Entry runoff velocity less than 1.5 feet/sec	Entry runoff velocity more than 5 feet/sec
Swales that are routinely mowed	Sediment buildup at top of swale
Poorly drained soils, deep roots	Trees with shallow root systems
Dense grass cover, 6 inches tall	Tall grass, sparse vegetative cover

10.7.6 Cost Considerations

Several studies have documented the increase of property values in areas adjacent to corridors. At the same time, the real costs of instituting a corridor program for local government involve the extra staff and training time to conduct plan reviews, and to provide technical assistance, field delineation, construction, and ongoing corridor education programs. To implement a stream corridor program, a community will need to adopt an ordinance, develop technical criteria, and invest in additional staff resources and training. The adoption of a corridor program also requires an investment in training for the plan reviewer and the consultant alike. Manuals, workshops, seminars, and direct technical assistance are needed to explain the new requirements to all the players in the land development business. Lastly, corridors need to be maintained, and resources should include systematic inspection of the corridor network before and after construction and work to increase resident awareness about corridors.

One way to relieve some of the significant financial hardships for developers is to provide flexibility through corridor averaging. Corridor averaging allows developers to narrow the corridor width at some points if the average width of the corridor and the overall corridor area meet the minimum criteria. Variances can also be granted if the developer or landowner can demonstrate severe economic hardship or unique circumstances that make compliance with the corridor ordinance difficult.

10.8 References

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Section 11.0 Funding Alternatives

11.1 Funding Alternatives

In Oregon, funding options available to cities for stormwater management are identical to those established for other municipal utility functions.

11.1.1 General Obligation Bonds

General obligation (GO) bonds are debt instruments backed by the full faith and credit of the City, which would be secured by an unconditional pledge of the City to levy assessments, charges or ad valorem taxes necessary to retire the bonds. GO bonds are the lowest-cost form of debt financing available to local governments and can be combined with other revenue sources such as specific fees, or special assessments charges to form a dual security through the City's revenue generating authority. The City as a whole backs these bonds, so the amount of debt issued from stormwater is limited to a fixed percentage of the total market value for taxable property within the city. The cap is a statutory mandate.

11.1.2 Revenue Bonds

Unlike GO bonds, revenue bonds are not backed by the City as a whole, but constitute a lien against the stormwater service charge revenues of the Storm Sewer Utility. Revenue bonds present a greater comparative risk to the investor than the GO bonds, since repayment of debt depends on an adequate revenue stream, legally defensible rate structure and sound fiscal management by the issuing jurisdiction. Due to this increased risk, revenue bonds generally command a higher interest rate than GO bonds. This type of debt also has very specific coverage requirements in the form of a reserve fund specifying an amount, usually expressed in terms of average or maximum debt service due in any future year. This debt service is required to be held as cash reserve for annual debt service payment to the benefit of bondholders.

11.1.3 System Development Charges

ORS 223.297-223.314 establishes the use of system development charges (SDCs) and provides a framework for establishing fees that recover from new development the City's costs in providing utility system capacity. It also establishes a basis for fee calculation, which the City must follow. However, the fundamental objective for the fee structure is the imposition on new development of a proportionate share of the costs associated with providing or expanding stormwater infrastructure to meet the capacity needs created by that specific development.

SDCs cannot be applied retroactively and are a one-time charge at the time of development approval. Only infrastructure funded through stormwater charges or other city fees is eligible for inclusion in the SDC. If the existing system has any capacity remaining and available to new development, this available capacity becomes the basis for reimbursement of the SDC. Table 11-1 provides SDC for selected communities in Oregon.

Table 11-1
Rates for Selected Oregon Communities in 1997 and 2002*

City	Population	Stormwater Utility Rate (per month)	ERU (Square Feet)	SDC (charge per EDU)
Banks	625	$4.00	2,640	$500.00
Beaverton	76,129*	$5.25*	2,640	$901.00
Cannon Beach	1,425	$3.50	5,000	$701.00
Clackamas County	338,391*	$4.00*		
Corvallis	49.322*	$4.70*		
Cottage Grove	8,005	$2.50		$628.96
Eugene	137,893*	$7.08*		
Gresham	90,205*	$6.00*	2,500	$725.00
Medford	57,610	$2.95	3,000	$400.00
Milwaukie	20,490*	$6.00*		
Portland	529,121*	$10.00*		
Roseburg	19,810	$2.85	3,000	$400.00
Sherwood	8,125	$4.00	2,640	
Tigard	36,680	$4.00	2,640	$500.00
Tualatin	22,791*	$4.00*	2,640	$500.00
West Linn	22,261*	$4.00*		$376.00
Wilsonville	10,940	$1.40	2,000	$81.00
Woodburn	16,150	n/a	n/a	$275.00

(Referenced from the City of Ashland Stormwater and Drainage Master Plan Final Report, June 2000, and from data (*) provided by Shaun Pigott Associates 2002. Population estimates (*) are based on 2000 census figures from the Population Research Center at Portland State University).

11.1.4 Stormwater User Fees

As conventional funding sources for stormwater management becomes more difficult to obtain, and as regulations for stormwater quality become mandatory, alternative approaches from management are becoming accepted. There are numerous options and variations for stormwater service charges (user fees). One method for structures that has been used across Oregon (see table 11-1) is based on an equivalent residential unit (ERU) approach. An ERU can be based on land use, water meter size, the set number of square feet of impervious surface, or other designations. Some of the values shown in Table 11-1 are based on average single-family home residential lot size in the City, along with land use limitations on the percent of impervious coverage. Because most single-family homes have similar impervious surface footprints, all single-family homes are considered to be one ERU. All other properties are charged based in their measured impervious surface divided by the base ERU square footage to determine the number of ERUs applied to that property.

Appendix A: Rogue River City Information

Rogue River information:

Government:

Type:	City, Mayor and City Council Address: 133 Broadway P.O. Box 1137 City: Rogue River OR, 97537
Responsible elected official:	Phil Peeters, Mayor
Contact info:	Phone: (541) 582-4401 Fax: (541) 582-0937

Demographics:

Population:	1,847 (2000 Census Bureau Statistics]
Land Area:	
Significant Local Waters:	Rogue River, Evans Creek, and Wards Creek.
303(d) Listed Waters:	Rogue River (Temperature –summer, Bacteria – summer) Evans Creek (Bacteria-all year, Temperature-summer)
Fish Usage:	Rogue River -Chinook, Coho, Steelhead, native trout, and Pacific Lamprey Evans Creek – Chinook, Coho, and Steelhead Wards Creek - Steelhead

Stormwater Contacts:

Principal:	Mark Reagles City Administrator Phone: (541) 582-4401 Fax: (541) 582-0937 Email: mreagles@ci.rogue-river.or.us
Alternate:	Ken Johnson Public Works Director Phone: (541) 582-4401 Fax: (541) 582-0937 Email: kjohnson@ci.rogue-river.or.us