

Chapter 3 – Stormwater Submittals

Table of Contents

Chapter 3 – Stormwater Submittals	3-1
3.1 Purpose, Content, and Organization.....	3-1
3.2 Drainage Review Types and Submittals	3-1
3.2.1 City Projects.....	3-2
3.2.2 Project Submittal Process	3-2
3.2.3 Design Plan Certification.....	3-3
3.3 Drainage Submittals for Permit Application	3-7
3.3.1 SWPPP Short Form	3-7
3.3.2 Abbreviated Drainage Plan.....	3-7
3.3.3 Drainage Control Plan	3-28
3.4 Plans and Documentation Required After Stormwater Site Plan Approval.....	3-55
3.4.1 Stormwater Site Plan Changes.....	3-55
3.4.2 Final Corrected Plan Submittal.....	3-55
3.4.3 Maintenance Covenant	3-55
Chapter 3 References	3-57
Appendix 3A – Construction Stormwater Pollution Prevention Plan (SWPPP) “Short Form”	3A-1
Appendix 3B – O&M Cost Estimate Calculations	3B-1
Introduction.....	3B-1
Part I: Inventory of On-Site Stormwater BMPs.....	3B-1
Part II: Routine Operation and Maintenance Assumptions.....	3B-1
Part III: Routine Operation and Maintenance Estimated Annual Cost	3B-2
Part IV: Estimated Annual Partial Replacement Cost	3B-2
Part V: Estimated Monthly Contribution to Stormwater BMPs Operation and Maintenance Account	3B-2

Tables

Table 3.1.	Thresholds for SWPPP Short Forms, Abbreviated Drainage Plans, and Drainage Control Plans.	3-5
Table 3.2.	Abbreviated Drainage Plan and Drainage Control Plan Requirements.	3-6
Table 3.3.	Example Existing Site Land Coverage Tabulation for an Abbreviated Drainage Plan.	3-10
Table 3.4.	Example Proposed Site Land Use Coverage Tabulation for an Abbreviated Drainage Plan.	3-10
Table 3.5.	Examples of Applicable City and Agency Permits to List in an Abbreviated Drainage Plan.	3-11
Table 3.6.	Example Existing Site Land Coverage Tabulation for a Drainage Control Plan.	3-30
Table 3.7.	Example Proposed Site Land Use Coverage Tabulation for a Drainage Control Plan.	3-30
Table 3.8.	Examples of Applicable City and Agency Permits to List in a Drainage Control Plan.	3-31

Chapter 3 – Stormwater Submittals

3.1 Purpose, Content, and Organization

This chapter outlines the various requirements for submittals of stormwater plans, reports, and other documents for review by the City of Lacey (City). The submittals described in this chapter are required for compliance with Core Requirement #1: Preparation of Stormwater Site Plans and Reports, as well as for preparation of a Construction Stormwater Pollution Prevention Plan (SWPPP), in accordance with Core Requirement #2.

The amount of document preparation and review required for stormwater plan submittals are tiered to match the impact potential of a particular project to the appropriate amount of regulatory oversight and control. All projects are subject to the core requirements outlined in Chapter 2, and the plans described in this chapter meet the requirements of the Stormwater Site Plan required by Core Requirement #1. Based on the project size and proposed conditions, a project applicant will have to prepare one of three submittal types: a SWPPP Short Form, an Abbreviated Drainage Plan, or a Drainage Control Plan (outlined further below).

The remainder of this chapter is divided into three major sections:

- Section 3.2 describes which submittals are required, depending on project thresholds.
- Section 3.3 describes each type of drainage review submittal, including SWPPP Short Forms, Abbreviated Drainage Plans, and Drainage Control Plans.
- Section 3.4 describes submittal requirements for changes that may occur after Stormwater Site Plan approval.

3.2 Drainage Review Types and Submittals

Project thresholds and associated submittal requirements are summarized in Table 3.1. Project applicants should identify their type of project in the Table 3.1 rows, and then identify the appropriate submittal requirements by each column, as well as any applicable table notes. Note that Table 3.1 only summarizes submittal requirements and cannot be used to identify applicable minimum requirements, exemptions, etc. Project proponents must refer to Chapter 2 for detailed information and requirements.

For projects requiring an Abbreviated Drainage Plan or Drainage Control Plan, Table 3.2 provides an overview of the submittal requirements. Additional requirements for the Abbreviated Drainage Plan and Drainage Control Plan can be found in Sections 3.3.2 and 3.3.3, respectively.

Information on other project permit requirements and materials—including applications, fees, right-of-way use requirements, and other code requirements—are outlined in the *City of Lacey Development Guidelines and Public Works Standards (DG&PWS)* or can be obtained from the City of Lacey Public Works Department or Community and Economic Development Department.

In addition, any activity that alters the approved plans for a given project (e.g., stormwater best management practice [BMP] maintenance or repair, drainage BMP resizing, other project design changes to impervious surfaces or land cover) will require re-approval by the City, regardless of whether the thresholds listed in Table 3.1 have been exceeded. This may include updates to the original SWPPP Short Form, Abbreviated Drainage Plan, or Drainage Control Plan, and associated Construction SWPPP. See Section 3.4 for additional details.

3.2.1 City Projects

Projects conceived, designed, or constructed by or through an agent of the City shall meet the requirements of this manual. This includes development of all required Stormwater Site Plan documentation, and maintenance of records adequate to reflect compliance with these requirements.

3.2.2 Project Submittal Process

Presubmission Meeting

Most projects will require a presubmission meeting, as outlined in the DG&PWS. The presubmission meeting is to help the City understand the project, to help the project applicant understand the requirements, and to make a preliminary determination of the type of submittal required based on project thresholds.

Stormwater Scoping Meeting

In addition to the presubmission meeting described above, an optional stormwater scoping meeting can be conducted at the request of the project applicant prior to any stormwater plan submittals. The purpose of the stormwater scoping meeting is to discuss what stormwater requirements apply to a given project, and what steps the project proponent must take toward developing a complete project submittal.

Draft Stormwater Site Plans

Projects requiring an Abbreviated Drainage Plan (per Section 3.3.2) or Drainage Control Plan (per Section 3.3.3) shall submit a complete draft of the plan for review and inclusion in the permit or land use application package, provided to the City in both electronic (PDF) and hard copy formats. **The draft plan shall target an approximately 90 percent (or greater) level of completion, with the majority of the content outlined in Section 3.3 being complete or nearly complete at the time of submittal.** The draft Stormwater Site Plan submittal for land-use approval shall include the following:

- Draft Abbreviated Drainage Plan or Drainage Control Plan Report
 - Documentation of feasibility for all proposed BMPs
 - Documentation that all applicable core requirements will be met
- 90 Percent Site Development Drawings
- Draft Construction SWPPP (Temporary Erosion and Sediment Control [TESC] Plan and narrative document)
- Soils Report (if required)
- Initial Land Use Application

Plan drawings shall show a well-developed concept with sufficient detail to enable review and evaluation of the feasibility and acceptability of the proposed Stormwater Site Plan. All pertinent Drainage Report documentation requirements (per Section 3.3), including the soils report and infiltration analysis, shall also be sufficient to enable review and evaluation of the proposed plan. Minor changes and revisions may be made following the draft plan submittal and review, though substantive changes are only expected if the draft plan does not meet the intent or requirements of this manual.

A Drainage Report template is available on the City’s website.

Final Stormwater Submittal

After the draft Abbreviated Drainage Plan or draft Drainage Control Plan has been reviewed and accepted (e.g., Site Plan Review approval or Preliminary Plat approval), the applicant shall submit a final plan for the project, incorporating any comments and necessary revisions from the draft plan review. The final Stormwater Site Plan shall incorporate any minor revisions and modifications identified in the draft and shall be provided to the City in both electronic (PDF) and hard copy formats as specified in the DG&PWS.

The final Abbreviated Drainage Plan or Drainage Control Plan is intended to be complete and final, however it is understood that occasionally further changes may be needed after project approval. See Section 3.4 for procedures related to submitting changes to final plans after approval.

3.2.3 Design Plan Certification

All preliminary and final plans, drawings, and reports must be stamped and signed by a professional engineer licensed in Washington State. In many situations, it also will be necessary for a licensed professional to prepare components of the Abbreviated Drainage Plan. See Sections 3.3.1 through 3.3.3 for plan-specific requirements.

All land boundary surveys, and legal descriptions used for preliminary and engineering plans must be stamped and signed by a land surveyor licensed in Washington State. Topographic survey data and mapping prepared for a proposed project may be performed by the professional engineer who stamps the engineering plans.

Table 3.1. Thresholds for SWPPP Short Forms, Abbreviated Drainage Plans, and Drainage Control Plans.

Category^{a,b,c}	<2,000 sq. ft. New or Replaced Impervious/Hard Surface	If Core Requirements #1 through #5 Apply	If Core Requirements #1 through #9 Apply
Subdivisions, Short Plats, Binding Site Plans	SWPPP Short Form	Abbreviated Drainage Plan	Drainage Control Plan
Creation of New or Replaced Impervious/Hard Surface ^d	SWPPP Short Form	Abbreviated Drainage Plan ^e	Drainage Control Plan ^e
Construction of Roads, Shared Accesses, and Alleyways	SWPPP Short Form	Abbreviated Drainage Plan	Drainage Control Plan
Building Permit	SWPPP Short Form	Abbreviated Drainage Plane	Drainage Control Plane
Clearing or Grading	SWPPP Short Form	Abbreviated Drainage Plan	Drainage Control Plan
Maintenance and Repair of Roads, Shared Accesses, and Alleyways		Abbreviated Drainage Plan	Drainage Control Plan
Utility Line Work (construction or maintenance—inside right-of-way) ^f		Abbreviated Drainage Plan	Drainage Control Plan
Utility Line Work (construction or maintenance—outside right-of-way) ^{d,g}		Abbreviated Drainage Plan	Drainage Control Plan
Driveway culvert installation in Roadside Swales/Ditches ^h	SWPPP Short Form		

SWPPP Short Form = Construction Stormwater Pollution Prevention Plan Short Form (see Appendix 3A).

sq. ft. = square feet.

Note that all Abbreviated Drainage Plans and Drainage Control Plans also require a completed Construction Stormwater Pollution Prevention Plan (SWPPP).

- ^a See Chapter 2 to identify applicable minimum requirements, exemptions, etc. Chapter 2, Section 2.1.3 in particular includes information on projects that are exempt from the requirements of this manual. Table 3.1 is only intended to summarize submittal requirements, not overall project requirements.
- ^b For sites that contain critical areas or critical area buffers, a submittal stamped by a professional engineer licensed in Washington State is required, unless waived by the City.
- ^c All development must consider the thirteen elements of Core Requirement #2 (see Section 2.4.2). Depending on the scope of the project, components of the Construction SWPPP shall be required with the plan submittal.
- ^d Routine, repetitive maintenance or repair activities that do not meet the threshold for an Abbreviated Drainage Plan or Drainage Control Plan shall be performed in accordance with standard BMPs as published by the City.
- ^e As noted in Chapter 2, Section 2.1.2, projects that exceed the above thresholds and: 1) are within the 1-year time of travel zone for a wellhead protection area, and 2) contain existing hard surfaces that do not drain to an approved stormwater management BMP are required to apply the applicable core requirements to the entire project site (i.e., not just to the new and replaced hard surfaces).
- ^f All work shall be performed in accordance with the DG&PWS, shall include the implementation of the applicable Abbreviated Drainage Plan or Drainage Control Plan measures, and shall be in compliance with this manual for the life of the installation.
- ^g An individual site development permit is not required if utility line improvements are performed within a larger project (i.e., subdivision construction) that has a site development permit and the utility line improvements have been addressed under the larger project's site development permit.
- ^h Driveway culvert size and location to be per City inspector's direction. The City may require that the project applicant retain an engineer to size and design the culvert in situations where there may be a drainage issue. Note that a driveway and/or right-of-way permit may also be required.

Table 3.2. Abbreviated Drainage Plan and Drainage Control Plan Requirements.

	Abbreviated Drainage Plan	Drainage Control Plan
Applicable Core Requirements		
Core Requirements #1-5	✓	✓
Core Requirements #6-9	Not Applicable	✓
Drainage Report		
Section 1: Project Overview	✓	✓
Section 2: Development Conditions and Requirements	✓	✓
Section 3: Site and Vicinity Description	✓	✓
Section 4: Soils and Infiltration Analysis	★	✓
Section 5: On-Site Stormwater Management and LID (Core Requirement #5)	✓	✓
Section 6: Runoff Treatment and Flow Control (Core Requirements #6 & #7)	Not Applicable	✓
Section 7: Runoff Collection and Conveyance System	If Applicable to Project	✓
Section 8: Source Control (Core Requirement #3)	✓	✓
Section 9: Covenants, Dedications, Easements, Agreements, and Guarantees	✓	✓
Appendices		
Appendix 1: Maps and Plans		
• Vicinity Map	✓	✓
• NRCS Soil Types Map	✓	✓
• Existing Site Topography	✓	✓
• Basin Map	If Applicable to Project	✓
• Soil Pits/Borings	★	✓
• Stormwater Drainage Plan (duplicated from full-size plan set)	✓	✓
• Stormwater Details (duplicated from full-size plan set)	✓	✓
Appendix 2: Supplemental Reports and Information		
• Soils and Geotechnical Report	★	✓
• Other Environmental Analyses (e.g., Wetlands Report)	If Applicable to Project	If Applicable to Project
• GULD Documents and Manufacturer's Product Information	If Applicable to Project	If Applicable to Project
Appendix 3: Design Calculations		
Appendix 4: Soil Management Plan		
Attachments		
Attachment No. 1: Construction SWPPP	✓	✓
Attachment No. 2: Maintenance and Source Control Manual	Not Applicable	✓

✓ Include in Abbreviated Drainage Plan or Drainage Control Plan

★ Soils documentation generally required for most sites/projects, though usually less extensive than for full Drainage Control Plan.

3.3 Drainage Submittals for Permit Application

3.3.1 SWPPP Short Form

In accordance with Core Requirement #2, all projects must address construction-phase erosion and sediment control, starting prior to initial land disturbance and continuing throughout the site work. Projects that are identified in Table 3.1 as needing a SWPPP Short Form shall submit a complete SWPPP Short Form (see Appendix 3A) as well as a basic site illustration showing existing and proposed site features including SWPPP BMPs. The intent of the SWPPP Short Form is to record basic project information, and to document that the 13 construction stormwater pollution prevention elements of Core Requirement #2 are being considered and addressed as applicable.

3.3.2 Abbreviated Drainage Plan

Projects that are identified in Table 3.1 as needing an Abbreviated Drainage Plan require a Site Development Permit submittal, document preparation, City review, and City inspection. Abbreviated Drainage Plans have to address Core Requirements #1 through #5. An overview of the Abbreviated Drainage Plan requirements is included in Table 3.2 and detailed descriptions are outlined in the following subsections. Refer to the DG&PWS for requirements related to the number of copies and dimensions required by the City.

The purpose of an Abbreviated Drainage Plan is:

1. To ensure that a project complies with the applicable core requirements.
2. To incorporate requirements that achieve the intent and purpose of the Critical Area Regulations. Flood, landslide, shoreline erosion, wetland, and other critical areas sometimes require measures that must be depicted on Abbreviated Drainage Plan drawings to achieve compliance with these regulations.
3. To prevent development-related stormwater runoff from impacting neighboring properties.

Abbreviated Drainage Plan Requirements

If new, replaced, or new plus replaced hard surfaces are greater than or equal to 2,000 square feet (but less than 5,000 square feet), or if land-disturbing activity is greater than or equal to 7,000 square feet, an Abbreviated Drainage Plan must be submitted. Fundamentally, the Abbreviated Drainage Plan must demonstrate how Core Requirements #1 through #5 are being met. Note that Core Requirement #5 includes detailed requirements and decision points that can affect the project significantly, which must be reflected in the Abbreviated Drainage Plan documentation. Likewise, compliance with Core Requirement #2 will require preparation of a full Construction SWPPP.

The following sections provide detail on the requirements for Abbreviated Drainage Plans. Each section covers a required Abbreviated Drainage Plan section or attachment. In many situations, it will be necessary for a licensed professional to prepare components of the Abbreviated Drainage Plan. In some cases, the additional required information pertinent to the Abbreviated Drainage Plan may be available within the plat or other approved documents related to the project.

The following Abbreviated Drainage Plan topics are discussed:

- Abbreviated Drainage Plan Report sections
- Abbreviated Drainage Plan appendices
 - Drawing requirements for Abbreviated Drainage Plans
 - Soils Report requirements
- Abbreviated Drainage Plan attachments
 - Construction SWPPP requirements

Abbreviated Drainage Plan Report

The Abbreviated Drainage Plan Report is a major component of the Abbreviated Drainage Plan. The Abbreviated Drainage Plan Report shall include detailed information and data related to stormwater planning and design that facilitate plan review. Specific components of the Abbreviated Drainage Plan Report are described in detail below.

Cover Sheet: The Abbreviated Drainage Plan Report must have a cover sheet with the following information included:

- Title “Abbreviated Drainage Plan Report for (project name)”
- Project location
- Project applicant’s name, address, telephone number, and e-mail address
- Project engineer’s (if applicable) name, company name, address, telephone number, and e-mail address
- Date of submittal

Project Engineer’s Certification: The project engineer responsible for completion of an Abbreviated Drainage Plan submittal as described herein shall be a professional engineer licensed in Washington State. All plans and specifications, calculations, certifications, as-built drawings, and all other submittals which will become part of the permanent record of the project must be dated and bear the project engineer’s official seal and signature.

The Abbreviated Drainage Plan Report shall contain a page with the project engineer's seal and the following statement:

"I hereby state that this Abbreviated Drainage Plan Report for _____ (name of project) has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Lacey does not and will not assume liability for the sufficiency, suitability, or performance of stormwater BMPs prepared by me."

Table of Contents: Show the page number for each section of the report. Show page numbers of appendices. Identify all attachments included with the report. All pages of the Abbreviated Drainage Plan Report shall be numbered.

All Abbreviated Drainage Plan Reports shall include each of the following section titles and subsections (if some sections do not apply, keep the section titles, but designate as "Not applicable" where a specific section does not apply.):

Abbreviated Drainage Plan Report Section 1: Project Overview

- 1.1 Site Information: Parcel number(s), address or legal description of site property, current zoning, streets/general vicinity, property owner(s), total project site area, surrounding land uses.
- 1.2 Project Description: Provide a brief description of the proposed development project (type, size, location, proposed improvements including structures and paving, phasing (if applicable), and for additions/remodels only, current assessed value and cost of improvements excluding land value).
- 1.3 Proposed Stormwater Drainage Design: Describe the overall drainage plan concept, proposed permanent stormwater BMPs, their locations and distribution across the site, and proposed ownership (e.g., private or public). Briefly describe all stormwater features proposed to be installed for runoff collection, conveyance, runoff treatment, and infiltration and/or discharge (types, sizes, and locations). If applicable, describe the detention system, control structure/outlet, and spillways. See Chapter 8 for more details regarding stormwater BMPs that could be adopted and maintained by the City.
- 1.4 Subarea Data Tabulation: Provide data tables for existing and proposed surface areas, including hard surface areas by type (roof, driveway, walkway, etc.); new and replaced impervious, pervious, and hard surface areas; pollution-generating impervious and pervious surfaces (PGIS and PGPS); disturbed pervious (such as landscaped areas); converted vegetation areas; and undisturbed areas. Example subarea data tabulations for existing and proposed surface areas are provided in Tables 3.3 and 3.4.

Table 3.3. Example Existing Site Land Coverage Tabulation for an Abbreviated Drainage Plan.

Existing Surface	Surface Type	Area (square feet)	Area (acres)
Driveway	Hard/Impervious		
Walkway	Hard/Impervious		
Roof	Hard/Impervious		
Forested/Trees	Pervious		
Pasture/Landscaping	Pervious		
Total Site/Parcel Area			

Table 3.4. Example Proposed Site Land Use Coverage Tabulation for an Abbreviated Drainage Plan.

Proposed Surface	Surface Type	Pollutant Generating	Area (square feet)	Area (acres)
Roadway	Hard/Impervious	Yes - PGIS		
Driveway	Hard/Impervious	Yes - PGIS		
Walkway	Hard/Impervious	No		
Roof	Hard/Impervious	No		
Permeable Pavement	Hard/Pervious	Yes - PGPS		
Landscaping	Pervious	Yes - PGPS		
Undisturbed (e.g., tree tract)	Pervious	No		
Other: _____				
Total Project Area				

PGIS = Pollution Generating Impervious Surface

PGPS = Pollution Generating Pervious Surface

Abbreviated Drainage Plan Report Section 2: Development Conditions and Requirements

2.1 **Project Vesting:** Specify applicable versions of SDM and DG&PWS (i.e., 2022 SDM); if other than current versions were used, provide justification.

2.2 **Permits Required:** List applicable permits for the project that are required by the City and other agencies. Describe type of permit for which the project applicant is applying, and describe other permits required (e.g., hydraulic permits, U.S. Army Corps of Engineers [USACE] Section 404 Permit, wetlands development permit, etc.) and present status.

Construction of stormwater BMPs may require additional permits from other agencies. These additional permits may contain more restrictive drainage control requirements. This section should provide the title of any other necessary permits, the agencies requiring the other permits, and identify the permit requirements that affect the project.

Other agencies including, but not limited to, those listed in Table 3.5 may require drainage review for a proposed project’s impact on surface waters, stormwater, and conveyance systems. The project applicant should take care to note that these other agency drainage requirements are separate from, and in addition to, City’s drainage requirements. The project applicant will be responsible to coordinate joint agency drainage review, including resolution of any conflicting requirements between agencies.

Table 3.5. Examples of Applicable City and Agency Permits to List in an Abbreviated Drainage Plan.

Agency	Permit/Approval
Thurston County Environmental Health Department	On-site Sewage Disposal and Well Permits
Washington State Department of Transportation (WSDOT)	Developer/Local Agency Agreement
Washington State Department of Ecology	Short Term Water Quality Modification Approval
Washington State Department of Fish and Wildlife	Hydraulic Project Approval
Washington State Department of Ecology	Dam Safety Permit
United States Army Corps of Engineers	Section 10 Permit
United States Army Corps of Engineers	Section 401 Certification
United States Army Corps of Engineers	Section 404 Permit
City of Lacey	Shoreline Substantial Development Permits, Conditional Use Permits, and Variance Permits
City of Lacey	Right-of-Way Access Permit
City of Lacey	Wetland Development Permit

Note: This is not a complete list of possible permits that may be required.

2.3 Project Type and Size: Specify the project type as either new development or redevelopment (per definitions in the glossary); the total area of new and/or replaced hard surfaces; the total area to be disturbed; and the results from the applicable flow chart in Figure 2.1 or 2.2 of applicable Core Requirements. Include the valuation of the proposed improvements, including interior improvements, for redevelopment projects.

2.4 Critical Areas: Projects that involve work in or near critical areas must demonstrate compliance with Chapter 16.54 LMC. Describe the presence of any critical areas or environmentally sensitive areas, including wetlands, Endangered Species Act (ESA) species habitat, Wellhead Protection Areas (WHPAs), Critical Aquifer Recharge Areas (CARAs), geologically hazardous areas, steep slopes, etc. on the project site. Include any specific requirements of a basin plan or water quality improvement program (such as the Henderson Inlet Watershed Total Maximum Daily Load [TMDL]) for the project area. See maps in Appendix 8B for WHPAs and CARAs. The Abbreviated Drainage Plan also must indicate any site design and construction requirements that implement the applicable critical area standards and requirements.

2.5 **Core Requirements: Identify which of the core requirements apply to the project, and how they are being addressed.** Utilize applicable flow charts and provide appropriate data to determine which Core Requirements apply to the project. Include justification for those core requirements that do not apply. For Core Requirement #5, describe how low impact development (LID) principles were applied to the site planning process, and indicate whether the project used the mandatory list option, or the LID performance standard option, and provide complete documentation demonstrating compliance with either approach. Refer to Abbreviated Drainage Plan Report Section 5 for additional guidance.

Abbreviated Drainage Plan Report Section 3: Site and Vicinity Description

A description of the site and vicinity analysis shall be submitted as part of the Abbreviated Drainage Plan submittal. Information in this section should also be used to help prepare the Construction SWPPP. Where subsequent report sections call for more details on these issues (e.g., soils, wells, septic systems), a brief description and reference to the specific Abbreviated Drainage Plan Report section or appendix is sufficient.

3.1 **Existing Physiography:** Describe the existing physical setting of the project site, including, but not limited to, the items listed below.

- Existing topography and slopes.
- Existing land cover, including trees, shrubs, lawn, etc.
- Creeks, lakes, ponds, wetlands, ravines, gullies, springs, or other surface waters, on or downgradient of the property.
- Determine whether the project is within the potential flood hazard area as defined in Chapter 14.34 LMC, show the 100-year flood hazard area on the plans. If project is determined to be in the flood hazard area additional requirements may apply per Chapter 14.34 LMC.

3.2 **Existing Improvements:** Describe any existing constructed improvements and other non-natural features on the project site, including, but not limited to, wells, septic tanks, septic drainfields, storage tanks, pipes, utilities (pedestals, lines, vaults, etc.), structures, pavement, encumbrances, or other features that will be removed or affected by the site development.

- Drinking water wells, both active and abandoned, shall be shown on the plans or as-builts (if found during construction).
 - If no wells are found, indicate so.
 - The project engineer shall inquire with the Thurston County Environmental Health Department and neighboring property owners as necessary to obtain location of wells that are not of record.

- Septic systems, both active and abandoned, shall be shown on the plans or as-builts (if found during construction).
 - If no septic systems are found, indicate so.
 - The project engineer shall inquire with the Thurston County Environmental Health Department and neighboring property owners as necessary to obtain location of septic systems that are not of record.
- Identify the existence of fuel tanks, in-use or abandoned. Fuel tanks shall be shown on the plans or as-builts (if found during construction). If fuel tanks will be abandoned, contact the Thurston County Environmental Health Department for specific instructions. If no fuel tanks are found, indicate so.

3.3 Drainage Patterns: Describe existing drainage patterns at the project site and adjacent lands, and proposed accommodations and/or alterations to existing drainage flows, including:

- Off-site drainage to the property, including slopes and drainage patterns.
- Drains, channels, and swales, within the project site and immediately adjacent.
- Points of exit for existing drainage from the property.
- Any known historical drainage problems such as flooding, erosion, etc. including drainage complaints history from City and road drainage problems (per City and Thurston County).
- Summary of existing soil type, groundwater levels, and soil hydraulic conductivity (details to be covered in Appendix 2).
- Include references to relevant reports such as basin plans, flood studies, groundwater studies, wetland designations, sensitive area designations, environmental impact statements, environmental checklists, lake restoration plans, water quality reports, soils reports, etc. Where such reports impose additional conditions on the project applicant, state these conditions and describe any proposed mitigation measures.

3.4 Qualitative Analysis: In accordance with Core Requirement #4, all projects shall submit a qualitative analysis downstream from the site to the receiving water and upstream of the site to characterize any potential offsite flow to the site or backwatering effects.

The **qualitative analysis** must be sufficient for the City to evaluate whether the project has adequately identified potential impacts and whether proposed mitigation measures are supported by the analysis. Some “rough” quantitative analysis, which can be based on non-surveyed field data, may be necessary at this stage. A downstream

analysis of the project for a minimum of one-half of a mile is required. The analysis must also extend upstream to a point beyond any backwater effects caused by the project and should characterize any run-on to the project site. The existing or potential impacts to be evaluated and mitigated should include:

- Conveyance system capacity problems
- Localized flooding
- Erosion, including landslide hazards and erosion along streambanks and at the outfall location
- Violations of surface water quality standards as identified in a basin plan or a TMDL; or violations of groundwater quality standards in a WHPA

The analysis must include field inspections of all existing stormwater drainage systems downstream from the project and determination of whether the capacity of the drainage system(s) is adequate to handle the existing flows, flows generated by the proposed project, and any overflow. Adequacy will be evaluated based on conveyance capacity, flooding problems, erosion damage or potential, amount of freeboard in channel and pipes, and storage potential within the system. Note that site visits should be conducted during winter months and after significant precipitation events to identify undocumented surface seeps or other indicators of near surface groundwater.

3.5 Quantitative Analysis: A quantitative analysis may be required for any project deemed to need additional downstream information or where the project engineer or the SDM Administrator determines that a quantitative analysis is necessary to evaluate the off-site impacts or the capacity of the conveyance system.

The **quantitative analysis** shall include the qualitative analysis described above, as well as:

- Quantitative calculations and/or modeling analyses of on-site and off-site water quality, erosion, slope stability, and other drainage-related impacts that may be caused or aggravated by a proposed project.
- Measures for preventing impacts and for not aggravating existing impacts. (“Aggravating existing impacts” means increasing the frequency of occurrence and/or severity of an impact.)

Both the qualitative analysis and the quantitative analysis (when required) shall include descriptions and/or analyses of the following items. The descriptions shall identify existing or potential problem areas, and whether adequate mitigation can be identified (or whether more detailed quantitative analysis is necessary). References to other Abbreviated Drainage Plan Report sections (e.g., BMP sizing, conveyance,

attachments, and appendices, etc.) are encouraged to eliminate report redundancy, as long as all of the required Drainage Report issues are clearly presented:

- Map of the study area showing all areas pertinent to the analyses including:
 - Site boundaries
 - Study area boundaries
 - Study area topography
 - Boundaries of proposed land disturbance
 - Streets and prominent features
 - Downstream flow path(s)
 - Tributary drainage areas to downstream flow path(s)
 - Potential and/or existing problems
- Describe drainage system between the site and the receiving surface waters (or pothole, regional detention BMP, etc.). Provide information on pipe sizes, channel characteristics, and drainage structures. Describe emergency services located along the flow path (e.g., fire/police stations, hospitals). Describe environmentally sensitive areas, such as wetlands, etc.
- Describe off-site drainage tributary to the project. Describe any bypass drainage from the project which will not be controlled.
- Identify CARAs, WHPAs, drinking water wells, and septic systems both of record and others on the site and on adjacent property within the setback distance for stormwater BMPs identified in Chapter 7. See area maps in Appendix 8B as well as on the City's website at <https://cityoflacey.org/resource_library/stormwater-utility/>.
- The bulk of the analysis shall focus on highlights of important considerations from the existing conditions section related to the drainage system and potential problems or concerns. The following information should be provided for each existing or potential problem:
 - Magnitude of or damage caused by the problem
 - General frequency and duration
 - Return frequency of storm or flow when the problem occurs
 - Names and concerns of parties involved

- Current mitigation of the problem
- Possible cause of the problem
- Whether the project is likely to aggravate the problem or create a new one.

Abbreviated Drainage Plan Report Section 4: Soils and Infiltration Analysis

4.1 Summary of Soils and Geotechnical Data: Provide a summary of existing site soil conditions and pertinent information from the site geotechnical report. Emphasis is on data used to assess infiltration at the site. This section should include the following components as applicable:

- Number of test pits and/or soil borings conducted on the project site, and when the soil explorations were conducted.
- Soil test pit/boring locations in relation to proposed stormwater BMPs.
- Soil types on-site, both geologic/glacial (e.g., Vashon till or recessional outwash) and Natural Resources Conservation Service [NRCS] Soil Units (e.g., Indianola series, Hydrologic Soil Group A).
- Presence of any fill material, mounds, piles, etc.

4.2 Subsurface Factors: Describe subsurface soil, rock, and groundwater conditions in relation to proposed stormwater BMPs.

- Infiltration feasibility assessment, including presence of any restrictive layers within 10 feet depth below the base of any proposed infiltration BMPs.
- Determination of seasonal high groundwater levels at the site and methodology.

4.3 Infiltration Rates: Describe the methodology and results used to determine initial and design infiltration rates.

- Measured (initial) saturated hydraulic conductivity, K_{sat} , for each proposed BMP location where infiltration is feasible.
- Design (long-term) infiltration rate calculations for each proposed BMP location where infiltration is feasible. For calculations, show your work.
- If infiltration is not feasible, provide justification.

Abbreviated Drainage Plan Report Section 5: On-Site Stormwater Management and Low Impact Development (Core Requirement #5)

This section shall describe how Core Requirement #5 will be implemented for the project. Where feasible, projects shall maximize the use of LID site design strategies to

minimize effective impervious areas, vegetation loss, and stormwater runoff. See Chapter 1, Section 1.4, and Chapter 4, Section 4.3 for additional details and recommended BMPs.

LID site design in particular is intended to complement the existing conditions on the site. However, not all sites are appropriate for all LID and on-site stormwater management BMPs, as site conditions often determine the feasibility of using these techniques. The site and vicinity analysis, consistent with the requirements of Section 3, shall determine the feasibility of using these BMPs. This section should include the following components:

5.1 LID Site Design: Provide the following:

- Summary of LID site design considerations and how they are being implemented.
- Description of how LID principles and practices will be applied to the project.

5.2 Methodology: For LID BMPs and Core Requirement #5, describe the following:

- Project narrative showing how the project will fulfill the requirement for on-site management of stormwater to the extent feasible.
- How site planning and layout (per Chapter 1, Section 1.4) were implemented in the project design.
- Total area of vegetation retained.
- Specify choice of List #1 or LID Performance Standard, and describe how the project complies with the selected option.
- For projects using the list option for Core Requirement #5, an explanation and documentation, including citation of site conditions identified in a Soils Report, for any determination that an on-site stormwater management BMP was considered infeasible for the site. Information obtained and documented in the Site and Vicinity Description (Section 3, see above) shall be used to substantiate any BMP infeasibility determinations. (See also Chapter 7, Appendix 7B, for a summary of infeasibility criteria for all BMPs.)
- For projects using the LID Performance Standard option for Core Requirement #5, provide modeling results that demonstrate compliance.

5.3 LID Practices: Describe the LID BMPs that are proposed to be implemented on-site. Specify the BMP names and BMP numbers per the SDM.

5.4 Post-Construction Soil Quality and Depth:

- Specify the implementation option(s) for post-construction soil quality and depth selected for the project site (see Chapter 7, Section 7.4.1).
- Quantify the areas of disturbed soils to be amended. (Note: All lawn and landscaped areas are to meet requirements of postconstruction soil quality and depth [see Chapter 7, Section 7.4.1]. Use of compost is one way to meet the requirement). Calculations shall be provided in the Soil Management Plan (Abbreviated Drainage Plan Report Appendix 4).

5.5 Retained Trees and Aesthetics:

- Identify retained trees and newly planted trees for which impervious reduction credits are claimed (see Chapter 7, Section 7.4.3 for information on impervious surface credits associated with trees).
- Describe how the stormwater design blends-in with the site layout and landscaping.
- Aesthetic Considerations for BMPs. Describe the effort made to make the BMPs aesthetically pleasing, how BMPs will provide useable open space, and how the BMPs will fit into the landscaping plan for the property and be in keeping with any approved community plan. Stormwater BMPs should be made attractive features of the urban environment. Engineers are encouraged to be creative in shaping and landscaping BMPs. Note that BMPs shall also meet the landscaping requirements of Chapter 16.80 LMC.

Abbreviated Drainage Plan Report Section 6: Runoff Treatment and Flow Control (Core Requirements #6 and #7)

This section is not applicable for the Abbreviated Drainage Plan. If runoff treatment and/or flow control is required, the project applicant must prepare a Drainage Control Plan. Refer to Section 3.3.3.

Abbreviated Drainage Plan Report Section 7: Runoff Collection and Conveyance System

Not all projects requiring an Abbreviated Drainage Plan will need Section 7. If applicable, this section must document the methods and results of analyses used to evaluate and design the conveyance system per the hydraulic computation guidance in Chapter 6. All calculations, equations, graphs, nomographs, and references used shall be provided in Appendix 3 of the Abbreviated Drainage Plan Report (Design Calculations) and summarized in this section.

- 7.1 System Design and Layout: Provide a narrative description of the runoff collection and conveyance system. Describe the general layout, and identify all components of the system including pipes, inlets, manholes, open channels, natural channels, and culverts.
- 7.2 Conveyance System Calculations Summary: Provide summaries of all calculations for capacity of channels, culverts, drains, gutters, etc. Describe design flow rates for each component, as well as pipe/culvert/ditch dimensions, inverts, slopes, and flow capacities. Summarize the applicable performance standard (e.g., 25-year return period peak runoff) used for the conveyance system. Describe required materials or specifications for the design (e.g., rock lining for channels when velocity is exceeded, high density polyethylene pipe needed for steep slope). If a backwater analysis is required, calculations should also include grate interception calculations (spread and bypass), hydraulic grade line at structures, and tabulated results.

If used, include nomographs and tables indicating how they were used. Show headwater and tailwater analysis for culverts when necessary. Provide details on references and sources of information used.

Abbreviated Drainage Plan Report Section 8: Source Control

- 8.1 Potential Sources of Pollutants: Describe potential pollutant sources that may occur on the developed project site, based on the expected site use.
- 8.2 Source Control BMPs: List and provide a description of applicable permanent post-construction Source Control practices.
- 8.3 Source Control Checklist and Worksheet: Check and list all activities that will occur at proposed project. Use one worksheet for each activity from the checklist. Refer to Chapter 9, Appendix 9A.

Abbreviated Drainage Plan Report Section 9: Covenants, Dedications, Easements, Agreements, and Guarantees

- 9.1 Covenants, Dedications, and Easements: Information relevant to covenants, dedications, and easements need only be summarized in this section. Details shall be provided in the Establishment of Maintenance Covenant (see Section 3.4.3).

Describe legal instruments needed to guarantee preservation of drainage systems and access for maintenance purposes (attach copies if not included as part of other Abbreviated Drainage Plan submittals). Describe the organization or person who will be responsible for operation and maintenance of stormwater BMPs. For projects subject to Core Requirement #5, a declaration of covenant must be recorded for each parcel that contains on-site stormwater management BMPs, to ensure future maintenance of those BMPs. Also attach a copy of any property owners' articles of incorporation, if applicable and available.

Last, describe how utilities will be installed, any easements that affect stormwater BMPs, and how the project will ensure no conflicts exist between proposed utility locations and proposed stormwater quantity and quality control measures.

- 9.2 Agreements and Guarantees: Maintenance and/or operational bonding or other appropriate financial guarantees are required for all projects to ensure construction and functionality of stormwater BMPs in compliance with applicable standards. These guarantees shall be consistent with the most recent edition of the DG&PWS.

Abbreviated Drainage Plan Appendices

The previous sections outline the required documentation for Abbreviated Drainage Plan submittals. Where the project warrants additional technical documentation, or where the SDM Administrator determines that additional information is necessary, that information shall be included as appendices to the Abbreviated Drainage Plan, bound within the Abbreviated Drainage Plan Report document. The following highlights typical Abbreviated Drainage Plan appendices.

Abbreviated Drainage Plan Report Appendix 1: Maps and Plans

In addition to full-size plan sets submitted for land-use and civil review/approval, various maps and plan drawings shall be included in Abbreviated Drainage Plan Report Appendix 1. Maps and plans in the printed version of the Abbreviated Drainage Plan Report should be 8.5"x11" or 11"x17" fold-outs, sized as needed to show details (see preferred sizes in list below).

Appendix 1 of the Abbreviated Drainage Plan Report shall include the following maps, sized so that all pertinent details are clearly visible:

- 1a. Vicinity Map (8.5"x11"): Show city boundary, major streets, and project location.
- 1b. NRCS Soil Types Map (8.5"x11"): e.g., from Web Soil Survey.
- 1c. Existing Site Topography Map (11"x17" fold-out): Show all features described in Drainage Report Section 3, including existing ground contours at 1-foot intervals, slopes, trees, surface waters, utilities, any existing constructed improvements (prior to project development), and drainage patterns.
- 1d. Basin Map (11"x17" fold-out): Delineation of post-development site areas draining to each runoff collection point, including surface flow arrows. Identify threshold discharge areas (TDAs) where applicable. Use an appropriate scale for the project site. Show the following on the Basin Map (or on a schedule):
 - Total project area (including project boundaries)
 - Subbasin boundaries
 - Off-site area tributary

- Total hard surfaces
 - PGIS/pollution-generating hard surface (PGHS), PGPS, and total disturbed area
 - Major drainage features (such as channels and detention BMPs and floodways)
 - Conveyance data, conveyance system capacities, identifier (for reference to model output), length, slope, inverts up and down
 - Overland flow paths and distances to receiving waters
 - Average slope
 - Projects with one basin do not require a Basin Map. A Basin Map is only required for projects with two or more basins.
- 1e. Soil Data Locations Map(s) (11"x17" fold-out): Locations of soil test pits and/or borings relative to both the existing ground contours and the proposed site layout and stormwater BMP locations.
- 1f. Site Plan and Stormwater BMP Plans (11"x17" fold-out): Reduced-size duplicate(s) of the site plan and drainage plan sheet(s) from the full-size plan set submittal, showing all proposed stormwater BMPs, site improvements, finished grades, etc. The site plan shall include a table or "schedule" for the storm drainage structures used on the project, including the following information:
- Catch basin/manhole number
 - Stationing, as applicable
 - City of Lacey Ground Scale Coordinate System (conversion from Washington State Plane Coordinate System) (i.e., Northings and Eastings) if used
 - Street name and side located on, if applicable
 - Catch basin/manhole diameter or size
 - Invert elevation in/out
 - Pipe diameter in/out
 - Type of each structure and pipe, i.e., Type II, concrete
- 1g. Stormwater Details (11"x17" fold-out): Reduced-size duplicate(s) of the Drainage Details sheet(s) from the full-size plan set submittal, showing stormwater system section views, BMP details, etc.

General Site Development Drawing Requirements

It is the responsibility of the project engineer to ensure that engineering drawings submitted for review are sufficiently clear to construct the project in proper sequence, using specified methods and materials, and with sufficient dimensions to fulfill the intent of drainage laws and ordinances and these design guidelines.

Refer to the DG&PWS for requirements related to site drawing size, content, notes, organization, etc. The following notes identify and emphasize important stormwater-related components that must be reflected in the site drawings. Complete drawing requirements are provided in the DG&PWS.

- The project’s existing and proposed storm drainage along with easements, tracts, stormwater BMPs, all buffer and screening areas, off-site and on-site existing drainage courses, delineated wetlands, and associated buffers. Indicate direction of flow, size, and kind of each drainage channel, pipe, and structure. The status of existing drainage structures must be clarified as either “existing-abandon” or “existing-remove.” For on-site stormwater management BMPs, provide a scale drawing of the lot or lots, and any public-right-of-way that displays the location of the BMPs and the areas served by them.
- Include details of all on-site stormwater management BMPs that are used to help achieve compliance with Core Requirement #5. See the DG&PWS for standard drawings and details.
- Identify locations and species types for newly planted or retained trees for which impervious surface reduction credits are claimed. Supporting areas such as the flow paths for dispersion BMPs shall also be shown.
- Existing paved surfaces, including roads.
- Areas of possible significant environmental concern (gullies, ravines, swales, wetlands, steep slopes, estuaries, springs, creeks, lakes, etc.). For natural drainage features show direction of flow.
- 100-year floodplain boundary (if applicable).
- Soil logs, soil log locations, and soils within the project site as verified by field testing (and documented in Abbreviated Drainage Plan Section 4).
- Wells and WHPAs—existing and proposed, on site and on adjacent properties (both of record and not of record) within specified setbacks.
- Topographic features that may act as natural stormwater storage, infiltration, or conveyance.

- Abbreviated Drainage Plans must include a complete Construction SWPPP. See Chapter 5, Section 5.2.2 for information on the items that shall be included as part of the Construction SWPPP narrative report and drawings. See the DG&PWS for standard notes related to SWPPPs. Construction SWPPP drawings should be included as part of the Site Development Drawings package.
- Proposed grades.
- Topographic information including contour lines of the property in its existing condition. City or U.S. Geological Survey (USGS) topographic mapping must be field verified and supplemented with additional field topographic information when necessary to provide an accurate depiction of the property.
- Other typical features as listed in the DG&PWS including but not limited to utilities, lot dimensions and areas, grading/clearing setbacks from property lines, earthwork/geotechnical requirements, etc.

Detail Drawings

The most recently adopted editions of standard specifications and standard plans shall be the standards for all design and construction of stormwater BMPs not explicitly described herein. In the event of a conflict between the standard specifications, standard plans, and the manual, this manual shall prevail. When required by the City, standard specifications and general provisions for construction must be submitted with any road construction plans. The detail drawings must include the following:

- All applicable standard notes from the DG&PWS.
- A minimum of two cross-sections of each retention/detention pond and bioretention area showing original property lines, slope catch points, and all other pertinent information to adequately construct the pond or bioretention area.
- Details of all on-site stormwater management BMPs that are used to help achieve compliance with Core Requirement #5.
- Identify locations and approximate size of all permeable pavement surfaces and bioretention areas to be installed, including those that will be installed on individual lots.
- Standard open conveyance system cross-sections if applicable.
- Right-of-way cross-sections as required by the City.
- Construction recommendations from a Soils Report, if applicable.

Abbreviated Drainage Plan Report Appendix 2: Supplemental Reports and Information

Depending on site and vicinity characteristics, various special reports and studies may be required to provide supplemental information.

The various types of supplemental reports and information may include:

- Soils/geotechnical report (see required contents below)
- Wetland delineation and description
- Groundwater quality and/or hydrogeology
- Critical areas analysis and delineation
- Slope protection/stability
- Floodplain delineation/flood protection BMP conformance
- Ecology’s applicable GULD documentation and the manufacturer’s product data

Soils Report: Criteria and Contents

For virtually all project sites, particularly those sites utilizing infiltration for stormwater management, a Soils Report must be prepared that is stamped by a professional engineer with geotechnical expertise, a licensed geologist, an engineering geologist, or a hydrogeologist, and that summarizes site characteristics and demonstrates that sufficient permeable soil for infiltration exists at the proposed BMP locations.

Soil explorations shall be performed during the winter “wet season” (October 1 through April 30) to accurately assess soil saturation and seasonally-high/perched groundwater conditions. Soil explorations conducted during other times of the year may require supplemental winter groundwater monitoring prior to approval of the draft stormwater site plan.

The reporting requirements depend on the types of BMPs proposed and analyses being performed. Note that additional BMP-specific soils and infiltration testing, analysis, and documentation requirements are outlined in Chapter 7, Section 7.2 (for infiltration basins and trenches), Section 7.4.4 (for bioretention), and Section 7.4.6 (for permeable pavements). Of particular note is that if the site is located near a groundwater protection area or water supply well, the Soils Report must demonstrate and document that the criteria for infiltrating near a water supply well (refer to Chapter 7 and Chapter 8) are met. Additional soils information related to runoff treatment may be required as outlined in Chapter 8 (e.g., Section 8.6).

At a minimum, the Soils Report for all project sites must contain the following:

- Map figure showing the following:
 - Existing site topography.
 - Locations of test pits and/or test borings relative to both existing topographic contours and proposed site plan layout, including infiltration BMP locations.
 - Locations of all water supply wells and monitoring wells on or near the site.
 - Locations of any groundwater protection areas, critical aquifer recharge areas, and 1-, 5-, and 10-year time-of-travel zones for WHPAs (see CARA and WHPA maps in Appendix 8B).
- Soil test pits and/or soil borings distributed across the site sufficiently to identify and characterize variability of the soils underlying the site. Depth should extend to at least 5 feet below estimated bottom elevation of proposed infiltration BMPs and road subgrades.
- Results of on-site soils tests including but not limited to:
 - Detailed soil logs, including the elevation of the ground surface at the test pit and/or test boring location, depths to soil strata, total depth of pit or boring, soil descriptions (see below), degree of compaction, depth to groundwater (if present), and presence of any restrictive layers/stratification affecting infiltration. Soil descriptions shall include the following:
 - Deposit Type (e.g., recessional outwash, compacted till, etc.)
 - Soil Classification (e.g., SM for silty sand, or GP for poorly-graded gravel)
 - Material Description (e.g., brown silty fine sand with minor gravel)
 - Relative Density (e.g., medium dense)
 - Moisture Content, relative/measured (e.g., dry, moist, or wet; MC = 12 percent)
 - Whether glacially-compacted till is present, and if so, its depth.
 - Visual grain-size analysis
 - Grain-size distribution (required if using the grain size analysis method to estimate infiltration rates)

- Percent clay content (include type of clay, if known)
- Color/mottling
- Variations and nature of stratification
 - Logs must substantiate whether stratification does or does not exist. The licensed professional may consider additional methods of analysis to substantiate the presence of stratification.
 - Seasonal high groundwater elevation (and/or perched groundwater elevation) during the late winter “wet season” (i.e., highest expected level of groundwater). If the groundwater level varies across the site, specify the level for each proposed infiltration BMP location.
- Detailed documentation of the initial measured K_{sat} and long-term (design) infiltration rate determination for each proposed infiltration BMP location, as specified in Chapter 7, Appendix 7A.
- State whether location is suitable for infiltration and recommend a design infiltration rate.
 - Note that surface infiltration must be determined to be infeasible before deep UIC wells can be considered. Refer to Chapter 7, Appendix 7C for additional guidance and requirements related to UIC wells.
- The results of testing for a hydraulic restriction layer (groundwater, soil layer with less than 0.3 in/hr K_{sat} , glacial till, bedrock, etc.) under possible sites for infiltration BMPs. This analysis shall be performed during the winter “wet season” (October 1 through April 30). Site historical information and evidence of high groundwater in the soils can also be used.
- Any additional BMP-specific soils and infiltration testing information that is required for the project’s flow control or runoff treatment BMPs (e.g., for infiltration basins and trenches, bioretention, and permeable pavements).
- If on-site infiltration may result in shallow lateral flow (interflow), the conveyance and possible locations where that interflow may re-emerge shall be assessed by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington.
- If a retention and/or detention BMP is near the top of a slope that is regulated through local ordinance, then a geotechnical assessment addressing effects of seepage and the potential for slope failure during any precipitation event though the design event is required as part of this section of the Drainage Report.

Abbreviated Drainage Plan Report Appendix 3: Design Calculations

Design calculations must include complete calculations for the conveyance, flow control, and water quality BMPs. Calculations must be presented in a clear and orderly manner and labeled and annotated as needed to facilitate an efficient review and approval process. Required calculation components include:

- Printouts of the continuous modeling computation files (e.g., continuous modeling inputs, screenshots, and results) annotated to highlight and clarify key inputs, results, and conclusions.
- Other computer printouts or manual calculations used in the stormwater design.
- Digital copies of the model files sufficient to re-run the model including input parameters and model output files.

Abbreviated Drainage Plan Report Appendix 4: Soil Management Plan

If Post-construction Soil Quality and Depth BMP is used on site (refer to Chapter 7, Section 7.4.1), a Soil Management Plan must be included in the project submittal. The Soil Management Plan must include the following:

- A site map showing areas to be fenced and left undisturbed during construction, and areas that will be amended at the turf or planting bed rates
- Determination of soil conditions
- Identified soil quality implementation option
- Calculations of the amounts of compost, compost amended topsoil, and mulch to be used on the site.

General guidance on these procedures can be found in the Building Soil manual (Stenn, et al. 2018), available at <<https://www.soilsforsalmon.org/>>.

Abbreviated Drainage Plan Attachments

Abbreviated Drainage Plan Attachment 1: Construction SWPPP Report

Chapter 5, Section 5.2.2, of this manual describes the items that shall be included in the Construction SWPPP report. At a minimum, all 13 Construction Stormwater Pollution Prevention elements in accordance with Core Requirement #2 (Chapter 2, Section 2.4.2) must be addressed. The Construction SWPPP shall be implemented starting prior to any land disturbance and continue until final stabilization. The City may require the completion, submission, and approval of a wet-season amendment to the Construction SWPPP, which may include additional construction BMPs (e.g., stabilized parking, dewatering provisions, etc.), stopping work during the wettest months, and/or a bond for maintenance of the downstream system. See Chapter 5, Section 5.2.3 for more details.

Note: The Construction SWPPP consists of two parts: a narrative report and drawings. **A complete Construction SWPPP (both report and drawings) is required as part of the Drainage Control Plan submittal.** Note that the Construction SWPPP drawings should be included in the drawing packet required as Abbreviated Drainage Plan Appendix 1.

Abbreviated Drainage Plan Attachment 2: Maintenance and Source Control Manual

A full Maintenance and Source Control Manual is not required for the Abbreviated Drainage Plan. If applicable, provide the manufacturer's maintenance recommendations for proprietary manufactured BMPs.

3.3.3 Drainage Control Plan

The Drainage Control Plan is the full submittal package meeting all core requirements per Chapter 2, Figures 2.1 and 2.2. The Drainage Control Plan submittal package includes the following components: Drainage Control Plan Report, Site Development Drawings, Construction SWPPP, Maintenance and Source Control Manual, and any plan appendices. An overview of the components of a typical Drainage Control Plan is presented in Table 3.2. The Construction SWPPP consists of two parts: a narrative report, and temporary erosion & sediment control (TESC) drawings, which should be included in the plan set with the other Site Development Drawings. Additional details on each component of the Drainage Control Plan are provided in the following sections. Refer to the DG&PWS for requirements related to the number of copies and dimensions required by the City.

Phased Project Submittals

Phased projects shall be completed in accordance with approved Drainage Control Plans and in accordance with phased development requirements placed upon the development by the City. Phasing of projects shall not result in a reduction of drainage control requirements. Drawings showing the overall project, clearly delineating phase boundaries, and estimating dates of construction (if known), shall be part of any initial submittal.

Drainage Control Plan Report

The Drainage Control Plan Report is a major component of the Drainage Control Plan. The Drainage Control Plan Report shall include detailed information and data related to stormwater planning and design that facilitate plan review. Specific components of the Drainage Control Plan Report are described in detail below.

A Drainage Control Plan Report template is available on the City's website.

Cover Sheet: The Drainage Control Plan Report must have a cover sheet with the following information included:

- Title "Drainage Control Plan Report for (project name)"

- Project location
- Project applicant’s name, address, telephone number, and email address
- Project engineer’s name, company name, address, telephone number, and email address
- Date of submittal

The initial submittal shall be titled “DRAFT Drainage Control Plan Report for (project name).”

Project Engineer’s Certification: The project engineer responsible for completion of a Drainage Control Plan submittal as described herein shall be a professional engineer licensed in Washington State. All plans and specifications, calculations, certifications, as-built drawings, and all other submittals which will become part of the permanent record of the project must be dated and bear the project engineer’s official seal and signature.

The Drainage Control Plan Report shall contain a page with the project engineer’s seal and the following statement:

“I hereby state that this Drainage Control Plan Report for _____ (name of project) has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Lacey does not and will not assume liability for the sufficiency, suitability, or performance of drainage BMPs prepared by me.”

Table of Contents: Show the page number for each section of the report. Show page numbers of appendices. Identify all attachments included with the report. All pages of the Drainage Control Plan Report shall be numbered.

All Drainage Control Plan Reports shall have each of the following section titles and subsections (if some sections do not apply, list and mark N.A.):

Drainage Control Plan Report Section 1: Project Overview

- 1.1 Site Information: Parcel number(s), address or legal description of site property, current zoning, streets/general vicinity, property owner(s), total project site area, surrounding land uses.
- 1.2 Project Description: Provide a brief description of the proposed development project (type, size, location, proposed improvements including structures and paving, phasing (if applicable), and for additions/remodels only, current assessed value and cost of improvements excluding land value).
- 1.3 Proposed Stormwater Drainage Design: Describe the overall drainage plan concept, proposed permanent stormwater BMPs, their locations and distribution across the site, and proposed ownership (e.g., private or public). Briefly describe all stormwater

features proposed to be installed for runoff collection, conveyance, runoff treatment, and infiltration and/or discharge (types, sizes, and locations). If applicable, describe the detention system, control structure/outlet, and spillways. See Chapter 8 for more details regarding stormwater BMPs that could be adopted and maintained by the City.

1.4 Subarea Data Tabulation: Provide data tables for existing and proposed surface areas, including hard surface areas by type (roof, driveway, walkway, etc.); new and replaced impervious, pervious, and hard surface areas; PGIS and PGPS; disturbed pervious (such as landscaped areas); converted vegetation areas; and undisturbed areas. Example subarea data tabulations for existing and proposed surface areas are provided in Tables 3.6 and 3.7.

Table 3.6. Example Existing Site Land Coverage Tabulation for a Drainage Control Plan.			
Existing Surface	Surface Type	Area (square feet)	Area (acres)
Driveway	Hard/Impervious		
Walkway	Hard/Impervious		
Roof	Hard/Impervious		
Forested/Trees	Pervious		
Pasture/Landscaping	Pervious		
Total Site/Parcel Area			

Table 3.7. Example Proposed Site Land Use Coverage Tabulation for a Drainage Control Plan.				
Proposed Surface	Surface Type	Pollutant Generating	Area (square feet)	Area (acres)
Roadway	Hard/Impervious	Yes - PGIS		
Driveway	Hard/Impervious	Yes - PGIS		
Walkway	Hard/Impervious	No		
Roof	Hard/Impervious	No		
Permeable Pavement	Hard/Pervious	Yes - PGPS		
Landscaping	Pervious	Yes - PGPS		
Undisturbed (e.g., tree tract)	Pervious	No		
Other: _____				
Total Project Area				

PGIS = Pollution Generating Impervious Surface

PGPS = Pollution Generating Pervious Surface

Drainage Control Plan Report Section 2: Development Conditions and Requirements

2.1 Project Vesting: Specify applicable versions of SDM and DG&PWS (i.e., 2022 SDM); if other than current versions were used, provide justification.

2.2 Permits Required: List applicable permits for the project that are required by the City and other agencies. Describe type of permit for which the project applicant is

applying, and describe other permits required (e.g., hydraulic permits, USACE Section 404 Permit, wetlands development permit, etc.) and present status.

Construction of stormwater BMPs may require additional permits from other agencies. These additional permits may contain more restrictive drainage control requirements. This section should provide the title of any other necessary permits, the agencies requiring the other permits, and identify the permit requirements that affect the project.

Other agencies including, but not limited to, those listed in Table 3.8 may require drainage review for a proposed project’s impact on surface waters, stormwater, and conveyance systems. The project applicant should take care to note that these other agency drainage requirements are separate from, and in addition to, City’s drainage requirements. The project applicant will be responsible to coordinate joint agency drainage review, including resolution of any conflicting requirements between agencies.

Table 3.8. Examples of Applicable City and Agency Permits to List in a Drainage Control Plan.	
Agency	Permit/Approval
Thurston County Environmental Health Department	On-site Sewage Disposal and Well Permits
Washington State Department of Transportation (WSDOT)	Developer/Local Agency Agreement
Washington State Department of Ecology	Short Term Water Quality Modification Approval
Washington State Department of Fish and Wildlife	Hydraulic Project Approval
Washington State Department of Ecology	Dam Safety Permit
United States Army Corps of Engineers	Section 10 Permit
United States Army Corps of Engineers	Section 401 Certification
United States Army Corps of Engineers	Section 404 Permit
City of Lacey	Shoreline Substantial Development Permits, Conditional Use Permits, and Variance Permits
City of Lacey	Right-of-Way Access Permit
City of Lacey	Wetland Development Permit

* This is not a complete list of possible permits that may be required.

2.3 Project Type and Size: Specify the project type as either new development or redevelopment (per definitions in this manual’s glossary); the total area of new and/or replaced hard surfaces; the total area to be disturbed; and the results from the applicable flow chart in Figure 2.1 or 2.2 of applicable Core Requirements. Include the valuation of the proposed improvements, including interior improvements, for redevelopment projects.

2.4 Critical Areas: Projects that involve work in or near critical areas must demonstrate compliance with Chapter 16.54 LMC. Describe the presence of any critical areas or environmentally sensitive areas, including wetlands, ESA species habitat, WHPAs, CARAs, geologically hazardous areas, steep slopes, etc. on the project site. Include

any specific requirements of a basin plan or water quality improvement program (such as the Henderson Inlet Watershed TMDL) for the project area. See maps in Appendix 8B for WHPAs and CARAs. The Drainage Control Plan also must indicate any site design and construction requirements that implement the applicable critical area standards and requirements.

- 2.5 **Core Requirements:** List the core requirements that apply to the project, and describe how they are being addressed. Utilize applicable flow charts and provide appropriate data to determine which Core Requirements apply to the project. Include justification for those core requirements that do not apply. For Core Requirement #5, describe how LID principles were applied to the site planning process, and indicate whether the project **used** the mandatory list option, or the LID performance standard option, and provide complete documentation demonstrating compliance with either approach. Refer to Drainage Control Plan Report Section 5 for additional guidance.

Drainage Control Plan Report Section 3: Site and Vicinity Description

A description of the site and vicinity analysis shall be submitted as part of the Drainage Control Plan submittal. Information in this section should also be used to help prepare the Construction SWPPP. Where subsequent report sections call for more details on these issues (e.g., soils, wells, septic systems), a brief description and reference to the specific Drainage Control Plan Report section or appendix is sufficient.

- 3.1 **Existing Physiography:** Describe the existing physical setting of the project site, including, but not limited to, the items listed below.
- Existing topography and slopes.
 - Existing land cover, including trees, shrubs, lawn, etc.
 - Creeks, lakes, ponds, wetlands, ravines, gullies, springs, or other surface waters, on or downgradient of the property.
 - Determine whether the project is within the potential flood hazard area as defined in Chapter 14.34 LMC, show the 100-year flood hazard area on the plans. If project is determined to be in the flood hazard area additional requirements may apply per Chapter 14.34 LMC.
- 3.2 **Existing Improvements:** Describe any existing constructed improvements and other non-natural features on the project site, including, but not limited to, wells, septic tanks, septic drainfields, storage tanks, pipes, utilities (pedestals, lines, vaults, etc.), structures, pavement, encumbrances, or other features that will be removed or affected by the site development.
- Drinking water wells, both active and abandoned, shall be shown on the plans or as-builts (if found during construction).

- If no wells are found, indicate so.
- The project engineer shall inquire with the Thurston County Environmental Health Department and neighboring property owners as necessary to obtain location of wells that are not of record.
- Septic systems, both active and abandoned, shall be shown on the plans or as-builts (if found during construction).
 - If no septic systems are found, indicate so.
 - The project engineer shall inquire with the Thurston County Environmental Health Department and neighboring property owners as necessary to obtain location of septic systems that are not of record.
- Identify the existence of fuel tanks, in-use or abandoned. Fuel tanks shall be shown on the plans or as-builts (if found during construction). If fuel tanks will be abandoned, contact the Thurston County Environmental Health Department for specific instructions. If no fuel tanks are found, indicate so.

3.3 Drainage Patterns: Describe existing drainage patterns at the project site and adjacent lands, and proposed accommodations and/or alterations to existing drainage flows, including:

- Off-site drainage to the property, including slopes and drainage patterns.
- Drains, channels, and swales, within the project site and immediately adjacent.
- Points of exit for existing drainage from the property.
- Any known historical drainage problems such as flooding, erosion, etc. including drainage complaints history from City and road drainage problems (per City of Lacey and Thurston County).
- Summary of existing soil type, groundwater levels, and soil hydraulic conductivity (details to be covered in Appendix 2).
- Include references to relevant reports such as basin plans, flood studies, groundwater studies, wetland designations, sensitive area designations, environmental impact statements, environmental checklists, lake restoration plans, water quality reports, soils reports, etc. Where such reports impose additional conditions on the project applicant, state these conditions and describe any proposed mitigation measures.

3.4 Qualitative Analysis: In accordance with Core Requirement #4, all projects shall submit a qualitative analysis downstream from the site to the receiving water and

upstream of the site to characterize any potential offsite flow to the site or backwatering effects.

The **qualitative analysis** must be sufficient for the City to evaluate whether the project has adequately identified potential impacts and whether proposed mitigation measures are supported by the analysis. Some “rough” quantitative analysis, which can be based on non-surveyed field data, may be necessary at this stage. A downstream analysis of the project for a minimum of one-half of a mile is required. The analysis must also extend upstream to a point beyond any backwater effects caused by the project and should characterize any run-on to the project site. The existing or potential impacts to be evaluated and mitigated should include:

- Conveyance system capacity problems
- Localized flooding
- Erosion, including landslide hazards and erosion along streambanks and at the outfall location
- Violations of surface water quality standards as identified in a basin plan or a TMDL; or violations of groundwater quality standards in a WHPA

The analysis must include field inspections of all existing stormwater drainage systems downstream from the project and determination of whether the capacity of the drainage system(s) is adequate to handle the existing flows, flows generated by the proposed project, and any overflow. Adequacy will be evaluated based on conveyance capacity, flooding problems, erosion damage or potential, amount of freeboard in channel and pipes, and storage potential within the system. Note that site visits should be conducted during winter months and after significant precipitation events to identify undocumented surface seeps or other indicators of near surface groundwater.

3.5 Quantitative Analysis: A quantitative analysis may be required for any project deemed to need additional downstream information or where the project engineer or the SDM Administrator determines that a quantitative analysis is necessary to evaluate the off-site impacts or the capacity of the conveyance system.

The **quantitative analysis** shall include the qualitative analysis described above, as well as:

- Quantitative calculations and/or modeling analyses of on-site and off-site water quality, erosion, slope stability, and other drainage-related impacts that may be caused or aggravated by a proposed project.
- Measures for preventing impacts and for not aggravating existing impacts. (“Aggravating existing impacts” means increasing the frequency of occurrence and/or severity of an impact.)

- Documentation of how flow control and runoff treatment BMPs identified in the Drainage Control Plan will mitigate the potential to create new problems or aggravate existing conditions. In many cases, design of flow control and runoff treatment BMPs according to the procedures contained in this manual will be adequate demonstration of mitigation. However, upon review of this analysis and the severity of an existing problem, the City may require more detailed analysis and/or additional mitigation measures.

Both the qualitative analysis and the quantitative analysis (when required) shall include descriptions and/or analyses of the following items. The descriptions shall identify existing or potential problem areas, and whether adequate mitigation can be identified (or whether more detailed quantitative analysis is necessary). References to other Drainage Control Plan Report sections (e.g., BMP sizing, conveyance, attachments, and appendices, etc.) are encouraged to eliminate report redundancy, as long as all of the required Drainage Control Plan Report issues are clearly presented:

- Map of the study area showing all areas pertinent to the analyses including:
 - Site boundaries
 - Study area boundaries
 - Study area topography
 - Boundaries of proposed land disturbance
 - Streets and prominent features
 - Downstream flow path(s)
 - Tributary drainage areas to downstream flow path(s)
 - Potential and/or existing problems.
- Describe drainage system between the site and the receiving surface waters (or pothole, regional detention BMP, etc.). Provide information on pipe sizes, channel characteristics, and drainage structures. Describe emergency services located along the flow path (e.g., fire/police stations, hospitals). Describe environmentally sensitive areas, such as wetlands, etc.
- Describe off-site drainage tributary to the project. Describe any bypass drainage from the project which will not be controlled.
- Identify CARAs, WHPAs, drinking water wells, and septic systems both of record and others on the site and on adjacent property within the setback distance for stormwater BMPs identified in Chapter 7. See area maps in Appendix 8B as well

as on the City's website at <https://cityoflacey.org/resource_library/stormwater-utility/>.

- The bulk of the analysis shall focus on highlights of important considerations from the existing conditions section related to the drainage system and potential problems or concerns. The following information should be provided for each existing or potential problem:
 - Magnitude of or damage caused by the problem
 - General frequency and duration
 - Return frequency of storm or flow when the problem occurs
 - Names and concerns of parties involved
 - Current mitigation of the problem
 - Possible cause of the problem
 - Whether the project is likely to aggravate the problem or create a new one.

Drainage Control Plan Report Section 4: Soils and Infiltration Analysis

4.1 Summary of Soils and Geotechnical Data: Provide a summary of existing site soil conditions and pertinent information from the site geotechnical report. Emphasis is on data used to assess infiltration at the site. This section should include the following components:

- Number of test pits and/or soil borings conducted on the project site, and when the soil explorations were conducted.
- Soil test pit/boring locations in relation to proposed stormwater BMPs.
- Soil types on-site, both geologic/glacial (e.g., Vashon till or recessional outwash) and NRCS Soil Units (e.g., Indianola series, Hydrologic Soil Group A).
- Presence of any fill material, mounds, piles, etc.

4.2 Subsurface Factors: Describe subsurface soil, rock, and groundwater conditions in relation to proposed stormwater BMPs.

- Infiltration feasibility assessment, including presence of any restrictive layers within 10 feet depth below the base of any proposed infiltration BMPs.
- Determination of seasonal high groundwater levels at the site and methodology.

4.3 Infiltration Rates: Describe the methodology and results used to determine initial and design infiltration rates.

- Measured (initial) saturated hydraulic conductivity, K_{sat} , for each proposed BMP location where infiltration is feasible.
- Design (long-term) infiltration rate calculations for each proposed BMP location where infiltration is feasible. For calculations, show your work.
- If infiltration is not feasible, provide justification.

Drainage Control Plan Report Section 5: On-Site Stormwater Management and Low Impact Development (Core Requirement #5)

This section shall describe how Core Requirement #5 will be implemented for the project. Where feasible, projects shall maximize the use of LID site design strategies to minimize effective impervious areas, vegetation loss, and stormwater runoff (before selecting permanent flow control and runoff treatment BMPs). See Chapter 1, Section 1.4, and Chapter 4, Section 4.3 for additional details and recommended BMPs.

LID site design in particular is intended to complement the existing conditions on the site. However, not all sites are appropriate for all LID and on-site stormwater management BMPs, as site conditions often determine the feasibility of using these techniques. The site and vicinity analysis, consistent with the requirements of Section 3, shall determine the feasibility of using these BMPs. This section should include the following components:

5.1 LID Site Design: Provide the following:

- Summary of LID site design considerations and how they are being implemented.
- Description of how LID principles and practices will be applied to the project.

5.2 Methodology: For LID BMPs and Core Requirement #5, describe the following:

- Project narrative showing how the project will fulfill the requirement for on-site management of stormwater to the extent feasible.
- How site planning and layout (per Chapter 1, Section 1.4) were implemented in the project design.
- Total area of vegetation retained.
- Specify choice of List #2 or LID Performance Standard, and describe how the project complies with the selected option.

- For projects using the list option for Core Requirement #5, an explanation and documentation, including citation of site conditions identified in a Soils Report, for any determination that an on-site stormwater management BMP was considered infeasible for the site. Information obtained and documented in the Site and Vicinity Description (Section 3, see above) shall be used to substantiate any BMP infeasibility determinations. (See also Chapter 7, Appendix 7B, for a summary of infeasibility criteria for all BMPs.)
- For projects using the LID Performance Standard option for Core Requirement #5, provide modeling results that demonstrate compliance.

5.3 LID Practices: Describe the LID BMPs that are proposed to be implemented on-site. Specify the BMP names and BMP numbers per the SDM.

5.4 Post-Construction Soil Quality and Depth:

- Specify the implementation option(s) for post-construction soil quality and depth selected for the project site (see Chapter 7, Section 7.4.1).
- Quantify the areas of disturbed soils to be amended. (Note: All lawn and landscaped areas are to meet requirements of postconstruction soil quality and depth [see Chapter 7, Section 7.4.1]. Use of compost is one way to meet the requirement). Calculations shall be provided in the Soil Management Plan (Drainage Control Plan Report Appendix 4).

5.5 Retained Trees and Aesthetics:

- Identify retained trees and newly planted trees for which impervious reduction credits are claimed (see Chapter 7, Section 7.4.3 for information on impervious surface credits associated with trees).
- Describe how the stormwater design blends-in with the site layout and landscaping.
- Aesthetic Considerations for BMPs. Describe the effort made to make the BMPs aesthetically pleasing, how BMPs will provide useable open space, and how the BMPs will fit into the landscaping plan for the property and be in keeping with any approved community plan. Stormwater BMPs should be made attractive features of the urban environment. Engineers are encouraged to be creative in shaping and landscaping BMPs. Note that BMPs shall also meet the landscaping requirements of Chapter 16.80 LMC.

Drainage Control Plan Report Section 6: Runoff Treatment and Flow Control (Core Requirements #6 and #7)

6.1 Runoff Treatment Selection: Summarize the selection process for runoff treatment BMPs. Specify the runoff treatment performance goals that are required for the

project site (e.g., oil control and enhanced treatment), and the basis for the selected BMPs (e.g., site location in a CARA Category 1).

6.2 BMP Types & Descriptions: Specify and describe the runoff treatment BMPs that are proposed to be implemented on-site to meet the required performance standards. If separate flow control BMPs are proposed, describe those BMPs and how they are proposed to be implemented. Use the BMP names and BMP numbers per the SDM.

6.3 Facility Selection and Design Data: Describe facility selection and sizing, both minimum required size/capacity and proposed size/capacity. If proprietary manufactured BMPs (or “emerging technologies”) are proposed to be implemented, provide Ecology’s applicable GULD (General Use Level Designation) documentation and the manufacturer’s product data in Appendix 2 of the Drainage Control Plan Report. Provide the manufacturer’s maintenance recommendations in Drainage Control Plan Report Attachment 2, the project’s Maintenance and Source Control Manual.

6.4 Design Calculations: Provide design calculations for all proposed BMPs. Complete engineering calculations, including hydrologic modeling analyses and documentation, must be included with the report. Generally, calculations should be summarized in this subsection of the Drainage Control Plan Report, with computer printouts placed in Appendix 3 and referenced where appropriate.

The project engineer shall provide complete calculations for the project’s flow control and runoff treatment system components. All WWHM inputs and results shall be provided in Appendix 3 and summarized in this section. All relevant work/calculations shall be submitted for City review, either in this section of the report or in included appendices if needed.

- Describe the sizing required and provided by each BMP.
- For infiltration BMPs, specify the design infiltration rate, describe how rate was determined, and provide calculations (“show your work”).
- All calculations shall be keyed to features shown on the Site Development Drawings.
- Include a table that identifies the design BMP stage expected for the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence interval flows.

If hydrologic modeling (see Chapters 2, 6, 7, and 8) is required, the project engineer and project applicant shall:

- Use an approved continuous simulation runoff model.
 - Continuous simulation runoff models must receive prior concurrence from the City before being used for BMP design. Ecology’s approval status for other

continuous simulation runoff models is provided in the “Additional Resources” section of the online 2019 Ecology Manual:

<<https://fortress.wa.gov/ecy/ezshare/wq/Permits/Flare/2019SWMMWW/2019SWMMWW.htm>>

- Document modeling methods, assumptions, parameters, data sources, and all other relevant information to the analysis.
- If model parameters are used that are outside the standards of practice, or if parameters are different than those standards, justify the parameters.
- Provide hard copies of the model inputs and outputs, with annotations (clear, hand-written notes are acceptable) in Appendix 3 of the Drainage Control Plan Report (Design Calculations) specifically highlighting key model inputs and results. This will provide clarity and facilitate a more efficient review and approval process.
- Provide digital copies of the model files sufficient to re-run the model and include input parameters, as well as model output files to the City.
- Projects taking an impervious surface reduction credit for newly planted or retained trees (see tree planting and tree retention in Chapter 7, Section 7.4.3) must provide those calculations and documentation on site plans for the locations of the trees. Projects using full dispersion or full downspout infiltration BMPs must provide information to confirm conformance with design requirements that allow removal of the associated drainage areas from computer model input.

For design of runoff treatment BMPs specifically, if bioretention and/or infiltration below PGHS through adequate soils (see Chapter 8, Section 8.6.3) will be used to help meet runoff treatment requirements, the runoff model output files must include the volume of water that has been treated through those BMPs. The summation of those volumes and the volume treated through a centralized, conventional treatment system must meet or exceed 91 percent of the total stormwater runoff file. This sum of volumes must include:

- Stormwater that has infiltrated through a bioretention area, and stormwater that has infiltrated below PGHS (e.g., permeable pavement) through adequate soils.
- Stormwater that passes through a properly-sized runoff treatment BMP. Note that stormwater that is re-collected below a bioretention area and routed to a centralized runoff treatment BMP must not be counted twice.
- Subtraction of any stormwater that does not receive treatment due to bypass of, or overflow from a runoff treatment BMP or a bioretention area (if the overflow is not subsequently routed to a runoff treatment BMP).

For a subdivision project, document assumptions related to roof, driveway, and other hard surface lot coverages (as well as contributing pervious areas) that have been used in the design and sizing of BMPs.

Drainage Control Plan Report Section 7: Runoff Collection & Conveyance System

This section must document the methods and results of analyses used to evaluate and design the conveyance system per the hydraulic computation guidance in Chapter 6. All calculations, equations, graphs, nomographs, and references used shall be provided in Appendix 3 of the Drainage Control Plan (Design Calculations) and summarized in this section.

7.1 System Design & Layout: Provide a narrative description of the runoff collection and conveyance system. Describe the general layout, and identify all components of the system including pipes, inlets, manholes, open channels, natural channels, and culverts.

7.2 Conveyance System Calculations Summary: Provide summaries of all calculations for capacity of channels, culverts, drains, gutters, etc. Describe design flow rates for each component, as well as pipe/culvert/ditch dimensions, inverts, slopes, and flow capacities. Summarize the applicable performance standard (e.g., 25-year return period peak runoff) used for the conveyance system. Describe required materials or specifications for the design (e.g., rock lining for channels when velocity is exceeded, high density polyethylene pipe needed for steep slope). If a backwater analysis is required, calculations should also include grate interception calculations (spread and bypass), hydraulic grade line at structures, and tabulated results.

If used, include nomographs and tables indicating how they were used. Show headwater and tailwater analysis for culverts when necessary. Provide details on references and sources of information used.

Drainage Control Plan Report Section 8: Source Control

8.1 Potential Sources of Pollutants: Describe potential pollutant sources that may occur on the developed project site, based on the expected site use.

8.2 Source Control BMPs: List and provide a description of applicable permanent post-construction Source Control practices that will be described in greater detail in the Maintenance and Source Control Manual (Drainage Control Plan Attachment 2). Refer to Chapter 9, Section 9.2 for Source Control BMP Selection.

8.3 Source Control Checklist and Worksheet: Check and list all activities that will occur at proposed project. Use one worksheet for each activity from the checklist. Refer to Chapter 9, Appendix 9A.

Drainage Control Plan Report Section 9: Covenants, Dedications, Easements, Agreements, and Guarantees

9.1 Covenants, Dedications, and Easements: Information relevant to covenants, dedications, and easements need only be summarized in this section. Details shall be provided in the Maintenance and Source Control Manual and the Establishment of Maintenance Covenant (see Section 3.4.3).

Describe legal instruments needed to guarantee preservation of drainage systems and access for maintenance purposes (attach copies if not included as part of other Drainage Control Plan submittals). Describe the organization or person who will be responsible for operation and maintenance of storm drainage BMPs. For projects subject to Core Requirement #5, a declaration of covenant must be recorded for each parcel that contains on-site stormwater management BMPs, to ensure future maintenance of those BMPs. Also attach a copy of any property owners' articles of incorporation, if applicable and available.

Last, describe how utilities will be installed, any easements that affect stormwater BMPs, and how the project will ensure no conflicts exist between proposed utility locations and proposed stormwater quantity and quality control measures.

9.2 Agreements and Guarantees: Maintenance and/or operational bonding or other appropriate financial guarantees are required for all projects to ensure construction and functionality of drainage BMPs in compliance with applicable standards. These guarantees shall be consistent with the most recent edition of the DG&PWS.

Drainage Control Plan Appendices

The previous sections outline the required documentation for Drainage Control Plan submittals. Where the project warrants additional technical documentation, or where the SDM Administrator determines that additional information is necessary, that information shall be included as appendices to the Drainage Control Plan, bound within the Drainage Control Plan Report document. The following highlights typical Drainage Control Plan appendices.

Drainage Control Plan Report Appendix 1: Maps and Plans

In addition to full-size plan sets submitted for land-use and civil review/approval, various maps and plan drawings shall be included in Drainage Control Plan Report Appendix 1. Maps and plans in the printed version of the Drainage Control Plan Report should be 8.5"x11" or 11"x17" fold-outs, sized as needed to show details (see preferred sizes in list below).

Appendix 1 of the Drainage Control Plan Report shall include the following maps, sized so that all pertinent details are clearly visible:

- 1a. Vicinity Map (8.5"x11"): Show city boundary, major streets, and project location.
- 1b. NRCS Soil Types Map (8.5"x11"): e.g., from Web Soil Survey.

- 1c. Existing Site Topography Map (11"x17" fold-out): Show all features described in Drainage Control Plan Report Section 3, including existing ground contours at 1-foot intervals, slopes, trees, surface waters, utilities, any existing constructed improvements (prior to project development), and drainage patterns.
- 1d. Basin Map (11"x17" fold-out): Delineation of post-development site areas draining to each runoff collection point, including surface flow arrows. Identify TDAs where applicable. Use an appropriate scale for the project site. Show the following on the Basin Map (or on a schedule):
- Total project area (including project boundaries)
 - Subbasin boundaries
 - Off-site area tributary
 - Total hard surfaces
 - PGHS, PGIS, PGPS, and total disturbed area
 - Major drainage features (such as channels and detention BMPs and floodways)
 - Conveyance data, conveyance system capacities, identifier (for reference to model output), length, slope, inverts up and down
 - Overland flow paths and distances to receiving waters
 - Average slope
- 1e. Soil Data Locations Map(s) (11"x17" fold-out): Locations of soil test pits and/or borings relative to both the existing ground contours and the proposed site layout and stormwater BMP locations.
- 1f. Site Plan & Stormwater BMP Plans (11"x17" fold-out): Reduced-size duplicate(s) of the site plan & drainage plan sheet(s) from the full-size plan set submittal, showing all proposed stormwater BMPs, site improvements, finished grades, etc. The drainage plan shall include a table or "schedule" for the storm drainage structures used on the project, including the following information:
- Catch basin/manhole number
 - Stationing, as applicable
 - City of Lacey Ground Scale Coordinate System (conversion from Washington State Plane Coordinate System) (i.e., Northings and Eastings) if used
 - Street name and side located on, if applicable

- Catch basin/manhole diameter or size
- Invert elevation in/out
- Pipe diameter in/out
- Type of each structure and pipe, i.e., Type II, concrete

1g. Stormwater Details (11"x17" fold-out): Reduced-size duplicate(s) of the Drainage Details sheet(s) from the full-size plan set submittal, showing stormwater system section views, BMP details, etc.

General Site Development Drawing Requirements

It is the responsibility of the project engineer to ensure that engineering drawings submitted for review are sufficiently clear to construct the project in proper sequence, using specified methods and materials, and with sufficient dimensions to fulfill the intent of drainage laws and ordinances and these design guidelines.

Refer to the DG&PWS for requirements related to site drawing size, content, notes, organization, etc. The following notes identify and emphasize important stormwater-related components that must be reflected in the site drawings. Complete drawing requirements are provided in the DG&PWS.

- The project's existing and proposed storm drainage along with easements, tracts, drainage BMPs, all buffer and screening areas, off-site and on-site existing drainage courses, delineated wetlands, and associated buffers. Indicate direction of flow, size, and kind of each drainage channel, pipe, and structure. The status of existing drainage structures must be clarified as either "existing-abandon" or "existing-remove." For on-site stormwater management BMPs, provide a scale drawing of the lot or lots, and any public-right-of-way that displays the location of the BMPs and the areas served by them.
- Include details of all on-site stormwater management BMPs that are used to help achieve compliance with Core Requirement #5. If distributed bioretention areas and/or storage below permeable pavement are used to also meet Core Requirements #6 and/or 7, provide drawing details to confirm accurate BMP representation in the runoff models (submitted as part of Drainage Report Control Plan Report Section 6). See the DG&PWS for standard drawings and details.
- Identify locations and species types for newly planted or retained trees for which impervious surface reduction credits are claimed. Supporting areas such as the flow paths for dispersion BMPs shall also be shown.
- If distributed bioretention areas and/or infiltration below pollution-generating hard surfaces are used to help meet treatment requirements, provide details to

confirm accurate representation in the runoff model (submitted as part of Drainage Control Plan Report Section 6).

- Existing paved surfaces, including roads.
- Areas of possible significant environmental concern (gullies, ravines, swales, wetlands, steep slopes, estuaries, springs, creeks, lakes, etc.). For natural drainage features show direction of flow.
- 100-year floodplain boundary (if applicable).
- Soil logs, soil log locations, and soils within the project site as verified by field testing (and documented in Drainage Control Plan Report Section 4).
- Wells and WHPAs—existing and proposed, on site and on adjacent properties (both of record and not of record) within specified setbacks.
- Topographic features that may act as natural stormwater storage, infiltration, or conveyance.
- Drainage Control Plan Reports must include a complete Construction SWPPP. See Chapter 5, Section 5.2.2, of this manual for information on the items that shall be included as part of the Construction SWPPP narrative report and drawings. See the DG&PWS for standard notes related to SWPPPs. Construction SWPPP drawings should be included as part of the Site Development Drawings package.
- Proposed grades.
- Topographic information including contour lines of the property in its existing condition. City or USGS topographic mapping must be field verified and supplemented with additional field topographic information when necessary to provide an accurate depiction of the property.
- Other typical features as listed in the DG&PWS including but not limited to utilities, lot dimensions and areas, grading/clearing setbacks from property lines, earthwork/geotechnical requirements, etc.

Detail Drawings

The most recently adopted editions of standard specifications and standard plans shall be the standards for all design and construction of stormwater BMPs not explicitly described herein. In the event of a conflict between the standard specifications, standard plans, and the manual, this manual shall prevail. When required by the City, standard specifications and general provisions for construction must be submitted with any road construction plans. The detail drawings must include the following:

- All applicable standard notes from the DG&PWS.

- A minimum of two cross-sections of each retention/detention pond and bioretention area showing original property lines, slope catch points, and all other pertinent information to adequately construct the pond or bioretention area.
- Details of all on-site stormwater management BMPs that are used to help achieve compliance with Core Requirement #5. If distributed bioretention areas and/or storage below permeable pavement are used, provide details to confirm accurate BMP representation in the runoff models (submitted as part of Drainage Control Plan Report Section 6).
- Identify locations and approximate size of all permeable pavement surfaces and bioretention areas to be installed, including those that will be installed on individual lots.
- If distributed bioretention areas and/or infiltration below pollution-generating hard surfaces are used to help meet treatment requirements, provide details to confirm accurate representation in the runoff model (submitted as part of Drainage Control Plan Report Section 6).
- Standard open conveyance system cross-sections if applicable.
- Right-of-way cross-sections as required by the City.
- Construction recommendations from a Soils Report, if applicable.

Drainage Control Plan Report Appendix 2: Supplemental Reports and Information

Depending on site and vicinity characteristics, various special reports and studies may be required to provide supplemental information.

The various types of supplemental reports and information may include:

- Soils/geotechnical report (see required contents below)
- Wetland delineation and description
- Groundwater quality and/or hydrogeology
- Critical areas analysis and delineation
- Slope protection/stability
- Floodplain delineation/flood protection BMP conformance
- Ecology's applicable GULD documentation and the manufacturer's product data.

Soils Report: Criteria and Contents

For virtually all project sites, particularly those sites utilizing infiltration for stormwater management, a Soils Report must be prepared that is stamped by a professional engineer with geotechnical expertise, a licensed geologist, an engineering geologist, or a hydrogeologist, and that summarizes site characteristics and demonstrates that sufficient permeable soil for infiltration exists at the proposed BMP locations.

Soil explorations shall be performed during the winter “wet season” (October 1 through April 30) to accurately assess soil saturation and seasonally-high/perched groundwater conditions. Soil explorations conducted during other times of the year may require supplemental winter groundwater monitoring prior to approval of the draft stormwater site plan.

The reporting requirements depend on the types of BMPs proposed and analyses being performed. Note that additional BMP-specific soils and infiltration testing, analysis, and documentation requirements are outlined in Chapter 7, Section 7.2 (for infiltration basins and trenches), Section 7.4.4 (for bioretention), and Section 7.4.6 (for permeable pavements). Of particular note is that if the site is located near a groundwater protection area or water supply well, the Soils Report must demonstrate and document that the criteria for infiltrating near a water supply well (refer to Chapter 7 and Chapter 8) are met. Additional soils information related to runoff treatment may be required as outlined in Chapter 8 (e.g., Section 8.6).

At a minimum, the Soils Report for all project sites must contain the following:

- Map showing the following:
 - Existing site topography.
 - Locations of test pits and/or test borings relative to both existing topographic contours and proposed site plan layout, including infiltration BMP locations.
 - Locations of all water supply wells and monitoring wells on or near the site.
 - Locations of any groundwater protection areas, critical aquifer recharge areas, and 1-, 5-, and 10-year time-of-travel zones for WHPAs (see CARA and WHPA maps in Appendix 8B).
- Soil test pits and/or soil borings distributed across the site sufficiently to identify and characterize variability of the soils underlying the site. Depth should extend to at least 5 feet below estimated bottom elevation of proposed infiltration BMPs and road subgrades.
- Results of on-site soils tests including but not limited to:
 - Detailed soil logs, including the elevation of the ground surface at the test pit and/or test boring location, depths to soil strata, total depth of pit or boring,

soil descriptions (see below), degree of compaction, depth to groundwater (if present), and presence of any restrictive layers/stratification affecting infiltration. Soil descriptions shall include the following:

- Deposit Type (e.g., recessional outwash, compacted till, etc.)
- Soil Classification (e.g., SM for silty sand, or GP for poorly-graded gravel)
- Material Description (e.g., brown silty fine sand with minor gravel)
- Relative Density (e.g., medium dense)
- Moisture Content (MC), relative/measured (e.g., dry, moist, or wet; MC = 12 percent)
- Whether glacially-compacted till is present, and if so, its depth.
- Visual grain-size analysis
- Grain-size distribution (required if using the grain size analysis method to estimate infiltration rates)
- Percent clay content (include type of clay, if known)
- Color/mottling
- Variations and nature of stratification
 - Logs must substantiate whether stratification does or does not exist. The licensed professional may consider additional methods of analysis to substantiate the presence of stratification.
 - Seasonal high groundwater elevation (and/or perched groundwater elevation) during the late winter “wet season” (i.e., highest expected level of groundwater). If the groundwater level varies across the site, specify the level for each proposed infiltration BMP location.
- Detailed documentation of the initial measured K_{sat} and long-term (design) infiltration rate determination for each proposed infiltration BMP location, as specified in Chapter 7 and Appendix 7A.
- State whether location is suitable for infiltration and recommend a design infiltration rate.
 - Note that surface infiltration must be determined to be infeasible before deep UIC wells can be considered. Refer to Chapter 7, Appendix 7C for additional guidance and requirements related to UIC wells.

- The results of testing for a hydraulic restriction layer (groundwater, soil layer with less than 0.3 in/hr K_{sat} , glacial till, bedrock, etc.) under possible sites for infiltration BMPs. This analysis shall be performed during the winter “wet season” (October 1 through April 30). Site historical information and evidence of high groundwater in the soils can also be used.
- Any additional BMP-specific soils and infiltration testing information that is required for the project’s flow control or runoff treatment BMPs (e.g., for infiltration basins and trenches, bioretention, and permeable pavements).
- If on-site infiltration may result in shallow lateral flow (interflow), the conveyance and possible locations where that interflow may re-emerge shall be assessed by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington.
- If a retention and/or detention BMP is near the top of a slope that is regulated through local ordinance, then a geotechnical assessment addressing effects of seepage and the potential for slope failure during any precipitation event though the design event is required as part of this section of the Drainage Control Plan Report.

Drainage Control Plan Report Appendix 3: Design Calculations

Design calculations must include complete calculations for the conveyance, flow control, and water quality BMPs. Calculations must be presented in a clear and orderly manner and labeled and annotated as needed to facilitate an efficient review and approval process. Required calculation components include:

- Printouts of the continuous modeling computation files (e.g., continuous modeling inputs, screenshots, and results) annotated to highlight and clarify key inputs, results, and conclusions.
- Other computer printouts or manual calculations used in the stormwater design.
- Digital copies of the model files sufficient to re-run the model including input parameters and model output files.

Drainage Control Plan Report Appendix 4: Soil Management Plan

If Post-construction Soil Quality and Depth BMP is used on site (refer to Chapter 7, Section 7.4.1), a Soil Management Plan must be included in the project submittal. The Soil Management Plan must include the following:

- A site map showing areas to be fenced and left undisturbed during construction, and areas that will be amended at the turf or planting bed rates
- Determination of soil conditions

- Identified soil quality implementation option
- Calculations of the amounts of compost, compost amended topsoil, and mulch to be used on the site.

General guidance on these procedures can be found in the Building Soil manual (Stenn, et al. 2018), available at <<https://www.soilsforsalmon.org/>>.

Drainage Control Plan Attachments

The following two attachments shall be included in the project submittals, but as stand-alone documents bound separately from the Drainage Control Plan Report. The final version of the Construction SWPPP will be used by the contractor, CESCL, and City inspectors on the project site during construction; the Maintenance and Source Control Manual will be used by the post-development owners, BMP maintenance personnel, and City inspectors.

Drainage Control Plan Attachment 1: Construction SWPPP Report

Chapter 5, Section 5.2.2, of this manual describes the items that shall be included in the Construction SWPPP report. At a minimum, all 13 Construction Stormwater Pollution Prevention elements in accordance with Core Requirement #2 (Chapter 2, Section 2.4.2) must be addressed. The Construction SWPPP shall be implemented starting prior to any land disturbance and continue until final stabilization. The City may require the completion, submission, and approval of a wet-season amendment to the Construction SWPPP, which may include additional construction BMPs (e.g., stabilized parking, dewatering provisions, etc.), stopping work during the wettest months, and/or a bond for maintenance of the downstream system. See Chapter 5, Section 5.2.3 for more details. See Chapter 5, Section 5.2.3 for more details.

Note: The Construction SWPPP consists of two parts: a narrative report and drawings. **A complete Construction SWPPP (both report and drawings) is required as part of the Drainage Control Plan submittal.** Note that the Construction SWPPP drawings should be included in the drawing packet required as Drainage Control Plan Report Appendix 1.

Drainage Control Plan Attachment 2: Maintenance and Source Control Manual

In accordance with Core Requirement #9 and Table 3.1, a Maintenance and Source Control Manual must be developed for projects that require a Drainage Control Plan. For privately-owned BMPs, a copy of the manual shall be retained on site or within reasonable access to the site, and shall be transferred with the property to the new owner. A log of maintenance activity that indicates what actions were taken shall also be kept and be available for inspection by the City. For public BMPs, a copy of the manual shall be retained in the appropriate department.

The manual must comply with the recording standards of the Thurston County Auditor's Office. The manual must be prepared by a professional engineer, but must be understandable to the typical property owner and/or person responsible for maintenance.

(Note that the Maintenance and Source Control Manual may be presented in outline form for the draft Drainage Control Plan Report submittal, but completed for Public Works civil plan approval. It is a document that will live with the project site after completion, so it needs to reflect final [built] conditions.)

For both private and public BMPs, it is important to work with maintenance personnel early and throughout the design process. During discussions with maintenance personnel, describe the maintenance procedures that will be performed on the site BMPs. This will help ensure that future maintenance work and potential access needs are clearly understood.

The Maintenance and Source Control Manual must include site-specific details including applicable BMPs, frequency of maintenance activities, a landscape plan, and specific contaminants that are restricted and controlled. The Maintenance and Source Control Manual must include the following components:

Cover Page: The Maintenance and Source Control Manual must have a cover page that includes the project name; engineer's name, address, telephone number, and email address; date of preparation of the manual (and any updates); project parcel numbers; and applicable City permit numbers.

Map: A map of the project site area must be included in the manual. The extent of the map shall be inclusive of all the drainage BMPs that are a part of the Drainage Control Plan for the project. The intent of the map is to show the drainage BMPs, boundaries (drainage easements) of the maintenance responsibilities, and access easements that the Maintenance and Source Control Manual addresses. Include a key referencing the applicable maintenance checklists required to be used in performing routine inspection and maintenance for the BMP. The map is not intended to provide a high level of detail nor is it intended to call out every drainage structure (e.g., catch basins). The map shall provide road names of the existing roads that the project connects to as well as any proposed roads. The map can be one or multiple pages.

Drawings and Specifications: The Maintenance and Source Control Manual must reference the approved plans, specifications, and Drainage Control Plan Report on file at the City.

Maintenance and Source Control Manual Sections

Section 1: Project Description

Provide a brief description of the development project, including project type (plat, short plat, commercial center, industrial, etc.) and size (acres, number of lots, linear feet of road, square feet of building, etc.). Describe the stormwater BMPs and conveyance systems, and how these systems are designed to manage the volume, rate, and quality of stormwater runoff from the project. Describe where stormwater flows come from, how water moves through the site and BMPs, and how and where the stormwater leaves the site.

Section 2: Maintenance Importance and Intent

Include the following statement in this section:

“The importance of maintenance for the proper functioning of stormwater control BMPs cannot be over-emphasized. A substantial portion of failures (clogging of filters, resuspension of sediments, loss of storage capacity, etc.) are due to inadequate maintenance. Stormwater BMP maintenance is essential to ensure that BMPs function as intended throughout their full life cycle.

The fundamental goals of maintenance activities are to ensure the entire flow regime and treatment train designed for this site continue to fully function. For this site these include (Note to engineer: include in your text all of the following bullets that apply to your site. Non-applicable content can be omitted):

- Maintain designed stormwater infiltration capacity
- Maintain designed stormwater detention/retention volume
- Maintain ability of stormwater BMP to attenuate flow rates
- Maintain ability to safely convey design stormwater flows
- Maintain ability to treat stormwater runoff
- Preserve soil and plant health, as well as stormwater flow contact with plant and soil systems
- Clearly identify systems so they can be protected
- Keep maintenance costs low
- Prevent large-scale or expensive stormwater system failures
- Prevent water quality violations or damage to downstream properties.

The intent of this section and manual is to pass on to the responsible party(s) all the information critical to understand the design of the system, risks and considerations for proper use, suggestions for maintenance frequencies, and cost so that realistic budgets can be established.”

Section 3: Responsible Parties

Stormwater BMPs range in size and complexity. Entities responsible for maintenance should be appropriately matched to the tasks required to ensure long-term performance. For example, an individual homeowner may be able to reasonably maintain a rain garden, permeable driveway, infiltration trench, or other small BMP. However, larger BMPs are

often maintained through private parties, shared maintenance covenants with the City, or by City ownership.

This section of the Maintenance and Source Control Manual must identify the party (or parties) responsible for maintenance and operation of all stormwater structures and BMPs requiring maintenance. Also include a statement of who will keep the Maintenance and Source Control Manual, the address where it will be kept, and language noting that it must be made available for inspection by the City upon request. For a subdivision, the Maintenance and Source Control Manual shall be held by the Home Owners Association president, and shall be included by reference in the articles of incorporation of the Home Owners Association.

Refer to the Maintenance Covenant (Section 3.4.3) for guidance.

Section 4: BMPs Requiring Maintenance

Provide a detailed inventory of all stormwater structures and BMPs requiring maintenance. For situations where there are split maintenance responsibilities (e.g., private/public), provide a breakdown of the entity responsible for each structure and BMP. Describe (or include reference to other plan sections) how each collection, conveyance, treatment, and flow control component works. Explain the principles of BMP operation, overview of maintenance requirements, and any other information that might be helpful for future maintenance of the BMPs. This could include pipe and swale data, the design capacities of the conveyance systems, sizing, and dimensions of BMPs, rip rap specifications, and calculated flow rates.

Section 5: Maintenance Instructions

This section shall begin with the following statement, unless otherwise approved by the City:

“The parties responsible for maintenance must review and apply the maintenance requirements contained herein. These maintenance instructions outline conditions for determining if maintenance actions are required, as identified through inspection. However, they are not intended to be measures of the BMP’s required condition at all times between inspections. Exceedance of these conditions at any time between inspections or maintenance activity does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance presented in the checklists shall be adjusted to minimize the length of time that a BMP is in a condition that requires a maintenance action. For BMPs not owned and maintained by the City, a log of maintenance activity that indicates what actions were taken must be kept on site and be available for inspection by the City.”

In addition, include a narrative description of the purpose, function, and maintenance requirements for all stormwater structures and BMPs requiring maintenance. Following the narrative description(s), include detailed maintenance checklists for all stormwater structures and BMPs requiring maintenance. Chapter 10 includes maintenance checklists for all stormwater BMPs and BMPs included in this Stormwater Design Manual. The Maintenance and Source Control Manual shall include only those checklist items that are

pertinent to the structures and BMPs proposed for your project. Do not include all of the checklists provided in Chapter 10. Note that the maintenance checklists (and narrative descriptions) can be included as an attachment to the Maintenance and Source Control Manual, so long as they are clearly referenced in this section. The checklists (or City-approved equivalent) shall be used as the required log sheet for recording inspection observations and maintenance activities in accordance with the stormwater maintenance requirements within the Chapter 14.25 LMC. Note also the ongoing stormwater BMP inspection and reporting requirements, also outlined in the Stormwater Code.

Section 6: Vegetation Maintenance

The effectiveness of many stormwater BMPs will depend on the plants included in the BMP design, and their proper maintenance. A listing and location of plant species from the approved landscape plans and their requirements for maintenance shall be included in this section. This includes newly planted and retained trees claimed as flow reduction credits, as well as vegetation retention and restoration areas. Maintenance requirements must address issues including but not limited to pest and disease management practices, pruning requirements, irrigation requirements, fertilization requirements, etc.

Section 7: Pollution Source Control Measures

Pollution source control is the application of pollution prevention practices on a developed site to reduce contamination of stormwater runoff at its source. BMPs and resource management systems are designed to reduce the amount of contaminants used and potentially discharged to the environment. This section of the Maintenance and Source Control Manual shall contain language regarding pollution source controls that are specifically applicable to the site. Include pertinent text from the 15 pollution prevention principles outlined in Chapter 9, Section 9.3, plus any additional site-specific pollution source control issues. Additional information on required and suggested source control measures is provided in Chapter 9.

The completed Stormwater Pollution Source Control Checklist and Worksheet provided in Chapter 9, Appendix 9A shall be attached to the Maintenance and Source Control Manual. Any required BMPs shall be listed on the Stormwater Pollution Source Control Worksheet and identified on Stormwater Site Plans.

Section 8: Annual Cost of Maintenance

Provide an estimate of the expected annual cost of maintenance projected for 20 years. The estimate shall include the annualized cost of both routine tasks (e.g., vegetation maintenance and debris removal, refurbishing media filter cartridges, etc.) and non-routine major tasks (e.g., wet pond sediment removal, infiltration enhancement, etc.). Refer to Section 4 and summarize the number of catch basins, control structures, linear feet of pipe, etc. that require maintenance and the cost implications. See Appendix 3B for specific requirements and examples, or contact the City for additional guidance if needed.

3.4 Plans and Documentation Required After Stormwater Site Plan Approval

3.4.1 Stormwater Site Plan Changes

If the designer wishes to make changes or revisions to the originally approved Stormwater Site Plan, the proposed revisions shall be submitted to the City for approval prior to construction. The submittals shall include the following:

1. Substitute pages of the originally approved Stormwater Site Plan that include the proposed changes.
2. Revised drawings showing any structural changes.
3. Changes shall be “clouded” and noted in the revision block on the drawing.
4. Any other supporting information that explains and supports the reason for the change.

3.4.2 Final Corrected Plan Submittal

If the project included construction of conveyance systems, treatment BMPs, flow control BMPs, or structural source control BMPs (even if only used to meet the requirements of Core Requirement #5), the project applicant shall submit a final corrected plan (“as-built”) to the City when the project is completed. These should be engineering drawings that accurately represent the project as constructed. These corrected drawings must be professionally drafted revisions that are stamped, signed, and dated by a licensed professional engineer registered in the state of Washington. The licensed professional shall certify that the construction of conveyance systems, runoff treatment BMPs, flow control BMPs, and/or structural source control BMPs conform to the intent of the design. Performance verification may be required prior to final approval per Chapter 7, Section 7.2.2.

3.4.3 Maintenance Covenant

A maintenance covenant is required for each site/lot that contains stormwater management BMPs that will be maintained by a private entity such as an individual, corporation, or homeowner’s association. The recorded maintenance covenant must be created using the provided City of Lacey *Stormwater Maintenance Covenant Form* (obtainable from the City’s website at https://cityoflacey.org/resource_library/stormwater-utility/), and any attachments shall meet the recording requirements of the Thurston County Auditor’s Office. The covenant shall be recorded at the Thurston County Auditor’s Office at the expense of the project applicant, and shall be tied to the parcel numbers that the project is built on. All covenants must be recorded prior to final construction approval for the proposed project.

The covenant shall include the following:

1. A legal description of the property.
2. Assessor parcel numbers.
3. Project name.
4. Project application/permit number.
5. Parties responsible (including contact information) for maintenance and implementation of pollution source control measures.
6. Language stating that the covenant shall run with the land and be binding on all successors and assigns.
7. A requirement that the responsible parties maintain the stormwater BMPs in accordance with the attached project Maintenance and Source Control Manual.
8. A requirement that the responsible parties implement pollution source control measures in the attached Maintenance and Source Control Manual.
9. A requirement that the responsible parties keep and maintain a log of maintenance activity that indicates what actions were taken, and that the log be made available for inspection by the City.
10. Language that prohibits unauthorized modifications, unless approved by the City.
11. Language that provides for a City approval process and allows modification to the covenant, or to the Maintenance and Source Control Manual.
12. Language that provides for a City process (remedies) for situations where the responsible party fails to perform the required maintenance or fails to implement the pollution source control measures.
13. Language that provides access authority to the City for purposes of inspection, maintenance, and repair.
14. Language that provides for reimbursement to the City by the responsible party in the event that the City incurs costs related to maintenance or repair.
15. The location of the approved Drainage Control Plan.
16. The Maintenance and Source Control Manual as an attachment.

Chapter 3 References

Stenn, et al. 2018. Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington. 2018 Edition. <<https://www.soilsforsalmon.org/>>.

Appendix 3A – Construction Stormwater Pollution Prevention Plan (SWPPP) “Short Form”



All projects are subject to Core Requirement #2 of the City of Lacey *Stormwater Design Manual* to address erosion and sediment control, starting prior to initial land disturbance and continuing until final stabilization of the entire project site. This “Short Form” is for small projects that are not required to complete a full Construction Stormwater Pollution Prevention Plan (SWPPP)*.

Please submit a completed Short Form to the City of Lacey along with a basic site illustration showing existing site features and proposed improvements. Refer to the *City of Lacey 2022 Stormwater Design Manual* for further information on construction erosion and sediment control. Please print clearly.

Project Information

Project Name: _____

Project Address or Location: _____

Parcel Number: _____

Parcel Owner: _____ Phone: _____

Address (if different from above): _____

Contractor/Construction Company: _____

Project Foreman: _____ Phone: _____

Form Completed By:

_____ (printed name) (signature) (date)

Project Description: _____

Total Area of Land Disturbance: _____ sq. ft. (must be <7,000 sq. ft.)*

Hard Surface Areas (e.g., driveways, sidewalks, pavement, etc.):

Existing Hard Surface = _____ sq. ft. (total, before project)

Proposed Hard Surface = _____ sq. ft. (total, after project)

Hard Surface Area to be Replaced = _____ sq. ft. (total, after project)

Roof Area of Structures:

Existing Roof Area = _____ sq. ft. (total, before project)

Proposed New Roof Area = _____ sq. ft. (total, after project)

Roof Area to be Replaced = _____ sq. ft. (total, after project)

Total of New + Replaced Hard Surfaces = _____ sq. ft. (must be <2,000 sq. ft.)*

* Note:

If project exceeds the size thresholds, you cannot use this Short Form and must complete a full SWPPP.

► Conditions or features present within or adjacent to the project site:

Trees/Forest Buffer	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Slopes >20%	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Wetlands, Lakes, Ponds	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Creek or Stream	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Ditches or Swales (along street frontage)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Storm Drain Inlets (in street gutter within 300 ft. of site)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

► Estimated schedule of site construction activities:

<u>Site Construction Activities</u>	<u>Estimated Start Date</u>	<u>Estimated End Date</u>
Begin Project: Install Temporary Erosion & Sediment Controls (stabilized construction access, silt fence, etc.)	_____	
Demolition, Vegetation Removal, and Earthwork (including Clearing, Grading, and Excavation)	_____	_____
Asphalt, Concrete, and/or Gravel Paving	_____	_____
House/Building/Structure Construction	_____	_____
Landscaping/Lawn and Final Site Stabilization	_____	_____
Completion of Project (Removal of Temporary Erosion & Sediment Controls)		_____

► **Erosion & Sediment Control “Best Management Practices” (BMPs)**

All land-disturbing projects are required to consider all 13 elements identified on the following pages. However, small sites using this Short Form should pay particular attention to these five **basic Erosion & Sediment Control objectives and Best Management Practices (BMPs)**:

1. Protection of Adjacent Properties, Drainage Systems, Surface Waters (Elements #1 – #9)
Protect adjacent off-site areas from surface water flows and sediment deposition by appropriate use of BMPs such as silt fencing, straw wattles, mulching, inlet protection, etc. Apply BMPs prior to initial land-disturbance, and maintain until site work is finished and site is stabilized.
2. Prevent Soil Track-out onto Streets (Element #2)
Stabilize access route with quarry spalls or crushed rock (or pavement) to minimize the tracking of soils and debris onto public roads. Limit vehicle access to one route to/from work site.
3. Stabilization of Cleared Areas (Elements #5, #6, and #8)
Stabilize all exposed soils through application of BMPs to prevent erosion and movement of sediments. At all times, contractor should have sufficient labor, materials, and equipment on-site to apply BMPs and stabilize all exposed soils within 12 hours as site and weather conditions dictate. Seasonal restrictions under Element #5 apply to all sites. Permanently stabilize site at project completion.
4. Apply and Maintain BMPs (Elements #11 and #12)
Control any adverse effects due to site work with appropriate erosion and sediment control BMPs, and regularly inspect and maintain all erosion and sediment control BMPs to ensure continued performance of their intended functions. Remove temporary BMPs at project completion.
5. Protect Low Impact Development BMPs (Element #13)
Protect stormwater infiltration areas from soil compaction and sedimentation, by using careful site planning, equipment operation, erosion & sediment control, and site restoration.

Checklist: 13 Elements of Construction Site Erosion and Sediment Control

Note: Each of the 13 Elements must be considered for applicability to your project. Review each element and identify all BMPs that are likely to be implemented on your site. Refer to the City of Lacey 2022 Stormwater Design Manual (SDM) Chapter 5 for more information on these and other construction-phase BMPs, and for supplemental information for each element that should also be considered for your site.

The 2022 SDM is available online at <https://cityoflacey.org/resource_library/stormwater-utility/>.

Required Elements	General Requirements	Best Management Practices (BMPs) (check all that are likely to be implemented)
Element #1: Clearing Limits	Prior to beginning land-disturbing activities, mark clearing limits and delineate sensitive areas and their buffers with high-visibility fencing.	<input type="checkbox"/> BMP C101: Preserve Natural Vegetation <input type="checkbox"/> BMP C102: Buffer Zones <input type="checkbox"/> BMP C103: High-Visibility Fence <input type="checkbox"/> BMP C233: Silt Fence
Element #2: Construction Access	Establish stabilized access to project site (quarry spalls, etc.). Clean the public road if sediment is tracked off site.	<input type="checkbox"/> BMP C105: Stabilized Construction Access <input type="checkbox"/> BMP C106: Wheel Wash <input type="checkbox"/> BMP C107: Construction Road/ Parking Area Stabilization
Element #3: Control Flow Rates	Prevent erosion and protect off-site and downstream areas by controlling the volume, velocity and peak flow rate of site runoff.	<input type="checkbox"/> BMP C207: Check Dams <input type="checkbox"/> BMP C209: Outlet Protection <input type="checkbox"/> BMP C235: Wattles <input type="checkbox"/> BMP C240: Sediment Trap <input type="checkbox"/> BMP C241: Sediment Pond (Temporary)
Element #4: Sediment Controls	Install sediment controls to prevent sediment movement and to keep sediment from leaving site.	<input type="checkbox"/> BMP C231: Brush Barrier <input type="checkbox"/> BMP C233: Silt Fence <input type="checkbox"/> BMP C234: Vegetated Strip <input type="checkbox"/> BMP C235: Wattles <input type="checkbox"/> BMP C240: Sediment Trap <input type="checkbox"/> BMP C241: Sediment Pond (Temporary)
Element #5: Stabilize Soils	All unworked and exposed soils shall be stabilized to prevent erosion. During the “wet season” (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.	<input type="checkbox"/> BMP C120: Temporary & Permanent Seeding <input type="checkbox"/> BMP C121: Mulching <input type="checkbox"/> BMP C122: Nets and Blankets <input type="checkbox"/> BMP C123: Plastic Covering <input type="checkbox"/> BMP C124: Sodding <input type="checkbox"/> BMP C125: Topsoiling/Composting <input type="checkbox"/> BMP C130: Surface Roughening <input type="checkbox"/> BMP C131: Gradient Terraces <input type="checkbox"/> BMP C140: Dust Control
Element #6: Protect Slopes	Design and construct cut and fill slopes to minimize erosion.	<input type="checkbox"/> BMP C120: Temporary & Permanent Seeding <input type="checkbox"/> BMP C121: Mulching <input type="checkbox"/> BMP C122: Nets and Blankets <input type="checkbox"/> BMP C130: Surface Roughening <input type="checkbox"/> BMP C131: Gradient Terraces <input type="checkbox"/> BMP C200: Interceptor Dike and Swale <input type="checkbox"/> BMP C201: Grass-Lined Channels <input type="checkbox"/> BMP C204: Pipe Slope Drains <input type="checkbox"/> BMP C206: Level Spreader <input type="checkbox"/> BMP C207: Check Dams

Required Elements	General Requirements	Best Management Practices (BMPs) (check all that are likely to be implemented)
Element #7: Protect Drain Inlets	Protect conveyance system from sediment by filtering or treating stormwater prior to flow entering inlets.	<input type="checkbox"/> BMP C220: Inlet Protection Note: Never put anything other than stormwater into a storm drain. “Only rain down the drain.”
Element #8: Stabilize Channels and Outlets	All conveyance channels and outlets shall be constructed and stabilized to prevent erosion.	<input type="checkbox"/> BMP C202: Riprap Channel Lining <input type="checkbox"/> BMP C122: Nets and Blankets <input type="checkbox"/> BMP C207: Check Dams <input type="checkbox"/> BMP C209: Outlet Protection
Element #9: Control Pollutants	Handle, store and dispose of concrete washout and const. debris in closed container or by removal from site so it does not contaminate stormwater. Apply spill prevention and cleanup to vehicle & equipment activities.	<input type="checkbox"/> BMP C151: Concrete Handling <input type="checkbox"/> BMP C152: Sawcutting and Surfacing Pollution Prevention <input type="checkbox"/> BMP C153: Material Delivery, Storage and Containment <input type="checkbox"/> BMP C154: Concrete Washout Area <input type="checkbox"/> BMP C251: Construction Stormwater Filtration
Element #10: Control Dewatering	Manage dewatering water to prevent sediment discharge from site. Manage turbid water separately from stormwater.	<input type="checkbox"/> BMP C203: Water Bars <input type="checkbox"/> BMP C206: Level Spreaders <input type="checkbox"/> BMP C236: Vegetative Filtration
Element #11: Maintain BMPs	Inspect, maintain and repair BMPs as needed to keep them in fully functional condition.	<input type="checkbox"/> BMP C150: Materials On Hand
Element #12: Manage the Project	Phase project to prevent soil erosion and transport. Avoid soil disturbance from October 1 through April 30. Certified Erosion and Sediment Control Lead (CESCL) to inspect and monitor BMPs on sites >1 acre.	<input type="checkbox"/> BMP C150: Materials On Hand <input type="checkbox"/> BMP C162: Scheduling
Element #13: Protect Low Impact Development (LID) BMPs	Protect all LID BMPs from sedimentation and compaction through preventative measures, as well as installation and maintenance of construction SWPPP BMPs on portions of the site that drain to the LID BMPs.	<input type="checkbox"/> BMP C102: Buffer Zones <input type="checkbox"/> BMP C103: High Visibility Fence <input type="checkbox"/> BMP C200: Interceptor Dike and Swale <input type="checkbox"/> BMP C201: Grass-Lined Channels <input type="checkbox"/> BMP C207: Check Dams <input type="checkbox"/> BMP C208: Triangular Silt Dike (TSD) <input type="checkbox"/> BMP C231: Brush Barrier <input type="checkbox"/> BMP C233: Silt Fence <input type="checkbox"/> BMP C234: Vegetated Strip

► **Submit completed form to the City along with a basic site illustration showing existing and proposed site features, including property boundaries, north arrow, adjacent streets, and planned locations of erosion & sediment control BMPs.**

Appendix 3B – O&M Cost Estimate Calculations

This appendix includes supplemental requirements and examples to aid in developing Section 8 of the Maintenance and Source Control Manual (Attachment 4 of the Drainage Control Plan), Annual Cost of Maintenance. The Cost Estimate for Operation and Maintenance shall be prepared by the design engineer, with the intention of assisting the postdevelopment owners of stormwater BMPs in understanding and budgeting for long-term BMP operation and maintenance costs.

The Cost Estimate for Operation and Maintenance should follow this general format:

- Introduction
- Part I: Inventory of On-Site Stormwater BMPs
- Part II: Routine Operation and Maintenance Assumptions
- Part III: Routine Operation and Maintenance Estimated Annual Costs
- Part IV: Estimated Annual Partial Replacement Cost
- Part V: Estimated Monthly Contribution to Stormwater BMPs Operation and Maintenance Account

Each section of the Cost Estimate for Operation and Maintenance is described in more detail below. The Cost Estimate for Operation and Maintenance may be in tabular format, so long as adequate annotations are provided.

Introduction

The Introduction should briefly describe what drainage BMP the cost estimate is for, where it is located, what information the estimate provides, and how to understand and use it.

Part I: Inventory of On-Site Stormwater BMPs

Part I is an Inventory of all stormwater management BMPs and drainage system components that are included in the analysis, and are the responsibility of the owners to operate and maintain. The Inventory should be accompanied by a plan map of BMP locations and detail drawings.

Part II: Routine Operation and Maintenance Assumptions

Part II lists the assumptions that are made in estimating the cost for routine operation and maintenance, including the frequency of routine maintenance tasks, which tasks will be performed by whom, and assumed cost of each maintenance activity.

Part III: Routine Operation and Maintenance Estimated Annual Cost

Part III provides detailed cost breakdowns for the routine operation and maintenance of the BMP. The sum of these cost breakdowns is the estimated annual cost of routine operation and maintenance, which is used in Part V.

Part IV: Estimated Annual Partial Replacement Cost

Part IV provides an estimate of the cost to replace a portion of the stormwater system in the future and an estimated annual contribution to the operation and maintenance account to cover the partial system replacement. These costs take inflation and interest into account. The annual payment for partial system replacement is used in Part V.

Part V: Estimated Monthly Contribution to Stormwater BMPs Operation and Maintenance Account

Part V provides an estimate of the monthly contributions from each lot owner to the operation and maintenance account. These contributions are intended to cover the routine operation and maintenance costs (Part III) and the partial replacement cost (Part IV).

* * * * *

On the following pages are three examples of a Cost Estimate for Operation and Maintenance. The examples address the five requirements above, except maps of the BMPs are not included. *The BMPs, assumptions, and values in the following examples are fictitious.* The design engineer preparing an actual estimate for actual BMPs will need to provide actual site information and current, realistic values in the calculations.

EXAMPLE 1

Residential Development with Centralized Stormwater Treatment BMP

(i.e., Wet Pond and Infiltration Basin)

Cost Estimate for Operation and Maintenance for the Stormwater System at “Stormy Estates”

Introduction:

The following are assumptions, estimates and recommendations for funds to set aside for routine maintenance costs and future replacement costs for the stormwater BMPs that are the responsibility of the Stormy Estates Homeowners’ Association. The sinking fund estimate is an approximation of the annual funding needed over the next 20 years to keep the stormwater system fully functional.

The initial value of the BMPs, the annual maintenance costs (assuming all work is performed by a contractor), occasional improvements, and factors such as inflation over time are incorporated in the “sinking fund” calculation of future costs and the annual funding reserve amount needed. The calculations take into account the expected life of the materials, structures, and BMPs, and include a summary of the amount of money suggested to be set aside annually for the fund as well as the annual charge per lot owner to equal the annual set-aside. The example assumes that each of the lot owners is an equal co-owner of the common stormwater BMPs. In this example, the bottom-line estimate of total annual funding needed is divided equally among the lot owners.

Note that the sinking fund calculations are only a “best estimate” using approximated values. The homeowners’ association should use these computations as a guide, and modify as needed to more accurately reflect actual costs as routine maintenance is conducted.

CITY OF LACEY 2022 STORMWATER DESIGN MANUAL

Part I: ON-SITE STORMWATER BMP INVENTORY			Part II: ROUTINE O&M ASSUMPTIONS		Part III: ROUTINE O&M ESTIMATED ANNUAL COST	
BMP	Quantity	Unit	Activity	Maintenance Frequency	Unit Price ^a	Annual Cost ^b
			Annual Report	Annual	\$300	\$300
Catch Basin	8	Each	Sediment removal with Vactor truck	Annual	\$170	\$1,360
Pipes	400	LF	Clean pipe ends as part of catch basin maintenance	Include with catch basins	\$-	\$-
Wet Pond	1,100	SF	Vegetation management	Annual	\$0.18	\$202
			Sediment removal including hauling, planting with shrubs and seeding mix, and site restoration	Once every 15 years	\$2.25	\$164
Infiltration Basin	3,100	SF	Mowing	Every 2 weeks	\$0.05	\$4,350
			Rehabilitation (sediment removal, repair, tilling, and reseeding)	Once every 15 years	\$0.25	\$51
ANNUAL TOTAL:					\$6,400	

Notes:

^a Cost to maintain each unit based on estimate from maintenance contractor or literature values.

^b Product of multiplying quantity by frequency by unit price.

O&M = operation and maintenance

LF = linear feet

SF = square feet

CONTINUE TO PART IV

Part IV: ESTIMATED PARTIAL REPLACEMENT COST		
Assumptions	Notes	
Annual Inflation Rate	4%	Annual inflation of construction cost.
Annual Interest Rate	2%	Estimate of how fast the account balance will grow.
Years in Calculation	20	Duration of calculation.
Percent of System Replaced in 20 Years	20%	Assumes 20% of the system will need replacement during the calculation period.
Present Value of Stormwater System	\$170,000	Initial construction cost of the stormwater system.
Initial Reserves	\$0	Initial balance in the O&M account.
Number of Owners	22	Number of lot owners.
Using Above Assumptions, Calculate Future Replacement Cost for 20% of System and Required Annual Payments		
Description	Cost	Notes
Present Value of 20% of Stormwater System (portion requiring replacement)	\$34,000	Present value of the stormwater system x percent of the system that requires replacement.
Future Replacement Cost for 20% of Stormwater System	\$74,498	Cost to replace the 20% of the system in the future, i.e., Present Value adjusted to account for inflation.
Annual Payment for Future Replacement	\$3,066	Annual account contributions required to cover the future replacement cost. Accounts for interest.
Part V: ESTIMATED MONTHLY CONTRIBUTION TO STORMWATER BMP O&M ACCOUNT		
Description	Cost	Notes
Annual Payment for Routine O&M	\$6,400	Result of Part III.
Annual Payment for Future Replacement	\$3,066	Result of Part IV.
Total <i>Annual</i> Cost for O&M and Repair	\$9,466	Sum of above values.
Total <i>Monthly</i> Cost for O&M and Repair	\$789	Annual cost divided by 12 months.
Monthly Cost per Lot Owner	\$36	Monthly cost divided by 22 lot owners.

O&M = operation and maintenance

Because operation and maintenance costs will vary and are also subject to inflation, they should also be adjusted over time. Owners should evaluate actual operation and maintenance needs and costs each year, and adjust set-aside funds for the following year's cost projection.

EXAMPLE 2

1-Acre Commercial Development with Bioretention

Cost Estimate for Operation and Maintenance *for the Stormwater System at “McStormy’s Fast Food Restaurant”*

Introduction:

The following are assumptions, estimates and recommendations for funds to set aside for routine maintenance costs and future replacement costs for the drainage BMPs that are the responsibility of the *McStormy’s Fast Food Restaurant*. The sinking fund estimate is an approximation of the annual funding needed over the next 20 years to keep the drainage system fully functional.

The initial value of the BMPs, the annual maintenance costs (assuming all work is by hired workers), occasional improvements, and factors such as inflation over time are incorporated in the “sinking fund” calculation of future costs and the annual funding reserve amount needed. The calculations take into account the expected life of the materials, structures, and BMPs, and include a summary of the amount of money to be set aside annually for the fund and the annual charge per lot owner to equal the annual set-aside.

Note that the sinking fund calculations are only a “best estimate” using approximated values. The owner should use these computations as a guide, and modify as needed to more accurately reflect actual costs as routine maintenance is conducted.

Part I: ON-SITE STORMWATER BMP INVENTORY			Part II: ROUTINE O&M ASSUMPTIONS		Part III: ROUTINE O&M ESTIMATED ANNUAL COST	
BMP	Quantity	Unit	Activity	Frequency	Unit Price ^a	Annual Cost ^b
			Annual Report	Annual	\$300	\$300
Catch Basin	5	Each	Sediment Removal with Vactor Truck	Annual	\$170	\$850
Bioretention	3,200	SF	Watering, sediment removal, vegetation management, mulching, and pest control	Annual	\$2.00	\$6,400
ANNUAL TOTAL:					\$7,600	

Notes:

^a Cost to maintain each unit based on estimate from maintenance contractor or literature values.

^b Product of multiplying quantity by frequency by unit price.

O&M = operation and maintenance

SF = square feet

CONTINUE TO PART IV

EXAMPLE

Part IV: ESTIMATED PARTIAL REPLACEMENT COST		
Assumptions	Notes	
Annual Inflation Rate	4%	Annual inflation of construction cost.
Annual Interest Rate	2%	Estimate of how fast the account balance will grow.
Years in Calculation	20	Duration of calculation.
Percent of System Replaced in 20 Years	20%	Assumes 20% of the system will need replacement during the calculation period.
Present Value of Stormwater System	\$90,000	Initial construction cost of the stormwater system.
Initial Reserves	\$0	Initial balance in the O&M account.
Number of Owners	1	Number of lot owners.
Using Above Assumptions, Calculate Future Replacement Cost for 20% of System and Required Annual Payments		
Description	Cost	Notes
Present Value of 20% of Stormwater System (portion requiring replacement)	\$18,000	Present value of the stormwater system x percent of the system that requires replacement.
Future Replacement Cost for 20% of Stormwater System	\$39,440	Cost to replace the system in the future, i.e., Present Value adjusted to account for inflation.
Annual Payment for Future Replacement	\$1,623	Annual account contributions required to cover the future replacement cost. Accounts for interest.
Part V: ESTIMATED MONTHLY CONTRIBUTION TO STORMWATER BMP O&M ACCOUNT		
Description	Cost	Notes
Annual Payment for Routine O&M	\$7,600	Result of Part III.
Annual Payment for Future Replacement	\$1,623	Result of Part IV.
Total <i>Annual</i> Cost for O&M and Repair	\$9,223	Sum of above values.
Total <i>Monthly</i> Cost for O&M and Repair	\$769	Annual cost divided by 12 months.
Monthly Cost per Lot Owner	\$769	Monthly cost divided by a single owner.

O&M = operation and maintenance

Because operation and maintenance costs will vary and are also subject to inflation, they should also be adjusted over time. Owners should evaluate actual operation and maintenance needs and costs each year, and adjust set-aside funds for the following year's cost projection.

EXAMPLE 3

10-Acre Commercial Development with Permeable Pavement

Cost Estimate for Operation and Maintenance *for the Stormwater System at “Storm-Co Wholesale”*

Introduction:

The following are assumptions, estimates and recommendations for funds to set aside for routine maintenance costs and future replacement costs for the drainage BMPs that are the responsibility of the *Storm-Co Wholesale*. The sinking fund estimate is an approximation of the annual funding needed over the next 20 years to keep the drainage system fully functional.

The initial value of the BMPs, the annual maintenance costs (assuming all work is by hired workers), occasional improvements, and factors such as inflation over time are incorporated in the “sinking fund” calculation of future costs and the annual funding reserve amount needed. The calculations take into account the expected life of the materials, structures, and BMPs, and include a summary of the amount of money to be set aside annually for the fund and the annual charge per lot owner to equal the annual set-aside.

Note that the sinking fund calculations are only a “best estimate” using approximated values. The owner should use these computations as a guide, and modify as needed to more accurately reflect actual costs as routine maintenance is conducted.

Part I: ON-SITE STORMWATER BMP INVENTORY			Part II: ROUTINE O&M ASSUMPTIONS		Part III: ROUTINE O&M ESTIMATED ANNUAL COST	
BMP	Quantity	Unit	Activity	Frequency	Unit Price ^a	Annual Cost ^b
			Annual Report	Annual	\$300	\$300
Permeable Pavement	283,000	SF	Regenerative Vacuum Sweeping	Twice per Year	\$0.03	\$17,000
					ANNUAL TOTAL:	\$17,300

Notes:

^a Cost to maintain each unit based on estimate from maintenance contractor or literature values.

^b Product of multiplying quantity by frequency by unit price.

O&M = operation and maintenance

SF = square feet

CONTINUE TO PART IV

EXAMPLE

Part IV: ESTIMATED PARTIAL REPLACEMENT COST		
Assumptions	Notes	
Annual Inflation Rate	4%	Annual inflation of construction cost.
Annual Interest Rate	2%	Estimate of how fast the account balance will grow.
Years in Calculation	20	Duration of calculation.
Percent of System Replaced in 20 Years	20%	Assumes 20% of the system will need replacement during the calculation period.
Present Value of Stormwater System	\$1,500,000	Initial construction cost of the stormwater system.
Initial Reserves	\$0	Initial balance in the O&M account.
Number of Owners	1	Number of lot owners.
Using Above Assumptions, Calculate Future Replacement Cost for 20% of System and Required Annual Payments		
Description	Cost	Notes
Present Value of 20% of Stormwater System (portion requiring replacement)	\$300,000	Present value of the stormwater system x percent of the system that requires replacement
Future Replacement Cost for 20% of Stormwater System	\$657,337	Cost to replace the system in the future, i.e., Present Value adjusted to account for inflation.
Annual Payment for Future Replacement	\$27,054	Annual account contributions required to cover the future replacement cost. Accounts for interest.
Part V: ESTIMATED MONTHLY CONTRIBUTION TO STORMWATER BMP O&M ACCOUNT		
Description	Cost	Notes
Annual Payment for Routine O&M	\$17,300	Result of Part III.
Annual Payment for Future Replacement	\$27,054	Result of Part IV.
Total <i>Annual</i> Cost for O&M and Repair	\$44,354	Sum of above values.
Total <i>Monthly</i> Cost for O&M and Repair	\$3,696	Annual cost divided by 12 months.
Monthly Cost per Lot Owner	\$3,696	Monthly cost divided by a single owner.

O&M = operation and maintenance

Because operation and maintenance costs will vary and are also subject to inflation, they should also be adjusted over time. Owners should evaluate actual operation and maintenance needs and costs each year, and adjust set-aside funds for the following year's cost projection.

