Stormwater Management Manual for Western Washington

Volume I
Minimum Technical Requirements and Site Planning

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Water Quality Program

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Chapter 3 - Preparation of Stormwater Site Plans

The Stormwater Site Plan is the comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Stormwater Site Plan will vary with the type and size of the project, and individual site characteristics.

The scope of the Stormwater Site Plan also varies depending on the applicability of Minimum Requirements (see Section 2.4).

This chapter describes the contents of a Stormwater Site Plan and provides a general procedure for how to prepare the plan. The specific BMPs and design methods and standards to be used are contained in Volumes II-V. The content of, and the procedures for preparing a Construction Stormwater Pollution Prevention Plan (Construction SWPPP) are covered in detail in Chapter 3 of Volume II. Guidelines for selecting treatment, flow control, and source control BMPs are given in Chapter 4 of this Volume, and Chapter 2 of Volume V.

The goal of this chapter is to provide a framework for uniformity in plan preparation. Such uniformity will promote predictability throughout the region and help secure prompt governmental review and approval. Properly drafted engineering plans and supporting documents will also facilitate the operation and maintenance of the proposed system long after its review and approval.

State law requires that engineering work be performed by or under the direction of a professional engineer licensed to practice in Washington State. Plans involving construction of treatment facilities or flow control facilities (detention ponds or infiltration basins), structural source control BMPs, or drainage conveyance systems generally involve engineering principles and should be prepared by or under the direction of a licensed engineer. Construction Stormwater Pollution Prevention Plans (SWPPPs) that involve engineering calculations must also be prepared by or under the direction of a licensed engineer.

3.1 Stormwater Site Plans: Step-By-Step

The steps involved in developing a Stormwater Site Plan are listed below.

1. Site Analysis: Collect and Analyze Information on Existing Conditions
2. Prepare Preliminary Development Layout
3. Perform Off-site Analysis (at local government's option)
4. Determine Applicable Minimum Requirements
5. Prepare a Permanent Stormwater Control Plan

6. Prepare a Construction Stormwater Pollution Prevention Plan
7. Complete the Stormwater Site Plan
8. Check Compliance with All Applicable Minimum Requirements

The level of detail needed for each step depends upon the project size as explained in the individual steps. A narrative description of each of these steps follows.

3.1.1 Step 1 – Site Analysis: Collect and Analyze Information on Existing Conditions

Site analysis results shall be submitted as part of an Existing Conditions Summary and a site map within the Stormwater Site Plan submittal (see Step 7). Part of the information in this step should be used to help prepare the Construction Stormwater Pollution Prevention Plan. The authorized project reviewer for the local government with jurisdiction may chose to waive certain components required in this section as appropriate.

Purpose of the Site Analysis: Low impact development site design is intended to complement the predevelopment conditions on the site. However, not all sites are appropriate for a complete LID project, as site conditions determine the feasibility of using LID techniques. The development context shall be established by an initial site analysis consistent with the requirements of this section.

The initial inventory and analysis process will provide baseline information necessary to design strategies that utilize areas most appropriate to evaporate, transpire, and infiltrate stormwater, and achieve the goal of minimizing the pre- development natural hydrologic conditions on the site.

The site analysis shall include, at a minimum, the following information for projects required to meet Minimum Requirements 1 – 5:

1. A survey prepared by a registered land surveyor (or other qualified professional) showing:
    - Existing public and private development, including utility infrastructure on and adjacent to the site if publicly available,
    - Minor hydrologic features, including seeps, springs, closed depression areas, drainage swales.
    - Major hydrologic features with a streams, wetland, and water body survey and classification report showing wetland and buffer boundaries consistent with the requirements of the jurisdiction.

      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 ground water.
    - Flood hazard areas on or adjacent to the site, if present.

- Geologic Hazard areas and associated buffer requirements as defined by the local jurisdiction
- Aquifer and wellhead protection areas on or adjacent to the site, if present.
- Topographic features that may act as natural stormwater storage, infiltration or conveyance.

  Contours for the survey are as follows:

  - Up to 10 percent slopes, two-foot contours.
  - Over 10 percent to less than 20 percent slopes, five-foot contours.
  - Twenty percent or greater slopes, 10-foot contours.
  - Elevations shall be at 25-foot intervals.

2. A soils report prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program), a locally licensed on-site sewage designer, or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. The report shall identify:

   a. Underlying soils on the site utilizing soil surveys, soil test pits, soil borings, or soil grain analyses (see http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm for soil survey information).

   b. The results of saturated hydraulic conductivity (K_{sat}) testing to assess infiltration capability and the feasibility of rain gardens, bioretention, and permeable pavement. Use small-scale Pilot Infiltration Tests (PIT), or other small-scale test acceptable to the local jurisdiction. Grain size analyses may substitute for infiltration tests on sites with soils unconsolidated by glacial advance.

      Note: The certified soils professional or engineer can exercise discretion concerning K_{sat} testing if in their judgment information exists confirming that the site is unconsolidated outwash material (high infiltration rates) and there is adequate depth to ground water (1 foot minimum from bottom of a rain garden, bioretention, or permeable pavement installation).

   c. The results of testing for an hydraulic restriction layer (ground water, soil layer with less than 0.3 in/hr K_{sat}, bedrock, etc) under possible sites for a rain garden, bioretention facility, or permeable pavement. Testing with a monitoring well or an excavated pit must extend to a depth at least 1 foot below the

estimated bottom elevation of a rain garden/bioretention excavation and at least 1 foot below the subgrade surface of a permeable pavement. This analysis should be performed in the winter season (December 21 through March 21). The optimum time to test for depth to ground water is usually late winter and shortly after an extended wet period. Site historic information and evidence of high ground water in the soils can also be used.

3. If there are native soil and vegetation protection areas proposed for the site, provide a survey of existing native vegetation cover by a licensed architect, arborist, qualified biologist or project proponent identifying any forest areas on the site and a plan to protect those areas. The preserved area should be placed in a separate tract or protected through recorded easements for individual lots.

The site analysis shall include, at a minimum, the following information for projects required to meet Minimum Requirements 1 – 9:

1. A survey prepared by a registered land surveyor or civil engineer showing:

   - Existing public and private development, including utility infrastructure on and adjacent to the site if publicly available,
   - Minor hydrologic features, including seeps, springs, closed depression areas, drainage swales.
   - Major hydrologic features with a streams, wetland, and water body survey and classification report showing wetland and buffer boundaries consistent with the requirements of the jurisdiction.

     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 ground water.
   - Flood hazard areas on or adjacent to the site, if present.
   - Geologic Hazard areas and associated buffer requirements as defined by the local jurisdiction
   - Aquifer and wellhead protection areas on or adjacent to the site, if present.
   - Topographic features that may act as natural stormwater storage, infiltration or conveyance.

     Contours for the survey are as follows:

- Up to 10 percent slopes, two-foot contours.
- Over 10 percent to less than 20 percent slopes, five-foot contours.
- Twenty percent or greater slopes, 10-foot contours.
- Elevations shall be at 25-foot intervals.

2. A soils report prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program), or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. The report shall identify:

   a. Underlying soils on the site utilizing soil surveys, soil test pits, or soil grain analyses (see http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm for soil survey information).

      Prepare detailed logs for each test pit or soil boring and a map showing the location of the test pits or borings. Logs must include depth of pit or boring, soil descriptions, depth to water (if present), and presence of stratification. Depth should extend to 5 feet below estimated bottom elevation of bioretention facilities and road subgrade. 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.

      Soil stratigraphy should be assessed for low permeability layers, highly permeable sand/gravel layers, depth to ground water, and other soil structure variability necessary to assess subsurface flow patterns. Soil characterization for each soil unit (soil strata with the same texture, color, density, compaction, consolidation and permeability) should include:

      - Grain size distribution
      - Textural class
      - Percent clay content
      - Cation exchange capacity
      - Color/mottling
      - Variations and nature of stratification

   b. The results of saturated hydraulic conductivity (K_{sat}) testing to assess infiltration capability and the feasibility of bioretention, and permeable pavement. Use small-scale Pilot Infiltration Tests (PIT), or other small-scale test acceptable to the local

jurisdiction. Grain size analyses may substitute for infiltration tests on sites with soils unconsolidated by glacial advance.

Placement of K_{sat} tests should be carefully considered to reduce cost. A few strategically placed soil test pits and saturated hydraulic conductivity test sites are generally adequate for initial site assessment and for smaller sites (e.g. less than an acre). On larger project sites, a more detailed soil assessment and additional K_{sat} testing may be necessary to direct placement of impervious surfaces such as structures away from soils that can most effectively infiltrate stormwater, and placement of permeable pavement roads, parking lots, driveways, walks, and bioretention/rain gardens over those soils. See Section 3.4 in Volume III of this manual for more details. The K_{sat} tests are also necessary as input to the runoff model to predict the benefits of LID BMPs which infiltrate.

Note: The certified soils professional or engineer can exercise discretion concerning K_{sat} testing if in their judgment information exists confirming that the site is unconsolidated outwash material (high infiltration rates) and there is adequate depth to ground water (1 foot minimum from bottom of a rain garden, bioretention, or permeable pavement installation).

c. The results of testing for an hydraulic restriction layer (ground water, soil layer with less than 0.3 in/hr K_{sat}, bedrock, etc) under possible sites for a bioretention facility, or permeable pavement. If the general site assessment cannot confirm that the seasonal high ground water or hydraulic restricting layer is greater than 5 feet below the bottom of the bioretention or permeable pavement (subgrade surface) monitoring wells or excavated pits should be placed strategically to assess depth to ground water. This analysis should be performed during the wet season prior to construction. Monitoring with a continuously logging censor between Dec. 21 and Mar. 21 provides the most thorough information. Monitoring for lesser time periods can be accepted but increases risk. Site historical data regarding ground water levels can be used in lieu of field testing if the data are reliable and sufficient. Also, soil evidence of historical ground water elevations may be used.

   Special considerations are necessary for highly permeable gravel areas. Signs of high ground water will likely not be present in gravelly soils lacking finer grain material such as sand and silt. Test pit and monitoring wells may not show high ground water levels during low precipitation years. Accordingly, sound professional judgment, considering these factors and water quality treatment needs, is required to design

multiple and dispersed infiltration facilities on sites with gravel deposits.

d. If on-site infiltration may result in shallow lateral flow (interflow), the conveyance and possible locations where that interflow may re-emerge should be assessed by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. This will likely require placement of ground water monitoring wells to determine existing ground water gradients and flow. In general, a minimum of three wells associated with three hydraulically connected surface or ground water features, are needed to determine the direction of flow and gradient.

3. If there are native soil and vegetation protection areas proposed for the site, provide a survey of existing native vegetation cover by a licensed architect, arborist, or qualified biologist identifying any forest areas on the site and a plan to protect those areas. The preserved area should be placed in a separate tract or protected through recorded easements for individual lots.

3.1.2 Step 2 – Prepare Preliminary Development Layout

Based upon the analysis of existing site conditions, locate the buildings, roads, parking lots, landscaping features, on-site stormwater management BMPs, and preliminary location of stormwater treatment and retention/detention facilities for the proposed development. Consider the following points when laying out the site:

- Fit development to the terrain to minimize land disturbance; Confine construction activities to the least area necessary, and away from critical areas.
- Preserve areas with natural vegetation (especially forested areas) as much as possible.
- On sites with a mix of soil types, locate impervious areas over less permeable soil (e.g., till), try to restrict development over more porous soils or take advantage of them by locating bioretention/rain gardens and permeable pavement over them. .
- Cluster buildings together.
- Minimize impervious areas.
- Maintain and utilize the natural drainage patterns.

The development layout designed here will be used for determining threshold discharge areas, for calculating whether size and flow rate thresholds under Minimum Requirements #6, #7, and #8 are exceeded (see Chapter 2), and for the drawings and maps required for the Stormwater Site Plan.

3.1.3 Step 3 – Perform an Off-site Analysis

Ecology recommends that local governments require an off-site analysis for projects that add 5,000 square feet or more of new hard surface, or that convert ¾ acres of vegetation to lawn or landscaped areas, or convert 2.5 acres of forested area to pasture.

The phased off-site analysis approach outlined in Optional Guidance #2 is recommended. This phased approach relies first on a qualitative analysis. If the qualitative analysis indicates a potential problem, the local government may require mitigation or a quantitative analysis. For more information, see Section 2.6.2.

3.1.4 Step 4 – Determine and Read the Applicable Minimum Requirements

Section 2.4 establishes project size thresholds for the application of Minimum Requirements to new development and redevelopment projects. Figures 2.4.1 and 2.4.2 provide the same thresholds in a flow chart format. Based on the preliminary layout, determine whether Minimum Requirements #1 through #5 apply to the project; or, whether Minimum Requirements #1 through #9 apply.

3.1.5 Step 5 – Prepare a Permanent Stormwater Control Plan

Select on-site stormwater control BMPs (all projects), and treatment and flow control facilities (projects subject to minimum requirements #1 through #9) that will serve the project site in its developed condition. The selection process for treatment and flow control facilities is presented in detail in Chapter 4 of this Volume, and Chapter 2 of Volume V.

A preliminary design of the On-site Stormwater Management BMPs and treatment/flow control facilities is necessary to determine how they will fit within and serve the preliminary development layout. After a preliminary design is developed, the designer may want to reconsider the site layout to reduce the need for construction of facilities, or the size of the facilities by reducing the amount of hard – especially impervious - surfaces created, and increasing the areas to be left undisturbed. After the designer is satisfied with the BMP and facilities selections, the information must be presented within a Permanent Stormwater Control Plan. The Permanent Stormwater Control Plan should contain the following sections:

Permanent Stormwater Control Plan – Existing Site Hydrology

If flow control facilities are proposed to comply with Minimum Requirement #7, provide a listing of assumptions and site parameters used in analyzing the pre-developed site hydrology. The acreage, soil types, and land covers used to determine the pre-developed flow characteristics, along with basin maps, graphics, and exhibits for each subbasin affected

by the project should be included. The pre-developed condition to be matched shall be a forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement.

Provide a topographic map, of sufficient scale and contour intervals to determine basin boundaries accurately, and showing:

- Delineation and acreage of areas contributing runoff to the site;
- Flow control facility location;
- Outfall;
- Overflow route; and
- All natural streams and drainage features.

The direction of flow, acreage of areas contributing drainage, and the limits of development should be indicated. Each basin within or flowing through the site should be named and model input parameters referenced.

Permanent Stormwater Control Plan – Developed Site Hydrology

All Projects:

Reporting totals of new hard surfaces, replaced hard surfaces, and converted pervious surfaces are necessary to determine which minimum requirements initially apply to the project.

Projects that apply only Minimum Requirements #1through #5:

Provide a scale drawing of the lot or lots, and any public-right-of-way that displays the location of On-site Stormwater Management BMPs and the areas served by them. These documents must be suitable to serve as a recordable document that can be attached to a declaration of covenant and grant of easement associated with each lot that includes On-site Stormwater Management BMPs.

Provide design details, figures, and maintenance instructions for each On-site Stormwater Management BMP. These documents must also be suitable to serve as a recordable document that can be attached to a declaration of covenant and grant of easement associated with each lot.

Provide a written summary of the proposed project and how it complies with the applicable stormwater management requirements. If using List #1 or List #2 (necessary for threshold discharge areas of projects that have triggered Minimum Requirements #1 - #9, but do not exceed the thresholds in Minimum Requirements #6, #7) to comply with Minimum Requirement #5, provide written justification, including citation of site conditions identified in a soils report, for any On-site Stormwater Management BMPs that are determined to be “infeasible” for the project site.

If the applicant elects or must use the LID performance standard option of Minimum Requirement #5, they shall provide design details of all BMP's that are used to help achieve the standard, and a complete computer model report including input files and output files. Projects taking an impervious surface reduction credit for newly planted or retained trees 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.

Skip down to Section 3.1.6 - Step 6.

Projects that are subject to Minimum Requirements #1 through #9:

a. Summary Section

By threshold discharge area, provide totals of new pollution-generating hard surfaces, replaced pollution-generating hard surfaces (where the replaced hard surfaces have been determined to be subject to requirements per Section 2.4.1 or 2.4.2), effective impervious surfaces, and converted vegetated areas to determine whether treatment (Minimum Requirement #6) and/or flow control facilities (Minimum Requirement #7) are necessary for those areas. See Chapter 4 of this Volume for more specific directions concerning treatment and flow control requirements, and selection of treatment and flow control facilities. For those threshold discharge areas that do not trigger Minimum Requirements #6, #7, or #8, follow the directions above for *Projects that apply only Minimum Requirements #1 through #5*. Otherwise, provide narrative, mathematical, and graphic presentations of computer model input parameters selected for each threshold discharge area of the developed site condition, including acreage, soil types, and land covers, road layout, and all drainage facilities.

Developed threshold discharge areas and flow routing should be shown on a map and cross-referenced to computer input screens and printouts or calculation sheets.

Any documents used to determine the developed site hydrology should be included. Whenever possible, maintain the same basin name as used for the pre-developed site hydrology. If the boundaries of a basin have been modified by the project, that should be clearly shown on a map and the name modified to indicate the change.

Final grade topographic maps shall be provided. Ecology recommends local governments also require finished floor elevations.

b. Permanent Stormwater Control Plan – Performance Standards and Goals

If treatment facilities are proposed, provide a listing of the water quality menus used (Chapter 3, Volume V). If flow control facilities

are proposed, provide a confirmation of the flow control standard being achieved (e.g., the Ecology flow duration standard). Indicate whether using the mandatory list or the LID performance standard option for Minimum Requirement #5.

c. Permanent Stormwater Control Plan – Low Impact Development Features.

A description of the proposed project including:

1. Project narrative showing how the project will fulfill the requirement for on-site management of stormwater to the extent feasible.
2. Total area of Native Vegetation retained.
3. Provide a scale drawing of the lot or lots, and any public-right-of-way that displays the location of On-site Stormwater Management BMPs and the areas served by them. These documents must be suitable to serve as a recordable document that can be attached to a declaration of covenant and grant of easement associated with each lot that includes On-site Stormwater Management BMPs.
4. For projects using the list option for Minimum 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.
5. Provide design details, figures, and maintenance instructions for each On-site Stormwater Management BMP. These documents must also be suitable to serve as a recordable document that can be attached to a declaration of covenant and grant of easement associated with each lot.
6. A summary of proposed public or private ownership of On-site Stormwater Management BMPs and areas serving a stormwater function within the project site both during and after construction.
7. Areas of disturbed soils to be amended. (NOTE: All lawn and landscaped areas are to meet BMP T5.13. Use of compost is one way to meet the requirement).
8. Retained trees and newly planted trees for which impervious reduction credits are claimed.

d. Permanent Stormwater Control Plan – Flow Control System

Provide a drawing of the flow control facility and its appurtenances. This drawing must be accompanied by basic measurements necessary to calculate the storage volumes available from zero to the maximum head, all orifice/restrictor sizes and head relationships, control structure/restrictor placement, and placement on the site. Provide

sufficient details on the drawings to show how the facility conforms with design criteria in Volume III for detention facilities or infiltration facilities. If distributed bioretention facilities and/or storage below permeable pavement are used to help meet the LID performance standard option of minimum requirement #5, and/or minimum requirement #7, drawings are necessary to confirm accurate representation in the runoff model. Identify locations and approximate size of all permeable pavement surfaces and bioretention facilities to be installed as part of this project, including those that will be installed on individual lots by subsequent contractors. 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 should also be shown."

Include computer printouts, calculations, equations, references, storage/volume tables, graphs as necessary to show results and methodology used to determine the storage facility volumes. Where the Western Washington Hydrology Model (WWHM), or other approved runoff model, is used, its documentation input and output files must be included.

e. Permanent Stormwater Control Plan – Water Quality System

Provide a drawing of the proposed treatment facilities, and any structural source control BMPs. The drawing must show overall measurements and dimensions, placement on the site, location of inflow, bypass, and discharge systems. If distributed bioretention facilities and/or infiltration below pollution-generating hard surfaces are used to help meet treatment requirements, drawings are necessary to confirm accurate representation in the runoff model. Identify locations and approximate dimensions of those facilities to be installed as part of this project, including those that will be installed on individual lots by subsequent contractors.

Include WWHM or other approved model printouts, calculations, equations, references, and graphs as necessary to show the facilities are designed consistent with the Volume V requirements and design criteria. If bioretention and/or infiltration through adequate soils (see Site Suitability Criteria in Section 3.3, Volume III) below pollution-generating hard surfaces will be used to help meet 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% of the total stormwater runoff file. The total stormwater runoff file includes:

- Stormwater that has infiltrated through a bioretention facility, and stormwater that has infiltrated through adequate soils below pollution-generating hard surfaces.

- Stormwater that passes through a properly sized treatment facility. Note that stormwater that is re-collected below a bioretention facility and routed to a centralized treatment facility should not be counted twice.
- Stormwater that does not receive treatment due to bypass of, or overflow from a treatment facility or a bioretention facility (if the overflow is not subsequently routed to a treatment facility).

f. Permanent Stormwater Control Plan – Conveyance System Analysis and Design

Present an analysis of any existing conveyance systems, and the analysis and design of the proposed stormwater conveyance system for the project. At a minimum, present an analysis of on-site hydrologic connectivity of surficial conveyance channels and/or pipes, and points of concentration. If the local government requires an off-site analysis, include the results of that analysis here. This information should be presented in a clear, concise manner that can be easily followed, checked, and verified. All pipes, culverts, catch basins, channels, swales, and other stormwater conveyance appurtenances must be clearly labeled and correspond directly to the engineering plans.

3.1.6 Step 6 – Prepare a Construction Stormwater Pollution Prevention Plan

The Construction SWPPP for projects adding or replacing 2,000 square feet of hard surface or more, or clearing 7,000 square feet or more, must contain sufficient information to satisfy the local government Plan Approval Authority that the potential pollution problems have been adequately addressed for the proposed project. Local governments may adopt a standard SWPPP format for use by projects less than 1 acre. An adequate Construction SWPPP includes a narrative and drawings. The narrative is a written statement to explain and justify the pollution prevention decisions made for a particular project. The narrative contains concise information concerning existing site conditions, construction schedules, and other pertinent items that are not contained on the drawings. The drawings and notes describe where and when the various BMPs should be installed, the performance the BMPs are expected to achieve, and actions to be taken if the performance goals are not achieved.

The 13 Elements listed in Section 2.5.2 - Minimum Requirement #2 - must be considered in the development of the Construction SWPPP unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the narrative of the Construction SWPPP. These elements are described in detail in Volume II, Chapter 3. They cover the general water quality protection strategies of limiting site impacts, preventing erosion and sedimentation, and managing activities and sources.

On construction sites that discharge to surface water, the primary consideration in the preparation of the Construction SWPPP is compliance with the State Water Quality Standards. The step-by-step procedure outlined in Volume II, Section 3.3 is recommended for the development of these Construction SWPPPs. A checklist is contained in Volume II, Section 3.3 that may be helpful in preparing and reviewing the Construction SWPPP.

On construction sites that infiltrate all stormwater runoff, the primary consideration in the preparation of the Construction SWPPP is the protection of the infiltration facilities from fine sediments during the construction phase and protection of ground water from other pollutants. Several of the other elements are very important at these sites as well, such as marking the clearing limits, establishing the construction access, and managing the project.

3.1.7 Step 7 – Complete the Stormwater Site Plan

The Stormwater Site Plan encompasses the entire submittal to the local government agency with drainage review authority. It includes the following documents

Project Overview

The project overview must provide a general description of the project, predeveloped and developed conditions of the site, site area and size of the improvements, and the pre- and post-developed stormwater runoff conditions. The overview should summarize difficult site parameters, the natural drainage system, and drainage to and from adjacent properties, including bypass flows.

A vicinity map should clearly locate the property, identify all roads bordering the site, show the route of stormwater off-site to the local natural receiving water, and show significant geographic features and sensitive/critical areas (streams, wetlands, lakes, steep slopes, etc.).

A site map, using a minimum USGS 1:2400 topographic map as a base, should display:

- Acreage and outlines of all drainage basins;
- Existing stormwater drainage to and from the site;
- Routes of existing, construction, and future flows at all discharge points; and
- The length of travel from the farthest upstream end of a proposed storm drainage system to any proposed flow control and treatment facility.

A soils map should show the soils within the project site as verified by field testing. It is the designer's responsibility to ensure that the soil types

of the site are properly identified and correctly used in the hydrologic analysis.

Existing Conditions Summary

This is the summary described in Section 3.1.1 above. If the local government does not require a detailed off-site analysis, this summary should also describe:

- The natural receiving waters that the stormwater runoff either directly or eventually (after flowing through the downstream conveyance system) discharges to, and
- Any area-specific requirements established in local plans, ordinances, or regulations or in Water Clean-up Plans approved by Ecology.

Off-site Analysis Report

This is the report described under Section 3.1.3 above.

Permanent Stormwater Control Plan

This is the plan described in Section 3.1.5 above.

Construction Stormwater Pollution Prevention Plan

This is the plan described in Section 3.1.6 above.

Special Reports and Studies

Include any special reports and studies conducted to prepare the Stormwater Site Plan (e.g., a soils report that could include the results of soil sampling and testing, infiltration tests and/or soil gradation analyses, depth to ground water; wetlands delineation).

Other Permits

Include a list of other necessary permits and approvals as required by other regulatory agencies, if those permits or approvals include conditions that affect the drainage plan, or contain more restrictive drainage-related requirements.

Operation and Maintenance Manual

Submit an operations and maintenance manual for each flow control and treatment facility, including any distributed bioretention facilities that are used to help meet flow control and/or treatment requirements. . The manual should contain a description of the facility, what it does, and how it works. The manual must identify and describe the maintenance tasks, and the frequency of each task. The maintenance tasks and frequencies must meet the standards established in this manual or an equivalent manual adopted by the local government agency with jurisdiction.

Include a recommended format for a maintenance activity log that will indicate what actions will have been taken.

The manual must prominently indicate where it should be kept, and that it must be made available for inspection by the local government.

Declaration of Covenant for Privately Maintained Flow Control and Treatment Facilities

To ensure future maintenance and allow access for inspection by the local government, any flow control and treatment facilities for which the applicant identifies operation and maintenance to be the responsibility of a private party must have a declaration of covenant and grant of easement. After approval by the local government, the declaration of covenant and grant of easement must be signed and recorded at the appropriate records office of the local government.

Declaration of Covenant for Privately Maintained On-site Stormwater Management BMPs

To ensure future maintenance and allow access for inspection by the local government, any On-site Stormwater Management BMPs for which the applicant identifies operation and maintenance to be the responsibility of a private party must have a declaration of covenant and grant of easement. Design details, figures, and maintenance instructions for each On-site Stormwater Management BMP shall be attached. A map showing the location of newly planted and retained trees claimed as flow reduction credits shall also be attached. This applies to every lot within a subdivision on which an On-site Stormwater Management BMP is proposed. After approval by the local government, the declaration of covenant and grant of easement must be signed and recorded at the appropriate records office of the local government.

Bond Quantities Worksheet

If the local government adopts a requirement for a performance bond (or other financial guarantee) for proper construction and operation of construction site BMPs, and proper construction of permanent drainage facilities, the designer shall provide documentation to establish the appropriate bond amount.

3.1.8 Step 8 – Check Compliance with All Applicable Minimum Requirements

A Stormwater Site Plan as designed and implemented should specifically fulfill all Minimum Requirements applicable to the project. The Stormwater Site Plan should be reviewed to check that these requirements are satisfied.

3.2 Plans Required After Stormwater Site Plan Approval

This section includes the specifications and contents required of those plans submitted after the local government agency with jurisdiction has approved the original Stormwater Site Plan.

3.2.1 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 local government agency with review authority prior to construction. The submittals should 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. Any other supporting information that explains and supports the reason for the change.

3.2.2 Final Corrected Plan Submittal

If the project included construction of conveyance systems, treatment facilities, flow control facilities, structural source control BMPs, bioretention facilities, permeable pavement, vegetated roofs, a rainwater harvest system, and/or newly planted or retained trees for which a flow reduction credit was taken, the applicant shall submit a final corrected plan ("as-builts") to the local government agency with jurisdiction when the project is completed. These should be engineering drawings that accurately represent the stormwater infrastructure of the project as constructed. These corrected drawings must be professionally drafted revisions that are stamped, signed, and dated by a licensed civil engineer registered in the state of Washington.

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

4.1 Purpose

The purpose of this chapter is to provide guidance for selecting permanent BMPs and facilities for new development and redevelopment sites (including retrofitting of redevelopment sites). The task of selecting BMPs and facilities is necessary to complete the Permanent Stormwater Control Plan - one of the major components of a Stormwater Site Plan. The details for how to complete the other major component - a Construction Stormwater Pollution Prevention Plan - are included in Chapter 3 of Volume II of this manual.

The Department of Ecology's (Ecology) pollution control strategy is to emphasize pollution prevention first, through the application of source control BMPs. Then the application of appropriate on-site, treatment, and flow control facilities fulfills the statutory obligation to provide "all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the State of Washington." (RCW 90.48.010) This statutory requirement is generally known by an acronym – AKART.

The remainder of this chapter presents seven steps in selecting BMPs, Treatment Facilities, and Flow Control Facilities.

4.2 BMP and Facility Selection Process

Step I: Determine and Read the Applicable Minimum Requirements

Section 2.4 establishes project size thresholds for the application of Minimum Requirements to new development and redevelopment projects. Figures 2.4.1 and 2.4.2 provide the same thresholds in a flow chart format. Total new hard surfaces, replaced hard surfaces, and converted vegetation areas to determine which minimum requirements apply to the project.

Step II: Select Source Control BMPs

Note: If your project is a residential development, you may skip this step.

Refer to Volume IV. If the project involves construction of areas or facilities to conduct any of the activities described in Section 2.2 of Volume IV, the "applicable" structural source control BMPs described in that section must be constructed as part of the project. In addition, if the specific business enterprise that will occupy the site is known, the "applicable" operational source control BMPs must also be described.

Structural source control BMPs should be identified in the stormwater site plan and should be shown on all applicable plans submitted for local government review and approval.

The project may have additional source control responsibilities as a result of area-specific pollution control plans (e.g., watershed or basin plans, water clean-up plans, ground water management plans, lakes management plans), ordinances, and regulations.

Step III: Determine Threshold Discharge Areas and Applicable Requirements for Treatment, Flow Control, and Wetlands Protection

Minimum Requirements #6 (Runoff Treatment) and #7 (Flow Control) have size thresholds that determine their applicability (see Sections 2.5.6 and 2.5.7). Minimum Requirement #8 (wetlands protection) uses the same size thresholds as those used in #6 and #7. Those thresholds determine whether certain areas (called "threshold discharge areas") of a project must use treatment and flow control facilities, designed by a professional engineer, or whether just Minimum Requirement #5 (On-Site Stormwater Management BMPs) applies (see Section 2.5.5).

Step 1: Read the definitions in Section 2.3 to become acquainted with the following terms: effective impervious surface, impervious surface, hard surface, pollution-generating impervious surface (PGIS), pollution-generating hard surface, pollution-generating pervious surface (PGPS), converted vegetation areas, and threshold discharge area.

Step 2: ***Outline the threshold discharge areas*** for your project site.

Step 3: Determine the amount of pollution-generating hard surfaces (including pollution-generating permeable pavements) and pollution-generating pervious surfaces (not including permeable pavements) in each threshold discharge area. Compare those totals to the project thresholds in Section 2.5.6 to determine where treatment facilities are necessary. Note that On-site Stormwater Management BMPs (Minimum Requirement #5) are always applicable.

Step 4: ***Compute the totals for effective impervious surface and converted vegetation areas in each threshold discharge area.*** Compare those totals to the project thresholds in Section 2.5.7 to determine if flow control facilities (Minimum Requirement #7 and #8) are needed. If neither threshold for flow control facilities (Minimum Requirement #7) is exceeded, proceed to Step 5. If one of the thresholds is exceeded, proceed to Step IV below.

Step 5: ***For each threshold discharge area, use an approved continuous runoff model (e.g., WWHM, MGS Flood) to determine whether there is an increase of 0.1 cfs in the 100-year return frequency flow.*** (Note: this is the threshold using 1-hour time steps. If using 15-minute time steps, the

threshold is a 0.15 cfs increase.) This requires a comparison to the 100-year return frequency flow predicted for the existing (pre-project; not the historic) land cover condition of the same area. If the above threshold is exceeded, flow control – Minimum Requirements #7 and #8 – is potentially required. See the "Applicability" sections of those minimum requirements. Note that On-site Stormwater Management BMPs (Minimum Requirement #5) are always applicable.

This task requires properly representing the hard surfaces, and the converted vegetation areas in the runoff model. Hard surfaces include impervious surfaces, permeable pavements, and vegetated roofs. Impervious surface area totals are entered directly. Permeable pavements are entered as lawn/landscaping areas over the project soil type if they do not have any capability for storage in the gravel base (more typical of private walks, patios, and private residential driveways). Permeable pavements with storage capability should use the permeable pavement "element" in the model. An "element" is provided for vegetated roofs also. See Appendix III-C in Volume III, and the WWHM users manual for guidance concerning proper representation of LID BMPs in approved computer models.

Step IV: Select Flow Control BMPs and Facilities

A determination should have already been made whether Minimum Requirement #7, and/ or Minimum Requirement #8 apply to the project site. On-site Stormwater Management BMPs must be applied in accordance with Minimum Requirement #5. In addition, flow control facilities must be provided for discharges from those threshold discharge areas that exceed the thresholds outlined in Section 2.5.7. Use an approved continuous runoff model (e.g. the Western Washington Hydrology Model) and the details in Chapter 3 of Volume III to size and design the facilities.

The following describes a selection process for those facilities.

Step 1: Determine whether you can infiltrate.

There are two possible options for infiltration.

The first option is to infiltrate through rapidly draining soils that do not meet the site characterization and site suitability criteria for providing adequate treatment. See Chapter 3 of Volume III for design criteria for infiltration facilities intended to provide flow control without treatment. In this case, a treatment facility must be provided prior to discharge to the ground for infiltration. The treatment facility could be located off-line with a capacity to treat the water quality design flow rate or volume (See Volume V, Chapter 4) to the applicable performance goal (See Volume V, Chapter 3). Volumes or flow rates in excess of the design volume or flow rate would bypass untreated into the infiltration basin. (Note that wetpool treatment facilities are always designed to be on-line.) The infiltration facility must provide adequate volume such that the flow duration standard

of Minimum Requirement #7, or the water surface elevation requirements of Minimum Requirement #8 will be achieved.

The second option is to infiltrate through soils that meet the site characterization and site suitability criteria in Chapter 3 of Volume III. The facility would be designed to meet the requirements for treatment and flow control. However, since such a facility would have to be located on-line it would be quite large in order to achieve the flow duration standard of Minimum Requirement #7.

If infiltration facilities for flow control are planned, the flow control requirement has been met. Proceed to Step V. If infiltration facilities are not planned, proceed to Step 2.

Step 2: Use the Western Washington Hydrology Model to size a detention facility.

Refer to Chapter 2, of Volume III for an explanation of the use of the Western Washington Hydrology Model. Detailed guidance concerning proper use of the model is provided in a separate document. Ecology recommends attendance at WWHM training classes.

Note that the more the site is left undisturbed, and the less impervious surfaces are created, the smaller the detention facility. Also, the greater the use of On-site Stormwater Management BMPs, the smaller the detention facility.

Step V: Select Treatment Facilities

Please refer to Chapter 2 of Volume V of this manual for step-by-step guidance to selection of treatment facilities.

Step VI: Review Selection of BMPs and Facilities

The list of on-site, treatment and flow control facilities, and the list of source control BMPs should be reviewed. The site designer may want to re-evaluate site layout to reduce the need for construction of facilities, or the size of the facilities by reducing the amount of impervious surfaces created, making more use of On-site Stormwater Management BMPs, and increasing the areas to be left undisturbed.

Step VII: Complete Development of Permanent Stormwater Control Plan

The design and location of the BMPs and facilities on the site must be determined using the detailed guidance in Volumes III, IV, and V. Operation and Maintenance manuals for each treatment and flow control facility are necessary. Please refer to Chapter 3 for guidance on the contents of the Stormwater Site Plan which includes the Permanent Stormwater Control Plan and the Erosion and Sediment Control Plan.