CITY OF REDMOND

CLEARING, GRADING, AND STORMWATER MANAGEMENT

TECHNICAL NOTEBOOK

Issue Number 5

PUBLIC WORKS DEPARTMENT

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Addendum to Issue No. 5, August 18, 2010
(Addendum is attached at end of this document)

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FOREWORD

This document may be referred to as the Stormwater Notebook. It constitutes Appendix B0D-5 of the Redmond Community Development Guide.

The Stormwater Notebook contains the goals, specifications, and standards for clearing, grading, and stormwater management authorized and required by Chapter 15.24 of the Redmond Municipal Code (RMC). Note that Chapter 15.24 of the RMC is the primary code basis for clearing, grading, and stormwater management and should, therefore, also be reviewed. It is included in Appendix A.

This January 1, 2007 issue is being submitted to the Department of Ecology (DOE) and is subject to revisions based on comments from that agency. Please make sure you have provided your name and mailing or email address to Public Works, Development Services Division at (425)556-2760 or pwgen@redmond.gov to obtain revisions.

How to Get Printed Copies of the Stormwater Notebook

If you would like to receive a copy of the updated manual please stop by the City of Redmond Development Services Center, located on the 2nd floor of City Hall (15670 NE 85th St., Redmond) to pick one up. To make other arrangements to receive a copy, contact Development Services Division at (425)556-2760 or pwgen@redmond.gov.

How to Find the Stormwater Notebook on the Internet

The Stormwater Notebook is available on the City of Redmond's website. The Internet address is:

http://www.redmond.gov/insidecityhall/publicworks/utilities/stormwater.asp

How to Find Corrections, Updates, and Additional Information

With a publication of this size and complexity, and with the rapid changes in stormwater management technologies, there may be errors that must be corrected and clarifications that are needed. The City intends to publish corrections, updates, and new technical information on the Stormwater Notebook page referenced above. Minor changes will be documented on the website. Major policy changes will be addressed through publication of a new issue of the Stormwater Notebook. The Development Services Division of the Public Works Department maintains an email list for use in notifying interested parties of changes to the Technical Notebook. To be added to the list, contact pwgen@redmond.gov.

How to Use the Stormwater Notebook

The Stormwater Notebook is a blend of basic information for everyone from the small, single home builder, to the large developer, to the civil engineer supporting them. You can read it from cover to cover or refer to specific sections as needed. For small projects, the Stormwater Notebook should include most of the information you need. For larger projects, or for more detailed information, the project proponent will need a copy of the 2005 Department of Ecology Stormwater Management Manual for Western Washington.

Chapter 1 provides some introductory material to get you started. Chapter 2 describes Redmond-specific differences from the Ecology Manual and a lot of detailed design information. Chapter 3 will help you classify your project as small, medium, or large, so you can move on to the appropriate Chapter 4, 5, or 6. Chapters 7 and 8 provide some design information to help you design your project to meet all of Redmond's requirements. Finally, Chapters 9 and 10 provide information related to erosion control during construction to help you build your project in accordance with water quality requirements.

Overview of Changes from Previous Issue

City of Redmond requirements have been updated to complement the 2005 Department of Ecology Stormwater Management Manual for Western Washington (2005 Ecology Manual). References have been updated to reflect that the City's stormwater code was moved from Redmond Community Development Guide (RCDG) 20E.90 to Redmond Municipal Code (RMC) 15.24.

The Stormwater Notebook has been reorganized and a detailed table of contents has been added to make things easier to find. There are numerous changes throughout the document, to improve consistency and readability.

<u>Key changes in organization include:</u>

- Eliminated "Part" organization.
- New Chapter 1, Introduction added.
- Old Chapter 1 is new Chapter 2.
- Old Chapter 2 is consolidated into new Chapter 8.
- Old Chapter 3 remains as new Chapter 3.
- Old Chapter 4 remains as new Chapter 4.
- Old Chapter 5 and 6 combined as new Chapter 5.
- Old Chapters 7, 8, 9, and 10 combined as new Chapter 6.
- Old Chapter 11 is new Chapter 7.
- Old Chapter 12 is consolidated into new Chapter 8.
- Old Chapters 13 and 14 combined as new Chapter 9.
- Old Chapter 15 is new Chapter 10.
- Appendices reorganized.

The key changes that may impact project designs include:

Permitting

- Threshold Discharge Areas, as used in the Ecology Manual are now accepted in Redmond (Chapter 2).
- Project classification information is updated along with descriptions of the permit process for small, medium, and large projects (Chapters 3, 4, 5, and 6).
- Guidance regarding other associated permits is expanded (Chapter 1).
- Drainage report outline is included (Chapter 2).
- Plan review checklist is updated (Appendix F).
- Project submittal data for stormwater facilities is updated (Chapter 6).

Low Impact Development

- Low Impact Development is encouraged and accommodated. LID BMPs approved in the Ecology Manual are permitted in Redmond under suitable site conditions. New section on LID in Redmond is added (Chapter 8).
- Ecology Manual guidance for modeling low impact development is used.
- Use Redmond-specific guidance for modeling compost-amended soil (Chapter 2).
- Apply maintenance standards for low impact development (Appendix P).
- Follow guidance for use of compost-amended soil (Appendix Q).

Wellhead Protection

- Infiltration of clean water is encouraged in Redmond (Chapter 2).
- Infiltration of stormwater is encouraged (with treatment) in Wellhead Protection Zone 4, but is restricted in Wellhead Protection Zones 1, 2, and 3 (Chapter 2).
- Infiltration from pollution generating impervious surfaces (PGIS) following enhanced treatment is permitted in Wellhead Protection Zone 3 (Chapter 2).
- Infiltration from non-pollution generating impervious surfaces that are demonstrated to be clean, is permitted in Wellhead Protection Zones 1, 2, and 3 (Chapter 2).
- To make site design without infiltration from PGIS feasible, in Wellhead Protection Zones 1, 2, or 3, outwash soils may be considered to be till for the purpose of detention pond sizing (Chapter 2).

Stormwater Flow Control

- Modified flow control standard allows some sites that discharge to stormwater pipes that drain directly to the river or lake to release the 50-year developed peak at the 10-year developed peak (Chapter 2).
- In Wellhead Protection Zones 1, 2, or 3, outwash soils may be considered to be till for the purpose of detention pond sizing (Chapter 2).
- Direct discharge conveyance capacity requirement reduced from 100-year to 50-year storm (Chapter 2).
- Projects with less than 0.1 cfs increase of the 100-year flood frequency may be exempt from flow control (Chapter 2).
- Contribution in lieu of detention is updated to reflect new City program for Regional Facilities (Chapter 8).
- Map of historical land cover is added (Appendix N).

Stormwater Quality Treatment

- Emerging technologies may be considered for use in Redmond (Chapter 2).
- Biofiltration swale design was changed in the Ecology Manual to be more like the 1992 manual's design standard (Chapter 2).
- Contribution in lieu of stormwater quality treatment is updated to reflect new City program for Regional Facilities (Chapter 8).
- Water quality facility types permitted in Ecology manual are allowed in Redmond, although some are preferred over others (Chapter 2).

Regional Facilities Plan

- The City has identified proposed locations for many new regional stormwater facilities that will be designed to meet the flow control or stormwater quality requirements of new development throughout the City (Chapter 8).
- Contribution toward construction of regional flow control or stormwater quality treatment facilities is mandatory in regional surcharge areas and optional in watersheds where proposed regional facilities have been identified. The project proponent is responsible for preparing a Contribution in Lieu proposal that evaluates potential impacts from the project (Chapter 8).
- Fee in lieu of compensatory flood storage has been removed from the Notebook.

Stormwater Conveyance and Facility Specifications

- PVC, ductile iron, or fusion-welded HDPE pipe are preferred for stormwater conveyance systems (Chapter 8).
- Freeboard standards for conveyance design updated (Chapter 8).
- Manhole spacing updated (Chapter 8).
- Catch basin and area drain maximum depths specified (Chapter 8).
- Vertical clearance from utilities updated (Chapter 8).
- Shear gates are now permitted (Chapter 2).
- Stormwater ponds shall be signed (Chapter 2).
- Installation of groundwater monitoring wells shall be coordinated with the City's wellhead protection program (Chapter 2).
- Guidance for pumping stormwater added (Chapter 8).
- Stormwater pipe inspection protocol requires enhanced inspection of all new pipe (Appendix R).

Temporary Erosion and Sedimentation Control

- Reference Ecology manual for guidance (Chapter 9).
- Added reference to NPDES permit for construction stormwater discharge (Chapter 9).
- No changes to Rainy Season Guidelines (Chapter 10).

CLEARING, GRADING, AND STORMWATER MANAGEMENT TECHNICAL NOTEBOOK

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CHAPTER 1: INTRODUCTION

The Clearing, Grading, and Stormwater Management Technical Notebook herein referred to as the Stormwater Notebook supplements the 2005 Department of Ecology Stormwater Management Manual for Western Washington, defines how the 2005 Ecology Manual is to be applied in the City of Redmond, and provides information and standards specific to stormwater management in Redmond. The Stormwater Notebook is intended to assist those who prepare and submit applications and construction documents by providing design requirements and processing information. The methods outlined in the Stormwater Notebook are not the only methods acceptable for use in the City, but any deviations from these methods must still meet or exceed the intended results and be reviewed and approved by the City. In cases where the information or requirements in the Stormwater Notebook are different from the 2005 Ecology Manual, the Stormwater Notebook will govern. A summary of modifications and additions to the 2005 Ecology Manual is presented in Chapter 2 of the Stormwater Notebook. Additional, Redmond-specific design standards are also described in Chapter 7 and 8, and also in the City of Redmond Standard Specifications and Details.

1.1 Code Requirements

Code requirements regarding stormwater management are identified in the Redmond Municipal Code, Chapter 15.24 (included in Appendix A). The Stormwater Notebook is a supplement to the code and the code should also be reviewed to understand the procedures and requirements.

1.2 Permitting Review Process

The permitting review process is a partnership between the applicant and representatives from the City. Throughout the Stormwater Notebook, there are specific stormwater management alternatives that may be approved for a specific project with the approval of the Stormwater Engineer or the Technical Committee. Private Development projects are reviewed by a Stormwater Engineer within the Development Services Division of Public Works. Public Capital Improvement Projects are reviewed by a Stormwater Engineer within the Natural Resources Division of Public Works. In some instances, the City's Technical Committee will review a project. Chapters 3, 4, 5, and 6 go into more detail about the review process for specific project types.

1.3 Documents Adopted by Reference

The following documents are adopted by reference:

- Redmond Municipal Code, Chapter 15.24, Latest Edition.
- Redmond Community Development Guide, Latest Edition.
- The 2005 Department of Ecology Stormwater Management Manual for Western Washington, dated February 2005, or its successor when approved by the Public Works Director.

- Low Impact Development Technical Guidance Manual for Puget Sound, May 2005, or its successor when approved by the Public Works Director.
- Standard Specifications and Details for Public Works Construction, prepared by the City of Redmond Public Works Department, Latest Edition.

1.4 Vesting

This document is subject to revision from time to time. The issue dates are shown on the front cover. The issue of this manual that applies to a particular project is the issue that is (or was) in effect when the proposed project was "vested." If a newer issue of the Stormwater Notebook is published after a project is vested, the project will have the right to use the newer version of the stormwater notebook in its entirety, or the older version in its entirety.

- A project subject to a Building Permit is vested when a Building Permit Application is submitted that is deemed complete by the City.
- A Preliminary Plat or a Short Plat is vested when the application for the Preliminary Plat or Short Plat is submitted and is deemed complete by the City.
- A project involving only clearing or grading is vested when an application for the clearing and/or grading work is submitted and determined to be complete by the City.
- Vesting for Public Works Capital Improvement Projects shall be determined by the Technical Review Committee.

Note that this vesting requirement applies only to the requirements of this Stormwater Notebook. Vesting rights for other land use actions such as building permits, land subdivision, and shoreline permits are specified in the Redmond Community Development Guide, 20F.10.60. For further information, contact the Development Services Center or the Stormwater Engineer.

1.5 Additional Permit Requirements

Additional City of Redmond requirements and special conditions listed on a specific project's permits apply to clearing, grading, or stormwater work in specific circumstances. While not necessarily a complete list, the following programs often apply to clearing, grading, and/or stormwater work in or near Critical Areas or Shorelines (defined in the Redmond Community Development Guide, Chapter 20D). Contact the City of Redmond Development Services Center for more information about these programs:

- Shorelines – Can apply to projects within 200 feet of Bear Creek, Evans Creek, the Sammamish River, Lake Sammamish, and their associated floodplains and wetlands.

- Critical Areas – Can apply if your project proposes work (as defined in the Redmond Community Development Guide, Section 20D.140) within:
    - fish and wildlife habitat conservation areas;
    - wetlands;
    - geologically hazardous areas;
    - frequently flooded areas; or
    - critical aquifer recharge areas.

Other agencies may also have requirements and permits related to work in Redmond. While not necessarily a complete list, the following agencies and their permits have been a part of many projects in Redmond:

- State Department of Fish and Wildlife – Hydraulic Project Approval (HPA) for work below the Ordinary High Water Mark (OHWM) of surface waters including intermittent streams (work that uses, diverts, obstructs or changes natural flow or bed of State waters).
- State Department of Ecology – NPDES Permit(s): programs related to water quality management from construction sites of 1 acre or more. Water Quality Certification (401) ensures that limits placed in a permit on the quantity and concentration of pollutants discharged are not exceeded.
- Corps of Engineers – a number of permits (under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act) related to protection of "waters of the United States" including wetlands, streams and other surface waters. As appropriate the Army Corps will coordinate with the NOAA Fisheries (regarding federally listed anadromous species such as salmon) and U .S. Department of Fish and Wildlife (regarding federally listed land or freshwater species – such as eagles or bull trout) to ensure Endangered Species Act consistency.
- Coastal Zone Management Certification (CZM) – issued by the federal permitting agency or state DOE. This is required for USACE authorized projects and other federally license or permitted projects. Ensures compliance with a number of federal and state acts relating to environmental protection including the federal Clean Water Act, Clean Air Act, WA State Environmental Policy Act, shoreline Management Act & Energy Facility Site Evaluation Criteria.
- U.S. Coast Guard & WA State DNR are also involved in certain projects involving impacts (such as a bridge) over or adjacent to navigable waters (Class 1 streams)
- Federal Emergency Management Agency – programs related to flood protection near major streams and rivers.

Also note that any work proposed beyond the applicant's property limits requires written concurrence of the owners of those properties.

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Chapter 2 is replaced by Addendum, August 18, 2010

CHAPTER 2: MODIFICATIONS TO THE 2005 DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

2.1 Redmond Requirements

Clearing, grading, and stormwater management issues relating to construction are regulated by Chapter 15.24 of the Redmond Municipal Code and the Redmond Community Development Guide. Issues not addressed in the RCDG are regulated by the requirements of the Stormwater Notebook. The 2005 Ecology Manual shall regulate issues not addressed in the Redmond Municipal Code, Redmond Community Development Guide, or the Stormwater Notebook.

2.2 Key Modifications for Redmond

In accordance with the Ecology Manual, infiltration is encouraged for recharge or as a method of discharging surface water as an option in areas with highly permeable soils for clean runoff from sidewalks and roofs. However, due to wellhead protection concerns, all other infiltration proposals shall be evaluated by the Stormwater Engineer on a case-by-case basis.

Infiltration of water draining from pollution generating impervious surfaces (streets, parking lots, etc.) in Wellhead Protection Zones 1 or 2 is not permitted. Infiltration for pollutant removal or flow control is permitted in Wellhead Protection Zone 4 with treatment as noted in the Ecology manual. In Wellhead Protection Zone 3, infiltration for treatment is not permitted, but infiltration for flow control is permitted following enhanced treatment.

2.3 Applicability of the 2005 Ecology Manual in Redmond

2.3.1 Volume I: Minimum Technical Requirements and Site Planning

2.3.1.1 Chapter 1: Introduction

No local changes but used for reference only in Redmond.

2.3.1.2 Chapter 2: Minimum Requirements for New Development and Re-development

2.1- Relationship to Puget Sound Water Quality Management Plan

Applies although appropriate applications for infiltration systems are limited.

2.3- Definitions Related to Minimum Requirements

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Chapter 2 is replaced by Addendum, August 18, 2010

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The the
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(labeled 2.2R, 2.3R, and 2.4R) follow.

Figures 2.2 and 2.3

Do not apply in Redmond. See 2.2R, 2.3R, and 2.4R below.

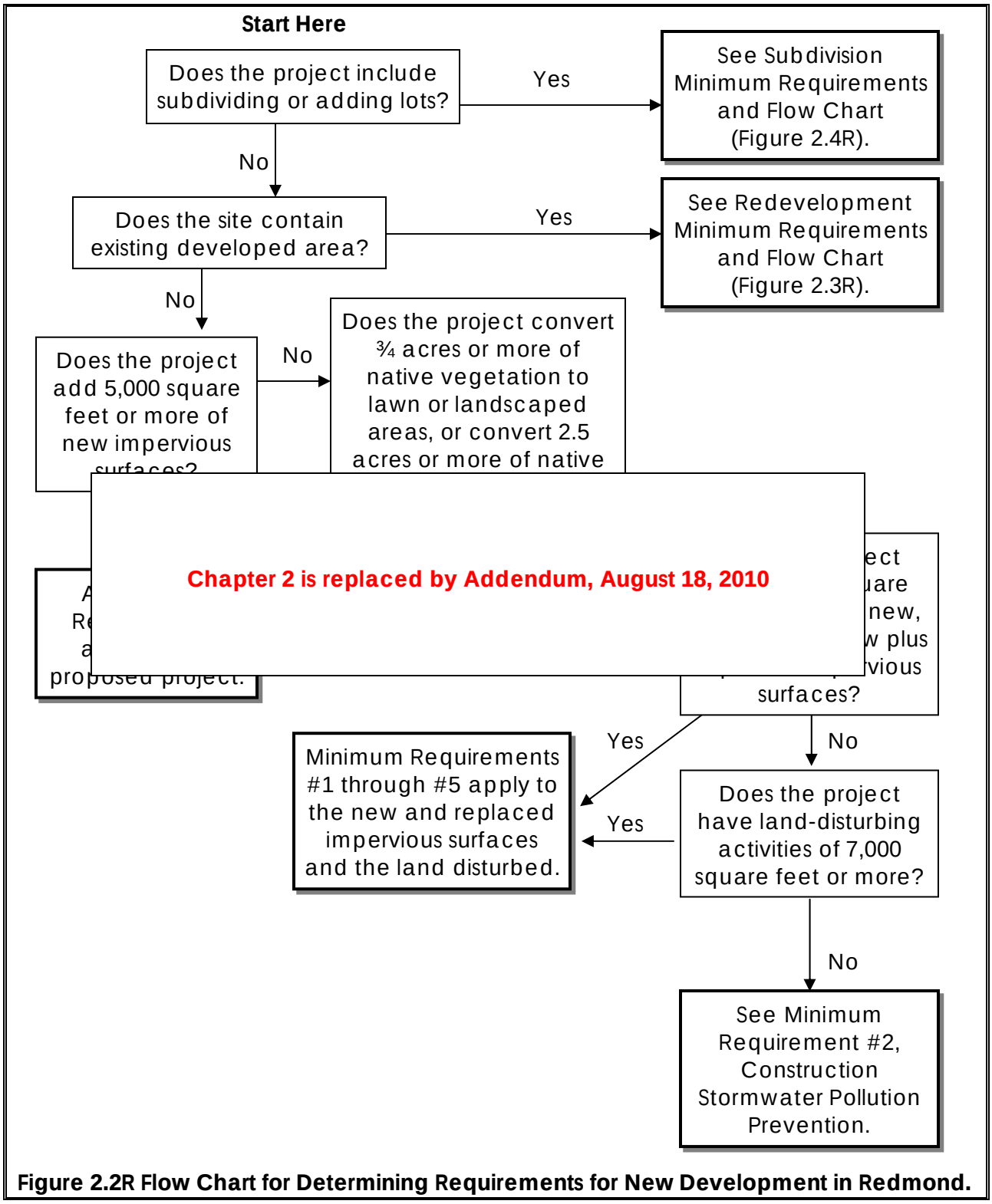

Figure 2.2R Flow Chart for Determining Requirements for New Development in Redmond.

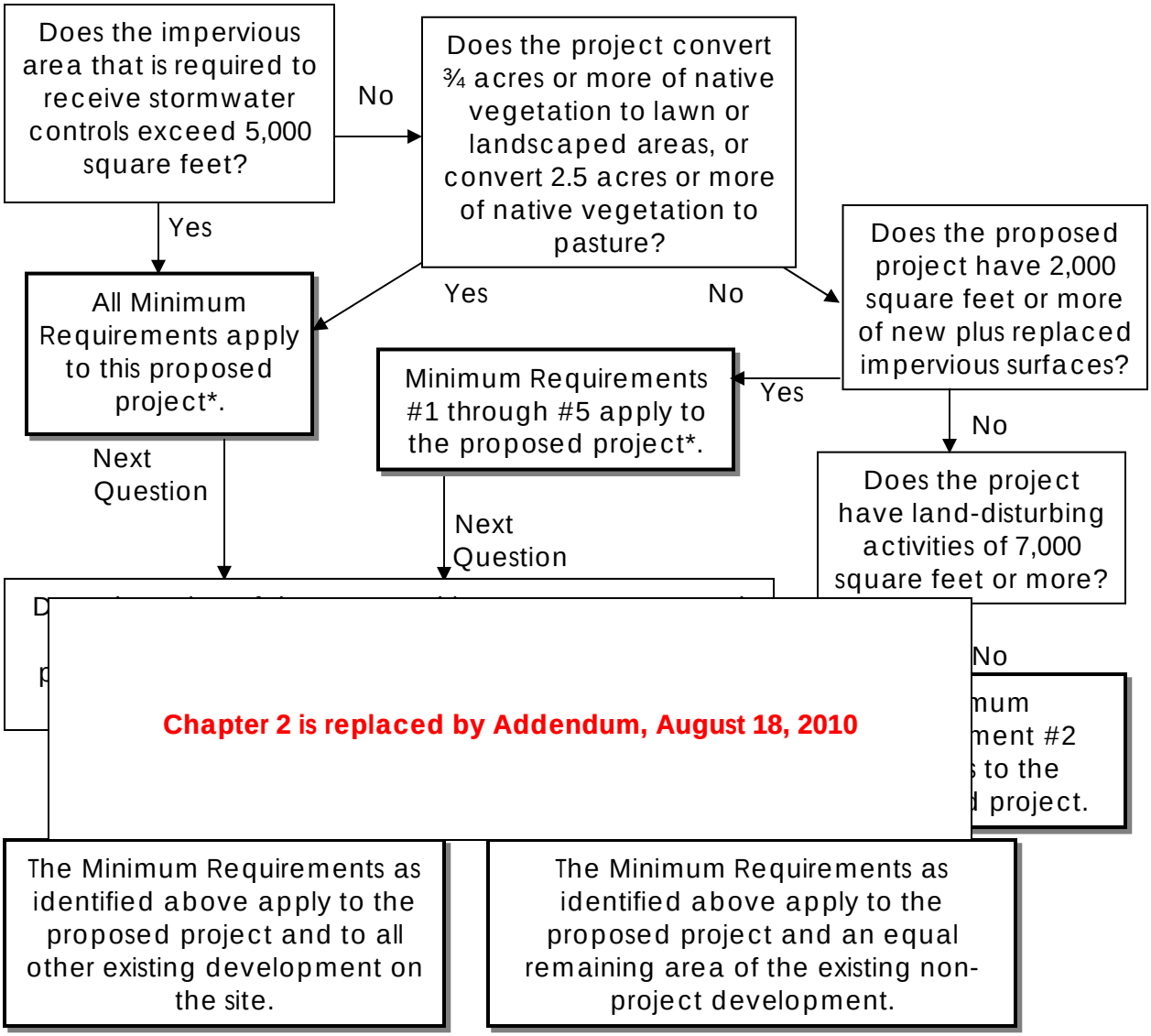

Figure 2.3R Flow Chart for Determining Requirements for Redevelopment in Redmond.

* In determining project area, include areas of the site with:

- Proposed new impervious surfaces, and
- Existing impervious surfaces that will be disturbed as part of the project, and
- All other areas that will be disturbed by the proposed project, and
- Additional existing development as required per "New Development" or "Re-development" definitions.

A landscaped area is disturbed if the earth surface is penetrated or roots are disturbed. A paved area is disturbed if the surface below the base course is disturbed.

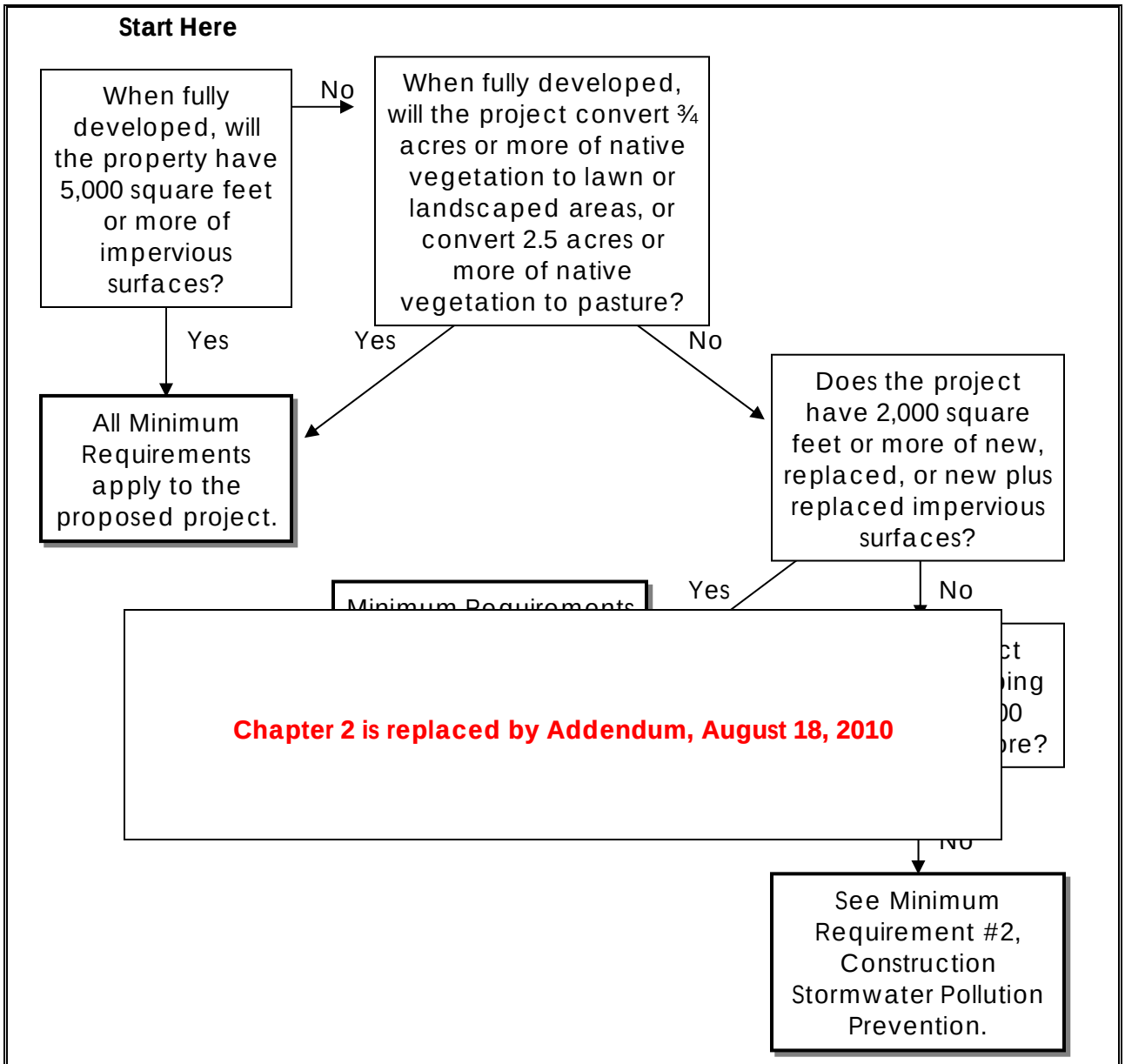

Figure 2.4R Flow Chart for Determining Requirements for Subdivisions in Redmond.

2.4.2- Redevelopment

Redmond does not have the "stop-loss" provision described in the 2005 Ecology Manual. However, Redmond does have provisions for fee-in-lieu of stormwater facilities as noted in Chapter 8 of the Stormwater Notebook.

2.5.1-Minimum Requirement #1 Preparation of Stormwater Site Plans

Applies. See Chapter 3 of Volume I of Ecology Manual. Also see Chapter 4, 5, 6 of Stormwater Notebook for requirements based on project size.

2.5.2- Minimum Requirement #2 Construction Stormwater Pollution Prevention (SWPP).

Applies with the following revisions:

Refer to Chapter 10 of this document for seasonal restrictions.

For Element 2, street washing is not permitted, even after shoveling or sweeping.

If material is being deposited on off-site streets, the following alternatives shall be considered:

Chapter 2 is replaced by Addendum, August 18, 2010

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- Suspension of work until dry weather.

For Element 4, note that Redmond's standard for turbidity for runoff leaving a site is 50 NTU.

If this standard is not being met, additional BMPs (including site-specific designs) shall be applied. If additional BMPs are not applied or are not successful, work may be suspended until a new plan for TESC is formulated and approved by the City.

For Element 7, the Contractor shall be responsible for removing inlet protection at the end of the project in a manner that does not release captured sediment into the storm system.

For Element 8, temporary conveyance channels shall be stabilized for the 10-year, 24-hour frequency storm under developed tributary area conditions.

For Element 12, note that Redmond requires special TESC planning for work in the Rainy Season (October 1 through April 30). See Chapter 10 of the Stormwater Notebook.

2.5.3-Minimum Requirement #3 Source Control of Pollution

Applies.

2.5.4-Minimum Requirement #4 Preservation of Natural Drainage Systems and Outfalls

Applies with the following revisions:

Use of dispersal systems is limited. In all cases stormwater runoff shall be conveyed to an acceptable discharge point unless the Stormwater Engineer specifically approves an alternative.

Item C of the supplemental guidelines is modified in Redmond as follows:

Chapter 2 is replaced by Addendum, August 18, 2010

2.5.5

Applies with the following revision:

On-site dispersal shall only be allowed on rural lots (5-acre minimum). Dispersal systems shall be a minimum of 100' up-gradient of the property line.

2.5.6-Minimum Requirement #6 Runoff Treatment

Stormwater treatment facilities shall be selected in accordance with the process identified in Chapter 4 of Volume I, as modified below.

2.5.7-Minimum Requirement #7 Flow Control

Applies with the following revisions:

> Predeveloped conditions in Redmond shall be modeled as pervious Forest or Pasture, regardless of the basin conditions in the last 20 years. In general, the valley floor was historically pasture or wooded wetland. Historical wooded wetlands should be modeled as pasture. The remainder of Redmond was forested. The map in Appendix N identifies the historical land cover based on the City's research.

Depending on the project site's location within Redmond, there are several alternatives that may apply for flow control. Maps of the City showing watersheds, the stormwater system, and Wellhead Protection Zones are available at: http://www.redmond.gov/cityservices/citymaps.asp). Some alternatives may not apply due to specific site constraints such as onsite soil conditions. Some alternatives may be made possible if the project obtains permits for and completes offsite improvements with approval from the Stormwater Engineer (i.e. increase size of existing conveyance system downstream). Flow control alternatives are summarized below:

On-Site Detention Alternative (May be used City-wide)

Stormwater discharges shall match developed discharge **durations** to pre-d[illegible]m
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E[illegible]

M[illegible]
Pr[illegible]
St[illegible]e-
d[illegible]m
50% of the 2-year peak flow up to the full 50-year peak flow. As a protective measure for the City's shallow groundwater aquifer, on-site detention in Wellhead Protection Zones 1, 2, and 3 shall be designed using the assumption that outwash soils are till. (In effect, the applicant shall assume the groundwater is too high to accommodate infiltration, so Ecology's alternative of modeling as till shall be used.)

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Infiltration with Enhanced Treatment Alternative (Applies only in Wellhead Protection Zone 3)

Stormwater draining from pollution generating impervious surfaces may discharge to an infiltration system, in Wellhead Protection Zone 3, with enhanced treatment prior to infiltration. Infiltration of water draining from pollution generating impervious surfaces is not permitted in Wellhead Protection Zones 1 or 2.

Infiltration Alternative (Applies only in Wellhead Protection Zone 4)
Stormwater discharge to an infiltration system is acceptable and encouraged, in Wellhead Protection Zone 4, if appropriate soil conditions exist. Provide treatment in accordance with the Ecology manual. Infiltration of water draining from pollution generating impervious surfaces is not permitted in Wellhead Protection Zones 1 or 2. Infiltration of water draining from pollution generating impervious surfaces is permitted following enhanced treatment in Wellhead Protection Zone 3.

Direct Discharge Alternative (Applies to Sites Draining to Lake Sammamish or the Sammamish River)
Systems directly discharging to the Sammamish River or Lake Sammamish can be exempted from detention by the Stormwater Engineer provided the project proposal includes analysis showing that the existing or proposed conveyance system meets all the requirements for direct discharge in the Ecology Manual and: a) the system conveys the **50-year frequency peak event** for the entire basin without surcharging catch basins above the catch basin rim; and b) the 50-year frequency event does not flood proposed buildings or any existing on-site or off-site buildings. The analysis shall consider full build-out conditions, based on current zoning using the direct discharge option for flow control for those parcels that drain to the conveyance system. The analysis shall consider both conveyance impacts to the system downgradient of the proposed project and also the project's backwater impact to upstream and lateral floo

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conveyance system should be designed to convey the 10-year peak flow. An analysis shall be performed to determine the capacity of the existing or proposed direct discharge system. The analysis shall consider full build-out conditions based on current zoning using the modified detention alternative for direct discharge option for flow control for those parcels that drain to the conveyance system. The analysis shall consider both conveyance impacts to the system downgradient of the proposed project and also the project's backwater impact to upstream and lateral flood stages in the conveyance system. If that system is adequate to convey the 10-year peak flow, within freeboard requirements noted in Chapter 8, then the project site shall include a detention facility sized to release the **50-year developed peak flow at the 10-year developed peak flow** rate. Analysis shall verify that relaxing the detention requirement in this way will not cause downstream flooding or damage to the conveyance system. The conveyance system must also meet all the requirements in the Ecology manual for direct discharge.

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Contribution in Lieu of Flow Control (Applies City-wide Under Certain Conditions)

With approval from the Stormwater Engineer, projects may be required or allowed to provide a contribution toward the cost of a regional detention or conveyance system in certain circumstances, as a means toward partially or fully satisfying flow control requirements. That alternative is discussed in Chapter 8.

2.5.8-Minimum Requirement #8 Wetlands Protection

Used for reference only. Wetland protection is also addressed in the Redmond Community Development Guide.

2.5.9-Minimum Requirement #9 Basin/Watershed Planning

Applies. The City has a Regional Facilities Program that works to identify appropriate regional facilities for conveyance, flow control, and water quality. Contribution to construction of these regional facilities, in lieu of on-site construction of smaller, less-coordinated facilities is required or allowed in some cases. This program is discussed in Chapter 8 of the Stormwater Notebook.

2.5.10-Minimum Requirement #10 Operation and Maintenance

Applies with the following revision:

An operations and maintenance manual shall be prepared for all detention or water quality facilities for review by the Stormwater Engineer as part of the developme
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- the party (parties) responsible for maintenance of the facility, with phone numbers and addresses;
- list of any proprietary components along with information from the vendor describing maintenance schedule and costs;
- what maintenance activities are required, and proposed schedule;
- care and maintenance of any powered devices (aeration);
- inspection procedures and how the maintenance schedule will be modified if inspections determine the facility is not operating properly;
- the minimum requirements for this type of facility as described in Chapter 4 of Volume V of the Ecology Manual as modified in this notebook;

- the minimum requirements for low impact development facilities as described in the following documents:
    - Appendix F of Volume III of the Ecology Manual;
    - the Low Impact Development Technical Guidance Manual for Puget Sound, published by the Puget Sound Action Team, May, 2005 or current edition,
    - Maintenance of Low Impact Development Facilities (Appendix P)
- The final O&M manual shall incorporate any comments made during the development review process, and shall incorporate any field changes made to the facilities during construction.

The review procedure for O&M Manuals shall be as follows:

- For Public Facilities (that will be maintained by the City): A copy of the draft operations and maintenance manual shall be provided to the Stormwater Maintenance Supervisor for Public Works for review at 90% design or earlier. Design of public facilities may be subject to revision through the review process to ensure that the facilities make adequate provisions for maintenance, including easements and physical access requirements. The final O&M manual shall be submitted for review and approval prior to acceptance of the completed construction project. The final approved O&M manual shall be submitted with one hard copy and one electronic copy on CD.

- For Private Facilities (that will be privately maintained): A copy of the draft operations and maintenance manual shall be provided to the Private
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The final O&M manual shall be submitted for review and approval prior to acceptance of the development. The final approved O&M manual shall be submitted with one hard copy and one electronic copy on CD.

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2.6.1 Optional Guidance #1 (Financial Liability)

Regarding financial guarantees, Redmond requires a performance bond to cover the cost of all proposed improvements. These bonds are typically released as improvements are completed and have satisfactorily met all inspection requirements of the City. Performance bonds remain in full force and effect until: 1) the obligations secured are fully performed as determined by the City's inspection program; 2) a bond guaranteeing maintenance and operation of all improvements for a guarantee period have been submitted to the City; and 3) the City has released the bonds in writing.

A maintenance bond will be required to guarantee maintenance and operation of the improvements for a period of one year. This guarantee period may be extended to two years for projects that use low impact development or other innovative technologies.

2.6.2- Optional Guidance #2: Off Site Analysis and Mitigation

The Stormwater Engineer may require additional off-site analysis and mitigation based on the results of the ¼ mile downstream analysis (if required).

2.7- Adjustments

Applies. Applicant shall submit a letter to the Stormwater Engineer to request any adjustments. Additional review or requirements may apply.

2.8- Exceptions/Variances

Applies. Applicant shall submit a letter to the Stormwater Engineer to request any exceptions or variances. Additional review or requirements may apply.

2.3.1.3 Chapter 3: Preparation of Stormwater Site Plans

3.1- Stormwater Site Plans: Step-By-Step

Applies.

3.1.3- Step 3 – Perform an Offsite Analysis

The one-quarter mile distance off-site analysis shall be provided for Medium or Large projects (See Chapter 3 of the Stormwater Notebook) unless specifically waived for a pr

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The drainage report shall be prepared with the following outline:

Drainage Report

A. Cover Page: Project name; project address; name of developer or owner; name, address, and phone number of engineer of record; engineer's stamp; date of report

B. Project Overview:
- o General description of project vicinity
- o Describe existing site hydrology
- o Description of proposed project
- o Description of nearby receiving waters
- o Site Vicinity Map showing site, nearby roads, and receiving waters

C. Minimum Requirements
- o Determine project size: Small, Medium, Large
- o Determine which Minimum Requirements Apply
- o Describe how each applicable requirement is being met

D. Offsite Analysis (See Section 2.6.2 of Ecology Manual Volume I.)
- o Describe study area
- o Upstream Analysis
- o Downstream Analysis
- o Summarize existing problems downstream
- o Summarize how project will avoid exacerbating or correct existing downstream problems
- o If downstream problems can be solved through offsite improvements, those offsite improvements must be sized for full buildout conditions under current zoning.

E. Conveyance Design
- o Pipe sizing
- o Area draining to each structure
- o HGL calculations for all conveyance

F. Flow Control Design
- o Existing hydrology
- o Pro
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- o Su wi elevations, etc.

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G. Water Quality Design
- o Summarize new proposed PGIS and PGPS
- o Summarize treatment level required (basic, enhanced, oil control, phosphorous)
- o Describe contaminants of concern
- o Describe proposed source control measures if applicable
- o Model results
- o Describe design criteria for water quality facilities
- o Summarize dimensions of water quality facilities: volumes, lengths, widths, depths, orifice sizes, bottom elevation, overflow elevations, vegetation types, etc.

- o If site is in Wellhead Protection Zones 1, 2, or 3, describe how proposed facilities will protect groundwater. Describe measures to be taken during construction to protect groundwater.

H. Construction cost estimates for stormwater facilities, if required by the Stormwater Engineer.

I. Draft Operations & Maintenance Manual. As described in Paragraph 2.3.1.2 of the Stormwater Notebook.

J. If low impact development BMPs are proposed, then submit a site assessment in accordance with Paragraph 8.27 of the Stormwater Notebook.

3.1.6- Step 6 – Prepare a Construction Stormwater Pollution Prevention Plan

Applies. Additional requirements are in Chapter 9 and 10 of the Stormwater Notebook.

2.3.1.4 Chapter 4: BMP and Facility Selection Process for Permanent Stormwater Control Plans

4.2 BMP and Facility Selection Process

Applies. Note that the City of Redmond has preferences for certain types of stormwater treatment over others. These preferences are based primarily on long term performance and maintenance cost. Actual selection of facilities must necessarily address site-specific constraints. However, these preferences are provided to help the designer in cases where more than one alternative exists to meet the same needs. Stormwater fees may reflect these preferences (i.e. lower maintenance-intensive facilities may receive credits toward capital facilities charges. Stormwater fees are found in the Redmond Municipal Code 13.20 and 15.24 and
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Treatment methods are designated in the table as follows:

- **Preferred.** These treatment methods are preferred by the City. Stormwater fees reflect this preference.
- **Accepted.** These treatment methods are acceptable to the City.
- **Conditional.** These treatment methods may be allowed based on site specific information, with approval from the Stormwater Engineer.
- **N/A.** These treatment methods are not accepted by the City.

Table 4.4R: Treatment Facility Options in Redmond

Facility Option	Basic	Enhanced	Phosphorous	Oil
Biofiltration Swale	Preferred	N/A	N/A	N/A
Wetpond	Preferred	N/A	N/A	N/A
Infiltration Treatment (Wellhead Protection Zone 4)	Preferred	N/A	N/A	N/A
Bio-infiltration Swale (WPZ 4)	Preferred	N/A	N/A	N/A
Stormwater Treatment Wetland	Preferred	Preferred	N/A	N/A
Large Wet Pond	Preferred	Preferred	Preferred	N/A
Stormwater Treatment Wetland / Sand Filter	Preferred	Preferred	Preferred	N/A
Stormwater Treatment Wetland / Sand Filter Vault	Preferred	Accepted	Accepted	N/A
Bioretention or Rain Garden (WPZ 4)	Preferred	Accepted	N/A	N/A
Phosphorous Control Credit	N/A	N/A	Preferred	N/A
Infiltration Treatment with Basic Treatment (WPZ 4)	Accepted	Accepted	Accepted	N/A
Infiltration Treatment with Enhanced Trtmnt (WPZ 3 4)	Accepted	Accepted	Accepted	N/A
Infiltra 4)			pted	N/A
Media			pted	N/A
Large			pted	N/A
Amen			pted	N/A
Biofiltr			pted	N/A
Biofiltr			pted	N/A
Filter Strip / Linear Sand Filter	Accepted	Accepted	Accepted	N/A
Linear Sand Filter / Filter Strip	Accepted	Accepted	Accepted	N/A
Wet Pond / Sand Filter	Accepted	Accepted	Accepted	N/A
Wet Pond / Sand Filter Vault	Accepted	Accepted	Accepted	N/A
Wet Vault / Sand Filter	Accepted	Accepted	Accepted	N/A
Wet Vault / Sand Filter Vault	Accepted	Accepted	Accepted	N/A
Ecology Embankment	Accepted	Accepted	N/A	N/A
Compost Amended Filter Strip	Accepted	Accepted	N/A	N/A
Biofiltration Swale / Media Filter Vault	Accepted	Accepted	N/A	N/A
Wet Pond / Media Filter Vault	Accepted	Accepted	N/A	N/A
Wet Vault / Media Filter Vault	Accepted	Accepted	N/A	N/A
Sand Filter / Media Filter Vault	Accepted	Accepted	N/A	N/A
Sand Filter Vault / Media Filter Vault	Accepted	Accepted	N/A	N/A
Media Filter Vault (Zeolite/Perlite/Granular Act. Carbon)	Accepted	N/A	N/A	N/A
Sand Filter	Accepted	N/A	N/A	N/A
Filter Strip	Accepted	N/A	N/A	N/A
Wetvault	Accepted	N/A	N/A	N/A
API OWS	N/A	N/A	N/A	Preferred
CP OWS	N/A	N/A	N/A	Accepted
CB Insert	N/A	N/A	N/A	Accepted
Linear Sand Filter	N/A	N/A	N/A	Accepted
Contribution in lieu of Treatment	Conditional	Conditional	Conditional	N/A
Alternative Technologies	Conditional	Conditional	Conditional	Conditional

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Step IV: Step 1: Determine whether you can infiltrate

Infiltration of clean water (water draining from non-pollution generating surfaces) is encouraged throughout Redmond. Infiltration of water draining from pollution generating impervious surfaces in Wellhead Protection Zones 1 or 2 (map available at: http://www.redmond.gov/cityservices/citymaps.asp) is not permitted. Infiltration of water draining from pollution generating impervious surfaces in Wellhead Protection Zone 3 is permitted following enhanced treatment.

Step V: Step 1: Determine the Receiving Waters and Pollutants of Concern Based on Off-Site Analysis.

The City may adopt a basin plan for any watershed in the City that may place additional stormwater requirements. Contact the Stormwater Engineer to

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available from Redmond for the project site.

Step V: Step 3: Determine if Infiltration for Pollutant Removal is Practicable.

Infiltration for pollutant removal of water draining from pollution generating surfaces in Wellhead Protection Zones 1, 2, or 3 (map available at: http://www.redmond.gov/cityservices/citymaps.asp) is not permitted. Infiltration for pollutant removal is permitted in Wellhead Protection Zone 4, provided all requirements in the Ecology Manual are met. Use of infiltration for water quality treatment is also subject to the requirements of the Washington State Department of Ecology's Underground Injection Control program. See Table 3.11R in Section 2.3.3.3 of the Stormwater Notebook.

Step V: Step 4: Determine if Control of Phosphorous is Required.

Phosphorus control treatment is required for "Large Project" sites that drain to Lake Sammamish. The City's watershed map delineates the boundaries between watersheds, and is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp. See Volume V, Chapter 3, Section 3.3.

Step V: Step 5: Determine if Enhanced Treatment is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/trafficcounts.asp*. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step V: Step 6: Determine if Fee in Lieu is Required.

Following review of the step by step process for selecting BMPs and review of Table 4.4R, determine if the project will be required or have the option to pay a fee in lieu of construction of the selected onsite BMPs. See paragraph 8.8 of the Stormwater Notebook.

2.3.1.5 Appendix 1-C:

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2.3.1.7 Glossary and Notations

City Definitions shall be used where applicable. The following definitions are different.

New Development:

A project proposed on vacant land or a project that is a modification or expansion to any existing improvements where the value of the proposed modification is of equal or greater value than the existing improvements. If a project is considered a new development the entire site shall be brought into compliance with the current code. (Ord. 1877 (145))

Predeveloped Condition:

Predeveloped conditions in Redmond shall be modeled as pervious Forest or Pasture, regardless of the basin conditions in the last 20 years. In general, the valley floor was historically pasture or wooded wetland. Historic wooded wetlands should be modeled as pasture. The remainder of Redmond was forested. The map in Appendix N identifies the historical information based on the City's research.

Redevelopment:

The expansion or modification that is of lesser value than the existing improvements. If a project is considered a re-development only the proposed improvements and an equal percentage of the existing improvements shall be brought into compliance with the current code. (Ord. 1877 (160))

Stormwater Engineer:

The Stormwater Engineer is the reviewing authority who reports to the Public Works Director and represents the City for projects that involve stormwater management. Private projects are reviewed by a Stormwater Engineer in the Development Services Division of the City's Public Works Department. Public Capital Improvement Projects are reviewed by a Stormwater Engineer within the Natural Resources Division of the Public Works Department.

2.3.2 Volume II: Construction Stormwater Pollution Prevention

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Additional local requirements can be found in:

- Wellhead Protection Zones (especially Zones 1, 2, and 3) (RCDG 20D.140.50)
- Critical Areas Regulations (RCDG 20D.140)
- Construction Stormwater Pollution Prevention (Chapter 9 of the Stormwater Notebook)
- Rainy-Season construction guidelines (Chapter 10 of the Stormwater Notebook)
- State regulations provide that turbidity in receiving waters shall not be increased over 5 NTU above existing levels due to runoff from a construction site. In addition to that regulation, Contractor shall take all necessary TESC measures to ensure that runoff from a site does not exceed 50 NTU (during construction). All or parts of a project shall be required by City Inspectors to be shut down until a satisfactory plan is developed and implemented with additional TESC measures as needed to meet these requirements. If the violations occur in the Rainy Season (October 1 through April 30) suspension of work until after April 30 may be required.

2.3.2.3 Chapter 3: Planning

3.1-General Guidelines

Stormwater pollution prevention plans are not required for Small Projects as defined in Chapter 3 of the Stormwater Notebook.

3.2.3- Step 3 - Construction SWPPP Development and Implementation

Element #4- BMP C230: Straw bale barrier and BMP C231: brush barrier are not allowed in Redmond.

Element #12- Refer to Chapter 10 of this document for seasonal restrictions/exemptions.

3.3.2-Drawings

Narrative section of Construction SWPPP Checklist applies. Refer to City Standard Notes (Appendix L) and City Plan Review Checklist (Appendix F) for SWPPP

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Project Planner.

BMP C103- High visibility plastic or metal fence. Refer to Redmond Standard Specifications and Details.

BMP C104- Stake and wire fence. Not approved in Redmond.

BMP C105- Stabilized construction entrance. Refer to Redmond Standard Specifications and Details.

BMP C106- Wheel wash. Refer to Redmond Standard Specifications and Details.

BMP C121- Compost mulch may only be used on proposed landscape areas. It is not approved as a general TESC mulch in Redmond.

BMP C140- Chemical dust suppressants are not approved for use in Redmond.

BMP C202- Rubble concrete channel lining is not approved in Redmond.

BMP C204- Pipe slope drain. Note that this is "temporary" only.

BMP C205- The minimum subsurface drain size shall be 6" diameter.

BMP C220- Catch basin filters are required in Redmond for storm drain inlet control. Provisions shall be made to remove filters at the end of the project without dropping accumulated sediment into the catch basin.

BMP C230- Straw Bales. Not approved in Redmond.

BMP C231- Brush Barrier. Not approved in Redmond.

BMP C233- Silt fence. Refer to Redmond Standard Specifications and Details.

BMP C234- Vegetated strips shall have a minimum length of 200 feet.

BMP C24

BMP C24
storm. Si

BMP C25
standard
the 100-year 7-day storm volume unless otherwise approved by the Stormwater Engineer.

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Appendix II-A- Use Redmond Standard Notes (See Appendix L of the Stormwater Notebook).

2.3.3 Volume III: Hydrologic Analysis and Flow Control BMPs

2.3.3.1 Chapter 1: Introduction

1.2- Content and Organization of this Volume

The 2005 Ecology Manual notes that conveyance system design is not addressed in that manual. See Chapter 8 of the Stormwater Notebook.

2.3.3.2 Chapter 2: Hydrologic Analysis

2.1- Minimum Computational Standards

Applies.

2.2- Western Washington Hydrology Model

For basins over 320 acres in size HSPF shall be used.

For commercial sites use actual proposed impervious area for the developed condition. For single-family developments use 80% of the maximum impervious area allowed by the zoning code. Detention systems serving Planned Residential Developments (PRDs) shall be designed based on the allowed maximum impervious lot area. Do not apply the 80% to PRDs. For single family lots, 4,200 s.f. impervious area per lot may be used with approval from the Stormwater Engineer.

Credits for infiltration of roof runoff or use of porous pavement require demonstration that stormwater is "clean" (draining from non-pollution generating [illegible] nearby.

2.3.3.3 Chapter 3:

Chapter 2 is replaced by Addendum, August 18, 2010

3.1-Roof Do

Applies only [illegible] detached Accessory Dwelling Unit).

Section 3.1.3 applies to single family detached homes with modifications as follows:

- The setback from any structure, property line, or steep slope (over 40%) shall be 50 feet minimum.
- The perforated pipe shall not be located where percolating water will encounter and be intercepted by another nearby (within 25 feet) utility trench or foundation drain.

Figure 3.1-Flow Diagram Showing Selection of Roof Downspout Controls

Does not apply. Use Figure 3.1R, below, instead.

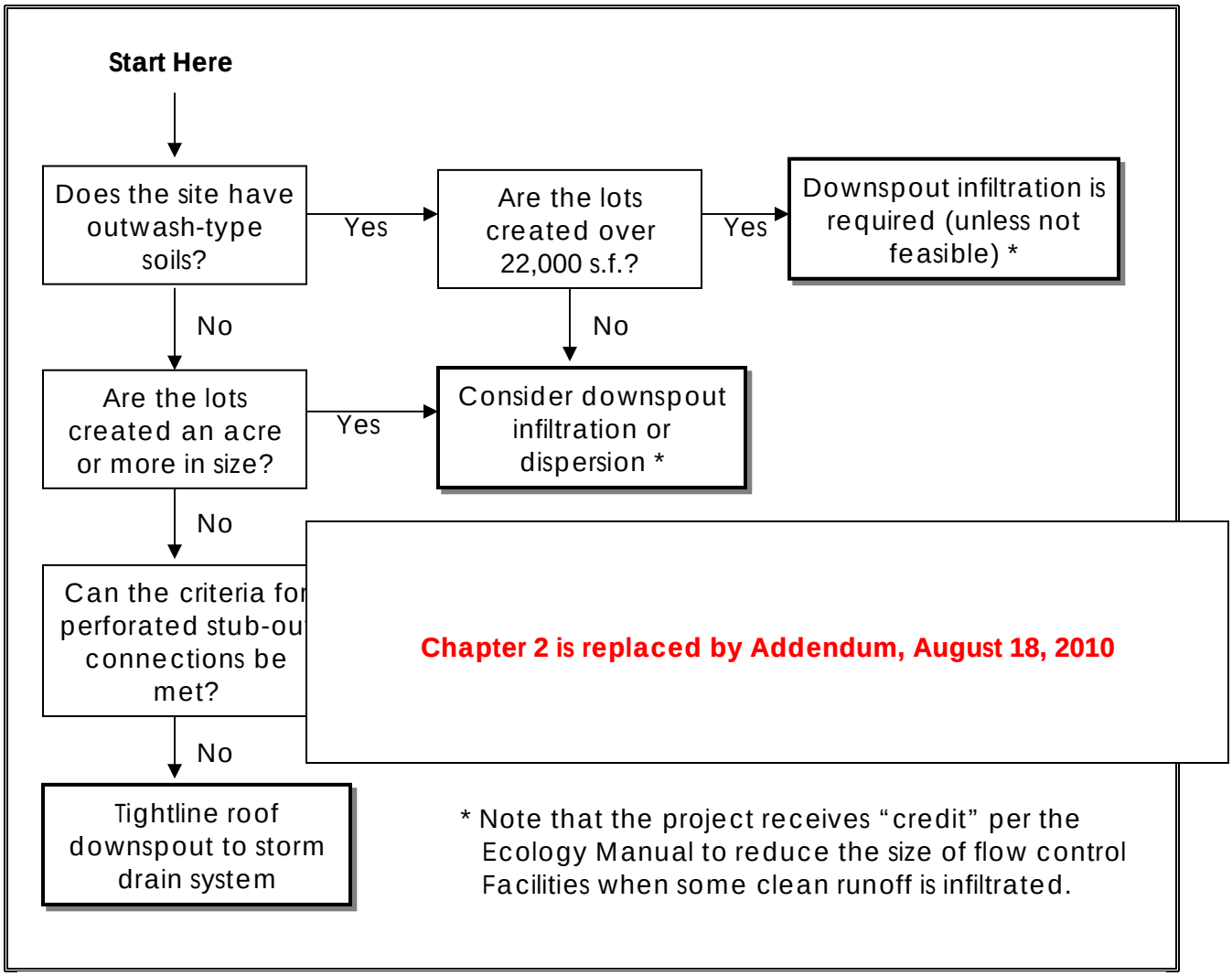

Figure 3.1R Diagram for Selection of Roof Downspout Controls in Redmond (Single Family Homes Only)

Figure 3.2-Typical Downspout Infiltration Trench

6" minimum diameter pipe required. Flexible single wall pipe is not approved in Redmond.

Figure 3.4-Typical Downspout Infiltration Drywell

6" minimum diameter pipe required.

3.2.1-Detention Ponds

Proposed slopes shall be 3:1 or flatter. Up to 25% of the pond perimeter may have vertical walls. Anything greater will require approval of the Stormwater Engineer.

Modular grid pavement is only allowed if specifically approved by the Stormwater Engineer.

Ponds shall be setback a minimum of 10 feet from structures, property lines or required vegetated buffers, and 50 feet from the limits of steep slope areas. The setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide. Conveyance pipes in steep slope areas shall be installed on the surface of the slope, with the minimum disturbance possible, and shall require applicable City approvals.

Minimum setback required for trees is 8 feet in Redmond. Trees shall be setback one (1) vertical foot above the maximum storage elevation to provide maintenance access and liner protection. Trees shall not be planted over any pond liner.

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Impervious bottoms and sides shall extend up to the stage of the 50-year event.

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Combination infiltration / detention ponds may be approved by the Stormwater Engineer, subject to the restrictions on infiltration in wellhead protection zones noted in Table 3.11R below.

Pond control structures shall be accessible by a Vactor truck. A backhoe must be able to access each pond for maintenance. The detention pond emergency overflow route must be independent from the primary outflow system.

Signs shall be posted at all stormwater ponds using the standard sign format described in Appendix M. There are several alternative sign formats, and they shall be selected based on the following:

- Ponds greater than 5000 square feet in size shall receive the large (24 x 48) sign. Smaller ponds may have either the small (12 x 18) or the large sign.
- Public ponds shall receive the sign with the City of Redmond logo. Private pond signs shall not include the logo, but shall indicate they are privately owned and maintained.
- Ponds with liners shall receive the sign indicating the liner. Ponds that infiltrate shall have the sign indicating the infiltration.

Ponds shall be named by the project proponent. The pond name shall be unique to the City of Redmond. In general, the pond name shall be the same as the name of the subdivision in which the pond is located. Pond names are subject to approval by the Stormwater Engineer.

Figure 3.12- Example of Permanent Surface Water Control Pond Sign

See Appendix M of the Stormwater Notebook for City of Redmond standard sign.

3.2.2- Detention Ta

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Corrugated metal

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Tanks shall be setb
required vegetated buffers, and 25 feet from the limits of steep slopes. The setback from steep slope may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide. For limitations on tree planting, see tree separation information for pipes in Chapter 8.

Add the following note to drawings that include detention tanks: "Pressure tests may be required by the City Inspector. Tanks that do not pass pressure tests shall be repaired or replaced." Avoiding leakage is particularly critical in Wellhead Protection Zones 1, 2, and 3.

Maintenance must be feasible and designs should strive to facilitate maintenance (design adjustments to facilitate maintenance may be required during plan review).

3.2.3- Detention Vaults

Vaults shall be setback a minimum of 10 feet from structures, property lines, required vegetated buffers, and 25 feet from the limits of steep slopes. The Stormwater Engineer may approve integrated vaults constructed as part of a

building structure. The setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide.

Vault setbacks from property lines or right-of-way limits must be a minimum of 10 feet, or the distance required to excavate a 1:1 slope from the bottom of the vault to the ground surface at the right-of-way or property line – whichever is greater. Trees may be as close as 2 feet from concrete vaults provided the trees do not interfere with access for maintenance. Specify shallow rooted trees by species on the project landscape plans for locations closer than 8 feet to vaults.

Maintenance must be feasible and designs should strive to facilitate maintenance (design adjustments to facilitate maintenance may be required during plan review).

Figure 3.17-Flow Restrictor (TEE)

Refer to City Standard Detail in "City of Redmond Standard Specifications and Details"

Figure 3.18-Flow Restrictor (Baffle)

Refer to City Standard Detail in "City of Redmond Standard Specifications and Details"

Figure 3.19-Flow Res

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3.2.5- Other Detentio

Parking lot ponding
maximum ponding depth of 6 inches is allowed. The 50-year event may not impact any buildings or other structures. Provisions to bypass offsite flows shall be included in design of parking lot detention.

Roof detention is not allowed in Redmond at this time.

3.3- Infiltration Facilities for Flow Control and for Treatment

Protection of the drinking water resource is a very high priority in Redmond. Therefore, infiltration of stormwater, even with treatment, is limited within Wellhead Protection Zones (map available at: http://www.redmond.gov/cityservices/citymaps.asp). Table 3.11R summarizes available options for infiltration.

Table 3.11R: Infiltration Options by Wellhead Protection Zone				
Facility Type	**WPZ 1**	**WPZ 2**	**WPZ 3**	**WPZ 4**
Infiltration for flow control per Ecology Manual	No	No	No	Yes
Infiltration as treatment per Ecology Manual	No	No	No	Yes
Infiltration for flow control following enhanced treatment	No	No	Yes	Yes
Infiltration of flow from non-pollution generating surfaces (roofs, sidewalks, etc.) for flow control	Yes	Yes	Yes	Yes

Infiltration of water draining from pollution generating impervious surfaces is not
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appropriate signage at inlets) are in place to prevent contamination of that water or clogging of the infiltration facility.

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Stormwater infiltration systems that include perforated pipe or drywells are also subject to Washington State Department of Ecology's Underground Injection Control Program. All such infiltration systems shall meet the groundwater protection requirements of Ecology's document, "Draft Guidance for UIC Wells that Manage Stormwater, February 2006", or the current revision.

3.3.5- Site Characterization Criteria

The soil infiltration rate may be determined by a falling head test conducted by a qualified engineer using commonly accepted methods. Infiltration locations will be considered unacceptable if the design infiltration rate is less than 1.0 inches/hour. In no case shall the design infiltration rate be more than 20.0 inches/hour.

Notify the City of Redmond's Wellhead Protection Program prior to installing groundwater monitoring wells. The City may consider allowing placement of such wells within public right-of-way if the City wishes to assume responsibility for the wells in the future. All wells shall either be required to be properly abandoned when they are no longer needed, or may be requested to be turned over to the City for ongoing monitoring by City staff.

3.3.6- Site Suitability Criteria (SSC)

At least 200 feet shall be provided for separation from public wells. Public wells are located within Wellhead Protection Zone 1. A map of wellhead protection zones is available at: http://www.redmond.gov/cityservices/citymaps.asp.

3.3.9-General Design, Maintenance, and Construction Criteria for Infiltration Facilities

Construction plans shall include a note to require field verification during construction of the facility, of soil conditions, and infiltration rates by an engineer with experience in stormwater management and licensed in the State of Washington. The engineer shall provide a written statement to the City of Redmond related to the field verification of the design parameters.

3.3.10- Infiltration Basins

Infiltration basins shall meet the same requirements for slopes, fences, signage, etc. as detention ponds.

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WWHM Information and Assumptions

5. Vegetation data

Predeveloped conditions shall be modeled as forested or pasture land cover. Forested land cover shall be used, except for the valley floors associated with the Sammamish River, Bear Creek, Evans Creek, and Lake Sammamish. For these valley floors, pre-developed condition is "pasture land cover." 100% of the site shall be assumed pervious. A map of historical land cover is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp.

6. Development land use data.

For commercial sites use actual proposed impervious area for the developed condition. For single-family developments use 80% of the maximum impervious area allowed by the zoning code. For single family lots, 4,200 s.f. impervious area per lot may be used with approval from the Stormwater Engineer.

2.3.3.5 Appendix IIIC: Washington State Department of Ecology Low Impact Development Design and Flow Modeling Guidance

Note: Use of low impact development BMPs requires more thorough site assessment than traditional measures. See Paragraph 8.29 of the Stormwater Notebook.

7.1 Permeable Pavements

Use of permeable pavements is subject to approval by the Technical Committee. Use of permeable pavements as pollution generating impervious surface is not allowed. A maintenance plan is required. Use of modular pavements in fire lanes is discouraged and is subject to approval from the Technical Committee.

7.2 Dispersion

7.2.5 Dispersion in Urban Areas

As noted in paragraph 2.3.5.5 of this Stormwater Notebook, full site dispersion is only allowed in rural zoned lots of 5 acres or more. However, if native soils are preserved, or are amended with compost, they provide great benefits for reduction of stormwater runoff, even in till soils. Flow credits available for compost-amended soils are described in paragraph 2.3.5.5.

2.3.4 Volume IV: Source Control BMPs

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2.3.5 Volume V: Runoff Treatment BMPs

2.3.5.1 Chapter 1: Introduction

Applies. See Table 4.4R in Section 2.3.1 of the Stormwater Notebook.

2.3.5.2 Chapter 2: Treatment Facility Selection Process

Applies. Note that the City of Redmond has preferences for certain types of stormwater treatment over others. These preferences are based primarily on long term performance and maintenance cost. Actual selection of facilities must necessarily address site-specific constraints. However, these preferences are provided to help the designer in cases where more than one alternative exists to meet the same needs. Stormwater fees may reflect these preferences (ie lower maintenance-intensive facilities may receive credits toward capital facilities charges. Stormwater fees are found in the Redmond Municipal Code 13.20, 15.24 and Appendix E.) Capital improvement projects, or projects not subject to stormwater fees shall involve the Stormwater Engineer early in the design process to ensure selection of stormwater treatment facilities that best meet the long term goals of the City. The Stormwater Engineer may direct substitution of an alternative treatment method based on these preferences. Table 4.4R, above, describes some of the City's preferences.

Step 1: Determine the Receiving Waters and Pollutants of Concern Based on Off-Site Analysis.

The City may adopt a basin plan for any watershed in the City that may place additional stormwater requirements. Contact the Stormwater Engineer to determine if any basin plans apply to your project site.

Step 2: Determine if an Oil Control Facility/Device is Required.

Traffic counts in Redmond are available for some roadways at:
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http://www.redmond.gov/cityservices/citymaps.asp) is not permitted. Infiltration for pollutant removal is permitted in Wellhead Protection Zone 4, provided all requirements in the Ecology Manual are met. Use of infiltration for water quality treatment is also subject to the requirements of the Washington State Department of Ecology's Underground Injection Control program. See Table 3.11R in Section 2.3.3.3 of the Stormwater Notebook.

Step 4: Determine if Control of Phosphorous is Required.

Phosphorus control treatment is required for "Large Project" sites that drain to Lake Sammamish. The City's watershed map delineates the boundaries between watersheds, and is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp. See Volume V, Chapter 3, Section 3.3.

Step 5: Determine if Enhanced Treatment is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/trafficcounts.asp*. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step 6: Determine if Fee in Lieu is Required.

Following review of the step by step process for selecting BMPs and review of Table 4.4R, determine if the project will be required or have the option to pay a fee in lieu of construction of the selected onsite BMPs. See paragraph 8.8 of the Stormwater Notebook.

2.3.5.3 Chapter 3: Treatment Facility Menus

3.2-Oil Control Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

3.3-Phosphorous Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

Projects within the Lake Sammamish Basin that are Large Projects as defined in Cha #6) are

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1. **Leaving part of the site undisturbed, including undevelopable land.** Full credit, or 10 points, is awarded for leaving 65 percent of a site in undisturbed native vegetation or areas re-established in native vegetation. Critical Areas and their buffers may be counted. All areas for phosphorus credit must be in tracts dedicated to the City protected in accordance with the requirements set forth for general critical area protective measures in Chapter 20D.140.10-180 of the Community Development Guide. A descending scale of points applies where lower percentages of the site are left undisturbed. Possible credit = 1 to 10 points.

2. **Directing runoff from pollution-generating surfaces to grassy areas with level spreading.** Directing runoff from pollution-generating areas to grassy areas that are not fertilized (a notice shall be made on the plat and signage posted to this effect) or to areas of native vegetation (protected by critical area tract) results in pollutant removals similar to those obtained in swales while also providing an increased opportunity for infiltration. To use this option, flows must remain unconcentrated and be spread uniformly over the intended area. The vegetated area receiving dispersed flows should be at least 25 percent as large as the area contributing flow. The receiving area should be increased by one percent for each percent increase in slope over four percent. The area should be configured so that the length of the flow path is no longer than the width over which flows are dispersed.

Example:

Assume a parking lot is 100'x600', or 60,000 sf. Flows will be dispersed through an adjacent area of native vegetation with a slope of 8 percent.

The area of vegetation must be at least 17,400 sf (25% +4% (for steeper slope) x 60,000 sf). Assuming runoff is dispersed continuously along the wider edge of the parking lot, the flow path would need to be at least 29 feet (17,400' ÷ 600'). If the water were dispersed along the shorter edge, flow path would be 174 feet (17,400' ÷ 100'). However, this flow path would be longer than the width over which flows were dispersed (100'), and would not be a satisfactory option. The parking lot could

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3. **Providing covered parking areas isolated from the stormwater conveyance system.** This item applies to all land uses for which covered parking for employees, residents, guests, and the general public is provided. This can be achieved for commercial land uses simply by covering the parking required by code. For other land uses, provision of additional covered parking for guests or the general public (total parking) in lieu of on-street parking can be used to provide this assurance. It is intended that covered parking would isolate the area from stormwater run-on as well as direct rainfall. A low curb, berm, or enclosing walls, in addition to a roof, would typically be needed. The water quality credit is proportional to the percentage of the total surface area that is effectively covered. One point is earned for every 25 percent of parking covered and

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sanitary sewer. Possible credit = 3 points

5. **Providing covered waste disposal and recycling areas isolated from the stormwater conveyance system.** One point is earned if all solid waste management areas are covered and protected from stormwater run-on. Possible credit = 1 point

Credit shall be applied to the whole site.

If the credit option is used, it should be applied for during initial drainage review by the City. The preliminary stormwater report should include a written request for credit based on either the site plan or the grading plan for the project. The request should outline how the point totals are to be achieved. Credit is not given unless requested. Use of the credit option does not release the project from the need for basic or enhanced treatment (as applicable).

Table 3.3R Water Quality Credit for Phosphorus Control	
Credit Option	Points
Leaving site undisturbed, in native vegetation. Buffers without trails may be counted.	At least 65 % = 10 60 % = 9 55 % = 8 50 % = 7 45 % = 6 40 % = 5 35 % = 4 30 % = 3 25 % = 2 20 % = 1
Directing ro vegetated	= 4 = 3 = 2 = 1
Covered pa	= 4 = 3 50 % of parking = 2 25% of parking = 1
Covered car wash area connected to sanitary sewer (multi-family)	3
Covered solid waste storage area	1

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3.4-Enhanced Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

3.5-Basic Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

2.3.5.4 Chapter 4: General Requirements for Stormwater Facilities

4.3.2-Side Slopes and Embankments

Up to 25% of the pond perimeter may have vertical walls. Anything greater will require approval of the Stormwater Engineer. Provide fence along slopes greater than 3:1.

4.4.1-General Design Criteria

Liners are required for all water quality ponds and most detention ponds (impermeable till layer, synthetic liner or bentonite).

4.4.3-Design Criteria for Low Permeability Liner Options

Concrete liners are not approved in Redmond.

4.5.3-Outfall Systems

Drop structures are not allowed unless specifically approved by the Stormwater Engineer.

Table 4.5-Maintenance Standards

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2.3.5.5 Chapter 5: On-Site Stormwater Management

BMP T5.10 Downspout Dispersion

Downspout dispersion shall only be used on sites that drain to native growth protection easements. Also, see additional requirements in paragraph 2.3.3.3.

BMP T5.13 Post-Construction Soil Quality and Depth

For landscaped areas and lawns, compost-amended soils are encouraged to be used. Compost-amended soils shall be installed in accordance with the requirements specified in “Guidelines for Landscaping with Compost-Amended Soils” in Appendix Q. If landscaped areas and lawns have slope lengths of at least 50 feet and are made up of contiguous areas with a minimum area of 500 square feet, then landscaped areas with compost-amended soils may be considered to be pasture when modeling with WWHM.

Compost-amended areas shall be marked to prevent vehicle traffic in those areas.

BMP T5.20 Preserving Natural Vegetation

Preserved areas shall be set aside as native growth protection easement and marked accordingly. No vehicle traffic shall be permitted in preserved areas. Full dispersion is only allowed on rural (5-acre minimum) lots.

BMP T5.30 Full Dispersion

Full dispersion credit is only allowed on rural (5-acre minimum) lots.

2.3.5.6 Chapter 6: Pretreatment

Applies

2.3.5.7 Chapter 7: Infiltration and Bio-infiltration Facilities

Applies. Note that infiltration for treatment is not allowed in Wellhead Protection Zones 1, 2, or 3.

2.3.5.8 Chapter 8: Sand Filtration Treatment Facilities

Applies

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quality facilities shall be lined (e.g. geomembrane) in Wellhead Protection Zones 1, 2, and 3, and shall be lined in other areas unless constructed over at least one foot of compacted till (native or constructed).

If biofilters are not able to be located off-line, the swale shall be designed so the maximum flow possible in the swale up to the 50 year does not produce a velocity over 3 feet per second.

The size and shape of biofilters (and other surface features) shall be compatible with the terrain and not detract from the landscape value (the latter as determined by the Technical Committee).

At least one side of each biofilter shall be accessible for maintenance by a backhoe.

Plant no trees within 8 feet of biofiltration swale banks. Their resulting shade and leaves impact the dense vegetated cover required for biofiltration. In designing the landscaping for the area, and placement of the biofiltration swale, take into account the need for sunlight within the swale.

Table 9.1- Sizing Criteria

Underdrains are not required.

Figure 9.2-Biofiltration Swale Underdrain Detail

Underdrains are not required.

2.3.5.10 Chapter 10: Wet Pool Facility Designs

10.3-Best Management Practices (BMPs) for Wetpool Facilities

See requirements for Detention Ponds in Volume III.

Provide a 5-foot wide level bench around the perimeter of the pond at or up to 1 foot below the permanent water surface.

All water quality ponds shall be lined to prevent infiltration. Lining may consist of an impermeable till layer 18 inches or thicker, bentonite or synthetic liners approved by the Stormwater Engineer. When a geomembrane is used, provide an analysis demonstrating that the required cover soil will be stable against sliding when saturated.

Gravity drains are not required for wet ponds or vaults. Access roads to the pond b

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setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide.

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A minimum, average depth of 3 feet is required for water quality treatment in vaults and tanks.

Storm pipes should discharge into wet ponds at/or above the normal control elevation (elevation of outlet pipe invert). Designs that include pipes discharging below the control elevation must include an analysis demonstrating that sediment will not accumulate within the pipe.

To avoid anaerobic conditions, wet ponds should not have permanent pool depths greater than 8 feet, unless aeration is provided. For publicly owned and maintained ponds, aeration requires approval from the Stormwater Engineer.

2.3.5.11 Chapter 11: Oil and Water Separator BMPs

11.7 Oil and Water Separator BMPs

API separators rise rate shall be 0.2187 foot/minute.

2.3.5.12 Chapter 12: Emerging Technologies

12.7- Use of Emerging Technologies in Redmond

The use of emerging technologies is not discouraged in Redmond, but will require more careful scrutiny, additional submittals, and may require post-construction monitoring. In general:

- Technologies that have received General Use (GULD) designation are acceptable for use in Redmond, within the guidance and recommendations for use provided by Ecology.
- Technologies that have received Conditional Use (CUD) designation are acceptable for use in Redmond, within the guidance and recommendations for use provided by Ecology.
- Technologies that have received Pre-Conditional Use (PCUD) designation are considered on a case-by-case basis.

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Contact the Stormwater Engineer to discuss use of emerging technologies. Final approval will be by a committee that includes a representative from the Natural Resources Division, the Development Services Division, and the Construction Division of Public Works.

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CHAPTER 3: PROJECT CLASSIFICATION IN REDMOND

Projects that involve clearing, grading, installation of new impervious surfaces, or modification of drainage patterns are subject to the requirements described in this Stormwater Notebook and the Redmond Municipal Code, Chapter 15.24.050.

Some very small projects may not require permits. See Redmond Municipal Code Chapter 15.24 (Appendix A) for minimum permit project size. For purposes of stormwater management in Redmond, projects are classified as Small, Medium, or Large.

3.1 Small Projects

Projects require a clearing and grading permit if they:

- Move over 50 CY of soil; or
- Change the topography by more than four feet; or
- Perform work within a City of Redmond easement or right-of-way; or
- Work with a stormwater pipe 12-inches in diameter or greater; or
- Clear 7,000 SF of land; or
- Remove more than 10 trees; or
- Add 2,000 SF or more of impervious surface; or
- Work within a Critical Area or buffer as defined in the Community Development Guide; or
- Modify a private water quality or flow control stormwater facility.

Projects are Small Projects if they involve:

- Less than 2000 square feet of new and/or replaced impervious surface; and
- Less than 7000 square feet of land disturbance; and
- Less than 500 CY of grading.

Small projects shall comply with the requirements described in Chapter 4.

3.2 Medium Projects

Projects are Medium Projects if they involve areas that exceed any of the criteria above for Small Projects and involve:

- Less than 5000 square feet of new impervious area; and
- Less than ¾ acre of native vegetation converted to lawn or landscaped areas; and
- Less than 500 CY of grading; and
- Less than 2.5 acres of native vegetation converted to pasture.

Medium projects shall comply with the requirements described in Chapter 5.

3.3 Large Projects

Projects are Large Projects if they involve areas that exceed one or more of the criteria above for Medium Projects.

Large projects shall comply with the requirements described in Chapter 6.

CHAPTER 4: SMALL PROJECT REQUIREMENTS

4.1 Project Classification

See Chapter 3 for project classification.

4.2 Project Requirements

Small Projects are required to meet Minimum Requirement #2 of the 2005 Ecology Manual. This minimum requirement lists provisions for stormwater management during construction. Those provisions are excerpted and included in Appendix C. Note that Chapter 2 of the Stormwater Notebook amends some of those requirements. The standard notes in Appendix L shall appear on all site plans, and apply to Small Projects.

4.3 Permit Process for Small Projects

The following is an overview of the steps and requirements for projects that require only a Clearing/Grading and Stormwater Management approval (and no other approvals). Projects requiring other permits may have additional steps and requirements. Consult the Development Services Center for additional guidance.

Table 4: Small Project Requirements

Responsible Party	Activity
Applicant	**I. Project Proposal** <u>Prepare project submittal</u> – see requirements below.
Applicant	**II. Complete and Submit Applications** All the following must be completed and submitted to the Stormwater Engineer for review for the application to be considered complete. Only complete applications will be processed. A. One (1) copy of a completed General Application form (found in Appendix D of the Stormwater Notebook and available at the Development Services Center). B. One (1) set of plans and computations including the applicable information on the application requirements checklist.

Table 4: Small Project Requirements	
Responsible Party	**Activity**
City	**III. City Review Process** A. The project engineer or applicant will be contacted when the review is complete. B. The plans and computations are red-lined and one (1) set of each is returned to the applicant with a Plan Review Checklist completed by the City.
Applicant	**IV. Revision and Resubmittal, if Required.** A. Revise plans per the City's comments. B. Resubmit the last set of red-lined prints and computations, the Plan Review Checklist and one (1) set of revised plans and computations as stated above.
City	**V. Review of Revised Plans** A. Once all comments have been satisfactorily addressed, the City will proceed with plan approval. B. The project engineer or applicant will be contacted.
Applicant	**VI. Submit Original Plans for City Approval.**
City	**VII. Plan Approval** Plans are approved by signature and returned to the applicant or engineer for reproduction as required.
Applicant	**VIII. Submittal of Permit Prints** Submit three (3) sets of prints made from the signed plans to the Stormwater Engineer.
City	**IX. Permit Preparation and Plan Distribution** The Stormwater Engineer prepares the permit letter, signs it, calculates the remaining fee, and determines performance bonds per the standard list. The project engineer or applicant will be contacted when the permit is ready to be issued.

Table 4: Small Project Requirements	
Responsible Party	**Activity**
Applicant	**X. Obtain Permit** When applicant is notified that the permit is ready to issue, applicant needs to come to the Development Services Center and pay any remaining fees and post required bonds. The Permit Letter is then issued.
Applicant	**XI. Pre-Construction Meetings** After plan approval and after submitting permit prints, applicant may be required to contact the Construction Division and schedule a Pre-Construction Meeting. Contact the Construction Division at (425)556-2723 for the date, time, and location (the inspector may have the meeting at the site). In addition to permit issuance, <u>construction may not begin before having a Pre-Construction Meeting (unless waived by the Construction Division).</u>
Applicant	**XII. Construction** The applicant shall complete all activities identified in the approved plans to meet City of Redmond standards. As items are completed, and at appropriate times during construction (i.e. before utilities are buried) the applicant shall notify the City Inspector assigned to the project at the Preconstruction Conference that elements are ready for inspection. Failure to notify the City of readiness for inspection in a timely manner may result in the requirement to remove and replace buried or hidden elements.
City	**XIII. Release of Performance Bonds** Performance bonds remain in full force and effect until 1) the obligations secured are fully performed to the satisfaction of the City's inspectors; 2) a bond guaranteeing maintenance of all improvements for a guarantee period have been submitted to the City; and 3) the City has released the bonds in writing.

Table 4: Small Project Requirements	
Responsible Party	**Activity**
City	**XIV. Cancellation of Non-Issued Permits** A. The permit is only valid for a designated time. It may be to the applicant's benefit to wait until construction is ready to begin before picking up the permit. B. The permit will be held for a maximum six (6) months without issuance (unless specifically stated otherwise in the conditions of approval) but will then be nullified after this period if not picked up. The permit application would have to be started again, from the beginning, if the project is still desired. A new application may be required by the Public Works Department.
Applicant	**XV. Permit Extension Request – (Optional)** A. If the proposed work cannot be completed within the time covered by the permit an extension may be granted. Additional fees for inspection and renewal are required for extension. B. <u>The applicant must submit a written extension request to the Stormwater Engineer at least two (2) working days before the expiration of the permit.</u>

4.4 Fees for Small Projects

Fees are charged for plan review and City inspection. Appendix E includes the Schedule of Public Works Fees that was current at the time the Stormwater Notebook was published. Updates are available from the Development Services Center.

Small project fees often include but are not limited to:

- Small & Simple Projects: Review
- Small & Simple Projects: Inspection

Consult the Development Services Center to determine what actual costs you can expect based on the specifics of your project.

Performance security may be required prior to issuance of a permit. Security requirements are determined after application.

4.5 Project Plan Submittal

The detail required for plans submitted for small projects is extremely variable, from very simple, hand-drawn plans, to detailed engineering drawings and reports. Request a meeting with the Stormwater Engineer to discuss your project specifics.

Note that if the project triggers State Environmental Policy Act (SEPA) thresholds, the permitting process will be more complex. Examples of SEPA thresholds include:

- Projects include stormwater pipes greater than 12-inches in diameter.
- Projects are located in Critical Areas (See RCDG 20D.140) such as:
    - Wetlands
    - Wetland buffers
    - Streams
    - Stream buffers
    - Critical wildlife habitat areas
    - Steep slopes
    - FEMA Floodways
    - Wellhead Protection Zones 1, 2, and 3.

Contact the Development Services Center at (425)556-2473 or the Development Services Division at (425)556-2760 for further information about Critical Areas.

4.6 Construction Stormwater Pollution Prevention

Small projects shall comply with the requirements of Minimum Requirement #2: Construction Stormwater Pollution Prevention, as described in the 2005 Ecology Manual. A description of those requirements is excerpted and included as Appendix C.

In addition to those requirements, the following shall apply:

- It shall be the responsibility of the contractor to obtain street use and other related permits prior to any construction.
- It shall be the responsibility of the contractor to verify the correct locations of utilities to avoid damage or disturbance.
- Keep project impacted off-site streets clean at all times. Use sweepers, flushing streets shall not be allowed.
- Tie impervious surfaces (roof, streets, driveways, etc.) to completed drainage system as soon as possible.
- The City will order stoppage of work and will order sampling and analysis of stormwater discharges, if stormwater controls do not meet standards described in paragraph 2.3.2.2 above.

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CHAPTER 5: MEDIUM PROJECT REQUIREMENTS

5.1 Project Classification

See Chapter 3 for project classification.

5.2 Project Requirements for Medium Projects

Medium Projects are required to meet Minimum Requirements #1 through #5 of the 2005 Ecology Manual. Note that Chapter 2 of the Stormwater Notebook amends some of those requirements. Medium projects also have more strenuous requirements for construction stormwater pollution prevention, as outlined in Chapters 9 and 10.

5.3 Permit Process for Medium Projects

The following is an overview of the steps and requirements for projects that require only a Clearing/Grading and Stormwater Management approval (and no other approvals). Projects requiring other permits may have additional steps and requirements. Consult the Development Services Center for additional guidance.

Table 5: Medium Project Requirements

Responsible Party	Activity
Applicant	**I. Project Proposal** A. Prepare project submittal – see requirements below. B. Prepare SEPA Checklist (if required – Consult Stormwater Engineer prior to application). 1. If any work is proposed in a Critical Area the City will require the completion of the SEPA environmental checklist. The Technical Committee may require any project to complete the SEPA process. 2. Checklists are available at the Development Services Center. Redmond has modified the state standard checklist. Therefore, only a City of Redmond SEPA Checklist will be accepted. Complete the checklist to the best of your ability.

Table 5: Medium Project Requirements	
Responsible Party	**Activity**
Applicant	**II. Complete and Submit Applications** All the following must be completed and submitted to the Stormwater Engineer for review for the application to be considered complete. Only complete applications will be processed. A. One (1) copy of a completed General Application form (found in Appendix D of the Stormwater Notebook and available at the Development Services Center). (If SEPA is required, submit 8 copies of the General Application form.) B. One (1) set of plans and computations including the applicable information on the application requirements checklist. C. Projects that require SEPA approval will be processed through the Technical Committee. Submit nine (9) copies of the SEPA document(s). D. Application fee.
City	**III. City Review Process** A. The project engineer or applicant will be contacted when the review is complete. B. The plans and computations are red-lined and one (1) set of each is returned to the applicant with a Plan Review Checklist completed by the City.
Applicant	**IV. Revision and Resubmittal, if Required.** A. Revise plans per the City's comments. B. Resubmit the last set of red-lined prints and computations, the Plan Review Checklist and one (1) set of revised plans and computations as stated above.
City	**V. Review of Revised Plans** A. Once all comments have been satisfactorily addressed, the City will proceed with plan approval. B. The project engineer or applicant will be contacted.
Applicant	**VI. Submit Original Plans for City Approval.**

Table 5: Medium Project Requirements	
Responsible Party	**Activity**
City	**VII. Plan Approval** Plans are approved by signature and returned to the applicant or engineer for reproduction as required.
Applicant	**VIII. Submittal of Permit Prints** Submit three (3) sets of prints made from the signed plans to the Stormwater Engineer.
City	**IX. Permit Preparation and Plan Distribution** The Stormwater Engineer prepares the permit letter, signs it, calculates the remaining fee, and determines performance bonds per the standard list. The completed permit package is sent to the Development Services Center. The project engineer or applicant will be contacted by the Development Services Center when the permit is ready to be issued.
Applicant	**X. Obtain Permit** When applicant is notified that the permit is ready to issue, applicant needs to come to the Development Services Center and pay any remaining fees and post required bonds. The Permit Letter is then issued.
Applicant	**XI. Pre-Construction Meetings** After plan approval and after submitting permit prints, applicant may be required to contact the Construction Division and schedule a Pre-Construction Meeting. Contact the Construction Division at (425)556-2723 for the date, time, and location (the inspector may have the meeting at the site). In addition to permit issuance, <u>construction may not begin before having a Pre-Construction Meeting (unless waived by the Construction Division).</u>
Applicant	**XII. Construction** The applicant shall complete all activities identified in the approved plans to meet City of Redmond standards. As items are completed, and at appropriate times during construction (i.e. before utilities are buried) the applicant shall notify the City Inspector assigned to the project at the Preconstruction Conference that elements are ready for inspection. Failure to notify the City of readiness for inspection in a timely manner may result in the requirement to remove and replace buried or hidden elements.

Table 5: Medium Project Requirements	
Responsible Party	**Activity**
City	**XIII. Release of Performance Bonds** Performance bonds remain in full force and effect until 1) the obligations secured are fully performed to the satisfaction of the City's inspectors; 2) a bond guaranteeing maintenance of all improvements for a guarantee period have been submitted to the City; and 3) the City has released the bonds in writing.
City	**XIV. Cancellation of Non-Issued Permits** A. The permit is only valid for a designated time. It may be to the applicant's benefit to wait until construction is ready to begin before picking up the permit. B. The permit will be held for a maximum six (6) months without issuance (unless specifically stated otherwise in the conditions of approval) but will then be nullified after this period if not picked up. The permit application would have to be started again, from the beginning, if the project is still desired. A new application may be required by the Public Works Department.
Applicant	**XV. Permit Extension Request – (Optional)** A. If the proposed work cannot be completed within the time covered by the permit an extension may be granted. Additional fees for inspection and renewal are required for extension. B. <u>The applicant must submit a written extension request to the Stormwater Engineer at least two (2) working days before the expiration of the permit.</u>

5.4 Fees for Medium Projects

Fees for Medium Projects are based on the type and number of activities proposed. Fees are charged for plan review and City inspection. Appendix E includes the Schedule of Public Works Fees that was current at the time the Stormwater Notebook was published. Updates are available from the Development Services Center.

Medium project fees often include but are not limited to:

- Small & Complex Projects: Review
- Small & Complex Projects: Inspection

Consult the Development Services Center to determine what actual costs you can expect based on the specifics of your project.

Performance security may be required prior to issuance of a permit. Security requirements are determined after application.

5.5 Project Submittal

At a minimum, the plans and narratives submitted shall include:

1. Written description outlining proposed activity.
2. Existing property lines (include bearings and distances).
3. Existing contours – 2-foot contour interval (information may be available from the City) – show as dashed lines.
4. Sketch showing proposed activity. This may require an engineer's endorsement; see the Stormwater Engineer before submittals.
5. Owner Information – name, address, and contact.
6. Project and Site Information – title, tax parcel, or plat (and lot) number(s).
7. Existing utilities – identify type and size (information may be available from the City).
8. Slope analysis – identify slopes 40% or greater.
9. Locations and drip lines of trees 6-inch caliper or greater (measured 4 feet above existing grade. (Only those trees to be cleared or trees within 50 feet of cleared areas need to be specifically designated.)
10. Roadways – existing and proposed (label name/number and identify public or private).
11. Existing surface waters (Streams, Lakes, Wetlands, etc.). Proposed drainage (flow arrows).
12. Existing adjacent property information within 50 feet of work area and any off-site area that drains onsite.
13. Proposed retaining walls/rockeries (indicate approximate heights).
14. Disturbed area – approximate (identify on the plan and label quantity in square feet).
15. Proposed contours – show as solid lines. Show approximate slopes and spot elevations at a minimum.
16. Proposed utilities – identify type and size.
17. Approximate quantities of cuts and fills, in cubic yards.
18. Methods to be used to meet applicable Minimum Requirements in the 2005 Ecology Manual.
19. Standard Notes (Appendix L).

Note that the City may require plans to be prepared, stamped, and signed by a State of Washington Registered Professional Engineer.

Note also that as-built plans need to be provided to the City after the project is complete to provide record drawings and finalize City processes.

Considerable flexibility exists in defining the level of plans and supporting documents needed for Medium Project(s) since these projects vary considerably in scope and circumstance. In general, the plans (and supporting documents, if warranted) need to define the existing and the proposed conditions, be readable, and the project shall be designed to ensure the health, safety, and welfare of the community. The Stormwater Engineer may require additional information and any standard for construction documents specified in the Stormwater Notebook for Large Projects that the Stormwater Engineer believes is appropriate to a specific Medium Project. The standards for Large Project construction documents are outlined in Chapter 6.

CHAPTER 6: LARGE PROJECT REQUIREMENTS

6.1 Project Classification

See Chapter 3 for project classification.

6.2 Project Requirements for Large Projects

Large Projects are required to meet Minimum Requirements #1 through #10 of the 2005 Ecology Manual. Note that Chapter 2 of the Stormwater Notebook amends some of those requirements. There are also more strenuous requirements for construction stormwater pollution prevention outlined in Chapters 9 and 10 of the Stormwater Notebook.

6.3 Permit Process for Large Projects

The following is an overview of the steps and requirements for projects that require only a Clearing/Grading and Stormwater Management approval (and no other approvals). Projects requiring other permits may have additional steps and requirements. Consult the Development Services Center for additional guidance.

Table 6: Large Project Requirements

Responsible Party	Activity
Applicant	**I. Project Proposal** A. <u>Prepare Project Plans</u> – an Application Checklist for Project Plan preparation is found in Appendix F. B. Prepare SEPA Checklist 1. All Large Projects are required to submit a SEPA Checklist. The Technical Committee will determine if the proposed activity requires formal SEPA process review. 2. SEPA Checklists are available at the Development Services Center. Redmond has modified the state standard checklist. Therefore, only a City of Redmond SEPA Checklist will be accepted. Complete the checklist to the best of your ability.

Table 6: Large Project Requirements	
Responsible Party	**Activity**
Applicant	**II. Complete and Submit Applications** All the following shall be completed and submitted for review for the application to be considered complete. Only complete applications will be processed. A. One (1) copy of a completed General Application Form (found in Appendix D of the Stormwater Notebook, also available at the Development Services Center) B. Eight (8) sets of Project Plans including the applicable information on the application requirements checklist in Chapter 10. C. Submit nine (9) copies of the SEPA document(s). D. Application fee.
City	**III. City Review Process** All Large Projects are processed through the Technical Committee. The Committee reviews the proposed project in concept and makes the SEPA determination. The Committee prepares a letter of conditions to be addressed during preparation of final construction drawings.
Applicant	**IV. Construction Plan Preparation** A. Prepare construction drawings based on the letter containing the conditions of approval from the Technical Committee and on Redmond's design standards (see Chapters 4 through 7). B. Submit three (3) sets of revised plans and supporting calculations to the Development Services Center (include a copy of the Technical Committee letter of conditions). C. Pay construction drawing review fee at the Development Services Center.
City	**V. Construction Plan Review** A. Plans are reviewed in house and with City's contracted consultant. B. The project engineer or applicant will be contacted when the review is complete. C. The plans and computations are red-lined and one (1) set of each is returned to the applicant with a Plan Review Checklist completed by the City.

Table 6: Large Project Requirements	
Responsible Party	**Activity**
Applicant	**VI. Revision and Resubmittal** A. Revise plans per the City's comments. B. Resubmit the last set of red-lined prints and computations, the Plan Review Checklist and three (3) sets of revised plans and computations.
City	**VII. Review of Revised Plans** A. Once all comments have been satisfactorily addressed, the City will proceed with plan approval. B. The project engineer or applicant will be contacted.
Applicant	**VIII. Submit Original Plans for City Approval** Submit original plans to the City for approval along with the final the calculations/report that accurately describes the drainage system and function. Plans shall be reproducible Mylar.
City	**IX. Plan Approval** Appropriate City staff sign plans and returns them to applicant or engineer.
Applicant	**X. Submittal of Permit Prints** For Clear and Grade Applications only: Submit six (6) sets of prints prepared from the signed plans to the Stormwater Engineer. Otherwise, submit prints to Engineering Division.
City	**XI. Permit Preparation and Plan Distribution** For Clear and Grade Applications: The Stormwater Engineer completes the permit, signs it, calculates the remaining fee, and determines bonds. The completed package is sent to the Development Services Center. The project engineer or applicant will be contacted by the Development Services Center when the permit is ready.
Applicant	**XII. Obtain Permit** When applicant is notified that the Permit is ready to issue, Applicant needs to come to the Development Services Center and: A. Pay any remaining fees and post required bonds, and B. Sign for and receive the permit.

Table 6: Large Project Requirements	
Responsible Party	**Activity**
Applicant	**XIII. Pre-Construction Meetings** After plan approval and after submitting permit prints, applicant shall contact the Construction Division and schedule a Pre-Construction Meeting. Contact the Construction Division at (425)556-2723 for the date, time, and location (the inspector may have the meeting at the site). In addition to permit issuance, construction may not begin before having a Pre-Construction Meeting.
Applicant	**XIV. Construction** The applicant shall complete all activities identified in the approved plans to meet City of Redmond standards. As items are completed, and at appropriate times during construction (i.e. before utilities are buried) the applicant shall notify the City Inspector assigned to the project at the Preconstruction Conference that elements are ready for inspection. Failure to notify the City of readiness for inspection in a timely manner may result in the requirement to remove and replace buried or hidden elements.
City	**XV. Release of Performance Bonds** Performance bonds remain in full force and effect until 1) the obligations secured are fully performed to the satisfaction of the City's inspectors; 2) a bond guaranteeing maintenance of all improvements for a guarantee period have been submitted to the City; and 3) the City has released the bonds in writing.
City	**XVI. Cancellation of Non-Issued Permits** A. The permit is only valid for a designated time. It may be to the applicant's benefit to wait until construction is ready to begin before picking up the permit. B. The permit will be held for six (6) months without issuance (unless specifically stated otherwise in the conditions of approval) but will then be nullified after this period if not picked up. The permit application would have to be started again, from the beginning, if the project is still desired.

Table 6: Large Project Requirements	
Responsible Party	**Activity**
Applicant	**XVII. Permit Extension Request – (Optional)** A. If the proposed work cannot be completed within the time covered by the permit an extension may be granted. Additional fees for inspection and renewal are required for extension. B. <u>The applicant must submit a written extension request to the Development Services Center at least two (2) working days before the expiration of the permit.</u>

6.4 Fees for Large Projects

Fees are charged for plan review and City inspection. Appendix E includes the Schedule of Public Works Fees that was current at the time the Stormwater Notebook was published. Updates are available from the Development Services Center.

Large project fees often include but are not limited to:

- Large Projects: review
- Large Projects: Inspection

There may be additional review fees related to project-specific items. For example, vaults must be designed for appropriate soil, groundwater, and surface loadings. Separate review and permits are required from the Building Department. Consult the Development Services Center to determine what actual costs you can expect based on the specifics of your project.

Performance security may be required prior to issuance of a permit. Security requirements are determined after application.

6.5 Project Submittal

These application requirements are for Regulated Activities (Chapter 15.24 of the Redmond Municipal Code) and may also require Building Permit review, Site Plan review, or Subdivision review. Other plan requirements may also apply. Consult the Stormwater Engineer prior to submittals for specific information.

A. Existing Conditions

1. Plan at 1”=20’ scale showing proposed activity (other scales may be approved by the Stormwater Engineer).

2. Plan size – 22”x34” – if possible show entire site in one (1) drawing (offsite area must be shown if drainage from it will be diverted or if it will drain to a sediment control feature onsite). If the area is too large to fit on one (1) 22”x34” sheet then break site into logical sections with matchlines. Provide a composite plan at a smaller scale that shows the matchline breaks and page numbers.
3. Owner Information – name, address, and contact: add to plan title sheet.
4. Project and Site Information – title, tax parcel or plat number, site area, disturbed area, and impervious area both existing and proposed.
5. Vertical Datum – must use 1990 City of Redmond datum (contact Development Services Division for specific details).
6. Written description outlining proposed activity.
7. Existing property lines (include bearings and distances).
8. Existing contours – 2-foot contour interval (information may be available from the City), use dashed lines.
9. Existing utilities – identify type and size (use screened lines or dashed lines).
10. Slope analysis – identify slopes 15% to 25%, 25% to 40%, and slopes greater than 40%. The slope analysis must clearly show the relationship of the slope to the proposed improvements.
11. Locations and drip lines of trees 6-inch diameter or greater (measured 4 feet above existing grade. (Only those trees to be cleared or trees within 50 feet of cleared areas need to be specifically designated.)
12. Roadways – existing (label name/number and identify public or private).
13. Existing surface waters (Streams, Lakes, Wetlands, etc.)
14. All required onsite information shall extend onto the adjacent property within 50 feet of site and any offsite area that drains onsite.
15. Identify source of survey information, date surveyed, surveyor, etc.
16. Provide a low impact development site assessment (see Chapter 8) if applicable.

B. Proposed Activity

1. Proposed retaining walls/rockeries (label approximate height).
2. Proposed contours – use solid lines; show connection to existing contours.
3. Proposed utilities – identify type and size and provide calculations for preliminary sizing.
4. Stormwater profile - Profiles shall be included for public streets and for easements that contain public storm drain systems. Profiles may be **required** for non-public areas **as determined by the Stormwater Engineer**. Profiles for the public streets and easements are to be included on the same sheet as the plan unless agreed otherwise by the Stormwater Engineer. Structure callouts in the profile shall include structure number, stationing, type, size, and compass locations of penetrations, and shall be shown complete for each structure shown on the plans. Structure callouts in the plan view shall include structure number, type, and size.
5. Approximate quantities of cuts and fills (in cubic feet).
6. Proposed roadways, if any.
7. Standard Notes (Appendix L).
8. Proposed retaining walls/rockeries (label approximate height).

C. Stormwater Detention / Water Quality Facility Data

1. Facility Type:_____
2. Live Storage (Detention) Volume:_____
3. Emergency Overflow Elev: _____
4. Dead Storage (Water Quality) Volume:_____
5. Pond Outlet Invert Elev:_____
6. Liner / Bottom Type:_____
7. Drain ?: Yes/No
8. Water Quality Type:_____

Notes about Stormwater Facility Data:

1. Facility type: pond, vault, tank, other
2. If there is no live storage, or no dead storage, fill in the blank with "N/A"
3. Liner / Bottom type should be descriptive. Examples include: 45 mil PVC Geomembrane, GCL, six-inches compacted clay, 12-inches compacted till, or if no liner then say, "infiltration" For concrete vault, say "concrete vault". For tanks, identify pipe material.

6.6 Construction Documents

The stormwater standards for the Construction Documents are as follows. All plans and documents must be prepared by a Registered Professional Engineer with experience in the applicable discipline and bear the appropriate stamp(s), date(s), and signature(s).

6.6.1 Provide Sufficient Construction Information

Sufficient information must be shown on construction documents to define and provide for construction of the work as designed. Construction documents (e.g., plans) must be clearly readable and show consistency between calculations and plans. The design concepts, calculations, and construction documents must clearly and explicitly show that all codes, standards, and approval conditions have been addressed. The designs must also be consistent with environmental documents and must reasonably minimize adverse impacts as specified in the project's environmental review.

6.6.2 Grading

Show existing and proposed lay of the land. Contours shall use the City of Redmond datum. The contour interval shall be based on the slope of the land. The contour interval is 2 foot for most sites; 5 foot may be used for steep slopes; and 1-foot intervals may be used if required by or approved by the Stormwater Engineer. For very flat sites spot elevations shall be provided. If part of the site is flat, provide a combination of contours and spot elevations. Proposed contours must not create undrained, ponding areas where such areas would not be appropriate (onsite or offsite). Contours of the same elevation beside each other must have high or low-spot elevations between them. Grading of swales must be shown. If contours are not closer together than 50 feet, spot elevations every 50 feet are required. Also, spot elevations are required at the beginning and end of the swale.

6.6.3 Outline the Construction Sequence

The construction sequence, including temporary erosion and sediment control must be outlined on the drawings. This sequence must be technically sound and feasible.

6.6.4 Check Specific Project Requirements

Make sure proposed construction meets the commitments and requirements in project documents such as SEPA Checklists (EIS, if done for the project), site plan approval conditions, special permits, and other such project documents.

6.6.5 Use the Checklists

The Plan Review Checklist, in Appendix F of the Stormwater Notebook, contains very detailed lists of items that are expected to be on project plans. For the initial application, many details can be omitted. For construction drawings, all applicable details need to be included.

6.6.6 Other Permits

Make sure proposed construction meets the commitments and requirements in project documents such as SEPA Checklists (EIS, if done for the project), site plan approvals, special permits, and other such project documents.

6.6.7 Include Basic Information Regarding the Project

The lead sheet (at a minimum) should identify the property (tax lot, address, vicinity map) and summarize information related to monthly billing credits (total square feet area of tax lot(s) comprising the project, square feet of proposed impervious area, water quantity control design storm(s), water quality facilities, and the design storm for each facility).

6.6.8 Provide Accurate As-built Drawings

As-built records of the storm drainage system are maintained by the City. Help make sure the records are correct when project information is provided by submitting accurate as-built drawings when a project is completed. Before acceptance of improvements an as-built plan shall be prepared by a Professional Land Surveyor or Civil Engineer, licensed in the State of Washington. The as-built plan shall include accurate locations, elevations, and sizes of all constructed features. As-built documents will bear the signature, stamp, and date of the licensed Land Surveyor preparing them. Visit the Development Services Center for a description of the as-built process.

6.7 Rough Grading Permits

Rough grading is the stage at which the grade is modified to conform approximately to the proposed final grade. This permit usually covers only earthwork but may also include stormwater systems especially if they are part of the pollution prevention

system. It is a prelude to further work on a development proposal that has received conceptual approval from the City.

The Rough Grading Permit Application is shown in Appendix G. It may be copied or picked up at the Development Services Center. Submit eight (8) sets of the grading and TESC plans with the permit application for review if they have not already received City approval. After the plans are approved submit ten (10) copies of these plans for the permit.

Rough Grading applications cannot be approved until all relevant items in the project's approval conditions are satisfactorily addressed and:

1. SEPA is completed for the entire project (if required).
2. Site plan (or equal) for the project is approved.
3. All major project feasibility issues have been resolved (included recording of all off-site easements, etc.).
4. Conceptual utility drawings are accepted.
5. Construction plans for Grading (or Rough Grading), dry season TESC, and if applicable, rainy-season TESC, including the Seasonal Suspension Plan are approved.
6. Site restoration is feasible (replanting of mature forested areas and restoring existing Topographic character after extensive cuts or fills are examples of work that makes restoration infeasible).
7. Acceptable performance security is posted.

A Rough Grading Permit is not an "automatic" permit and may not be issued as a separate part of project permitting where, in the opinion of the Development Services Division, special circumstances exist related to "advance" site work. Such circumstances include, but are not limited to, consideration of project size, aesthetics, availability of City inspections, feasibility of restoration, and other factors.

Rough grading will not be approved under a separate permit for work during the rainy season for certain situations as shown in Chapter 10.

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CHAPTER 7: DESIGN GOALS

The purpose of the information in Chapters 7 through 10 is to provide engineers, designers, technicians, inspectors, and others with a reference to City of Redmond's goals and standards for the planning and design of clearing and grading activities and stormwater management facilities.

The following design goals are applied to clearing, grading, and stormwater system designs in Redmond. Design goals are broad targets that indicate desirable outcomes, even though they may not be fully met in specific situations. Failure to completely meet a general design goal (e.g., minimize erosion and sedimentation) is not intended to constitute a deficiency subject to legal or procedural challenge. The goal must, however, be reasonably addressed in specific situations. If an alternate approach to a project's stormwater management design would provide a significantly greater achievement of a goal without significant additional cost (monetary, land use, etc.) then the alternative could be considered an alternative that is reasonable and could be required under this chapter. Specific situations can only be evaluated on a case-by-case basis.

7.1 Provide a Basic System of Drainage

The drainage system shall:

- serve all lots and site improvements that are part of or affected by the project;
- direct runoff off of and away from buildings, traveled ways, and other developed surfaces; and
- provide water quality management where appropriate.

Basic systems protect walkways, crosswalks, etc., from concentrated runoff flows (for example, by adding catch basins upslope of the walkways).

7.2 Prevent Flooding of Inhabited Buildings

Overflow and emergency runoff routes shall be provided. Floodways adjacent to defined channels should accommodate flood flows (to at least the 100-year storm from fully developed upstream conditions). Projects that are located within the floodplain shall submit a Flood Control Zone Application (Appendix H) prior to submittal of final engineering drawings.

7.3 Minimize Erosion and Sedimentation

Consider both on-site and downstream locations; many detention criteria are based on protecting streams from scour as well as from flooding.

7.4 Minimize Water Quality Degradation

Much of the newer code is focused on water quality, an evolving field that needs sound engineering applications.

7.5 Don't Mix Clean and Untreated Stormwater

Stormwater that has been treated for water quality should not be mixed with stormwater that has not been treated for quality.

7.6 Protect Water-Related Habitat

Refer to the Critical Area Code Requirements (contained in the Redmond Community Development Guide).

7.7 Maintain Recharge and Subsurface Flow Patterns

Maintaining groundwater supplies is important but do not increase recharge over natural conditions without careful hydrogeologic studies to avoid land stability problems. In areas of existing land stability concerns recharge should be reduced. Water quality is critical for recharge areas. Infiltration is limited or not permitted in Wellhead Protection Zones.

7.8 Address "Real-World" Conditions

Engineering designs should recognize that field conditions, debris, and poor maintenance/repair practices exist which need to be considered so long-term viability is possible. Maintenance access and guidelines should be included with designs.

7.9 Provide for Operation and Maintenance

Elements of the system proposed need to be capable of operating in the municipal context, have good access for maintenance and operation, and need to avoid very specialized parts, equipment, and operator qualifications whenever possible.

7.10 Proceed Based on Clear, Professional Thinking

Engineering documents submitted for approval must have clear concepts (including a narrative description if concepts are non-standard or not obvious) and design explanations, calculations, and other supporting information to show that the construction drawings implement the concepts.

7.11 Meet Standards

Designs need to: (1) comply with City regulations and standards; (2) comply with accepted legal principles; (3) apply sound engineering principles; and (4) include alternatives or adjustments to enhance aesthetics.

CHAPTER 8: LOCAL DESIGN STANDARDS

This chapter contains information on specific issues for projects in Redmond to help define what is necessary to meet our local codes and regulations and to help define terms in ways that are meaningful to specific engineering design situations in Redmond.

8.1 Standard Specifications and Details

All projects shall be designed and constructed to conform to the City of Redmond Standard Specifications and Details, Current Edition. These are available on the City's website at: http://www.redmond.gov/insidecityhall/publicworks/standarddetails.asp.

8.2 Proper Drainage

The Stormwater Notebook describes minimum drainage requirements. These requirements must be addressed in all projects (Small, Medium, or Large) whether or not plans and permits are required. Even though plans and permits are not required for most Small Projects, proper drainage facilities are required with all projects.

Proper drainage directs runoff away from structures, meets legally accepted practice, and meets the intent of RMC 15.24. For projects not requiring plans or permits, drainage systems are not required by code to have detention or formally designed water quality facilities. Nevertheless, if downstream conveyance capacity is not adequate, the project proponent may elect to provide detention or infiltration. Drainage systems shall be provided to prevent flooding of developed areas, connect downspouts, and provide positive drainage for footing drains.

Runoff from upslope properties must be accepted at natural and established locations at property boundaries and be discharged at natural or established downslope locations along property boundaries or to a constructed drainage system if authorized, subject to required on-site quantity and quality controls.

8.3 Stormwater Management in Wellhead Protection Zones

Wellhead Protection Zones (WPZ) were established, based on proximity to City groundwater wells and groundwater travel times to the various well locations. A map of the WPZ is available at: http://www.redmond.gov/cityservices/citymaps.asp. Zones 1 and 2 delineate the 6-month and 1-year time of travel zones for groundwater to reach the wells and are, therefore, the areas of greatest concern. Zone 3 delineates the 5 to 10-year time of travel zone. An excerpt from the Redmond Community Development Guide, concerning protection of Wellhead Protection Zones is included in Appendix B.

In Zones 1, 2, and 3, certain land uses and activities are prohibited, as noted in the current Redmond Community Development Guide Regulations (20D.140.10-220). Other special requirements for these zones are listed in 20D.140.

If a project area includes portions that are in more than one Wellhead Protection Zone, then the Stormwater Engineer will assess, based on drainage patterns and soil types, whether any portion of the site may be considered to be in the Wellhead Protection Zone with fewer restrictions. Otherwise, the whole site shall be considered to be within the Wellhead Protection Zone with more restrictions.

Stormwater systems for new development and redevelopment projects in Zones 1, 2, and 3 shall address the following:

1. During construction, if construction vehicles will be refueled onsite and/or the quantity of hazardous materials that will be stored, dispensed, used, or handled on the construction site is in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid, exclusive of the quantity of hazardous materials contained in fuel or fluid reservoirs of construction vehicles, the City may require any or all of the items listed in the Redmond Community Development Guide 20D.140.50-040 (1)(f). Generally, the following items will be required in writing as part of the TESC Plan:
    a. Monitoring plan.
    b. Designated project contact.
    c. Secondary containment.
    d. Provisions to secure hazardous materials.
    e. Response to leaking vehicles and equipment.
    f. Practices and procedures regarding transfer of flammable and combustible liquids.
    g. On-site cleanup materials (materials are to be listed in the TESC Plan) and other containment and cleanup provisions. All hazardous material releases shall be contained, cleaned up, and reported.
2. The Drainage Report required for projects shall include a section describing how each of the items above has been addressed in the plans for the proposed project.
3. Infiltration for flow control or water quality treatment is limited within Wellhead Protection Zones. See Chapter 2 for more information.

8.4 Conveyance System Design

8.4.1 Guidance Documents

For basic conveyance system design in Redmond use the latest edition of the Washington State Department of Transportation (WSDOT) "Hydraulics Manual" (M23-03). The manual is available from WSDOT's website at: http://www.wsdot.wa.gov/eesc/design/hydraulics/#HydMan.

Note that the 2005 Ecology Manual shall be used for detention sizing and stormwater treatment.

For computation of hydraulic grade lines in Redmond use one of the following models:

1. King County Surface Water Management Backwater Analysis Program
2. PCSWMM by Computational Hydraulics
3. StormCad by Haestad Methods
4. Mouse by DHI Software
5. Equivalent model approved by the Stormwater Engineer

8.4.2 Pipe Materials

The City of Redmond Standard Specifications and Details describes pipe material requirements. In general,

- sewer grade PVC is preferred for normal installations;
- ductile iron pipe is preferred for shallow bury installations; and
- fusion-welded HDPE pipe is preferred for overland installations on steep slopes.

Due to concerns about the quality of final installation of some pipe materials, the City has implemented a detailed inspection protocol for stormwater pipe. A fee shall be charged to all Contractors installing pipe in Redmond, on the basis of the length of pipe installed, to cover the cost of the stormwater pipe inspection protocol. Pipes that fail the inspection protocol will be replaced by the Contractor and reinspected. The project's performance bond will be used to ensure performance of the Contractor and the Pipe. A summary of the City's stormwater pipe inspection protocol can be found in Appendix R.

Corrugated polyethylene pipe (CPEP) or concrete pipe may be allowed with approval from the Stormwater Engineer. Corrugated aluminum pipe may be allowed for stream culverts with approval from the Stormwater Engineer.

8.4.3 Pipe Sizing

Pipe sizing analysis shall be for the 10-year fully-developed, peak flow unless otherwise specified.

If a stormwater detention or water quality facility lies downstream of the conveyance system, that conveyance system shall be sized to convey the peak flow to the facility (i.e. a pipe draining to a pond that detains or treats the 50-year developed flow must convey the 50-year developed flow).

If a culvert (pipe section that passes under a road with an open channel at each end) conveys water under and across a City right-of-way, the design shall be for the 25-year fully-developed peak flow.

Stormwater shall be managed such that the 50-year frequency event does not flood proposed buildings, any existing on-site buildings, or other existing buildings on contiguous parcels. Required conveyance standards may be adjusted by the Stormwater Engineer based on site and downstream conditions.

For public stormwater pipe, the minimum size shall be 12-inches. For private stormwater pipe, the minimum size shall be 6-inches. To accommodate special installation scenarios, smaller pipe may be used with Stormwater Engineer approval.

8.4.4 Catch Basin and Manhole Freeboard

Pipe systems shall be designed such that the following freeboard requirements are met at catch basins and manholes:

Table 8.1: Catch Basin and Manhole Freeboard	
Design Storm	**Freeboard**
10-year	12-inches
25-year	6-inches
50-year	0-inches (no overtopping)

8.4.5 Horizontal Clearance and Crossing Angle

The minimum horizontal spacing between closed storm drains and water mains, gas mains, other underground utility facilities, and all structures shall be five feet (5') horizontally. The minimum horizontal distance between any open storm drainage facilities (swales, open channels, biofiltration swales, etc.) and water mains, gas mains, and other underground facilities shall be 10 feet.

For pipe crossings, the preferred angle is 90 degrees, but 20 degrees obtuse or acute of 90 degrees is acceptable.

8.4.6 Vertical Clearance - Utilities

The minimum vertical clearance spacing between the outside of storm drain pipelines and water mains, gas mains, electrical or communication conduits, and other underground utility facilities, shall be as noted in Table 8.2. It is expected that the "Standard" vertical clearance will be provided. If that is not possible, use of Ethafoam pads or pipe sleeves may be allowed with approval from the Stormwater Engineer.

Table 8.2: Vertical Clearance – Utilities			
Utility	**Location (Above or below Storm Pipe)**	**Minimum Clearance**	**Special Requirement**
Electrical	Above or below	12-inches	Standard
Communications	Above or below	12-inches	Standard
Water main or gas main	Above or below	12-inches	Standard
Water main or gas main	Above or below	6-inches	Ethafoam pad
Sanitary Sewer	Below storm pipe	12-inches	Standard
Sanitary Sewer	Above storm pipe	18-inches	Standard
Sanitary Sewer	Above or below storm pipe	6-inches	Pipe sleeve and Ethafoam pad
Liquid petroleum	Above or below	See Stormwater Engineer	

An Ethafoam pad is required for some installations to provide additional protection between adjacent utilities. The size of the pad shall be based on the outside diameter (O.D.) of the larger crossing pipe. The pad shall be O.D. by O.D. square by 2.5 inches thick minimum or as required to protect the pipes. The pad shall be a strong, resilient, medium-density, closed-cell, polyethylene foam plank (Dow Ethafoam 220, or accepted equivalent.)

A pipe sleeve is required for some installations to provide additional protection of stormwater from potential leakage from other utilities. A pipe sleeve shall be a single section of PVC pipe (no joints) with a minimum length of 3 feet to each side of pipe crossing. The pipe sleeve shall be placed around the stormwater pipe with the annular space between the pipe sleeve and the stormwater pipe filled with grout.

Additional measures may be necessary to ensure system integrity and may be required as determined by the Stormwater Engineer on a case by case basis.

8.4.7 Minimum Cover

The standard minimum cover over storm drainage lines is dependent on the pipe material. The Redmond Design Standards and Specifications outline cover requirements. The minimum cover over yard drain lines is 18 inches.

8.4.8 Unstable Soils

Unstable soil conditions, such as peat, shall be removed from under pipes unless special measures are approved by the Stormwater Engineer.

8.4.9 Maximum and Minimum Slopes

Maximum slope on storm drain lines is 20%, unless approved by the Stormwater Engineer. Minimum slope on storm drain lines is 0.25%, unless approved by the Stormwater Engineer.

8.4.10 Stream Culverts

Stream culverts shall be designed to have natural bottom conditions, with 1/3 of the pipe diameter buried. Culverts used for stream conveyance shall be a minimum of 24 inches in diameter. Bridges shall be the first choice for stream crossings. More information can be found in the Redmond Community Development Guide, Section 20D.140.

8.4.11 Conveyance System Emergency Overflow

Sites shall be designed to prevent flooding of inhabitable buildings in the 100-year, 24-hour storm as determined by the Rational Method. The Stormwater Engineer may require this analysis as part of the design submittal.

8.4.12 Trees

Trees shall not be located within 8 feet horizontally from storm drain pipe unless root barriers are provided as approved by the Stormwater Engineer. With root barriers, trees may be no closer than 3 feet to pipes.

8.4.13 Pump System Requirements

Pumping stormwater is the method of last resort. When no other alternatives are feasible, pump systems may be considered provided they meet the following:

- Pump: 10-year peak flow rate as calculated by the rational method
- Backup Pump
- Alternative Power Source (Emergency Generator)
- Auto-Transfer Switch Disconnecting Generator from Public Grid. Auto-Start Required.
- Audio Alarm for High Water / Pump Failure
- 3-Hour Flow Storage Volume (may be combined with water quality treatment)

In addition to these requirements, a note shall be placed on the plat or title that says, "Property owner is responsible for operation of the stormwater pump, and for any damages to offsite property if the pump fails to transfer stormwater as designed."

8.5 Catch Basin and Manhole Requirements

8.5.1 Structure Materials

The City of Redmond Standard Specifications and Details describes structure material requirements.

8.5.2 Structure Spacing

Space catch basins in accordance with best engineering practice and the WSDOT Hydraulics manual. To accommodate maintenance of the pipes, a manhole or catch basin (structure) shall be placed periodically with the following maximum spacing:

- 200 feet for pipes less than 12-inch or with design velocities less than 3 feet per second (fps); otherwise,
- 300 feet for pipes less than 30-inch diameter with design velocities greater than 3 fps; or
- 400 feet for pipes equal or greater than 30-inch but less than 42-inch diameter with design velocities greater than 3 fps; or
- 600 feet for pipes of 42-inch diameter or larger with design velocities greater than 3 fps; or
- 600 feet for tightlines down steep slopes.

Structures shall be installed at the end of all dead end mainlines, at horizontal or vertical pipe bends, at changes in pipe size or material, and at pipe junctions for access.

8.5.3 Pipe Connections

Inlet pipe crowns shall not be lower than outlet pipe crowns unless specifically waived by the Stormwater Engineer. Pipe connections shall be water-tight.

8.5.4 Spill Prevention Device

Multifamily, commercial, and industrial properties shall include at a minimum a spill prevention device at the last structure on the property before connecting to the public stormwater system. The minimum requirement for a spill prevention device is a downturned elbow, removable for maintenance, located on the outlet pipe leaving a type 2 catch basin. Depending on the uses on the site, the Stormwater Engineer may require additional measures of protection.

8.5.5 Knockouts

Knockouts shall be provided in structures where future extensions are anticipated. These shall be shown on the plans.

8.5.6 Drop Structures

Drop structures shall only be allowed where approved by the Stormwater Engineer. Generally, drop structures will not be approved if the drop is less than 5 feet.

8.5.7 Maximum Depth

The maximum depth for catch basins shall be as follows:

- Type I Catch Basin: 4 feet
- Type II Catch Basin: 12 feet
- Type III Catch Basin: 25 feet

For greater depths, structures shall be designed by a structural engineer.

8.5.8 Lot and Area Drains

Lot drains or area drains in excess of two feet deep and up to four feet deep shall be Type I catch basins. Area drains exceeding four feet deep shall be Type 2 catch basins with bolt-down lids.

8.5.9 Through-Curb Inlet Frames

Through-curb inlet frames shall be specified on plans at sag points, at any inlet where by-passing runoff would escape the intended control system and at every third inlet on a continuous run along a continuous slope. Through-curb inlet frames may be used at all points except at proposed or likely driveway locations.

8.5.10 Grates

Vaned grates shall be used on all slopes over five percent and on all public systems. Herringbone grates may be used on flatter slopes in private systems. All grates shall be ductile iron.

8.6 Site Design

8.6.1 Flood Protection

All parts of any structure constructed below the 100-year flood elevation of associated waterways shall be protected from flooding using floodproofing.

Floodproof to the 100-year elevation plus one foot. Floodproofing shall conform to Federal Emergency Management Agency standards in effect at project vesting.

Projects planning work within flood control zones shall submit a Flood Control Zone Application (Appendix H).

8.6.2 Impervious Area for Single Family Residential Plats and Short Plats

Projects creating lots for single-family houses (residential plat and short plat projects) shall provide drainage systems for all lots. The drainage systems shall address runoff quantity and quality, based on the impervious area assuming no impervious areas in the existing pre-developed condition.

These projects shall assume each lot has impervious surface based on the following formula. For each lot created, the assumed impervious area is taken as the area of the lot, less any unbuildable area as defined in Critical Area regulations times the percentage of allowable coverage (from the Land Use section of the Redmond Community Development Guide) times 0.80. However, the maximum impervious area one is required to assume for a lot is 4,200 square feet (unless specific building plans indicate larger areas).

The total impervious area for these projects is taken to equal the paving, sidewalks, etc., required of the project plus the assumed impervious area of each lot.

8.6.3 Drainage Connections for All lots

All types of plats and short plats (residential, commercial, industrial, and others) shall provide for drainage connections on each lot, unless otherwise approved by the Stormwater Engineer. (Low impact development measures may make the use of lot connections unnecessary.)

Drainage connection points are to be located at the low elevation point of the allowable building area of each lot. The connections must be below finished grade so as to allow connection of footing drains, roof drain leaders, and other drains.

Providing for drainage connections typically means providing a piped system from the drainage connection points described above to the drainage system in the plat or short plat. A maximum of three (3) lots may be connected to a common private collection pipe. Multiple collection pipes may be used.

In some cases it may be acceptable to include only the plan for the lot drainage connections as part of the City-approved drainage plan for the plat or short plat and defer construction until building construction on the lots.

In some cases, it may be possible (and even desirable) to infiltrate runoff from buildings. Infiltration of clean water can reduce runoff problems and maintain groundwater supplies. Infiltration is generally acceptable where the soils and geology are suitable, and at locations outside Wellhead Protection Zones 1, 2 and 3. Treatment to provide acceptable water quality is still required and is particularly critical in the vicinity of the City's wells (see section in this chapter regarding the Wellhead Protection Program). Percolation tests are required at all proposed infiltration locations.

In all cases, appropriate easements must be provided, as part of the plat or short plat, for the specific drainage systems shown on the construction documents. Those documents shall also show anticipated grading, rockeries, retaining walls, etc. Construction of the lot drainage connection systems must be feasible and allow connection to the proposed plat improvements or to the documented infiltration areas. The minimum private easement width is 5 feet.

8.6.4 Single Family Roof and Foundation Drain Requirements

Size and Connection – Roof drain/foundation drain connection from the house shall be 6-inch diameter and shall be extended to a storm drain structure (not connected directly to a stormwater pipe). Foundation drains shall be separate from roof drains around the building foundation. Pipes shall be smooth wall, rigid type (sewer grade). Pipes shall not be corrugated polyethylene (such as flexible ADS). Roof and footing drain connection stubs shall be at least one (1) foot below the lowest existing elevation of the building envelope on all newly-created lots, unless a different elevation is approved or required by the Stormwater Engineer. The minimum cover over yard drain lines is 18 inches. For subdivisions, no more than three (3) roof drain stubs are allowed on a single roof drain collection pipe. Provide a tracer wire along plastic pipe from the building to the property line.

Building Footings – Building footings shall be designed, or pipe located, such that the footing shall not bear on the pipe.

8.6.5 Separation of Systems Serving Separate Owners

Stormwater facilities provided to control quantity and quality generally should be provided within the site they are serving although certain exceptions are acceptable.

Facilities for single family plats may be located in common areas (even in public roads that are created by the plat or short plat).

Water quantity and quality controls provided for the private part of a project shall be separate from water quantity and quality controls for public impervious surfaces that are part of the project. Individual lots within single family plats and short plats with public road improvements may drain to the public water quantity and quality control systems constructed to serve the development.

In some circumstances, water quantity and quality control requirements for the proposed impermeable areas may be met by adding such control(s) to equivalent existing developed areas of the site, which do not already have such controls.

8.6.6 Grading

The maximum ground slope on graded surfaces is 3 horizontal to 1 vertical (3:1) except as approved in association with roadway section in City rights-of-way where the maximum ground slope may be up to 2:1.

Proposed contours shall not create undrained, ponding areas where such areas would not be appropriate (onsite or offsite).

8.6.7 Rockeries/Retaining Walls

Rockeries or retaining walls should not cross or be near storm-drain pipes. Any crossing of a wall shall be perpendicular to the wall and special construction techniques including steel casings may be required.

Rockeries under 4 feet are not regulated. Rockeries over 4 feet shall only be used against cut slopes.

Rockeries and retaining walls shall have foundation drains (6 inches in diameter of approved materials) behind the wall connected to a defined conveyance system. Rockeries 48 inches and taller and retaining walls must be designed by a structural or geotechnical engineer. No retaining structure may be higher than 8 feet (unless a relief from general design standards is obtained). Structural retaining walls (not rockeries) over four feet in height are reviewed and permitted by the Building Department following UBC Section 106.2.

8.6.8 Public Easements

Where public storm drain line easements are necessary, they shall be 20 feet in width. Easement widths of less than 20 feet may be considered by the Stormwater Engineer, in special situations, but shall not be less than 15 feet in width.

Publicly maintained water quality and detention facilities shall be located in tracts dedicated to the City. The size of the tract shall be based on the size of the stormwater facility. At a minimum, the tract shall include the entire facility, site access area, and at least 5 feet around the facility. In limited cases an easement may be permitted. If an easement is permitted, dimensions shall be determined by the Stormwater Engineer.

In cases where pipes and/or other facilities are deeper than 8 feet or have other special conditions, larger tracts or easements may be required.

All easements needed for City stormwater systems shall be provided by the developer in the name of the City. The required easements shall be shown on the construction drawings and the easement legal description or plat markup shall be submitted for review at the same time construction drawings are submitted for review.

Easements shall have language acceptable to the City, similar to the example in Appendix K.

An alternative to separately recording a City of Redmond easement form is to record an easement on the face of a plat. If this is the method used, a standard City of Redmond easement statement shall be included in the plat documents.

Buildings, structures, garages, carports, dumpster enclosures, decks, rockeries over 4 feet, etc., shall not be located in easement areas.

8.6.9 Stormwater Facilities

8.6.9.1 Maintenance Access

Access for maintenance is a very important design feature. Facilities designed with improper access may be subject to additional review iterations and cost. Unless specifically waived by the Stormwater Engineer, all stormwater facilities shall be accessible to maintenance vehicles. If not located in or adjacent to a vehicle access way, then access by an improved roadway surface shall be provided. Materials of construction for an improved roadway surface may include asphalt concrete, cement concrete, structurally stabilized vegetated surface, crushed surfacing, or other surfacing as approved by the Stormwater Engineer. Access roads shall be designed with 40 foot inside radius on curves, with slopes less than 15% and with widths as determined by the Stormwater Engineer (but not less than 10 feet). The Stormwater Engineer may require access ways to be located in separate tracts.

Outlet control valves shall be detailed so as to be operable from the surface (not subject to confined space entry requirements) unless approved otherwise by the

Stormwater Engineer. The specific detail for these valves depends on the type of valve and shall be subject to approval by the Stormwater Engineer. Gravity-flow draw-down systems (for ponds, vaults, etc.) shall be provided with an outlet control valve.

8.6.9.2 Facility Maintenance

Provision shall be made for long-term maintenance of water quality and detention facilities.

8.6.10 Transfer of Assets to the Public

When projects include construction of improvements that will be turned over to the Public, a Public Utility & Stormwater Facilities Bill of Sale Form (Appendix I) and a Developer Extension Asset Summary (Appendix J) shall be completed and submitted to the Development Services Division of Public Works.

8.7 Low Impact Development (LID)

8.7.1 LID Overview

Low impact development (LID) is a stormwater management and land development strategy applied at the parcel and subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic predevelopment hydrologic functions. Implementation of LID benefits streams, lakes, and Puget Sound by moderating the impacts of stormwater runoff generated by the built environment. These techniques may be accessory or alternative to traditional, structural stormwater management solutions. Information on the scope, benefit, and applicability of LID can be found in the Low Impact Development Technical Guidance Manual prepared by the Puget Sound Action Team and Washington State University Pierce County Extension.

Use of LID is one way to implement the following Comprehensive Plan policies:

- **NE-9** Encourage environmentally friendly construction practices such as the build green program and low impact development.
- **NE-10** Encourage projects which utilize alternative technologies, engineering, and plans which emphasize Low Impact Development strategies through incentives and flexibility in application of regulatory requirements.

8.7.2 Intent of LID

The City encourages the use of LID techniques, including techniques for stormwater management.

These goals are to:

- Maintain or restore the pre-developed condition surface water flow volumes, durations and frequencies;
- Retain or restore native forest cover to capture, infiltrate and evaporate all or a portion of the rainfall on the site;
- Cluster development and minimize land disturbance;
- Preserve or restore the health and water-holding capacity of soils;
- Incorporate natural site features that promote infiltration of stormwater;
- Minimize total impervious surfaces and effective impervious surfaces;
- Reduce or eliminate piped stormwater conveyance and conventional detention ponds;
- Manage stormwater through infiltration, bioretention, and dispersion; and
- Manage stormwater runoff as close to its origin as possible.

8.7.3 Land Use

LID is not merely the use of specific stormwater management facilities, but is an approach to land development that integrates with and responds to the natural conditions of a site. A low impact development should strive to minimize the impact of development on the pre-developed hydrologic condition. From a land use perspective, this is accomplished by minimizing the development envelope and minimizing impervious surfaces.

8.7.3.1 Minimize development envelope

Minimizing the development envelope means confining lots and land uses to confine development and activity areas to the smallest impact area. While the City's development standards are generally designed for conventional development that consumes most or all of a development site with buildings, infrastructure and activity areas, the Community Development Guide provides several mechanisms to focus development on a site. Residential clustering can be accomplished through the clustering provisions of RCDG 20C.30.50 and the modifications allowed under RCDG 20C.30.105, Planned Residential Development.

8.7.3.2 Retain areas of native vegetation

Minimizing the development envelope allows retention of a portion of the site in its natural or pre-developed state. In addition to offering an aesthetic amenity and opportunities for passive recreation, preservation of natural open spaces provides areas for dispersion of stormwater generated on the developed portion of the site. The extent to which dispersion to a natural area may be allowed depends on the size of the preserved area relative to the tributary area as well as underlying soil types. Where native forest is preserved or restored to disturbed areas, a portion of the rain that falls on the site will be intercepted and evaporated or absorbed. In recent years, researchers

have speculated that retention of 65 to 75 percent of the natural land cover and soils should be preserved in a watershed to retain sufficient hydrologic conditions to prevent stream channel degradation, maintain base flows, and contribute toward properly functioning conditions for salmonids. While preservation of significant natural areas is a challenge in urban areas, conservation of existing habitat is a key element of LID. LID projects should preserve or re-establish a minimum of 35 percent of the overall site area in native vegetation. (This 35% does not include any critical areas that are already required to be set aside.) Areas retained as native open space are most effective for dispersion when located downslope of proposed development areas.

8.7.3.3 Preserve native soils

In addition to retention of areas of native vegetation, preservation of native soils is an important aspect of low impact development. Native soils have a significantly higher capacity to absorb, retain and transmit water than soils remaining on a site following conventional development. Commonly, native soils are graded and removed from development sites. In the process, the underlying soils are significantly compressed, resulting in a reduction in the ability of the soils to absorb water from the surface. Vehicles with tracks or tires with axle loads exceeding 10 tons per axle can compact soils as deep as three feet. A majority of the total soil compaction (70-90 percent) can occur in the first pass with equipment. Minimal disturbance techniques can be employed to reduce the limits of clearing and grading and minimize hydrologic impacts.

Prior to any clearing or grading, areas of the site more conducive to infiltration should be identified (see Site Assessment, below), and site design should preserve such areas. Ground disturbance should be limited to road, utility, building pad, landscape areas, and the minimum additional area needed to maneuver equipment. A ten-foot perimeter around the building site can provide adequate work space for most activities. The number and extent of construction access roads should be limited and located where future roads and utility corridors will be placed. Where prior clearing or grading has occurred, soils should be restored according to the guidelines in RCDG 20D.80.10-170 in all areas except where impervious surfaces are proposed.

8.7.3.4 Compost Amendment of Soils

Compost amendment of soils may be a more viable alternative to preservation of native soils for some sites, but can realize many of the same benefits. Compost amendment of soils shall be performed in accordance with the requirements found in Appendix Q. See Chapter 2 for incentives for use of compost amended soils in sizing detention facilities.

8.7.3.5 Minimize impervious surfaces

Minimizing the development envelope may also limit the extent of new roadways and other impervious surfaces. Limiting impervious surfaces is a primary emphasis of low impact development. Impervious surfaces can be minimized by limiting vehicular and pedestrian infrastructure, e.g., roads, driveways, parking areas, and sidewalks, to the minimum functional needs of the facilities. The City's Community Development Guide

provides opportunities for modifying street standards through RCDG 20C.30.105, Planned Residential Development, and RCDG 20C.60.60, Planned Commercial Development. The Rustic Street Standards in RCDG Appendix B0D-3, while not applicable to all areas or all roadway use conditions, represent a good template for LID road design. LID techniques to minimize impervious surface area also include the use of various pervious paving materials, minimal excavation foundations, and green roofs. These alternatives to conventional development techniques decrease the effective impact of new surfaces and buildings on the pre-developed conditions.

8.7.4 LID BMPs

To achieve the intent of LID, stormwater should be managed on-site to the greatest extent possible.

8.7.4.1 LID BMPs

The following onsite BMPs, subject to modifications within this Stormwater Notebook or requirements in the Redmond Municipal Code, should be considered:

- Permeable pavements;
- Dispersion;
- Vegetated rooftops;
- Rainwater harvesting;
- Reverse slope sidewalks;
- Minimal excavation foundations; and
- Bioretention.

Descriptions of these BMPs, along with design criteria, maintenance standards, and modeling guidance, can be found in Appendix F of Volume III of the 2005 Ecology Manual.

Other BMPs may be considered for use by the Technical Committee, provided that the committee finds that there is reasonable scientific justification that such BMPs will provide equal or better flow control and water quality results, and that long-term performance is assured.

8.7.4.2 Treatment BMPs

Updated by Addendum, August 18, 2010

The only LID BMPs that may be approved for water quality treatment are:

- Dispersion (lots 5 acres and greater), when consistent with DOE BMP T5.30; and
- Bioretention, when consistent with the design criteria in the Ecology Manual. Any stormwater that infiltrates through the imported soil mix be considered to have received the equivalent of Enhanced Treatment.

8.7.4.3 LID in Wellhead Protection Zones

Infiltration as treatment is limited to Wellhead Protection Zone 4. Infiltration of clean water from roofs and sidewalks is encouraged throughout the City.

8.7.5 Site Assessment for LID

Updated by Addendum, August 18, 2010

Unless waived or modified by the City Engineer, all requests to use LID BMPs to achieve conformance with the City's stormwater regulations shall require a site assessment. This initial inventory and assessment process will provide the baseline information necessary to design strategies that preserve natural resources, preserve areas most appropriate to evaporate, transpire, and infiltrate stormwater, and help to achieve the goal of maintaining pre-development natural hydrologic conditions on the site. The assessment should result in a series of maps identifying streams, lakes, wetlands, buffers, steep slopes and other hazard areas and hydrologic features, significant wildlife habitat areas, and permeable soils offering the best available infiltration potential. Maps can be combined as hard copies or in electronic mapping formats to delineate the best areas to direct development.

The site assessment shall be a component of the project submittal. At a minimum, the site assessment shall include the following:

1. A survey prepared by a registered land surveyor showing existing public and private development, including utility infrastructure, on and adjacent to the site, major and minor hydrologic features, including seeps, springs, closed depression areas, drainage swales, and two-foot contours up to ten percent slope and five foot contours for slopes above ten percent. Spot elevations shall be at 25-foot intervals.
2. Location of all existing lot lines, lease areas and easements.
3. A soils report prepared by a licensed geotechnical engineer or licensed engineering geologist. The report shall identify:
    a. Underlying soils on the site utilizing soil pits and soil grain analysis to assess infiltration capability on site. The frequency and distribution of test pits shall be adequate to direct placement of the roads and structures away from soils that can most effectively infiltrate stormwater;
    b. Percolation tests if appropriate, or requested by the Stormwater Engineer;
    c. Topographic and geologic features that may act as natural stormwater storage or conveyance and underlying soils that provide opportunities for storage and partial infiltration;
    d. Depth to wet season high groundwater;
    e. Geologic hazard areas and associated buffer requirements as defined in RCDG 20D.140;
    f. Distance from site boundaries to any areas within 200 feet of the site identified as landslide hazard areas or having a slope of 40 percent or steeper with a vertical relief of 10 feet or more; **[Note: the City may require the applicant to expand the 200 feet to encompass a larger area if there are concerns for downstream geological hazards.]**
    g. Identification of wellhead protection zone(s); and
    h. For previously cleared or graded sites, analysis of topsoil according to the soil guidelines in RCDG 20D.80.10-170.
4. A survey of existing native vegetation cover and wildlife habitat by a qualified biologist identifying any forest areas on the site, species and condition of ground cover and shrub layer, and tree species, seral stage, and canopy cover.

5. A streams, wetland, and water body survey and classification report by a qualified biologist showing wetland and buffer boundaries consistent with the requirements of RCDG 20D.140 and Critical Areas Ordinance Reporting Requirements.
6. Flood hazard areas on or adjacent to the site.
7. A preliminary drainage report providing analysis of the existing site hydrologic conditions on the site and recommendations for type, location, and restrictions on LID BMPs.
8. Other studies as deemed necessary by the Stormwater Engineer.

Applicants for LID projects should meet with engineering and planning staff following completion of the site assessment and prior to site design. Staff will provide feedback on additional analysis that may be required, preliminary recommendations on meeting the City's stormwater regulations and options for low impact options for site design. It is recommended that applicants consult the Low Impact Development Technical Guidance Manual for additional information on LID site planning, site preparation, and BMPs.

8.7.6 Maintenance

All BMPs, impervious surface area restrictions, maintenance agreements, preserved native areas and any other requirements or restrictions imposed as conditions of approval under this chapter shall be recorded as covenants, deed restrictions, easements, or other legally binding limitations and commitments in a form approved by the City. Easements or rights of access shall be provided to the City to allow inspection, maintenance and repair, as necessary, to ensure that approved drainage systems are preserved and maintained according to the conditions of approval. BMPs approved on private property under the provisions of this chapter shall remain the responsibility of the person or persons holding title to the property, their heirs and assigns.

Native forest or other natural areas preserved or established as part of a dispersion BMP approved under the provisions of this chapter shall require, as a permit condition, that the native forest area tract or tracts be protected in accordance with the requirements set forth for general critical area protective measures in Chapter 20D.140.10-180 of the Community Development Guide.

8.7.7 Evaluation and Monitoring

The Stormwater Engineer may require implementation of a monitoring and evaluation program designed to measure the performance of the drainage system or specific elements that are approved for a project under the provision of this chapter.

8.8 Contribution in Lieu of Onsite Facilities

In recognition of the need to improve the water quality of streams, and to meet the requirements of the City's National Pollutant Discharge Elimination Systems (NPDES) Municipal Stormwater Permit, the City requires new development and redevelopment to provide flow control and water quality treatment of stormwater. At the same time, the City is working to identify and construct Regional Stormwater Facilities that meet the requirements for flow control and water quality treatment for new projects while retrofitting areas that have not developed under current standards.

As a part of the City's coordinated, regional approach to managing stormwater City-wide, some projects will have the requirement or option of contributing a fee, in lieu of building site-specific facilities. The fee shall be used toward construction of regional stormwater facilities. The City has responsibility for ensuring that:

- Potential impacts from all new development or redevelopment within the City are addressed in a manner that meets the City's obligations on a watershed basis to protect water quality and prevent erosion of streams.
- Funds received for construction of regional facilities are used for that purpose.

To meet these responsibilities, the City's program, administered by the Natural Resources Division of the Public Works Department, includes procedures for:

- coordinating with the Development Services Division's review of development and redevelopment projects;
- determining what projects are eligible for "fee in lieu";
- accounting for areas that have been treated by existing regional facilities;
- accounting for funds that have been received for construction of new regional facilities; and
- locating, designing, and constructing regional facilities.

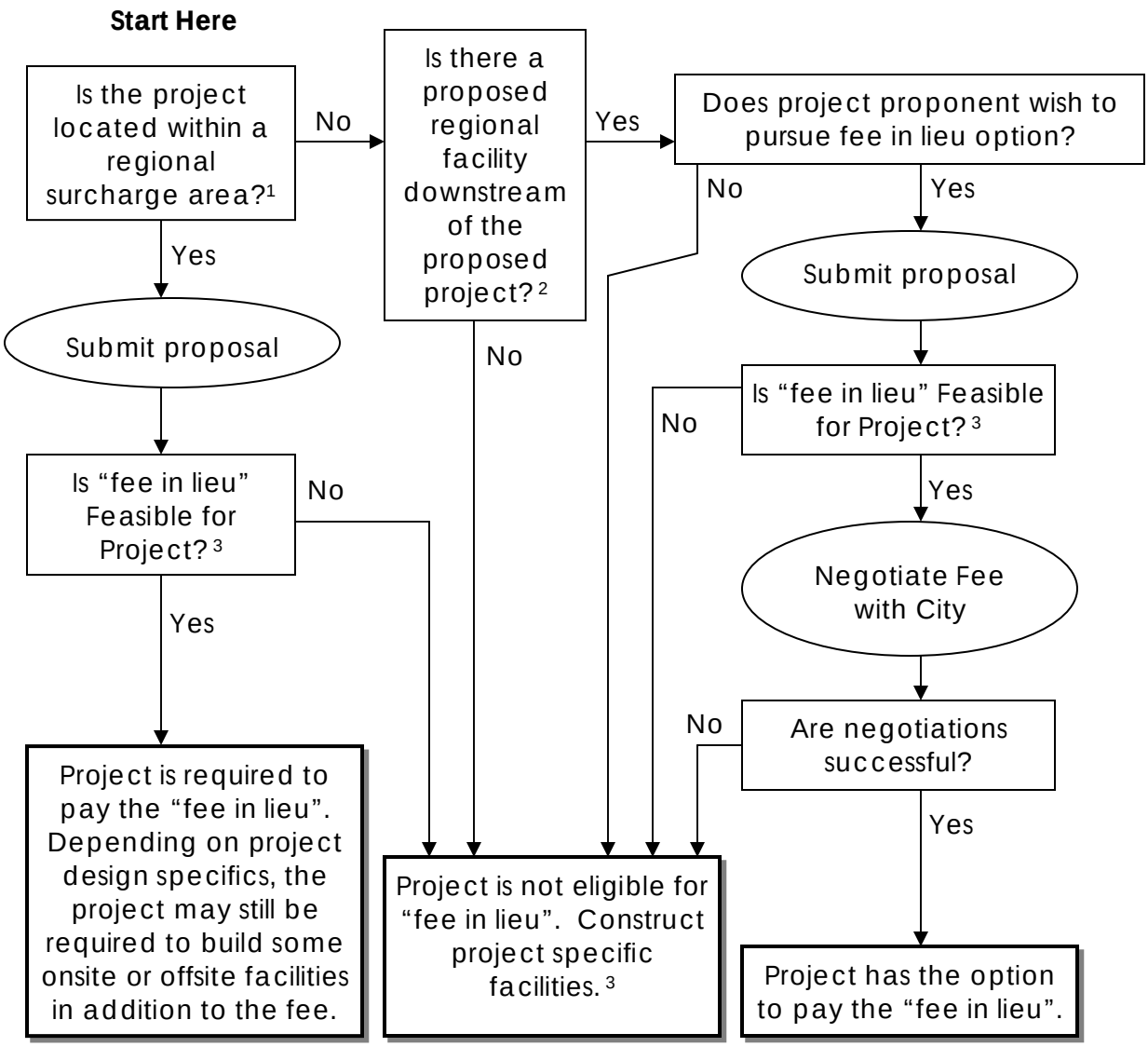
Updated by Addendum, August 18, 2010

8.8.1 <u>Determine "Fee in Lieu" Eligibility</u>

As noted in Chapter 2 of the Stormwater Notebook, some projects may be required or have the option to pay a fee in lieu of constructing project specific flow control or water quality facilities. A specific project's eligibility for "fee in lieu" depends upon the:

- scope of the project;
- project location in relation to regional surcharge areas or proposed regional stormwater facilities;
- project specific drainage issues; and
- feasibility of constructing the project using the fee in lieu option without causing harm to downstream systems.

Figure 8.1 addresses these issues to help project proponents understand the process by which "fee in lieu" eligibility is determined.



Notes:

1. See Appendix O for locations of regional surcharge areas.
2. See Appendix O for locations of proposed regional facilities.
3. See discussion of feasibility criteria in Section 8.8.2.

Figure 8.1 Flow Chart for Determining Eligibility for "Fee in Lieu".

8.8.2 Determining Feasibility of Fee in Lieu Proposal

The feasibility of a project's fee in lieu proposal will be determined by the Stormwater Engineer.

Criteria used to make this determination include:

- If the fee is accepted in lieu of project specific facilities, will there be harm to streams or property?
- Is there available capacity within the regional facility (flow control or water quality)?
- Are there cumulative impacts from multiple project proposals that if combined would make the proposal infeasible?
- Does the project benefit from the regional facility?
- Does accepting the fee in lieu meet the overall objectives of the regional facilities program?

The following elements will also apply in the determination of feasibility:

- Many projects will be required to build some onsite facilities and some offsite facilities to get stormwater to the City's proposed or existing regional stormwater facility. (As noted in Section 2.3.1.3, improvements to downstream systems shall be sized for full buildout conditions, based on current zoning.) This shall not result in a project's proposal being considered not feasible.
- The feasibility of a fee in lieu of water quality proposal shall not impact the feasibility of a fee in lieu of flow control proposal, and vice versa.
- Incomplete fee in lieu proposals will not be considered.
- If the fee in lieu proposal is found to be not feasible, then the project shall be required to construct project specific facilities and will not be required to pay the fee in lieu or regional surcharge. Some combination of these two options may be appropriate for some projects with approval from the Stormwater Engineer.
- With approval from the Stormwater Engineer, project areas may be separated to use fee in lieu for some portions of the project site and project specific facilities for other areas.

8.8.3 Contribution in Lieu of Providing Flow Control

The City requires flow control measures for projects, as outlined by Minimum Requirement #7 of the Ecology Manual (Section 2.5.7 of the Stormwater Notebook.) One alternative for meeting flow control requirements is to provide a contribution in lieu of providing project specific facilities. This alternative is mandatory in some cases and optional in others. In either case, projects may still be required to provide some flow control facilities to address existing deficiencies or prevent new ones, as determined through development of the Contribution in Lieu of Flow Control Proposal.

8.8.3.1 Project Site in Regional Surcharge Area

If a project site is located within a regional surcharge area, as noted on the City's Regional Stormwater Facilities Map (Appendix O), then the project is required to pay the regional surcharge for flow control that has been established for that area, unless the fee in lieu of proposal is determined to be not feasible (See Section 8.8.2 above). This payment will satisfy the site specific flow control requirements that relate to the improvements that are not being built for the site. The project proponent will be required to submit a "Fee in Lieu of Flow Control Proposal" as described below as part of the project's Drainage Report.

8.8.3.2 Project Site Drains to Regional Stormwater Facility

If a project site is located such that it naturally drains to the proposed location for a proposed or existing regional stormwater facility, as noted on the City's Regional Stormwater Facilities Map (Appendix O), then the project may have the option to pay a fee, in lieu of constructing site specific stormwater facilities. (Some facilities may be required in addition to the fee, depending upon site specific issues.) This payment will satisfy the site specific flow control requirements that relate to the improvements that are not being built. If the project proponent wishes to pursue this option, the project proponent shall submit a "Fee in Lieu of Flow Control Proposal" as described below as part of the project's Drainage Report. If the City cannot come to an agreement with the project proponent of the amount of the fee, or the other improvements that may be required in addition to the fee, then payment of a fee in lieu of flow control will not be an option and the project will be required to provide site specific improvements accordingly.

8.8.3.3 Contribution in Lieu of Flow Control Proposal

A contribution in lieu of flow control proposal shall include the following key elements:

- Identify the regional surcharge area or the relevant Potential Regional Stormwater Facility.
- Provide a drainage report describing what would be required for flow control if the project were constructed instead of using the fee in lieu option.
- Provide a description of what flow control facilities (if any) are proposed as part of the project. (In some cases, the contribution may not fully meet all project flow control requirements.)
- Unless specifically waived by the Stormwater Engineer, provide a downstream hydrologic and hydraulic analysis that evaluates the potential impacts of contribution in lieu of providing flow control. The downstream analysis shall continue to:
    1. an existing regional stormwater facility;
    2. an infiltration facility;
    3. the Sammamish River;
    4. Lake Sammamish; or
    5. ¼ mile beyond the City Limits.

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- Document how this project will meet the following conditions:
  1. Allowing the contribution in lieu of providing site specific flow control shall not create an unsafe situation.
  2. The downstream system shall have adequate capacity to convey the undetained flow for the required maximum return period storm events without causing or aggravating any downstream flow-related problems such as flooding or erosion.
  3. A regional flow control project downstream of the project site (or within the regional surcharge area) with available capacity for new development is on the City's Regional Stormwater Facility Map (Appendix O).
  4. If the project drains into Bellevue, site specific flow control facilities that meet Bellevue's current design standards shall be constructed in addition to payment of the fee in lieu of flow control. Document how Bellevue's requirements will be met. (No review by the City of Bellevue is required.)
  5. The Natural Resources Division Manager or his/her designee approves the contribution in lieu of flow control as being consistent with the City's goals and objectives of the regional facilities program. (Include a letter from the Natural Resources Division. Contact the Natural Resources Division early in the process to develop a timeline and review schedule.)

8.8.3.4 Contribution in Lieu of Flow Control Fee

If a project lies within an identified regional facility surcharge area then the project proponent shall pay the regional surcharge fee as identified on the current permit review fee schedule. The fee is based on the final amount of impervious surfaces within the project limits that drain to the public stormwater system.

If a regional surcharge area has not yet been identified for the project site, then the cost of the fee in lieu of flow control will be negotiated between the project proponent and the City, and will be based on the full costs that would be expended if flow control were addressed with site specific facilities (site studies, geotechnical, structural, site, landscaping design, construction, construction administration, sales tax, etc.). (Land costs are not required to be included in the negotiated fee.)

For bookkeeping purposes, costs for joint water quality / detention facilities shall be divided into a water quality component and a flow control component.

8.8.4 Contribution in Lieu of Providing Stormwater Quality Treatment

The City requires stormwater quality treatment measures for projects, as outlined by Minimum Requirement #6 of the Ecology Manual (Section 2.5.6 of the Stormwater Notebook.) One alternative to meeting this requirement is to provide a contribution in lieu of providing site specific facilities. This alternative is mandatory in some cases and optional in others. In either case, projects may still be required to provide some water quality facilities to address existing deficiencies, prevent new ones, or meet site-specific treatment needs as determined through development of the Contribution in Lieu of Stormwater Quality Treatment Proposal.

8.8.4.1 Project Site in Regional Surcharge Area

If a project site is located within a regional surcharge area, as noted on the City's Regional Stormwater Facilities Map (Appendix O), then the project is required to pay the regional surcharge for stormwater quality treatment that has been established for that area, unless the fee in lieu of proposal is determined to be not feasible (See Section 8.8.2 above). This payment will satisfy the site specific stormwater quality treatment requirements that relate to the improvements that are not being built. The project proponent will be required to submit a "Fee in Lieu of Stormwater Quality Treatment Proposal" as described below as part of the project's Drainage Report.

8.8.4.2 Project Site Drains to Regional Stormwater Facility

If a project site is located such that it naturally drains to the proposed location for a proposed or existing regional stormwater facility, as noted on the City's Regional Stormwater Facilities Map (Appendix O), then the project may have the option to pay a fee in lieu of constructing site specific stormwater facilities. This payment will satisfy the site specific stormwater quality treatment requirements that relate to the improvements that are not being built. If the project proponent wishes to pursue this option, the project proponent will be required to submit a "Fee in Lieu of Stormwater Quality Treatment Proposal" as described below as part of the project's Drainage Report. If the City cannot come to an agreement with the project proponent of the amount of the fee, or the other improvements that may be required in addition to the fee, then payment of a fee in lieu of stormwater quality treatment will not be an option and the project will be required to provide site specific improvements accordingly.

8.8.4.3 Contribution in Lieu of Stormwater Quality Treatment Proposal

A contribution in lieu of stormwater quality treatment proposal shall include the following key elements:

- Identify the regional surcharge area or the relevant Potential Regional Stormwater Facility.
- Provide a drainage report describing what would be required for stormwater quality treatment if the project specific improvements were constructed instead of using the fee in lieu option.
- Provide a description of what stormwater quality treatment facilities (if any) are proposed as part of the project. (In some cases, the contribution may not fully meet all stormwater quality treatment requirements.)
- Document how this project will meet the following conditions:
    1. Allowing the contribution in lieu of providing site specific stormwater quality treatment shall not create an unsafe situation.
    2. Appropriate source control procedures are still implemented on the site.
    3. If the site drains to an infiltration system in Wellhead Protection Zone 3, it shall pass through an existing facility for enhanced treatment.
    4. The site may not drain to an infiltration system in Wellhead Protection Zones 1 or 2.

5. A regional water quality project downstream of the project site (or within the regional surcharge area) with available capacity for new development shall be on the City's Regional Stormwater Facility Map (Appendix O).
6. If the project drains into Bellevue, site specific stormwater quality facilities that meet Bellevue's current design standards shall be constructed in addition to payment of the fee in lieu of stormwater quality treatment. Document how Bellevue's requirements will be met. (No review by the City of Bellevue is required.)
7. The Natural Resources Division Manager or his/her designee approves the contribution in lieu of stormwater quality treatment as being consistent with the City's goals and objectives of the regional facilities program. (Include a letter from the Natural Resources Division. Contact the Natural Resources Division early in the process to develop a timeline and review schedule.)

8.8.4.4 Contribution in Lieu of stormwater quality treatment Fee

If a project lies within an identified regional facility surcharge area then the project proponent shall pay the regional surcharge fee as identified on the current permit review fee schedule. The fee is based on the final amount of pollution generating impervious surfaces within the project limits.

If a regional surcharge area has not yet been identified for the project site, then the cost of the fee in lieu of stormwater quality treatment will be negotiated between the project proponent and the City, and will be based on the full costs that would be expended if stormwater quality treatment were addressed with site specific facilities (site studies, geotechnical, structural, site, landscaping design, construction, construction administration, sales tax, etc.). (Land costs are not required to be included in the negotiated fee.)

For bookkeeping purposes, costs for joint water quality / detention facilities shall be divided into a stormwater quality treatment component and a flow control component.

8.9 Other Development Topics

8.9.1 Internal Building Changes as Redevelopment

Re-development projects that are confined to existing interior spaces shall not require new drainage controls (except those drainage systems described above as may be required by the City for proper drainage).

If redevelopment projects include any work involving the exterior part of the site, the project shall be subject to redevelopment requirements under this Stormwater Notebook. Where exterior work occurs, the value of the interior work shall be included in determining the extent of exterior redevelopment requirements.

8.9.2 Site Improvements Involving Hazardous Materials

Site improvements to existing facilities that would otherwise not be subject to stormwater system improvement but involve hazardous materials shall meet the water quality requirements of this Stormwater Notebook, Redmond Municipal Code (RMC) 15.24, RMC 15.06 and RCDG 20D.140. There are also specific source control best management practices in Volume IV of the Ecology Manual.

8.9.3 Dumpster Area Stormwater Drainage

Dumpster areas are classified into one of three (3) groups. Generally, as an introduction, Group 1 is for small containers (not over 1.5 cubic yards) and single family sites, Group 2 is for all other sites that are not listed in Table 8.3, and Group 3 is for all sites involving uses listed in Table 8.3.

Quite often, the land uses at a site change over time. A development may initially have a Group 1 or Group 2 dumpster area. At a later time, if this site's land use changes and a Group 3 dumpster area becomes appropriate, the City may require an upgrade to the Group 3 specifications. For existing developments which need to add dumpster areas, these guidelines generally apply, but requirements may be adjusted or alternatives accepted by the Stormwater Engineer based on the particular characteristics of the existing situation. If compactors are used, the dumpster area is in Group 2 or Group 3 regardless of dumpster capacity. A dumpster area may contain more than one cart or dumpster. To be considered separate areas two (2) dumpster areas need to be separated by at least 25 feet.

8.9.3.1 Group 1: Single Family Parcels and Dumpster Areas having Total Dumpster Capacity not over 1.5 Cubic Yards

Group 1 Dumpster Areas include:

1. All dumpster areas where the volume of the container(s) does not exceed 1.5 cubic yards and compactors are not used.
2. All dumpster areas in single family lots except where certain on-site businesses are conducted. For single-family lots where on-site businesses create additional pollutant potentials in the dumpster area, the dumpster areas may be assigned to Group 2 or Group 3 by the Stormwater Engineer.

No special requirements apply to Group 1 dumpster areas.

8.9.3.2 Group 2: Dumpster Areas having Capacities Over 1.5 Cubic Yards and Uses Not Listed in Table 8.3

Group 2 dumpster areas include areas where the capacity of the dumpster(s) exceed 1.5 cubic yards or dumpsters have compactors and site uses are not included in Table 8.3.

For Group 2 dumpster areas, special requirements apply. Surface drainage from dumpster areas may be connected to the storm drainage system, provided:

1. Dumpster areas are sloped to drain out onto paved, impervious surfaces (such as parking lots).
2. No storm drain inlets are located in the dumpster area.
3. Runoff from the dumpster area flows over the paved surface at least 15 feet prior to entering a catch basin.
4. Catch basins receiving runoff from dumpster areas are Type II, 48-inch diameter minimum, with a "tee" fitting providing floatables separation (and a cleanout port with gasketed cover) but no overflow standpipe.
5. Potential pollutants are not put in the dumpsters on any routine basis.

If pollutants are put in the dumpster on any routine basis the City may require the dumpster area to meet the requirements for Group 3 dumpster areas.

8.9.3.3 Group 3: Dumpster Areas having Capacities Over 1.5 Cubic Yards and Uses Listed in Table 8.3

Group 3 dumpster locations include areas where the capacity of dumpster(s) exceeds 1.5 cubic yards or dumpsters have compactors and the site uses include any uses described in Table 8.3.

In Group 3 dumpster areas, surface drainage from the dumpster areas may be handled in one of two ways:

Preferred Alternative:

Surface drainage from dumpster areas may be connected to the sanitary sewer, provided:

1. The dumpster area is covered.
2. The surface drain from the dumpster area to the sanitary sewer is directed through a City-approved baffle-type oil/water separator.
3. Any issues are resolved with the Fire Department (they may require fire sprinklers) and the Planning Department (regarding aesthetic and site-planning issues).

Alternative if the Preferred Alternative is not feasible:

Surface drainage from dumpster areas may be connected to the storm drainage system, provided:

1. No storm drain inlet is located in the dumpster area.
2. Dumpster areas are sloped to drain out onto paved, impervious surfaces (such as parking lots).
3. Runoff from the dumpster area flows over the paved surface at least 15 feet prior to entering a catch basin.
4. Catch basin(s) receiving runoff from dumpster areas are Type I or Type II.
5. Storm drain pipe(s) from catch basins receiving dumpster area runoff convey the runoff through a baffle-type oil/water separator prior to connection to other parts of the storm drainage system. The flow rate for design of the separator shall be the sum of two rates. The first rate is the peak 50-year storm runoff in cubic feet per second that can enter the separator from contributing areas (Rational Method acceptable). The second rate is the capacity of the dumpster(s) in cubic feet, divided by 5 minutes (300 seconds) to yield cubic feet per second.
6. The storm drain pipes that carry flow from the catch basins receiving dumpster area runoff to the separator shall be gasketed pipe that meets the requirements for sanitary sewer pipe as noted in the City of Redmond Standard Details.

Table 8.3: Dumpster Area Group 3 Land Uses

Dumpster areas are in Group 3 if they serve land uses that are normally associated with the following types of waste materials:

- Accumulated food wastes
- Vegetable or animal grease
- Used oil
- Liquid feedstock
- Cleaning chemicals
- Liquid or solid dangerous waste (as defined by the Department of Ecology under WAC Chapter 173-303). The Development Services Division may require special handling for any items on this list and not allow their discharge to the storm or sanitary sewer systems.

Additional guidance regarding applicable uses is contained in the 2005 Ecology Manual. The determination about a specific use in Redmond will be made by the City's Technical Committee.

Note that multi-family residential uses (including town homes), printing and publishing businesses, restaurants, gas stations, vehicle maintenance facilities, and dry cleaners are examples of common uses in Redmond that are typically included in Group 3.

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CHAPTER 9: CONSTRUCTION STORMWATER POLLUTION PREVENTION

The 2005 Ecology Manual provides detailed guidance regarding the plans for stormwater runoff management during construction. That guidance is to be followed in the City of Redmond. Field adjustments, likely to be required as the project construction progresses, must also be consistent with the Stormwater Notebook and the 2005 Ecology Manual.

9.1 Key Points to Address

The following are key points to address when formulating a Stormwater Pollution Prevention Plan (SWPPP) and Temporary Erosion and Sedimentation Control (TESC) Plan in Redmond:

1. Consider Stormwater Pollution Prevention in the "Bigger Picture" of the project.

   A. Review Volume II of the Ecology Manual, particularly the general principles in Section 3.1.4.

   B. Plan the use of the site or adjust critical parts of the site plan (in Critical Areas, for example) to avoid potential issues and problems. As noted in the Rainy-Season Guidelines (Chapter 10 of this document).

   C. Avoid Rainy-Season work, especially on large and/or weather-sensitive sites. The Rainy-Season Guidelines (Chapter 10 of this document) may show that work can be done in the rainy season but enhanced (and more costly) TESC Plans are typically required.

2. Include a list of Key Contacts on the TESC Plan.

   Key Contacts related to preparation, implementation, and operation of the TESC measures shall be included on a plan sheet. For each person include the name, title, role in preparing the plan, and phone number(s). The types of people involved in preparing the plan will typically vary depending on the complexity of the project. For relatively small, straightforward projects, the Key Contact may be just the project's civil engineer. For complex sites and projects the list could include:
   - Project's Civil Engineer
   - Project's lead SWPPP specialist
   - Applicant's Project Manager
   - General Contractor
   - Grading Contractor

3. Include the construction Start-up Sequence on the TESC Plan.

The construction start-up sequence is a list of actions to be followed, in the order presented, to set up the stormwater pollution prevention measures prior to other construction.

Initial work in the field needs to follow the sequence on the approved plan, with adjustments to fit field conditions that are approved, in advance, by the City Inspector.

4. Delineate Clearing Limits.

Clearing limits show the area(s) of the site to be left undisturbed. Staging and stockpile areas are considered to be disturbed so they need to be included as cleared area(s). In all cases, disturbed areas shall be the minimum necessary for construction.

On the TESC Plan, show the Clearing Limits. If there are key dimensions to use in the field for locating the clearing limits, show the dimensions on the plan. Such dimensions involve buffers, setbacks, geotechnical considerations, and other such factors.

5. Include "Disconnection" of Surface Inflows.

Runoff from areas upslope of the project's disturbed area(s) must be managed so the upslope runoff does not mix with the disturbed area.

The basic approach is to: cut off the approaching runoff using lined trenches or barriers (that are erosion-proof); collect that runoff at one or more points (depending on topography and other site circumstances); and convey the water around (or across) the work area (in erosion-proof ditches and/or temporary pipes).

6. Apply all available measures to surface runoff leaving the disturbed area to meet water quality standards.

Water quality standards include the State Standards and the City Standards. City Standards include the following:

A. At the outflow point(s) from the treatment system(s), the turbidity standard is 50 NTU, maximum. NTU = Nephelometric Turbidity Unit.
B. At downstream points of discharge to surface waters, the standard is as follows: runoff from the site is not to cause the turbidity level in the receiving water(s) to increase more than 5 NTU.
C. At the outflow point(s) from the site, the standard for pH is 6.5, minimum, and 8.5, maximum.

All available measures can include, but are not necessarily limited to, project phasing, advanced erosion and sediment control measures, and delaying all or part of any project work that has not commenced to avoid working during the rainy season.

Unless a larger design storm is specified for a specific project or pollution control method, the minimum design storm for construction phase measures is the 10-year return frequency storm.

7. Surface runoff leaving the disturbed area shall be controlled using all available measures to meet water quantity limits where sensitive downstream conveyance situations exist. For discharge(s) to streams or channels subject to erosion, the standards for construction phase discharge are the same as those specified for permanent stormwater management for the project.

8. The TESC Plan must include provisions for other pollutants that are likely to be present on site during construction.

   The SWPPP must:
   - list other potential pollutants that are likely to be present on site and provide basic instructions for their management and control;
   - list materials and equipment to be onsite to implement the instructions; and
   - list key emergency phone numbers for resource agencies involved in pollution incidents.

   The 2005 Ecology Manual provides additional information about potential problem areas (Volume II, Chapter 4).

9. Include provisions to prevent mud and dirt from being tracked onto off-site streets in the TESC Plan.

   The minimum basic provision for controlling mud and dirt is the temporary quarry spall entry/exit pad. This approach is successful only in limited circumstances.

   A more reliable approach (which may be proposed or required by the City) is a wheel-wash station. At a minimum (unless specifically waived by the City) the TESC Plan must show the standard wheel-wash facility (including site location and related "plumbing") as an optional measure. The City may stipulate that this measure is required. The City Inspector may require immediate implementation of an optional wheel wash if off-site streets become muddy or dirty from the project. Also see 2005 Ecology Manual Volume II, Chapter 4, BMPs C105, C106, and C107.

10. Include provisions to prevent sediment-laden stormwater from draining into areas proposed for infiltration BMPs like infiltration basins or areas designed for low impact development.

11. Include a Minimum Inspection and Maintenance Schedule for all management practices included on the plan.

    The Minimum Inspection and Maintenance Schedule is to be a table or matrix listing the management practices on the left and the inspection and maintenance frequencies across the top. Two types of frequencies need to be specified. One type is the minimum time-related frequency (e.g. once per day, once per week, beginning and end of each work day, etc.) The other type is the event-related frequency (e.g. after each rainfall, after each larger storm rainfall, after each windstorm, etc.).

12. Comply with other federal, state, and city laws and regulations that relate to the construction phase.

    Of primary importance under this title is safety. Safety of the project workers and other personnel, City staff, the neighbors, and other people who could be affected by the work is of paramount concern. The SWPPP should be reviewed by the plan's designers with safety in mind. Extra features (e.g. fencing, signs, walkways, etc.) should be considered.

    Other laws and regulations that typically apply include:
    A. Noise standards (City)
    B. Construction work hours (City)
    C. Dust control (City and the Clean Air Agency)
    D. Rainy-Season Guidelines (City)
    E. A Pre-Construction Meeting with the City prior to starting work (City)

13. Post required Performance Securities prior to starting work.

    The performance securities that are required for a specific project are specified either in the approval conditions for the project or in the requirements for permits that are required for the project.

9.2 CONTENTS OF CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

The 2005 Ecology Manual requires a Construction Stormwater Pollution Prevention Plan (SWPPP) for Medium and Large Projects. A copy of the SWPPP is to be submitted to the City of Redmond. The SWPPP shall follow the outline and include the elements provided in the "Construction Stormwater Pollution Prevention Plan Checklist" at the end of Volume II, Chapter 3 of the 2005 Ecology Manual.

9.3 National Pollutant Discharge Elimination Systems Permit

A permit is required from the Washington State Department of Ecology for all soil disturbing activities (including clearing, grading, and/or excavation) where 1 or more acres will be disturbed, and stormwater will be discharged to a receiving water directly (e.g., wetlands, creeks, unnamed creeks, rivers, marine waters, ditches, estuaries), or to storm drains that discharge to a receiving water. If all stormwater is retained on-site and cannot enter surface waters of the state under any condition, you do not need permit coverage.

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CHAPTER 10: RAINY SEASON CLEARING / GRADING

10.1 INTRODUCTION

These standards are adopted per Redmond Municipal Code 15.24. These general standards identify what development projects in the City of Redmond can undertake site construction work in the rainy season, what level of Temporary Erosion and Sediment Control (TESC) is necessary and what runoff monitoring is required. Since these are general standards, specific projects and sites may warrant exceptions to these standards.

Planning for rainy-season work needs to begin early in a project. The "Permit Processing Implications" section presents important information for those who may be pursuing construction work in the rainy season. It is important to plan ahead if rainy-season work is to occur given that:

- The SWPPP approved for good weather will probably not be adequate for the rainy season.
- A Seasonal Suspension Plan will be required for rainy-season work.
- Higher levels of TESC require City meetings as these plans are formulated (advance scheduling with City staff is important).
- High TESC levels can involve chemical treatment, so the possible use of such measures must be part of SEPA documents. If such measures become necessary for a project and were not included in SEPA reviews, then SEPA processes would need to be amended prior to approval of the special TESC measures.
- State Department of Ecology approval is required for some state-of-the-art TESC.

Clearing/grading work shall comply with provisions in the Stormwater Notebook and other applicable regulations and standards. Project work shall also comply with City regulations and with requirements developed through SEPA (State Environmental Policy Act) processes, through the City's site plan review processes, and through other project reviews. These project-specific requirements are in addition to and take priority over the general standards in this document where differences occur.

The rest of this chapter contains eight (8) sections:

1. Definitions. This section presents definitions for a few key terms used in this document.
2. TESC Standards. This section presents the standards that define what constitutes successful Temporary Erosion and Sediment Control for a project.
3. Special Requirements for Rainy-Season Work. This section describes two special requirements that apply to rainy-season project work: the Seasonal Suspension Plan and additional performance security.
4. Rough Grading Permits. This section briefly identifies a permit that allows clearing and grading to get started under certain circumstances, so that such work does not occur in the rainy season.

5. Explanation of the Rainy-Season Clearing/Grading Matrix. This section discusses the elements of the "Matrix" (Table 10.2).
6. How to Use the Rainy-Season Clearing/Grading Matrix. This section describes the steps to follow to use the Matrix.
7. Project Planning Implications. This section outlines the project review and approval implications related to rainy-season work. This section contains information to request an exception to the general standards presented in the Matrix.
8. Appeals: Wet Weather Committee. This section describes the group of City staff that have reviewed these general standards and that considers the Correction Requests and Appeals. This group is called the Wet Weather Committee.

There are four (4) tables in this chapter:

Table 10.1 Hydrologic Groups for Area Soils
Table 10.2 Rainy-Season Clearing/Grading Matrix (This table consists of five (5) pages)
Table 10.3 TESC Requirements
Table 10.4 Monitoring Requirements

10.2 DEFINITIONS

10.2.1 Clearing

The term "clearing," as used in these General Standards means the removal of timber, brush, grass, ground cover or other vegetative matter from a site which exposes the earth's surface or any actions which disturb the existing ground surface.

10.2.2 Grading

The term "grading" means any action that changes the elevation of the ground surface. Grading includes, but is not limited to, dredging, landfills, excavations, filling, earthwork, and embankments.

10.2.3 NTU

The letters "NTU" stand for Nephelometric Turbidity Units. These units are a quantitative measure of water clarity based on the scattering of a standard beam of light directed into a standard sample of the water when the scattering is measured at right angle to the beam. A higher reading means the sample is less clear (more cloudy). See also the definition for "turbidity" included below.

10.2.4 Potential Hydraulic Influence

The term "potential hydraulic influence" means surface runoff from the project would follow an identifiable conveyance route to a surface water or regulated wetland and would not be infiltrated enroute.

10.2.5 Rainy Season

The term "rainy season" means the period of time starting on October 1 of each year and ending April 30 of each following year. These dates may be adjusted by the Public Works Director based on climatic conditions for a particular year.

10.2.6 Turbidity

The term "turbidity" as related to construction runoff is the visual cloudiness of the runoff especially as caused by suspended solids and settle-able solids that are being carried by the runoff. In these standards, turbidity shall be measured as specified in Method 2130B of the following reference:

> Standard Methods for the Examination of Water and Wastewater. Current Edition. Franson, Mary Ann H., Managing Editor. Clesceri, Lenore S; Greenberg, Arnold E; and Eaton, Andrew D editorial board. Published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation.

10.2.7 Turbidity Meter

The term "turbidity meter" means a portable, electric, hand-held measuring device designed to give a numerical value of the turbidity (cloudiness) of a sample of water. The numerical values are expressed in units known as Nephelometric Turbidity Units (NTUs).

10.3 TESC STANDARDS

Successful TESC will meet all the following standards:

A. Site areas which do not need to be disturbed are not disturbed (clearing limits are defined and maintained).
B. Flows of runoff from areas not under construction are kept off of disturbed soils in the construction areas.
C. Disturbed soil in an area that is not being worked receives temporary cover.
D. The turbidity in runoff from the construction area does not exceed 50 NTU.
E. Run-off from the construction area that reaches receiving waters does not cause the turbidity in the receiving waters to increase more than 5 NTU as a result of the project runoff.
F. Disturbed areas receive final, permanent cover in accordance with the approved project plans without unnecessary delay.
G. Off-site streets are kept free of dirt and mud originating from the construction site. (Using sweeping, not flushing, in the streets and, if appropriate, on-site wheel wash facilities.)
H. Dust is controlled and is in compliance with the Puget Sound Clean Air Agency.
I. Contingency plans for controlling spills and other potential pollutants have been developed and are ready to implement at the construction site.

J. Work in Critical Areas conforms to requirements of the City's Critical Areas Ordinance (CAO). See Redmond Community Development Guide for additional information and definitions regarding Critical Areas.

K. 24-hour, 7-day-per-week point(s) of contact is/are designated who can call out and direct crews, obtain materials, and authorize immediate expenditures for on-site temporary erosion and sediment control (TESC) work.

L. Compliance exists with all project approval conditions and permits (including applicable non-City permits such as, but not necessarily limited to, the Hydraulics Project Approval from Washington State Department of Fish and Game and the Washington Department of Ecology NPDES Permit).

10.4 SPECIAL REQUIREMENTS FOR RAINY-SEASON WORK

There are two special requirements that apply specifically to rainy-season clearing and grading:

A. Project must have a City-approved Seasonal Suspension Plan for suspending work until the end of the rainy season if on-site TESC is found to be inadequate.

A Seasonal Suspension Plan is a separate outline on the TESC PLAN that describes how the site is closed for the duration of the rainy season if directed by the City. Sites may be closed if they cannot meet the criteria for successful TESC outlined in Section 2. The Seasonal Suspension Plan must have sufficient detail to clearly define the work to be performed under this plan if it is implemented.

The Seasonal Suspension Plan can include measures in the TESC Plan and /or additional BMPs. No site work is allowed under the Seasonal Suspension Plan in the rainy season except for work that is necessary to implement the measures in the TESC Plan and the Seasonal Suspension Plan.

B. Performance security must be provided in a manner acceptable to the City. Performance security will need to provide for monitoring (Level M2 minimum; discussed later in these General Standards), operation of TESC measures, implementation of the Seasonal Suspension Plan, and site restoration.

10.5 Rough Grading Permits

A. Note that a separate permit for clearing and grading may be issued in certain circumstances when such action could allow substantial clearing and grading work to be completed before the rainy season begins. This permit is called a "Rough Grading Permit." See Chapter 6 of the Stormwater Notebook for requirements.

10.6 Explanation of the rain-season clearing/grading matrix

Four factors are considered to classify sites and set standards for clearing and grading work during the rainy season:

A. Location of work areas as related to surface waters (streams and lakes) or wetlands and the buffers of these Critical Areas.
B. The slope of the land surface in the work areas. In some instances the direction of the slope relative to nearby surface waters or wetlands is also a factor.
C. The actual soils in the work area expressed as Soil Conservation Service (SCS) Soil Hydrologic Groups designations (A, B, C, or D) (Table 10.1).
D. Amount of land that is disturbed, considering both the cleared area and volume of earth to be moved.

10.6.1 Location(s) of Work Area(s)

For purposes of these General Standards, the entire City of Redmond is classified into five (5) types of work areas.

Class 1 Work Areas: areas within the banks of a stream, in a lake, in a regulated wetland or on steep slopes (equal to or over 40 percent).

Class 2 Work Areas: areas that are the buffers of streams, lakes, regulated wetlands, or steep slopes.

Class 3 Work Areas: areas within the current conditions 100-year frequency floodplains of major streams or lakes but outside the buffers of the stream or lake (the Sammamish River, Bear Creek, Evans Creek, and Lake Sammamish).

Class 4 Work Areas: areas that have "potential hydraulic influence" on a stream, lake, or regulated wetland (See definitions section regarding this term).

Class 5 Work Areas: consist of all other areas not included in any of the previous four (4) areas.

Work areas are further defined and sub-divided in Table 10.2.

10.6.2 Slope of the Land Surface

This factor refers to the general slope of the land in and immediately adjacent to a work area. The slope used in these General Standards generally refers to the steepest gradient before work or during work, prior to final cover.

Slopes are considered in categories as shown in Table 10.2. The percent of slope is the vertical rise divided by the horizontal run between two points on the ground surface (measured in the steepest direction) multiplied by 100.

10.6.3 Soil(s)

This document is based on soil hydrologic groups as defined by the United States Soil Conservation Service (SCS):

Group A. (Low runoff potential). Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well-to-excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them.

Group B. Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately deep-to-deep, moderately well-to-well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C. Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine-to-fine texture. These soils have a slow rate of water transmission.

Group D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Group A soils have high infiltration capacity in their natural locations because they are associated with permeable underlying geology. In these guidelines, a work area is considered to have Group A soils only if the underlying geology is highly permeable (to a depth of at least 6 feet below the elevation of the lowest project excavation) and only Group A material is used in any filling.

A site's soil types must be determined by a qualified Professional Engineer based on field observations, borings, and test pits at the site. For reference, Table 10.1 in these General Standards shows hydrologic groups for various soils found in the SCS Soil Survey for King County.

10.6.4 Amount of Land Disturbed

The area disturbed is measured in acres and includes all land area that will be cleared at any one time. An area is considered cleared or disturbed until it has the final permanent cover as shown in approved project plans.

Permanent cover can include: final landscaping; buildings (at least to pad or first floor stage); and walkways, parking, and roadways (at least to first lift of compacted gravel sub-base or equal).

For some projects, project phasing can be part of the TESC Plan so the amount of land disturbed at any one time is reduced (see Table 10.2 to determine how disturbed area can affect requirements for a site).

The volume of material to be moved on a site is also a factor in setting standards. The volume of material to be moved is measured in cubic yards, independent of site area.

10.7 How to Use the Rainy-Season Clearing/Grading Matrix

Table 10.2 classifies sites, determines if clearing/grading work can occur in the rainy season, determines the level of TESC required, and determines the level of monitoring required. Table 10.3 defines the four (4) levels of TESC shown in Table 10.2. Table 10.4 defines the three (3) levels of monitoring shown in Table 10.2.

To use Table 10.2, it is recommended that this document be reviewed to understand site factors and other issues related to rainy-season work. For specific projects, start with the first page of Table10.2. If any part of the proposed rainy-season work area is in a Class 1 area, then the entire rainy-season work area must comply with requirements for the Class 1 area.

If none of the proposed rainy-season work area is in a Class 1 area, do the same review using the second page of Table 10.2. Continue through the table until the proposed rainy-season work area is shown in the table. That point in the table defines the class for the proposed work.

Once the work area class is found; Table 10.2 shows whether or not work can be undertaken in the rainy season and if so, what levels of TESC and monitoring are required.

10.7.1 Temporary Erosion and Sediment Control (TESC) Levels

Table 10.2 requires different levels of TESC for different site circumstances. The TESC Levels are defined in Table 10.3. Level TESC1 is the most basic level and Level TESC4 is to be used in critical or sensitive situations. The levels of TESC effort shown in Table 10.3 specify the nature of the TESC Plan and:

- The expertise involved in preparation of the TESC Plan.
- The expertise and experience of the TESC implementation team (during project construction).

Moving large volumes of earth is also a factor in determining the TESC Level required. If rainy-season work involves large quantities of earthwork (over 10,000 cubic yards, as a general threshold), then Level TESC3 is the minimum required.

As experience is obtained by the City concerning TESC3 and TESC4 levels, additional guidance will be added to this document.

10.7.2 Monitoring Requirements

Table 10.2 requires different levels of monitoring for different site circumstances. The three (3) levels of monitoring are defined in Table 10.4. The monitoring relates to inspection of the TESC measures and to monitoring of site runoff and receiving waters for turbidity levels. Portable, electronic turbidity meters are required TESC tools for Contractors working in this area.

If monitoring or other inspections lead to a determination that the TESC measures are not adequate to meet the standards outlined in Section 2, the City may stop work on the entire project and issue further direction. The developer must take actions that are necessary (subject to City approval) to meet the TESC criteria listed in Section 2. Such actions may include compliance with the approved TESC Plan, preparation of an improved TESC plan, suspension of work during the rainy season, or other actions depending on the situation.

10.8 Project Planning Implications

These standards are intended to protect surface and ground water quality and fisheries resources during construction and keep streets in the vicinity of construction sites safe, free of dirt and mud.

Almost all construction sites have the potential to adversely affect water quality and the safety of nearby streets. Such potential greatly increases in the rainy season. It is this increased potential that led to formulation of these general standards for rainy-season work.

The best general strategies to avoid the risks associated with rainy-season work are:

Strategy One: Plan projects so that major, if not all, site work is done in the dry season.

Strategy Two: Plan projects so the site work is phased, if rainy-season work is to be pursued. Work phasing can be applied in two ways as related to these general standards.

First, if part of the site is in an area where work would not generally be allowed during the rainy season, a proposed rainy-season work plan might exclude the site work that cannot be constructed in the rainy season.

Second, project phasing may be used as a general strategy to reduce the area of bare earth exposed at any one time during the rainy season. Such project phasing can reduce costs and land area required for the more complex TESC measures. This approach can reduce the scope and costs (including bonding) for implementation of the Seasonal Suspension Plan.

Even with phasing, some work areas pose such a risk to water quality and fisheries resources that they are not suitable for rainy-season work. These standards identify such work areas.

These standards also identify work areas that pose a high risk but one that can be reduced by using exceptional temporary erosion and sediment control (TESC) measures. Further guidance is provided in this document.

Even lower risk sites need to carefully plan and implement TESC measures in the rainy season.

If rainy-season site work is being contemplated, the project applicant should consider the following questions:

10.8.1 General Project Planning Stage

A. The City has significant limitations and conditions regarding clearing and grading work in the rainy season. Is there any way that this project can be scheduled to conduct all clearing and grading activities in the dry weather? This will expedite permitting and reduce the cost of erosion control measures during construction.

B. Can work avoid Critical Areas altogether? A project that avoids or at least minimizes work in Critical Areas also avoids or minimizes permitting issues related to Critical Areas.

C. Can work be phased? This strategy is discussed above.

10.8.2 Preliminary Design and Application Stage

A. If site work is allowed in the rainy season under these general standards, what levels of TESC and Monitoring will be required? See Tables 10.2, 10.3, and 10.4.

B. If state-of-the-art TESC4 is required, what notifications need to be included in the SEPA documents to allow such TESC options to be used?

Note: If chemical treatment options for TESC may be required, this option must be included in the SEPA Environment Checklist (or EIS) for the project. It is possible to amend a SEPA determination at a later date to add the chemical treatment options but initial disclosure is preferable and saves time for the applicant.

C. Are appropriate TESC planning and implementation team members and those with monitoring expertise being brought into the design process?

Note: For sites and projects requiring only TESC1 or TESC2 levels, the specialized expertise of the team may be less critical. For TESC3 and TESC4 levels, the composition, knowledge, and experience of the team will be a

major consideration in allowing rainy-season work. See Table 10.3 for requirements regarding team participants.

D. Is adequate scheduling, including lead times, being included to involve the City staff in TESC issues?

Note: The TESC1 and TESC2 levels require a minimum of City staff involvement in addition to normal project review activities. However, TESC3 and TESC4 require additional review by City staff. Joint meetings will likely be needed. As the rainy season approaches in each year, demands for City staff time can increase to the point where scheduling involves significant lead time. Please plan ahead if rainy-season work is a possibility.

10.8.3 Project Approval Stage

As part of the City's initial, written preliminary approval for a project, the Rainy-Season Classification will be included.

The City's classification may be appealed based on specific issues of fact or the project's context. Appeals may be submitted only after the written preliminary project approval is issued. Appeals are submitted as described in Paragraph 10.9.

10.8.4 Construction Documents Stage

As construction documents are being developed, it is imperative to apply the expertise of appropriate team members. For most sites, rainy-season TESC will involve significant costs. The TESC measures and their costs are an inherent part of rainy-season work. The design team needs to produce high-quality TESC plans for projects to proceed in the rainy season.

10.8.5 Pre-Construction Stage

The main interaction with the City in this stage is the Pre-Construction Meeting. This meeting needs to include members of the TESC and Monitoring planning and implementation team including contractors and sub-contractors. The contractor doing the clearing and grading work must attend.

If appropriate parties are not represented at the Pre-Construction Meeting, the City may cancel that meeting and require it to be rescheduled.

10.8.6 Construction Stage

The construction stage is the critical stage. It is the responsibility of the developer to meet the standards outlined in Paragraph 10.3 of this chapter. (If the approved plan is not sufficient, the developer must take actions to propose and, after approval by the City, implement additional measures.)

It is the TESC standards not just the measures on the approved plan that must be achieved.

If TESC (including monitoring) is not being successfully addressed, the City may take action ranging from "Notices of Correction" to "Stop Work Orders" that apply to the whole project including all trades and activities. The Stop Work Order can apply for the entire rainy-season duration and can require implementation of the Seasonal Suspension Plan.

The construction stage does not end under these general guidelines until all disturbed earth surfaces are covered with the final, permanent cover as shown on approved project plans.

10.9 Appeals: the Wet Weather Committee

After the City has issued the initial written approval or disapproval for a project (which will include the classification of the site and project under these general standards) an appeal may be made based on issues of fact and/or the project's context.

Appeals are to be submitted to the Development Services Division and will be considered by the Wet Weather Committee. The Wet Weather Committee is composed of one representative from each of the following divisions of the Public Works Department:

- Construction Division
- Development Services Division
- Natural Resources Division

Appeals must be in writing (five copies) and must include clearly organized supporting data developed by well-qualified professionals for all key points.

Upon reviewing written appeals, the Wet Weather Committee may take one of six (6) actions:

- Determine that inadequate or insufficient information has been provided or that information was not developed by appropriate, well-qualified professionals. (The appeal will be returned without action and additional details may or may not be included.)
- Approve the appeal.
- Approve the appeal with conditions.
- Deny the appeal.
- Deny the appeal but include information that could be addressed so as to warrant reconsideration.
- Request additional information.

For sites that require an NPDES permit from the State Department of Ecology, initial review(s) of appeals may be made by the Wet Weather Committee but final approval for rainy-season work will require submittal of the NPDES Permit.

For sites that require an HPA from the Washington State Department of Fish and Wildlife, a copy of the State-approved HPA must be submitted with an appeal to the Wet Weather Committee.

Table 10.1
Hydrologic Groups for Area Soils*

SCS Symbol	SCS Soil Name	SCS Hydrologic Group
Ag	Alderwood gravelly sandy loam	C
Be	Beausite gravelly sandy loam	B
Bh	Bellingham silt loam	C
Br	Briscot silt loam	B
Bu	Buckley silt loam	B/C
Ea	Earlmont silt loam	B/C
Ed	Edgewick fine sandy loam	B
Ev	Everett gravelly sandy loam	B
In	Indianola loamy fine sand	A
Kp	Kitsap silt loam	C
Ks	Klaus gravelly loamy sand	A
Ne	Neilton very gravelly loamy sand	A
Ng	Newberg silt loam	B
Nk	Nooksack silt loam	B
No	Norma sandy loam	B
Or	Orcas Peat	D
Os	Oridia silt loam	C
Ov	Ovall gravelly loam	C
Pc	Pilchuck loamy fine sand	A
Pu	Puget silty clay loam	C
Py	Puyallup fine sandy loam	B
Ra	Ragnar fine sandy loam	B

*Compiled from Soil Conservation Service information that applies to King County.

Table 10.2 Rainy-Season Clearing / Grading Matrix[1] Work Located in Critical Areas				
Area Class[2]	**Description[3]**	**Surface Slope**	**Soil Group**	**Work in Rainy Season, General Guidance (Guidance may be modified or waived during City-designated emergencies)**
1a	• Within the Ordinary High Water mark of a stream (all stream classes) • Within a lake • Within a regulated wetland (all wetland classes) • On steep slopes (equal to or greater than 40 percent)	All	All	No work in rainy season

[1] Decisions for a specific project regarding work in the rainy season may be appealed to the Public Works Department's "Wet Weather Committee." Contact the Engineering Division for details. For TESC Levels and Monitoring Levels see Tables 3 and 4, respectively.

[2] "Area Classes" are labels used to identify sub-parts of a project site that meet the descriptions presented in this table.

[3] See Redmond's Critical Areas Ordinance (20D.140 of the Redmond Community Development Guide) for additional definitions and information regarding streams, lakes, wetlands, and buffers. "Artificially Created Wetlands" as mitigation to maintain wetland resources are to be treated as closest wetland type.

Table 10.2 - Continued Rainy-Season Clearing / Grading Matrix[1] Work Located in Critical Area Buffers				
Area Class[2]	**Description[3]**	**Surface Slope**	**Soil Group**	**Work in Rainy Season, General Guidance (Guidance may be modified or waived during City-designated emergencies)**
2a	Buffers associated with: • Class I Streams • Class II Streams where native fish are present or could be present during the construction time • All classes of regulated wetlands • The area within 25 feet of Lake Sammamish Ordinary High Water (elevation 27, City Datum) • The area within 15 feet of steep slopes (those equal to or greater than 40 percent)	All slopes less than 40 percent	All	No work in rainy season
2b	Buffers associated with: • Class II Streams not included in 2a above • Class III Streams • The area within 5 feet of Class IV Streams	Ground slopes away from stream (at slope of at least 5 percent at all times before, during, and after project construction) or work area is isolated from stream by dike or equal; slopes less than 40 percent	All	Work Possible if: • TESC3 or TESC4 Plan (as directed by City); M3 monitoring • Separation of work from 100-year stream flows • Restoration/mitigation and performance assurances are approved by City
2c		All other ground slopes less than 40 percent	All	No work in rainy season

Table 10.2 - Continued Rainy-Season Clearing / Grading Matrix[1] Work Located in Major Floodplain (Outside Buffers)				
Area Class[2]	**Description[3]**	**Surface Slope**	**Soil Group**	**Work in Rainy Season, General Guidance (Guidance may be modified or waived during City-designated emergencies)**
3a	Within the current 100-year FEMA Floodplain but outside of stream buffers and wetland buffers (all stream classes, and wetland types)	Ground slopes away from stream (at slope of at least 5 percent at all times before, during and after project construction) or work area is isolated from stream by dike or equal; slopes less than 40 percent	All	Work Possible if: • TESC3 Plan minimum; M3 monitoring • Separation of work from 100-year stream flows • Restoration/mitigation and performance assurance are approved by City
3b		All other ground slopes less than 40 percent	All	No Work in rainy season (unless the work area has been isolated from current 100-year frequency flood flows)

Table 10.2 - Continued Rainy-Season Clearing / Grading Matrix[1] Work Located in "Hydraulic Influencing" Areas				
Area Class[2]	**Description[3]**	**Surface Slope**	**Soil Group**	**Work in Rainy Season, General Guidance (Guidance may be modified or waived during City-designated emergencies)**
4a	Potential hydraulic influence; [44] disturbed area for entire project is less than ¼ acre	All slopes less than 40 percent	A	Work possible with: • TESC1 • M1 monitoring
4b			All other soils (B, C, and D)	• TESC2 • M1 monitoring
4c	Potential hydraulic influence;[4] two or more phases used so maximum disturbed area does not exceed ¼ acre at any one time	All slopes less than 40 percent	A	Work possible with: • TESC3 • M1 monitoring
4d			All other soils (B, C, and D)	• TESC3 • M2 monitoring
4e	Potential hydraulic influence;[4] disturbed area(s) over ¼ acre	All slopes less than 40 percent	A	Work possible with: • TESC3 • M2 monitoring
4f			All other soils (B, C, and D)	• TESC3 minimum; TESC4 approved and ready to implement at site • M3 monitoring

[4] Potential Hydraulic Influence means surface runoff from the site would follow an identifiable conveyance route to a surface water or regulated wetland and would not be infiltrated enroute.

Disturbed areas less than ¼ acre typically include:

- Trenching/backfill operations
- Berm construction/cover work
- Small sites, including single family homes
- Large sites where work can be phased so as to create only a small disturbed area at any one time.

  TESC Plans for disturbed areas in Area Classification 4a, 4b, 4c, and 4d must provide methods to cover all disturbed areas and temporarily cease work during rainfall.

Table 10.2 - Continued
Rainy-Season Clearing / Grading Matrix[1]
Work Located in Other Areas

Area Class[2]	Description[3]	Surface Slope	Soil Group	Work in Rainy Season, General Guidance (Guidance may be modified or waived during City-designated emergencies)
5a	Areas not included in previous types with disturbed area of 1 acre or less	0-10% slope	All	Work possible if: • TESC2 plan minimum; M1 monitoring
5b		Slopes over 10%, but less than 40%	All	Work possible if: • TESC2 plan minimum; M2 monitoring
5c	Areas not included in previous types with disturbed area over 1 acre	0-10% slope	Group A Soils	Work possible if: • TESC2 plan minimum; M1 monitoring
5d			Group B, C, or D Soils	Work possible if: • TESC3 plan minimum; M2 monitoring
5e		Slopes over 10%, but less than 40%	All	Work possible if: • TESC3 minimum; TESC4 approved and ready to implement at site; M2 monitoring

Table 10.3
TESC Requirements[5]

TESC Level Number	Recommended Participants in TESC Plan	TESC Plan General Formulation and Features (Note: Seasonal Suspension Plan required for all TESC Levels)	TESC Implementation Team (during construction)
TESC1	• Applicant's Engineer	Focus is on standard, common BMPs for site and project type. General sequencing list required.	Designated contractor or sub-contractor[6]
TESC2	• Applicant's Engineer • Applicant's Project Manager • Designated Contractor or Sub-Contractor for TESC[6]	Focus is still on standard BMPs. Written summary required outlining how TESC is to be addressed through main construction phases. More detailed sequencing info on plan.	Designated contractor or sub-contractor[6] with documented experience[7]
TESC3	• Applicant's TESC Engineer(s) • Applicant's Project Manager • General Contractor • Designated Contractor or Sub Contractor[6] for TESC • Grading Contractor • City's Stormwater Engineer • City's Construction Inspector	Plan content similar to Level TESC2, above. More attention to all aspects of plan from conceptual to practical considerations included by team during plan formulation so as assure successful TESC.	Designated contractor or sub-contractor(s)[6] with Level TESC3 experience[7]
TESC4	Same as Level TESC3 plus: • Representative from City's Natural Resources Division	Same as Level TESC3 but will include state-of-art stormwater treatment systems, currently including chemical/filtration systems and such systems as "electrofloc".	Designated contractor(s) or sub-contractor(s)[6] with Level TESC4 experience[7]

[5] Projects moving over 10,000 cubic yards of earth require TESC3 or TESC4.
[6] Designated 24-hour, 7-day-per-week contact list is required.
[7] TESC Contractor must document prior experience in TESC at level designated. For Level 4, TESC Contractor must document experience in chemical treatment and latest mechanical TESC methods (even if they are not initially included in TESC Plan).

Table 10.4
Monitoring Requirements[8]

Monitoring Level	Turbidity Monitoring[9]		
	Monitoring to be by	**Monitoring What and When**	**Frequency[10]**
M1	• Contractor or sub-contractor acceptable to City	• Monitoring of surface runoff whenever it is leaving the work area	• Frequency and details as directed by City; adjusted as project proceeds
M2	• City-approved contractor • Supplemental verification, if directed by City, by third party to be approved by City and hired by Developer	• Monitoring of surface runoff whenever it is leaving the work area • Monitoring of receiving waters (if applicable) if and when directed by City	• Surface runoff to be monitored at least twice per day • Receiving waters to be monitored immediately after surface runoff monitoring
M3	• Monitoring to be done by City-approved "third party" hired by Developer • If so specified, monitoring shall be done by "third party" hired by City and paid for by Developer's advance deposit of funds	• Monitoring of surface runoff whenever it is leaving the work area • Monitoring of receiving waters whenever surface runoff is leaving site and is reaching the receiving waters	

[8] For all three (3) Monitoring Levels, the minimum inspection frequency of all of the TESC measures shall be:

- After each day of site work (but not less than 3 times per week even if no site work has occurred)
- After each storm
- Twice per day during storms; more frequently if directed by City

[9] TESC Contractor must have portable, electronic turbidity meter. At all monitoring levels, a log is to be kept on-site by the TESC Contractor showing monitoring dates, times, locations, weather conditions, estimated discharge rates, monitoring readings, name(s) of those doing the monitoring and equipment used.

[10] Frequencies listed are minimum frequencies. More frequent monitoring including continuous monitoring during heavy storms may be required.

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APPENDICES

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APPENDIX A
Redmond Municipal Code, Chapter 15.24

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Chapter 15.24
CLEARING, GRADING, AND STORM WATER MANAGEMENT*

Sections:

15.24.010 Purpose and intent.
15.24.020 Design, construction and maintenance – General requirements.
15.24.030 Director.
15.24.040 Issuance of permits.
15.24.050 Activities requiring permits.
15.24.055 Activities that do not require a clearing, grading, and storm water permit.
15.24.060 Classification of clearing, grading and storm water management construction activities.
15.24.070 Rough grading projects.
15.24.080 Design and construction requirements.
15.24.090 Relief from general design standards.
15.24.100 Enforcement – Authorization.
15.24.110 Inspection.
15.24.120 Stop work orders.
15.24.130 Suspension or revocation of permit.
15.24.140 Penalty for violation.
15.24.150 Restoration.
15.24.160 Notification of noncompliance.
15.24.170 Penalties.
15.24.180 Processing fees.
15.24.190 Permit fees.
15.24.200 Inspection fees.

*Prior legislation: Ords. 1877, 2180 and 2215. Formerly Chapter 20E.90 RCDG.

15.24.010 Purpose and intent.

The purpose of the Clearing, Grading, and Storm Water Management Code is to: safeguard life, property, public health, and general welfare; minimize water quality degradation; prevent excessive sedimentation of or erosion by surface waters; and prevent the creation of public nuisances such as fouling of surface or groundwater. Furthermore, this section is intended to reduce impacts from land development; preserve and enhance wildlife habitat in and along surface waters; enhance the aesthetic quality of the area waters; minimize erosion; preserve trees; and preserve natural topographic features. These regulations focus on prevention of adverse impacts associated with clearing, grading and storm water activities rather than remediation of adverse impacts after they have occurred. (Ord. 2218 § 1, 2004)

15.24.020 Design, construction and maintenance – General requirements.

(1) The design, construction, and maintenance of all clearing, grading and storm water management systems and facilities shall comply with the requirements and design standards contained in all the following documents:

(a) This chapter.

(b) The Department of Ecology Storm Water Management Manual for Western Washington, dated August 2001 or its successor when approved by the City's Technical Committee.

(c) Any applicable construction specifications, design standards and details approved under the authority of subsection (2) of this section.

(2) The Public Works Director shall prepare and shall adopt construction specifications and design standards and details for clearing, grading, and storm water management. The specifications, design standards and details shall be based on the Department of Ecology Storm Water Management Manual for Western Washington, dated August 2001 or its successor when approved by the City's Technical Committee. The Public Works Director has the authority to make changes as local conditions warrant with approval of the Technical Committee. The specifications, design details, and any changes shall be made available to the public. A fee set by the Public Works Director may be charged for these documents.

(3) In the case of conflicts between the documents listed in subsection (1) of this section, conflicts shall be resolved by applying the following order of precedence:

(a) This chapter;

(b) The standard specifications and details referred to in subsection (2) of this section; and

(c) The Storm Water Management Manual for Western Washington. (Ord. 2218 § 1, 2004)

15.24.030 Director.

For the purposes of this chapter only, "Director" shall mean the Director of the Public Works Department or his/her designee. (Ord. 2218 § 1, 2004)

15.24.040 Issuance of permits.

(1) Regulated clearing, grading and/or storm water activity as defined in RMC 15.24.050 requires City approval and the issuance of the appropriate permit(s) before initiating any of the regulated activities.

(2) Speculative clearing and grading shall be prohibited.

(3) For regulated activities, City approval means approval of appropriate plans, prepared by the applicant's engineer(s), indicating compliance with the requirements and design standards specified in this chapter under RMC 15.24.020. Approval shall be evidenced by the signature of the Public Works Director or designee. Once plans are approved, a permit may be issued by the City. Fees for plan review and permit processing may be charged as established by separate ordinance. Issued permits shall be posted on the construction site at all times when work is underway. To ensure that the actual work in the field conforms with the approved plans, permitted activities shall be inspected by the City during construction. (Ord. 2218 § 1, 2004)

15.24.050 Activities requiring permits.

All clearing, grading or storm water management construction activities listed below require approved plans and a permit(s). The thresholds are cumulative during a one-year period for any given site.

(1) Clearing of 7,000 square feet of land area or more.

(2) Earthwork of 50 cubic yards or more. This means any activity which moves 50 cubic yards of earth, whether the material is excavated or filled and whether the material is brought into the site, removed from the site, or moved around on the site.

(3) Removal of 11 or more trees that are six-inch diameter or larger. The tree diameter is measured four feet from the ground. The removal of 10 or fewer trees is regulated in RCDG 20D.80.20.

(4) Any clearing or grading within a sensitive area or buffer of a sensitive area. Sensitive areas are defined in Chapter 20D.140 RCDG. Any disturbance to vegetation

within sensitive areas and their corresponding buffers is also regulated by Chapter 20D.140 RCDG, the Sensitive Area Ordinance (SAO). Note that under the SAO, a clearing/grading permit for work on steep slopes must first receive a variance from the Hearing Examiner and must address criteria in the SAO which include considerations of alternatives that avoid any disturbance of steep slopes.

(5) Any change of the existing grade by four feet or more. This criterion applies to all permanent changes in grade and grade changes for extended periods of time (60 days or longer) located outside structure footprints.

(6) Any work within a public easement, City-owned tract or City right-of-way. Any clearing, grading or landscaping must be approved by the Department of Public Works prior to construction.

(7) The creation or addition of new, replaced or new plus replaced impervious surface in the amount of 2,000 square feet or more.

(8) Any construction of public drainage facilities to be owned or operated by the City.

(9) Any construction of private storm drainage pipes 12 inches in diameter or larger.

(10) Any modification of, or construction which affects, the private quantity or quality control system. (Does not include maintenance or repair to the condition defined by previously approved plans). (Ord. 2218 § 1, 2004)

15.24.055 Activities that do not require a clearing, grading, and storm water permit.

(1) All clearing, grading and storm water management construction activities that do not involve any of the thresholds listed above do not require City-approved clearing, grading and storm water management plans or a permit, but still must meet the requirements specified in RMC 15.24.020.

(2) Activities that do not require approved plans or permits must still provide BMPs as necessary to control water quality. Any surface intended for vehicular traffic shall provide a floatables separator. Minimum requirements for other activities may be obtained by written request to the Development Services Division, accompanied by an adequate description of proposed work.

(3) The following activities are unregulated by this chapter even if the criteria in RMC 15.24.050 are exceeded:

(a) Agricultural crop management of existing farmed areas.

(b) Cemetery graves involving less than 50 cubic yards of excavation, and related filling per each cemetery plot. (Ord. 2218 § 1, 2004)

15.24.060 Classification of clearing, grading and storm water management construction activities.

(1) A clearing, grading and storm water management permit may be considered as a component of a building permit or other permit, rather than as a separate permit, if City-approved drawings for such activities are included under the other permit.

(2) The Director shall specify what submittal and application materials are required for a complete application, including the type of submittals, the required level of detail, the minimum qualifications of preparers of technical documents, and the number of copies that must be submitted.

(3) Clearing, grading and storm water management activities are classified based on type, location and timing of development activity proposed. Table 1 outlines the classifications for clearing, grading and storm water management activities and briefly reviews processing. Other City processes, approvals and permits may also be required for projects. The Director may adjust classifications and permit processing steps for proposed projects which are shown to be in multiple classifications or are otherwise not

appropriately classified under the criteria shown in Table 1 and may adjust processing steps and fees as appropriate.

(4) Project Classification and Processing Table. (See next page.)

Table 1

Project Classification	Typical Type of Development Activity	City Permit Which Allows Clearing, Grading and Storm Water Management Construction*	Summary of Permit Process for Clearing, Grading and Storm Water Management Construction
Building Projects	Single-family, duplex construction, commercial, industrial and multifamily construction, additions	Building Permit	Clearing, grading and storm water management activities are reviewed in conjunction with the Building Permit plans. Single-family and duplexes are reviewed by the Construction and Building Divisions, all other projects are reviewed by the Development Services Division
Development Projects	Subdivision, utility construction outside City right-of-way, clearing and grading only projects including landscaping projects	No permit issued at this time	Clearing, grading and storm water management activities are reviewed by the Development Services Division as all or part of the site improvement plans
Right-of-Way Projects	Construction activities all or partly within the City right-of-way	Street Use Permit	Clearing, grading and storm water management activities are reviewed by the Development Services Division as part of the project
Rough Grading Projects	Clearing and/or grading of a site before all final approvals of the entire project	Rough Grading Permit	Clearing and grading activities are reviewed by the Development Services Division prior to other site improvements plans. Special conditions shall be met for issuance of Rough Grading plans (see RMC 15.24.070).

* Construction is allowed only when approved plans for clearing, grading and storm water management construction are issued with the appropriate permit listed in the table.(Ord. 2218 § 1, 2004)

15.24.070 Rough grading projects.

(1) Rough Grading Prerequisites. The Technical Committee shall determine whether rough grading will be permitted for a project. At a minimum, to obtain a Rough Grading

Permit approval for a project all the following shall have been processed and have received approval:

(a) Site plan approval including conceptual utility layout.

(b) SEPA review for the entire project completed (if required).

(c) Clearing, grading and temporary erosion control construction plans.

(d) Resolution of all project feasibility issues (i.e., required off-site easements, significant utility design issues, etc.).

(2) Rough Grading Application. Upon completion of the prerequisites listed above, the following information shall be submitted, if applicable, for a rough grading application to be considered complete:

(a) Seven sets of rough grading drawings and supporting information stamped and signed by a professional civil engineer.

(b) Clear identification of all work proposed under the rough grading application.

(c) Clear identification of existing and proposed grades.

(d) Clear identification of all areas that will be disturbed.

(e) Identification of proposed quantity of earthwork.

(f) Identification of proposed erosion control measures.

(g) An erosion control plan designed in accordance with the City Design Specifications.

(h) Payment of the appropriate plan review fees.

(i) Prior to issuance of Rough Grading Permits, acceptable site restoration assurance (bonding, cash deposits, etc. as specified by the Technical Committee) shall be posted with the City. (Ord. 2218 § 1, 2004)

15.24.080 Design and construction requirements.

(1) Minimum Requirements. The design and construction standards found in this section are the minimum requirements. The Director may require additional or modified standards for specific projects or areas based on approved interlocal agreements, identified capacity limitations, significant erosion potential, seasonal factors, or other applicable factors.

(2) Checklist. The Director of Public Works shall maintain a checklist of Project Requirements that will be available at the Development Services Division. For those activities that require preparation of plans (see regulated activities RMC 15.24.050), the applicant shall prepare plans that, at a minimum, include the following:

(a) Erosion and Sediment Control. All clearing, grading and storm water management activities shall be designed and constructed to minimize erosion and the transport of sediment.

(b) Drainage Facilities. Drainage facilities shall be provided with site improvements as needed to meet the intent of this section. As a minimum, conveyance systems shall be designed to convey the 10-year storm. Culvert crossings of public rights-of-way shall be designed for at least the 25-year storm. Additional analysis may be required and if excessive flooding, erosion and other damage would occur, the design storm may be increased by the Director.

(c) Water Quality Control. All projects that create or add 5,000 square feet or more of pollution-generating impervious surface (PGIS) or 3/4 acre or more of pollution-generating pervious surface (PGPS) shall provide treatment of runoff from the added impervious area. Treatment shall, at a minimum, be sized to capture and treat the water quality design storm, defined as the six-month, 24-hour return period storm. Flows exceeding the water quality design storm shall bypass water quality control systems. The Director may exempt trails and other linear types of construction projects if not used by motor vehicles and no significant impacts are identified.

(d) Water Quantity Control. All projects that create or add 5,000 square feet of impervious area shall control runoff from the added impervious area. The maximum allowable discharge rate(s) depend on the downstream conveyance system. Where downstream systems contain streams, other channels susceptible to erosion, or special local conditions as determined by the Director, storm water discharges shall match developed discharge durations for the range of predeveloped discharge rates from 50 percent of the two-year peak flow up to the full 50-year peak flow, assuming the predeveloped condition is forested land cover except on the Sammamish Valley floor, where pasture may be taken as the predeveloped condition. The developed peak discharge rates for the two- and ten-year return periods shall match the existing (predeveloped) site conditions peak rates. If downstream analyses show flooding, erosion, and other damage would still occur, the allowable discharge rates may be decreased by the Director. For other downstream systems, the peak discharge rate shall not be increased due to the proposed development over that for natural conditions for the water quality design storm and 10-year design storm. In some cases direct discharge without detention may be permitted as determined by the Director. Trails and other linear types of construction activities may be exempt if not used by motor vehicles and no significant impacts are identified with approval by the Director.

(e) Stabilization of Disturbed Areas. All exposed soil shall be stabilized by suitable application of BMPs, including but not limited to sod or other vegetation, plastic covering, mulching, or application of base course(s) on areas to be paved. All BMPs shall be selected, designed and maintained according to the approved Manual. From October 1st through April 30th, no unworked soil shall remain exposed for more than two days. From May 1st through September 30th, no unworked soil shall remain exposed for more than seven days. The City may permit extension of these times or require reduction of these times based on current and projected weather with prior approval and/or direction by the City inspectors.

(f) Protection of Adjacent Properties. Adjacent properties shall be protected from sediment deposition by appropriate use of vegetative buffer strips, sediment barriers or filters, dikes or mulching, or by a combination of these measures and other appropriate BMPs.

(g) Maintenance. All erosion and sediment control BMPs shall be regularly inspected (minimum once a week and after each storm) and maintained to ensure continued performance of their intended function.

(h) Identification of Sensitive Areas and Associated Buffers. No clearing or grading activity shall take place without first delineating sensitive area and buffers. All sensitive areas shall be delineated and clearly marked on the plans for permits. On-site and off-site sensitive areas that may be affected by the proposed activity shall be identified. All such on-site areas shall be fenced before any clearing or grading whether a permit is required or not required. These areas shall not be cleared and the vegetation shall not be disturbed per the Sensitive Areas Ordinance (Chapter 20D.140 RCDG).

(i) Identification of Easements. Native growth protection easements (NGPE), utility easements, etc., and corresponding setbacks shall be delineated and clearly marked on the plans. These areas shall not be cleared and the vegetation shall not be disturbed without proper approval.

(j) Accurately Describe Work Area. Provide a plan showing location of the property where the activity is proposed. Show areas to be cleared and graded, stockpile areas, staging areas, etc.

(k) Control of Pollutants Other Than Sediment on Construction Sites. All potential pollutants in addition to sediment that occur on-site during construction shall be handled and disposed of in a manner that does not cause contamination of storm water.

(l) Source Control of Pollution. Source control BMPs shall be applied to all projects to the maximum extent practicable. Source control BMPs shall be selected, designed, and maintained according to the approved manual.

(m) Controlling Off-Site Erosion. Properties and waterways downstream from development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of storm water runoff from the site to the maximum extent practicable.

(n) Other BMPs. Shall be applied as appropriate to mitigate the effects of potential increased runoff and/or decreased runoff water quality to the maximum extent practicable.

(o) Separate public and private drainage storm water facilities for public land and City rights-of-way shall be separate from private on-site facilities to the maximum extent practicable.

(p) Limit Topographic Change.

(i) Within structure footprints, this chapter does not limit cuts or fills (even with the presence of significant trees).

(ii) Within building work areas, the maximum permitted vertical depth or height of a cut or fill is a total of eight vertical feet based on finished grades.

(iii) Outside building work areas, and where significant trees are not present, the maximum permitted vertical depth or height of a cut or fill is a total of eight vertical feet.

(iv) Outside building work areas, and where significant trees are present, grades shall not be changed.

(v) Cut or fill slopes may not exceed 33 percent (3H:1V). Cut and fill slopes for roadways may, however, be designed at (2H:1V) upon review and approval by the Director.

(q) Tree preservation plan information in accordance with the City's Tree Preservation Regulations shall be incorporated into the clearing and grading drawings and shall become part of all construction documentation. This information shall define spatial limits for tree protection and include detailed drawings of tree protection measures and all required mitigation plantings. The tree preservation information must be prepared by a certified arborist or a certified landscape architect in conjunction with a registered civil engineer. (Note: In most instances, the tree survey will serve as the basis for the tree preservation information.) (Ord. 2218 § 1, 2004)

15.24.090 Relief from general design standards.

(1) The process for requesting relief from the general design standards specified in RMC 15.24.080 shall be through the application of a general development permit and approval through the Technical Committee. One of the following shall be clearly demonstrated to consider granting of relief:

(a) There are no feasible and reasonable alternatives to the clearing, grading and/or storm water activity being proposed;

(b) The proposed activity will result in significantly less impacts than meeting the standards;

(c) Meeting the requirements creates an unacceptable life safety concern; and

(d) No reasonable use with less impacts is feasible and reasonable.

(2) The Technical Committee may determine that a public hearing is necessary because of the nature of the clearing and grading request. If such a determination is made, the Hearing Examiner shall hold the hearing and take final action on the request. (Ord. 2218 § 1, 2004)

15.24.100 Enforcement – Authorization.

The Director is authorized and directed to enforce all the provisions of this section. For such purpose, the Director may appoint officers, inspectors, assistants and other employees as needed from time to time. The Director may authorize such employees, as may be necessary, to carry out the duties and functions of that office. (Ord. 2218 § 1, 2004)

15.24.110 Inspection.

The Director is authorized to make such inspections and take such actions as may be required to enforce the provisions of this chapter or whenever the Director has reasonable cause to believe that any land is being used in violation of this section. Inspections shall be made as follows:

(1) As a condition of any permit issued for activity covered by this chapter, the property owner shall be required to consent to entry upon the land by the Director at all reasonable times to inspect the same or to perform any duty imposed upon the Director by this section. If the land is occupied, the Director shall first present proper credentials and request entry. If the land is unoccupied, a reasonable effort shall be made to locate the owner or other persons at the site who are in apparent charge or control of the land and demand entry. If no person is located, the Director may enter said property and shall, with due diligence, make attempts to notify the owner, occupant, or other person having charge within a reasonable amount of time.

(2) Where the Director has reasonable grounds to believe that activities for which a permit is required by this chapter are being conducted without a permit on land within the City, the Director may seek to inspect the land and such activity. If the land is occupied, the Director shall first present proper credentials and request entry for inspection. If the land is unoccupied, a reasonable effort shall be made to locate the owner or other persons at the site in apparent charge or control of the land and request entry for inspection. If no person is located, or if entry is refused, the Director may request the assistance of the City Attorney, City Prosecutor or Police Department regarding access. (Ord. 2218 § 1, 2004)

15.24.120 Stop work orders.

(1) Whenever any activity is being done contrary to the provisions of this section, the Director may order the work stopped by notice verbally or in writing served on any persons engaged in the doing or causing such work to be done, and any such person shall forthwith stop such work until authorized by the Director to proceed with the work.

(2) The Director may suspend work on any project during periods of inclement weather to reduce actual or potential erosion and/or sedimentation. Such a period may involve days or weeks during storm events or may, at the discretion of the Director, involve the entire rainy season.

(3) The Director may order work stopped because of inadequate on-site erosion/sedimentation controls. In such cases, a revised and improved erosion/sediment control plan (including but not limited to addition of or additional phasing) shall be submitted to the City for review. Once approved, the Director shall lift the stop work order and work can continue. If the revised and improved erosion/sediment control plan is found to be inadequate and work is again ordered stopped, then the following shall be required:

(a) If it is the rainy season, work will be suspended until the end of the season (until April 30th, or later if weather conditions warrant, and work shall not continue beyond October 1st or earlier if weather conditions warrant).

(b) A revised plan shall be required to be submitted to the City Public Works Department. Once approved, work can continue between April 30th - October 1st.

(c) An on-site, full-time erosion control inspector (provided by developer) shall be required to monitor all work involving land disturbance. All costs for this inspector shall be paid by the contractor. The inspector shall provide weekly reports to the City regarding all clearing and grading work; monitor all erosion control features; and be a direct contact for the City inspectors. (Ord. 2218 § 1, 2004)

15.24.130 Suspension or revocation of permit.

The Director may suspend or revoke a permit whenever the permit is issued on the basis of incorrect information supplied, approved plans are not accurately reflective of actual field conditions, or the work is being done contrary to, or in violation of, any pertinent ordinance, regulation, procedure or permit. Upon receipt of a timely appeal under RCDG Title 20F, suspension or revocation shall be stayed pending decision on the appeal; provided, that such a stay shall not affect any stop work order issued by the Director. (Ord. 2218 § 1, 2004)

15.24.140 Penalty for violation.

All violations of this chapter, including hazards and failure to comply with terms of the clearing/grading permit and conditions, are determined to be detrimental to the public health, safety, and welfare and declared to be public nuisances. All such violations are also criminal gross misdemeanors and punishable as provided in RMC 1.01.110. All conditions that, after inspection, have been determined by the Director to render any site or portion thereof to be used or maintained in violation of the section, shall be abated. (Ord. 2218 § 1, 2004)

15.24.150 Restoration.

Any work not done in compliance with this chapter or any permit issued pursuant thereto or with any other section of the Redmond Community Development Guide may be required by Director to be removed or restored to as near pre-project original condition as possible in the sole opinion of the Director. Such restoration may include, but shall not be limited to, the following:

(1) Filling, stabilizing and landscaping with vegetation similar to that which was removed, cuts or fills;

(2) Planting and maintenance of trees of a size that will reasonably assure survival and that replace functions and values of removed trees; and

(3) Reseeding and landscaping with vegetation similar to that which was removed, in areas without significant trees where bare ground exists. (Ord. 2218 § 1, 2004)

15.24.160 Notification of noncompliance.

If, while fulfilling their responsibility under this chapter, the inspector, the engineer, the soil engineer, the engineering geologist or the testing agency finds that the work is not being done in conformance with this chapter or the approved grading plans, the discrepancies shall be reported immediately in writing to the person in charge of the grading work and to the Director. Recommendations for corrective measures, if necessary, shall be submitted.

The appropriate clearing, grading or storm water management permit (see RMC 15.24.060) shall be required regardless of any permit issued by any other department or agency that may be interested in certain aspects of the proposed work. Where work for which a permit is obtained by this chapter is started or proceeding before obtaining such

a permit, the work shall be stopped, and the violator shall be subject to such penalties as provided in this chapter. However, the payment of such penalties shall not relieve any person from fully complying with the requirements of this chapter in the execution of the work nor any other penalties prescribed thereon.

The Director may require that the approved activity, operations and project designs be modified if delays occur which incur weather-generated problems not apparent at the time the permit was issued. (Ord. 2218 § 1, 2004)

15.24.170 Penalties.

Whenever any work for which a permit is required by this code has been commenced without first obtaining said permit, the work shall be stopped, and special investigation shall be made before a permit may be issued for such work. Work shall not commence during the investigation other than restoration, work on pollution control measures or stabilization approved by the Public Works Director. An investigation fee, in addition to the permit fee, shall be collected whether or not a permit is then or subsequently issued. The investigation fee shall be equal to the amount of the permit fee required by the code. The minimum investigation fee shall be the same as the minimum fee set forth in the standard clearing and grading fee for permit application. The payment of such investigation fee shall not exempt any person from compliance with all other provisions of this code nor from any penalty prescribed by law. (Ord. 2218 § 1, 2004)

15.24.180 Processing fees.

Clearing and grading and storm water management fees shall be determined by the Director, and upon approval by the City Council shall be made available to the public.

Before accepting a set of plans and specifications for checking, the Director shall collect a plan-checking fee. Separate permits and fees shall apply to retaining walls or major drainage structures as required by the Uniform Building Code. There shall be no separate charge for standard terrace drains and similar facilities. The amount of the plan-checking fee for clearing/grading plans shall be as set forth in the schedule of fees adopted pursuant to RCDG Title 20F. (Ord. 2218 § 1, 2004)

15.24.190 Permit fees.

A fee for each clearing, grading or storm water management permit shall be paid to the Director as set forth in the fee schedule adopted pursuant to RCDG Title 20F.

Permits may be extended, before their expiration, for up to a total of one year. Inspection fees shall be paid before the start or extension of work and are required for the duration of the project. An additional fee may be charged for processing of a permit extension. (Ord. 2218 § 1, 2004)

15.24.200 Inspection fees.

A fee for each clearing, grading or storm water management construction inspection shall be paid to the Director as set forth in the fee schedule adopted pursuant to RCDG Title 20F. (Ord. 2218 § 1, 2004)

APPENDIX B
Wellhead Protection Zone Performance Standards

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20D.140.50-040 Wellhead Protection Zone Performance Standards.

Any uses or activities locating in the City of Redmond which involve storing, handling, treating, using, producing, recycling, or disposing of hazardous materials or other deleterious substances shall comply with the following standards that apply to the zone in which they are located. Residential uses of hazardous materials or deleterious substances are exempt from the following standards.

If a property is located in more than one wellhead protection zone, the Director of Public Works shall determine which standards shall apply based on an assessment evaluation of the risk posed by the facility or activity. The assessment evaluation shall include, but not be limited to: (a) the location, type, and quantity of the hazardous materials or deleterious substances on the property; (b) the geographic and geologic characteristics of the site; and (c) the type and location of infiltration on the site.

(1) Development within **Wellhead Protection Zones 1 or 2** shall implement the following performance standards:

(a) **Secondary Containment**.

(i) The owner or operator of any facility or activity shall provide secondary containment for hazardous materials or other deleterious substances in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid or in quantities specified in the Redmond Fire Code (Chapter 15.06 RMC), whichever is smaller.

(ii) Hazardous materials stored in tanks that are subject to regulation by the Washington State Department of Ecology under Chapter 173-360 WAC (Underground Storage Tank Regulations) are exempt from the secondary containment requirements of this section; provided, that documentation is provided to demonstrate compliance with those regulations.

(b) **Vehicle Fueling, Maintenance, and Storage Areas**. Fleet and automotive service station fueling, equipment maintenance, and vehicle washing areas shall have a containment system for collecting and treating all runoff from such areas and preventing release of fuels, oils, lubricants, and other automotive fluids into soil, surface water, or groundwater. Appropriate emergency response equipment shall be kept on-site during transfer, handling, treatment, use, production, recycling or disposal of hazardous materials or other deleterious substances.

(c) **Loading and Unloading Areas**. Secondary containment or equivalent best management practices, as approved by the Director of Public Works, shall be required at loading and unloading areas that store, handle, treat, use, produce, recycle, or dispose of hazardous materials or other deleterious substances in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid.

(d) **Storm Water Infiltration Systems**. Design and construction of new storm water infiltration systems must address site-specific risks of releases posed by all hazardous materials on-site. These risks may be mitigated by physical design means or equivalent best management practices in accordance with an approved Hazardous Materials Management Plan. Design and construction of said storm

water infiltration systems shall also be in accordance with RMC 15.24.095 and the City of Redmond Technical Notebook and shall be certified for compliance with the requirements of this section by a professional engineer or engineering geologist registered in the State of Washington.

(e) **Well construction and operation** shall comply with the standards in RMC 15.24.095.

(f) **Protection Standards During Construction**. The following standards shall apply to construction activities occurring where construction vehicles will be refueled on-site and/or the quantity of hazardous materials that will be stored, dispensed, used, or handled on the construction site is in aggregate quantities equal to or greater than 20 gallons liquid or 200 pounds solid, exclusive of the quantity of hazardous materials contained in fuel or fluid reservoirs of construction vehicles. As part of the City's project permitting process, the City may require any or all of the following items:

(i) A development agreement;

(ii) Detailed monitoring and construction standards;

(iii) Designation of a person on-site during operating hours who is responsible for supervising the use, storage, and handling of hazardous materials and who has appropriate knowledge and training to take mitigating actions necessary in the event of fire or spill;

(iv) Hazardous material storage, dispensing, refueling areas, and use and handling areas shall be provided with secondary containment adequate to contain the maximum release from the largest volume container of hazardous substances stored at the construction site;

(v) Practices and procedures to ensure that hazardous materials left on-site when the site is unsupervised are inaccessible to the public. Locked storage sheds, locked fencing, locked fuel tanks on construction vehicles, or other techniques may be used if they will preclude access;

(vi) Practices and procedures to ensure that construction vehicles and stationary equipment that are found to be leaking fuel, hydraulic fluid, and/or other hazardous materials will be removed immediately or repaired on-site immediately. The vehicle or equipment may be repaired in place, provided the leakage is completely contained;

(vii) Practices and procedures to ensure that storage and dispensing of flammable and combustible liquids from tanks, containers, and tank trucks into the fuel and fluid reservoirs of construction vehicles or stationary equipment on the construction site are in accordance with the Redmond Fire Code (Chapter 15.06 RMC); and

(viii) Practices and procedures, and/or on-site materials adequate to ensure the immediate containment and cleanup of any release of hazardous substances stored at the construction site. On-site cleanup materials may suffice for smaller spills whereas cleanup of larger spills may require a subcontract with a qualified

cleanup contractor. Releases shall immediately be contained, cleaned up, and reported if required under RMC 13.07.120. Contaminated soil, water, and other materials shall be disposed of according to state and local requirements.

(g) **Fill Materials**. Fill material shall comply with the standards in RMC 15.24.095.

(h) **Cathodic Protection Wells**. Cathodic protection wells shall be constructed following the standards in RMC 15.24.095.

(i) **Underground Hydraulic Elevator Cylinders**. All underground hydraulic elevator pressure cylinders shall be constructed following the standards in RMC 15.24.095.

(j) **Best Management Practices**. All development or redevelopment shall implement best management practices (BMPs) for water quality and quantity, as approved by the Technical Committee, such as biofiltration swales and use of oil-water separators, BMPs appropriate to the particular use proposed, clustered development, and limited impervious surfaces.

(2) Development within **Wellhead Protection Zone 3** shall implement the following performance measures:

(a) Compliance with the performance standards for vehicle fueling, maintenance and storage areas; loading and unloading areas; well construction and operation; cathodic protection wells; underground hydraulic elevator cylinders, and best management practices in subsections (1)(b), (c), (e), (h), (i), and (j) of this section; and

(b) Fill materials shall not contain concentrations of contaminants that exceed cleanup standards for soil specified in WAC 173-340-740, Model Toxics Control Act, regardless of whether all or part of the contamination is due to natural background levels at the fill source site.

(3) Development within **Wellhead Protection Zone 4** shall implement best management practices (BMPs) for water quality and quantity as approved by the Technical Committee.

(4) An incremental environmental improvement to a system protective of groundwater shall not alter, expand, or intensify an existing nonconformance but may proceed without having to meet the following City codes, with prior approval from the Director of Public Works or his/her designee:

(a) Restrictions associated with critical areas and critical area buffers, if the footprint of the original system protective of groundwater is located within the same critical area buffer and it can be demonstrated through best available science that there will be no significant adverse impacts to the critical area and its buffer;

(b) Any requirement to bring a portion of the facility up to current building, fire, or land use codes that is triggered by the value or design of the incremental environmental improvement to a system protective of groundwater;

(c) The incremental improvement shall not qualify as a redevelopment that would otherwise be prohibited by RCDG 20D.140.50-030(1). (Ord. 2259)

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APPENDIX C
Requirement #2 of the 2005 Ecology Manual (excerpt)

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2.5.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

All new development and redevelopment shall comply with Construction SWPP Elements #1 through #12 below.

Projects in which the new, replaced, or new plus replaced impervious surfaces total 2,000 square feet or more, or disturb 7,000 square feet or more of land must prepare a Construction SWPP Plan (SWPPP) as part of the Stormwater Site Plan (see 2.5.1). Each of the twelve elements must be considered and included in the Construction SWPPP unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the narrative of the SWPPP.

Projects that add or replace less than 2,000 square feet of impervious surface or disturb less than 7,000 square feet of land are not required to prepare a Construction SWPPP, but must consider all of the twelve Elements of Construction Stormwater Pollution Prevention and develop controls for all elements that pertain to the project site.

Element 1: **Mark Clearing Limits**

Prior to beginning land disturbing activities, including clearing and grading, all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area shall be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts.

- **Plastic, metal, or stake wire fence may be used to mark the clearing limits.**

  The duff layer, native top soil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable. If it is not practicable to retain the duff layer in place, it should be stockpiled on-site, covered to prevent erosion, and replaced immediately upon completion of the ground disturbing activities.

Element 2: **Establish Construction Access**

- **Construction vehicle access and exit shall be limited to one route, if possible, or two for linear projects such as roadways where more than one access is necessary for large equipment maneuvering.**
- **Access points shall be stabilized with a pad of quarry spalls or crushed rock prior to traffic leaving the construction site to minimize the tracking of sediment onto public roads.**
- **Wheel wash or tire baths should be located on-site, if applicable.**
- **If sediment is tracked off site, public roads shall be cleaned thoroughly at the end of each day, or more frequently during wet weather, if necessary to prevent sediment from entering waters of the state. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled**

sediment disposal area. Street washing will be allowed only after sediment is removed in this manner.

- **Street wash wastewater shall be controlled by pumping back on-site, or otherwise be prevented from discharging into systems tributary to state surface waters.**

Element 3: **Control Flow Rates**

- **Properties and waterways downstream from development sites shall be protected from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site, as required by local plan approval authority.**
- **Downstream analysis is necessary if changes in flows could impair or alter conveyance systems, stream banks, bed sediment or aquatic habitat. See Chapter 3 for offsite analysis guidance.**
- **Where necessary to comply with Minimum Requirement #7, stormwater retention/detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g. impervious surfaces).**
- **The local permitting agency may require pond designs that provide additional or different stormwater flow control if necessary to address local conditions or to protect properties and**
- **waterways downstream from erosion due to increases in the volume, velocity, and peak flow rate of stormwater runoff from the project site.**
- **If permanent infiltration ponds are used for flow control during construction, these facilities should be protected from siltation during the construction phase.**

Element 4: **Install Sediment Controls**

- **Prior to leaving a construction site, or prior to discharge to an infiltration facility, stormwater runoff from disturbed areas shall pass through a sediment pond or other appropriate sediment removal BMP. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Element #3, bullet #1. Full stabilization means concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion. The Local Permitting Authority shall inspect and approve areas stabilized by means other than pavement or quarry spalls.**
- **Sediment ponds, vegetated buffer strips, sediment barriers or filters, dikes, and other BMPs intended to trap sediment on-site shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.**

- **Earthen structures such as dams, dikes, and diversions shall be seeded and mulched according to the timing indicated in Element #5.**
- **BMPs intended to trap sediment on site must be located in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages, often during non-storm events, in response to rain event changes in stream elevation or wetted area.**

Element 5: **Stabilize Soils**

- **All exposed and unworked soils shall be stabilized by application of effective BMPs that protect the soil from the erosive forces of raindrop impact and flowing water, and wind erosion.**
- **From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This condition applies to all soils on site, whether at final grade or not. These time limits may be adjusted by the local permitting authority if it can be shown that the average time between storm events justifies a different standard.**
- **Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.**
- **Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.**
- **Soil stabilization measures selected should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water.**
- **Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and when possible, be located away from storm drain inlets, waterways and drainage channels.**
- **Linear construction activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall be conducted to meet the soil stabilization requirement. Contractors shall install the bedding materials, roadbeds, structures, pipelines, or utilities and re-stabilize the disturbed soils so that:**
- **from October 1 through April 30 no soils shall remain exposed and unworked for more than 2 days; and**
- **from May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days.**

Element 6: **Protect Slopes**

- **Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion.**
- **Consider soil type and its potential for erosion.**
- **Reduce slope runoff velocities by reducing the continuous length of slope with terracing and diversions, reduce slope steepness, and roughen slope surface.**
- **Off-site stormwater (run-on) shall be diverted away from slopes and disturbed areas with interceptor dikes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.**
- **At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion. Temporary pipe slope drains shall handle the peak flow from a 10 year, 24 hour event assuming a Type 1A rainfall distribution. Alternatively, the 10-year and 25-year, 1-hour flow rates indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. Consult the local drainage requirements for sizing permanent pipe slope drains.**
- **Provide drainage to remove ground water intersecting the slope surface of exposed soil areas.**
- **Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.**
- **Check dams shall be placed at regular intervals within channels that are cut down a slope.**
- **Stabilize soils on slopes, as specified in Element #5.**

Element 7: **Protect Drain Inlets**

- **All storm drain inlets made operable during construction shall be protected so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.**
- **All approach roads shall be kept clean. All sediment and street wash water shall not be allowed to enter storm drains without prior and adequate treatment unless treatment is provided before the storm drain discharges to waters of the State.**
- **Inlets should be inspected weekly at a minimum and daily during storm events. Inlet protection devices should be cleaned or removed and replaced when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).**

Element 8: **Stabilize Channels and Outlets**

- **All temporary on-site conveyance channels shall be designed, constructed and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10- year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used.**

- **Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.**

Element 9: **Control Pollutants**

- **All pollutants, including waste materials and demolition debris, that occur on-site shall be handled and disposed of in a manner that does not cause contamination of stormwater. Woody debris may be chopped and spread on site.**
- **Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment.**
- **Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.**
- **Wheel wash or tire bath wastewater, shall be discharged to a separate on-site treatment system or to the sanitary sewer.**
- **Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application rates and procedures shall be followed.**
- **BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters. Stormwater discharges shall not cause or contribute to a violation of the water quality standard for pH in the receiving water.**
- **Construction sites with significant concrete work shall adjust the pH of stormwater if necessary to prevent violations of water quality standards.**

Element 10: **Control De-Watering**

- **Foundation, vault, and trench de-watering water, which has similar characteristics to stormwater runoff at the site, shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond. Channels must be stabilized, as specified in Element #8.**
- **Clean, non-turbid de-watering water, such as well-point ground water, can be discharged to systems tributary to state surface waters, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of receiving**

waters. These clean waters should not be routed through a stormwater sediment pond.

- **Highly turbid or otherwise contaminated dewatering water, such as from construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam, shall be handled separately from stormwater.**
- **Other disposal options, depending on site constraints, may include: 1) infiltration, 2) transport off-site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters, 3) Ecology-approved on-site chemical treatment or other suitable treatment technologies, 4) sanitary sewer discharge with local sewer district approval, if there is no other option, or 5) use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.**

Element 11: **Maintain BMPs**

- **All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to assure continued performance of their intended function. All maintenance and repair shall be conducted in accordance with BMP specifications.**
- **All temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal of BMPs or vegetation shall be permanently stabilized.**

Element 12: **Manage The Project**

- **Phasing of Construction - Development projects shall be phased where feasible in order to prevent soil erosion and, to the maximum extent practicable, the transport of sediment from the site during construction. Revegetation of exposed areas and maintenance of that vegetation shall be an integral part of the clearing activities for any phase.**
- **Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing these permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance/compaction of native soils except as needed for building purposes. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions, shall be delineated on the site plans and the development site.**
- **Seasonal Work Limitations - From October 1 through April 30, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:**

1. **Site conditions including existing vegetative coverage, slope, soil type and proximity to receiving waters; and**
2. **Limitations on activities and the extent of disturbed areas; and**
3. **Proposed erosion and sediment control measures.**

   Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance. The local permitting authority shall take enforcement action - such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:

   - **If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard; or**
   - **If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.**

The following activities are exempt from the seasonal clearing and grading limitations:

1. **Routine maintenance and necessary repair of erosion and sediment control BMPs;**
2. **Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and**
3. **Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.**

- **Coordination with Utilities and Other Contractors - The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.**

  Inspection and Monitoring - All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have the skills to 1) assess the site conditions and construction activities that could impact the quality of stormwater, and 2) assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

- **For construction sites one acre or larger that discharge stormwater to surface waters of the state, a Certified Erosion and Sediment Control Specialist shall be identified in the Construction SWPPP and shall be on-site or on-call at all times. Certification may be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology.**

Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

- **Maintaining an Updated Construction SWPPP - The Construction SWPPP shall be retained on-site or within reasonable access to the site.**

  The SWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

  The SWPPP shall be modified, if during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) calendar days following the inspection.

Objective

To control erosion and prevent sediment and other pollutants from leaving the site during the construction phase of a project.

Supplemental Guidelines

If a Construction SWPPP is found to be inadequate (with respect to erosion and sediment control requirements), then the Plan Approval Authority[1] within the Local Government should require that other BMPs be implemented, as appropriate.

The Plan Approval Authority may allow development of generic Construction SWPPP's that apply to commonly conducted public road activities, such as road surface replacement, that trigger this minimum requirement.

[1] The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve stormwater site plans.

APPENDIX D
General Application Form

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CITY OF REDMOND GENERAL **APPLICATION FORM** Clearing, Grading, and Stormwater Management	File No. Type of Application Date Received Fee Paid

GENERAL INFORMATION

Name of Development			Area of Property (Acres/Sq. Ft.)
Name of Applicant			
Address			
City	State	Zip Code	Telephone
Description of Proposed Action			

FOLLOWING INFORMATION REQUIRED IF APPLICABLE

Location of Subject Property

Legal Description (Attach additional pages if required)

Properties contiguous to hazardous liquid pipelines must provide Ticket Number from One Call Center: _____

AUTHORIZATION TO FILE SIGNATURE OF ALL PERSONS WITH AN INTEREST IN THE PROPERTY

Name		Name	
Signature		Signature	
Tax Lot and STR/Lot Subdivision		Tax Lot and STR/Lot Subdivision	
City	State	City	State
__ Owner __ Contract Purchaser __ Option Purchaser* _____ Option Expiration Date *Owners Signature also required		__ Owner __ Contract Purchaser __ Option Purchaser* _____ Option Expiration Date *Owners Signature also required	

CERTIFICATION

I certify that the information and exhibits herewith submitted are true and correct to the best of my knowledge and that I am to file this application and act on the behalf of the signatories of the above authorization.

Signature	Date

F069 (1/04)

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APPENDIX E
Permit Review Fee Schedule

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Permit Review Fee Schedule

(This document is updated annually. A version current when this document was published is provided here for your convenience. Obtain a current copy from the Development Services Center.)

CLEARING, GRADING AND STORM WATER MANAGEMENT FEES

SMALL PROJECTS

As Defined by Section 20E.70.050 of the Community Development Guide
*Clear less than 30,000 square feet land area; or
*Move less than 500 cubic yards of soil; or
*Create less than 5,000 square feet of impervious surface.

	Fee
Application Fee	$154
Review	
Small/Simple Project	$763
Small/Complex Project	$1,391
Inspection	
Small/Simple Project	$1,338
Small/Complex Project	$5,018

NOTE: Application Fee is due upon submittal of the application. All other fees are due prior to permit issuance.

LARGE PROJECTS

As defined by Section 20E.70.050 of the Redmond Community Development Guide:
*Clear more than 30,000 square feet land area; or
*Move more than 500 cubic yards of soil; or
*Create more than 5,000 square feet of impervious surface.

Application Fees: Applies to the following applications which meet the definition of a "large project": Plats, Short plats, Site plan, Large Projects, Special Development Projects, and General Development Projects.	$320

	Fee
Review	
Clearing/Grading Only	$3,275
All Other Review	$6,793
Inspection	
Clearing/Grading Only	$4,462
All Other Inspections	$8,921

A 3% technology surcharge is applied as authorized by Ordinance No. 2090 and extended by Resolution No. 1162 on December 3, 2002

APPENDIX F
City Plan Review Checklist

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CITY OF REDMOND

CLEARING, GRADING AND STORMWATER MANAGEMENT PLAN REVIEW CHECKLISTS - F068

	Submittal Dates:	Review Dates/Initials:
Project Name:_____		
Tax Parcel or Plat #:_____	_____	_____/_____
Engineer:_____	_____	_____/_____
Contact:_____	_____	_____/_____
Phone:_____	_____	_____/_____

Review Notes: I = Incomplete/Incorrect/Must be Addressed,
C = Complete/Correct
N = Non-Applicable
[ ] = Reference
__/__/__ = 1st/2nd/3rd Review

REDMOND MUNICIPAL CODE

Plans shall conform to Redmond Municipal Code Chapter 15.24, and the Stormwater Technical Notebook. The general headings listed below must be addressed.

__/__/__Erosion and Sediment Control
__/__/__Conveyance Facilities
__/__/__Water Quality Control
__/__/__Water Quantity Control
__/__/__Stabilization of Disturbed Areas
__/__/__Protection of Adjacent Properties
__/__/__Maintenance
__/__/__Identification of Critical Areas and Associated Buffers
__/__/__Identification of Easements
__/__/__Accurate Description of Work Area
__/__/__Control of Pollutants other than Sediment on Construction Sites
__/__/__Source Control of Pollution
__/__/__Controlling Off-Site Erosion
__/__/__Other BMPs
__/__/__Separate Public and Private Drainage
__/__/__Limited Topographic Change
__/__/__Tree Preservation Plan

DRAWING FORMAT AND CONTENT

__/__/__ Construction Drawing Size - 22” x 34”
__/__/__ Drawing Content - shall contain all information necessary to review the design and to construct the improvements.
__/__/__ Title Block/Drawing Title
- __/__/__ Issue or Revision Date
- __/__/__ Section, Township, and Range
- __/__/__ Project Name & Phase
- __/__/__ Tax Parcel/Plat Number
- __/__/__ Legal Description
- __/__/__ Engineer Information - name, address, phone and contact
- __/__/__ Owner Information - name, address, phone and contact

__/__/__ Vicinity Map - showing the general location of the project
__/__/__ City Approval Block - must be on every sheet at lower right hand corner
__/__/__ Horizontal Scale - 1”=20’
__/__/__ Vertical Scale - 1”=5’
__/__/__ Vertical Datum - minimum of two (2) C.O.R. datum must be shown
__/__/__ Horizontal Datum - minimum of two (2) C.O.R. datum and NAD 83-91 coordinates on two (2) minimum points at exterior lot/boundary corners must be shown
__/__/__ North Arrow & Scale Bar - shown in the upper left hand corner of the drawings
__/__/__ Drawing Layout - shall be laid out to afford the maximum understanding possible
__/__/__ Profiles of Storm Drainage Systems - required for public drainage systems and may be required for private systems where conflicts with other utilities are possible
__/__/__ Profile Information - include existing and proposed grade, all utility crossings and crossings clearances, pipe slope, pipe size, pipe length, pipe material, manhole depths, inverts, etc.
__/__/__ Plan View Information - shall indicate and identify all existing and proposed features, utilities, street improvements and paving, and other features that will affect the design and construction of the site grading and the drainage system.
__/__/__ Engineer Stamp and Signed and Dated Consistently with Issued or Revised Date - drawings shall be stamped before submittal and review by the City.
__/__/__ Legend - identify line types and symbols used
__/__/__ Property Data - shall include property lines with bearings and distances, right-of-way lines, parcel numbers, lot numbers, plat names, and street names.
__/__/__ Phased Project Drawings - depict all construction necessary to complete the phase (each phase shall be independently approved).
__/__/__ Standard Notes found in Appendix of the Stormwater Notebook
__/__/__ Identify source and dates of survey information used in design.

SITE PLAN (All Proposed Information must be Distinguishable from Existing Information)

__/__/__ Property Lines - including bearings and distances
__/__/__ Right of Way - including bearings and distances
__/__/__ Lot Numbers
__/__/__ Site Area - shown in s.f. and acres
__/__/__ Streets - edge of pavement or curb and sidewalk, centerline, and name shown
__/__/__ Contours - (dashed lines for existing and solid lines for proposed) 1' or 2' interval (slopes 40% or greater may be shown with 5 foot contours)
__/__/__ Onsite Features - easements, buffers, +40% slopes, etc.
__/__/__ Offsite Information - all features within offsite areas that drain onsite, and all information within 20' of all property lines
__/__/__ Utilities (water, sewer, telephone, cable television, gas, power, etc.)
__/__/__ All Utilities Easements Shown with Dimensions Labeled
__/__/__ Setbacks
    __/__/__ Building
    __/__/__ Steep Slope (in accordance with geotechnical recommendations)
    __/__/__ Other_____
__/__/__ Parcel Information – Area (s.f.), existing, new, and proposed impervious area, and water quality and quantity design storms

CLEARING AND GRADING

__/__/__ Fully Identify Work - clearing and grading limits shown, with stockpile/staging areas and sequence of construction
__/__/__ Disturbed Area - in acres must be shown on the clearing and grading plans
__/__/__ Limits of Clearing - fenced with 42" orange safety fence or approved filter fence
__/__/__ Trees to Remain - shall be shown with the dripline designated (must have protective fencing at five feet (5') beyond the dripline if adjacent to cleared areas) - no grading or filling permitted within the dripline. Show pertinent information within 50' of clearing.
__/__/__ Buffers of Critical Areas
__/__/__ Steep Slope Setback
__/__/__ Grades - show existing and proposed contours
__/__/__ Cut/Fill - shall not exceed 8'
__/__/__ Stabilization of Disturbed Areas
__/__/__ Stockpile location and ground slopes
__/__/__ Estimate of Earthwork Quantities

TEMPORARY EROSION AND SEDIMENTATION CONTROL

__/__/__ Timing and Stabilization of Sediment Trapping Measures
__/__/__ Silt Fence [COR Std 502] (no straw bale permitted - must use silt fence)
__/__/__ Construction Entrance [COR Std 503]
__/__/__ Clean Water Diversion - areas onsite and offsite that are not disturbed must be diverted away from disturbed areas.
__/__/__ Dewatering Construction Sites – show sediment traps
__/__/__ Stabilization of Temporary Conveyance Channels and Outlets – no erosion for 10-year/24-hour storm
__/__/__ Storm Drain Inlet Protection – inlet protection must be provided for all storm drain inlets within the construction vicinity
__/__/__ Temporary Swales and/or Trenches - show shape, dimensions, spot elevations every 50', drainage area, channel stabilization treatment type and computations of flow and velocity (cannot exceed 4 fps without rip-rap lining) [COR Std 504].
__/__/__ Check Dams - show detail, dimensions and quantity of rock protection. No straw bales allowed.
__/__/__ Temporary Culverts - show drainage area, 1' minimum cover, type of pipe, length and diameter, and slope.
__/__/__ Temporary Sediment Pond(s) - show size, bottom elevation, top elevation, cleanout elevation, outlet protection, drainage area, volume required, volume provided, cross-section through the dam, profile through the pond, spillway and consistent with calculations. Not allowed near future infiltration sites.
__/__/__ Rip-rap Outlet Protection - show size of stone, quantity and stabilization fabric under stone [COR Std 620].
__/__/__ Maximum open trench length = 300'
__/__/__ TESC performance bond posted
__/__/__ Construction Access Routes
__/__/__ Note concerning Removal of Temporary BMPs upon completion of project
__/__/__ Preservation of Natural Drainage Systems
__/__/__ Sequence of Construction - describe how construction will proceed in order to limit erosion, include phasing if appropriate.

STORMWATER PLAN

__/__/__ Minimum Pipe Size - 12” minimum for public storm drain systems and 6” minimum for private systems.
__/__/__ Pipe Data - pipe size, length, slope, and material labeled
__/__/__ Horizontal Clearance - 5’ from all other utilities and structures, and 8’ from trees (street trees may be 3’ minimum with root barrier).
__/__/__ Vertical Clearance - 1’ from other utilities - 18” for sewer with storm above sewer
__/__/__ Rockeries/Retaining Walls - shall not cross or be near storm drain pipes. Exceptions shall only be approved where no alternatives exist. Any crossing of a wall shall be perpendicular to the wall and special construction techniques including steel casings may be required. No rockeries allowed over roof or footing drains
__/__/__Structure Data - structure number, structure type and/or size, type of cover, rim elevation, and all pipe inverts labeled
__/__/__Structure Spacing – 300’ typical, varies by size of pipe.
__/__/__Easements – shown with dimensions labeled - 20’ minimum width - no obstructions allowed in easements
__/__/__Drains Behind Sidewalk - required in all cut situations and at the base of slopes
__/__/__Cleanouts Spacing - to be at bends, end of lines and at 100’ o.c. (required in all cut situations and at the base of slopes)
__/__/__Cleanouts Specifications - shall be specified with Carson boxes or equal with ungasketted caps in soft area and traffic bearing in paved areas [COR Std 621].
__/__/__Footing/Foundation Drains - including pipe size, material, and cleanouts shall be connected to the storm drain system (shown as stubbed to lots only for plats).
__/__/__Roof Drains - including pipe size, material, and cleanouts shall be connected to the stormdrain system (shown as stubbed to lots only for plats) 6” minimum. Maximum of three roof drain stubs are allowed to be connected per collection pipe.
__/__/__Footing/Foundation Drains and Roof Drains - shall be connected at a structure only (private onsite structure or at the street).
__/__/__3’ Paved Area - around roof drain cleanout or catch basin Type 1A required
__/__/__Tracer Wire – must be shown on roof drains from the building to the property line.
__/__/__Outfall Protection - sized for 10-year storm (unless otherwise specified by Development Services Division); provide: type, size dimensions and quantity of stone. Stone must be laid on approved filter fabric. Maximum allowable discharge velocity to rock outlet is 10 fps without special design [COR Std 620].
__/__/__In control structures, hoods for risers over 15” in diameter shall have an annular space equal to the riser pipe flow area.

STORMWATER PROFILES (Required for Public System)

__/__/__Profile - pipes and structures
__/__/__Other Utilities - labeled and designate size and type
__/__/__Profile grades - show and label existing and proposed grades
__/__/__Pipe Cover - 18" minimum
__/__/__Pipe Profile Information - show invert and top of pipe, pipe size, pipe material, and design slope.
__/__/__Drop structures only allowed per approval of Stormwater Engineer
__/__/__Grates: - through-curb inlets at sag curves, possible bypass points and every third inlet; Vaned Grates for public system, herringbone OK for private.
__/__/__Utility Crossings - all crossings must be shown, label utility type, line size, invert of utility and storm lines and clearance between pipes (1' minimum vertical clearance and 30 degrees minimum crossing angle).
__/__/__Structure Profile Information - label type of structure, structure number, size, and pipe inverts
__/__/__Berm Section - in accordance with geotechnical recommendation for open ponds
__/__/__Public Storm Structure – with 4' or greater from the top to the invert must be Type II catch basin - 5' for private structure - see Standard detail 608
__/__/__Type III catch basin required for structures with bottoms between 12' and 25'. See Standard Detail 615.

DRAINAGE BASIN MAP

__/__/__ North Arrow
__/__/__ Scale (larger engineering scale may be used as appropriate)
__/__/__ Title Block
__/__/__ Property Lines
__/__/__ Proposed and Existing Contours
__/__/__ Proposed Storm Drainage Inlets and Numbers
__/__/__ Existing Storm Drainage
__/__/__ Drainage Area to Each Inlets
__/__/__ Drainage Area to SWM Facility
__/__/__ Offsite Areas Draining Onsite
__/__/__ Flow Path for Time of Concentration Computations
__/__/__ Legend of Symbols
__/__/__ Storm Drainage Table (include: inlet number, drainage area, rational method "C" factor and t_c,)
__/__/__ Stormwater Management Data (include: facility number, drainage area and compensated area)
__/__/__ Zoning
__/__/__ Road and Stream Names

STORMWATER QUALITY TREATMENT AND FLOW CONTROL FACILITIES

Wetpond / Detention Pond

__/__/__Setbacks - 10' minimum away from structure and ROW, and 50' minimum away from steep slope (15% or greater)

__/__/__Length/Width Ratio - minimum of 3.0 (preferred)

__/__/__Interior Slope - maximum of 3H:1V. A 2:1 slope below water surface OK where no geotechnical liner is used and pool depth is under 4'.

__/__/__Pond fencing is required where walls or slopes steeper than 3:1 are designed.

__/__/__Permanent Pool - minimum of 6-month/24-hour basin runoff volume.

__/__/__Live Storage - maximum of 50-year/24-hour release.

__/__/__ Berm Embankment - maximum of 6' high (preferred)

__/__/__ Toe of Embankment - minimum of 55' from ROW.

__/__/__ Pond permanent pool depth under 8'

__/__/__ Multi-Celled - minimum of 2 cell (preferred)

__/__/__ Emergency Overflow - for open pond, shall be completely separated from pond outlet.

__/__/__ 5' wide safety bench set at or 1' below the permanent water surface elevation around perimeter of pond. Plant bench with wetland planting.

__/__/__Trees must be setback from the 50-year storm stage. Maintenance access to the pond must be unhindered by trees.

__/__/__ Natural shape preferred

__/__/__ Maintenance access - a Vactor truck shall be able to access the control structure, a backhoe shall be able to access the pond bank.

__/__/__ Inflow pipes to the pond discharge at or above the control elevation. (Stormwater Engineer may approve submerged inflow).

Underground Detention

__/__/__Runoff Determination - per 2005 Ecology Manual, for the design storms as established by the Technical Committee review.

__/__/__Area Draining to SWM System, Bypass and Compensation Areas

__/__/__Offsite Areas Draining on Site - generally do not need to be controlled but, must be safely conveyed

__/__/__Detention Volume Computation - show volume required and volume provided - stage/storage curve must match proposed facility

__/__/__Controlling Orifice Computation - plans and computation must match

__/__/__Control Structure - designed and detailed (plan view and cross section required) shall conform to COR Std 610 or equivalent.

__/__/__Profile of Detention Pipe or Vault

__/__/__Structural Details and Vault Calculations (separate building division review and permit required)

__/__/__Inverts - show for all pipes entering and leaving control structure or vault

__/__/__Vent - minimum 2" diameter for pipe detention systems

__/__/__Maintenance Vehicle Access - required to both ends of detention pipes and two (2) accesses to vaults (one near control structure)

__/__/__Maximum Distance between Detention System Access Points - 100' and ladder access must be provided at all ends.

__/__/__Easement - 5' minimum around all public detention systems (20' min. width)
__/__/__Minimum 10-foot setback from structures, property lines, and right-of-way, or minimum distance to allow construction of a 1:1 slope to the bottom of the facility, whichever is greater.
__/__/__Fire Hydrant - within 100 feet of detention pipe systems 4' in diameter or larger, and for all vault systems over 1000 cubic feet of total volume may be required.
__/__/__Tank Note- "Detention tanks may be air tested before final acceptance".

Infiltration

__/__/__Wellhead Protection Zone noted and accommodated.
__/__/__Soil Permeability Tests or Gradation per DOE - two (2) tests minimum or one (1) for every 5000 s.f. of infiltration system bottom area. Test must end up being not more than 20' from the final location of the infiltration system. Note on plans - to be verified by field observation.
__/__/__Soil Test - must be taken at the proposed bottom of infiltration system.
__/__/__Excavation or Boring - is required in the trench area to a minimum depth of 4' below the proposed bottom of the trench. Infiltration not feasible if evidence of ground water or bedrock/hard pan.
__/__/__Infiltration Bed - all infiltration system should be a minimum of 3' above the seasonal high water mark, bedrock, hardpan and impermeable layer.
__/__/__Setbacks
- __/__/__Minimum 200' from drinking water wells and springs, septic tanks and drain fields
- __/__/__Minimum 20' down slope and 100' up slope of building foundations
- __/__/__Minimum 10' from NGPE and property line

__/__/__Down Spout Infiltration System - shall be designed with overall project for typical lot with individual homes.
__/__/__Maximum Drainage Area
- __/__/__Down Spout Infiltration Systems - 5000 s.f.
- __/__/__Infiltration Basin - 50 acres
- __/__/__Infiltration Trench - 15 acres

__/__/__Infiltration System Location - may not be located in an area previously used as a sediment trap.
__/__/__Inflow to an Infiltration System - must first pass through a pre-settling BMP or a biofilter. Disturbed areas shall not drain to the infiltration system.
__/__/__Add the following note to the plan: "The contractor shall construct infiltration systems only after the entire area draining to it has been stabilized".
__/__/__Filter fabric is required on all sides, top and bottom of infiltration trenches.
__/__/__Maximum Trench Length - 100'
__/__/__Observation Well - one is required per trench
__/__/__Provisions for the 100-year overflow path required.
__/__/__Maximum Ponding - in an open infiltration basins is 3' for the maximum storm entering the basin (not to exceed the 100 year - this includes headwater to pass storm flow out any overflow) 1' of freeboard is required to the top of the structure.
__/__/__Basins Side Slopes - shall not exceed 3:1

__/__/__Infiltration Basin Berm - must use impervious material for berm and the berm must be 2' wide at the top for each foot in height as measured from the ponding area bottom.

Biofiltration

__/__/__Required Length - 200' minimum (may be reduced to 150' for redevelopment projects only).
__/__/__Designed Storm - 6-month/24-hour storm, high flow bypass required unless otherwise designated.
__/__/__Maximum Velocity - 1 fps for the design storm. 3 fps for stability
__/__/__Swale Slope - For slope greater than 2.5%, check dams must be provided.
__/__/__Swale bottom width – Maximum 8 feet
__/__/__Setbacks - no buildings or trees within 8' of the normal high water.
__/__/__Maintenance Access – A backhoe must be able to access at least one side of each biofiltration swale.
__/__/__Easement - public systems shall be in tracts, or easements, unless approved during site review.
__/__/__Cross Section - show dimensions, design flow depth and 1' minimum freeboard
__/__/__Vegetation Specifications - shall provide for water tolerant plants and shall address shading of vegetation. Biofilter planting shall be shown on the civil drawings and subject to approval from the Construction Division.
__/__/__Swales/Trenches - including, grading, slope, spot elevations (a minimum of every 50' and at both ends), bottom width, side slopes, and lining.
__/__/__Biofiltration swales lined or over impermeable soil in WPZ 1,2,3
__/__/__Setback from biofiltration swale top of bank to property line shall be a minimum of 5'.

LOW IMPACT DEVELOPMENT SITE ASSESSMENT

__/__/__Survey
__/__/__Soils report
__/__/__Land cover assessment
__/__/__Streams, wetlands, buffers
__/__/__Flood hazard areas
__/__/__Drainage Report
__/__/__Compost Amended Soil or Protection of Undisturbed soils
__/__/__LID BMPs to be used_____
__/__/__Credits used in modeling_____

OPERATIONS AND MAINTENANCE

__/__/__O&M Manual
__/__/__Provisions for long term maintenance noted on plat

DRAINAGE REPORT

Hydrologic Calculations

__/__/__ Pre-develop Condition
- __/__/__ Forest Area _____
- __/__/__ Pasture Area _____

- __/__/__ Outwash Soil Area _____
- __/__/__ Till Soil Area _____
- __/__/__ Saturated Soil Area _____

__/__/__ Post-develop Condition
- __/__/__ Impervious Roof Area _____
- __/__/__ PGIS Area _____
- __/__/__ Landscaped Area _____
- __/__/__ Forest Area _____
- __/__/__ Pasture Area _____
- __/__/__ Pond Area _____

- __/__/__ Outwash Soil Area _____
- __/__/__ Till Soil Area _____
- __/__/__ Saturated Soil Area _____

Quantity Control

__/__/__ Option 1: Discharge Durations: Match developed condition discharge durations to predeveloped condition discharge durations for the range of discharge rates from one half of the 2-year peak flow up to the 50-year peak flow.

__/__/__ Option 2: Modified Detention Alternative. (Assume outwash soils in WPZ 1, 2, 3 are till in existing and proposed condition.) Discharge Durations: Match developed condition discharge durations to predeveloped condition discharge durations for the range of discharge rates from one half of the 2-year peak flow up to the 50-year peak flow.

__/__/__ Option 3: Infiltration with enhanced treatment in WPZ 3.

__/__/__ Option 4: Infiltration in WPZ 4.

__/__/__ Option 5: Direct discharge. 50-year flow conveyed to river or lake in manmade conveyance.

__/__/__ Option 6: Modified detention for direct discharge. Release 50 year at 10 year peak.

__/__/__ Option 7: Fee in lieu. Include proposal. Letter from Natural Resources Division included.

__/__/__ Storage Volume Required _____

__/__/__ Storage Volume Provided _____

__/__/__ Control Structure(s)

__/__/__ Quantity Control Facilities

Water Quality Design Storm

__/__/__ Approved Continuous flow runoff model
__/__/__ Online BMP
    __/__/__ 24 hour volume (cf) _____
    __/__/__ Hourly flow rate (cfs) _____
    __/__/__ 15 min flow rate (cfs) _____
__/__/__ Offline BMP
    __/__/__ Hourly flow rate (cfs) _____
    __/__/__ 15 min flow rate (cfs) _____

__/__/__ Treatment Volume Provided _____
__/__/__ Control Structure(s)
__/__/__ Quality Control Facility type_____
__/__/__ Quality Control Fee in Lieu Proposal_____

Conveyance System

__/__/__Storm Drain Computations - rational method may be used for pipe sizing. Include: "C" factor determination, time of concentration determination and flow calculations.
__/__/__Design Slope - 0.25% minimum and 20% maximum
__/__/__Hydraulic Grade Line Computations – hgl for 10 year must be 12-inches below overflow condition (allowances may be made near detention system or large bodies of water surcharge). 25 year = 6 inches below. 50 year = no overtopping.
__/__/__Downstream Analysis - provide storm drain computations and hydraulic grade line computations for existing storm drainage systems which are being revised by changes to the drainage area or system expansion.
__/__/__Safe 100-Year Flow Conveyance - the 100-year storm flow shall not impact any buildings (this is beyond traditional conveyance system).
__/__/__Information presented in the calculations is consistent with plan.
__/__/__Concrete inlets may be installed only where downstream catch basins are available to collect sediment. They should be used where sump maintenance would be difficult.
__/__/__Maintenance access to all catch basins and drainage structures has been provided. Extreme cases may be waived by the Stormwater Engineer.
__/__/__Roof drain stubs should cross sidewalk at close to a 90 degree angle.
__/__/__A maximum of three (3) single family houses may share a common roof drain stub.

Off-site Analysis

_/_/_ Upstream analysis of off-site area tributary to the site
_/_/_ Downstream analysis (minimum of 1/4 mile downstream in accordance with DOE standards, etc.)

ADDITIONAL COMMENTS

1. _____
2. _____
_____
_____
_____
_____

APPENDIX G
Rough Grading Permit Application

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ROUGH GRADING PERMIT
Clearing, Grading, and Stormwater Management

Project Name _____ **Permit #CGP** _____

Description of Work: _____

Location: _____

Area Disturbed: _____ **Earthwork Quantity:** _____

Approval by Development Services Division:

_____
Authorized Signature Date

Permit Received by:

_____
Authorized Signature Date

TIME LIMITATION: Permit good for _____ from date issue by Permit Center.

PERMIT FEE:

Permitting: **Yes** _____ **No** _____ **Amount** _____

Inspection: **Yes** _____ **No** _____ **Amount** _____

Total Fee _____

BONDS REQUIRED:

Restoration: **Yes** _____ **No** _____ **Amount of Bond** _____

For Cash bonds - Receipt No. _____ **Date** _____

Contractor (owner): _____

Address and
Phone: _____

Permission is hereby given to do the above-described work, according to the conditions herein and according to the approved plans and specifications pertaining thereto, subject to compliance with the Ordinances of the City of Redmond.

SPECIAL CONDITIONS ATTACHED YES____ NO____

F064 (10/04)

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APPENDIX H
Flood Control Zone Application Form

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FLOOD CONTROL ZONE APPLICATION

APPLICANT:

Name: _____
Company: _____
Address: _____
_____
Telephone: _____

OWNER (if different from applicant):

Name: _____
Company: _____
Address: _____
_____
Telephone: _____

PROJECT IDENTIFICATION AND SCHEDULE:

Type of Work: _____ Construct _____ Reconstruct _____ Modify
Project Description_____
_____
Project Name_____
Construction to commence on_____
and to be completed by_____
Permit if sought for period_____

PROJECT LOCATION:

Tax parcel number_____
Project address_____
Located in _____ ¼ Section ___ T ___ R ___ E (WM)
Within the flood plain of_____
(body of water)

F065 (10/04)

APPLICANT'S SIGNATURE

Applicant, by signature following, herby applies for a Flood Control Zone Permit and stipulates that information provided is correct to the best of applicant's knowledge:

_____ _____
Date

_____
Print

PERMIT: This document grants permission under provision of Chapter 86.16 RCW when and only when signed below and is subject to all conditions noted:

Minimum Finished Elevation shall be _____ NGVD, 1929

Permit Granted

_____ _____
City of Redmond Flood Control Zone Administration Date

Permit and Conditions:

_____

_____

_____

_____

_____

Acknowledged_____ _____
Date

Print_____

F065-con't (10/04)

APPENDIX I
Bill of Sale and Instructions Form

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PUBLIC UTILITY & STORMWATER FACILITIES
BILL OF SALE FORM
INSTRUCTIONS

PURPOSE:

To transfer ownership of a newly constructed public utility and/or stormwater system and appurtenances that have been newly constructed as part of the following project to the City of Redmond.

The project name, as shown on official City approvals is:

_____

PROPERTY DESCRIPTION:

All constructed stormwater conveyance systems and appurtenances constructed as part of the subject project that: (1) are located in City Rights-of-Way; and (2) any stormwater conveyance systems and appurtenances not in City Rights-of-Way that: (a) have been specifically approved for acceptance by the City in writing and (b) are contained within approved easements granted to the City.

SIGNATURE

The Bill of Sale shall be signed by the party who paid for the system improvements. Signature shall be notarized. The notary space for individuals or corporations as appropriate.

QUESTIONS:

If you have any questions about how to complete the form, please contact the Public Works Development Services Division at (425)556-2760.

BILL OF SALE

FOR VALUABLE CONSIDERATION, receipt of which is hereby acknowledged, the undersigned hereby conveys, bargains and sells and transfers to the City of Redmond, hereinafter referred to as the "City", all its present and future right, title and any interest in and to all of the following property:

to have and hold the same for itself, its successors and assigned forever, free of all liens and encumbrances, or interest of third parties.

The undersigned, on behalf of itself and its successors, and assigns covenants and agrees that the undersigned is the owner of said property and has good right and authority to sell the same and that it will, and does, hereby warrant title to said property and agrees to defend and hold harmless the City, its successors and assigns, against all and every person or persons whomsoever lawfully claiming any right, title, or interest in or to the same.

The undersigned warrants that the above-described property is in good operating condition and repair; that the undersigned has not received any citation or warning to the effect that these assets do not comply with all governmental laws or regulations; and further covenants and agrees with the City to replace, repair and correct any defect in work or materials in respect to the personal property subject to this Bill of Sale arising during a period of one (1) year from the date of Acceptance by Public Works Development Services Division, without cost to the City.

DATED this _____ day of _____, 20 _____.

By _____
Its _____

STATE OF WASHINGTON)
) ss.
COUNTY OF _____)

I certify that I know or have satisfactory evidence that _____ signed this instrument, acknowledged it to be his/her free and voluntary act for the uses and purposes mentioned in the instrument.

DATED this _____ day of _____, 20 _____.

_____
NOTARY PUBLIC
My Commission Expires: _____

STATE OF WASHINGTON)
) ss.
COUNTY OF _____)

I certify that I know or have satisfactory evidence that this instrument, acknowledged it to be his/her free and voluntary act for the uses and purposes mentioned in the instrument.

DATED this _____ day of _____, 20 _____.

_____
NOTARY PUBLIC
My Commission Expires: _____

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APPENDIX J
Developer Extension Asset Summary Form

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DEVELOPMENT SERVICES DIVISION

DEVELOPER EXTENSION ASSET SUMMARY

Project Name: _____

Developer: _____

Contractor: _____

****

WATER SYSTEM CONSTRUCTION COSTS

Land $_____
Storage $_____
Pump Station $_____
Pressure Reducing Valve $_____
Water Mains and Appurtenances:

Main Size:	4"	6"	8"	12"	16"	Other ( )
Length:						
Type:						
Lineal Ft $:						
Main Cost:						

Water Mains and Appurtenances Total $_____
Service Lines (Line, Meter Box / Vault, Meter Setter) $_____
Meter Size _____ Qty _____ $_____
Hydrant Qty _____ $_____

Water Total **$_____**

****

SEWER SYSTEM CONSTRUCTION COSTS

Pump Station $_____
Side Sewer (Within Right of Way) Qty _____ $_____
Manholes Qty _____ $_____
Sewer Mains and Appurtenances:

Main Size:	8"	8”	10”	10”	12”	Other ( )
Length:						
Type:	PVC	DI	PVC	DI		
Lineal Ft $:						
Main Cost						

Sewer Mains and Appurtenances Total $_____

Sewer Total **$_____**

(Combined Water/Sewer) Project Total **$_____**

F060 (10/04)

****

PUBLIC STORMWATER SYSTEM CONSTRUCTION COSTS

Land $_____

Pond / Vault / Tank Construction $_____

Pipe Storage Size _____ & Length_____ $_____

Water Quality Type _____ $_____

Stormwater Mains and Appurtenances:

Main Size:	8"	12"	18"	24"	36"	Other ( )
Length:						
Type:						
Lineal Ft $:						
Main Cost:						

Stormwater Mains and Appurtenances Total $_____

Stormwater Total $_____

****

NOTES:

1. Include total cost of improvements including sales tax, engineering and administration.
2. As a separate instrument, a Bill of Sale has been provided for the above improvements.

****

I hereby certify that all bills pertaining to the installation of the improvements have been paid in full and that the above costs represent the true value of the improvements.

HERE AND IN WITNESS WHEREOF, the undersigned have hereunto set their hand and seal.
DATED this _____ day of _____, 20____.

_____

_____

STATE OF WASHINGTON)
)ss
COUNTY OF KING)

On this day personally appeared before me_____to be known to be the individual _____ as described in and who executed the within and foregoing instrument and acknowledged that (he/she/they) signed the same as (his/hers/their) free and voluntary act and deed of the uses and purposes therein mentioned.

GIVEN under my hand and official seal this _____day of _____ 20____.

_____
Notary Public
My commission expires_____

F060 con't (10/04)

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APPENDIX K
Typical Drainage Easement

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Please Return To:
City of Redmond
Public Works Adm. MS: 4NPW
Attn: D. Wilson
P.O. Box 97010
Redmond, WA 98073-9710

WASHINGTON STATE COUNTY AUDITOR/RECORDER INDEXING FORM

Document Title(s) (*or transactions contained therein*):

EASEMENT

Reference Number(s) of Documents assigned or released:
Additional reference numbers on page ____ of document

Grantor(s): (*Last name first, then first name and initials*)
1.

☐ Additional names on page __ of document

Grantee(s): (*Last name first, then first name and initials*)
1. **REDMOND, CITY OF**

☐ Additional names on page __ of document

Legal Description: *(abbreviated form i.e. lot, block, plat name, section-township-range)*

Ptn

■ Additional legal on **Exhibit "A"** of document

Assessor's Property Tax Parcel Account Number(s):

City of Redmond Reference*:*

Project Number: Permit Number:

The Auditor/Recorder will rely on the information provided on the form. The staff will not read the document to verify the accuracy or completeness of the indexing information provided herein.

EASEMENT

THE GRANTOR(S), _____, a _____ _____, for Ten and no/100 Dollars ($10.00) or other valuable consideration, in hand paid, receipt of which is hereby acknowledged, conveys and grants to **CITY OF REDMOND** (Grantee), its successors and assigns, a permanent non-exclusive easement, over, under, in, along, across and upon, that certain land legally described as:

Exhibit "A", attached hereto and incorporated herein by reference,

and graphically depicted on Exhibit "B", for the purpose of constructing, reconstruction, installing, repairing, replacing, operating and maintaining a public storm drain system, with ordinary and necessary appurtenances, together with the right of ingress and egress thereto without prior institution of any suit or proceedings of law and without incurring any legal obligation or liability therefore. This easement is granted subject to the following terms and conditions:

1. The Grantee shall, upon completion of any work within the property covered by the easement, restore the surface of the easement, and any private improvements disturbed or destroyed during execution of the work, as nearly as practicable to the condition they were in immediately before commencement of the work or entry by the Grantee.

2. Grantor shall retain the right to use the surface of the easement as long as such use does not interfere with the easement rights granted to the Grantee. Grantor shall not, however, have the right to:

   (a) Erect or maintain any building or structures within the easement; or
   (b) Plant trees, shrubs or vegetation having deep root patterns which may cause damage to or interfere with the utilities to be placed within the easement by the Grantee; or
   (c) Develop, landscape, or beautify the easement area in any way which would unreasonably increase the cost to the Grantee of restoring the easement area and any private improvements therein.

   This easement shall be recorded with the King County Recorder, shall run with the land described herein, and shall be binding upon the parties, their heirs, successors in interest and assigns.

   Grantor covenants that he is the lawful owner of the above-described property and has authority to convey such easement.

   Dated this _____ day of _____, 2006.

   Grantor:

By: _____

Its _____

STATE OF _____)
) §
COUNTY OF _____)

I certify that I know or have satisfactory evidence that_____ _____is the person who appeared before me, and said person acknowledged that __he signed this instrument, on oath stated that __he was authorized to execute this instrument and acknowledged it as _____of _____to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

Dated this _____ day of _____, 2006.

Notary Seal Please stay within block.

Notary Signature: _____

Print Name: _____

Notary Public in and for the State of _____

Residing in _____

My Commission Expires: _____

EXHIBIT "A"

EASEMENT
KING COUNTY TAX ID #

EXHIBIT "B"

Map

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APPENDIX L
Standard Notes

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STANDARD NOTES

CLEARING, GRADING AND TEMPORARY EROSION CONTROL PLANS

1. All work and materials to be per City of Redmond Standards.

2. Keep off-site streets clean at all times. Flushing streets shall not be allowed. All streets should be swept.

3. Additional erosion/sediment control measures may be required by City Inspector.

4. When work is stopped/completed in an area, the City Inspector may require post-construction erosion control including seeding or other measures.

5. Locations shown of existing utilities are approximate. It shall be the responsibility of the contractor to verify the correct locations to avoid damage or disturbance.

6. It shall be the responsibility of the contractor to obtain street use and other related permits prior to any construction.

7. All ground cover is to remain undisturbed outside of clearing areas.

8. The temporary erosion/sediment controls shall be installed, inspected, and operating before any grading or extensive land clearing. These controls must be satisfactorily maintained until construction and landscaping are complete.

9. Tie impervious surfaces (roof, streets, driveways, etc.) to completed drainage system as soon as possible.

10. A Pre-Construction Meeting with the Construction Division and all permits must be completed before start of construction.

11. Clearing limits shall be located by a licensed Civil Engineer or Land Surveyor.

12. Approval of this temporary erosion/sedimentation control (TESC) plan does not constitute an approval of permanent road or drainage design.

13. This approval for TESC is valid for construction between May 1 and September 30. This approval for TESC is not valid for the rainy season (October 1 through April 30).

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APPENDIX M
Standard Sign for Stormwater Pond

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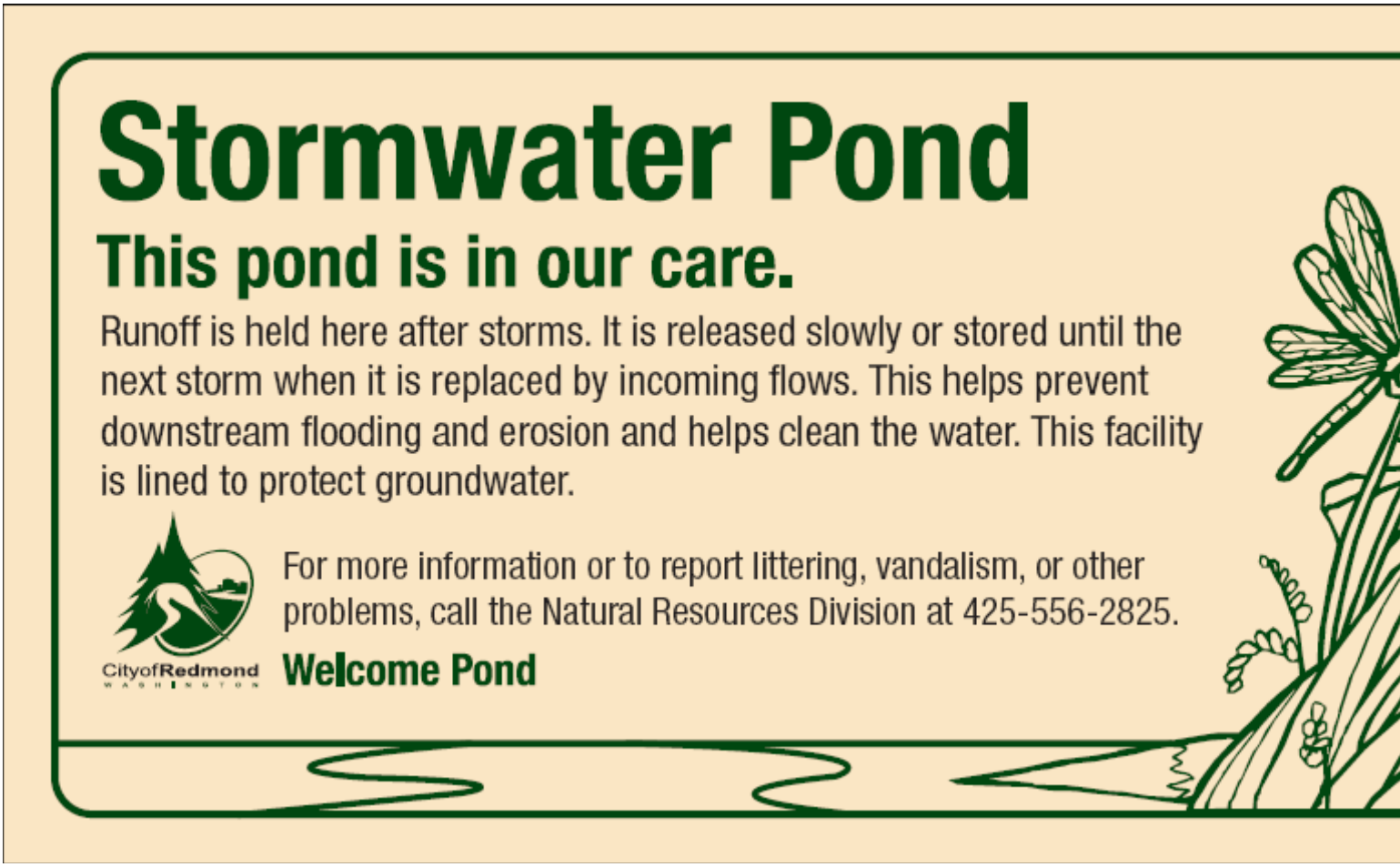

Large Lined Public Pond

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Large Lined Private Pond

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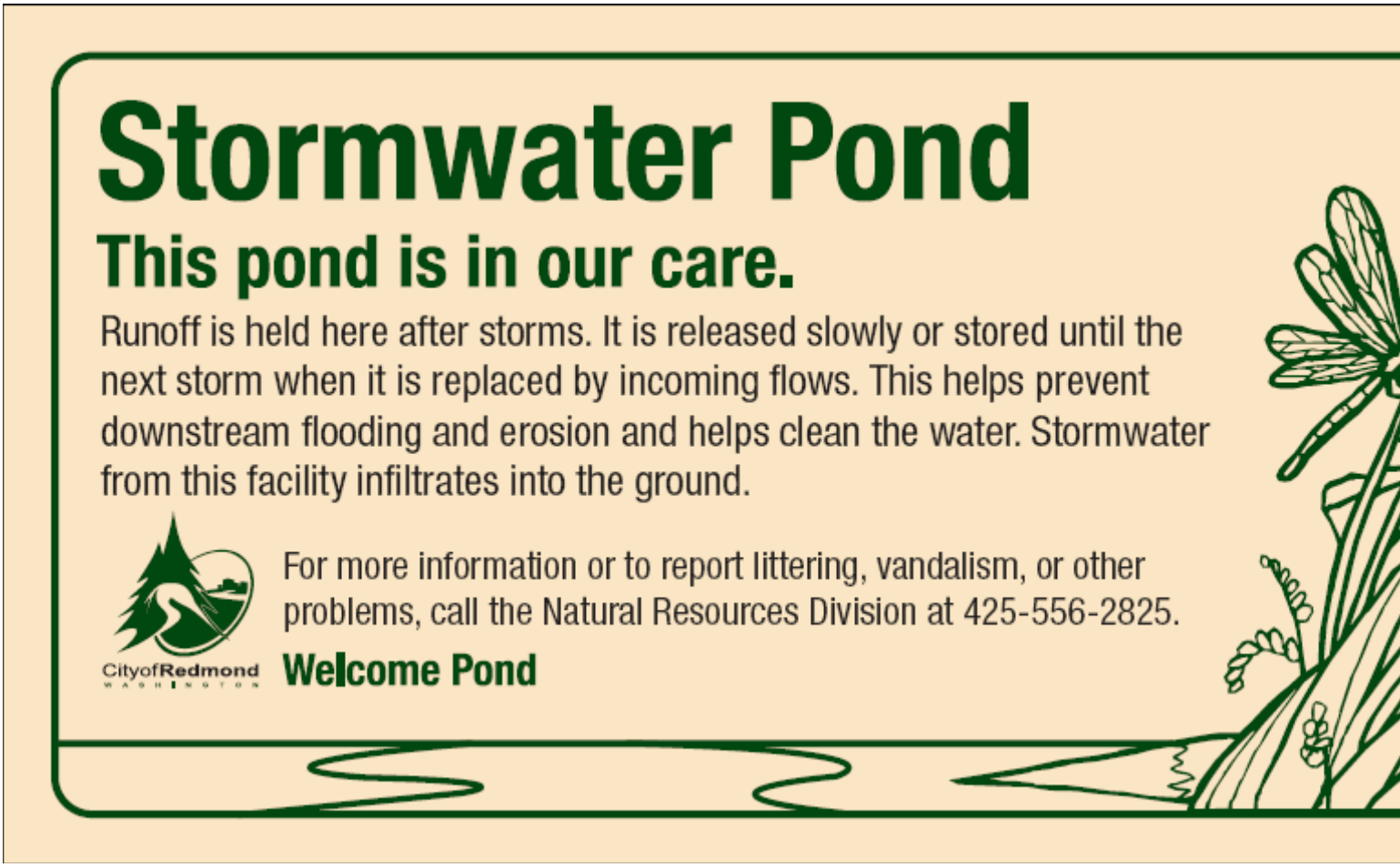

Large Unlined Public Pond

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Large Unlined Private Pond

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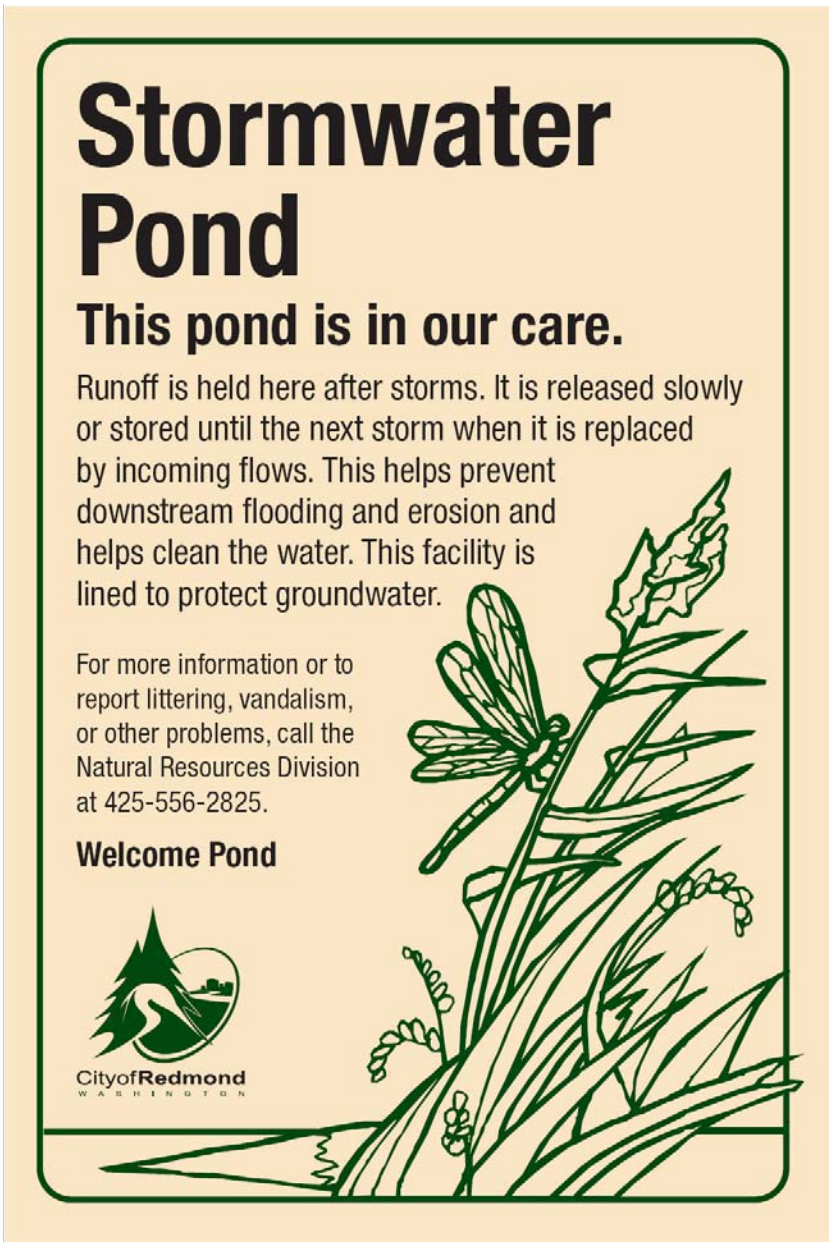

Small Lined Public Pond

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Small Lined Private Pond

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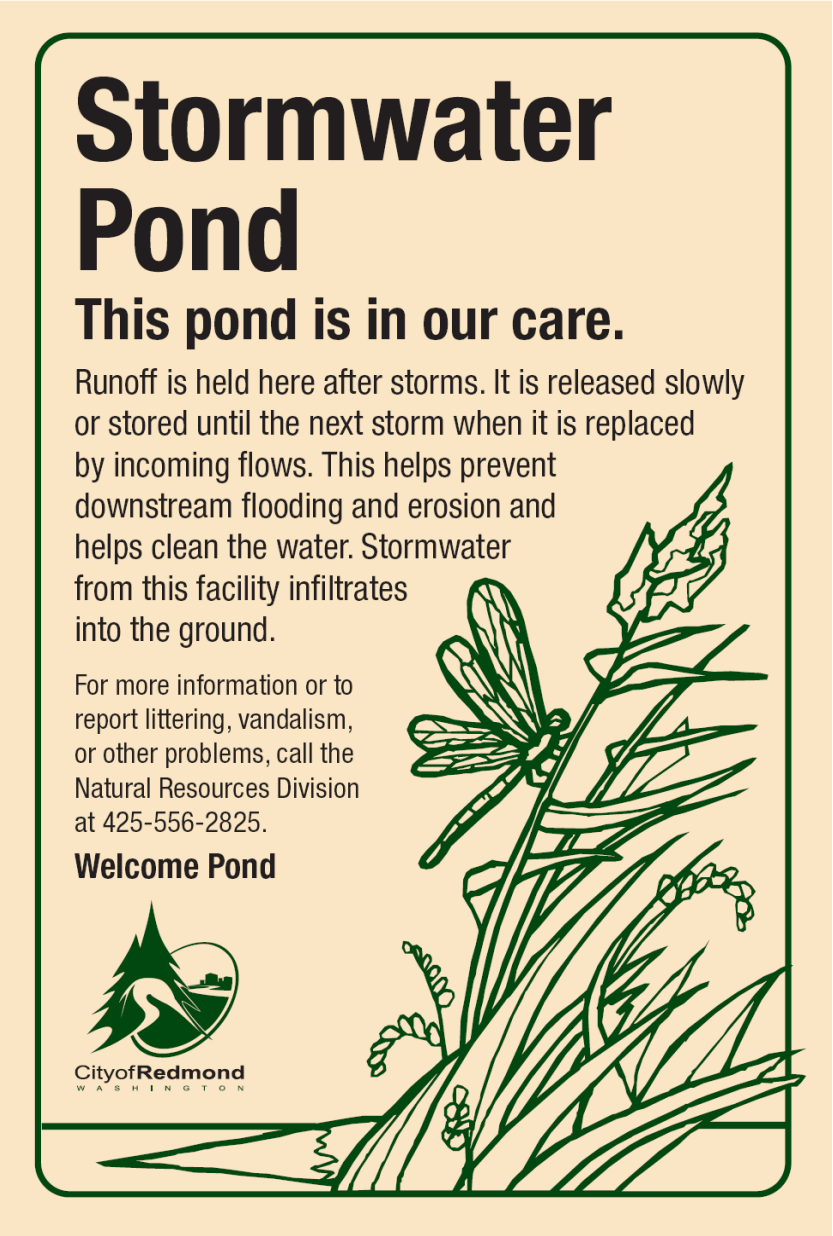

Small Unlined Public Pond

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Small Unlined Private Pond

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Sign Specifications

- The sign colors are PMS 350 (dark green) for the lettering and PMS 726 (light tan) for the background.
- The font used is Helvetica Neue Condensed (bold and regular).
- Size: 48 inches by 24 inches (large sign) or 18 inches by 12 inches (small sign)
- Material: 0.125-gauge aluminum
- Face: Non-reflective vinyl or 3 coats outdoor enamel (sprayed)
- Lettering: Silk screen enamel or vinyl letters
- Installation: Mount on fence, or with pressure treated posts with beveled tops, 1-1/2 inch higher than si 30-inch deep by 8-inch diameter, concrete filled post holes. Top of sign should be 3'-6" above ground posts. For small sign, use one post.
- Placement: Face sign in direction of primary visual or physical access. Do not block access road. Do structures. Location is subject to approval by the Stormwater Engineer.
- The pond name is optional and subject to approval by the Stormwater Engineer.
- An electronic file of the sign is available from the Stormwater Engineer, and is available on the City's w Notebook.
- Sign format varies depending on whether the pond is lined or unlined, public or private, and if it is a la Use the correct sign format for the site.

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APPENDIX N
Map of Historical Land Cover

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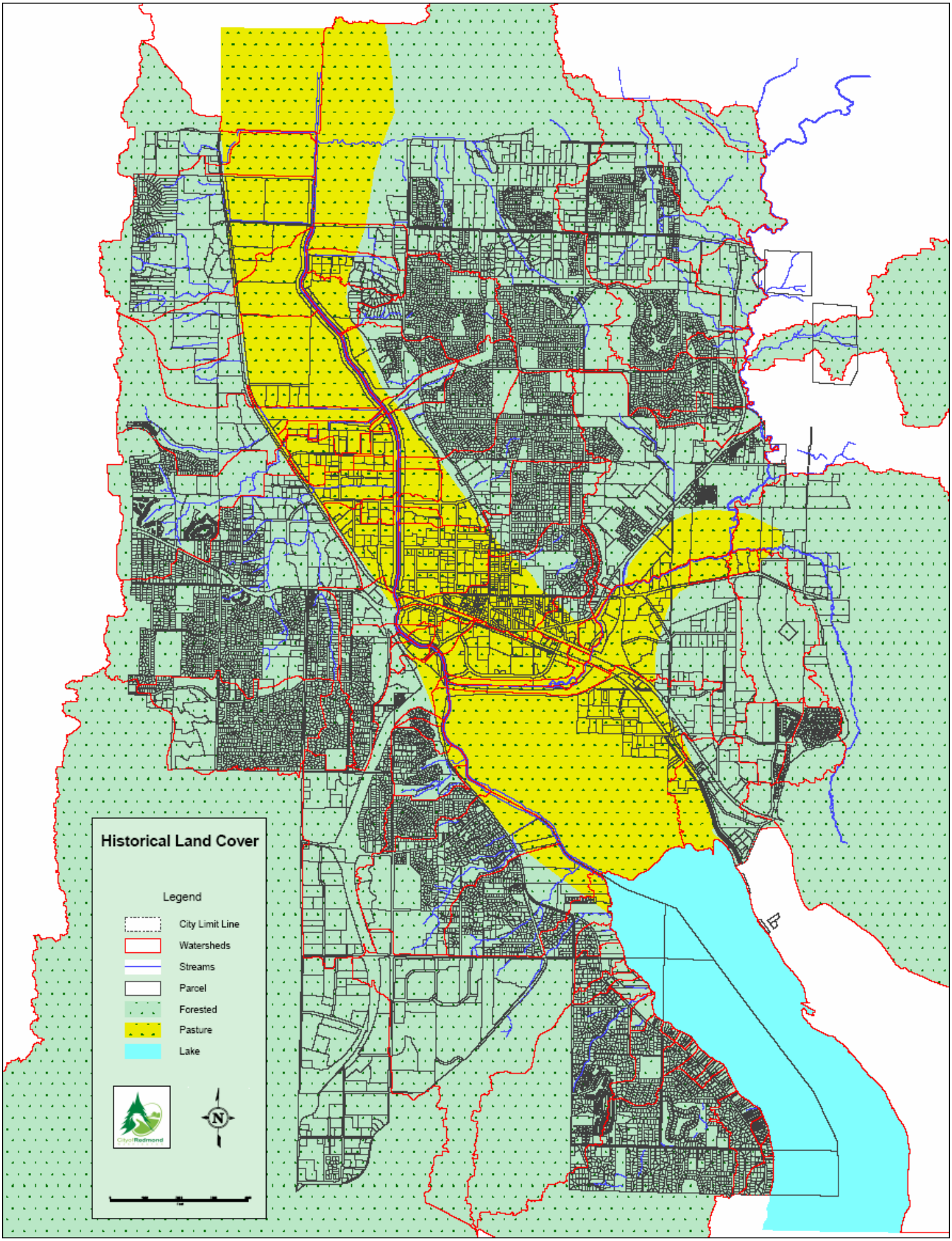

A large version of this map is available on the City's website under City Services – Maps.

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APPENDIX O
Regional Facilities Plan Map

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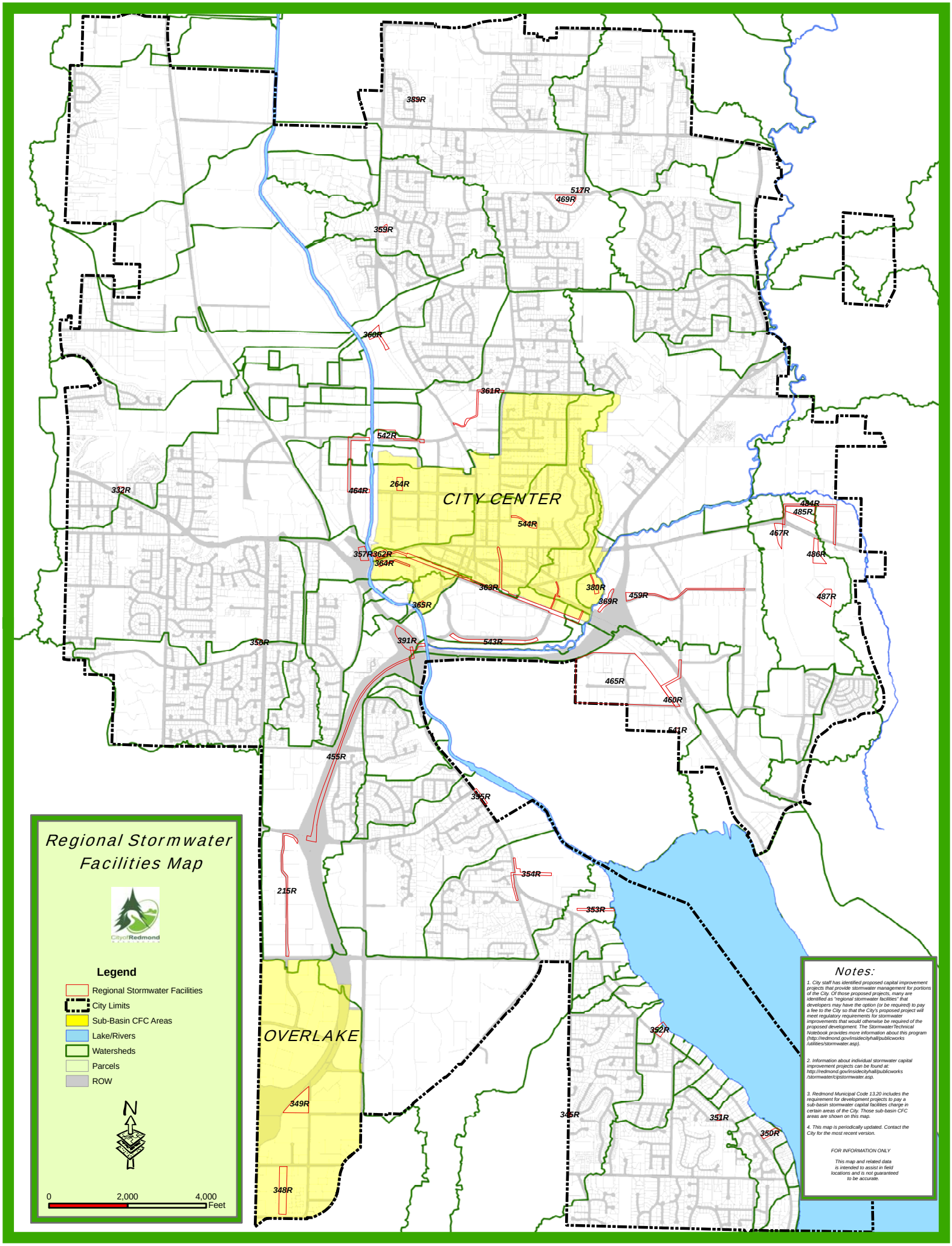
Regional Stormwater Facilities Map
CityofRedmond
Legend
Regional Stormwater Facilities
City Limits
Sub-Basin CFC Areas
Lake/Rivers
Watersheds
Parcels
ROW
N
0
2,000
4,000
Feet
CITY CENTER
OVERLAKE
389R
517R
469R
359R
360R
361R
542R
264R
464R
332R
544R
434R
485R
467R
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351R
350R
348R
Notes:
1. City staff has identified proposed capital improvement projects that provide stormwater management for portions of the City. Of those proposed projects, many are identified as "regional stormwater facilities" that developers may have the option (or be required) to pay a fee to the City so that the City's proposed project will meet regulatory requirements for stormwater improvements that would otherwise be required of the proposed development. The Stormwater Technical Notebook provides more information about this program (http://redmond.gov/insidecityhall/publicworks/utilities/stormwater.asp).
2. Information about individual stormwater capital improvement projects can be found at: http://redmond.gov/insidecityhall/publicworks/stormwater/cipstormwater.asp.
3. Redmond Municipal Code 13.20 includes the requirement for development projects to pay a sub-basin stormwater capital facilities charge in certain areas of the City. Those sub-basin CFC areas are shown on this map.
4. This map is periodically updated. Contact the City for the most recent version.
FOR INFORMATION ONLY
This map and related data is intended to assist in field locations and is not guaranteed to be accurate.

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APPENDIX P
Maintenance of Low Impact Development Facilities

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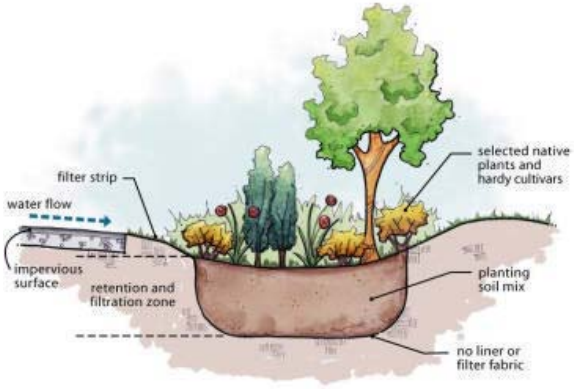
Maintenance of Low Impact Development Facilities



Prepared by:

WASHINGTON STATE UNIVERSITY
PIERCE COUNTY EXTENSION

AHBL

For:

PUGET SOUND ACTION TEAM

Maintenance of Low Impact Development Facilities

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Maintenance of Low Impact Development Facilities

A. Introduction

The maintenance of LID facilities is essential to ensure that designed stormwater management performance and other benefits continue over the full life cycle of the installation. Some of the maintenance agreements and activities associated with LID practices are similar to those performed for conventional stormwater systems; however, the scale, location, and the nature of a LID approach will also require new maintenance strategies.

The following outlines typical maintenance goals and objectives, types of maintenance agreements and training, and provides matrices with maintenance activities and schedules for bioretention areas, amended construction site soils, permeable paving, vegetated roofs, and roof rainwater collection systems.

1. *Goals and Objectives*
   Many maintenance goals of LID facilities will be similar throughout the Puget Sound region. The following provides a standard set of goals that can be added to or modified according to the specific physical settings and needs of a local jurisdiction.
   A) Flow Control and Drainage
      - Maintain pre-development infiltration capacity (reduce total volume of surface flows) and flow attenuation of facility.
      - Maintain pre-development detention capability to reduce peak flows.
      - Safely convey design storm flows.
   B) Water Quality Treatment
      - Maintain pre-development infiltration and detention capability.
      - Preserve soil and plant health and contact of storm flows with those plant soil systems.
   C) Safety and Emergency Vehicle Access
      - Maintain adequate sight distances.
      - Create signage for emergency vehicle access and facilities.
      - Ensure the sufficient carrying capacity for emergency vehicles of any permeable load-bearing surfaces.
   D) Cost Effectiveness
      - Maintain facilities for long-term, high quality performance at a cost that is equal to, or less than, conventional systems.
      - Prevent expensive repair of large scale or catastrophic problems through continued routine procedures.
   E) Aesthetics
      - Develop LID facilities as a landscape amenity as well as a stormwater management system.
   F) Public Health
      - Minimize potential for disease transmission and mosquito breeding by maintaining designed infiltration capacity, storm flow conveyance, ponding depths, and dewatering rates.
   G) Community Participation
      - Provide educational materials to homeowners and commercial property owners explaining the benefits, function, and importance of community participation for the long-term performance of LID facilities.

2. *Support Strategies*
Effective measures to support and ensure quality maintenance of LID facilities include education, incentives, and regulations. In order to provide the most effective maintenance programs, a variety of strategies should be selected from the list below.

A) Education
- Simple, concise messages delivered throughout the project life cycle.
- Brochures explaining the functions, benefits, and responsibilities of facilities at transfer of deed.
- Information bulletins over public access channels.
- Community volunteers providing informal workshops.
- Ongoing involvement of developer with community groups.
- Training programs for those maintaining the systems.

B) Incentives
- Reduce stormwater utility fees for individual homeowners or commercial properties.
- Provide support for property owners with technical advice and materials, such as mulch and plants.
- Provide awards and recognition to innovative developers and communities that build and properly maintain LID facilities.

C) Regulations
- Require maintenance plans and agreements prior to project approvals. (These would include a list of all proposed facilities, facility locations, a schedule of maintenance procedures, monitoring requirements, if any, and an agreement that all subject properties are collectively liable for the ongoing maintenance of the facilities.)
- Mandate jurisdictional maintenance and additional taxes for funding.
- Require fines for corrective actions.
- State that maintenance responsibilities and liabilities are shared by all property owners for projects with facilities designed to serve multiple properties or owned and/or maintained collectively.
- Require deed restrictions or covenants conveyed with deed for the full life cycle of all project types.

3. *Maintenance Responsibilities*
Low Impact Development facilities range in size and complexity. Accordingly, entities responsible for maintenance should be appropriately matched to the tasks required to ensure long-term performance. An individual homeowner may be able to reasonably maintain a rain garden, permeable driveway, or other small facility; however, larger facilities are often maintained through private parties, shared maintenance agreements or the presiding jurisdiction. In addition, the use and ownership of properties can often help dictate the most appropriate means of facility maintenance. Below are some general guidelines for the three primary categories of Maintenance Responsibilities.

A) Property Owners

- Are usually responsible for small facilities located on an individual property.
- Require basic knowledge and understanding of how the system functions.
- Jurisdiction(s) can improve system function over time by offering basic training to property owners.
- Should know when to seek and where to find technical assistance and any additional information.
- Requirements for maintenance should be conveyed with deed.
- Failure to properly maintain LID facilities may result in jurisdictional liens.

B) Private Parties

- Handle the widest range of LID projects in size and scope.
- Handle most commercial or multi-family properties. Copies of agreement may be required prior to project approval.
- Unique maintenance agreements should be developed based on the scale, use, and characteristics of the site and conservation areas, as well as level of expertise of the property owner and the responsible jurisdiction.
- Maintenance agreements can be between a variety of parties, such as individual homeowners, property owner associations, or even jurisdictions.
- Outside groups responsible for maintenance should be trained in the design, function, benefits, and maintenance of LID facilities.
- Recognize that integrated LID management practices require more frequent inspection than conventional facilities.
- Third-party maintainers should provide documentation to the property owners of the type of maintenance performed, a certificate of function, and any non-routine maintenance needs requiring specialized corrective actions.
- Jurisdictions may choose to provide an educational course for prospective maintenance parties and a list of approved or recommended parties.

C) Jurisdictions

- Will handle most public LID infrastructure.
- Should be prepared to handle non-routine maintenance issues for a variety of facilities.
- Maintain primarily large facilities, except for those requiring corrective action.
- Private LID facilities requiring corrective action may require a jurisdiction to hire a private party or use their own staff to complete the work. Property owners should be billed for these expenses.

4. *Inspections*

Regular and appropriately timed inspections are necessary for the proper operation of LID facilities over the full life cycle of the installation. Inspectors should be trained in the design and proper function and appearance of LID practices. Inspections should be seasonally timed in order to have early detection, repair and efficiency. These inspections should include the following: During Fall to clear debris and organic material from structures and prepare for impending storms; early winter storm events to confirm proper flow control operation and to identify any erosion problems; before major horticultural cycles (i.e., prior to weed varieties dispersing seeds); and any other regularly scheduled maintenance activities. To ensure continuity and to better identify trends in the function of facilities, the same individual(s) should inspect the same drainage area. Finally, LID facilities are integrated into the development landscape and willing homeowners can provide frequent inspection and identification of basic problems with minimal training.

B. Bioretention Maintenance Schedule

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage and pollutant removal capabilities. The majority of routine maintenance procedures are typical landscape care activities and can be performed by various entities including individual homeowners.

Routine

Activity	Objective	Schedule	Notes
Watering: Maintain drip irrigation system without breaks or blockages. Hand water as needed for specific plants.	Establish vegetation with a minimum 80% survival rate.	Twice annually (May and July) or as indicated by plant health.	Plants should be selected to be drought tolerant and not require watering after establishment (2-3 years). Watering may be required during prolonged dry periods after plants are established.
Clean curb cuts: Remove any accumulation of debris from gutter and entrance to bioretention area.	Maintain proper flow of stormwater from paved/impervious areas to bioretention facility.	Twice annually (October and January)	
Remove and/or prune vegetation	Maintain adequate plant coverage and plant health. Reduce shading of under-story if species require sun. Maintain soil health and infiltration capability. Maintain clearances from utilities and sight distances.	Once or twice annually.	Depending on aesthetic requirements, occasional pruning and removing dead plant material may be necessary.
Weeding: Remove undesired vegetation by hand.	Reduce competition for desired vegetation. Improve aesthetics.	Prior to major weed species disbursing seeds (usually twice annually)	Periodic weeding is necessary until plants are established. The weeding schedule should become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants excluded.
Mulching: Replace or add mulch with hand tools to a depth of 2-3 inches.	Replenish organic material in soil, reduce erosion, prolong good soil moisture level, and filter pollutants.	Once annually or every two years.	Consider replacing mulch annually in bioretention facilities where high pollutant loading is likely (e.g. contributing areas that include quick marts). Use compost in the bottom of the facility and wood chips on side slopes and rim (above typical water levels).
Trash removal	Maintain aesthetics and prevent clogging of infrastructure.	Twice annually.	
Maintain access to infrastructure: Clear vegetation within 1 foot of inlets and out falls, maintain access pathways.	Prevent clogging of infrastructure and maintain sight lines and access for inspections.	Once annually.	

Bioretention Maintenance Schedule (cont.)

Non routine

Activity	Objective	Schedule	Notes
Erosion control: Replace soil, plant material, and/or mulch layer in areas if erosion has occurred.	Reduce sediment transport and clogging of infrastructure. Maintain desired plant survival and appearance of facilities.	Determined by inspection.	Properly designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention cell sizing; (2) flow velocities and gradients within the cell; and (3) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance.
Sediment removal: Shovel or rake out sediment within vegetated areas. Vactor catch basins or other sediment structures.	Reduce sediment transport and clogging of infrastructure. Maintain desired plant survival and appearance of facilities. Maintain proper elevations and ponding depths.	Determined by inspection.	If sediment is deposited in the bioretention area, immediately determine the source within the contributing area and stabilize.
Clean under-drains: Jet clean or rotary cut debris/roots from under-drains.	Maintain proper subsurface drainage, ponding depths, and dewatering rates.	Determined by inspection of clean-outs.	
Clean intersection of pavement and vegetation: Remove excess vegetation with a line trimmer, vacuum sweeper, rake or shovel.	Prevent accumulation of vegetation at pavement edge and maintain proper sheet flow of stormwater from paved/impervious areas to bioretention facility.	Determined by inspection.	Bioretention facilities should be designed with a proper elevation drop from pavement to vegetated area to prevent blockage of storm flows by vegetation into infiltration area.
Replace vegetation: Reseed or replant bare spots or poor performing plants.	Maintain dense vegetation cover to prevent erosion, encourage infiltration and exclude unwanted weed species.	Determined by inspection.	If specific plants have a high mortality rate, assess the cause and replace with appropriate species.
Replace soil: Remove vegetation (save as much plant material as possible for replanting) and excavated soil with backhoe, excavator or, if small facility, by hand.	Maintain infiltration, soil fertility, and pollutant removal capability.	Determined by inspection (visual, infiltration, pollutant, and soil fertility tests).	Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems. Replacing mulch in bioretention facilities where heavy metal and hydrocarbon deposition is likely provides an additional level of protection for prolonged performance.
Rebuild or reinforce structures: Various activities to maintain walls, intake and outfall pads, weirs, and other hardscape elements.	Maintain proper drainage, and aesthetics and prevent erosion.	Determined by inspection.	
Re-grade or re-contour side slopes: Maintain proper slope with hand tools, back hoe or excavator, replant exposed areas.	Prevent erosion where side slopes have been disturbed by foot or auto traffic intrusion.	Determined by inspection.	

C. Compost Amended Construction Site Soil Maintenance Schedule

Compost amendments enhance the water storage and pollutant filtering capability of disturbed soils and improve plant performance on construction sites.

Routine

Activity	Objective	Schedule	Notes
Add compost of mulch: Spread material by hand to minimize damage to plant material.	Maintain organic matter content of soil, optimize soil moisture retention, prevent erosion, and enhance plant growth and survivability.	Once every one or two years.	Compost amended landscapes are stormwater management facilities and pesticide inputs should be eliminated or used only in unusual circumstances. Landscape management personnel should be trained to adjust chemical applications accordingly.

D. Permeable Paving Maintenance Schedule

The following matrices provide general maintenance recommendations applicable to all permeable paving and specific procedures for asphalt, concrete, Eco-Stone pavers, and Gravelpave2.

Routine

Activity	Objective	Schedule	Notes
All permeable paving surfaces			
Erosion and sediment control: Mulch and/or plant all exposed soils that may erode to paving installation.	Minimize sediment inputs to pavement, reduce clogging and maintain infiltration of pavement.	Once annually.	Erosion control is critical for long-term performance of permeable paving.
Permeable asphalt or concrete			
Clean permeable paving installation: Use street cleaning equipment with suction, sweeping and suction or high-pressure wash and suction.	Maintain infiltration capability.	Once or twice every year.	Street cleaning equipment using high-pressure wash with suction provides the best results for improving infiltration rates. Sweeping with suction provides adequate results and sweeping alone is minimally effective. Hand held pressure washers are effective for cleaning void spaces and appropriate for smaller areas such as sidewalks.
Remove snow: Use conventional snow removal techniques.	Maintain access.	Determined by inspection/snow depth.	
Eco-Stone pavers			
Clean permeable paving installation: Use street cleaning equipment with sweeping and suction when surface **and** debris are dry.	Maintain infiltration capability.	Once annually.	Washing should not be used to remove debris and sediment in the openings between the pavers. Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints.
Remove snow: Use snow plow with skids or rollers to slightly raise blade above pavers.	Maintain access.	Determined by inspection/snow depth.	The structure of the top edge of the paver blocks reduces chipping from snowplows. For additional protection, skids or rollers on the corner of plow blades are recommended.
Gravelpave2			
Remove snow: Use snow plow with skids or rollers to slightly raise blade above gravel surface.			Elevating blades slightly above the aggregate surface prevents loss of top course aggregate and damage to plastic grid.

Permeable Paving Maintenance Schedule (cont.)

Non-routine

Activity	Objective	Schedule	Notes
All permeable paving surfaces			
Backfill utility cuts: Use same aggregate base as under permeable paving.	Maintain conveyance of stormwater through base and prevent migration of fines from standard base aggregate to the more open graded permeable paving base material.	Determined by inspection.	Small utility cuts can be repaired with permeable top course or with conventional asphalt or concrete if small batches of permeable material are not available or are too expensive.
Replace permeable paving material	Maintain infiltration and stormwater storage capability.	Determined by inspection.	If facility is designed, installed and maintained properly permeable paving should last as long as conventional paving.
Eco-Stone pavers			
Replace aggregate in paver cells: Remove aggregate with suction equipment.	Maintain infiltration capacity.	Determined by inspection.	Clogging is usually an issue in the upper most few centimeters of aggregate. Check infiltration at various depths in the aggregate profile to determine excavation depth.
Utility maintenance: Remove pavers individually by hand and replaced when utility work is complete.	Repair utilities, maintain structural integrity of pavement.	When maintaining utilities.	Pavers can be removed individually and replaced when utility work is complete.
Replace broken pavers: Remove individual pavers by hand and replace.	Maintain structural integrity of pavement.	Determined by inspection.	
Gravelpave2			
Clean permeable paving installation: Use vacuum trucks for stormwater collection basins to remove and replace top course aggregate if clogged with sediment or contaminated.	Restore infiltration capability.	Determined by inspection.	Permeable gravel paving systems have a very high void to surface coverage ratio. System failure due to clogging is unlikely except in unusual circumstances.
Replenish aggregate material: Spread gravel with rake	Maintain structural integrity.	Determined by inspection.	Gravel level should be maintained at the same level as the plastic rings or above the top of rings.
Remove and replace grid segments: Remove pins, pry up grid segments, replace gravel.	Maintain structural integrity.	Determined by inspection.	Replace grid segments where three or more adjacent rings are broken or damaged.

E. Vegetated Roof Maintenance Schedule

Proper maintenance and operation are essential to ensure that designed performance and benefits continue over the full life cycle of the installation. Each roof garden installation will have specific design, operation and maintenance guidelines provided by the manufacturer and installer. The following guidelines are for extensive roof systems and provide a general set of standards for prolonged roof garden performance.

General maintenance guidelines

- All facility components, including structural components, waterproofing, drainage layers, soil substrate, vegetation, and drains should be inspected for proper operation throughout the life of the roof garden.
- Drain inlets should provide unrestricted stormwater flow from the drainage layer to the roof drain system unless the assembly is specifically designed to impound water as part of an irrigation or stormwater management program.
- The property owner should provide the maintenance and operation plan and inspection schedule.
- Written guidance and/or training for operating and maintaining roof gardens should be provided along with the operation and maintenance agreement to all property owners and tenants.
- All elements of an extensive roof installation should be inspected twice annually.
- The facility owner should keep a maintenance log recording inspection dates, observations, and activities.
- Inspections should be scheduled to coincide with maintenance operations and with important horticultural cycles (e.g., prior to major weed varieties dispersing seeds).

Routine

Activity	Objective	Schedule	Notes
Structural & drainage components			
Clear inlet pipes: Remove soil substrate, vegetation or other debris.	Maintain free drainage of inlet pipes.	Twice annually.	
Inspect drain pipe: Check for cracks settling and proper alignment, and correct and re-compact soils or fill material surrounding pipe, if necessary	Maintain free drainage of inlet pipes.	Twice annually.	
Inspect fire ventilation points for proper operation	Fire and safety.	Twice annually.	
Maintain egress and ingress: Clear routes of obstructions and maintained to design standards	Fire and safety.	Twice annually.	
Insects (see note)			Roof garden design should provide drainage rates that do not allow pooling of water for periods that promote insect larvae development. If standing water is present for extended periods correct drainage problem. Chemical sprays should not be used.

Vegetated Roof Maintenance Schedule (cont.)

Prevent release of contaminants: Identify activities (mechanical systems maintenance, pet access, etc.) that can potentially release pollutants to the roof garden and establish agreements to prevent release.	Water quality protection.	During construction of roof and then as determined by inspection.	Any cause of pollutant release should be corrected as soon as identified and the pollutant removed.
Vegetation and growth medium			
Invasive or nuisance plants: Remove manually and without herbicide applications.	Promote selected plant growth and survival, maintain aesthetics.	Twice annually.	At a minimum, schedule weeding with inspections to coincide with important horticultural cycles (e.g., prior to major weed varieties dispersing seeds).
Removing and replacing dead material: See note.	See note.	Once annually.	Normally, dead plant material will be recycled on the roof; however specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
Fertilization: If necessary apply by hand (see note).	Plant growth and survival.	Determined by inspection.	Extensive roof gardens should be designed to not require fertilization after plant establishment. If fertilization is necessary during plant establishment or for plant health and survivability after establishment, use an encapsulated, slow release fertilizer (excessive fertilization can contribute to increased nutrient loads in the stormwater system and receiving waters).
Mulching: (see note)			Avoid application of mulch on extensive roof gardens. Mulch should be used only in unusual situations and according to the roof garden provider guidelines. In conventional landscaping mulch enhances moisture retention; however, moisture control on a vegetated roof should be through proper soil/growth media design. Mulch will also increase establishment of weeds.
Irrigate: Use subsurface or drip irrigation.		Determined by inspection and only when absolutely necessary for plant survival.	Surface irrigation systems on extensive roof gardens can promote weed establishment, root development near the drier surface layer of the soil substrate, and increase plant dependence on irrigation. Accordingly, subsurface irrigation methods are preferred. If surface irrigation is the only method available, use drip irrigation to deliver water to the base of the plant.

F. Roof Rainwater Collection System Maintenance Schedule

Maintenance requirements for rainwater collection systems include typical household and system specific procedures. All controls, overflows and cleanouts should be readily accessible and alerts for system problems should be easily visible and audible. The following procedures are operation and maintenance requirements recorded with the deed of homes using roof water harvesting systems in San Juan County, Washington.

Routine

Activity	Objective	Schedule	Notes
Remove debris from roof: Sweep, rake or use leaf blower.	Prevent debris from entering collection and filter system.	Determined by inspection.	
Clean gutters: By hand or use leaf blower.	Prevent debris from entering collection and filter system.	Determined by inspection (generally September, November, January and April). The most critical cleaning is in mid- to late-Spring to flush the pollen deposits from surrounding trees.	Covers for gutters may be appropriate for specific locations, but can make regular cleaning more difficult and will not prevent pollen from entering filter system.
Clean downspout basket screens: Remove debris from screens at top of downspout.	Prevent debris from entering collection and filter system, and clogging of system.	Same as gutters.	
Clean pre-filters	Prevent debris from entering collection and filter system, and clogging of system.	Monthly	
Clean storage tanks of debris: Drain tank and remove debris from bottom of tank.	Prevent contamination.	Determined by inspection.	
Clean particle filters	Prevent contamination.	6 months or determined by pressure drop in system.	
Clean and replace UV filters	Prevent contamination.	Clean every 6 months and replace bulb every 12 months or according to manufacturer's recommendation.	
Chlorinate storage tank: Chlorinate to 0.2ppm-0.5ppm (1/4 cup of household bleach (5.25%) at the rate of 1 cup of bleach to 1000 gallons of stored water)	Prevent contamination.	Quarterly	
Flush household taps: Remove carbon filter and flush until chlorine odor is noticed at taps. Chlorinated water should be left standing in the piping for 30 minutes. Replace the carbon filter.	Prevent contamination.	When storage tanks are cleaned.	

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APPENDIX Q
Guidelines for Landscaping with Compost-Amended Soils

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Guidelines for Landscaping with Compost-Amended Soils

September 1998

Prepared for:
City of Redmond Public Works
Phone: (425) 556-2701

Prepared by:
Tracy Chollak
Chollak Services
11 W. Dravus Street
Seattle, WA 98119
Phone (206) 301-9501
E-mail: tchollak@nwlink.com

Paul Rosenfeld
University of Washington
College of Forest Resources
Phone (206) 523-7399
E-mail: paulrose@u.washington.edu

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Executive Summary

The *Guidelines for Landscaping with Compost-Amended Soils* provide direction for the incorporation of compost as a soil amendment prior to vegetation establishment. Primary focus is placed on amending soil types found in the City of Redmond and the Puget Sound Area, and planting this amended soil with turf. Turf establishment was focused on because most landscapes in these urban and suburban areas primarily consist of turf. Turf areas are a major contributor to stormwater runoff with high concentrations of fertilizers and pesticides, and also have a high summer irrigation demand.

Amending a soil with compost increases the soil's permeability and water holding capacity, thereby delaying and often reducing the peak stormwater run-off flow rate, and decreasing irrigation water requirements. Amending soils will also enhance the lawn's long-term aesthetics while reducing fertilizer and pesticide requirements.

The benefits of increasing a soils organic content have previously been established through research, however, traditional lawn installation procedures continue in new developments. As a means to promote the use of soil amendments, the *Guidelines for Landscaping with Compost-Amended Soils* were developed. These guidelines:

1) address the benefits associated with turf grown on compost-amended soil,
2) describe factors to be considered and the procedures to be followed,
3) provide a cost analysis of compost amending over traditional lawn installation procedures,
4) project the payback-period for turf grown on compost-amended soil, and
5) address how compost-amendment improves soil quality.

To maximize the benefits of compost addition, these guidelines set an amended soil organic content goal of between eight and thirteen percent, by weight. As a general rule of thumb this goal can be achieved by incorporating two units of loose soil with one unit of loose compost (a 2:1 ratio). Final depth of amended soil will be between eight and ten inches, dependent upon the equipment used.

The projected payback periods have been calculated for turf grown on compost amended soil versus the most common variations of lawn installation methods currently practiced. The calculations were performed with an economic model that used projected City of Redmond peak summer water rates, fertilizer, and turf installation costs. Additional environmental benefits achieved by soil-amending were excluded from the model. Results show that turf grown on tilled compost-amended soil by hydroseed application (*TCT*–seed) pays for itself:

1) Between the fifth and sixth year when compared to topsoil-seed,
2) During the first year when compared to topsoil-sod,
3) Between the sixth and seventh year when compared to minimum-seed, and
4) Between the second and third year when compared to minimum-sod.

Chapter I: Introduction

I.A Introduction

This report has been prepared on behalf of the City of Redmond Public Works. It provides guidance for the incorporation of compost as a soil amendment for turf establishment and landscaping. Furthermore, this report: (1) addresses the benefits associated with turf grown on compost-amended soil, (2) describes the installation process, (3) examines the direct costs of compost amendment, (4) projects the payback-period for turf grown on compost-amended soil, and (5) addresses the soil quality issues associated with compost-amended soil.

Compost-amended soil has many potential benefits when instituted with establishment of turf and landscaping, including: (1) increased water conservation, (2) increased nutrient retention, (3) better turf aesthetics, (4) reduced need for chemical use, (5) improved stormwater retention, and (6) cost-savings to the private landowner, and, the City of Redmond.

Compost is aerobically decomposed organic waste and it has a long history of use as an agricultural soil amendment. Now, as urban and suburban communities are taking up more of the landscape, compost is being reassessed as a tool for improving the overall soil quality within these environments.

The quantity of compost to be incorporated into as site is determined by the final organic content goal for the soil. These guidelines are established based on an organic content goal between eight and thirteen percent. Although these guidelines specifically address soil amending for turf establishment, other landscaping vegetation would benefit from these procedures.

I.B Geologic History of Redmond, Washington; Soil Compaction, and Organic Matter

The most recent glaciation in the Puget Sound occurred approximately 15,000 years ago. The glaciers were massive sheets of ice with a thickness of more than 5,000 feet. As the glaciers advanced, the topsoil in the region was scoured away, while the phenomenal weight of the glaciers compacted the remaining soil. The remaining soil, which extends beneath 60 to 70 percent of the Redmond area, is called glacial till. Glacial till contains little organic matter and is nearly impermeable. The soil profile predominantly composed of till is called an Alderwood soil series; it is generally found on slopes from 0 to 70 percent in elevations of 100 to 800 feet. The upper three feet of the soil profile soils have naturally developed into gravely sandy loam with an organic content of four to six-percent. The gravely sandy loam layer, however, is usually removed during construction practices to expose the underlying layer of compacted glacial till.

Glacial tills possess physical properties that are poor for turf establishment and plant livability. These soils are often compacted with a high bulk density (expressed as the dry weight of soil per the in situ volume of soil) exceeding 2700 pounds per cubic yard (1.6 grams per cubic centimeter). A typical non-glaciated (therefore non-compacted) sandy soil often has a bulk density of 2020 pounds per cubic yard (1.2 grams per cubic centimeter) and provides a much superior medium for turf establishment. Compacted soils restrict root penetration, impede water infiltration, and contain few macropore spaces needed for adequate aeration.

Incorporation of organic matter such as compost improves the structure (tilth) of the till and any other soil types, with the exception of soils that are already highly organic. For example, in till soils compost will keep the micro and macro pores open until allowing roots to penetrate and air and water to circulate. In sandy soils, compost increases the water holding capacity and nutrient retention. Therefore, the physical and chemical properties of most Redmond soils can be significantly improved by blending in compost as described in Chapter II.

I.C Water Conservation

The term “moisture holding capacity” indicates the amount of water a soil can hold, while the term “moisture retention capacity” refers to the length of time a soil can retain water (Epstein et al. 1976). Both properties are greater in soils with large amounts of organic matter or clay particles. Water is held in the soil by capillary force and is released as a result of forces such as gravity, root uptake and evaporation. Numerous studies have found an increase in the moisture holding capacity and moisture retention capacity of soil as a result of compost applications (Hortenstine and Rothwell, 1972; Bengston and Cornette, 1973; Epstein et al., 1976). Therefore, the incorporation of compost into the soil of turf sites will reduce the need to irrigate. Water savings resulting from compost-amendment vary from location to location due to the many variables associated with turf including soil type, grass species, slope, aspect, climate, wind exposure and irrigation practices at each site. Typical water savings potentials have been estimated from experienced landscapers in the Redmond area. This data has been used in an economic model (Chapter IV) to project the payback period for turf grown on compost-amended soil. For instance, on a typical site in Redmond with little slope, and little wind, turf grown on compost-amended soil can reduce peak summer irrigation needs by 60% when compared to sites with unamended topsoil.

I.D Fewer Fertilizer Applications

Compost is more valuable as a source of organic matter than as a source of nutrients. However, compost can supply all of the nutrients necessary for turf growth and development for an entire year and possibly longer (Landshoot, 1996). More importantly for long-term turf health is organic soil amendments to increase a soil’s ability to retain applied fertilizer. Organic matter has a high

cation (ions with positive charge) exchange capacity, or ability to bond with positively charged nutrients. While some composts may not contain large quantities of nutrients essential for plant growth, compost amended soils require less fertilization in order to attain the same aesthetic appeal As more fertilizer is added to an unamended-soil, increases in nutrient runoff occur (Harrison et al., 1996).

Finally, compost-amended turf requires less water than unamended-soils due to the higher moisture retention of the organic matter. Reduced water application can result in less nutrient leaching. Conversely, unamended-soils require more water and fertilizer resulting in an increase in nutrient runoff.

I.E Improved Aesthetics

Observing turf plots grown on compost amended and non-amended glacial till soils, Harrison et al. (1996) noted that turf grown on compost-amended soil “greened up” more quickly than on unamended-soil during initial turf establishment. He also observed that 100% turf coverage occurred more rapidly in compost amended plots. Furthermore, the long term aesthetic appeal of an amended-soil lawn is sustained naturally by the increased biological activity of biota living within the soil. These life forces in the soil work 24 hours a day providing aeration, material decomposition, and nutrient conversion.

I.F Decreased Pesticide Needs

Given the same growing conditions (light, water), turf grown on compost-amended soil is typically healthier than turf on unamended-soil. The better aeration, reduction of soil compaction, deeper rooting depth, and improved soil structure helps fight undesired turf problems. Healthier turf is generally more tolerant to diseases, weeds insects, and fungus, which should result in an overall reduction in pesticide utilization (Stahnke, 1997).

I.G Stormwater Retention

Compost-amended turf increases the stormwater retention capacity of a lawn. Typical lawns in the Redmond area provide minimal stormwater retention and act as relatively impervious surfaces for detention facility sizing calculations. Demonstration plots at the University of Washington’s Center of Urban Horticulture have shown turf grown on compost-amended-soil reduced peak and total water discharge. Thus, if the future compost-amended soil is used throughout a typical residential development, stormwater runoff from the development, and the subsequent environmental degradation, would be reduced.

I.H Significant Cost-Savings

Turf grown on compost-amended soil has proven to have less summer irrigation demand, improved stormwater retention, improved quality, and improved aesthetics when compared to traditional lawn installation.
Also, turf grown on compost-amended soil is anticipated to yield environmental benefits which have not been incorporated into an economic model. These benefits include reducing pesticide and fertilizer use and run off, consequently reducing degradation of water quality in Lake Sammamish, other receiving water bodies, and area ground water aquifers. Further research must be conducted in the Redmond area to address these issues (See Chapter V – Soil Quality Issues).

I.I Conclusion

In conclusion the proven benefits in Redmond resulting from compost-amended soil versus glacial till-based soil include:

1) reduced summer irrigation demand,
2) reduces stormwater runoff, thereby reducing erosion
3) improved soil quality, and
4) improved turf aesthetics.

Other potential environmental benefits of turf grown on compost-amended soil versus till-grown turf include:

1) reduced pesticide use and run off,
2) reduced fertilizer consumption and runoff,
3) reduced-degradation of water quality in Lake Sammamish and other waterbodies,
4) reduced-degradation of ground water aquifers,
5) reduced degradation of watersheds,
6) cost-savings to homeowners and the City of Redmond.

Chapter II: Installation of Soil Amendments

This chapter provides details for amending a soil with compost. Lawns established by this process are termed *Tilled Compost-Amended Turf (TCT)*. A *TCT* is set apart from other lawns because it results in an eight to ten-inch soil base having an organic content between 8 and 13 percent, by weight. Organic content is defined as the weight of organic matter divided by the weight of mineral soils. This report will discuss the proposed soil amending and turf establishment procedures and site preparation.

The *TCT* procedure is also recommended for use in other landscaped features such as ornamental vegetation and flowerbeds. The maximum benefits of incorporating compost are achieved by amending the entire site, regardless of the vegetation to be planted. Nutrient requirements for non-turf vegetation, however, may be different than those identified in these turf establishment guidelines.

II.A Site Plan Preparation

Prior to soil preparation and lawn installation, a site evaluation must be made. Of primary importance is documenting the presence of natural features such as steep slopes, large vegetation, stream corridors wetlands, and shaded areas. The landscape practitioner must establish any special precautions that are necessary for these concerns. Estimates of the change in soil depth are necessary to determine grading elevations. Recommendations and guidelines for frequently experienced situations follow.

II.A.1 Potential Concerns: Poorly Draining Sites and Steep Slopes

Increasing the organic content of a soil increases the ability of the soil to hold moisture. Concern has been expressed, however, that the increased water holding capacity of an amended lawn could have a potential drawback if the site's underlying soil does not drain well, or the area to be landscaped is on a steep slope.

II.A.1.a Poorly Draining Sites

Readily draining soil is necessary for turf to survive in amended or non-amended soils. If the site being considered for turf establishment is does not drain well, an alternative to planting a lawn should be considered. If the site is acceptable for traditional lawn installation, however, a compost-amended soil lawn will also drain equally well, if not better, presuming the landscape professional provides a drainage route (see II.C Subsurface Collection Systems). At the University of Washington's Center for Urban Horticulture, post-storm-event monitoring of glacial till plots which were amended with varying degrees of

compost has demonstrated enhanced drainage of amended soil compared to non-amended soil (Burges, 1997). Kolsti (1995) observed the high degree of saturation in compost amended plots is not sustained once the precipitation has stopped. These plots, which are on a five-percent slope, suggest that drainage problems would not be a problem in freely draining amended soil.

If the site is not freely draining, and turf placement is still being attempted, compost addition in excess of 30 percent by volume should not be incorporated. This upper limit is suggested in the Pacific Northwest because winter's extended saturated conditions may create water logging of the lawn (Stahnke, 1997). Saturated soils are easily compacted loosing aeration, and creating a poor rooting environment reversing any desired improvements.

II.A.1.b Steep Slopes

With regard to steep slopes, increased soil instability could potentially result from the increasing the moisture content of amended soils. Observations of amended sites, however, indicate that this concern presents minimal risk. The Washington State Department of Transportation (WSDOT) has been incorporating compost-amendment to almost all of its vegetated sites since 1992. Even at the steepest end of the slopes that they amended (33% slope) they have not experienced problems created by the increased moisture holding capacity of compost amended soils. This observation includes all types of soils encountered in the Puget Sound Lowlands (Bennett, 1997).

In turf areas the slope angle should be minimized to the greatest extent possible, for both stability and lawn maintenance concerns. Geotechnical engineers suggest a maximum slope of 30-percent, provided the site is freely draining. Terracing is recommended to minimize steep slope angle. If the site slope can be altered with retaining walls less than 3 to 4 feet in height, geotechnical engineers are generally not needed. (Retaining walls in excess of 4 feet should always be approved by an engineer.) Any slope that is to remain in excess of this 30-percent threshold should be planted with deep rooting vegetation to aid slope stability. Slopes equal to or in excess of 40 percent with a vertical rise more than ten feet are zoned as sensitive areas by King County's Sensitive Areas Ordinance; geotechnical engineers should always be consulted before any land development in these areas. Rototilling may want to be avoided on these slopes, as erosion becomes a problem.

To provide for a freely draining site, the engineer or landscape practitioner must determine the drainage pattern of the slope and furnish controlled drainage at the outfall of these areas. A subsurface collection system should be installed at the base of each terrace to redirect water away from the retaining structure, if applicable. Subsurface collection systems may also be necessary in low depressions of a non-uniform site, although it is recommended to eliminate these depressional areas through site grading if possible. An appropriate receiving area for the water collected and concentrated by the subsurface drainage system must be provided.

Although few long-term problems are expected as a result of incorporating amendments, extra precaution must be taken in the steeper sloped areas during the soil work and turf installation. Work at these sites should be done during dry weather and early enough in the year to allow vegetation establishment prior to the onset of the wet season and colder temperatures. Non-saturated conditions are desired not only for erosion concerns but also because working with saturated soil is difficult and time consuming as well as destructive to the soil structure, which, in turn, may be detrimental to plant viability by the means mentioned above.

II.A.2 Tree and Shrub Root Considerations

A landscape practitioner must determine how close to a tree or shrub base, and to what depth soil amendment can be performed without root damage. Many landscape practitioners can easily make these determinations based on the tree or shrub type; others, however, may not be as familiar with the vegetation's root structure in which case a professional horticulturist should be consulted.

There are feeder, transport, and stabilization roots. Feeder roots, which uptake the water and nutrients, often lie within the top two to three inches of the soil. The sturdier transport and stabilization roots, that are one-quarter to one-inch in diameter, are usually located four to twelve inches below the soil, spreading radially around the tree or shrub. In many tree species, both of these types of roots extend well beyond the outer limits of the branches, or drip-line; root-spread twice the diameter of the drip-line is not uncommon.

Site development will have some deleterious effect on existing trees and shrubs. As a general rule, avoid disturbance to the soil within the plant's drip-line. Landscape practitioners, however, frequently perform rototilling between the drip line and the outer perimeter of the root-spread area. Although tree or shrub health may initially impacted, most species are able to recover when disturbances are minimal. For soil amendment within three-feet of the drip zone, compost should be worked into the upper three to four-inch depth of the soils, just short of the transport roots, with a hand-tiller or similar tool. Because of the reduced depth of incorporation, amendment quantity will need to be reduced proportionately (see Section II.D.3: Estimating Compost Quantities for guidance). For sites that are being amended with large equipment, smaller sized shrubs are sometimes dug up, the site amended, and then the shrubs replanted.

II.A.3 Estimating Soil Depth and Height Changes

After determining the elevation to which a site must be graded for drainage and other reasons, estimation of the changes in soil depth and height need to be calculated. A final grade of the soil desired ranges between one-half and two inches below the elevation of sidewalks, driveways and other permanent site.

The difference in volume of the dense versus the loose soil condition is determined by the “fluff factor” of the soil. The fluff factor of compacted subsoils in the Puget Sound Area tends to be between 1.3 and 1.4. Rototilling typically penetrates the upper 6 to 8inches of the existing soil. Assuming only a 6-inch depth is achieved, this depth adjusted by the fluff factor will correspond to a 7.8 to 8.4-inch depth of loose soil. This loose volume will then be amended at a 2:1 ratio of loose soil to compost, corresponding to an imported amendment depth of approximately four inches for this example. In the loose state, both the soil and compost have a high percentage of pore spaces (volume of total soil not occupied by solids). The resulting change in elevation must account for compost settling into void spaces of the loose soil. (Calculations presented in Table II-1 assume 15percent of the soils’ void spaces become occupied by compost particles.) After compost incorporation, the amended site will undergo some degree of compaction by the rolling procedure and the weight of the soil itself Calculation presented below used a compression factor of 1.15 for soils with a 1.3 fluff factor, and 1.2 for soils with a 1.4 fluff factor. The resulting change in elevation for a site amended to a 6-inch depth will be approximately three inches. Additional calculations performed following these same guidelines indicate a site elevation change between 75% and 80% of the imported compost loose depth. Therefore make the finish grade three inches lower than desired final finish grade.

Table II-1: Estimating Soil Depth and Height Changes

Procedure	Calculation	Relative Elevation, Inches
Beginning Elevation		0
Rototill soil to a depth of 6-inchesa, assuming a 1.4-inch fluff factor of the soil	Depth achieved by machinery x fluff factor of soil: (6 x 1.4) = 8.4 8.4 - 6 = 2.4	+2.4
Add compost, 2 units soil to 1 unit compost, by loose volume	Depth of soil 2: 8.4 2 = 4.2	+4.2
Filling of pore spaces	Depth of loose soil x percentage of pore space filled by compost addition: 8.4 x (-.15) = -1.3	-1.3
Rototill compost into soil and roll site to compact soil, assuming compression factor of 1.2	(Amended soil depth . compression factor) – amended soil depth: [(11.3 . 1.2) - (11.3)] = -2.1	-2.1
RESULTING ELEVATION CHANGE	Sum	+3.2
Addition of turf, as sod	½ to ¾ of an inch	+0.5
Addition of turf, as hydroseed	0	0

*__Bold__ values will change according to individual site conditions.

The actual degree of expansion or compaction exhibited is a function of both existing soil and imported compost properties so it will vary from site to site. If the desired final grade is not met at the fixed points (sidewalk, driveway, etc.), soil can be redistributed in a mounding fashion to other areas of the lawn as necessary (Survey, 1996).

II.B Installation Schedule Considerations

Grass seed germination requirements often place major constraints on a landscape installer's schedule. However, this is not the only time constraint placed upon the landscaper. The client, either developer or homeowner, also has to consider other time constraints such as the completion of building construction.

II.B.1 Turf Germination Period

The turf establishment period takes between nine and twelve weeks and is determined predominantly by species, soil temperature and moisture conditions. The critical seed germination period of this window, however, is the first two to three weeks. Grass seeds will not germinate if saturated or dry for extended periods, or if the soil or air temperatures are too cold. Seeding is suggested in the Puget Sound Lowlands between April 1 and October 1, dependent upon grass type. Spring applications have the advantage of a decreased watering frequency, but cool evening temperatures result in an extended germination period. Mid-summer applications offer an increased growth rate as a result of the long periods of sunshine, but the need for watering is increased. Late summer seeding has the advantages of the warm ground temperatures, adequate moisture from scattered showers and evening dew, and reduced weed problems.

September is considered the ideal period to seed and establish a lawn for the above mentioned reasons, and also because a September application allows for the longest established lawn growth prior to the time of highest stress to the lawns, July and August. For sites where no irrigation system is to be installed, seeding should be performed between April 1 to April 15, or between August 15 to October 1. Again, September is the preferred month for seeding.

Soil amending can be done almost any time but is discouraged unless immediately followed by turf establishment. Otherwise, rain and wind erosion control measures will be necessary to hold the amended soil in place until it can be vegetated. Additionally, soil amending should not be performed during saturated or frozen soil conditions due to the destruction of the soil structure that occurs.

II.B.2 Site Development Considerations

In residential and commercial developments, the building construction completion date is the primary factor in determining the landscape installer's schedule. Driveways and sidewalk installation generally follow building construction, followed by yard landscaping. Often these two processes overlap.

Landscape practitioners follow a general sequence of events, shown in Table II-2. The first step involves site grading. The construction crew usually performs a rough site grading, but the landscape practitioner is responsible for additional site grading. Grading must accommodate landscaping features, such

as ornamental ponds, planting beds, sidewalks, and final grade elevations (see Section II.A.3). Following grading, underdrain systems are usually installed. Irrigation system installation follows soil amending to avoid the potential damage to irrigation heads by rototilling practices.

Table II-2: Landscape Practitioner's Installation Schedule Considerations

Procedure
Initial Site Grading and Building Construction
Driveway and Sidewalk Installation
Site Landscaping
Site Grading to accommodate landscape features
Soil Sample Collection for Analysis
Underdrain and/or other utilities Installation
Soil Development Sequence (See Table II-4)
Irrigation System Installation
Lawn Seeding or Sod placement

Once all site development considerations have been accounted for, the resulting dates of soil work in new developments allows minimal flexibility. The seasonal conditions apparent at the onset of landscaping work will determine if the desired lawn installation schedule can be maintained. As discussed above, the primary seasonal scheduling constraint of lawn installation is the growing conditions needed for seed germination.

II.B.3 Retrofit of existing lawns

The beneficial properties offered by an amended soil are not reserved to new site development only; soil amendment can be utilized when replacing an existing lawn. Retrofitting existing lawns allows more flexibility to the landscape practitioner because the site is not subjected to the same time constraints discussed above for new development. The ideal months for lawn installation, early September or May, should be the target date of lawn retrofits.

There are two methods of dealing with existing grass and moss prior to incorporation of a composted amendment: removal from the site, or incorporation into existing soil. Removing the turf from the site is recommended procedure. The grass or moss can be removed from the site most efficiently by using a sod cutter, which is a piece of equipment specifically designed for removing turf; most equipment rental locations rent sod cutters. At least two weeks before cutting the

sod, grass should be sprayed with nonselective herbicide. Once the grass is removed, amending the soil should proceed as if installing a lawn at a new site. The other option for lawn retrofits, incorporating the grass or moss into the soil, will require approximately 8 weeks prior to reseeding the site because of the time required to decompose the incorporated material. If there is a significant thatch layer on the site, however, the existing lawn should not be incorporated into the soil.

II.C Subsurface Collection Systems

Subsurface drainage systems are costly but are necessary for turf establishment in some sites. A landscape practitioner usually determines the necessity of underdrains by visually assessing the site conditions. Factors such as European crane fly (Tipula paludosa) problems, thin turf cover, moss, and standing water can all indicate the necessity of underdrains (overwatering can also result in these problems). Standing water, however, is the conclusive sign that drainage problems exist. Wherever possible, the site should be graded to a smooth-surfaced slope, minimum of 2 percent, eliminating areas of ponding water and directing the excess soil moisture to one location in the site. Grading the site in this manner will limit the area where underdrains are necessary.

Should an underdrain system be required, a French drain configuration is most commonly constructed (Survey, 1996). The drainage trench is usually excavated 12 to18 inches in depth, dependent upon soil conditions. The minimum depth of 12 inches is necessary so soil placed above it can be tilled during soil preparation without damaging the drain or equipment. The width of the trench is generally 12 inches. Following excavation, one of two procedures is commonly utilized. The trench is lined with a filter fabric, filled partially with pea gravel, then perforated piping is placed at a minimum slope of 2-percent, and then the remainder of the pea gravel is placed. In the second option, lining the trench is substituted with piping wrapped with filter fabric. These systems should be connected to the municipal storm drainage system or to roof and footing drains. If a direct connection to the municipal storm drain is necessary, timing must be coordinated with obtaining any necessary permits, and sidewalk placement.

Drainage is enhanced initially by the subsurface collection system, but its effectiveness decreases with time. After periods as short as four years many underdrains become inoperable and must be replaced if the turfgrass is to survive. The problem is usually a result of the pea gravel or filter fabric clogging with fine sediments. Field observations suggest the filter fabric clogs more readily than pea gravel. For this reason, the filter fabric is often omitted in hopes of extending the subsurface collection system's operability period (Survey, 1996). If a filter cloth is not used a layer of newspaper will help reduce system clogging.

System operation can be enhanced by several other means. High quality construction materials should be purchased and inspected on site. Four-inch diameter perforated PVC piping is suitable. The drainage rock should be washed pea gravel. Cleanouts or yard catch basins should be utilized to reduce problems with system clogging.

If underdrains are determined to be necessary after turf establishment, installation procedures will be slightly modified. Remove established turf with a sod cutter and store the sod on site. Once the impacted lawn areas have the turf removed, underdrain installation procedures can continue in their usual manner. Sod can then be reinstalled.

II.D Soil and Site Preparation

A site visit is necessary to evaluate the soil to be amended and existing conditions at the site. The schedule of activities is given in Table II-3.

Table II-3: Landscape Practitioner's Planning Schedule Considerations

Procedure Considered	Section Discussed
Reuse of on-site soils	II.D.1
Weed Control	II.D.2.a
Soil testing, existing soil and amendment	II.D.2.b
Use of a ripper to break up sub-surface soils	II.D.2.c
Ordering Compost	II.E.3

II.D.1 Use of On-site Soils

A determination of the soil that is being amended is the first step of soil preparation. Some developers sell the soil removed during site clearing and then import topsoil for landscaping. The reason stated for this practice is a minimal quantity of good quality soil found at the site (Survey, 1996). Undisturbed sites in the Puget Sound Lowland area, however, are comprised of up to 3.5-feet of what is termed forest duff soil. This native topsoil usually has an organic content from four to six percent, significantly higher than the average subsoil organic content of less than one percent. In light of this variance, the value of existing soil on the site must be considered on a site-by-site basis.

When using stockpiled soils, screen it to remove unwanted debris. Determination of compost quantity to be incorporated should be based on the organic content goal described in Section II.E.3. Amendment addition to the excavated soil can occur prior to soil distribution, or after in the same manner as amending subsoils.

Tilling the distributed soil into, at minimum, the upper 2 inches of the existing subsoil, will ensure a suitable soil transition. Standard machinery used for mixing has a maximum depth of penetration between 6 and 8-inches. Because of this limitation, if the depth of distributed soil will exceed 5 inches, distribution of the native soil or soil compost mix should be done in lifts, or incorporation of the amendment in stages. (For example, distributing three inches of amendment and tilling it could be the first lift. Then distributing the remaining two inches of amendment and tilling it would be the second lift). The first lift consists of distributing and integrating one-third to one-half of the imported soil. The remainder of the soil is distributed and mixed in the second lift.

II.D.1.a Use of Native Topsoil

Reusing existing topsoil can be advantageous for the proposed goal of increasing soil organic content to 8 to 13-percent by weight. Redistribution of the native soils can decrease the amount of compost and nutritional amendments required on-site. For this reason, the costs of stockpiling, screening and redistributing the existing topsoil may be justified at locations where there is a suitable quantity of decent quality native topsoil.

II.D.1.b Use of Excavated soils

Excavated soil may be obtained from the site of construction, within the same subdivision, or from an off-site source. Excavated soil from off-site have the potential to import an invasive weed problems Additionally, excavated soils generally have a low organic content, such as the glacial till described in Section I.B. It is likely that excavated soils will require comparable amendment quantities as the existing subsoils. If this is the case, redistribution soils excavated from the site may not warrant the cost.

II.D.2 Pre-Amendment Soil Evaluation

Prior to soil amendment, the soil samples must be collected. After this site visit the landscaper can use the soil analyses to determine amendment quantities (guidelines are given in Section II.E.3) and plan the amending process (described in Section II.E), and materials ordered.

II.D.2.a Weed Control

Open soil areas allow weed seeds to blow in and dormant weed seeds to sprout. Integration of compost into the soil will uproot the weeds and kill most of them. If the weeds are perennial grasses, however, they need to be killed prior to rototilling or they will be broken into small propagates throughout the soil. Following integration the site should be watered to encourage the growth of remaining weed seeds. Shallow tilling or raking, about ½ -inch in depth,

performed two or three times over a four to six week period is an effective means of diminishing weed invasion in young turf. If the existing weed problem is not severe, one shallow tilling or one Round-Up™ application prior to hydroseed or sod application should be sufficient to control weed problems during the turf germination period. Mowing the site may also be sufficient to kill the weeds. If a pesticide is used, it should be done only as necessary and according to label recommendations.

II.D.2.b Soil Sampling

The soil to be amended, either existing subsoil or redistributed native soil, needs analysis to determine amendment quantities. The compost-amendment to be incorporated will also need to be sampled. Sample collection procedures, analysis considerations and costs are described in Section II-H. Sample analysis turn-around time is usually between 15 and 30 days in the Puget Sound Area.

II.D.2.c Use of a Ripper

Soil sampling also allows the landscaper to generally estimate the ability of standard equipment to till the soil. If the soil is too dense for hydraulic tillers or shaft driven tillers, a preliminary step of breaking open the soil with a ripper or similar type of machinery will be necessary. As a general rule of thumb, a ripper is necessary when a standard pick or s3hovel cannot penetrate the soil beyond a 6-inch depth. At these sites the ripper will break the upper 12 to 18 inches of the dense soil into large aggregates, at which point the tiller can further break-up the soil as in other sites.

II.E Amendment Quantities

Amendments include nutrients, lime, gypsum and compost. The optimum quantities for each of these amendments must be determined to receive the maximum benefits from compost amending.

II.E.1 Nutrient and Lime Requirements

In addition to incorporating compost into existing soils, whether intact subsoils or previously excavated soils, nutritional deficiencies and unsuitable alkalinity levels must be corrected. Readily leached nutrients are often deficient. Micronutrients, the nutrients needed by vegetation in small quantities, will be supplied by the addition of compost with the possible exception of boron (Landschoot, 1996). The need for macronutrients, the nutrients needed by vegetation in large quantities, should be expected. Nitrogen and sulfur are the most commonly deficient macronutrients in Puget Sound Lowland soils. Potassium, phosphorous, magnesium and calcium levels are sometimes also

insufficient for grasses. Soil analysis will determine optimum quantities of the various nutrients.

If the soil pH is below 6.0, incorporating pelletized dolomite lime into the soil during the amendment process is recommended, additionally providing the benefit of correcting calcium and magnesium shortages. Application rates of lime will be in the range of 50 to 100 pounds per 1000 square feet. Nitrogen requirements range from 2 to 8 pounds per 1000 square feet on an annual basis. Applications of slow release, water-insoluble forms of nitrogen, such as sulfur-coated urea (SCU) or polycoated fertilizers, is the preferred means of supplying this nitrogen. Urea formaldehyde (UF) is not suggested due to the low soil temperatures in Pacific Northwest soils; the UF breaks down too slowly in low temperatures so it is not of much use in turf establishment (Stanke, 1997). Incorporation of compost, however, may limit the need for nitrogen application during the first year after lawn establishment, although a starter fertilizer is recommended for turf establishment (Landschoot, 1996). Sulfur quantity required, as elemental sulfur, ranges between 2 and 5 pounds per 1000 square feet on an annual basis (Stahnke, 1996; Muntean, 1997). Boron deficiencies will be much lower, it is recommended at only one-tenth of ounce elemental boron per 1000 square feet per year (Muntean, 1997).

II.E.2 Use of gypsum

Gypsum, hydrated calcium sulfate ($CaSO4\ 2H2O$), is used for three primary purposes in soil: the addition of calcium and sulfur without increasing the pH, the displacement of sodium ions in extremely salty soils, and the binding of clay particles to enhance macropore abundance. Gypsum is not generally needed in the Puget Sound Lowlands; the low pH necessitates calcium carbonate (lime) addition to neutralize the soil pH, which corrects calcium deficiencies present. In areas where soil is calcium deficient and the pH is above 5.5, lime addition is favored over gypsum addition because of its pH stabilization effects. If the soil is sulfur deficient, it can be added to the soil independently.

Gypsum enhances clay's soil structure by adding chemicals required to bind clay particles together. There is not a consensus among soil scientist that gypsum addition to clay soil in the Puget Sound Lowlands is necessary. According to Washington State University's (WSU) Extension Service in Puyallup, clay soils in the Puget Sound Lowlands do not lack the chemical parameters necessary for soil structure. Cogger (1997) indicates that clay soils are missing the physical parameters (such as macropores) which are not enhanced by gypsum addition. Cogger additionally stated the addition of well-degraded compost will provide the physical requirements necessary for soil structure. Contrary to Cogger, Unterschuetz (1997) and Muntean (1997) believe that 50 to 100 pounds of gypsum per 1000 square feet should be applied to heavy clay soils at the same time as compost incorporation. Since the addition of gypsum does not present any negative side effects, its utilization is at the discretion of the landscape practitioner.

II.E.3 Estimating Compost Quantities

A final organic content of amended soil between 8 percent and 13 percent by soil weight is the target of the proposed soil amendment procedure. The organic content of all existing subsoils exposed during site construction is expected to be less than one percent. Compost typically has a 45-60% organic content, and is used to supply almost all of the organics to the soil profile. As a general rule of thumb, a 2 to 1 ratio of existing soil to compost, by loose volume, will achieve the desired organics level. The optimum benefits are achieved by utilizing a 7/16- inch well-degraded compost (Kolsti, 1995). Acceptable compost criteria are suggested in Appendix A.

To maximize the benefits of compost incorporation, a minimum of the top six inches of soil should be amended. To determine the loose soil volume which is to be amended, the fluff factor discussed previously in Section IIA.3 must again be considered. Assuming a fluff factor of 1.4, amending the top six inches of a soil will result in 8.4 inches of soil to be amended. The depth of amendment applied should therefore be 4.2 inches, or 13 cubic yards per 1000 square feet. In areas where tree root considerations or other natural features limit the maximum depth of incorporation, compost quantities should be adjusted. For example, if feeder roots are observed at a 3.5-inch depth, only the top three inches of the soil should be amended. (These three inches corresponds to 2.1 inches of compost amendment.)

Calculations for the various amendment quantities can be kept simple by the following conversion: one inch of material spread over 1000 square feet is equivalent to about three cubic yards. If this one inch is a typical yard debris compost, with an organic content of 50% and bulk density of 1000 pounds per cubic yard, it will increase the organic content of the soil by approximately 2.5 to 3.5 percent when incorporated into the loose eight-inch soil depth.

Assume a four-inch depth of native soil, with an organic content of five percent, is redistributed and incorporated throughout the site. Only a 2.5-inch depth of compost throughout the site would be necessary to get a final organic content between eight and thirteen percent, once both soils are incorporated. For precise calculations, volume, bulk density and organic content of both soil and compost are necessary.

Once the quantity of compost has been determined, the supplier should be contacted to establish compost availability and quality. Compost may need to be ordered two weeks in advance in the spring. On the other hand, ample quantities of compost are generally available in the fall, but they are frequently delivered before the product has completely decomposed. If space is available at the site, having the compost delivered up to eight weeks in advance of use is suggested. The composting process can then be completed on-site by keeping the compost moist.

II.F Incorporating the Compost

Once the necessary amendment quantities of compost and nutrients have been determined and materials ordered, soil preparation can be executed. Suggested procedure for soil amendment incorporation is to rototill or rip and rototill the subgrade, remove rocks, distribute compost, spread lime and nutrients, rerototill soils several times in perpendicular directions, fine grade or "float", and hand roll the site. Ripping of the subgrade is only necessary when a soil's high density requires it, as discussed in Section II.D.2.*c*. Ripping soil breaks dense soil into large clumps that will be further processed by other equipment. Multiple passes with a rototiller will uniformly break-up the top six to eight inches of the subsoil. Following soil integration, the soil should be watered and allowed to settle for one week. Depressions and other irregularities throughout the site can then be filled and graded until a uniform surface is achieved.

Table II-4: Site Preparation Using Soil Amendment

Procedure	Soil Amending Guidelines
Initial soil disturbance	For highly compacted sites, performed with a ripper
Uniformly break-up subsoil	2-passes with rototiller
Rock removal	Performed with a rock rake, rock hound, or hand
Distribution of imported compost	Predetermined depth of a well-composted product
Lime and fertilizer application	Rates determined by soil analysis
Soil Integration	2-passes with rototiller
Grading and rolling of site	To achieve a uniformly smooth site surface

If compost delivered to the site is immature, and there is not time to complete the composting process on site as described in section II.E.3, the landscape practitioner may want to modify the above procedure. The settling period should be extended two to five weeks to allow the soil to fully settle prior to the final grading and rolling of the site. This time frame may allow weed seeds to blow in or latent weed seeds to sprout. If weeds are observed refer to Section II.D.2.a for weed removal procedures. If seeding or sod placement cannot be delayed, thin areas can be overseeded the following spring or fall.

To ensure that sites are developed in the best manner, individuals with professional credentials should be hired for landscape and turf installation work (Survey, 1996). Such professionals could be Washington State Nursery and Landscape Association (WSNLA) certified (Washington Certified Landscapers), Washington Association of Landscape Professionals certified (Certified Landscape Technicians), or other certified landscape professionals. These certifications are industry-sponsored to compensate for the lack of mandated testing for contractor licensing in Washington State.

II.G Turf Establishment

II.G.1 Turf Installation

Turf is provided in new developments by hydroseeding or sod placement. Hydroseeding is the preferred method of establishing turf on an amended site. The reason for this preference is the greater depth of root penetration observed in hydroseeded lawns over sod lawns, possibly due to the soil interface problem associated with sod placement (Survey, 1996). Standard seeding results in a lawn similar to a hydroseeded site, but hydroseeding is generally preferred because the increased ease of seed application. A full lawn is generally achieved within 60 to 90 days after hydroseeding or seed application. Accelerated growth mixes are also available when time limitations warrant their increased cost.

The type of grasses utilized should be based on the site's degree of shading, but a blend of perennial rye and improved fine fescue varieties developed for the Northwest is suggested. Perennial ryegrasses are a durable thin blade that will adapt to the sunny portions of the lawn, whereas fine fescue is drought resistant and adapted for shaded areas as well as full sun areas. For more information on lawn seeding refer to WSU's publication "Home Lawns" (1993) or consult a reputable local seed dealer.

II.G.2 Startup Irrigation

Desiccation, or drying, of the seed or sod mulch is the most frequent problem with lawn installation, as seed germination and subsequent root growth are halted without an adequate water supply. To ensure grass survival, landscape practitioners generally determine the optimum watering schedule and educate the site's owner about these practices (Survey, 1996). The critical period for lawn establishment is the first two to three weeks. Watering during this period should be light and frequent. To achieve this environment, watering may be performed two to three times per day, distributing water to approximately a one-half to one-inch depth with each irrigation cycle. Actual watering duration will vary depending on the type of irrigation system, but 10 to 15 minutes is the average time requirement.

After root establishment has begun, over-watering must be avoided because it inhibits the ability of oxygen to reach the roots and can promote diseases. The goal of watering during this period is to maintain moist conditions throughout the root establishment zone. As the seeds continue to grow, watering duration is increased, encouraging a deep root zone by allowing for moisture penetration beyond the full depth of roots. By week seven, one watering per day, of about a 2-inch depth is usually sufficient. Approximately ten weeks after the lawn has been installed watering is reduced to 2 times per week. By the end of the third month the lawn is fully established and watering is performed on an as needed basis.

II.H Soil Testing Considerations

Prior to amending soil, the compost and the soil will need analyses for chemical and physical properties. This analysis will reveal necessary proportions of nutrients, soil amendment and soil. There are two options for submitting samples: soil and compost separately, or a combined sample. A combined sample is preferable, consisting of the same proportions to be used in the field (Landschoot, 1996). The analyzing laboratory will provide recommendations for fertilizer, lime and compost requirements. Allow a one-month time window for analysis and reporting.

For the site soil analysis, a composite sample of one quart by volume should be submitted for analysis. This is a composite of fifteen to twenty sub-samples obtained at locations evenly distributed throughout the site, each reaching an 8-inch depth. Analyses suggested of the composite sample are detailed fertility, sulfate, bulk density and percent organic matter. Detailed fertility consists of moisture holding capacity, pH, sodium, salinity, nitrate-nitrogen, ammonium-nitrogen, phosphate phosphorus, potassium, calcium, magnesium, copper, zinc, manganese, iron, and boron levels.

Compost analysis consists of total and available macro and micronutrients, percent organic matter, pH, sodium, salinity, moisture content, bulk density, particle size distribution, and estimated carbon to nitrogen ratio. Since this type of testing is routinely performed by the compost manufacturer, results of a current compost analysis should be sufficient for determining amendment needs. If recent analyses are not available, a sample should be obtained from the compost manufacturer prior to its delivery.

Once the compost product is delivered to the site, compost maturity must be determined to ensure the material is well decomposed. This can be accomplished in approximately four hours with a simple compost maturity test manufactured by Woods End Research Laboratory, Inc[1]. An experienced

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[1] Woods End Research Laboratory, Inc., box 297, Mount Vernon, Maine 04352, 207-293-2457. E-mail: infor@woodsend.org

professional can forgo the testing kit and establish compost maturity by evaluating the composts for dark color, moderate heat generation, and emissions of earthy-odors (not foul odor). Guidelines for determining compost maturity are outlined by EA Environmental Consultants (1994). If the delivered product is determined not to be mature, adjustments to the installation process may be desired, as described in Section II.F.

The organic content of compost coupled with a compost maturity test is a measure of compost's relative benefit to the surrounding soil and plants. For example, a low organics and immature compost reading indicates lots of clay and silt fines mixed with manure (which is bad on a nitrogen and microporosity basis). A high percentage of organics and mature compost indicates the soil is better suited for root growth and nutrient and water exchange.

II-I Local Agency Inspection

In areas where soil amending is regulated, local agency inspection will be performed (At the time of this publication, however, no areas are requiring soil amendment). Upon completion of the lawn installation the landscape practitioner will be required to submit a synopsis of the work which has been performed to the regulating agency. Required information is site size, compost type and quantity purchased, compost maturity rating, the procedure followed, and the depth of amendment achieved. Documentation of the compost purchase must also be attached.

On-site inspection by the local agency will document the depth of amendment achieved and sample for final organic content. Upon receiving the analysis results for the organic content, the local agency will determine if compliance with the given regulation has been achieved.

Chapter III. Comparative Costs of Soil Amendment

This chapter provides the comparative cost associated with the benefits of compost-amended soil, which were addressed in Chapter I. A comparative dollar evaluation of initial installation procedures for both traditional and the proposed site preparation are shown. Dollar values were obtained between 1996 and 1997 when inflation rates were less than three-percent. Installation procedures vary widely, as do hourly wages and equipment costs; this information provides a method for cost-benefit analyses at future site developments.

Installation costs of a *Tilled Compost Turf (TCT)* are higher than that of standard lawn installation procedures. However, *TCT* can potentially lower site development costs in residential subdivisions by reducing the size of stormwater detention facilities. Long term cost comparisons, factoring in the homeowner savings resulting from reduced watering and maintenance requirements of a *TCT* lawn, are discussed in Chapter IV.

III.A Costs for Standard Turf Installation

This section reviews the costs for traditional lawn establishment as customarily done at new residential and commercial developments. A traditional lawn is considered as one in which the grass roots are confined to a shallow soil depth between one and three inches, underlain by nutrient and organic deficient subsoil. Traditional lawns have low water and nutrient infiltration rates and low moisture-holding capacities.

Traditional soil preparation procedures are influenced by the homeowners or builder's budget, developer time constraints, traditional landscaping procedures and, sometimes, lack of proper procedural knowledge. Developers, who are trying to minimize costs, are interested in beautiful lawns during the sale of the residences, but are generally not concerned with long-term aesthetics or maintenance requirements. Individuals who purchase these homes usually have little input to the site landscaping, unless a retrofit of their property is being performed.

Lawns without proper soil preparation have the minimum installation costs desired by developers, but they usually require higher maintenance by the homeowner to retain an acceptable appearance. Applications of pesticides could be more prevalent. The low moisture-holding capacity necessitates frequent watering during dry summer months, a practice that is discouraged as water conservation continues to be a growing concern. During rain events, lawns without proper soil preparation offer little stormwater-holding capacity. The downstream effects of fertilization and herbicide practices are also a concern, but they are not factored into this cost analysis.

III.A.1 Soil and Site Preparation

As described in Chapter II, the primary site preparation procedures include soil preparation, subsurface drainage collection, and irrigation system installation. To aid in the comparison between the different soil preparation methods, the economic costs of these processes were researched and are provided below. A description of traditional site preparation processes and the associated materials used in these lawns is also provided.

III.A.1.a Soil Preparation

There are two general sequences that are followed for soil development. They are referred to in these guidelines as *Topsoil Amended Turf (TAT)* and the *Minimum Input Turf (MIT*).

The *Topsoil Amended Turf* method consists of the following:

- scarification of subsoil and rock removal
- importation and even distribution of additional topsoil
- fertilizer and lime application
- integration of soil layers by rototilling
- grading and rolling of soil
- seed, sod, or hydroseeding application.

The final depth of topsoil applied ranges between two and five inches when the subsoil is derived from glacial till. Variation in the average depth of topsoil applied significantly affects the cost of soil preparation work. For the calculations shown in Table III-6, an average depth of 3.5 inches is used. The resulting cost of *TAT* soil preparation, omitting the sod or hydroseeding application, is $0.49 per square foot for large sites (greater than 5000 square feet of lawn area) and $0.51 per square foot for small sites (less than or equal to 5000 square feet of lawn area). For example, a lot with 5000 square feet of lawn would cost approximately $2550. Table III-6 provides detail on how the author derived these costs. The variation in cost between large and small sites is a factor of the equipment that can be used on the site. The relatively high cost of this type of soil work limits its use to residential housing projects with substantial landscape budgets, and individual owners who are willing to pay the extra cost to receive the benefits of a deep soil base. These lawns still do not offer the same benefits achieved by *TCT*, in that the topsoil used is of a highly variable organic content and quality, and vegetation root depth is still confined within the upper few inches of the soil.

A more frequent procedure found in both residential and commercial development is *Minimum Input Turf* development.

The *Minimum Input Turf* soil preparation consists of

- some rock removal and grading
- even distribution of imported topsoil
- fertilizer and lime application
- grading and rolling of the soil
- seed, sod or hydroseeding application.

When hydroseeding is to be used, the fertilizer step is often omitted on the assumption that the fertilizer mix in hydroseed slurry will be sufficient. Depth of distributed topsoil in the *MIT* procedure is 1 to 3 inches; a 2-inch average depth is used for determining cost. Associated costs for *MIT* soil preparation is $0.25 per square foot for large sites and $0.27 per square foot for small sites.

Table III-1: Comparison of *TAT* versus *MIT* Soil Preparation

Procedure	***Topsoil Amended Turf***	***Minimum Input Turf***
Scarify Subsoil	Provided by rock removal equipment	Not performed
Rock removal	Thorough, using a “rock hound”	Minimal, using a “rock rake”
Distribution of imported soil	2 to 5 inches, 3.5 inches used for calculations	1 to 3 inches, 2 inches used for calculations
Fertilizer and lime application	Performed*	Performed*
Soil Integration	1 pass with hydraulic rototiller	Not performed
Grading and rolling of soil	Performed	Performed
Average cost per square foot	$0.49/$0.51	$0.25/$0.27

*Sometimes fertilizer is added only during hydroseeding application.

An itemized listing of procedures and the associated costs are shown in Table III-6. *Minimum Input Turf* and *Topsoil Amended Turf* procedures stated are generalizations of current practices in an effort to establish standard soil development costs. Many variations of these processes exist. For example, topsoil may be spread in lifts with the first lift being incorporated into the existing soil, fertilizer may be applied before or after topsoil and may or may not be incorporated into the existing soil, and rolling between steps may be used.

III.A.1.b Subsurface Collection Systems

When conditions warrant, subsurface collection systems are installed. As described in Chapter II, systems consist of a drainage ditch lined with a filter fabric in which a perforated pipe is placed and surrounded by gravel bedding. Drainpipe suggested is four-inch perforated PVC pipe with cleanouts; a one hundred-foot length will cost approximately $53. Corrugated plastic piping, which comes in 100-foot coils for about $38, is sometimes used but is not suggested due to associated problems of pipe clogging. Gravel used is specified as pea-gravel, approximately $25 per cubic yard. Filter fabric, sold in 3' X 300' rolls, can be purchased for $63. Installation price will vary considerably from site to site, averaging around $2.50 per lineal foot.

III.A.1.c Irrigation System Installation

Irrigation system installation is another integral part of site preparation work. Irrigation systems are priced according to type of system desired (standard or low volume) and number of sprinkler heads. Sprinkler head requirements are a function of coverage desired, number of irrigation zones, gallons per minute and dynamic water pressure available in each zone, and size and location of planted beds. Minimal pressure zone irrigation systems costs between $0.50 and $0.75 per square foot for sites larger than 5000 square feet. At minimum, expect an $1800 base cost for any residential irrigation system (Survey, 1996). A water efficient irrigation system is encouraged when selecting the type of system for purchase.

III.A.2 Top Soil Haul and Application

Topsoil used by contractors is usually a manufactured three-way mix. "Three-way mixes" are described as a sandy loam, compost, and sawdust blend. The quality of these mixes varies considerably between suppliers. "Sandy loam" is screened excavation dirt; the true texture will depend upon the native soil of the given excavation site. Compost, usually processed through a 5/8-inch screen, is either wood or animal derived. When purchasing by the truckload, average cost of three-way soil delivered to Redmond is $12 per cubic yard (Survey, 1996).

Topsoil is applied in two steps. First the soil is distributed throughout the site into large piles using a bucket loader on a tractor or bobcat, or with a wheelbarrow when site conditions restrict the use of large machinery. These soil piles are then uniformly spread. Again site conditions will determine the equipment chosen for the spreading process; tractors, backhoes and hand tools are most commonly used. The cost of topsoil application varies according to the equipment utilized, refer to Table III-6 for values obtained from local sources.

III.A.3 Sod: Production, Purchase, and Installation

If construction delays the installation of turf until the end of the growing season, or there is only a short timeframe before homeowners are moving onto the property, sod use may be specified by the developer. Seed mixes vary from a 100 percent perennial rye mix to a 50% perennial rye, 30% Kentucky bluegrass and 20% fine fescue mix. Kentucky bluegrass is used for its rich color and texture in addition to its ability for rapid recovery of divots and grooves due to rhizome development. Many cultivars of Kentucky bluegrass, however, do not do well on this side of the Cascades due to the lack of freezing climate periods. It commonly thins out within the first few years and requires overseeding.

The soil base used in this area for sod mixtures is advertised as a sandy loam, but sometimes higher percentages of clay are visible in the delivered product. This variance in sod subsoil is due to the differences in soil particle size distribution throughout the sod farm acreage. Sandy loam soil base should be specified upon ordering and confirmed by on-site inspection.

Delivered prices of sod have a narrow range in cost: $0.17 to $0.22 per square foot, as shown in Table III-3 (Survey, 1996). Deposits of $8 to $11 per pallet are also required; each pallet holds 500 square feet of sod resulting in an additional refundable charge of about $0.02 per square foot (this cost is not included in the cost analysis).

Prior to sod placement, a starter fertilizer is applied. Prices quoted in this analysis include the even distribution of starter fertilizer application; however, some landscapers recommend distribution of only 50-percent of fertilizer prior to sod application and the other 50-percent after the sod has been laid. Transfer and unrolling of the sod onto the site is then performed. Sod is delivered fresh the day that it is to be installed and should be lightly irrigated within thirty minutes of placement onto the soil. Installation is completed by soaking the lawn with water to an eight-inch depth, base soil conditions permitting. In a typical residence, between 300 to 350 square feet of sod is placed in one hour, resulting in an average installation cost of $0.07 per square foot. At larger sites up to 500 square feet of sod can be placed in an hour, averaging $0.06 per square foot (Survey, 1996).

Table III-2: Sod Costs, per Square Foot

Purchased Quantity, square feet	Price Range of Delivered Sod	Average Price of Delivered Sod	Average Installation cost of Sod	Average Total Installed Cost of Sod
≤5,000	0.18 - 0.22	$0.20	$0.07	$0.27
5,000-10,000	0.17 - 0.21	$0.19	$0.06	$0.25
Quantity ≥10,000	0.17 - 0.19	$0.18	$0.06	$0.24

III.A.4 Hydroseed Application

Hydroseeding is a process of applying a grass seed mix in slurry containing wood fiber mulch, fertilizer, tackifier and water in addition to seed mix. In Western Washington standard seed mix consists of 70 to 80-percent perennial rye blend and 30 to 20-percent fine fescue blend. Prices quoted are for this type of mix.

Application costs are influenced by a variety of factors, with site size being most predominant. Ease of access and water supply are also important considerations. As shown in Table III-3, application cost per square foot decreases as site size increases. Minimum costs fluctuate between hydroseeding companies and time of year, ranging from $200 to $325 per site. When demands for applications are at their peak, generally in the fall, the minimum costs reach the high end of the scale (Survey, 1996).

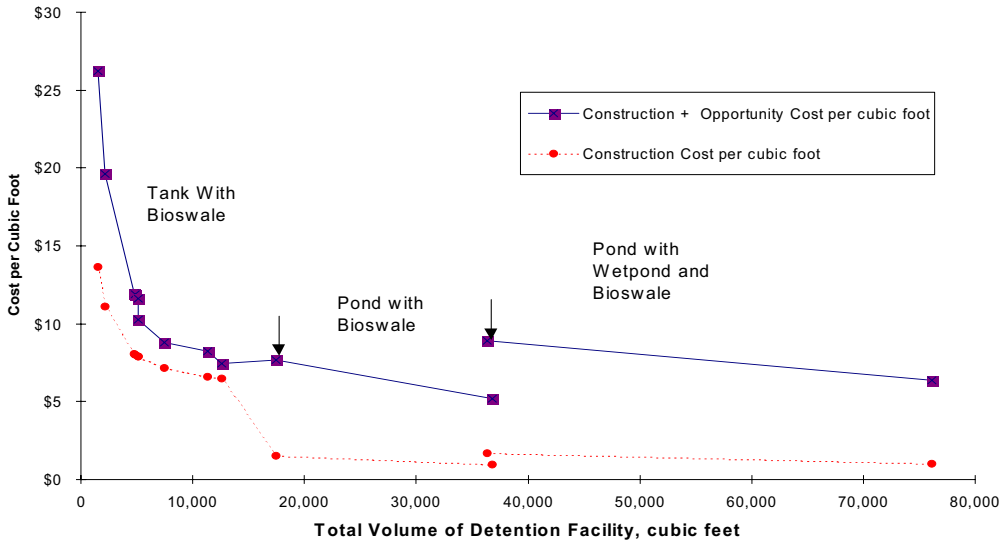
Table III-3: Hydroseeding Cost Estimates III.A.5 Detention Facility Costs

Site Size (square feet)	Range of Costs (square foot)	Average Cost (square foot)
≤3,000	0.09-0.13	.10
≤5,000	0.07-0.09	.078
≤7,000	0.062-0.08	.07
≤10,000	0.057-.07	.065
≤15,000	0.05-0.065	.06
> 15,000	0.05-0.065	.055

The *TAT* and *MIT* lawns described above offer little stormwater holding capacity, therefore stormwater runoff is created from even minor and intermediate storm events. Regulations require detention facilities to control runoff flows when a predetermined area of impervious surface is created. For both Redmond and King County, the flow control threshold is 5,000 square feet of impervious area, equating to development areas of approximately 10,000 square feet or more. As the development size increases, more impervious area is created, resulting in larger volumes of runoff. The actual amount of runoff

generated will be a function of the storm event's magnitude, the permeability of the soils, and the antecedent (prior to rain event) soil saturation conditions. Detention facility construction costs are substantial; therefore, methods to decrease runoff volume could provide substantial savings to the developer. The following graph compares the cost of various sized stormwater facilities. Cost saving estimates from reduced stormwater facility sizing shown in Table III-5 were determined using this graph.

Figure III-1: Detention Facility Costs per Cubic Foot Detention Volume Required



after Johnson 1996, King County Surface Water Management Division, Seattle, Washington

Opportunity cost reflects lost revenue from land that would have been developed for residential use, but instead is used for stormwater facilities. Opportunity costs used in this analysis are based on a study by Johnson (1996), in which opportunity costs were found to be $5.95 per square foot in the King County area. This value was adjusted for the Redmond area and found to be $6.15 per square foot, which is reflected in the graph above.

III.B Cost Associated with Soil Amending

Enhancement of existing soil with well composted derived from yard debris compost or biosolid amendment to form a Tilled Compost-Amended Turf (*TCT*) will have higher soil preparation costs than that of *TAT* or *MIT* procedures. *TCT* practices will require a larger volume of material to be delivered to the site and more extensive site preparation procedures to ensure the amendment is well mixed with the existing soil. Additional soil analyses will be required to determine the optimum quantities of the various soil amendments. The following sections address the costs of *TCT*. Cost savings and benefits provided by *TCT* practices are long term and it is difficult to assign dollar values to some. Long-term costs are addressed in Chapter IV.

III.B.1 Soil and Site Preparation

The amendment process will not affect the subsurface collection and irrigation system aspects of site preparation. Soil preparation for amended turf, however, has several additional steps compared to the *TAT* and *MIT* procedures. Soil preparation on sites that are accessible by large machinery will cost approximately $0.59 per square foot, while sites requiring all hand work will cost approximately $0.63 per square foot (See Table III-6 for details). As shown in Table III-6, breaking up of the soil accounts for the majority of cost escalation. If the subsoil density prohibits the initial use of standard equipment, a ripper must be utilized raising site preparation costs by an additional $0.11 per square foot.

III.B.2 Delivered Curb Costs of Soil Amendments

Mature 7/16-inch screened yard debris compost or biosolid product is specified for the amendment process (refer to Appendix A for compost specifications). The delivered cost of this type of product is comparable to the cost of standard soil delivery. Land developers in the Redmond area most frequently use the products listed below. Cedar Grove, a yard debris compost manufacturer, has generally been preferred due to their product consistency and routine testing. Pacific Garden Mulch is also yard debris compost. GroCo, a

biosolid product, has been associated with nitrogen depletion and the associated lawn "yellowing", as well as sealing or hardening the soil when excess quantities are applied. However, when utilized properly GroCo also produces a similar quality lawn as lawns amended with other compost varieties (Survey, 1996). Location and phone numbers for these compost suppliers are listed in Appendix B.

Table III-4: Delivered Curb Costs of Soil Amendments

Quantity, Cubic Yards	Soil Amendment Cost per Cubic Yard			
	Cedar Grove Fine	GroCo		Pacific Garden Mulch
		Delivered	Blower Applied	
6 – 10	N/A	$17.20 - $14.20		$20.00
≥ 10	$14.50	$13.45		$16.00
≥ 15	$13.00			$14.00
≥ 20			$14.70	$13.00
≥ 25	$12.00	$10.95	$13.95	
≥ 30	$11.50			
≥ 40				$12.00

Blower application of GroCo requires two on-site crew workers to direct the distribution hose. Application of a full 25 cubic yard truckload takes about 1.25 hours. If GroCo is the compost product used, blower application will save $0.04 per square foot over standard distribution and spreading techniques.

III.B.3 Sod and Hydroseeding Applications

Turfgrass and hydroseeding application cost will be the same for amended and nonamended sites. Hydroseeding applications are preferred over sod applications because depth of root penetration is increased due to the lack of soil interface problems. Macronutrient proportions can be determined by on-site soil and compost analyses. Hydroseeding companies surveyed indicated a willingness to alter their standard fertilizer for such applications.

III.B.4 Detention Facility Costs

Compost amended soils have an increased moisture holding capacity. Therefore, they are able to delay and often reduce the peak stormwater run-off flow rates. Furthermore, compost amended soil hold more moisture in winter, when precipitation in the Northwest is most abundant (Stanke, 1997). The change in flow rates between amended and non-amended glacial till soils are illustrated in Figure III-2 (Fig 4-3 of Kolsti, 1995). The amended plot (plot 2) was incorporated with a 7/16-inch well-composted yard debris compost on a two-unit soil to one-unit compost basis. The amended plots generated 53 to 74-percent of

the runoff volume produced by unamended plots under unsaturated conditions (Hielema, 1996).

The lawn's storage capacity may allow for reduced detention facility sizing requirements in the future. Computations were performed to determine estimated storage volume reductions and the respective reduced detention facility sizing assuming a 6month stormwater holding capacity of amended soils. The 6-month 24-hour stormwater holding capacity was chosen to perform this hypothetical scenario. This scenario is based on the professional judgment of City of Redmond Stormwater Utility staff. Runoff volumes were calculated for areas of two different subsoil compositions that were not amended, identified by their curve numbers (CN). The curve number of 78 represents soils having a higher percentage of sand than the soils with a curve number of 84, which are denser. Runoff volumes were then recalculated for the same hypothetical subdivisions, assuming all conditions were identical except for soil preparation. The same curve numbers were used for the amended soils, the only variable which changed in the calculations was the water.

Figure III-2: Comparison of Hydrologic Responses from Amended and Non-amended Plots

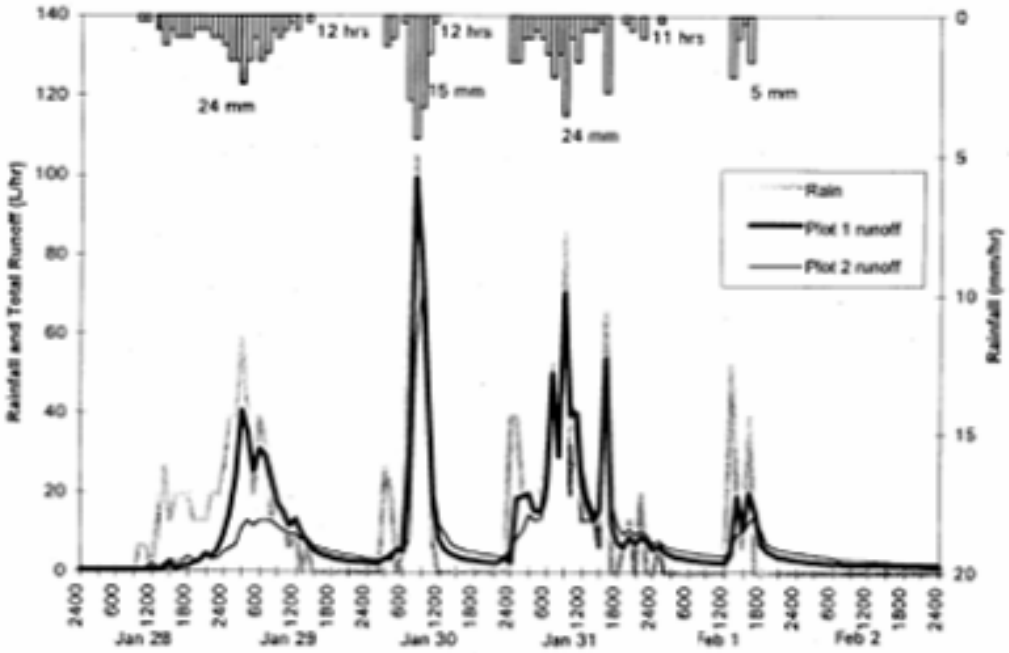


Figure 4-3: Rainfall and runoff for Plots 1 and 2 for the storms of January 28-February 2, 1995

holding capacity of the soils. Calculations were performed using the hydrology software Water Works, which incorporates the Santa Barbara Urban Hydrograph method (Kong, 1996). Values shown in Table III-5 depict the changes in detention facility volumes and costs as a result of soil amending.

Detention facilities represented in Table III-5 are sized to release storm flow at the 100-year predeveloped rate in Redmond; a 100-year storm event in Redmond is currently equivalent to 3.7-inches of rainfall in a 24-hour period. For example, a 11.5-acre development with a 3.168-acre pervious area having a curve number of 84 was calculated to require a 19,227 cubic foot detention facility. Recalculating the stormwater runoff from this development, assuming the soils were amended to a 10-inch depth, resulted in a detention volume of 18,147 cubic feet, 93.38 percent of the original detention facility volume. Estimates of opportunity and construction costs were obtained from Graph III-1. The reduction in stormwater facility volume of 1080 cubic feet for this example equates to a potential reduction in cost of $8,640, or approximately $0.05 per square foot of amended lawn. As shown in the table below, potential cost savings range from $0.02 to $0.21 per square foot of amended lawn area. The largest benefits are exhibited by development sites less than or equal to one acre.

Table III-5: Potential Stormwater Detention Cost Savings from *TCT*

Nominal Size, acres	Curve Number (CN)	Impervious Area, acres	Previous Area, acres	Change in Detention Volume, %[a]	Opportunity Costs Savings per square foot[b]	Construction Cost Savings per square foot[b]	Total Savings per square foot[b]
0.75	84	0.537	0.213	97.5	$0.03	$0.14	$0.17
	78	0.537	0.213	99.52	$0.00	$0.02	$0.02
1	84	0.48	0.52	85.8	$0.03	$0.18	$0.21
	78	0.48	0.52	90.99	$0.02	$0.12	$0.15
5.5	84	3.985	1.515	94.38	$0.02	$0.02	$0.04
	78	3.985	1.515	94.56	$0.02	$0.03	$0.04
6	84	2.88	3.12	94.56	$0.01	$0.06	$0.07
	78	2.88	3.12	94.3	$0.01	$0.01	$0.02
11.5	84	8.332	3.168	93.38	$0.01	$0.04	$0.05
	78	8.332	3.168	92.18	$0.02	$0.03	$0.05
12	84	5.67	6.24	92.18	$0.01	$0.02	$0.03
	78	5.67	6.24	92.96	$0.01	$0.01	$0.02

a Values determined by Kong (1996) b Preliminary savings estimates

Detention facility sizing represented by these calculations are only preliminary estimates. The software used for calculations is single storm event based. Future modeling with a continuous storm event model such as King County Run Time Series (KCRTS) would provide more accurate detention volume estimates. However, there are currently no parameters available from which to base soil conditions throughout a storm event.

III.B.5 Inspection and Testing Costs

Soil analyses and associated costs from local soil laboratories are as follows: detailed fertility, $40; sulfate, $8; organic matter, $12; bulk density, $15. The total cost, including the $40 report fee, is $115. The compost analysis is $125, and the report fee is $50. The compost manufacturer, however, will usually provide the compost analysis. Post amendment organic content analysis costs $12 per sample.

Non-composted amended sites usually have existing soil analyzed for fertility, for a total fee of $80, including report. The increased testing required by *TCT* sites therefore would only be $35 for existing soil, and $12 for post amendment testing.

III.C Cost Comparisons between TAT, MIT and TCT

Soil preparation costs increase substantially from *TAT* and *MIT* to *TCT*, up to $0.12 and $0.36 per square foot, respectively. Comparing the total site development costs, however, reduces the gap between the procedures. As shown in Table III-8, a *MIT* site that uses sod provides savings of only $0.15 per square foot over the hydroseeded *TCT* site. The increased installation cost may be compensated by future stormwater regulations, once *TCT* stormwater holding capacity has additional documentation. The reduced detention facility costs could save a developer up to $0.21 per square foot. The increase cost of *TCT* site development can be justified without changes to detention facility sizing, however, by the reduced maintenance cost of *TCT* as will be discussed in Chapter IV.

Chapter IV: Payback Period for Tilled Compost-Turf

IV.A Assumptions

An economic analysis has been conducted that predicts payback periods for the various soil preparation methods discussed earlier. Estimates of water and fertilizer savings have been used to predict the payback period of Tilled Compost Turf (*TCT*) by hydroseed application (*TCT*–seed) compared to that of the four other most common lawn installation approaches. These other installation procedures are variations of the traditional lawn installation procedures described previously. They include: (1) *Topsoil Amended Turf* by hydroseeding application (topsoil-seed), (2) *Topsoil Amended Turf* by sod placement (topsoil-sod), (3) *Minimum Input Turf* by hydroseed application (minimum-seed), and (4) *Minimum Input Turf* by sod placement (minimum-sod). For more description of each approach, see Chapters II and III.

The economic model uses the projected peak summer water rates for the City of Redmond supplied by Financial Consulting Solutions (Cebron and Seat 1996, Sullivan 1997). Financial Consulting Solution's model assumes that Seattle Public Utilities Water may increase its summer peak water fees to the City of Redmond by approximately 10% annually, which in turn will inflate the City of Redmond's water rates by approximately 6% annually (See Table IV.1). (Higher increases are scheduled in 1999 due to several Capital Improvement Projects being implemented by SPU.)

Table IV-1: Projected Summer Peak City of Redmond Water Rates for 100 Cubic Feet of Water

	1997	**1998**	**1999**	**2000**	**2001**	**2002**
Percent increase	0%	5.28%	12.04%	4.74%	5.25%	5.23%
Summer Peak Water Rate for 100 ft^3	$1.94	$2.04	$2.29	$2.40	$2.52	$2.65

The model created to determine the payback period for a *TCT*-seed assumes a 14week summer watering period where *TCT*-seed receives between 0.67 to 0.75-inches of water per week, topsoil-amended turf receives 1.25-inches of water per week, and minimum-input turf receives 2-inches of water per week (See Figures IV-1, IV-2, IV-3, IV-4, and Table IV-2).

Furthermore the model assumes fertilizer applications of 2-pounds of nitrogen per year in compost-amended turf, 4-pounds of nitrogen in topsoil-amended turf, and 6pounds of nitrogen per 1000 square feet in minimum-input turf. These application rates are based on the experience of landscape professionals (Survey, 1996).

IV.B Variables Excluded from Model

A great deal of scientific literature exists documenting: (1) that organic matter increases the water holding capacity of soil and (2) that organic matter increases the ability of soil to retain fertilizer (Brady and Weil, 1996). However, there is only anecdotal evidence that turf grown on tilled-compost soil reduces the need for herbicide, insecticide, and fungicide applications. Thus, these variables were excluded from the model. Finally, while minimum-input turf soils are typically compacted (requiring more aeration and thatch removal treatments than *TCT*-seed), this variable was also excluded.

IV.C Projected Payback Period

The projected payback periods have been calculated using the previously mentioned assumptions. Table IV-2 summarizes payback periods for *TCT*–seed.

Table IV-2: Payback Period of Tilled Compost Turf by hydroseeding Versus the Following Turf Installation Practices

Alternative Turf Installation Practice	Years for Payback
Topsoil-seed	5 to 6
Topsoil-sod	0
Minimum-seed	6 to 7
Minimum-sod	2 to 3

Table IV-3: Average Projected Cumulative-Cost of 1000 Square Feet of Turf

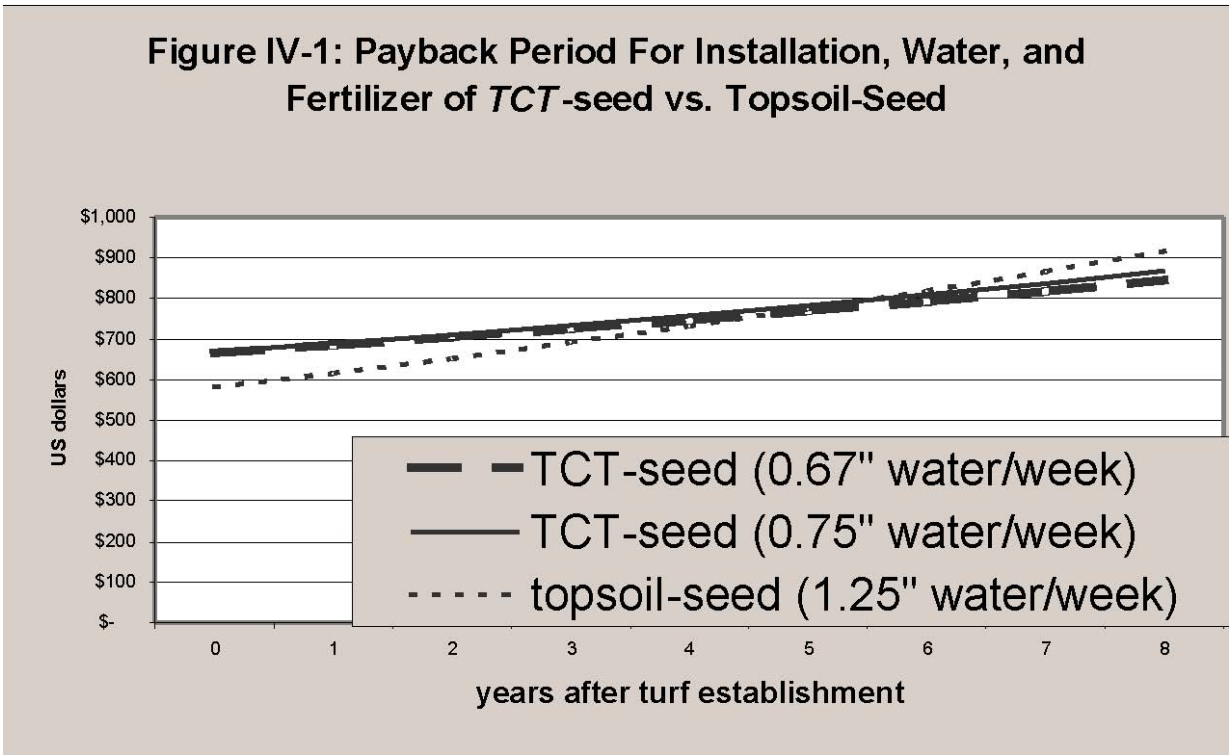
	1997	1998	1999	2000	2001	2002	2003	2004	2005
TCT-seed (0.67" water/week)	$667	$685	$705	$726	$747	$770	$794	$818	$847
TCT-seed (0.75" water/week)	$669	$689	$711	$734	$758	$784	$810	$838	$869
topsoil-seed (1.25" water/week)	$582	$616	$654	$693	$733	**$776****	$821	$867	$920
topsoil-sod (1.25" water/week)	**$767****	$801	$839	$878	$918	$961	$1006	$1052	$1105
minimum-seed (2" water/week)	$391	$445	$504	$566	$631	$698	$769	**$844****	$927
Minimum-sod (2" water/week)	$586	$640	$699	**$761****	$826	$893	$964	$1039	$1122

BOLD** = Payback year

IV.D TCT-seed versus Topsoil-Seed

Topsoil-seed is a common practice in the Redmond area. Typically 4 to 6-inches of topsoil are distributed over a relatively compacted soil (with a bulk density over 1.6 grams per cubic centimeter) with less than 2 percent organic matter. This soil depth then compacts to approximately a 2-inch soil depth. The main problems with topsoil-seed are: (1) the turf establishes shallow roots that can not penetrate the compacted subsoil below, and (2) excess water that comes in contact with the compacted till moves laterally as runoff resulting in loss of water, fertilizer, and pesticides. The result is that topsoil-seed requires approximately 1.25-inches of water per week during the summer months (Hawn 1997), while *TCT*-seed requires 0.67 to 0.75 inches of water per week (Hawn 1997). Thus the model predicts that the payback period for tilled compost versus topsoil-seed is between 5 to 6-years (Figure IV.1).

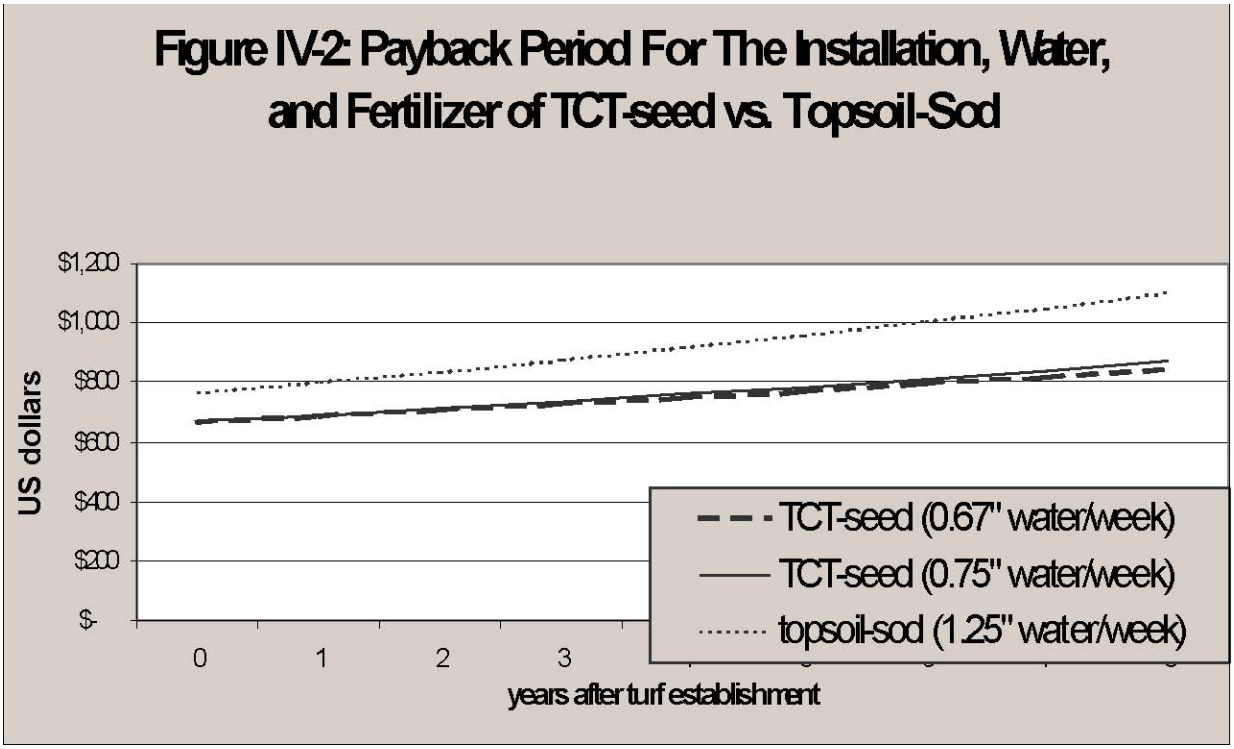
Figure IV-1: Payback Period for Installation, Water, and Fertilizer of TCT-seed vs. Topsoil-Seed



IV.E TCT-seed versus Topsoil-Sod

Topsoil-sod is a very common turf establishment practice in the Redmond area due to the short-term ease of establishing an instant lawn. However, *TCT*-seed turf looks more aesthetically pleasing than sod within three to five years. Furthermore, in areas where an adequate soil interface layer is not established, sod establishes shallow roots, has a fuzzy unnatural look, and promotes unhealthy thatch buildup. And just as with topsoil-seed in the Redmond area, topsoil-sod is typically established on compacted impervious subsoil resulting in the lateral runoff of water, fertilizer, and pesticides. Topsoil-sod required approximately 1.25-inches of water each week during the summer months, while tilled compost requires approximately 0.67 to 0.75-inches of water per week during the summer months. *TCT*-seed is projected to provide cost-savings of approximately $100 per 1000 square feet in the very first year (See Figure IV.2).

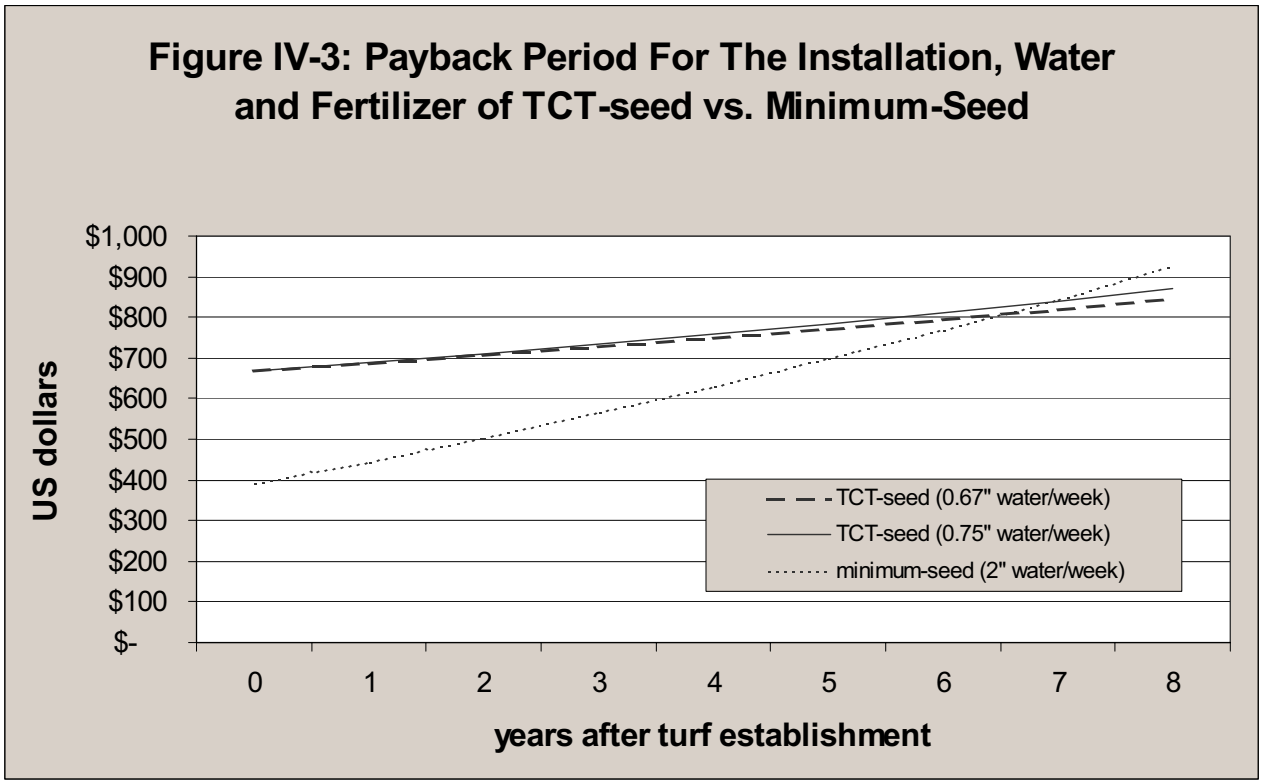
Figure IV-2: Payback Period for the Installation, Water, and Fertilizer of TCT-seed vs. Topsoil-Sod



IV.F TCT-seed versus Minimum-Seed:

Minimum-seed turf in Redmond is often located on compacted soils with very little organic matter (less than 2 percent). While sandy soils without organic matter drain and desiccate most rapidly, clay soils without organic matter are typically impervious with slow water infiltration rates, inducing heavy run-off and poor drainage. Thus the economic model estimates that if a landowner wishes to maintain a green minimum-input lawn during the summer months, between 2 to 2.5-inches of water will have to be applied each week. On the other hand *TCT*-seed with high porosity and moisture holding capacity often requires only 0.67 to 0.75-inches of water per week (Hawn 1997). Thus the model predicts a payback period for *TCT*-seed versus minimum-seed is approximately 6 to 7-years (See Figure IV-3).

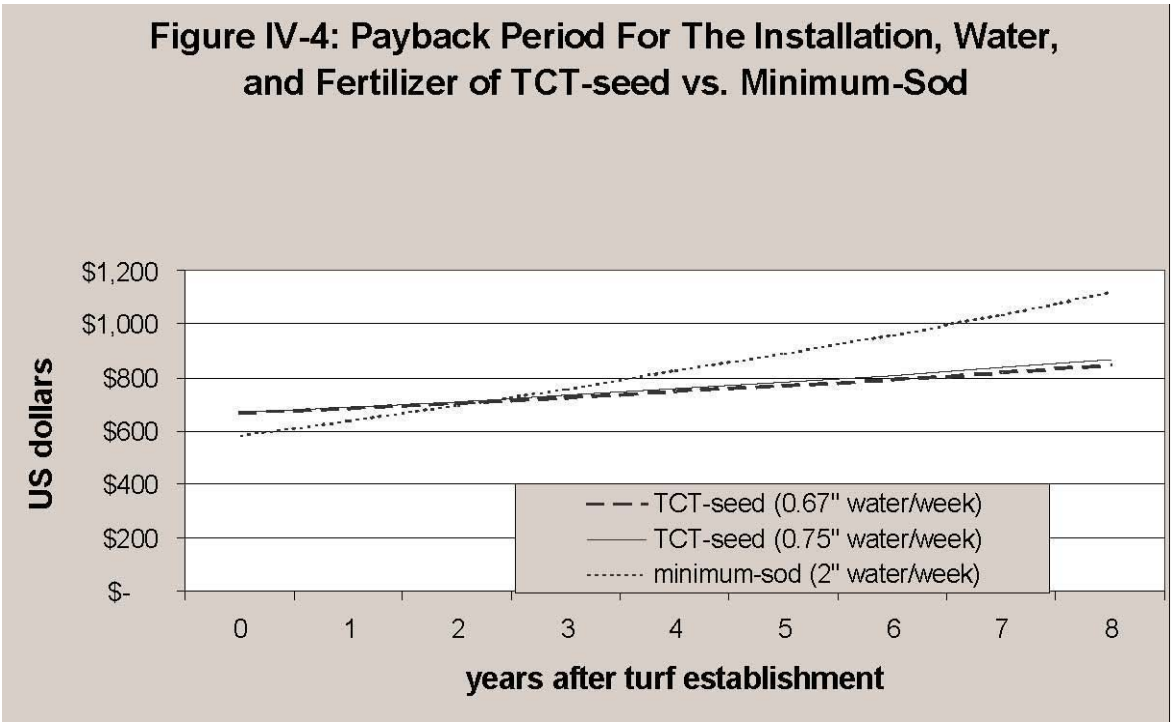
Figure IV-3: Payback Period for the Installation, Water and Fertilizer of TCT-seed vs. Minimum-Seed



IV.G TCT-seed versus Minimum-Sod

In the worst case scenario individuals simply lay sod down upon compacted soil with very little organic matter. In order for the sod to retain sufficient nutrients to look aesthetically appealing, minimum-sod must be fertilized with 6 to 8-pounds of nitrogen annually, as opposed to the 2 to 4-pounds of nitrogen applied to turf grown on compost-amended soil. Each of these 6 annual nitrogen applications is usually accompanied by a proportional quantity of phosphorous, as well as several of other fertilizers. Furthermore, "sod-on-cement" type turf typically requires between 2 to 2.5-inches of water a week in order to stay green during the entire summer (Hawn 1997). The frequent fertilizer applications and enormous leaching potential of continuous watering results in significant off-site nutrient run off degrading the water quality in Lake Sammamish and local groundwater aquifers. Finally the model predicts that the payback period for minimum-sod versus *TCT*-seed is approximately 2 to 3-years (See Figure IV.4).

Figure IV-4: Payback Period for the Installation, Water and Fertilizer of TCT-seed vs. Minimum-Sod



IV.H Conclusion

In conclusion, turf grown on compost-amended soil can save homeowners, residences, and businesses money on water and fertilizer when compared to the other types of turf. *TCT*-seed seeded-turf pays for itself: (1) in year-5 to 6 when compared to topsoil-seed, (2) in year-0 when compared to topsoil-sod, (3) in year-6 to 7 when compared to minimum-seed, and (4) in year-2 to 3 when compared to minimum-sod.

There are several external costs that can be alleviated by compost-amended soil that have not been put into the economic model. These external costs have not been quantified, however compost-amended soil can potentially reduce pesticide and fertilizer runoff into local streams and groundwater aquifers. Finally, by adopting the compost-amended soil programs in the Puget Sound area, the general population will save money on water and fertilizer, and the environment may benefit from improved soil quality (See Chapter V – Soil Quality Issues).

Chapter V: Soil Quality Issues

V.A Soil Quality Issues

Compost-amended-soil can benefit the City of Redmond by improving the soil quality and thus the environmental health of Redmond's urban and suburban landscapes. Soil quality is defined as "the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health." The three major components that define soil quality include (Doran et al, 1994):

(1) **Productivity**-The ability of soil to enhance biological productivity.
(2) **Environmental quality**-The ability of soil to attenuate environmental contaminants, pathogens, and offsite damage.
(3) **Biota health**- The interrelationship between soil quality and plant, animal, and human health.

V.B Turf grown on Compost-Amended Soil Is More Productive

Turf grown on compost-amended soil is more productive (or produces more biomass) than turf on unamended soils. Typically compost amended turf possesses (1) larger individual grass blades resulting in a thicker more healthy looking lawn, and (2)deeper grass roots resulting in a more spongy and resilient lawn. Compost amended soil is more productive due primarily to the physical and chemical characteristics of compost itself.

As noted earlier, proper incorporation of compost into a typical Redmond glaciated soil will increase the soil organic matter to eight to thirteen percent by weight. Compost increases the moisture holding capacity and moisture retention capacity of a soil (Hortenstine and Rothwell, 1972; Bengston and Cornette, 1973; Epstein et al., 1976), thus the soil can hold onto more water for a longer period of time than an unamended soil. During the dry summer months, water is a limiting factor for turf productivity, and any increase in available water will increase productivity.

Furthermore, compost itself contains slow-release nutrients. Soil organisms slowly decompose the compost releasing nutrients into the soil environment over several years. Compost also increases the cation exchange capacity of a soil (or the ability of a soil to retain positively charged nutrients such as NH4+, Ca2+, Mg2+, and K+). Thus compost-amended soil typically contains more available nutrients which can increase net photosynthesis and starch and protein production.

V.C Turf grown on Compost-Amended Soil Improves Environmental Quality

Turf grown on compost-amended soil is typically healthier than turf grown on unamended-soil due to the better aeration, reduction of soil compaction, deeper rooting depth, and improved soil structure. Healthier turf is generally more tolerant to insect, disease, weed invasion and fungal attack, resulting in an overall reduction in pesticide and herbicide utilization (Stahnke, 1997).

Over the counter fertilizer-with-herbicide products commonly used in the Puget Sound area (e.g., “weed and feed”) contain 2,4-D mecoprop, and dicamba. Researchers applied herbicides and fertilizer to turf in Georgia, and found that 10% of applied 2,4 D, 14% of the mecoprop, and 15% of the dicamba washed off mildly-sloped green turf after two days following two inches of simulated rain. However 26% of applied 2, 4 D, 24% of the mecoporp, and 37% of the dicamba washed off a mildly-sloped dormant turf in the same experiment (Kenna, 1995). Furthermore, Kenna (1995) found that 16% of nitrate fertilizer washed off the mildly-sloped green-turf in two days, and 64% of the nitrate fertilizer washed off a mildly sloped dormant-turf in two days. Thus one can deduce that actively growing turf absorbs more nutrients and herbicides than dormant turf.

An increasing portion of these fertilizers and pesticides are getting out into the streams and lakes in the Puget Sound Region. In September of 1997, Lake Sammamish suffered from an algal bloom. Phosphorus is usually the limiting nutrient for algae, although nitrogen is sometimes the limiting nutrient. It appears that fertilizer runoff and sediment (from development in the watershed) are supplying sufficient quantities of these limiting nutrients to deteriorate the local water quality.

In 1992 and 1993 the Washington State Department of Ecology sampled eleven local sites for some common pesticides. In 1992 nine pesticides including glyphosate (Roundup), diazinon, and 2, 4-D were detected in both Thorton and Mercer Creeks. Resampling of Mercer Creek in 1993 found the aquatic contamination to have increased to fifteen pesticides. While all identified pesticides were at levels below one part per billion (ppb), the increase in pesticides indicate further degradation of the Puget Sound Region aquatic environment. If compost-amended-soil increases turf health and reduces the need for pesticide applications, the water in the Puget Sound Region may become less contaminated over time.

V.D Compost-Amended-Soil Improves Biota Health

Compost can increase the available microhabitats necessary for beneficial predatory insects and soil microorganisms, thus increasing the biodiversity in the soil ecosystem. Earthworms, soil arthropods, and soil microorganisms improve the soil structure by recycling recalcitrant difficult-to-decompose organic debris, such as thatch, back into nutrients needed for turf production. Predacious invertebrates use the improved soil structure of compost-amended soil as habitat, and consume herbivorous insects that cause damage to turf. On the

other hand soils with little organic matter have low moisture holding capacities and lack microhabitats necessary for beneficial predatory insects, earthworms and soil microorganisms (Paul and Clark, 1996).

Compost-amended-turf is generally healthier than unamended-turf requiring less fertilizer and pesticides (Sthanke, 1997). Overapplication of fertilizers which reduce soil pH and some pesticides can reduce turf earthworm populations, and grass vigor resulting in thatch buildup (King and Dale, 1977).

Furthermore, soils rich in organic matter (e.g., compost) typically have more microbial biodiversity than soils without organic matter. This is mainly due to the fact that microorganisms require a carbon substrate for reproduction. And microorganisms can decompose soil contaminants such as hydrocarbons and pesticides. Hence, increased concentrations of organic matter in soil can result in faster degradation (or chelation) of toxic compounds (Paul and Clark, 1996).

V.E Conclusion

Compost incorporation into Redmond soils typically improves the overall soil quality by increasing soil productivity, possibly improving environmental quality, and increasing soil biodiversity. Compost-amendment improves turf productivity by increasing the amount and duration of available water, available nutrients and aeration, and the rooting depth of turf. Compost can improve environmental quality by reducing the amount of fertilizer and pesticides used on turf, and by potentially reducing the amount of pesticide and fertilizer runoff from turf. Compost can increase the biodiversity of the soil environment by increasing available carbon substrate for microorganisms and microhabitats for predatory insects.

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Washington State University Research and Extension Center (1996) “Commercial Food Waste Collection and Composting Demonstration Project, Volume VI: Food Waste Compost Growth Trials and Public Education and Demonstration.” Puyallup, Washington.

WSU Cooperative Extension. (1993) “Home Lawns.” Extension Bulletin No. 0482, Washington State University. Pullman, WA.

Appendix A: Suggested Compost Specifications

(Washington Department of Transportation Landscape Architectural Specifications)

Future provisions may include price adjustments for failure to meet specifications.

Compost shall be stable, mature, decomposed organic solid waste that is the result of the accelerated, aerobic biodegradation and stabilization under controlled conditions. The result is a uniform dark, soil-like appearance.

Compost maturity or stability is the point at which the aerobic biodegradation of the compost has slowed and oxygen consumption and carbon dioxide generation has dropped. Subsequent testing provides consistent results.

Compost production and quality shall comply with the Interim Guidelines for Compost Quality, #94-38 or superseding editions, and amendments, published by the Washington State Department of Ecology.

Compost products shall meet the following physical criteria:

1. 100 percent shall pass through a 1-inch sieve when tested in accordance with AASHTO Test Method T87 and T88. (Note: 7/16–inch size has shown to provide the optimum benefits (Kolsti,1995)
2. The pH range shall be between 5.5 and 8.5 when tested in accordance with WSDOT Test Method 417.
3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1 percent on a dry weight or volume basis, whichever provides for the least amount of foreign material.
4. Minimum organic matter shall be 30 percent dry weight basis as determined by loss on ignition. (LOI test)
5. Soluble salt contents shall be less than 4.0 mmhos/cm.
6. Compost shall score a number 5 or above on the Solvita Compost Maturity Test before planting (Woodsend Laboratories, Inc.[1]).

Acceptance of composted products shall be based on the following submittals by the Contractor:

1. A Request for Approval of Material Source.
2. A copy of the Solid Waste Handling Permit issued to the supplier by the Jurisdictional Health Department as per WAC 173-304 (Minimum Functional Standards for Solid Waste Handling).

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[1] Woods End Research Laboratory, Inc., Box 297, Mount Vernon, Maine 04352, 207-293-2457. E-mail: infor@woodsend.org

3. Written verification from the supplier that the material complies with the processes, testing, and standards specified in the Interim Guidelines for Compost Quality.
4. Written verification from the supplier that the compost products originate a minimum of 65 percent by volume from recycled plant waste. A maximum of 35 percent by volume of other approved organic waste and/or biosolids may be substituted for recycled plant waste.
5. A copy of the lab analyses described under Testing Parameters in the Guidelines for Compost Quality. The analyses shall be less than three months old.
6. A list of the feedstock by percentage present in the final compost product.

Appendix B: Individuals and Businesses Surveyed

Contact	Company	Phone	Street Address	City
LANDSCAPE CONTRACTORS				
Scott	Attractive Landscape	(253) 836-1215	8302 Chambers Creek Rd West	Tacoma
Charles Martin	Beowulf Landscaper	(206) 440-0067	1121 NE Perkins Way	Shoreline
Mike Freedman	Benchmark Land Management	(425) 880-4578	P. O. Box 1078	Fall City
Tom Berg	Berg's Landscaping	(425) 483-0717	P. O. Box 1628	Woodinville
Leon Hussey	Classic Nursery	(425) 885-5678	12526 Avondale Road	Redmond
Mitch Ferguson	Clifford Quality Landscaping	(2530 527-1284	11814 -23 Avenue South	SeaTac
Dan Defreece	Defreece Landscape Services, Inc.	(425) 481-6889	23010 East Echo Lake Rd	Snohomish
Jerry Gorton	Gorton's Landscaping	(425) 228-8719	955 Edmonds NE, Apt. D	Renton
Lauren Stouhish	The Highridge Corporation	(425) 587-0249	P. O. Box 260	Issaquah
Ladd Smith	In Harmony Landscapting	(425) 486-2180	P. O. Box 755	Woodinville
Joel	Mohoric Landscaping Inc.	(206) 775-0659		
Monti	Pro Grass	(425) 486-4799	1734 – 211 Way NE	Redmond
Pat Hunsaker	Shamrock Landscaping	(206) 271-6568	11335 Durland Place NE	Seattle
Mike Palmer	Star Nurseries	(253) 241-2115	13916 – 42 South	Tukwila
Dave	Terrain Company	(206) 839-4295		
Michael	Thomas Catwalks	(206) 946-9449		
Tim Goss	Tim Goss Landscape Design	(206) 842-8664	353 Wallace Way NE, #17	Bainbridge Island
Ross Fletcher	Teufel	(425) 482-1112	6303 200 33 Place SE	Woodinville

Company	Phone	City
SOD & HYDROSEEDING COMPANIES		
Agrow –Tech Hydroseeding	1-800-605-4446	Marysville
Briargreen	1-800-635-TURF	Kent
Choice Turf	(206) 487-1240	Snohomish
Country Green Turf Farms	1-800-300-1763	Olympia
Emerald Turfgrass Farms	(206) 641-0608	Sumner
Grass Masters	1-800-859-4727	Redmond
Green Valley Turf Farm	1-800-237-3884	Sumner
Hydroseeding Inc.	1-800-870-0242	Puyallup
JB Instant Lawn	(206) 821-0444	Redmond
COMPOST DISTRIBUTORS		
Cedar Grove Composting Inc.	(206) 521-9439	Maple Valley
GroCo	(206) 622-5141	Seattle
Pacific Topsoil	(425) 522-7180	Bothell

OTHER CONTACTS

Contact	Company	Profession	Street Address	City
Rod Bailey	Evergreen Services Corp.	Landscape Management	12010 SE 32 Street	Bellevue
Phillip Unterschuetz	Integrated Fertility Mgmt	Soil Scientist	333 Ohme Gardens Road	Wenatchee
Dirk Muntean	Plant and Soil Science	Soil Scientist	P. O. Box 1648	Bellevue

APPENDIX R

Stormwater Pipe Inspection Protocol

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Stormwater Pipe Inspection Protocol

This protocol is under development and will be published December 1, 2006.

Protocol Outline

- Roles and Responsibilities for Inspection
    - Contractor
    - Construction Division
    - Third Party Consultant
- Material Specifications
- Installation Specifications and Allowable Tolerances
- Materials Acceptance
- Trench Inspection
- 30-day Camera Inspection
- 1-year Camera Inspection
- Performance Guarantee
- Performance Bond
- Stormwater Pipe Inspection Report

August 18, 2010

SUBJECT: Addendum to the Clearing, Grading and Stormwater Management Technical Notebook

Ladies and Gentlemen,

The City of Redmond has adopted the attached Addendum dated August 18, 2010 to the Stormwater Management and Erosion Control Technical Notebook. The main purpose of this addendum is to bring the City into Compliance with the Department of Ecology NPDES Phase 2 Permit issued to the City January 17, 2007. In addition, the requirements for regional facilities have been updated to reflect Ecology's approval of the City's regional stormwater facility program. The Addendum replaces all of Chapter 2 of Issue 5 of the Stormwater Technical Notebook. Chapter 15.24 of the Redmond Municipal Code has also been updated to reflect changes required by the City's NPDES Permit coverage.

This addendum is effective August 18, 2010 for all projects vested on or after that date. For projects vested prior to August 18, 2010, the Notebook effective at the vesting date still applies.

If you have any questions please contact Lisa Rigg, City of Redmond Stormwater Engineer at (425) 556-2758.

Sincerely,

City of Redmond
Public Works Department

ADDENDUM TO THE CLEARING, GRADING AND STORMWATER TECHNICAL NOTEBOOK, ISSUE 5

Effective August 18, 2010

CityofRedmond
WASHINGTON

CHAPTER 2: MODIFICATIONS TO THE 2005 DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON

2.1 Redmond Requirements

Clearing, grading, and stormwater management issues relating to construction are regulated by Chapter 15.24 of the Redmond Municipal Code and the Redmond Community Development Guide. Issues not addressed in the RCDG are regulated by the requirements of the Stormwater Notebook. The 2005 Ecology Manual as modified by the Western Washington Phase II Municipal Stormwater Permit, issued January 17, 2007, shall regulate issues not addressed in the Redmond Municipal Code, Redmond Community Development Guide, or the Stormwater Notebook.

This chapter is divided into two parts to address Department of Ecology requirements as well as issues specific to the City of Redmond. Volume 1, Chapter 2 of the 2005 Ecology Manual is replaced in full by Chapter 2, Sections 2.2 through 2.8 of the Stormwater Technical Notebook, as updated by this addendum. Section numbering of this chapter is intentionally the same as section numbering in the 2005 Ecology Manual (Volume 1, Chapter 2). Modifications and additions specific to the City of Redmond are in bold. Section 2.9 of Chapter 2 contains modifications to the remainder of the 2005 Ecology Manual to address work within the City of Redmond.

Key Modifications for Redmond

In accordance with the Ecology Manual, infiltration is encouraged for recharge or as a method of discharging surface water as an option in areas with highly permeable soils for clean runoff from sidewalks and roofs. However, due to wellhead protection concerns, all other infiltration proposals shall be evaluated by the Stormwater Engineer on a case-by-case basis.

Infiltration of water draining from pollution generating surfaces in single-family residential developments is allowed in Wellhead Protection Zones 1 and 2 following enhanced treatment in a BMP that is exposed to the surface (such as bioretention in view of sidewalks or roads). Infiltration of stormwater from pollution generating surfaces is prohibited in Wellhead Protection Zones 1 and 2 for all other uses. In Wellhead Protection Zone 3, infiltration for treatment is not permitted, but infiltration for flow control following treatment based on site use (per the requirements of the 2005 Ecology Manual) is allowed.

2.2 Exemptions

Forest Practices:
Forest practices regulated under Title 222 WAC, except for Class IV General forest practices that are conversions from timber land to other uses, are exempt from the provisions of the minimum requirements.

Commercial agriculture:
Commercial agriculture practices involving working the land for production are generally exempt. However, the conversion from timberland to agriculture, and the construction of impervious surfaces are not exempt.

Oil and Gas Field Activities or Operations:
Construction of drilling sites, waste management pits, and access roads, as well as construction of transportation and treatment infrastructure such as pipelines, natural gas treatment plants, natural gas pipeline compressor stations, and crude oil pumping stations are exempt. Operators are encouraged to implement and maintain Best Management Practices to minimize erosion and control sediment during and after construction activities to help ensure protection of surface water quality during storm events. These activities may be prohibited by 20D.140.50-030.

Road Maintenance:
The following road maintenance practices are exempt: pothole and square cut patching, overlaying existing asphalt or concrete pavement with asphalt or concrete without expanding the area of coverage, shoulder grading, reshaping/regrading drainage systems, crack sealing, resurfacing with in-kind material without expanding the road prism, and vegetation maintenance.

The following road maintenance practices are considered redevelopment, and therefore are not categorically exempt. The extent to which this chapter applies is explained for each circumstance.

- Removing and replacing a paved surface to base course or lower, or repairing the roadway base; If impervious surfaces are not expanded, Minimum Requirements #1 - #5 apply. However, in most cases, only Minimum Requirement #2, Construction Stormwater Pollution Prevention, will be germane. Where appropriate, project proponents are encouraged to look for opportunities to use permeable and porous pavements.

- Extending the pavement edge without increasing the size of the road prism, or paving gravel shoulders; These are considered new impervious surfaces and are subject to the minimum requirements that are triggered when the thresholds identified for redevelopment projects are met.

- Resurfacing by upgrading from dirt to gravel, asphalt, or concrete; upgrading from gravel to asphalt, or concrete; or upgrading from a

bituminous surface treatment ("chip seal") to asphalt or concrete; These are considered new impervious surfaces and are subject to the minimum requirements that are triggered when the thresholds identified for redevelopment projects are met.

Underground utility projects:
Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics are only subject to Minimum Requirement #2, Construction Stormwater Pollution Prevention.

All other new development is subject to one or more of the Minimum Requirements (see Section 2.4 of this chapter).

2.3 Definitions Related to the Minimum Requirements

The following definitions are to help the end user of the Stormwater Notebook understand the application of Minimum Requirements.

Arterial – A road or street primarily for through traffic. A major arterial connects an Interstate Highway to cities and counties. A minor arterial connects major arterials to collectors. A collector connects an arterial to a neighborhood. A local access road connects individual homes to a collector.

Certified Erosion and Sediment Control Lead (CESCL) – means an individual who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by the Department of Ecology (see BMP C160 in the 2005 Ecology Manual). A CESCL is knowledgeable in the principles and practices of erosion and sediment control. The CESCL must have the skills to assess site conditions and construction activities that could impact the quality of stormwater and the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. Certification is obtained through an Ecology approved erosion and sediment control source. Course listings are provided online at Ecology's web site.

***Clearing* – means the removal of timber, brush, grass, ground cover or other vegetative matter from a site which exposes the earth's surface or any actions which disturb the existing ground surface.**

Effective Impervious Surface – Those impervious surfaces that are connected via sheet flow or discrete conveyance to a drainage system. Impervious surfaces on residential development sites are considered ineffective if the runoff is dispersed through at least one hundred feet of native vegetation in accordance with BMP T5.30 – "Full Dispersion," as described in Chapter 5 of Volume V of the Ecology Manual.

***Grading* – means any action which changes the elevation of the ground surface. Grading includes, but is not limited to, dredging, landfills, excavations, filling, earthwork, embankments, etc.**

Highway – A main public road connecting towns and cities.

Impervious surface – A hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater. Open uncovered retention/detention facilities shall not be considered as impervious surfaces for purposes of determining whether the thresholds for application of minimum requirements are exceeded. Open, uncovered retention/detention facilities shall be considered impervious surfaces for purposes of runoff modeling.

Land disturbing activity – Any activity that results in movement of earth, or a change in the existing soil cover (both vegetative and non-vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to clearing, grading, filling, and excavation. Compaction that is associated with stabilization of structures and road construction shall also be considered a land disturbing activity.

Maintenance – Repair and maintenance includes activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing and results in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse, or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. One example is the replacement of a collapsed, fish blocking, round culvert with a new box culvert under the same span, or width, of roadway. See also Road Maintenance exemptions in Section 2.2 of this chapter.

Native vegetation – Vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and which reasonably could have been expected to naturally occur on the site. Examples include trees such as Douglas Fir, western hemlock, western red cedar, alder, big-leaf maple, and vine maple; shrubs such as willow, elderberry, salmonberry, and salal; and herbaceous plants such as sword fern, foam flower, and fireweed.

New development – Land disturbing activities, including Class IV –general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivision, short subdivision and binding site plans, as defined and applied in Chapter 58.17RCW. Projects meeting the definition of redevelopment shall not be considered new development.

***NTU* – The letters "NTU" stand for Nephelometric Turbidity Units. These units are a quantitative measure of water clarity based on the scattering of a standard beam of light directed into a standard sample of the water. A higher reading means the sample is less clear (more cloudy/muddy). See also the definition for turbidity.**

Pollution-generating impervious surface (PGIS) – Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to: vehicular use; industrial activities (as further defined in the glossary); or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow-in of rainfall. Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff. Examples include erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, and garbage dumpster leakage. Metal roofs are also considered to be PGIS unless they are coated with an inert, non-leachable material (e.g., baked-on enamel coating).

A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles. The following are considered regularly-used surfaces: roads, unvegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, vehicular equipment storage yards, and airport runways.

The following are not considered regularly-used surfaces: paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles, fenced fire lanes, and infrequently used maintenance access roads.

Pollution-generating pervious surfaces (PGPS) – Any non-impervious surface subject to use of pesticides and fertilizers or loss of soil. Typical PGPS include lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields.

***Potential hydraulic influence* – Means surface runoff from the project would follow an identifiable conveyance route to surface water (including wetlands) and would not be infiltrated en-route.**

Pre-developed condition – The native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. The pre-developed conditions shall be assumed to be a forested land cover unless reasonable,

historic information is provided that indicates the site was prairie prior to settlement. **Historically the Sammamish River valley floor was pasture or wooded wetland. The map in Appendix N of the Technical Notebook identifies the historical land cover based on the City's research.**

Project site – The portion of a property, properties, or right of way subject to land disturbing activities, new impervious surfaces, or replaced impervious surfaces. **Projects that include improvements to an existing City right-of-way may consider the right of way as a separate project site, with approval of the City Stormwater Engineer, when determining Minimum Requirements.**

***Rainy season* – The period of time starting on October 1 of each year and ending April 30 of the following year. These dates may be adjusted by the Public Works Director based on climatic conditions for a particular year.**

Receiving waters – Bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow.

Redevelopment – On a site that is already substantially developed (i.e., has 35% or more of existing impervious surface coverage), the creation or addition of impervious surfaces; the expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of impervious surface that is not part of a routine maintenance activity; and land disturbing activities.

Replaced impervious surface – For structures, the removal and replacement of any exterior impervious surfaces or foundation. For other impervious surfaces, the removal down to bare soil or base course and replacement.

Site – The area defined by the legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment. For road projects, the length of the project site and the right-of-way boundaries define the site.

Source control BMP – A structure or operation that is intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. The Ecology Manual separates source control BMPs into two types. *Structural Source Control BMPS* are physical, structural, or mechanical devices, or facilities that are intended to prevent pollutants from entering stormwater. *Operational BMPs* are non-structural practices that prevent or reduce pollutants from entering stormwater. See Volume IV of the 2005 Ecology Manual for details.

***Stormwater Engineer* – The Stormwater Engineer is the reviewing authority who reports to the Public Works Director and represents the City for projects that involve stormwater management. City of Redmond Capital Improvement Projects are reviewed by a Stormwater Engineer within the Natural Resources**

Division of the Public Works Department. All other public or private projects are reviewed by a Stormwater Engineer in the Development Services Division of the Public Works Department.

***Turbidity* – The visual cloudiness of runoff, especially as caused by suspended solids and settle-able solids in runoff. Turbidity shall be measured as specified in Method 2130B of the following reference: Standard Methods for the Examination of Water and Wastewater. Current Edition. Franson, Mary Ann H., Managing Editor. Clesceri, Lenore S; Greenberg, Arnold E; and Eaton, Andrew D editorial board. Published jointly by the American Public Health Association, the American Water Works Association, and the Water Environment Federation.**

***Turbidity Meter* – A portable, electric, hand-held measuring device designed to give a numerical value of the turbidity (cloudiness) of a sample of water. The numerical values are expressed in units know as Nephelometric Turbidity Units (NTUs).**

Threshold Discharge Area – An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath). The examples in Figure 2.1 illustrate this definition. The purpose of this definition is to clarify how the thresholds of this manual are applied to project sites with multiple discharge points.

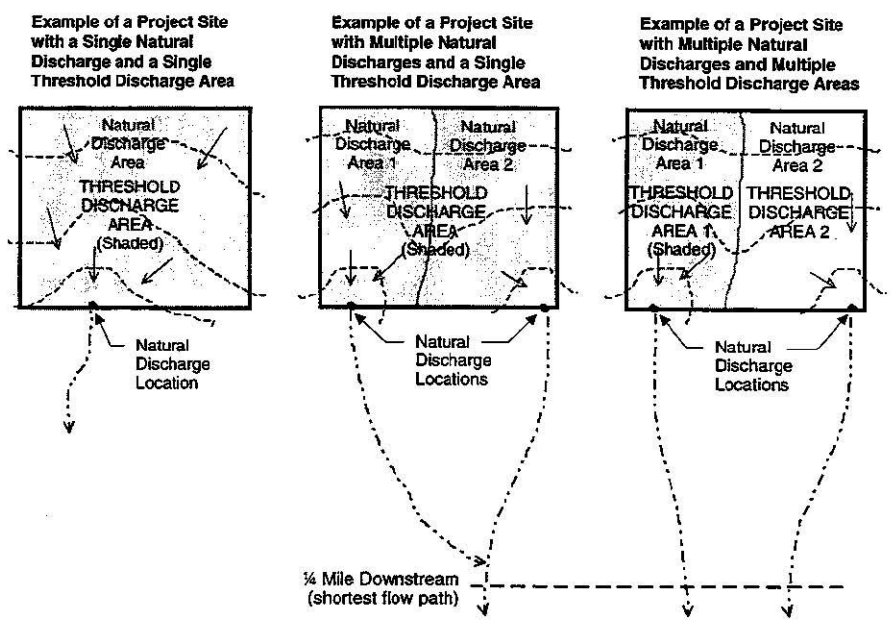

Figure 2.1 Threshold Discharge Areas

Wetland – Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands. **Note: This definition is only applicable to the 2005 Ecology Manual. A separate definition for all other uses is contained in the Redmond Community Development Guide.**

2.4 Applicability of the Minimum Requirements

Thresholds

Not all of the Minimum Requirements apply to every development or redevelopment project. The applicability varies depending on the type and size of the project. This section identifies thresholds that determine the applicability of the Minimum Requirements to different projects. The flow charts in Figures 3.2 and 3.3 **(from the NPDES Phase 2 permit)** can be used to determine which of the Minimum Requirements apply. The Minimum Requirements themselves are presented in Section 2.5. **Project proponents are encouraged to submit a copy of the flow charts indicating how they determined the Minimum Requirements applicable to their project.**

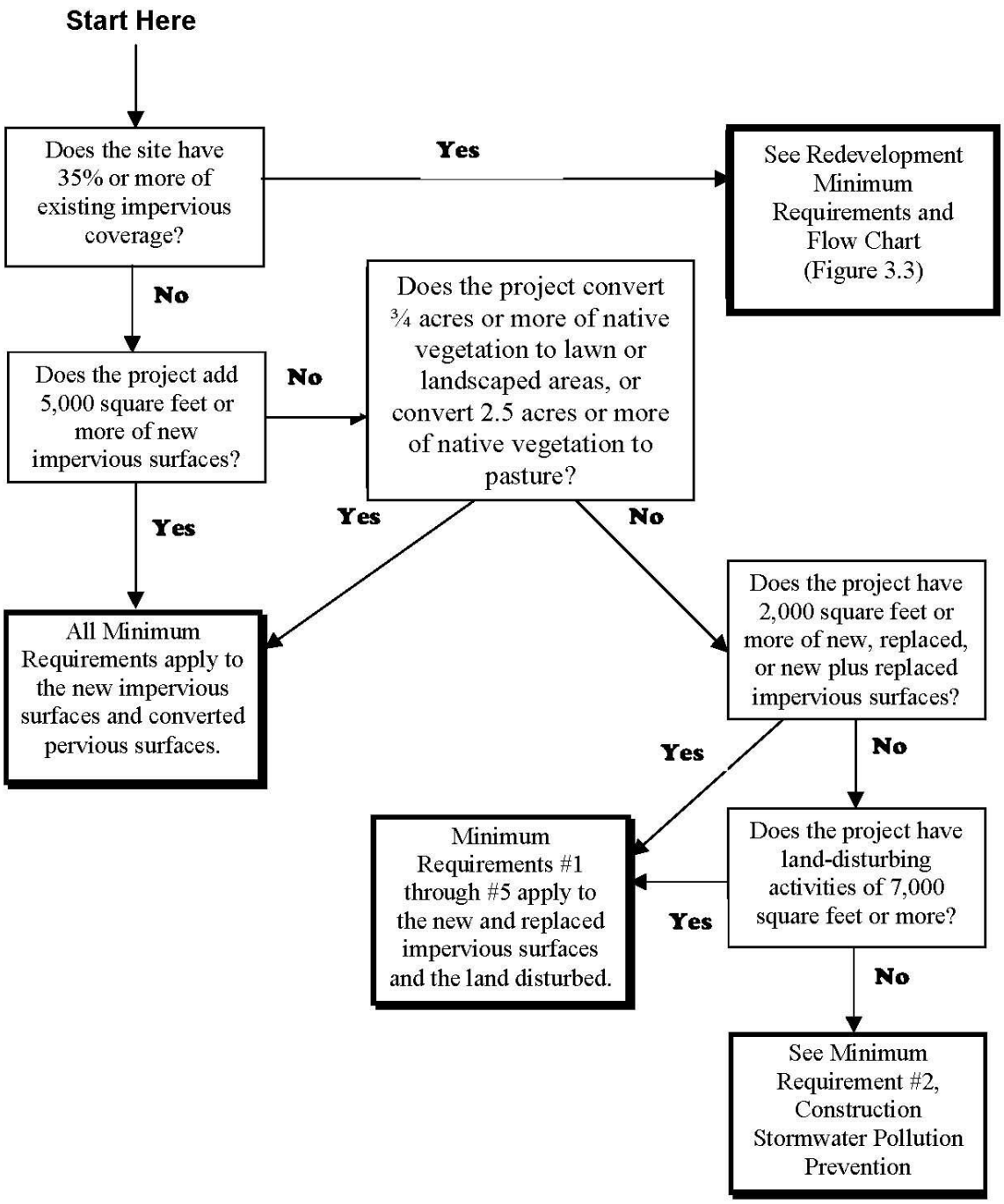

Figure 3.2 Flow Chart for Determining Requirements for New Development

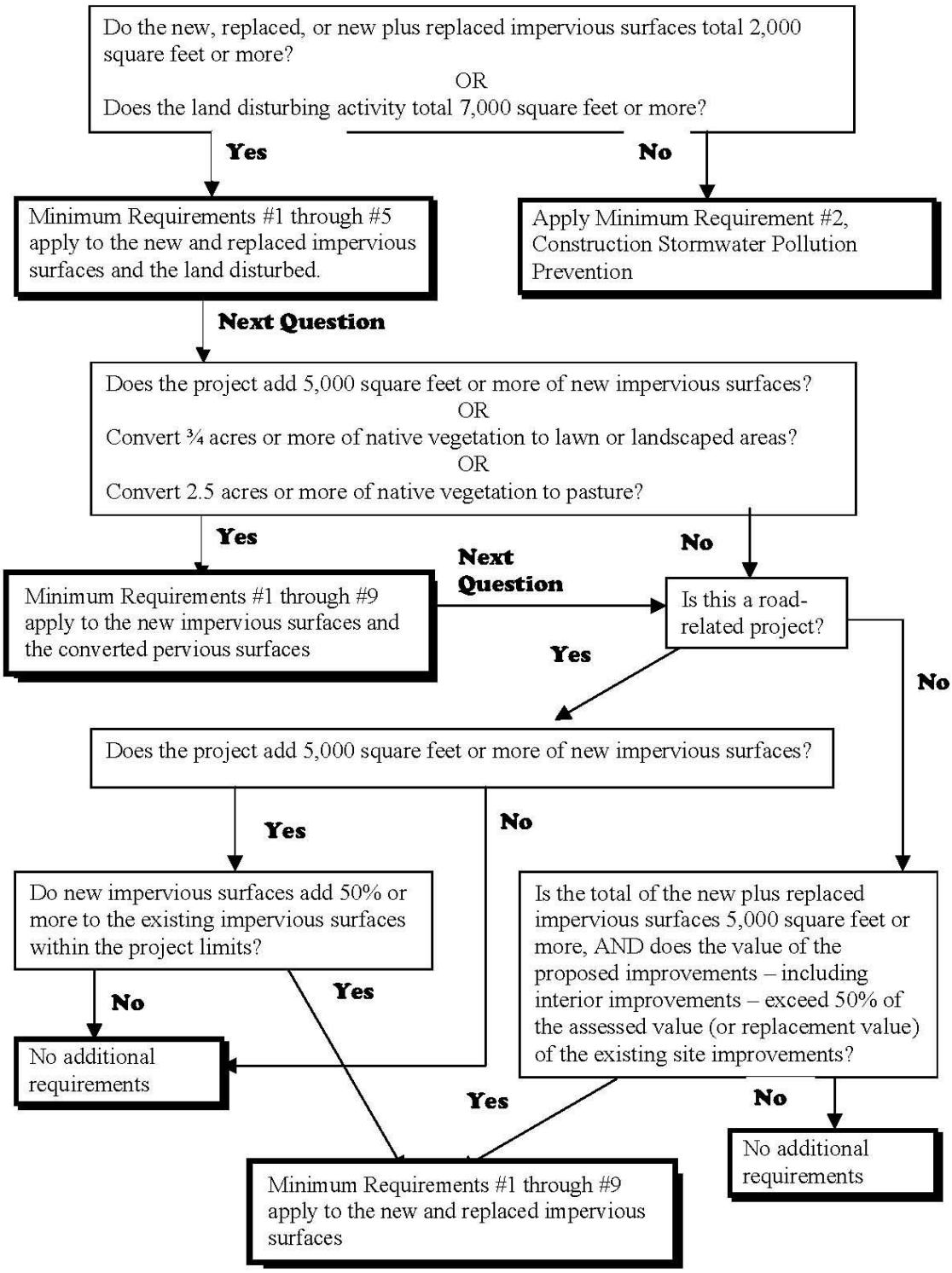

Figure 3.3 Flow Chart for Determining Requirements for Redevelopment

2.4.1 New Development

All new development shall be required to comply with Minimum Requirement #2.

The following new development shall comply with Minimum Requirements #1 through #5 for the new and replaced impervious surfaces and the land disturbed:

Creates or adds 2,000 square feet, or greater, of new, replaced, or new plus replaced impervious surface area, or
Has land disturbing activity of 7,000 square feet or greater.

The following new development shall comply with Minimum Requirements #1 through #9 for the new impervious surfaces and the converted pervious surfaces:

- Create or add 5,000 square feet, or more, of new impervious surface area, or
- Converts ¾ acres, or more, of native vegetation to lawn or landscaped areas, or
- Converts 2.5 acres, or more, of native vegetation to pasture.

2.4.2 Redevelopment

All redevelopment shall be required to comply with Minimum Requirement #2. In addition, all redevelopment that exceeds certain thresholds shall be required to comply with additional Minimum Requirements as follows.

The following redevelopment shall comply with Minimum Requirements #1 through #5 for the new and replaced impervious surfaces and the land disturbed:

- The new, replaced, or total of *new plus replaced* impervious surfaces is 2,000 square feet or more, or
- 7,000 square feet or more of land disturbing activities.

The following redevelopment shall comply with Minimum Requirements #1 through #10 for the new impervious surfaces and converted pervious areas:

- Adds 5,000 square feet or more of *new* impervious surfaces or,
- Converts ¾ acres, or more, of native vegetation to lawn or landscaped areas, or
- Converts 2.5 acres, or more, of native vegetation to pasture.

If the runoff from the new impervious surfaces and converted pervious surfaces is not separated from runoff from other surfaces on the project site, the stormwater treatment facilities must be sized for the entire flow that is directed to them.

With approval of the Stormwater Engineer, the Minimum Requirements may be met for an equivalent (flow and pollution characteristics) area within the same

site. For public roads' projects, the equivalent area does not have to be within the project limits, but must drain to the same receiving water.

If flow control/runoff treatment facilities are required of a City right-of-way project, project proponents are encouraged to purchase flow control/runoff treatment in regional facilities, if available.

Additional Requirements for Re-development Project Sites
For road-related projects, runoff from the replaced and new impervious surfaces (including pavement, shoulders, curbs, and sidewalks) shall meet all the Minimum Requirements if the new impervious surfaces total 5,000 square feet or more and total 50% or more of the existing impervious surfaces within the project limits. The project limits shall be defined by the length of the project and the width of the right-of-way.

Other types of redevelopment projects shall comply with all the Minimum Requirements for the new and replaced impervious surfaces if the total of new plus replaced impervious surfaces is 5,000 square feet or more, and the valuation of proposed improvements – including interior improvements – exceeds 50% of the assessed value of the existing site improvements.

Redmond does not have the "stop-loss" provision described in the 2005 Ecology Manual.

2.5 Minimum Requirements

This section describes the Minimum Requirements for stormwater management at development and redevelopment sites. Section 2.4 of this Chapter should be consulted to determine which of the minimum requirements below apply to any given project. Figures 3.2 and 3.3 should be consulted to determine whether the minimum requirements apply to new surfaces, replaced surfaces or new and replaced surfaces.

2.5.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

A Stormwater Site Plan is required for all projects meeting the thresholds in Section 2.4 of this Chapter. Stormwater Site Plans shall be prepared in accordance with Chapter 3 of Volume 1 of the 2005 Ecology Manual.

2.5.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)

All new development, redevelopment **and maintenance** projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. Projects subject to Minimum Requirement #2 are required to provide a Construction Stormwater Pollution Prevention Plan (SWPPP) as part of the Stormwater Site Plan (see Minimum Requirement #1). The SWPPP shall be implemented beginning with initial soil disturbance and until final stabilization.

Sediment and erosion control BMPs shall be consistent with the BMPs contained in chapters 3 and 4 of Volume II of the 2005 Ecology Manual and/or other equivalent BMPs contained in technical stormwater manuals approved by the Department of Ecology.

The SWPPP shall include a narrative and drawings. All BMPs shall be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative shall include documentation to explain and justify the pollution prevention decisions made for the project. Clearing and grading activities for development shall be permitted only if conducted pursuant to an approved site development plan (e.g. subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing these permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance/compaction of native soils except as needed for building purposes. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas shall be delineated on the site plans and the development site.

Seasonal Work Limitations – From October 1 through April 30, clearing, grading, and other soil disturbing activities **shall require submittal of Wet Weather Plans for review and approval by Redmond's Wet Weather Committee, as detailed in Chapter 10 of the Stormwater Technical Notebook.**

Based on the information provided and/or local weather conditions, the City of Redmond may expand or restrict the seasonal limitation on site disturbance. **Redmond may take enforcement action – such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:**
If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment or contaminants leave the construction site causing a violation of the Washington State surface water quality standard or groundwater quality standard; or
If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.

The following activities are exempt from the seasonal clearing and grading limitations;
Routine maintenance and necessary repair of erosion and sediment control BMPs;
Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil, and
Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

Project proponents are required to notify the City of Redmond within 24 hours if a turbidity reading is 250 NTU or higher. Projects discharging water during construction in excess of 25 NTU are required to take immediate action, applying

additional temporary sediment and erosion control measures, to lower the NTU in runoff leaving the site below 25 NTU. If a site discharges directly to a surface water body, the NTU limit is based on the standards in WAC 173-201. In general, projects are not allowed to discharge sediment laden water to surface waters unless the background turbidity is not increased by more than 5 NTU. Project sites in seasonal suspension are still required to meet this requirement.

Construction Stormwater Pollution Prevention Plan (SWPPP) Elements
The construction site operator shall include each of the twelve elements below in the SWPPP and ensure that they are implemented unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP. All BMPs shall be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative shall include documentation to explain and justify the pollution prevention decisions made for the project.

1. Preserve Vegetation/Mark Clearing Limits:
   a. Prior to beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
   b. The duff layer, native top soil, and natural vegetation shall be retained in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access:
   a. Construction vehicle access and exit shall be limited to one route, if possible.
   b. Access points shall be stabilized with quarry spalls, crushed rock or other equivalent BMP to minimize the tracking of sediment onto public roads.
   c. Wheel wash or tire baths shall be located on site, if the stabilized construction entrance is not effective in preventing sediment from being tracked onto public roads.
   d. If sediment is tracked off site, roads shall be cleaned thoroughly at the end of each day, or more frequently during wet weather. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area.
   e. Street flushing of sediment into stormwater systems is prohibited in Redmond.

3. Control Flow Rates:
   a. Properties and waterways downstream from development sites shall be protected from erosion due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
   b. Where necessary to comply with Minimum Requirement #7, stormwater retention/detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g. impervious surfaces).

c. **Permanent infiltration facilities shall not be operational or used to control/treat runoff during construction. Runoff may be infiltrated in locations other than the permanent infiltration facilities.**

4. Install Sediment Controls:
   a. Stormwater runoff from disturbed areas shall pass through a sediment pond, or other appropriate sediment removal BMP, prior to leaving a construction site or prior to discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but shall meet the flow control performance standard of 3.a, above. **Full stabilization means concrete or asphalt paving; quarry spalls used as ditch lining; or the use of rolled erosion products, a bonded fiber matrix product, or vegetative cover in a manner that will fully prevent soil erosion. Redmond inspectors shall determine if an area is stabilized by means other than pavement or quarry spalls.**
   b. Sediment control BMPs (sediment ponds, traps, filters, etc.) shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place, **and shall be maintained and removed once the site is stabilized and the inspector approves removal.**
   c. BMPs intended to trap sediment on site shall be located in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
   d. Earthen structures such as dams, dikes, and diversions shall be seeded and mulched according to the timing indicated in element 5.

5. Stabilize Soils:
   a. Exposed and unworked soils shall be stabilized by application of effective BMPs that prevent erosion.
   b. No soils should remain exposed and unworked for more than the time periods set forth below to prevent erosion:
      - During the dry season (May 1 – September 30): 7 days
      - During the wet season (October 1 – April 30): 2 days

      This condition applies to all soils on site, whether at final grade or not. Redmond inspectors may adjust time limits depending on site conditions, forecasted weather, site characteristics, and to protect human safety, habitat, and property downstream.
   c. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.
   d. Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways and drainage channels.
   e. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, the early application of gravel base on areas to be paved, and dust control.
   f. Soil stabilization measures selected should be appropriate for the time of year, site conditions, estimated duration of use, and potential water

quality impacts that stabilization materials may have on downstream waters or ground water.

g. Linear construction activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall be conducted to meet the soil stabilization requirement. Contractors shall install the bedding materials, roadbeds, structures, pipelines, or utilities and re-stabilize the disturbed soils so that:
From October 1 through April 30 no soils shall remain exposed and unworked for more than 2 days; and
From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days.

6. Protect Slopes:
   a. Design and construct cut and fill slopes in a manner that will minimize erosion.
   b. Reduce slope runoff velocities by reducing the continuous length of slope with terracing and diversions, reduce slope steepness, and roughen slope surface.
   c. Off-site stormwater (run-on) or groundwater shall be diverted away from slopes and undisturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
   d. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion. Temporary pipe slope drains shall handle the expected peak 10-minute flow velocity from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model to predict flows, bare soil areas should be modeled as "landscaped area."
   e. Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.
   f. Check dams shall be placed at regular intervals within constructed channels that are cut down a slope.
   g. Provide drainage to remove groundwater intersecting the slope surface of exposed soil areas.
   h. Stabilize soils on slopes, as specified in Element #5.

7. Protect Drain Inlets:
   a. Storm drain inlets made operable during construction shall be protected so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment. **Catch basins are considered operational when project**

proponents create a hole in the side of the drain inlet to allow for drainage when the road is below finished grade. Flows allowed to enter the drain through the created hole are not being treated unless the catch basin insert is installed to provide protection/treatment of runoff entering through the side of the catch basin.

b. All approach roads shall be kept clean. Approach roads shall have inlet protection if they could be impacted by the construction site and at the discretion of the City inspector.

c. Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

d. When projects are completed, removal of inlet protection devices is required. Removal will be done in a way that does not allow the captured sediment to enter or later be washed into the stormwater inlet.

8. Stabilize Channels and Outlets:
    a. All temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the following expected peak flows. Channels shall handle the expected peak 10-minute flow velocity from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6 may be used. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model to predict flows, bare soil areas should be modeled as "landscaped area."
    b. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

9. Control Pollutants:
    a. All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater, soils or groundwater.
    b. Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks shall include secondary containment.
    c. Maintenance, fueling and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures. Contaminated surfaces shall be cleaned immediately following any spill incident.

d. **Wheel wash or tire bath wastewater shall be discharged to a sanitary sewer with appropriate permits or alternative as approved by the Stormwater Engineer**
e. Application of **agricultural chemicals, including** fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' label requirements for application rates and procedures shall be followed.
f. BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to: bulk cement, cement kiln dust (with Stormwater Engineer pre-approval), new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. **Stormwater discharges shall not cause or contribute to a violation of the water quality standard for pH in the stormwater drainage system or receiving water. Allowable runoff pH concentrations shall be within the range of 6.5 to 8.5 pH.**
g. Construction site operators are required to obtain written approval from the Department of Ecology prior to using chemical treatment other than CO2 or dry ice to adjust pH.

10. <u>Control De-watering:</u>
    a. Foundation, vault, and trench de-watering water, which have similar characteristics to stormwater runoff at the site, shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond.
    b. Clean, non-turbid de-watering water, such as well-point ground water, can be discharged to systems tributary to, or directly into surface waters of the state as specified in #8, above, provided the de-watering flow does not cause erosion or flooding of receiving waters. Clean de-watering water should not be routed through stormwater sediment ponds.
    c. Other de-watering disposal options may include: (i) infiltration; (ii) transport offsite in vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters; (iii) on-site chemical treatment or other suitable treatment technologies approved by Ecology; (iv) sanitary sewer discharge with **City of Redmond and King County** approval, if there is no other option; or (v) use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized de-watering.
    d. Highly turbid or contaminated dewatering water, **such as from construction equipment operation, clamshell digging, concrete tremie pour, or work inside a cofferdam,** shall be handled separately from stormwater.

11. <u>Maintaining BMPs:</u>

a. All temporary and permanent erosion and sediment control BMPs shall be inspected, maintained and repaired as needed to assure continued performance of their intended function in accordance with BMP specifications.
b. All temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

12. Manage the Project:
    a. Development projects shall be phased to the maximum degree practicable and shall take into account seasonal work limitations.
    b. Construction site operators shall maintain, and repair as needed, all sediment and erosion control BMPs to assure continued performance of their intended function.
    c. Construction site operators shall periodically inspect their sites. For projects that disturb one or more acres, site inspections shall be conducted by a Certified Erosion and Sediment Control Lead who shall be identified in the SWPPP and shall be present on-site or on-call at all times. **Certification may be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology. Sites smaller than one acre that require a SWPPP shall also have an on-site and on-call person at all times during construction.**
    d. Construction site operators shall maintain, update and implement their SWPPP. Construction site operators shall modify their SWPPP whenever there is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

Coordination with Utilities and Other Contractors – The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.

Inspection and Monitoring – All BMPs shall be inspected, maintained and repaired as needed to assure continued performance of their intended function. Site inspections shall be conducted by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have the skills to 1) assess the site conditions and construction activities that could impact the quality of stormwater, and 2) assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.

Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible. The

SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) calendar days following the inspection.

The Construction SWPPP shall be retained on-site or within reasonable access to the site.

The SWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

2.5.3 Minimum Requirement #3: Source Control of Pollution

This minimum requirement is also codified in RMC 13.06 (Appendix A). All known, available and reasonable source control BMPs must be required for all projects approved by the City. Source control BMPs must be selected, designed, and maintained in accordance with Volume IV of the Ecology Manual.

2.5.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and down gradient properties. All outfalls require energy dissipation.

Where no conveyance system exists at the adjacent downgradient property line and the discharge was previously unconcentrated flow or significantly lower concentrated flow, then measures must be taken to prevent downgradient impacts. Drainage easements from downstream property owners may be needed and shall be obtained prior to approval of engineering plans.

Where no conveyance system exists at the abutting downstream property line and the natural (existing) discharge is unconcentrated, any runoff concentrated by the proposed project must be discharged as follows:

a. **If the 100-year peak discharge is less than or equal to 0.2 cfs under existing conditions and will remain less than or equal to 0.2 cfs under developed conditions, then the concentrated runoff may be discharged onto a rock pad or to any other system that serves to disperse flows.**

b. **If the 100-year peak discharge is less than or equal to 0.5 cfs under existing conditions and will remain less than or equal to 0.5 cfs under developed conditions, then the concentrated runoff may be discharged through a dispersal trench or other dispersal system, provided the**

applicant can demonstrate that there will be no significant adverse impact to downhill properties or drainage systems.

c. **If the 100-year peak discharge is greater than 0.5 cfs for either existing or developed conditions, or if a significant adverse impact to downgradient properties or drainage systems is likely, then a conveyance system must be provided to convey the concentrated runoff across the downstream properties to an acceptable discharge point (i.e., an enclosed drainage system or open drainage feature where concentrated runoff can be discharged without significant adverse impact).**

Stormwater control or treatment structures should not be located within the expected 25-year water level elevations for salmonid-bearing waters. Such areas may provide off-channel habitat for juvenile salmonids and salmonid fry. Redmond Stormwater Engineer pre-approval is required for any structure proposed in the 25-year water level elevation of salmonid bearing streams. Designs for outfall systems to protect against adverse impacts from concentrated runoff are included in Volume V, Chapter 4 of the Ecology Manual.

2.5.5 Minimum Requirement #5: On-site Stormwater Management

Projects are required to implement On-site Stormwater Management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing flooding, **groundwater contamination**, or erosion impacts. Roof Downspout Control BMPs, functionally equivalent to those described in Chapter 3 of Volume III of the Ecology Manual, and Dispersion and Soil Quality BMPs, functionally equivalent to those in Chapter 5 of Volume V of the Ecology Manual are required to reduce the hydrologic disruption of developed sites.

"Flooding and erosion impacts" include impacts such as flooding of septic systems, crawl spaces, living areas, outbuildings, etc; increased ice or algal growth on sidewalks/roadways; earth movement/settlement, increased landslide potential; erosion and other potential damage.

Project proponents are encouraged to use runoff reduction/on-site stormwater management techniques to meet flow control requirements, if Minimum Requirement 7 is triggered. Projects that require flow control are required to perform a site assessment to determine applicability and feasibility of runoff reduction techniques.

Groundwater Protection
Protection of the City's shallow unconfined drinking water aquifer needs to be considered when managing stormwater runoff from pollution generating surfaces. Except for single-family residential projects, infiltrating runoff from pollution generating surfaces in wellhead protection zones 1 and 2 is prohibited. Single-family residential projects in wellhead protection zones 1 and 2 can infiltrate from pollution generating surfaces after enhanced runoff treatment using

a BMP that is exposed to the surface (such as bioretention in view of sidewalks or roads).
In wellhead protection zone 3, runoff from pollution generating surfaces can be infiltrated with treatment prior to infiltration based on land use (see minimum requirement 6). In wellhead protection zone 4, runoff from pollution generating surfaces can be directly infiltrated provided the soil profile provides treatment per the requirements of the Ecology Manual. Infiltration from areas considered to be clean, including most roofs and sidewalks, is strongly encouraged where infiltration is feasible.

2.5.6 Minimum Requirement #6: Runoff Treatment

Project Thresholds

The following require construction of stormwater treatment facilities (see Table 2.1 below):

Projects in which the total of pollution generating impervious surface (PGIS) is 5,000 square feet or more in a threshold discharge area of the project, or Projects in which the total of pollution-generating pervious surfaces (PGPS) is three-quarters (3/4) of an acre or more in threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site.

Groundwater Protection – please refer to Minimum Requirement #5 for requirements specific to Redmond regarding groundwater protection.

Table 2.1 Treatment Requirements by Threshold Discharge Area

	<3/4 acres of PGPS	>3/4 acres PGPS	<5,000 sf PGIS	>5,000 sf PGIS
Treatment Facilities		x		x
Onsite Stormwater BMPS	x	x	x	x

PGPS = pollution generating pervious surfaces
PGIS = pollution generating impervious surfaces
sf = square feet

Treatment-Type Thresholds

1. Oil Control:

Treatment to achieve Oil Control applies to projects that have "high-use sites." High-use sites are those that typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil. High-use sites include:

a. An area of commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area;
b. An area of commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil;
c. An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.);
d. A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

2. Phosphorus Treatment:

Phosphorus treatment facilities are required for stormwater runoff that discharges directly or indirectly to Lake Sammamish.

3. Enhanced Treatment:

Enhanced treatment for reduction in dissolved metals is required for the following project sites that discharge to fish-bearing streams, lakes, or to waters or conveyance systems tributary to fish-bearing streams or lakes:

Industrial project sites, Commercial project sites Multi-family project sites, and High AADT roads as follows:

Fully controlled and partially controlled limited access highways with Annual Average Daily Traffic (AADT) counts of 15,000 or more
- All other roads with an AADT of 7,500 or greater

Enhanced treatment is also required for single family residential projects that infiltrate stormwater runoff from pollution generating surfaces in wellhead protection zones 1 and 2.
For developments with a mix of land use types, the Enhanced Treatment requirement shall apply when the runoff from the areas subject to the Enhanced Treatment requirement comprise 50% or more of the total runoff within a threshold discharge area.

4. Basic Treatment:

Basic Treatment generally applies to:
• Project sites that discharge to the ground, UNLESS:
1) The soil suitability criteria for infiltration treatment are met; (see Chapter 3 of Volume III of the *Stormwater Management Manual for Western Washington* (2005) for soil suitability criteria) or

- 2) The project uses infiltration strictly for flow control – not treatment - and the discharge is within ¼-mile of a phosphorus sensitive lake (use a Phosphorus Treatment facility), or within ¼ mile of a fish-bearing stream, or a lake (use an Enhanced Treatment facility). **See limitations on infiltrating runoff from pollution generating surfaces under Minimum Requirement #5.** Residential projects not otherwise needing phosphorus control; and
- Project sites that drain to streams that are not fish-bearing, or to waters not tributary to fish-bearing streams;
- Landscaped areas of industrial, commercial, and multi-family project sites, and parking lots of industrial and commercial project sites that do not involve pollution-generating sources (e.g., industrial activities, customer parking, storage of erodible or leachable material, wastes or chemicals) other than parking of employees' private vehicles.

  For developments with a mix of land use types, the Basic Treatment requirement shall apply when the runoff from the areas subject to the Basic Treatment requirement comprise 50% or more of the total runoff within a threshold discharge area.

Treatment Facility Sizing

Water Quality Design Storm Volume: The volume of runoff predicted from a 24-hour storm with a 6-month return frequency (a.k.a., 6-month, 24-hour storm). Wetpool facilities are sized based upon the volume of runoff predicted through use of the Natural Resource Conservation Service curve number equations in Chapter 2 of Volume III of the *Stormwater Management Manual for Western Washington* (2005), for the 6-month, 24hour storm. Alternatively, the 91st percentile, 24-hour runoff volume indicated by an approved continuous runoff model may be used.

Water Quality Design Flow Rate

1. <u>Preceding Detention Facilities or when Detention Facilities are not required:</u> The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model, will be treated. Design criteria for treatment facilities are assigned to achieve the applicable performance goal at the water quality design flow rate (e.g., 80% TSS removal).

2. <u>Downstream of Detention Facilities:</u> The water quality design flow rate must be the full 2-year release rate from the detention facility. Alternative methods may be used if they identify volumes and flow rates that are at least equivalent. That portion of any development project in which the above PGIS or PGPS thresholds are not exceeded in a threshold discharge area shall apply On-site Stormwater Management BMPs in accordance with Minimum Requirement #5.

Treatment Facility Selection, Design, and Maintenance

Stormwater treatment facilities shall be:

- Selected in accordance with the process identified in Chapter 4 of Volume I of the *Stormwater Management Manual for Western Washington* (2005), as modified by the Stormwater Technical Notebook.
- Designed in accordance with the design criteria in Volume V of the *Stormwater Management Manual for Western Washington* (2005), as modified by the Stormwater Technical Notebook, and
- Maintained in accordance with the maintenance schedule in Volume V of the *Stormwater Management Manual for Western Washington* (2005) as modified by the Stormwater Technical Notebook.

Additional Requirements

The discharge of untreated stormwater from pollution-generating impervious surfaces to ground water is prohibited, except for the discharge achieved by infiltration or dispersion of runoff from residential sites through use of On-site Stormwater Management BMPs.

In some areas of the City, regional runoff treatment facilities have been built, or are planned to be built. One alternative to building runoff treatment facilities within the site is to pay a regional facility surcharge. This alternative is mandatory in some locations, and optional in others. See Chapter 8 of the 2007 Stormwater Notebook for additional information on regional facilities and to confirm if participation in the regional facilities program is required or an option.

Treatment facilities applied consistent with this Notebook and the 2005 Ecology Manual are presumed to meet the requirement of state law to provide all known available and reasonable methods of treatment (RCW 90.52.040, RCW 90.48.010). This technology-based treatment requirement does not excuse any discharge from the obligation to apply whatever technology is necessary to comply with state water quality standards, Chapter 173-200 WAC; state sediment management standards, Chapter 173-204 WAC; and the underground injection program, Chapter 173-218WAC. Additional treatment to meet those standards may be required by the federal government, Washington State or the City of Redmond.

2.5.7 Minimum Requirement #7: Flow Control

Applicability

Except as provided below, projects subject to Minimum Requirement #7 must provide flow control to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system,

into a fresh water.

Flow control is not required for projects that discharge directly to, or indirectly through a conveyance system to Lake Sammamish or the Sammamish River subject to the following restrictions:

- Direct discharge to Lake Sammamish or the Sammamish River does not result in the diversion of drainage from any perennial stream classified as Class 1, 2, 3, or 4 in the City of Redmond Critical Areas Regulations, or from any category I, II, or III wetland; and
- Flow splitting devices or drainage BMP's are applied to route natural runoff volumes from the project site to any downstream Class 4 intermittent stream or category IV wetland:
    - Design of flow splitting devices or drainage BMP's will be based on continuous hydrologic modeling analysis. The design will assure that flows delivered to Class 4 intermittent stream reaches will approximate, but in no case exceed, durations ranging from 50% of the 2-year to the 50-year peak flow.
    - Flow splitting devices or drainage BMP's that deliver flow to category IV wetlands will also be designed using continuous hydrologic modeling to preserve pre-project wetland hydrologic conditions unless specifically waived or exempted by regulatory agencies with permitting jurisdiction; and
- The project site must be drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the exempt receiving water; and
- The conveyance system between the project site and the exempt receiving water shall have sufficient hydraulic capacity to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected; and
- Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above.
- **Use of the manmade conveyance system is subject to restrictions that may be placed by the owner of that system.**

The City of Redmond may require a maximum discharge rate for a site that is flow control exempt. This would typically occur due to existing limits of downstream conveyance capacity.

If the discharge is to a stream that leads to a wetland, or to a wetland that has an outflow to a stream, both this minimum requirement (Minimum Requirement #7) and Minimum Requirement #8 apply.

Thresholds

The following require construction of flow control facilities and/or land use management BMPs that will achieve the standard flow control requirement for western Washington (see Table 4.2):

- Projects in which the total of impervious surfaces is 10,000 square feet or more in a threshold discharge area, or
- Projects that convert ¾ acres or more of native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site, or
- Projects **with 1 acre or more of disturbed area** that through a combination of impervious surfaces and converted pervious surfaces cause a 0.1 cubic feet per second increase in the 100-year flow frequency from a threshold discharge area as estimated using the Western Washington Hydrology Model or other approved model.

That portion of any development project in which the above thresholds are not exceeded in a threshold discharge area shall apply Onsite Stormwater Management BMPs in accordance with Minimum Requirement #5.

Table 2.2 Flow Control Requirements by Threshold Discharge Area

	Flow Control Facilities	On-site Stormwater Management BMPs
<3/4 acres conversion to lawn/landscape, or <2.5 acres to pasture		x
> ¾ acres conversion to lawn/landscape, or > 2.5 acres to pasture	x	x
<10,000 square feet of impervious area		x
>10,000 square feet of impervious area	x	x
>0.1 cubic feet per second increase in the 100-year flood frequency for sites 1 acre or larger	x	x

Standard Flow Control Requirement

Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition to be matched shall be a forested land cover unless:

- Reasonable, historic information is available that indicates the site was not forested prior to settlement. **A map showing where project proponents can assume pasture for predevelopment conditions (modeled as "pasture" in the Western Washington Hydrology Model) is contained in Appendix N of the Technical Notebook**; or

- The drainage area of the immediate stream and all subsequent downstream basins have had at least 40% total impervious area since 1985. In this case, the pre-developed condition to be matched shall be

the existing land cover condition. Where basin-specific studies determine a stream channel to be unstable, even though the above criterion is met, the pre-developed condition assumption shall be the "historic" land cover condition, or a land cover condition commensurate with achieving a target flow regime identified by an approved basin study.

Alternative Flow Control Design Areas in Redmond
Redmond allows alternative flow control design standards in portions of the City. Those areas allowed, or required to meet and alternative flow control requirement are detailed as follows:

North Overlake Flow Control Alternative Area (see Attachment A1). This portion of the City directly discharges to the Sammamish River, a flow control exempt receiving water. The conveyance to the Sammamish River is largely owned by Washington Department of Transportation (WSDOT). As such, the City is required to control flows entering WSDOT conveyance to prevent flooding. See Attachment A1 for flow control design standards for this area. Project proponents are required to control flows from this area at the rates detailed in Attachment A1.

Regional Facility Areas (see Appendix O). Proposed project sites in the areas mapped in Appendix O may not be required to construct flow control facilities. This does not waive runoff reduction as required in Minimum Requirement #5. Alternatively, project proponents would be required to participate in the regional flow control facility. See Chapter 8 for information on regional facilities.

Groundwater Protection. To protect Redmond's shallow, unconfined aquifer/drinking water supply, infiltration in Wellhead Protection Zones (WPZ) 1 and 2 is limited. In WPZ 1 and 2, soils are typically sand and gravel and contain low amounts of organic material. Infiltration rates range from 4 – 20 inches/hour. The groundwater table has been frequently measured at less than 5 feet from the surface. Stormwater detention facilities would need to be extremely large as modeled predevelopment runoff quantities are so small. Based on these conditions, and Redmond's desire to protect its drinking water supply by limiting infiltration of stormwater runoff from PGIS in WPZ 1 and 2, Redmond has adjusted the soil modeling requirements for this area. Project proponents are allowed to model soil type as till (group C) when determining flow control requirements.

Additional Requirement

Flow Control BMPs shall be selected, designed, and maintained in accordance with Volume III of the *Stormwater Management Manual for Western Washington* (2005) or an approved equivalent.

2.5.8 Minimum Requirement #8: Wetlands Protection

Applicability

The requirements below apply only to projects whose stormwater discharges

into a wetland, either directly or indirectly through a conveyance system. These requirements must be met in addition to meeting Minimum Requirement #6, Runoff Treatment.

Thresholds

The thresholds identified in Minimum Requirement #6 – Runoff Treatment, and Minimum Requirement #7 – Flow Control shall also be applied for discharges to wetlands. Additional requirements to protect wetlands are documented in Redmond's Community Development Guide.***Standard Requirement***

Discharges to wetlands shall maintain the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses. The hydrologic analysis shall use the existing land cover condition to determine the existing hydrologic conditions unless directed otherwise by a regulatory agency with jurisdiction. A wetland can be considered for hydrologic modification and/or stormwater treatment in accordance with Guide Sheet 1B in Appendix I-D on the *Stormwater Management Manual for Western Washington* (2005) **if allowed by the Community Development Guide.**

Additional Requirements

Stormwater treatment and flow control facilities shall not be built within a natural vegetated buffer, except for:

- necessary conveyance systems as approved by the Permittee; or
- as allowed in wetlands approved for hydrologic modification and/or treatment in accordance with Guidesheet 1B in Appendix I-D of the *Stormwater Management Manual for Western Washington* (2005) **if allowed by the Community Development Guide.**

An adopted and implemented basin plan prepared in accordance with the provisions of Section 2.9 of this Chapter may be used to develop requirements for wetlands that are tailored to a specific basin.

2.5.9 Minimum Requirement #9: Operation and Maintenance

An operation and maintenance manual that is consistent with the provisions in Volume V of the *Stormwater Management Manual for Western Washington* (2005) is required for all proposed stormwater facilities and BMPs. The party (or parties) responsible for maintenance and operation shall be identified in the operation and maintenance manual. For private facilities approved by the City, a copy of the manual shall be retained onsite or within reasonable access to the site, and shall be transferred with the property to the new owner. For public facilities, a copy of the manual shall be retained in the appropriate department. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection by the local government. **The operations and maintenance manual shall be submitted for review by the Stormwater Engineer as part of the development proposal, and shall be revised following**

construction for approval. The development proposal shall include provisions for maintenance of facilities in perpetuity.

At a minimum, the operations and maintenance manual shall include:

- **the purpose of the facility;**
- **the dimensions and other characteristics of the facility (site map);**
- **the party (parties) responsible for maintenance of the facility, with phone numbers and addresses;**
- **list of any proprietary components along with information from the vendor describing maintenance schedule and costs;**
- **what maintenance activities are required, and proposed schedule;**
- **care and maintenance of any powered devices (aeration);**
- **inspection procedures and how the maintenance schedule will be modified if inspections determine the facility is not operating properly; the minimum requirements for this type of facility as described in Chapter 4 of Volume V of the Ecology Manual as modified in this notebook; the minimum requirements for low impact development facilities as described in the following documents:**
    - **Appendix F of Volume III of the Ecology Manual;**
    - **the Low Impact Development Technical Guidance Manual for Puget Sound, published by the Puget Sound Action Team, May, 2005 or current edition,**
    - **Maintenance of Low Impact Development Facilities (Appendix P)**

The final O&M manual shall incorporate any written comments made during the development review process, and shall incorporate any field changes made to the facilities during construction.

The review procedure for O&M Manuals shall be as follows:

<u>For Public Facilities (that will be maintained by the City)</u>: A copy of the draft operations and maintenance manual shall be provided to the Stormwater Maintenance Supervisor for Public Works for review at 90% design or earlier. Design of public facilities may be subject to revision through the review process to ensure that the facilities make adequate provisions for maintenance, including easements and physical access requirements. The final O&M manual shall be submitted for review and approval prior to acceptance of the completed construction project. The final approved O&M manual shall be submitted with one hard copy and one electronic copy on CD.

<u>For Private Facilities (that will be privately maintained)</u>: A copy of the draft operations and maintenance manual shall be provided to the Private System Inspection Program Lead for Public Works during the development review process. The developer shall also submit to the Stormwater Engineer for approval, a proposal indicating the method by which ongoing maintenance will be ensured. For developments that include multiple lots, the party (or parties)

responsible for maintenance shall be identified (i.e. homeowners association). Notes shall be added to the property title or plat indicating this maintenance requirement. The final O&M manual shall be submitted for review and approval prior to acceptance of the development. The final approved O&M manual shall be submitted with one hard copy and one electronic copy on CD.

2.6 Adjustments

Adjustments to the Minimum Requirements may be granted by the City of Redmond. See RMC 15.24.084 (Appendix A) for details and requirements for adjustments to be granted.

2.7 Variances

Variances can be allowed in Redmond. See RMC 15.24.089 (Appendix A) for details and requirements for variances to be granted in Redmond.

2.8 Basin/Watershed Planning

Basin/Watershed planning may be used by the City of Redmond to tailor Minimum Requirement #6 Runoff Treatment, Minimum Requirement #7 Flow Control, and/or Minimum Requirement #8 Wetlands Protection. Basin planning may be used to support alternative treatment, flow control, and/or wetland protection requirements to those contained in Section 4 of this chapter. Basin planning may also be used to demonstrate an equivalent level of treatment, flow control, and/or wetland protection through the construction and use of regional stormwater facilities. Basin planning provides a mechanism by which the minimum requirements and implementing BMP's can be evaluated and refined based on an analysis of a basin or watershed. Basin plans are may be used to develop control strategies to address impacts from future development and to correct specific problems whose sources are known or suspected. Basin plans can be effective at addressing both long-term cumulative impacts of pollutant loads and short-term acute impacts of pollutant concentrations, as well as hydrologic impacts to streams, wetlands, and ground water resources.

Basin planning will require the use of computer models and field work to verify and support the models. The USGS has developed software called "GenScn" (Generation and Analysis of Model Simulation Scenarios) that can facilitate basin planning. The program is a Windows-based application of HSPF that predicts water quality and quantity changes for multiple scenarios of land use and water management within a basin. Permittees who are considering the use of basin/watershed plans to modify or tailor one or more of the minimum requirements are encouraged to contact Ecology early in the planning stage.

Some examples of how Basin Planning can alter the minimum requirements are given in Appendix I-A from the *Stormwater Management Manual for Western Washington* (2005).

In order for a basin plan to serve as a means of modifying the minimum requirements the following conditions must be met:

- The plan must be formally adopted by all jurisdictions with responsibilities under the plan; and
- All ordinances or regulations called for by the plan must be in effect; and
- The basin plan must be reviewed and approved by Ecology.

2.9 Applicability of the 2005 Ecology Manual in Redmond

2.9.1 Volume I: Minimum Technical Requirements and Site Planning

2.9.1.1 Chapter 1: Introduction

No local changes but used for reference only in Redmond.

2.9.1.2 Chapter 2: Minimum Requirements for New Development and Re-development

Replaced by Chapter 2 of this Addendum.

2.9.1.3 Chapter 3: Preparation of Stormwater Site Plans

3.1- Stormwater Site Plans: Step-By-Step

Applies.

3.1.3- Step 3 – Perform an Offsite Analysis

The one-quarter mile distance off-site analysis shall be provided for Medium or Large projects (See Chapter 3 of the Stormwater Notebook) unless specifically waived for a project, by the Stormwater Engineer.

3.1.5- Step 5 – Prepare a Permanent Stormwater Control Plan

In addition to the requirements of this section, the report covering the Permanent Stormwater Control Plan (Drainage Report) shall be submitted in electronic format. Submit a CD to the engineer that includes a PDF of the completed report with all electronic modeling and calculations included in their native format.

The drainage report shall be prepared with the following outline:

Drainage Report

A. Cover Page: Project name; project address; name of developer or owner; name, address, and phone number of engineer of record; engineer's stamp; date of report
B. Project Overview:
   - General description of project vicinity
   - Describe existing site hydrology

- Description of proposed project
- Description of nearby receiving waters
- Site Vicinity Map showing site, nearby roads, and receiving waters

C. Minimum Requirements
- Determine project size: Small, Medium, Large
- Determine which Minimum Requirements Apply
- Describe how each applicable requirement is being met

D. Offsite Analysis
- Describe study area
- Upstream Analysis
- Downstream Analysis
- Summarize existing problems downstream
- Summarize how project will avoid exacerbating or correct existing downstream problems
- If downstream problems can be solved through offsite improvements, those offsite improvements must be sized for full buildout conditions under current zoning.

E. Conveyance Design
- Pipe sizing
- Area draining to each structure
- HGL calculations for all conveyance

F. Flow Control Design
- Existing hydrology
- Proposed hydrology
- Soil Types
- Summarize existing and proposed land use/condition
- Describe modeling inputs
- Model results
- Describe design criteria for flow control facilities
- Summarize dimensions of flow control facilities: volumes, lengths, widths, depths, orifice sizes, bottom elevation, overflow elevations, etc.

G. Water Quality Design
- Summarize new proposed PGIS and PGPS
- Summarize treatment level required (basic, enhanced, oil control, phosphorous)
- Describe contaminants of concern
- Describe proposed source control measures if applicable
- Model results
- Describe design criteria for water quality facilities
- Summarize dimensions of water quality facilities: volumes, lengths, widths, depths, orifice sizes, bottom elevation, overflow elevations, vegetation types, etc.
- If site is in Wellhead Protection Zones 1, 2, or 3, describe how proposed facilities will protect groundwater. Describe measures to be taken during construction to protect groundwater.

H. Construction cost estimates for stormwater facilities, if required by the Stormwater Engineer.
I. Draft Operations & Maintenance Manual. As described in Paragraph 2.5.9 of the Stormwater Notebook.
J. If low impact development BMPs are proposed, then submit a site assessment in accordance with Paragraph 8.27 of the Stormwater Notebook.

3.1.6- Step 6 – Prepare a Construction Stormwater Pollution Prevention Plan

Applies. Additional requirements are in Chapter 9 and 10 of the Stormwater Notebook.

2.9.1.4 Chapter 4: BMP and Facility Selection Process for Permanent Stormwater Control Plans

4.2 BMP and Facility Selection Process

Applies. Note that the City of Redmond has preferences for certain types of stormwater treatment over others. These preferences are based primarily on long term performance and maintenance cost. Actual selection of facilities must necessarily address site-specific constraints. However, these preferences are provided to help the designer in cases where more than one alternative exists to meet the same needs. Capital improvement projects shall involve the Stormwater Engineer early in the design process to ensure selection of stormwater treatment facilities that best meet the long term goals of the City.

The Stormwater Engineer may direct substitution of an alternative treatment method based on these preferences. Table 4.4R, below, describes some of the City's preferences for basic, enhanced, phosphorous, and oil treatment. Treatment methods are designated in the table as follows:

- **Preferred.** These treatment methods are preferred by the City.
- **Accepted.** These treatment methods are acceptable to the City.
- **Conditional.** These treatment methods may be allowed based on site specific information, with approval from the Stormwater Engineer.
- **N/A.** These treatment methods are not accepted by the City.

Table 4.4R: Treatment Facility Options in Redmond				
Facility Option	**Basic**	**Enhanced**	**Phosphorous**	**Oil**
Biofiltration Swale	Preferred	N/A	N/A	N/A
Wetpond	Preferred	N/A	N/A	N/A
Infiltration Treatment (Wellhead Protection Zone 4)	Preferred	N/A	N/A	N/A
Bio-infiltration Swale (WPZ 4)	Preferred	N/A	N/A	N/A
Stormwater Treatment Wetland	Preferred	Preferred	N/A	N/A
Large Wet Pond	Preferred	N/A	Preferred	N/A
Stormwater Treatment Wetland / Sand Filter	Preferred	Preferred	Preferred	N/A
Stormwater Treatment Wetland / Sand Filter Vault	Preferred	Accepted	Accepted	N/A
Bioretention or Rain Garden (WPZ 4)	Preferred	Accepted	N/A	N/A
Phosphorous Control Credit	N/A	N/A	Preferred	N/A
Infiltration Treatment with Basic Treatment (WPZ 4)	Accepted	Accepted	Accepted	N/A
Infiltration Treatment with Enhanced Trtmnt (WPZ 3,4)	Accepted	Accepted	Accepted	N/A
Infiltration Treatment with Phosphorous Trtmnt (WPZ 4)	Accepted	Accepted	Accepted	N/A
Media Filter Vault (Iron Media)	Accepted	Conditional	Accepted	N/A
Large Sand Filter	Accepted	Accepted	Accepted	N/A
Amended Sand Filter	Accepted	Accepted	Accepted	N/A
Biofiltration Swale / Sand Filter	Accepted	Accepted	Accepted	N/A
Biofiltration Swale / Sand Filter Vault	Accepted	Accepted	Accepted	N/A
Filter Strip / Linear Sand Filter	Accepted	Accepted	Accepted	N/A
Linear Sand Filter / Filter Strip	Accepted	Accepted	Accepted	N/A
Wet Pond / Sand Filter	Accepted	Accepted	Accepted	N/A
Wet Pond / Sand Filter Vault	Accepted	Accepted	Accepted	N/A
Wet Vault / Sand Filter	Accepted	Accepted	Accepted	N/A
Wet Vault / Sand Filter Vault	Accepted	Accepted	Accepted	N/A
Filterra	Accepted	Accepted	N/A	N/A
Ecology Embankment	Accepted	Accepted	N/A	N/A
Compost Amended Filter Strip	Accepted	Accepted	N/A	N/A
Biofiltration Swale / Media Filter Vault	Accepted	Accepted	N/A	N/A
Wet Pond / Media Filter Vault	Accepted	Accepted	N/A	N/A
Wet Vault / Media Filter Vault	Accepted	Accepted	N/A	N/A
Sand Filter / Media Filter Vault	Accepted	Accepted	N/A	N/A
Sand Filter Vault / Media Filter Vault	Accepted	Accepted	N/A	N/A
Media Filter Vault (Zeolite/Perlite/Granular Act. Carbon)	Accepted	N/A	N/A	N/A
Sand Filter	Accepted	N/A	N/A	N/A
Filter Strip	Accepted	N/A	N/A	N/A
Wetvault	Accepted	N/A	N/A	N/A
API OWS	N/A	N/A	N/A	Preferred
CP OWS	N/A	N/A	N/A	Accepted
CB Insert	N/A	N/A	N/A	Accepted
Linear Sand Filter	N/A	N/A	N/A	Accepted
Contribution in lieu of Treatment	Conditional	Conditional	Conditional	N/A
Alternative Technologies	Conditional	Conditional	Conditional	Conditional

Step IV: Step 1: Determine whether you can infiltrate

Infiltration of clean water (water draining from non-pollution generating surfaces) is encouraged throughout Redmond. Infiltration of water draining from pollution generating impervious surfaces in Wellhead Protection Zones 1 or 2 (map available at: http://www.redmond.gov/cityservices/citymaps.asp) is only permitted for single-family residential projects, and requires enhanced treatment using a BMP that is exposed to the surface. Infiltration of water draining from pollution generating impervious surfaces in Wellhead Protection Zone 3 is permitted following treatment based on land use.

Step V: Step 1: Determine the Receiving Waters and Pollutants of Concern Based on Off-Site Analysis.

The City may adopt a basin plan for any watershed in the City that may place additional stormwater requirements. Contact the Stormwater Engineer to determine if any basin plans apply to your project site.

Step V: Step 2: Determine if an Oil Control Facility/Device is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/trafficcounts.asp*. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step V: Step 3: Determine if Infiltration for Pollutant Removal is Practicable.

Infiltration for pollutant removal of water draining from pollution generating surfaces in Wellhead Protection Zones 1, 2, or 3 (map available at: http://www.redmond.gov/cityservices/citymaps.asp) is not permitted. Infiltration for pollutant removal is permitted in Wellhead Protection Zone 4, provided all requirements in the Ecology Manual are met. Note that there are additional requirements regarding infiltration in Wellhead Protection Zones 1, 2 and 3. Please refer to Section 2.5.5 of this Addendum for details. Use of infiltration for water quality treatment is also subject to the requirements of the Washington State Department of Ecology's Underground Injection Control program.

Step V: Step 4: Determine if Control of Phosphorous is Required.

Phosphorus control treatment is required for "Large Project" sites that drain to Lake Sammamish. The City's watershed map delineates the boundaries between watersheds, and is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp. See Volume V, Chapter 3, Section 3.3.

Step V: Step 5: Determine if Enhanced Treatment is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/trafficcounts.asp*. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step V: Step 6: Determine if Fee in Lieu is Required.

Following review of the step by step process for selecting BMPs and review of Table 4.4R, determine if the project will be required or have the option to pay a fee in lieu of construction of the selected onsite BMPs. See chapter 8, section 8.8of the Stormwater Notebook.

2.9.1.5 *Appendix 1-C:*

Phosphorus control is required for sites draining to Lake Sammamish. See Step V, Step 4, above.

2.9.1.6 *Appendix I-E: Flow Control-Exempt Surface Waters*

Applies with the following revision:

The Sammamish River in Redmond is included on the exempt surface waters list.

2.9.1.7 *Glossary and Notations*

City Definitions shall be used where applicable.

2.9.2 *Volume II: Construction Stormwater Pollution Prevention*

2.9.2.1 *Chapter 1: Introduction to Constr. Stormwater Pollution Prevention*

Applies

2.9.2.2 *Chapter 2: Regulatory Requirements*

Applies with the following additions:

Additional local requirements can be found in:

- Wellhead Protection Zones (especially Zones 1, 2, and 3) (RCDG 20D.140.50)
- Critical Areas Regulations (RCDG 20D.140)
- Construction Stormwater Pollution Prevention (Chapter 9 of the Stormwater Notebook)
- Rainy-Season construction guidelines (Chapter 10 of the Stormwater Notebook)

- State regulations provide that turbidity in receiving waters shall not be increased over 5 NTU above existing levels due to runoff from a construction site. In addition to that regulation, Contractor shall take all necessary TESC measures to ensure that runoff from a site does not exceed 50 NTU (during construction). All or parts of a project shall be required by City Inspectors to be shut down until a satisfactory plan is developed and implemented with additional TESC measures as needed to meet these requirements. If the violations occur in the Rainy Season (October 1 through April 30) suspension of work until after April 30 may be required.

2.9.2.3 Chapter 3: Planning

3.1-General Guidelines

Applies.

3.2.3- Step 3 - Construction SWPPP Development and Implementation

Element #4- BMP C230: Straw bale barrier and BMP C231: brush barrier are not allowed in Redmond.

Element #12- Refer to Chapter 10 of this document for seasonal restrictions/exemptions.

3.3.2-Drawings

Narrative section of Construction SWPPP Checklist applies. Refer to City Standard Notes (Appendix L) and City Plan Review Checklist (Appendix F) for SWPPP drawing requirements.

2.9.2.4 Chapter 4: Standards and Specs for Best Management Practices

4.1-Source Control BMPs

BMP C101: Preserving Natural Vegetation. No disturbance is allowed within 5 feet of drip lines of trees to be saved unless specifically approved by the Project Planner.

BMP C103- High visibility plastic or metal fence. Refer to Redmond Standard Specifications and Details.

BMP C104- Stake and wire fence. Not approved in Redmond.

BMP C105- Stabilized construction entrance. Refer to Redmond Standard Specifications and Details.

BMP C106- Wheel wash. Refer to Redmond Standard Specifications and Details.

BMP C121- Compost mulch may only be used on proposed landscape areas. It is not approved as a general TESC mulch in Redmond.

BMP C140- Chemical dust suppressants are not approved for use in Redmond.

BMP C202- Rubble concrete channel lining is not approved in Redmond.

BMP C204- Pipe slope drain. Note that this is "temporary" only.

BMP C205- The minimum subsurface drain size shall be 6" diameter.

BMP C220- Catch basin filters are required in Redmond for storm drain inlet control. Provisions shall be made to remove filters at the end of the project without dropping accumulated sediment into the catch basin.

BMP C230- Straw Bales. Not approved in Redmond.

BMP C231- Brush Barrier. Not approved in Redmond.

BMP C233- Silt fence. Refer to Redmond Standard Specifications and Details.

BMP C234- Vegetated strips shall have a minimum length of 200 feet.

BMP C240- Sediment trap shall be sized using the 10-year design storm.

BMP C241- Temporary sediment pond shall be sized using the 10-year design storm. Side slopes shall be 3:1 or flatter (interior and exterior).

BMP C250- Construction stormwater chemical treatment and other non-standard treatment systems must be approved by the City.

Appendix II-A- Use Redmond Standard Notes (See Appendix L of the Stormwater Notebook).

2.9.3 Volume III: Hydrologic Analysis and Flow Control BMPs

2.9.3.1 Chapter 1: Introduction

1.2- Content and Organization of this Volume

The 2005 Ecology Manual notes that conveyance system design is not addressed in that manual. See Chapter 8 of the Stormwater Notebook.

2.9.3.2 ***Chapter 2: Hydrologic Analysis***

2.1- Minimum Computational Standards

Applies.

2.2- Western Washington Hydrology Model

For commercial sites use actual proposed impervious area for the developed condition. For single-family developments use 80% of the maximum impervious area allowed by the zoning code. Detention systems serving projects utilizing green infrastructure design bonuses shall be designed based on the allowed maximum impervious lot area. . For single family lots, 4,200 s.f. impervious area per lot may be used with approval from the Stormwater Engineer.

Credits for infiltration of roof runoff or use of porous pavement require demonstration that stormwater is "clean" (draining from non-pollution generating surface) and that it will infiltrate without causing a flooding problem nearby.

2.9.3.3 ***Chapter 3: Flow Control Design***

3.1-Roof Downspout Controls:

Applies only to single family detached homes (with or without an attached or detached Accessory Dwelling Unit).

Section 3.1.3 applies to single family detached homes with modifications as follows:

- The setback from any structure, property line, or steep slope (over 40%) shall be 50 feet minimum.
- The perforated pipe shall not be located where percolating water will encounter and be intercepted by another nearby (within 25 feet) utility trench or foundation drain.
  Figure 3.1-Flow Diagram Showing Selection of Roof Downspout Controls
  Applies.

Figure 3.2-Typical Downspout Infiltration Trench

6" minimum diameter pipe required. Flexible single wall pipe is not approved in Redmond.

Figure 3.4-Typical Downspout Infiltration Drywell

6" minimum diameter pipe required.

3.2.1-Detention Ponds

Proposed slopes shall be 3:1 or flatter. Up to 25% of the pond perimeter may have vertical walls. Anything greater will require approval of the Stormwater Engineer.

Modular grid pavement is only allowed if specifically approved by the Stormwater Engineer.

Ponds shall be setback a minimum of 10 feet from structures, property lines or required vegetated buffers, and 50 feet from the limits of steep slope areas. The setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide. Conveyance pipes in steep slope areas shall be installed on the surface of the slope, with the minimum disturbance possible, and shall require applicable City approvals.

Minimum setback required for trees is 8 feet in Redmond. Trees shall be setback one (1) vertical foot above the maximum storage elevation to provide maintenance access and liner protection. Trees shall not be planted over any pond liner.

A fire hydrant shall be located within 100 feet of the control structure for maintenance.

Detention ponds in infiltrative soils shall be lined, unless otherwise approved as combination infiltration facilities. Lining may consist of an impermeable till layer 18 inches or thicker, bentonite or synthetic liners approved by the Stormwater Engineer. When a geomembrane is used, provide an analysis demonstrating that the required cover soil will be stable against sliding when saturated. Impervious bottoms and sides shall extend up to the stage of the 50-year event.

Combination infiltration / detention ponds may be approved by the Stormwater Engineer, subject to the restrictions on infiltration in wellhead protection zones noted in Table 3.11R below.

Pond control structures shall be accessible by a Vactor truck. A backhoe must be able to access each pond for maintenance. The detention pond emergency overflow route must be independent from the primary outflow system.

Signs shall be posted at all stormwater ponds using the standard sign format described in Appendix M. There are several alternative sign formats, and they shall be selected based on the following:

- Ponds greater than 5000 square feet in size shall receive the large (24 x 48) sign. Smaller ponds may have either the small (12 x 18) or the large sign.
- Public ponds shall receive the sign with the City of Redmond logo. Private pond signs shall not include the logo, but shall indicate they are privately owned and maintained.
- Ponds with liners shall receive the sign indicating the liner. Ponds that infiltrate shall have the sign indicating the infiltration.

Ponds shall be named by the project proponent. The pond name shall be unique to the City of Redmond. In general, the pond name shall be the same as the name of the subdivision in which the pond is located. Pond names are subject to approval by the Stormwater Engineer.

Figure 3.12- Example of Permanent Surface Water Control Pond Sign

See Appendix M of the Stormwater Notebook for City of Redmond standard sign.

3.2.2- Detention Tanks

Corrugated metal detention tanks are not approved in Redmond.

Corrugated metal pipe (CMP) risers are not approved in Redmond.

Tanks shall be setback a minimum of 10 feet from structures, property lines, required vegetated buffers, and 25 feet from the limits of steep slopes. The setback from steep slope may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide. For limitations on tree planting, see tree separation information for pipes in Chapter 8.

Add the following note to drawings that include detention tanks: "Pressure tests may be required by the City Inspector. Tanks that do not pass pressure tests shall be repaired or replaced." Avoiding leakage is particularly critical in Wellhead Protection Zones 1, 2, and 3.

Maintenance must be feasible and designs should strive to facilitate maintenance (design adjustments to facilitate maintenance may be required during plan review).

3.2.3- Detention Vaults

Vaults shall be setback a minimum of 10 feet from structures, property lines, required vegetated buffers, and 25 feet from the limits of steep slopes. The Stormwater Engineer may approve integrated vaults constructed as part of a building structure. The setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide.

Vault setbacks from property lines or right-of-way limits must be a minimum of 10 feet, or the distance required to excavate a 1:1 slope from the bottom of the vault to the ground surface at the right-of-way or property line – whichever is greater. Trees may be as close as 2 feet from concrete vaults provided the trees do not interfere with access for maintenance. Specify shallow rooted trees by species on the project landscape plans for locations closer than 8 feet to vaults.

Maintenance must be feasible and designs should strive to facilitate maintenance (design adjustments to facilitate maintenance may be required during plan review).

Figure 3.17-Flow Restrictor (TEE)

Refer to City Standard Detail in "City of Redmond Standard Specifications and Details"

Figure 3.18-Flow Restrictor (Baffle)

Refer to City Standard Detail in "City of Redmond Standard Specifications and Details"

Figure 3.19-Flow Restrictor (Weir)

Refer to City Standard Detail in "City of Redmond Standard Specifications and Details"

3.2.5- Other Detention Options

Parking lot ponding is only allowed for the 50-year storm event or greater. A maximum ponding depth of 6 inches is allowed. The 50-year event may not impact any buildings or other structures. Provisions to bypass offsite flows shall be included in design of parking lot detention.

Roof detention is not allowed in Redmond at this time.

3.3- Infiltration Facilities for Flow Control and for Treatment

Protection of the drinking water resource is a very high priority in Redmond. Therefore, infiltration of stormwater, even with treatment, is limited within Wellhead Protection Zones (map available at: http://www.redmond.gov/cityservices/citymaps.asp).

3.3.5- Site Characterization Criteria

The soil infiltration rate may be determined by a falling head test conducted by a qualified engineer using commonly accepted methods. Infiltration locations will be considered unacceptable if the design infiltration rate is less than 1.0 inches/hour. In no case shall the design infiltration rate be more than 20.0 inches/hour.

Notify the City of Redmond's Wellhead Protection Program prior to installing groundwater monitoring wells. The City may consider allowing placement of such wells within public right-of-way if the City wishes to assume responsibility for the wells in the future. All wells shall either be required to be properly abandoned when they are no longer needed, or may be requested to be turned over to the City for ongoing monitoring by City staff.

3.3.6- Site Suitability Criteria (SSC)

At least 200 feet shall be provided for separation from public wells. Public wells are located within Wellhead Protection Zone 1. A map of wellhead protection zones is available at: http://www.redmond.gov/cityservices/citymaps.asp.

3.3.9-General Design, Maintenance, and Construction Criteria for Infiltration Facilities

Construction plans shall include a note to require field verification during construction of the facility, of soil conditions, and infiltration rates by an engineer with experience in stormwater management and licensed in the State of Washington. The engineer shall provide a written statement to the City of Redmond related to the field verification of the design parameters.

3.3.10- Infiltration Basins

Infiltration basins shall meet the same requirements for slopes, fences, signage, etc. as detention ponds.

3.3.11- Infiltration Trenches

Geotextile fabric or sand base required for infiltration trenches in Redmond. Maximum length shall be 100 feet.

2.9.3.4 Appendix IIIB: Western Washington Hydrology Model – Information, Assumptions, and Computation Steps

WWHM Information and Assumptions

5. Vegetation data

Predeveloped conditions shall be modeled as forested or pasture land cover. Forested land cover shall be used, except for the valley floors associated with the Sammamish River, Bear Creek, Evans Creek, and Lake Sammamish. For these valley floors, pre-developed condition is "pasture land cover." 100% of the site shall be assumed pervious. A map of historical land cover is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp.

6. Development land use data.

For commercial sites use actual proposed impervious area for the developed condition. For single-family developments use 80% of the maximum impervious area allowed by the zoning code. For single family lots, 4,200 s.f. impervious area per lot may be used with approval from the Stormwater Engineer.

2.9.3.5 ***Appendix IIIC: Washington State Department of Ecology Low Impact Development Design and Flow Modeling Guidance***

Note: Use of low impact development BMPs requires more thorough site assessment than traditional measures. See Paragraph 8.29 of the Stormwater Notebook.

7.1 Permeable Pavements

Use of permeable pavements is subject to approval by the Technical Committee. Use of permeable pavements as pollution generating impervious surface is not allowed. A maintenance plan is required. Use of modular pavements in fire lanes is discouraged and is subject to approval from the Technical Committee.

7.2 Dispersion

7.2.5 Dispersion in Urban Areas

As noted in paragraph 2.5.5 of this Stormwater Notebook, full site dispersion may be limited by site conditions...

2.9.4 ***Volume IV: Source Control BMPs***

2.9.4.1 ***Appendix IVG: Recommendations for Management of Street Wastes***

Street Waste Liquids

Decant liquid shall be discharged to sanitary sewer or otherwise disposed. It shall not be discharged to the storm system, even if it passes through a stormwater treatment BMP.

2.9.5 ***Volume V: Runoff Treatment BMPs***

2.9.5.1 ***Chapter 1: Introduction***

Applies. See Table 4.4R in Section 2.9.1.4 of the Stormwater Notebook.

2.9.5.2 ***Chapter 2: Treatment Facility Selection Process***

Applies. Note that the City of Redmond has preferences for certain types of stormwater treatment over others. These preferences are

based primarily on long term performance and maintenance cost. Actual selection of facilities must necessarily address site-specific constraints. However, these preferences are provided to help the designer in cases where more than one alternative exists to meet the same needs. Capital improvement projects shall involve the Stormwater Engineer early in the design process to ensure selection of stormwater treatment facilities that best meet the long term goals of the City. The Stormwater Engineer may direct substitution of an alternative treatment method based on these preferences. Table 4.4R describes some of the City's preferences.

Step 1: Determine the Receiving Waters and Pollutants of Concern Based on Off-Site Analysis.

The City may adopt a basin plan for any watershed in the City that may place additional stormwater requirements. Contact the Stormwater Engineer to determine if any basin plans apply to your project site.

Step 2: Determine if an Oil Control Facility/Device is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/trafficcounts.asp*. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step 3: Determine if Infiltration for Pollutant Removal is Practicable.

Infiltration for pollutant removal of water draining from pollution generating surfaces in Wellhead Protection Zones 1, 2, or 3 (map available at: http://www.redmond.gov/cityservices/citymaps.asp) is not permitted. Infiltration for pollutant removal is permitted in Wellhead Protection Zone 4, provided all requirements in the Ecology Manual are met. Use of infiltration for water quality treatment is also subject to the requirements of the Washington State Department of Ecology's Underground Injection Control program. See Table 3.11R in Section 2.3.3.3 of the Stormwater Notebook.

Step 4: Determine if Control of Phosphorous is Required.

Phosphorus control treatment is required for "Large Project" sites that drain to Lake Sammamish. The City's watershed map delineates the boundaries between watersheds, and is available on the City's website at: http://www.redmond.gov/cityservices/citymaps.asp. See Volume V, Chapter 3, Section 3.3.

Step 5: Determine if Enhanced Treatment is Required.

Traffic counts in Redmond are available for some roadways at: *http://www.redmond.gov/insidecityhall/publicworks/transportation/traffi*

ccounts.asp. Follow guidance in the Ecology Manual if traffic counts are not available from Redmond for the project site.

Step 6: Determine if Fee in Lieu is Required.

Following review of the step by step process for selecting BMPs and review of Table 4.4R, determine if the project will be required or have the option to pay a fee in lieu of construction of the selected onsite BMPs. See chapter 8, section 8.8 of the Stormwater Notebook.

2.9.5.3 Chapter 3: Treatment Facility Menus

3.2-Oil Control Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

3.3-Phosphorous Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.3.1 of the Stormwater Notebook.

Projects within the Lake Sammamish Basin that are Large Projects as defined in Chapter 3 of the Stormwater Notebook (subject to Minimum Requirement #6) are required to provide phosphorus controls.

In addition to the Treatment Methods listed in the 2005 Ecology Manual, phosphorous control may be provided by applying measures listed below such that a score of 10 points or more is achieved. Credit options for phosphorus reduction are as summarized in Table 3.3R and are described as follows:

1. **Leaving part of the site undisturbed, including undevelopable land.** Full credit, or 10 points, is awarded for leaving 65 percent of a site in undisturbed native vegetation or areas re-established in native vegetation. Critical Areas and their buffers may be counted. All areas for phosphorus credit must be in tracts dedicated to the City protected in accordance with the requirements set forth for general critical area protective measures in Chapter 20D.140.10-180 of the Community Development Guide. A descending scale of points applies where lower percentages of the site are left undisturbed. Possible credit = 1 to 10 points.

2. **Directing runoff from pollution-generating surfaces to grassy areas with level spreading.** Directing runoff from pollution-

generating areas to grassy areas that are not fertilized (a notice shall be made on the plat and signage posted to this effect) or to areas of native vegetation (protected by critical area tract) results in pollutant removals similar to those obtained in swales while also providing an increased opportunity for infiltration. To use this option, flows must remain unconcentrated and be spread uniformly over the intended area. The vegetated area receiving dispersed flows should be at least 25 percent as large as the area contributing flow. The receiving area should be increased by one percent for each percent increase in slope over four percent. The area should be configured so that the length of the flow path is no longer than the width over which flows are dispersed.

Example:
Assume a parking lot is 100'x600', or 60,000 sf. Flows will be dispersed through an adjacent area of native vegetation with a slope of 8 percent.

The area of vegetation must be at least 17,400 sf (25% +4% (for steeper slope) x 60,000 sf). Assuming runoff is dispersed continuously along the wider edge of the parking lot, the flow path would need to be at least 29 feet (17,400' ÷ 600'). If the water were dispersed along the shorter edge, flow path would be 174 feet (17,400' ÷ 100'). However, this flow path would be longer than the width over which flows were dispersed (100'), and would not be a satisfactory option. The parking lot could be graded, however, so that flows would be dispersed at both of the 100-foot ends, making each flow path 87 feet, which would be acceptable.

Credit is proportional to the total volume of runoff diverted; one point is earned for every 25 percent of total volume so directed. Possible credit = 1 to 4 points

3. **Providing covered parking areas isolated from the stormwater conveyance system.** This item applies to all land uses for which covered parking for employees, residents, guests, and the general public is provided. This can be achieved for commercial land uses simply by covering the parking required by code. For other land uses, provision of additional covered parking for guests or the general public (total parking) in lieu of on-street parking can be used to provide this assurance. It is intended that covered parking would isolate the area from stormwater run-on as well as direct rainfall. A low curb, berm, or enclosing walls, in addition to a roof, would typically be

needed. The water quality credit is proportional to the percentage of the total surface area that is effectively covered. One point is earned for every 25 percent of parking covered and protected from run-on. Possible credit = 1 to 4 points

4. **Providing covered vehicle washing areas connected to the sanitary sewer system.** This item applies to commercial, industrial, and multi-family sites. Frequent car-washing can contribute significant amounts of phosphorus to stormwater. Note that sewer districts may have pretreatment requirements before allowing connection to the sanitary sewer. Possible credit = 3 points

5. **Providing covered waste disposal and recycling areas isolated from the stormwater conveyance system.** One point is earned if all solid waste management areas are covered and protected from stormwater run-on. Possible credit = 1 point

Credit shall be applied to the whole site.

If the credit option is used, it should be applied for during initial drainage review by the City. The preliminary stormwater report should include a written request for credit based on either the site plan or the grading plan for the project. The request should outline how the point totals are to be achieved. Credit is not given unless requested. Use of the credit option does not release the project from the need for basic or enhanced treatment (as applicable).

Table 3.3R Water Quality Credit for Phosphorus Control	
Credit Option	Points
Leaving site undisturbed, in native vegetation. Buffers without trails may be counted.	At least 65 % = 10 60 % = 9 55 % = 8 50 % = 7 45 % = 6 40 % = 5 35 % = 4 30 % = 3 25 % = 2 20 % = 1
Directing road runoff to pervious, non-pollution-generating vegetated area.	100 % of volume = 4 75 % of volume = 3 50 % of volume = 2 25% of volume = 1
Covered parking protected from run-on	100 % of parking = 4 75 % of parking = 3 50 % of parking = 2 25% of parking = 1
Covered car wash area connected to sanitary sewer (multi-family)	3
Covered solid waste storage area	1

3.4-Enhanced Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.9.1.4 of the Stormwater Notebook.

3.5-Basic Treatment Menu

Applies. However, the Stormwater Engineer may direct substitution of an alternative treatment method based on the preferences noted in Table 4.4R of Section 2.9.1.4 of the Stormwater Notebook.

2.9.5.4 Chapter 4: General Requirements for Stormwater Facilities

4.3.2-Side Slopes and Embankments

Up to 25% of the pond perimeter may have vertical walls. Anything greater will require approval of the Stormwater Engineer. Provide fence along slopes greater than 3:1.

4.4.1-General Design Criteria

Liners are required for all water quality ponds and most detention ponds (impermeable till layer, synthetic liner or bentonite).

4.4.3-Design Criteria for Low Permeability Liner Options

Concrete liners are not approved in Redmond.

4.5.3-Outfall Systems

Drop structures are not allowed unless specifically approved by the Stormwater Engineer.

Table 4.5-Maintenance Standards

No. 4 – Control Structure / Flow Restrictor

Under "General", maintenance is required if Trash and Debris (Includes Sediment) material exceeds **20%** of sump depth or 1 foot below orifice plate.

Figure 4.8-Flow Dispersal Trench

6" minimum diameter perforated pipe required.

2.9.5.5 Chapter 5: On-Site Stormwater Management

BMP T5.10 Downspout Dispersion

Downspout dispersion may be limited based on site and downstream conditions.

BMP T5.13 Post-Construction Soil Quality and Depth

For landscaped areas and lawns, compost-amended soils are encouraged to be used. Compost-amended soils shall be installed in accordance with the requirements specified in "Guidelines for Landscaping with Compost-Amended Soils" in Appendix Q. If landscaped areas and lawns have slope lengths of at least 50 feet and are made up of contiguous areas with a minimum area of 500 square feet, then landscaped areas with compost-amended soils may be considered to be pasture when modeling with WWHM.

Compost-amended areas shall be marked to prevent vehicle traffic in those areas.

BMP T5.20 Preserving Natural Vegetation

Preserved areas shall be set aside as native growth protection easement and marked accordingly. No vehicle traffic shall be permitted in preserved areas.

BMP T5.30 Full Dispersion

Full dispersion credit may be limited based on site and downstream conditions.

2.9.5.6 ***Chapter 6: Pretreatment***

Applies

2.9.5.7 ***Chapter 7: Infiltration and Bio-infiltration Facilities***

Applies. Note that infiltration for treatment is not allowed in Wellhead Protection Zones 1, 2, or 3.

2.9.5.8 ***Chapter 8: Sand Filtration Treatment Facilities***

Applies

2.9.5.9 ***Chapter 9: Biofiltration Treatment Facilities***

9.4-Best Management Practices

Swales shall be at least 200 feet long. Swale length may be reduced to 150 feet for re-development projects if no feasible alternative exists. Maximum swale bottom width shall be 8 feet (parallel swales are acceptable if needed to provide adequate treatment area). Biofiltration swales and similar water quality facilities shall be lined (e.g. geomembrane) in Wellhead Protection Zones 1, 2, and 3, and shall be lined in other areas unless constructed over at least one foot of compacted till (native or constructed).

If biofilters are not able to be located off-line, the swale shall be designed so the maximum flow possible in the swale up to the 50 year does not produce a velocity over 3 feet per second.

The size and shape of biofilters (and other surface features) shall be compatible with the terrain and not detract from the landscape value (the latter as determined by the Technical Committee).

At least one side of each biofilter shall be accessible for maintenance by a backhoe.

Plant no trees within 8 feet of biofiltration swale banks. Their resulting shade and leaves impact the dense vegetated cover required for biofiltration. In designing the landscaping for the area, and placement

of the biofiltration swale, take into account the need for sunlight within the swale.

Table 9.1- Sizing Criteria

Underdrains are not required.

Figure 9.2-Biofiltration Swale Underdrain Detail

Underdrains are not required.

2.9.5.10 Chapter 10: Wet Pool Facility Designs

10.3-Best Management Practices (BMPs) for Wetpool Facilities

See requirements for Detention Ponds in Volume III.

Provide a 5-foot wide level bench around the perimeter of the pond at or up to 1 foot below the permanent water surface.

All water quality ponds shall be lined to prevent infiltration. Lining may consist of an impermeable till layer 18 inches or thicker, bentonite or synthetic liners approved by the Stormwater Engineer. When a geomembrane is used, provide an analysis demonstrating that the required cover soil will be stable against sliding when saturated.

Gravity drains are not required for wet ponds or vaults. Access roads to the pond bottom are not required but are encouraged for wet ponds.

Wet ponds that are intended solely for water quality treatment shall have a high flow bypass to divert peak flows above the water quality design storm.

Wetponds shall be setback a minimum of 10 feet from structures, property lines, or required vegetated buffers, and 50 feet from the limits of steep slopes. The setback from steep slopes may be reduced per Section 20D.140.10-120 of the Redmond Community Development Guide.

A minimum, average depth of 3 feet is required for water quality treatment in vaults and tanks.

Storm pipes should discharge into wet ponds at/or above the normal control elevation (elevation of outlet pipe invert). Designs that include pipes discharging below the control elevation must include an analysis demonstrating that sediment will not accumulate within the pipe.

To avoid anaerobic conditions, wet ponds should not have permanent pool depths greater than 8 feet, unless aeration is provided. For publicly

owned and maintained ponds, aeration requires approval from the Stormwater Engineer.

2.9.5.11 Chapter 11: Oil and Water Separator BMPs

11.7 Oil and Water Separator BMPs

API separators rise rate shall be 0.2187 foot/minute.

2.9.5.12 Chapter 12: Emerging Technologies

12.7- Use of Emerging Technologies in Redmond

The use of emerging technologies is not discouraged in Redmond, but will require more careful scrutiny, additional submittals, and may require post-construction monitoring. In general:

- Technologies that have received General Use (GULD) designation are acceptable for use in Redmond, within the guidance and recommendations for use provided by Ecology.
- Technologies that have received Conditional Use (CUD) designation are acceptable for use in Redmond for some projects, on a case-by-case basis. Such projects may require post-construction monitoring.
- Technologies that are going through Ecology's Technology Assessment Protocol may be considered for use in Redmond for some projects, on a case-by-case basis. Such projects will require substantial performance data submittals and post-construction monitoring.

Contact the Stormwater Engineer to discuss use of emerging technologies. Final approval will be by a committee that includes a representative from the Natural Resources Division, the Development Services Division, and the Construction Division of Public Works.

Additional Updates

Chapter 8, Section 8.7.42 – Remove *(lots 5 acres and greater)*.

Chapter 8, Section 8.7.5 – All large projects are required to submit a site assessment for LID. If infiltration and/or dispersion are not feasible options, the applicant shall provide justification to demonstrate why.

Chapter 8, Section 8.8.1 – Add the following:
For new development projects (less than 35% existing impervious area), regional facilities must be operational to be eligible for "fee-in-lieu". Redevelopment projects (more than 35% existing impervious area) are eligible if associated regional facilities are operational or are on the City's six year Stormwater Capital Improvement Plan.

To be eligible for "fee-in-lieu", project areas must drain to the existing or proposed regional facility. For public road projects, the project area must drain to the same receiving water as the existing or proposed regional facility.

Chapter 8, Section 8.8.3.3 – Add the following:
If a redevelopment project drains into Bellevue, and regional facilities have not yet been constructed, then onsite interim facilities may be required. The purpose of such facilities is to ensure that the proposed project does not create a greater negative environmental impact on receiving waters than is currently caused by the project site. Such facilities may use the existing release rate from the site as the proposed release rate from the site (instead of predeveloped conditions).

Chapter 8, Section 8.8.4.1 – Add the following:
Within the Overlake regional surcharge area, the Overlake Village is required to provide onsite treatment for pollution generating impervious surfaces. Low impact development methods shall be used to the extent practical to meet this requirement.

Appendix A – See current RMC, Chapter 15.24.

Appendix C – Contained in updated Chapter 2.