



**Cowlitz County Stormwater Drainage Manual**  
*For the unincorporated urbanized areas within Cowlitz County,*

**June 2022**

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## Cowlitz County Stormwater Drainage Manual

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## **I.0 Introduction**

### **I.1 Purpose**

The purpose of this Cowlitz County Stormwater Drainage Manual (SWDM) is to identify minimum stormwater management requirements and standards for development activities, in accordance with Cowlitz County Code (CCC) 16.22. The area of oversight is the unincorporated urbanized areas of Cowlitz County adjacent to the cities of Longview and Kelso. The minimum requirements and standards are intended to promote and protect the health, safety, and welfare of the people of Cowlitz County, minimize property damage and safeguard the aesthetic and biotic integrity of the County's water resources. The minimum requirements and standards include the application of best management practices (BMPs) for stormwater management and erosion control.

This manual is intended to represent the minimum requirements and design standards for stormwater. They are intended to assist the design professional. Compliance with these requirements and standards does not relieve the designer of the responsibility to apply sound professional judgment to health, welfare and safety of the general public. The minimum requirements and design standards of this manual cannot provide for all situations. Special site conditions and environmental constraints may require a greater level of protection than would normally be required by the manual. Development activities must be designed to comply with conditions of any permits, codes and regulations in addition to this manual.

### **I.2 Relationship to the 2019 Ecology Stormwater Manual**

The minimum requirements and standards of this manual are written to comply with the Western Washington Phase II Municipal Stormwater Permit (Permit) issued by the Washington State Department of Ecology (Ecology). To comply with the Permit, this manual adopts the Thresholds, Definitions, Minimum Requirements, Exceptions, Adjustments and Variance Criteria found in Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit. Appendix 1 of the Permit references specific sections of the 2019 Stormwater Management Manual for Western Washington (SWMMWW); consequently, this manual references those same specific sections of the SWMMWW as well.

Local jurisdictions may modify or add to the requirements found in Appendix 1 of the Permit and the SWMMWW as long as those modifications are equivalent to or stricter than the requirements found within the Permit or the SWMMWW. Where portions of the Cowlitz County SWDM conflicts with the SWMMWW, the SWDM shall apply. This manual does not repeat content of the SWMMWW, so both manuals must be consulted. It does, however direct the user to relevant sections in the SWMMWW. If provisions of this manual conflict with Cowlitz County Code, or State and Federal requirements, the more stringent provisions shall apply.

### 1.3 Other Applicable Permits

For all applicable land disturbing activities the developer shall obtain a fill and grade permit in accordance with the provisions described in the Cowlitz County Grading Ordinance, Chapter 16.35 of the Cowlitz County Code.

Additionally the developer shall comply with all applicable federal, state and local regulations associated with construction and development.

### 1.4 Definitions

For the purposes of this manual the following definitions shall apply:

**Applicant** means the person constructing the stormwater facilities and/or the person holding title to the property where the subject stormwater facilities are located. Also see definition of “person” found below.

**Best Management Practices (BMP)** means the physical, educational, structural and/or managerial practices and activities that, when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State or the County’s municipal stormwater facilities. BMPs include the following categories:

1. **Source control BMP** means a BMP that is intended to prevent pollution from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants.
2. **Treatment BMP** means a BMP that is intended to remove pollutants from stormwater.
3. **Flow control BMP** means a structural BMP that is intended to mitigate the impacts of increased stormwater runoff rates generated by development.
4. **Low Impact Development (LID) BMP** means a stormwater management and land development strategy applied at an individual parcel or at a subdivision scale that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic pre-development hydrologic functions.

**Clean Water Act (CWA)** means the Federal Water Pollution Control Act.

**Clearing** means the removal of vegetation by manual, mechanical, chemical or other such methods.

**Commercial agriculture** means those activities conducted on lands defined in RCW Section 84.34.020(2), and activities involved in the production of crops or livestock for wholesale trade. An activity ceases to be considered commercial agriculture when the area on which it is conducted is proposed for conversion to a nonagricultural use.

**Common plan of development** means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules, but still under a single plan. Examples include: phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (i.e., a development where lots are sold to separate builders); a

development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; and projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility. If the project is part of a common plan of development, the disturbed area of the entire plan shall be used in determining the application of Minimum Requirements.

**Construction** means a land disturbing activity that results in development. Such activities include but are not limited to clearing, grubbing, grading, excavating, filling, demolition, compaction and building.

**Construction Stormwater Pollution Prevention Plan (SWPPP)** means a document which describes the BMPs, schedules and activities to be implemented for a Project to eliminate or reduce pollutant discharges to stormwater during construction activities.

**Conveyance Facility** means a constructed component of a stormwater drainage system designed or constructed to convey storm water. Conveyance facilities include but are not limited to pipes, ditches, culverts, street gutters, catch basins, manholes and storm water pump stations.

**County** means any and all applicable Departments of Cowlitz County, including employees, representatives or designees representing the County in the administration and enforcement of this chapter.

**Detention** means temporary storage of stormwater to facilitate the release of stormwater runoff from the site at a slower rate than collected by the stormwater facility system.

**Development** includes construction, new development and/or redevelopment, including a combination thereof. See definitions for each.

**Director** means the County Engineer for Cowlitz County or their designee.

**Ecology** means the Washington State Department of Ecology.

**Erosion** means the removal of solids (sediment, soil, rock and other particles) in the natural environment due to transport by wind, water or ice; by down-slope creep of soil and other material under the force of gravity; or by living organisms.

**Excavation** means the mechanical removal of earth material.

**Fill** means a deposit of earth material placed by artificial means.

**Forest practice** means any activity conducted on or directly pertaining to forest land and relating to growing, managing or harvesting timber, as described in Chapter 222-16 WAC.

**Hard Surface** means an impervious surface, a permeable pavement or a vegetated roof.

**Hazardous Materials** means any material or agent, which because of its quantity, concentration, or physical, chemical or infectious characteristics may pose a present or potential hazard to human health, safety, property or the environment.

**Impervious surface** means a hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include but are not limited to roof tops, walkways, patios, driveways,

parking lots or storage areas, concrete or asphalt paving, packed gravel surfaces, packed earthen materials and macadam or other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces for purposes of determining whether the thresholds for application of Minimum Requirements are exceeded but shall be considered impervious surfaces for purposes of runoff modeling.

**Land disturbing activity** means any activity that results in movement of earth or a change in the existing soil cover (both vegetative and non-vegetative) and/or the existing soil topography. Land disturbing activities include but are not limited to clearing, grading, filling and excavation. Compaction that is associated with stabilization of structures and road construction shall also be considered a land disturbing activity. Vegetation maintenance practices and gardening are not considered land-disturbing activities.

**Low Impact Development (LID)** means a stormwater and land use management strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design.

**LID Best Management Practices** means distributed stormwater practices, integrated into a project design, that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration.

**LID Principles** mean land use management strategies that emphasize conservation, use of on-site natural features, and site planning to minimize impervious surfaces, native vegetation loss and stormwater runoff.

**Maintenance** means activities conducted on currently serviceable structures, facilities and equipment that involve no expansion or use beyond that previously existing use and resulting in no significant adverse hydrological impact. Maintenance includes those usual activities taken to prevent a decline, lapse or cessation in the use of structures and systems. Those usual activities may include but are not limited to removal and replacement of nonfunctional or poorly functioning facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. As an example, the replacement of a collapsed fish-blocking round culvert with a new box culvert under the same span, or width, of roadway is a maintenance activity.

**Minimum Requirements** means Ecology's Minimum Technical Requirements for New Development and Redevelopment for land disturbances of one acre or more or land disturbance less than one acre that are part of a larger common plan of development.

**Municipal Separate Storm Sewer System (MS4)** means any part of a man-made physical system owned or maintained by the County designed and constructed to collect, treat, convey, store, or control the flow of stormwater, including, but not limited to any roads with drainage systems, municipal streets, catch basins, curbs, gutters, inlets, piped storm drains, constructed channels and ditches, stormwater conveyances and containment facilities, including infiltration facilities, retention and detention facilities, stormwater treatment facilities, erosion and sedimentation control facilities, pumping facilities and all other

drainage structures and appurtenances which are within the County and not considered a combined sewer or part of a publicly owned treatment works or system used in the conveyance and treatment of municipal sewage or industrial wastes of a liquid nature.

**National Pollutant Discharge Elimination System (NPDES) Permit** means a permit issued by the Washington State Department of Ecology under authority delegated pursuant to 33 USC § 1342(b) that authorizes the discharge of pollutants to surface waters of the United States. See also the Western Washington Phase II Municipal Stormwater Permit.

**Native vegetation** means vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and which reasonably could have been expected to occur naturally on the site. Examples may include but are not limited to trees such as Douglas fir, western hemlock, western red cedar, alder, big-leaf maple and vine maple; shrubs such as willow, elderberry, salmonberry and salal; and herbaceous plants such as sword fern, foam flower and fireweed.

**New development** means land disturbing activities, including Class IV -general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivision, short subdivision and site plans, as defined and applied in the Cowlitz County Code. Projects meeting the definition of redevelopment shall not be considered new development.

**Permit** means an approval from the Department of Building and Planning of a land use application associated with Chapters 16, 18 or 19 of the Cowlitz County Code.

**Person** means any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

**Phase II Permit** means the Western Washington Phase II Municipal Stormwater Permit.

**Pre-developed condition** means the native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. The pre-developed condition shall be assumed to be a forested land cover unless reasonable historic information is provided that indicates the site was prairie prior to settlement.

**Premises** means any building, lot, parcel of land or portion of land, whether improved or unimproved, including adjacent sidewalks and parking strips.

**Project site** means that portion of a property, properties or right of way subject to land disturbing activities, new hard surfaces, or replaced hard surfaces. The total projected area of new, replaced or new plus replaced impervious surfaces for subdivisions shall constitute a project site.

**RCW** means the Revised Code of Washington.

**Receiving waters** means body/bodies of water or surface water systems where surface runoff is discharged via outfall or sheet flow. Roadside ditches are not considered receiving waters. They are a part of the MS4.

**Redevelopment** means on a site that is already substantially developed (i.e. has thirty five percent or more of existing hard surface coverage), the creation or addition of hard surfaces;

the expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of hard surface that is not part of a routine maintenance activity; and land disturbing activities.

**Regulatory Threshold** means the threshold for applicability of this manual and applicability of Ecology's nine Minimum Requirements. The regulatory threshold refers to any land disturbance of one acre or more, or any land disturbance less than one acre that is part of a larger common plan of development.

**Replaced impervious surface** means with respect to structures, the removal and replacement of any exterior impervious surfaces or foundation. With respect to other impervious surfaces, the removal down to bare soil or base course and replacement of impervious surface.

**Road, street or highway** means a public or private thoroughfare leading from one place to another, which has typically been prepared to allow travel by some conveyance.

**Routine Maintenance** means preventative or cyclical maintenance that is an essential part of the on-going care and upkeep of a system or facility against normal wear and tear.

**Site** means the area defined by the legal boundaries of one or more parcels of land that are subject to new development or redevelopment. For road projects, the site includes the full length of the project and the associated right-of-way.

**Soil** means the unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

**Stormwater** means surface runoff of water resulting from natural precipitation.

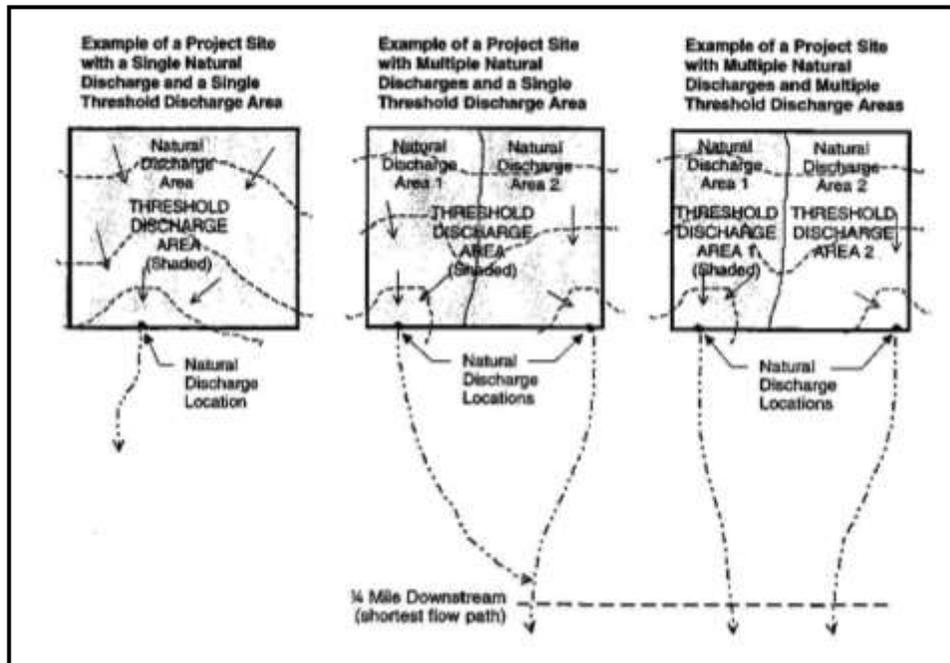
**Stormwater Site Plan** means the comprehensive report containing all of the technical information and analysis necessary for a regulatory agency to evaluate a proposed new development or redevelopment project for compliance with the Permit's Minimum Requirements.

**Stormwater Facility** means a constructed component of a stormwater drainage system designed or constructed to perform a particular (or multiple) function other than conveyance. Stormwater facilities include but are not limited to swales, detention ponds, retention ponds, constructed wetlands, infiltration devices, oil/water separators, biofiltration swales, LID features and BMPs

**Stormwater Management Manual for Western Washington (SWMMWW)** means the 2019 edition of the manual prepared by Ecology, containing BMPs to prevent, control or treat pollution in stormwater and reduce other stormwater-related impacts to waters of the State. The SWMMWW is intended to serve as a reference and supplement to this Chapter to control the quantity and quality of stormwater runoff from new development, redevelopment and construction activities.

**SWPPP Threshold** means the threshold for applicability of Minimum Requirement #2 (Construction Stormwater Pollution Prevention Plan). The SWPPP threshold refers to any land disturbance of 7,000 square feet or more.

**Threshold Discharge Area** means an onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath). The examples in figure below illustrate this definition. The purpose of this definition is to clarify how the thresholds of this manual are applied to project sites with multiple discharge points.



**Unincorporated Urbanized Area** means the unincorporated area within Cowlitz County constituting an urbanized area as defined by the State of Washington Department of Ecology's Western Washington Phase II Municipal Stormwater Permit. The area includes those parcels depicted on Figure 1.

**WAC** means the Washington Administrative Code.

**Waterbody** means lakes, rivers, ponds, streams, inland waters, sloughs, diking ditches and all other surface waters and watercourses within the jurisdiction of the State of Washington.

**Western Washington Phase II Municipal Stormwater Permit (Permit)** means a permit issued by the Washington State Department of Ecology under Sections 307, 318, 402 and 405 of the Federal Clean Water Act that authorizes the discharge of pollutants to surface waters of the State for a Phase II community. Also known as an NPDES permit.

**Wetlands** means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites including but not limited to irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds and landscape amenities or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street or

highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.

**Vegetation** means organic plant life growing on the surface of the earth.

## **2.0 Minimum Requirements**

### **2.1 How to Identify Applicable Minimum Requirements**

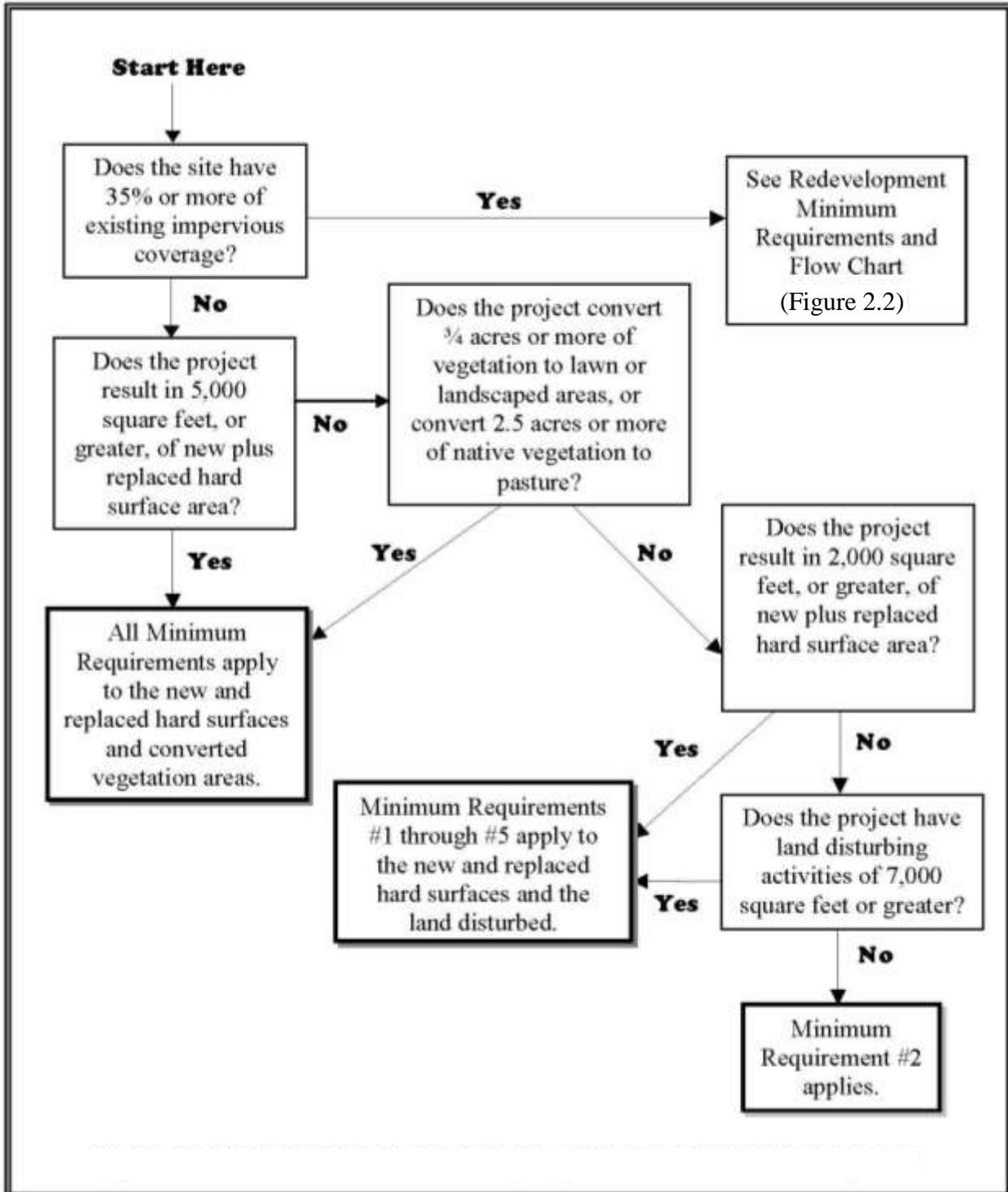
Nine minimum requirements for stormwater management shall apply to development projects meeting the regulatory threshold.

1. Preparation of Stormwater Site Plan
2. Construction Stormwater Pollution Prevention Plan
3. Source Control of Pollution
4. Preservation of Natural Drainage Systems and Outfalls
5. Onsite Stormwater Management
6. Runoff Treatment
7. Flow Control
8. Wetland Protection
9. Operations and Maintenance

Not all of the minimum requirements apply to every development activity; the applicability varies, depending on the characteristics and size of the development activity. To determine which requirements apply, consult Figure 2.1 and Sections 2.2 and 2.3 on the following pages.

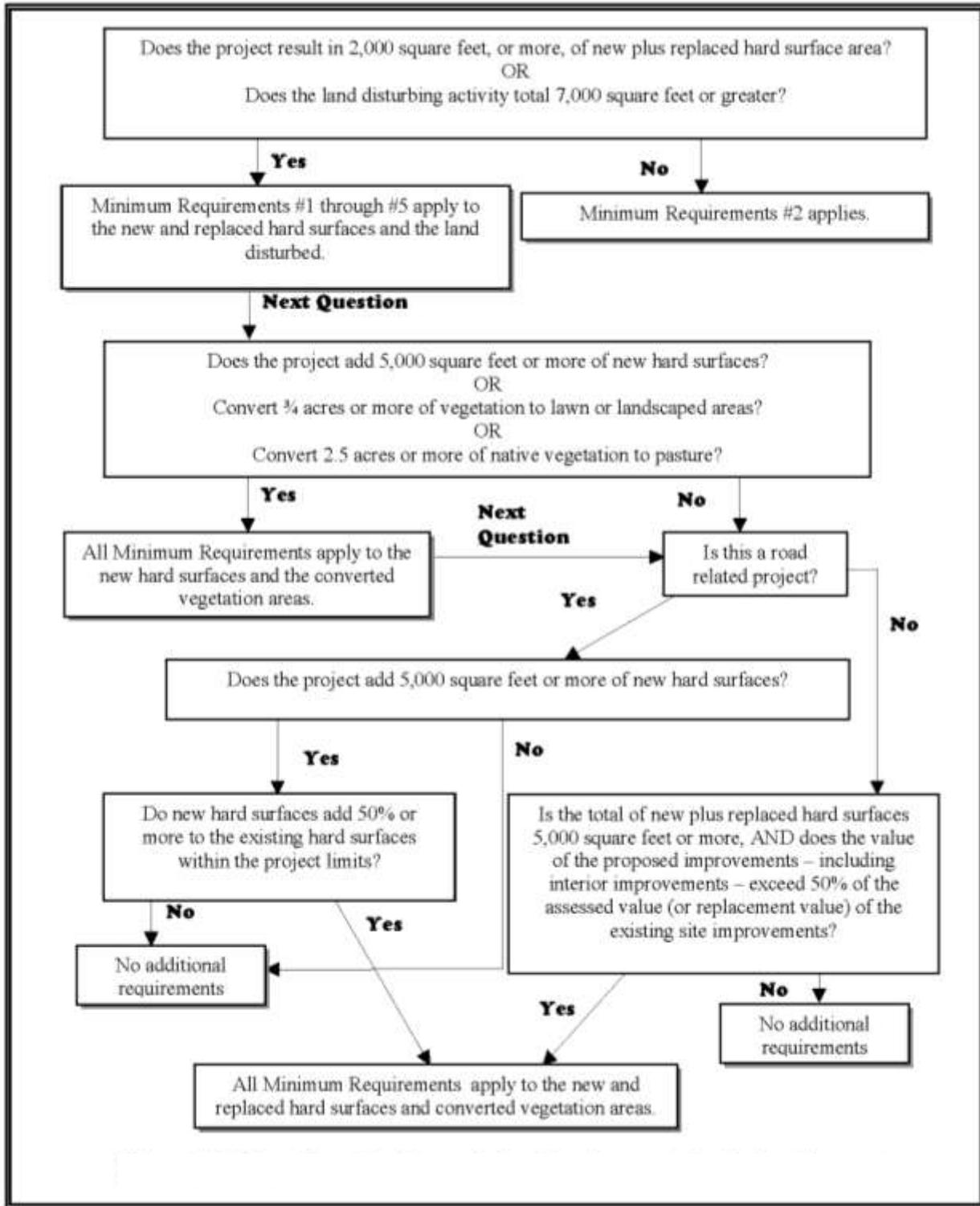
### Cowlitz County Stormwater Drainage Manual Determination of Project Requirements

— Figure 2.1 —



### Cowlitz County Stormwater Drainage Manual Determination of Project Requirements (continued)

— Figure 2.2 —



### 2.1.1 Requirements for Construction Stormwater Management.

All development activities result in 2,000 square feet or more of new plus replaced hard surface area or disturb 7,000 square feet or more of land shall satisfy Minimum Requirement 2 – Construction SWPPP.

Ecology also requires activities that meet the regulatory threshold requirement of one acre of land disturbance to obtain a *General NPDES Permit for Stormwater Discharges Associated with Construction Activities*. More information can be found at [www.ecy.wa.gov/programs/wq/stormwater/construction](http://www.ecy.wa.gov/programs/wq/stormwater/construction).

## 2.2 Exemptions from the Minimum Requirements

### 2.2.1 Total Exemptions

The following activities are exempt from Chapter 16.22 of the Cowlitz County Code and this manual:

- **Forest Practices.** Forest practices regulated under WAC Title 222, except for Class IV General Forest Practices that are conversions from timber land to other uses.
- **Commercial Agriculture.** Commercial agriculture practices involving working the land for production are generally exempt. However, the conversion from timberland to agriculture and the construction of impervious surfaces are not exempt.
- **Road Maintenance.** Pothole and square cut patching, overlaying existing asphalt or concrete pavement with asphalt or concrete without expanding the area of coverage, shoulder grading, reshaping/regrading drainage systems, crack sealing, resurfacing with in-kind material without expanding the road prism and vegetation maintenance are exempt from all minimum requirements described in Chapter 2 of this manual.

### 2.2.2 Partial Exemptions

The following activities are not categorically exempt but are exempt from certain requirements of this manual:

#### I. Road Maintenance.

- A. Removing and replacing a paved surface to base course or lower, or repairing the roadway base: If the impervious surfaces are not expanded the activity is considered redevelopment and subject to Minimum Requirements 1 through 5 apply. The Minimum Requirements are further described in Chapter 2 of this manual.
- B. Resurfacing the roadway by upgrading from dirt to gravel, asphalt or concrete; upgrading the roadway surface from gravel to asphalt or concrete (i.e., extending the pavement edge without increasing the size of the road prism, or paving graveled shoulders); or upgrading from a bituminous surface treatment (“chip

seal”) to asphalt or concrete are all roadway maintenance activities that would generate new impervious surface and are subject to all the Minimum Requirements in Chapter 2 of this manual.

- C. Extending the pavement edge without increasing the size of the road prism, or paving graveled shoulders is considered new impervious surfaces and are subject to all technical and administrative requirements.
2. **Underground Utility Projects.** Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics are only subject to Minimum Requirement 2 – Construction Stormwater Pollution Prevention Plan, found in Chapter 2 of this manual.
3. **Oil and Gas Field Activities or Operations.** Construction of drilling sites, waste management pits and access roads as well as construction of transportation and treatment infrastructure such as pipelines, natural gas treatment plants, natural gas pipeline compressor stations and crude oil pumping stations are exempt from all Minimum Requirements in this manual. Operators are encouraged to implement and maintain Best Management Practices (BMPs) to minimize erosion and control sediment during and after construction activities to help ensure protection of surface water quality during storm events.
4. **Diking Districts No. #1 and #3.** New development and redevelopment within the boundaries of Consolidated Diking Improvement District #1 (CDID #1) and Consolidated Diking Improvement District #3 (CDID #3) are partially exempt from Minimum Requirement #7. CDID #1 is generally within the boundaries of the Cowlitz River on the east, the Columbia River to the south, Ditch No. 10 to the west, and Ditch No. 6 to the north. CDID #3 includes properties draining to drainage ditches served by five pump stations: Tam O’Shanter Pump Stations #1 and #2; Coweeman Pump Station; Baker Way Pump Station; and Elk’s Pump Station. Development and redevelopment within these areas shall design flow control facilities utilizing the Santa Barbara Urban Hydrograph (SBUH) modeling method, and the existing site characteristics as the pre-developed condition. Facilities shall be sized such that the peak release rate from the development shall not exceed the peak release rate from half the pre-developed 2-year, 24-hour, the pre-developed 25-year and the pre-developed 100-year, 24-hour design storms.

### **2.3 Requirements for Post-Construction Stormwater Management.**

1. All development activities shall satisfy Minimum Requirements 1 through 5 for the new and replaced impervious surfaces and the disturbed land if the project:
  - A. Results in two thousand (2,000) square feet or more of new, replaced or a total of new plus replaced hard surface area; or
  - B. Has development activities that affect seven thousand (7,000) square feet of area or more.
2. All development activities shall satisfy Minimum Requirements 1 through 9 for the new impervious surfaces and the converted pervious surfaces if the project:

- A. Results in five thousand (5,000) square feet or more of new, replaced, or a total of new plus replaced hard surface area; or
  - B. Converts three-quarters ( $\frac{3}{4}$ ) of an acre, or more of native vegetation to lawn or landscaped areas; or
  - C. Converts two and a half ( $2\frac{1}{2}$ ) acres, or more of native vegetation to pasture.
3. All redevelopment activities shall satisfy Minimum Requirements 1 through 5 for the new and replaced hard surfaces if the project:
    - A. Results in two thousand (2,000) square feet or more of new, replaced or a total of new plus replaced hard surface area; or
    - B. Has development activities that affect seven thousand (7,000) square feet of area or more.
  4. All redevelopment activities shall satisfy Minimum Requirements 1 through 9 for the new and replaced hard surfaces if the project:
    - A. Adds five thousand (5,000) square feet or more of new, hard surface area; or
    - B. Converts three-quarters ( $\frac{3}{4}$ ) of an acre, or more of vegetation to lawn or landscaped areas; or
    - C. Converts two and a half ( $2\frac{1}{2}$ ) acres, or more of native vegetation to pasture; or
    - D. Results in five thousand (5,000) square feet or more of new, replaced or a total of new plus replaced hard surface area and the valuation of proposed improvements, including interior improvements, exceeds fifty percent of the assessed value of the existing site improvements.
  5. All Road related activities shall satisfy Minimum Requirements 1 through 9 for the new and replaced impervious surfaces, including pavement, shoulders, curbs and sidewalks, if the project:
    - A. Creates or adds five thousand (5,000) square feet or more of new impervious surfaces; and
    - B. If the new impervious surface area total meets or exceeds fifty percent of the existing impervious surface area within the project limits, defined by the length of the project and the width of the right-of-way.
  6. If the runoff generated from the new impervious area and converted pervious area is not separated from runoff from other surfaces on the project site, the stormwater treatment facilities shall be sized for the entire flow that is directed to them.
  7. An equivalent area with similar flow and pollution characteristics within the same site can be used to meet the Minimum Requirements. For public roads projects, the equivalent area does not have to be within the project limits, but must drain to the same receiving water.

## **2.4 How to Meet the Minimum Requirements**

After determining which minimum requirements apply to a specific project, refer to the relevant requirements below to determine how to meet each requirement.

### **1. Preparation of Stormwater Site Plans**

Prepare and submit a stormwater site plan in accordance Chapter 3 of this manual.

If a hearing is required or final construction plans will be submitted after the decision from the department of building and planning is issued, a preliminary stormwater plan shall be submitted. All other projects that meet the regulatory threshold requirement shall submit just a final stormwater plan.

### **2. Construction Stormwater Pollution Prevention Plan (SWPPP)**

Prepare and submit a Construction Stormwater Pollution Prevention Plan (SWPPP) in accordance with Chapters 3 and 7 of the manual.

### **3. Source Control of Pollution**

Source control BMPs must be selected, designed and maintained in accordance with Volume IV of the SWMMWW. For construction sites, also refer to Volume II, Chapter 4 for BMP selection, design and maintenance.

### **4. Preservation of Natural Drainage Systems and Outfalls**

Consult Volume I, Section 2.5.4 of the SWMMWW to fulfill Minimum Requirement 4.

### **5. Onsite Stormwater Management**

Consult Volume I, Section 2.5.5 of the SWMMWW to fulfill Minimum Requirement 5.

Projects qualifying as flow control exempt in accordance with the section 2.2 of this manual or the SWMMWW do not have to achieve the LID performance standard, nor consider bioretention, rain gardens, permeable pavement, or full dispersion is using List #1 or List #2. However, those projects must implement BMP T5.13; BMPs T5.10A, B, or C; and BMP T5.11 or T5.12, if feasible.

### **6. Runoff Treatment**

Runoff treatment facilities shall be selected, designed and maintained in accordance with Volume I, Section 2.5.6 of the SWMMWW.

### **7. Flow Control**

Flow control facilities shall be selected, designed and maintained in accordance with Chapter 4.0 of this manual.

### **8. Wetland Protection**

Consult Volume I, Section 2.5.8 of the SWMMWW to fulfill Minimum Requirement 8.

## **9. Operations and Maintenance**

Prepare and submit an Operations and Maintenance Manual in accordance with Volume I, Section 2.5.10 of the SWMMWW.

### **2.5 Modifications and Variances to the Minimum Requirements**

#### **2.5.1 Modifications**

A modification is a technical variation in the application of the Minimum Requirements. Modifications may be granted at the discretion of the Director only after a determination has been made and a written finding of fact prepared, providing all the following criteria are met:

1. Written documentation shall be provided to the Director describing the rationale for granting a modification;
2. The modification shall provide substantially equivalent protection or a comparable result which is in the overriding public interest; and based upon sound engineering judgment, meet the objectives of safety, function, environmental protection and facility maintenance;
3. The modification will not otherwise result in noncompliance with Chapter 16.22 of the Cowlitz County code or with any development conditions imposed upon the project; and
4. No modification shall be used in place of an exception procedure as outlined below.

#### **2.5.2 Variance**

A variance to a Minimum Requirement may be granted only if application of the Minimum Requirement imposes a severe and unexpected economic hardship. Legal public notice shall be made for all applications for variance. The application for variance shall be written documentation to the Director describing the rationale for granting a variance and shall include:

1. The current (pre-project) use of the site;
2. How the application of the Minimum Requirements restricts the proposed use of the site compared to the restrictions that existed prior to the adoption of the Minimum Requirements;
3. The remaining possible uses of the site if the variance were not granted;
4. The uses of the site that would have been allowed prior to the adoption of the Minimum Requirements;
5. A comparison of the estimated amount and percentage of value loss as a result of the Minimum Requirements versus the estimated amount and percentage of value loss as a result of requirements that existed prior to adoption of the Minimum Requirements; and
6. The feasibility for the owner to alter the project to apply the minimum

requirements.

At the discretion of the Director, a determination shall be made based upon the following:

1. A severe and unexpected economic hardship resulting from the application of the Minimum Requirements does exist;
2. The variance will not increase risk to the public health and welfare, nor be injurious to other properties in the vicinity and/or downstream and to the quality of waters of the state; and
3. The variance results in the least possible variation that could be granted and still comply with the intent of the Minimum Requirements.

A written finding of fact will be prepared and regarding the County's decision.

### **2.5.3 Prior Approval.**

Any variance or exception shall be approved prior to approval of the Stormwater Site Plan and the start of construction.

### **2.5.4 Right of Appeal.**

The original applicant or an aggrieved party may appeal the Directors decision to the Hearings Examiner in accordance with Cowlitz County Code 16.22.070D. Appeals shall be filed in writing with the Department of Building and Planning.

## 3.0 Submittals

### 3.1 Abbreviated Construction Stormwater Pollution Prevention Plan

An Abbreviated Stormwater Pollution Prevention Plan is may be submitted for projects where the development activities does not exceed one (1) acre, The simplified form of the site improvement plans shall show erosion control BMPs and provide a simple narrative addressing the 12 elements found in Section 5.3.

The abbreviated SWPPP may be prepared by a non-engineer from a set of pre-engineered or prescriptive detail details. Abbreviated SWPPPs are only allowed for projects that disturb less than an acre and would not otherwise be prepared by an engineer. The abbreviated SWPPP shall contain at a minimum:

1. Contour lines from the best available source, spot elevations or indications of direction and steepness of slopes with the source clearly identified.
2. Areas to be graded, filled, excavated or otherwise disturbed. The location of graded slopes shall be indicated, together with the proposed steepness and height. The location of any stockpiles, haul roads and disposal sites shall also be indicated.
3. To scale grading cross-sections (minimum of one section each direction).
4. The location of on-site stormwater management facilities such as downspout infiltration, dispersion systems, bioretention filters, amended soils and pervious pavement.
5. The location and type of erosion and sedimentation control measures proposed.

### 3.2 Construction Stormwater Pollution Prevention Plan (SWPPP) Requirements

In accordance with Minimum Requirement 2 a Construction Stormwater Pollution Prevention Plan (SWPPP) is required for all projects where the development activities meet or exceed the regulatory threshold (land disturbance of one acre or more, or any land disturbance less than one acre that is part of a larger common plan of development), unless the project meets the requirements of the “Erosivity Waiver”. See 2.2.3 of this manual.

All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. The Construction SWPPP shall be implemented beginning with initial soil disturbance and remain in place until final stabilization.

The Construction SWPPP shall include a narrative and drawings. All BMPs shall be clearly referenced in the narrative and marked on the drawings. Sediment and erosion control BMPs referenced in the Construction SWPPP shall be consistent with the BMPs contained in Volume II, Chapters 2 and 3, of the *Stormwater Management Manual for Western Washington* (SWMMWW) or the functionally equivalent BMPS for Construction located at [Emerging stormwater treatment technologies \(TAPE\) - Washington State Department of Ecology](#). The SWPPP narrative shall include documentation to explain and justify the pollution prevention decisions made for the project. The SWPPP shall be submitted with the development application.

Construction SWPPPs for major developments shall be prepared by and bear the stamp of a professional engineer licensed in the state of Washington. Abbreviated Construction SWPPP for eligible projects as described in Section 3.1 do not have to be prepared or stamped by a professional engineer.

### **3.2.1 Narrative**

The narrative shall address the following:

#### **Twelve (12) Elements**

Describe how the Construction SWPPP addresses each of the 12 elements listed in section 5.3. Each of the 12 elements must be considered and included in the Construction SWPPP. The Construction SWPPP shall include the type and location of BMPs used to satisfy the required element. If site conditions render an element unnecessary to a project, a written justification for why it is not necessary shall be included in the narrative of the Construction SWPPP.

#### **Project Description**

Describe the nature and purpose of the construction project. Include the total size of the area; any increase in existing impervious area; the total area expected to be disturbed by clearing, grading, excavation or other construction activities, including offsite borrow and fill areas; and the volumes of grading cut and fill that are proposed.

#### **Existing Site Conditions**

Describe the existing topography, vegetation, and drainage. Include a description of any structures or development on the parcel, including the area of existing impervious surfaces.

#### **Adjacent Areas**

Describe adjacent areas, including streams, lakes, wetlands, residential areas and roads that might be affected by the construction project. Provide a description of the downstream drainage leading from the site to the receiving body of water.

#### **Critical Areas**

Describe areas on or adjacent to the site that are classified as critical areas per Chapter 19.15 of the Cowlitz County Code. Critical areas that receive runoff from the site shall be described up to one-quarter mile away. The distance may be increased by the plan approval authority. Describe special requirements for working near or within these areas.

#### **Soils**

Describe the soil on the site, giving such information as soil names, mapping unit, erodibility, settleability, permeability, depth, texture and soil structure.

### **Potential Erosion Problem Areas**

Describe areas on the site that have potential erosion problems. Include a completed Construction Site Sediment Transport Potential Worksheet (see Appendix B).

### **Construction Phasing**

Describe the intended sequence and timing of construction activities and proposed construction phasing.

### **Construction Schedule**

Describe the construction schedule. If the schedule extends into the wet season, describe what activities will continue during the wet season and how the transport of sediment from the construction site to receiving waters will be prevented.

### **Financial/Ownership Responsibilities**

Describe ownership and obligations for the project. Include bond forms and other evidence of financial responsibility for environmental liabilities associated with construction.

### **Engineering Calculations**

Attach any calculations made for the design of such items as sediment ponds, diversions, and waterways as well as calculations for runoff and stormwater detention design if applicable. Engineering calculations must bear the signature and stamp of an engineer licensed in the state of Washington.

### **Certified Erosion and Sediment Control Lead (CESCL)**

A responsible, Certified Erosion and Sediment Control Lead (CESCL) shall be identified, or a page at the front of the SWPPP document shall be made available where information regarding the CESCL may be written once the CESCL is selected.

## **3.2.2 Drawings**

### **Vicinity map**

Provide a map with enough detail to identify the location of the construction site, adjacent roads, and receiving waters.

### **Site map**

Provide a site map(s) showing the following features:

1. A legal description of the property boundaries or an illustration of property lines (including distances) in the drawings.
2. The direction of north in relation to the site.
3. Existing structures and roads, if present.
4. Boundaries and labeling of the different soil types.

5. Areas of potential erosion problems.
6. Any onsite and adjacent surface waters, critical areas, their buffers, FEMA base flood boundaries and shoreline management boundaries.
7. Existing contours and drainage basins and the direction of flow for the different drainage areas.
8. Final and interim grade contours as appropriate, drainage basins and the direction of stormwater flow during and upon completion of construction.
9. Areas of soil disturbance, including all areas affected by clearing, grading and excavation.
10. Locations where stormwater discharges to surface waters during and upon completion of construction.
11. Existing unique or valuable vegetation and the vegetation that is to be preserved.
12. Cut and fill slopes, indicating top and bottom of slope catch lines.
13. Stockpile, waste storage and vehicle storage/maintenance areas.
14. Total cut and fill quantities and the method of disposal for excess material.

### **Conveyance systems**

Show on the site map the following temporary and permanent conveyance features:

1. Locations for swales, interceptor trenches or ditches.
2. Drainage pipes, ditches or cut-off trenches associated with erosion and sediment control and stormwater management.
3. Temporary and permanent pipe inverts and minimum slopes and cover.
4. Grades, dimensions and direction of flow in all ditches and swales, culverts and pipes.
5. Details for bypassing offsite runoff around disturbed areas.
6. Locations and outlets of any dewatering systems.

### **Location of detention BMPs**

Show on the site map the locations of stormwater detention BMPs.

### **Erosion and sediment control (ESC) BMPs**

Show on the site map all major structural and non-structural ESC BMPs, including:

1. The location of sediment pond(s), pipes and structures.
2. Dimension pond berm widths and inside and outside pond slopes.
3. The trap/pond storage required and the depth, length and width dimensions.
4. Typical section views through pond and outlet structure.
5. Typical details of gravel cone and standpipe and/or other filtering devices.

6. Stabilization technique details for inlets and outlets.
7. Control/restrictor device location and details.
8. Stabilization practices for berms, slopes and disturbed areas.
9. Rock specifications and detail for rock check dam, if used.
10. Spacing for rock check dams, as required.
11. Front and side sections of typical rock check dams.
12. The location, detail and specification for silt fence.
13. The construction entrance location and detail.

### **Detailed drawings**

Any structural practices used that are not referenced in this manual or other local manuals shall be explained and illustrated with detailed drawings.

### **Other pollutant BMPs**

Indicate on the site map the location of BMPs to be used for the control of pollutants other than sediment.

### **Monitoring locations**

Indicate on the site map the water quality sampling locations if required by the County or the Department of Ecology. Sampling stations shall be located in accordance with applicable permit requirements.

### **Notes**

Addressing construction phasing and scheduling shall be included on the drawings.

## **3.3 Preliminary Stormwater Plan**

### **3.3.1 Purpose**

In accordance with Minimum Requirement 1 a preliminary stormwater plan is required for all new development and redevelopment projects that will go to a hearing or will submit final construction drawings after a decision is issued from the Department of Building and Planning. The purpose of the preliminary stormwater plan is to allow Cowlitz County to determine whether a proposal will meet the requirements of chapter 16.22 of the Cowlitz County Code.

The preliminary stormwater plan submittal shall consist of:

1. A preliminary development plan; and
2. A preliminary stormwater report.

The preliminary stormwater plan shall identify how stormwater runoff that originates on site or flows through the site is currently controlled and how this will change with the proposed development activities.

The project engineer shall include a statement that all the required information is included in the preliminary stormwater plan and that the proposed stormwater facilities are feasible. All plans, studies and reports that are part of the preliminary and final stormwater plans shall be stamped, signed and dated by a professional engineer licensed in the state of Washington responsible for preparation of the plan and report. The preliminary stormwater plan shall be submitted with the land use application.

### **3.3.2 Preliminary Development Plan**

The preliminary development plan shall consist of 22 inch by 34 inch or 24 inch by 36 inch drawings showing existing and proposed conditions. The preliminary development plan shall show characteristics of the existing site and proposed features, including but not limited to:

1. Existing and proposed property boundaries, easements and rights-of-way.
2. Existing and proposed contours with a 5-foot maximum contour interval, unless the Director determines a lesser interval is sufficient to show the drainage patterns and basin boundaries.
3. Offsite areas contributing runoff to the site.
4. Natural and manmade drainage features adjacent to the project site, including existing and proposed (if known) stormwater facilities.
5. Existing onsite water wells, known agricultural drains, areas of potential slope instability, structures, utilities and septic tanks and drain fields.
6. Location of the 100-year floodplain and floodways and shoreline management area limits on the project site.
7. Existing water resource features on and adjacent to the project site, including streams, wetlands, springs, sinks and stormwater facilities.
8. Existing and proposed drainage flow routes for each threshold discharge area to and from the project site, including bypass flows.
9. Proposed location of structural source control BMPs.
10. Point of discharge locations from the proposed project site that preserves the natural drainage patterns and existing outfall locations.
11. Areas of the project site where onsite stormwater management BMPs will be effectively implemented.
12. All existing drainage facilities, including structural water quality or flow control BMPs and conveyance systems.
13. Existing and proposed pollution-generating pervious surfaces (PGPS), including lawns, landscaped areas and pasture areas.
14. Existing areas of the project site predominately covered by native vegetation and areas of native vegetation to be preserved under the proposed conditions.
15. Approximate location and size of proposed runoff treatment and flow control facilities implemented.

16. The delineated wetland boundary, including project sites that discharge to a wetland, either directly or indirectly through a conveyance system.
17. A conceptual grading plan that verifies the constructability of a stormwater facility for sites with slopes greater than five percent.
18. The Director may require additional site or vicinity information if needed to determine the feasibility of the stormwater proposal.

### **3.3.3 Preliminary Stormwater Report**

The preliminary stormwater report shall contain all technical information and analysis necessary to determine that the proposed stormwater facilities are feasible. The required contents of the preliminary stormwater report are identified below.

#### **Table of Contents**

1. List of section headings and their respective page numbers.
2. List of tables with page numbers.
3. List of figures with page numbers.
4. List of attachments, numbered.
5. List of references.

#### **Map Submittals**

All maps shall contain a scale and north arrow.

1. **Vicinity Map:** All vicinity maps shall clearly show the project site.
2. **Soils Map:** The soils map shall show soils within the contributing area that drains to the site itself. Soils maps may be obtained from the following resources:
  - Updated version of the Soil Survey of Cowlitz Area, Washington, originally published in 1974, and updated by the Natural Resources Conservation Service (NCRS)
  - Washington soil survey data as available on the NCRS website (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm> )
  - If the maps do not appear to accurately represent the soils for the site, the applicant is responsible for verifying the actual soils for the site
3. **Other Maps:** The following additional maps shall be required in the situations noted:
  - Floodplains. If a floodplain mapped by the Federal Emergency Management Agency (FEMA) exists on or adjacent to the project site, a map showing the floodplain is required.
  - Shoreline Management Area. If the site contains or is adjacent to a stream or lake regulated under the Washington Shorelines management Act, a map showing the boundary of the shoreline management area in relation to the project site is required.

**Section A – Project Overview**

1. Describe the project site location.
2. Describe the topography, natural drainage patterns, vegetative ground cover and presence of critical areas (Cowlitz County Code 19.15). Critical areas that receive runoff from the project site shall be described to a minimum of one-quarter mile away from the site boundary.
3. Identify and discuss existing onsite stormwater systems and their functions.
4. Identify and discuss site parameters that influence stormwater system design.
5. Describe drainage to and from adjacent properties.
6. For agricultural sites with drain tiles, discuss the impact of construction on the drain tiles, site drainage and the impact of the drainage tiles on proposed stormwater facilities.
7. Describe adjacent and downstream areas, including streams, lakes, wetland areas, residential areas and roads that might be affected by the construction project.
8. Generally describe proposed site construction, size of improvements and proposed methods of mitigating stormwater runoff quantity and quality impacts.

**Section B – Minimum Requirements**

Describe the land disturbing activity and document the applicable Minimum requirements for the project site (see Section 2.0 for guidance). Include the following information in table format:

1. The amount of existing impervious surface area;
2. The amount of new impervious surface;
3. The amount of replaced impervious surface;
4. The amount of native vegetation converted to lawn or landscaping;
5. The amount of native vegetation converted to pasture; and
6. The amount of land-disturbing activity.

Provide a statement that confirms the Minimum Requirements that will apply to the development activity. For land-disturbing activities where Minimum Requirements 1 through 9 must be met:

1. Provide the amount of effective impervious area in each Threshold Discharge Area, and document through an approved continuous runoff simulation model (i.e., Western Washington Hydrologic Model) the increase in the 100-year flood frequency from the pre-developed condition to the developed condition for each Threshold Discharge Area.
2. List the Threshold Discharge Areas that must meet the runoff treatment requirements listed in Minimum Requirement 6 – Runoff Treatment.
3. List the Threshold Discharge Areas that must meet the runoff flow control requirements listed in Minimum Requirement 7 – Flow Control.

4. List the Threshold Discharge Areas that must meet the wetland protection requirements listed in Minimum Requirement 8 – Wetland Protection.

### **Section C – Soils Evaluation**

1. Describe the site's suitability, found in Volume III, Section 3.3.7 of the SWMMWW, for stormwater infiltration for flow control, runoff treatment and low impact development (LID) measures.
2. Identify water table elevations, flow directions (where available) and data on seasonal water table fluxuations with minimum and maximum water table elevations where these may affect stormwater facilities.
3. Identify and describe soil parameters and design methods for use in hydrologic and hydraulic design of proposed facilities.
4. Report findings of testing and analysis used to determine the infiltration rate.
5. Where unstable or complex soils conditions exist that may significantly affect the design of stormwater facilities, the Director may require a preliminary soils report that addresses stormwater design considerations arising from soil conditions. The preliminary soils report shall be prepared by a registered professional engineer proficient in geotechnical investigation and engineering or a registered soil scientist. The preliminary soils report shall include a soils map developed using the criteria set in the NCRS *National Soils Survey Handbook* (NCRS 2007) and the SCS *Soil Survey Manual* (SCS 1993), at a minimum scale of 1:5,000 (12.7 inches/mile).

### **Section D – Source Control**

If the development activity includes any of the activities listed in Volume IV, Section 2.2 of the SWMMWW, identify the source control BMPs to be used with the land disturbing activity.

### **Section E – Onsite Stormwater Management BMPs**

1. On the preliminary development plan or other maps, show the site areas where onsite stormwater management BMPs will be effectively implemented, if applicable. The plan must show the areas of retained native vegetation and required flow lengths and vegetated flow paths, as required for proper implementation of each onsite stormwater BMP. Arrows must show the stormwater flow path to each BMP.
2. Identify and describe geotechnical studies and other information used to complete the analysis and design of each onsite stormwater BMP.
3. Identify the criteria (and other sources) used to complete analyses for each onsite stormwater BMP.
4. Describe how design criteria will be met for each proposed onsite stormwater management BMP.
5. Describe any onsite application of LID measures planned for the project. Provide a plan that shows the proposed location and approximate size of each LID facility.

6. Identify and describe the assumptions used to complete the analysis.
7. Describe site suitability, including hydrologic soil groups, slopes, area of native vegetation and adequate location of each BMP.

### **Section F – Runoff Treatment Analysis and Design**

1. Document the level of treatment required.
2. Identify the BMPs used in the design and their sources.
3. Provide background and description to support the selection of treatment BMPs being proposed. Include an analysis of initial implementation costs and long-term maintenance costs.
4. Identify geotechnical or soils studies or other information used to complete the analysis and design.
5. Provide a table that lists the amount of pollution generating pervious surfaces (PGPS) and pollution generating impervious surfaces (PGIS).
6. Summarize the results of the runoff treatment design and describe how the proposed design meets the requirements of Chapter 16.22 of the Cowlitz County Code.

### **Section G – Flow Control Analysis and Design**

1. Identify the site's suitability for stormwater infiltration for flow control, including tested infiltration rates, logs of soil borings and other information.
2. Identify and describe geotechnical or other studies used to complete the analysis and design.
3. If infiltration cannot be provided for flow control, provide the following additional information:
  - a. Identify the areas where flow control credits can be obtained for dispersion, LID or other measures, per the requirements in the SWMMWW.
  - b. Provide the approximate sizing and location of flow control facilities for each Threshold Discharge Area.
  - c. Identify the criteria (and their sources) used to complete the analyses, including pre-developed and post-developed land use characteristics.
  - d. Complete a hydrologic analysis for existing and developed site conditions, using an approved model. Compute existing and developed flow duration for all subbasins. Provide an output table from the continuous flow model.
  - e. Include and reference all hydrologic computations, equations, graphs and any other aids necessary to clearly show the methodology and results.
  - f. Include all maps, exhibits, graphics and references used to determine existing and developed site hydrology.
4. Submit electronic copies of the WWHM (.wdm, .prj, .usi) project files upon request, if applicable.

## **Section H – Wetlands Protection**

For projects with stormwater discharges to a wetland, either directly or indirectly through a conveyance system, the preliminary stormwater report shall describe wetland protection measures to be implemented. The narrative shall describe the measures that will maintain the hydrologic conditions, hydrophytic vegetation and substrate characteristics necessary to support existing and designated uses.

### **3.4 Final Stormwater Plan**

#### **3.4.1 Purpose**

In accordance with Minimum Requirement 1, the final stormwater plan provides final engineering design and construction drawings for the stormwater aspects of a proposed new development and redevelopment project. The final stormwater plan shall be submitted to the Cowlitz County Public Works Department with any final construction drawings and approved by the Director before construction of the project can begin.

The final stormwater plan submittal shall include the following:

1. Any conditions of approval from the land use process.
2. Any easements, covenants or agreements necessary to permit construction.
3. Final engineering plans that provide sufficient detail to allow construction of the stormwater facilities. These plans shall be stamped, signed and dated by the engineer(s), registered in the state of Washington, responsible for hydrologic, hydraulic, geotechnical, structural and general civil engineering design and by the project engineer responsible for the preparation of the final stormwater plan. The final engineering plan shall show all utilities to ensure that conflicts between proposed utility lines do not exist.
4. The approved preliminary stormwater plan, with an explanation of any differences between the design concepts included in the preliminary and final stormwater plans. If a final stormwater plan differs from the approved preliminary stormwater plan in a manner that, in the opinion of the Director, raises material water quality or quantity control issues.
5. A final development plan (which may be a part of the final engineering plans or a separate plan). See the requirements identified below.
6. A final technical information report (Stormwater Report). See the requirements identified below.
7. A construction stormwater pollution prevention plan (SWPPP). See Section 3.2.

#### **3.4.2 Final Development Plan**

The final development plan shall be consistent with the preliminary development plan and may be combined with the final engineering plans. In addition to the information required in the preliminary development plan, the final plan requires the following information:

1. Threshold discharge area (TDA) delineations and total impervious and pervious area delineations and acreages by TDA.
2. The acreage of pollution-generating pervious surfaces (PGPS) and pollution-generating impervious surfaces (PGIS) used in the hydraulic/hydrologic calculations both onsite and offsite that contribute surface runoff.
3. Directions and lengths of overland, pipe and channel flow.
4. Outfall points from each TDA and overflow routes for over the 100-year storm.
5. Onsite conveyance systems, including pipes, catch basins, channels, ditches, swales and culverts.
6. Primary flow path arrows for drainage under developed conditions, with the calculated flow rates. Cross-reference the flow rates to the hydrological model output file used to calculate the flow rates.
7. Approved location for storm runoff from the building lots.
8. The Director may require additional site or vicinity information if needed to determine the feasibility of the stormwater proposal.

### **3.4.3 Final Stormwater Report**

The final Stormwater Report shall be a comprehensive report, supplemental to the final engineering plans, that contains all technical information and analyses necessary to complete final engineering plans based on sound engineering practices and appropriate geotechnical, hydrologic, hydraulic and water quality design.

The final Stormwater Report shall be stamped, signed, and dated by the professional engineer(s), registered in the state of Washington, responsible for hydrologic, hydraulic, geotechnical, structural and general civil engineering design.

The required contents of the final Stormwater Report, which is part of the final stormwater plan, are identified below.

#### **Table of Contents**

See the preliminary Stormwater Report requirements.

#### **Map Submittals**

See the preliminary Stormwater Report requirements.

#### **Section A – Project Overview**

Provide the information from the preliminary Stormwater Report, with the following additional elements:

1. Reference the conceptual design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual design contained within the final engineering plans.

**Section B – Minimum Requirements**

If applicable, provide the information from Section B of the preliminary Stormwater Report, revised as necessary for the final design. Confirm the applicable minimum requirements identified in the preliminary Stormwater Report. For land-disturbing activities where minimum requirements 1 through 9 must be met provide the required information listed in Section B of the preliminary Stormwater Report, revised to reflect the final design.

**Section C – Soils Evaluation**

See the preliminary Stormwater Report requirements.

**Section D – Source Control**

See the preliminary Stormwater Report requirements.

**Section E – Onsite Stormwater Management BMPs**

Provide the information from the preliminary Stormwater Report, with the following additional elements:

1. Reference the conceptual design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual design contained within the final engineering plans.
3. For bioretention systems, provide the following:
  - a. The proposed soil matrix for the facility.
  - b. The planting plan, listing proposed plant types and locations.
  - c. Detail drawings, including the following:
    - If an underdrain is used show drain rock, pipe and filter fabric specifications.
    - All stormwater piping associated with the facility, including catch basin, pipe materials, sizes, slopes and invert elevations.
    - Rain garden width, length, side slopes and maximum design water depth.
    - Irrigation system, if installed.
    - Designs for any retaining walls proposed. Structural walls shall meet City building permit requirements.
4. For porous pavements, provide the following:
  - a. Supporting design calculations showing adequate infiltration rates to accommodate flows from all impervious surfaces directed onto any porous pavement.
  - b. Geotextile specification.
  - c. Base material gradation.
  - d. Asphalt mix design and void calculations.

- e. Acceptance test procedures.
  - f. Detail drawings, including the following:
    - Geotextile
    - Base material
    - Asphalt layer
5. For reversed slope sidewalks, show the following:
- a. Details on the planting plan for any areas receiving water from reversed slope sidewalks.

### **Section F – Runoff Treatment Analysis and Design**

For land-disturbing activities where runoff treatment facilities are required, provide the information from the preliminary Stormwater Report, with the following additional elements:

1. Reference the conceptual runoff treatment design proposed in the preliminary stormwater plan.
2. Identify revisions to the conceptual runoff treatment design contained in the preliminary stormwater plan.
3. Complete a detailed analysis and design of all proposed runoff treatment system elements, in accordance with Volume V of the WWM. Reference runoff treatment system elements to labeled points shown on the site location map or final development plan.
4. Include and reference all computations, equations, charts, nomographs, detail drawings and other tabular or graphic aids used to design water quality system elements in the technical appendix.
5. Summarize the results of the runoff treatment design, and describe how the proposed design meets the requirements of the SWMMWW.

### **Section G - Flow Control Analysis and Design**

For land-disturbing activities where flow control facilities are required:

1. Identify revisions to the conceptual design proposed in the preliminary stormwater plan.
2. Identify initial conditions, including stream base flows, beginning water surface elevations, hydraulic or energy grade lines, initial groundwater elevations, beginning storage volumes and other data or assumptions used to complete the analyses of initial conditions. Reference the sources of information.
3. Describe any assumptions used to complete the analysis, including flow credits through the use of onsite stormwater BMPs or LID measures.
4. Complete a detailed hydrologic analysis for existing and developed site conditions, in accordance with the requirements of Chapter 2, Volume III of the SWMMWW, using an approved continuous runoff simulation model. Compute

pre-developed and developed flow durations for all subbasins. Provide an output table from the continuous flow model, including the following:

- a. Flow rates for the 2, 10 and 100-year return periods for pre-developed and developed conditions.
  - b. A table listing the pass/fail rates for each flow level where duration statistics were calculated.
  - c. A graph showing the flow rate on the y axis and percent time exceeding on the x axis (logarithmic) for pre-developed conditions and post-developed mitigated conditions from 50 percent of the 2-year through the 50-year flow rate.
5. Provide a hydraulic analysis of pipes and/or channels that lead to and/or from the outlet structure. The analysis should confirm the capacity of pipes and channels to convey the peak flow rates for the 2, 10, 50 and 100-year return period flow rate with the water surface elevation of the pond at the elevation for those return period flow rates.
  6. Submit electronic copies of the WWHM (.wdm, .prj, .usi) project files to allow reviewers to run the model and confirm the model results.
  7. Refer to labeled points shown on the site location map and development plan.
  8. Include and reference all hydrologic and hydraulic computations, equations, rating curves, stage/storage/discharge tables, graphs and any other aids necessary to clearly show the methodology and results.
  9. Include all maps, exhibits, graphics and references used to determine existing and developed site hydrology.

#### **Section H - Flow Control System Plan**

1. Provide an illustrative sketch of the flow control facility and its appurtenances.
2. Show basic measurements necessary to confirm storage volumes.
3. Show all orifice, weir, and flow restrictor dimensions and elevations.
4. The sketch shall correspond with final engineering plans. Alternatively, a final site grading plan that incorporates the above information may be included as an attachment to the final stormwater plan.
5. Provide electronic copies of the drawings used for analysis, measurement, and design inputs for the hydrologic analysis submitted with the final drawing in one of the following approved file formats: Portable Document Format (.pdf), AutoCAD (.dwg, .dxf) or MicroStation (.dgn).

#### **Section I – Wetlands Protection**

For projects with stormwater discharges to a wetland or wetland buffer, either directly or indirectly through a conveyance system, the Stormwater Report shall describe wetland protection measures to be implemented in accordance with Minimum Requirement 8. The narrative shall describe the measures that will maintain the hydrologic conditions,

hydrophytic vegetation and substrate characteristics necessary to support existing and designated uses.

### **Section J – Other Permits**

Construction of roads and stormwater facilities may require additional permits from other agencies. These permits may contain requirements that affect the design of the stormwater system. This section lists the titles of other possible required permits, the agencies that require the permits and the permit requirements, if known, that affect the final stormwater plan. Approved permits that are critical to the feasibility of the stormwater facility design shall be included in this section.

### **Section K – Conveyance Systems Analysis and Design**

1. Reference the conceptual drainage design proposed in the preliminary stormwater plan.
2. In the technical appendix, include and reference all computations, equations, charts, nomographs, detail drawings and other tabular or graphic aids used to design water quality system elements.
3. Identify revisions to the conceptual drainage design contained in the preliminary stormwater plan.
4. Identify the criteria used to complete the analyses and their sources.
5. Identify and discuss initial conditions, including stream base flows, beginning water surface elevations, hydraulic or energy grade lines, beginning storage elevations and other data or assumptions used to complete the analyses of initial conditions. Reference the sources of information.
6. Describe any assumptions used to complete the analyses.
7. Complete a detailed hydraulic analysis of all proposed collection and conveyance system elements and existing collection and conveyance elements, including outfall structures and outlet protection that influence the design or are affected by the proposal in accordance with Section 4 of these standards. Identify, compute, reference, verify, summarize and tabulate the following:
  - a. Design flows and velocities and conveyance element capacities for all conveyance elements within the development.
  - b. The 10-year recurrence interval stage for detention facility outfalls. Provide stage-frequency documentation from WWHM.
  - c. The existing 100-year floodplain elevations and lateral limits for all channels and no net loss of conveyance or storage capacity from development.
  - d. The conveyance system elements to labeled points shown on the site location map or development plan.
  - e. The capacity of each conveyance system element to convey design flow and discharge at non-erosive velocities and the capacity of the onsite conveyance system to convey design flows that result from ultimate build-out of upstream areas.

- f. All hydraulic computations, equations, pipe flow tables, flow profile computations, charts, nomographs, detail drawings and other tabular or graphic aids used to design and confirm the performance of conveyance systems.
- g. The results of system analyses, and how the proposed design meets the requirements of these standards.

### **Section L – Offsite Analysis**

If applicable, provide the results of an offsite analysis prepared in accordance with Chapter 6 (Offsite Analysis and Mitigation) of this manual (see exemptions in Chapter 6.)

### **Section M - Approval Conditions Summary**

List each preliminary approval condition related to stormwater control, wetlands, wetland buffers, floodplains and other water-related issues and explain how the final design addresses or conforms to each condition.

### **Section N – Special Reports and Studies**

Where site-specific characteristics such as critical areas as described in the CCC present difficult drainage and water quality design problems, the Director may require additional information or the preparation of special reports and studies. These shall further address the specific site characteristics, the potential for impacts associated with the development and the measures that would be implemented to mitigate impacts. Special reports shall be prepared by professionals with expertise in the particular area of analysis, who shall date, sign, stamp and otherwise certify the report. Subjects of special reports may include, but are not be limited to:

1. Geotechnical
2. Wetlands
3. Floodplains and floodways
4. Groundwater
5. Structural design
6. Fluvial geomorphology (erosion and deposition)

All special reports and studies shall be included in the technical appendix.

### **Section O – Groundwater Monitoring Program**

Where required, a groundwater monitoring program shall be included in the final stormwater plan. The groundwater monitoring program shall be prepared by a person with expertise in groundwater contamination investigation, prevention and monitoring and shall clearly describe a comprehensive groundwater testing and evaluation program designed to ensure compliance with federal and state of Washington laws and these standards. The Director will review proposed groundwater monitoring programs on a site-specific basis.

**Section P – Maintenance and Operations Manual**

The project engineer shall attach the maintenance manual required in Chapter 7.3 of this Manual.

**Technical Appendix**

All Stormwater Reports shall contain a technical appendix that includes all computations completed in the preparation of the Stormwater Report, together with copies of referenced data, charts, graphs, nomographs, hydrographs, stage-storage discharge tables, maps, exhibits and all other information required to clearly describe the stormwater flow control and runoff treatment design for the proposed development activity. The format of the technical appendix shall follow as closely as possible the section format of the Stormwater Report and shall be adequately cross-referenced to ensure that the design may be easily followed, checked and verified. The technical appendix shall also contain all special reports and studies, other than those included as attachments to the Stormwater Report.

## 4.0 Hydrologic Analysis

### 4.1 Santa Barbara Urban Hydrograph (SBUH) Method

SBUH calculation method may be used to size conveyance systems and flow control facilities located within the boundaries of Consolidated Diking Improvement District #1 (CDID #1) and Consolidated Diking Improvement District #3 (CDID #3).

A description of the calculations for this method can be found in the Highway Runoff Manual (HRM), WSDOT 2006. Calculation of the peak flow rate or volume using SBUH is usually performed with a spreadsheet or a commercial software program. The following information is required for an SBUH analysis:

- Time of concentration;
- Precipitation: 24-hour average daily precipitation for the design storm and for a 2-year event (used in the time of concentration calculations);
- Runoff curve number; and
- Impervious and pervious areas.

The sections below provide supplemental information about estimation of the time of concentration, 2-year precipitation depth and runoff curve numbers.

#### 4.1.1 Time of Concentration

Time of concentration ( $T_c$ ) is the sum of the travel times for sheet flow, shallow concentrated flow, and channel flow. Travel time ( $T_t$ ) is the time it takes water to travel from one location to another in a watershed.  $T_t$  is a component of the time of concentration. The minimum time of concentration is 5 minutes.

##### Sheet Flow

With sheet flow, the friction value ( $n_s$ ) is used (a modified Manning's effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges and rocks; and erosion and transportation of sediment). These  $n_s$  values are for very shallow flow depths of about 0.1 foot and are used only for travel lengths up to 300 feet. Table B-1 in Appendix B gives Manning's  $n_s$  values for sheet flow for various surface conditions.

For sheet flow of up to 300 feet, use Manning's kinematic solution to directly compute  $T_t$ :

$$T_t = \frac{0.42 (n_s L)^{0.80}}{P^{0.5} (S_0)^{0.4}} \quad \text{Equation 4-1}$$

where:

$T_t$  = travel time (minutes)

$n_s$  = sheet flow Manning's effective roughness coefficient (Table D-1)

$L$  = flow length (feet)

$P_2$  = 2-year, 24-hour rainfall (inches)

$S_0$  = slope of hydraulic grade line (land slope, feet/feet)

The maximum allowable distance for sheet flow shall be 300 feet; the remaining overland flow distance shall be shallow concentrated flow until the water reaches a channel.

#### Shallow Concentrated Flow

After a maximum of 300 feet, sheet flow is assumed to become shallow concentrated flow. The average velocity for this flow can be calculated using the  $k_s$  values from Table B-1, in which average velocity is a function of watercourse slope and type of channel. The average velocity of flow, once it has measurable depth, shall be computed using the following equation:

$$V = k \sqrt{S_0} \quad \text{Equation 4-2}$$

where:

$V$  = velocity (feet/seconds)

$k$  = time of concentration velocity factor (feet/seconds)

$S_0$  = slope of flow path (feet/feet)

“ $k$ ” is computed for various land covers and channel characteristics, with assumptions made for hydraulic radius using the following rearrangement of Manning’s equation:

$$k = \frac{1.49R^{0.667}}{N} \quad \text{Equation 4-3}$$

where:

$R$  = an assumed hydraulic radius

$n$  = Manning’s roughness coefficient for open channel flow (Table B-2)

“ $k$ ” values have been tabulated in Table C-1 from the WSDOT HRM. After computing the velocity,  $T_t$  can be computed as follows:

$$T_t = \frac{L}{60V} \quad \text{Equation 4-4}$$

where:

$L$  = flow length (feet)

$V$  = average velocity (feet/second)

$60$  = conversion factor from seconds to minutes

Open channels are assumed to begin where surveyed cross-section information has been obtained, where channels are visible on aerial photographs or where lines indicating streams appear on maps and are field verified. The  $k_c$  values from Table B-1 can be used to estimate average flow velocity. After average velocity is computed, the travel time for the channel segment can be calculated using Equation 5-4.

### Time of Concentration Calculation

The time of concentration is the sum of the  $T_t$  values for the various consecutive flow segments.

$$T_t = T_{t1} + T_{t2} + \dots + T_{tm} \quad \text{Equation 4-5}$$

#### 4.1.2 Precipitation

The standard design hyetograph is the Soil Conservation Service (SCS) Type 1A 24-hour rainfall distribution resolved into 10-minute time intervals. Various interpretations of the hyetograph are available and may differ slightly from distributions used in other unit hydrograph-based computer simulations. Other distributions will be accepted with adequate justification and as long as they do not decrease the peak flow rate.

#### 24-hour Design Storms for the Cowlitz County Urbanized Area

2-year	2.54"	25-year	4.37"
5-year	3.10"	50-year	5.17"
10-year	3.60"	100-year	6.17"

#### 4.1.3 Runoff Curve Numbers

The curve numbers in Section 2.3 of the SWMMWW shall be used. The NRCS soil classifications for use in determining the appropriate runoff curve numbers can be obtained from one of the sources listed in section 3.3.3.

### 4.2 Continuous Simulation Hydrologic Method

The Department of Ecology has moved from calculating stormwater runoff using a single, 24-hour storm event model to using a continuous hydrologic model that models rainfall/runoff relationships over long time periods. Ecology has developed the Western

Washington Hydrology Model (WVHM) for use in western Washington. WVHM uses the software program HSPF (Hydrologic Simulation Program – Fortran) as its base to model hydrologic processes.

WVHM uses rainfall and evaporation data and 18 model parameters to simulate runoff from three components: groundwater, interflow, and surface runoff. The model user can specify where these three types of runoff should be directed. Normally, surface runoff and interflow is directed to the stormwater facility. Precipitation data are obtained from local sources and currently all evaporation data used in WVHM are from a pan evaporation station located in Puyallup, Washington. The 18 model parameters were set based upon calibration modeling conducted by the U.S. Geological Survey (USGS) on three basins in the Puget Sound area, with some revisions made by the WVHM developers. Additional information on WVHM can be found in Volume III of the SWMMWW or in the WVHM help files and user's manual.

### 4.2.1 Data Requirements

WVHM requires the following information:

- Site location. The site location is picked from a map to determine the proper scaling of rainfall data.
- Soil type and associated NRCS hydrologic soil group for all soils on the site.
- Types of pre-developed land cover and the acreage of each. WVHM has three pre-developed land cover categories:
  - Forest, which is designated as second growth Douglas Fir.
  - Pasture, which is non-forested natural areas, scrub and rural vegetation.
  - Lawn.

### 4.2.2 Pre-developed Land Cover

The pre-developed condition for modeling flow control facilities shall be a forested condition.

## 4.3 Allowable Infiltration Testing Methods

The single-ring falling head infiltration test and the pilot infiltration test (PIT) are the acceptable methods for determining infiltration rates on a site.

The pilot infiltration test (PIT) shall be performed in accordance with the guidance in Appendix III-D of the SMMWW. The single-ring falling head infiltration test shall be conducted using the following procedures, in accordance with ASCE (2007).

### Single-Ring Falling Head Infiltration Test Procedures

The test procedure is based in large part on mathematical equations derived from Darcy's Law for saturated flow in homogeneous isotropic media. The following equation shall be used for determining the soil coefficient of permeability:

$$k = \frac{L}{t} \ln \frac{h_1}{h_2} \quad \text{Equation 4-6}$$

where:

**k** = coefficient of permeability (in/hr)

**L** = length of flow (in)

**t** = time (hr)

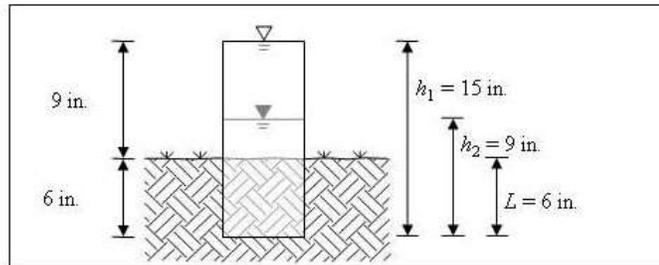
**h<sub>1</sub>** = initial head (in)

**h<sub>2</sub>** = final head (in)

The recommended test configuration and procedure described below has been developed using Equation 4-6 so that the observed drawdown rate can be divided in half to achieve the approximate coefficient of permeability. However, different test configurations can be used to fit varying site conditions or test depths. In all cases, the coefficient of permeability shall

be calculated using Equation 4-6 and the principles outlined in the following procedure. Figure 4-1 shows the test configuration and relevant parameters.

**Figure 4-1: Single-Ring Falling Head Infiltration Test Procedure**



Source: ASCE 2007.

Begin the infiltration test procedure by embedding a 6-inch-diameter, 15-inch-long, rigid standpipe 6 inches ( $L$ , as noted in Equation 4-6 and Figure 4-1) into the ground at the depth and location of the proposed test. The standpipe should be as thin-walled as practical, and the pipe should be carefully pressed or inserted vertically into the soil. Saturate or presoak the soil by maintaining measurable water in the standpipe for at least 4 hours. (A 4-hour presoak phase is assumed to allow adequate soil saturation to properly measure and calculate the coefficient of permeability. This should be verified by ensuring that the cumulative water drop in inches during the saturation period exceeds the standpipe embedment depth.)

After the saturation period, fill the pipe to the top (i.e., the pipe will contain a 9-inch vertical column of free water). Note that although the pipe contains 9 inches of water, the initial system head ( $h_1$ ) is 15 inches because head is measured from the top of the free water surface to the bottom of the soil specimen inside the pipe. Perform as many repeated 6-inch drawdown trials as can be completed in a 1-hour time period (i.e., allow the water in the pipe to drop from 15 to 9 inches [ $h_1$  to  $h_2$ ], and then repeat the process). Conclude the field test and record the following parameters: field observed drawdown rate,  $L$ ,  $t$ ,  $h_1$ , and  $h_2$ .

If the water level does not drop 6 inches in a 1-hour time period, the test can be concluded after 1 hour by recording the drawdown rate as the drop over the 1-hour time period. The applicable test parameters ( $L$ ,  $t$ ,  $h_1$ , and  $h_2$ ) should also be recorded. In this case,  $h_2$  would equal  $h_1$  minus the amount of water drop observed over the 1-hour time period.

If desired, 6-inch drawdown trials may be performed during the saturation period. If three consecutive 6-inch drawdown trials indicate the rate has stabilized to within 5 percent variation between all three trials, the test may be concluded and the average rate of the three tests may be recorded as the drawdown rate. The applicable test parameters should also be recorded.

### Coefficient of Permeability

After the field test procedure has been performed and the relevant test parameters recorded, the coefficient of permeability should be calculated using Equation 6-1. As described previously, the coefficient of permeability obtained from Equation 6-1 is the approximate rate at which water can be expected to infiltrate vertically into a given soil surface under long-term saturated flow conditions. This value should be reported by the geotechnical engineer/geologist as the soil coefficient of permeability for the tested location.

### **Test Limitations**

It should be noted that the coefficient of permeability calculations identified above are based on ideal homogenous isotropic media. Cowlitz County soils are often neither homogenous nor isotropic. This may result in permeability coefficients that vary with depth and direction. Groundwater mounding or an elevated seasonal groundwater table may also affect the infiltration rate. In rare cases, the soil's ability to infiltrate water may be determined by its horizontal rather than vertical coefficient of permeability. The design professional should verify whether these are reasonable assumptions to allow for an approximate estimate of the soil coefficient of permeability. If not, specialized testing or analysis may be required.

Infiltration systems can be expected to undergo long-term degradation of infiltration capacity as a result of siltation, debris collection, and soil crusting; therefore, a correction factor must be calculated into the coefficient of permeability for the design of infiltration systems. Correction factors should be applied to the calculated coefficient of permeability to determine the allowable design infiltration rate.

### **Modification to the Recommended Single-Ring Falling Head Infiltration Test Procedures**

The recommended test configuration described above has been designed to produce an observed drawdown rate that is approximately twice the coefficient of permeability. This is due to careful selection of the test configuration and geometry and may provide the benefit of simplicity and standardization. It is important to note that the coefficient of permeability will equal approximately one-half of the observed drawdown rate only when full 6-inch drawdown trials are conducted, and the relevant test parameters equal those indicated in the standpipe schematic shown in Figure 4-1. However, the test configuration, standpipe length, embedment depth, and other parameters may be modified by an experienced geotechnical professional, provided that Equation 4-6 is used to calculate the coefficient of permeability. This provides the professional consultant with flexibility to modify or tailor the test configuration, based on site-specific conditions. When the test configuration or procedure is modified, the geotechnical report must consider the implications of the modifications, such as:

- Standpipe diameters smaller than 6 inches may be adversely affected by the presence of large gravels or cobbles.
- Standpipe embedments of less than 6 inches in some granular soils may result in an inadequate seal around the pipe and subsequent seepage around the pipe tip, which may result in an overestimate of the coefficient of permeability.

Excessive head in the standpipe may result in an overestimate of the coefficient of permeability. The head shall be limited to one-half the height of the anticipated water depth in the proposed infiltration system (e.g., a field test for a pond with a maximum retained water depth of 3 feet shall have a maximum head of 1.5 feet).

### **Alternative Test Procedure – Auger Borehole**

While the test pit and falling head method recommended above are the preferred methods for infiltration testing, they are neither feasible nor practical in some environments. Examples of such environments include cohesionless soils where open test pits pose a collapse hazard, systems at depths deeper than the reach of standard construction excavation equipment, or

developed sites with existing asphalt or concrete pavements. In such situations, infiltration testing is often conducted in exploratory hollow-stem auger boreholes by geotechnical engineers and geologists. Auger borehole infiltration testing is an acceptable alternative to the suggested methods, provided the test method and calculation of the coefficient of permeability follow the test procedure below.

### Test Procedure

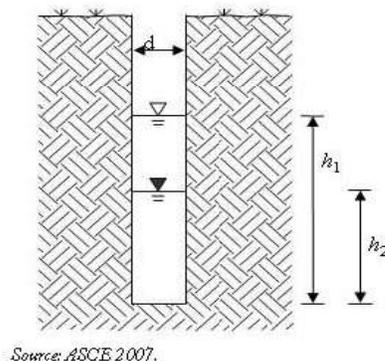
Advance an auger borehole to the desired elevation of the infiltration test. The auger must be hollow-stem, or the boring must be cased to prevent lateral leakage. Sample subsurface soils at depth to confirm that appropriately granular soils are present at or below the auger tip. Log the boring in accordance with Unified Soil Classification System (USCS) specifications, and collect a soil sample from the zone where the infiltration test is performed.

As the tip of the auger reaches the test zone, apply down pressure to the drill pipe and advance the auger slightly into the soil to form a seal. Withdraw the inner plug and rod from the hollow-stem auger to expose the test zone soil inside the auger. Measure and record the inner auger diameter ( $d$ ). Pour water into the standpipe or auger and saturate the soils, as described previously.

After the presoak period, establish an initial head of water in the auger ( $h_1$ ). Depending on the soil gradation, range of expected infiltration rates, and proposed depth of retained water in the future infiltration system; the head level may vary, based on the geotechnical professional's recommendations. However, an initial head in excess of 4 feet or greater than the future depth of retained water in the system is not recommended. Also, water levels should not rise above joints between auger sections, so water does not leak out of the joints and skew drawdown readings.

Begin conducting the infiltration test by recording the time ( $t$ ) required for the head in the auger to drop from the initial head ( $h_1$ ) to the final head ( $h_2$ ). Refill the standpipe or auger and conduct multiple test runs until relatively constant rates are achieved (less than 5 percent variation between three consecutive trials). An electric water level probe, indicator rod with pegs set at a 6-inch interval, or a float and tape may be used to accurately measure the drop in head over elapsed time. Figure 4-2 shows the auger borehole test configuration and relevant parameters.

**Figure 4-2: Single-Falling Head Test Procedure  
(Auger Borehole Method)**



After relatively constant drawdown rates are observed as described above, record the final test parameters ( $d$ ,  $h_1$ ,  $h_2$ , and  $t$ ).

### **Coefficient of Permeability**

After the field test procedure has been performed and the relevant test parameters recorded, the coefficient of permeability should be calculated using Equation 4-7 (Lambe and Whitman 1969). Equation 4-7 applies only for coefficient of permeability calculations using the auger borehole method. The value obtained from Equation 4-7 should be reported by the geotechnical professional as the soil coefficient of permeability for the tested location.

$$k = \frac{\pi d}{11t} \ln \frac{h_1}{h_2} \quad \text{Equation 4-7}$$

*where:*

**k** = coefficient of permeability (in/hr)

**L** = length of flow (in)

**t** = time (hr)

**h<sub>1</sub>** = initial head (in)

**h<sub>2</sub>** = final head (in)

### **Test Limitations**

The test limitations described above for the suggested standard methods also apply to the auger borehole method. In addition, the borehole method assumes flush soil at the bottom of the auger and groundwater levels sufficiently below the depth of the test.

Soil swelling, segregation, and consolidation are assumed to be negligible. Hydraulic loss in the auger is also assumed to be negligible. This method also assumes homogenous soils with directional isotropy (i.e., the horizontal and vertical coefficients of permeability are constant and equal). The design professional should verify whether these are reasonable assumptions to allow for an approximate estimate of the soil coefficient of permeability. If not, specialized testing or analysis may be required.

### **Allowable Infiltration Rates**

The correction factors in Table 4-1 shall be used to establish the allowable infiltration rate for both the PIT test and the single-ring falling head test for closed infiltration systems. The safety factor for a sacrificial system can be reduced if the system is designed to infiltrate runoff for a design event with a 2-year return period.

An overflow route shall be identified for stormwater flows that overtop the facility when infiltration capacity is exceeded or the facility becomes plugged and fails. The overflow route shall be able to safely convey the 100-year peak flow to the downstream conveyance system or other acceptable discharge point, in accordance with conveyance requirements.

**Table 4-1: Coefficient of Permeability Correction Factors**

Design Condition	Correction Factor
<b>Base Correction Factor</b>	
The base correction factor is meant to account for soil variability and long-term system degradation due to siltation, crusting, or other factors.	2
<b>Soils Correction Factor</b>	
Additive correction factor recommended by geotechnical professional as a result of soil or groundwater conditions.	Minimum value of 2, or greater as recommended by the geotechnical engineer
<b>System Design Correction Factors</b>	
If the infiltration facility serves a basin with an impervious area greater than 2 acres	Add ½
If the infiltration facility serves a basin with an impervious area greater than 5 acres.	Add 1
Infiltration facilities in closed depressions.	Add 2
If a sacrificial system is provided and left operational following permanent site stabilization.	Subtract ½

## **5.0 Construction Stormwater Pollution Prevention Plan**

### **5.1 Seasonal Work Limitations**

When weather conditions make erosion problems likely, such as in the threat of heavy rain or high winds, work shall be stopped (by the County if necessary) until erosion control facilities are determined to be operating satisfactorily and are adequate to support the resumption of activity. In addition:

1. From October 1 through April 30, clearing, grading, and other soil disturbing activities may only be authorized if silt-laden runoff will be prevented from leaving the site through a combination of the following mitigating factors:
  - A. Acceptable site conditions including existing vegetative coverage, slope, soil type and proximity to receiving waters; and
  - B. Limitations on activities and the extent of disturbed areas; and
  - C. Proposed erosion and sediment control measures.
2. The following activities are exempt from the seasonal limitations:
  - A. Routine maintenance and necessary repair of erosion and sediment control BMPs;
  - B. Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
  - C. Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

### **5.2 Construction SWPPP Requirements**

The Construction SWPPP shall include a narrative and drawings. The narrative shall include documentation to explain and justify the pollution prevention decisions made for the project (see Section 3.2).

All BMPs shall be clearly referenced in the narrative and marked on the drawings.

Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting and filling. When establishing these permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance/compaction of native soils, except as needed for building purposes. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements or tree retention areas as may be required by local jurisdictions shall be delineated on the site plans and the development site.

### **5.3 Construction SWPPP Elements**

The construction site operator shall include each of the 12 elements below in the Construction SWPPP and ensure they are implemented, unless site conditions render the

element unnecessary and the exemption from that element is clearly justified in the Construction SWPPP.

### **1. Preserve Vegetation/Mark Clearing Limits**

- A. Prior to beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
- B. The duff layer, native top soil and natural vegetation shall be retained in an undisturbed state to the maximum degree practicable.

### **2. Establish Construction Access**

- A. Construction vehicle access and exit shall be limited to one route, if possible.
- B. Access points shall be stabilized with quarry spalls, crushed rock or other equivalent BMP to minimize the tracking of sediment onto public roads.
- C. Wheel wash or tire baths shall be located onsite if the stabilized construction entrance is not effective in preventing sediment from being tracked onto public roads.
- D. If sediment is tracked offsite, roads shall be cleaned thoroughly at the end of each day or more frequently during wet weather. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area.
- E. Street washing is allowed only after sediment is removed in accordance with 2.D, above. Street wash wastewater shall be controlled by pumping it back onsite or otherwise be prevented from discharging into systems tributary to waters of the state.
- F. Control street wash wastewater by pumping back on-site, or otherwise prevent it from discharging into systems tributary to waters of the State.

### **3. Control Flow Rates**

- A. Properties and waterways downstream from development sites shall be protected from erosion resulting from increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
- B. Where necessary to comply with 3.A, above, stormwater retention or detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g., impervious surfaces).
- C. If permanent infiltration ponds are used for flow control during construction these facilities shall be protected from siltation during the construction phase in accordance with the Construction SWPPP, including but not limited to temporary sedimentation ponds.

### **4. Install Sediment Controls**

- A. Design, install, and maintain effective erosion controls and sediment controls to

minimize the discharge of pollutants.

- B. Sediment control BMPs (sediment ponds, traps, filters, etc.) shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land-disturbing activities take place.
- C. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.
- D. Stormwater runoff from disturbed areas shall pass through a sediment pond or other appropriate sediment removal BMP prior to leaving a construction site or prior to discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but shall meet the flow control performance standard of 3.a, above.
- E. BMPs intended to trap sediment onsite shall be located in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
- F. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

## 5. Stabilize Soils

- A. Exposed and unworked soils shall be stabilized by application of effective BMPs that prevent erosion.
- B. Control stormwater volume and velocity within the site to minimize soil erosion.
- C. Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
- D. No soils shall remain exposed and unworked for more than the time periods set forth below to prevent erosion:
  - During the dry season (May 1 – September 30): 7 days
  - During the wet season (October 1 – April 30): 2 days
- E. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed, based on the weather forecast.
- F. Soil stockpiles shall immediately be stabilized from erosion, protected with sediment trapping measures, and where possible, located away from storm drain inlets, waterways and drainage channels.
- G. Minimize the amount of soil exposed during construction activity.
- H. Minimize the disturbance of steep slopes.
- I. Minimize soil compaction and, unless infeasible, preserve topsoil.

## 6. Protect Slopes

- A. Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion.
- B. Offsite stormwater (run-on) or groundwater shall be diverted away from slopes and undisturbed areas with interceptor dikes, pipes and/or swales. Offsite stormwater shall be managed separately from stormwater generated on the site.
- C. At the top of slopes, drainage shall be collected in pipe slope drains or protected channels to prevent erosion. Temporary pipe slope drains shall handle the expected peak 10-minute flow velocity from a Type 1A, 10-year, 24-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If the Western Washington Hydrology Model is used to predict flows, bare soil areas shall be modeled as “landscaped area.”
- D. Check dams shall be placed at regular intervals within constructed channels that are cut down a slope.

## 7. Protect Drain Inlets

- A. Storm drain inlets made operable during construction shall be protected so stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.
- B. Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

## 8. Stabilize Channels and Outlets

- A. All onsite conveyance channels shall be designed, constructed and stabilized to prevent erosion from the following expected peak flows. Channels shall handle the expected peak 10-minute flow velocity from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If the Western Washington Hydrology Model is used to predict flows, bare soil areas shall be modeled as “landscaped area.”
- B. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.

## 9. Control Pollutants

- A. Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants.
- B. All pollutants, including waste materials and demolition debris occurring onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater.
- C. Cover, containment and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products and other materials that have the potential to pose a threat to human health or the environment. Onsite fueling tanks shall include secondary containment.
- D. Maintenance, fueling and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures. Contaminated surfaces shall be cleaned immediately following any spill incident.
- E. Wheel wash or tire bath wastewater shall be discharge to separate onsite treatment system or to the sanitary sewer with local sewer district approval.
- F. Application of fertilizers and pesticides shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' label requirements for application rates and procedures shall be followed.
- G. BMPs shall be used to prevent or treat contamination of stormwater runoff by pH-modifying sources. These sources include, but are not limited to bulk cement, cement kiln dust, fly ash, new concrete washing and curing water, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.
- H. Adjust the pH of stormwater if necessary to prevent violations of water quality standards.
- I. Assure that washout of concrete trucks is performed offsite or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete onsite, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.
- J. Obtain written approval from Cowlitz County and the Department of Ecology prior to using chemical treatment other than CO<sub>2</sub> or dry ice to adjust pH.

## 10. Control Dewatering

- A. Foundation, vault and trench dewatering water, which have similar characteristics to stormwater runoff at the site, shall be discharged into a controlled conveyance system prior to discharge to a sediment trap or sediment pond.
- B. Clean, non-turbid dewatering water, such as well-point ground water, can be discharged to systems tributary to or directly into surface waters of the state, as specified above in 8 provided the dewatering flow does not cause erosion or

flooding of receiving waters. Clean dewatering water shall not be routed through stormwater sediment ponds.

- C. Other dewatering disposal options may include: (i) infiltration; (ii) transport offsite in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters; (iii) onsite chemical treatment or other suitable treatment technologies approved by the county; (iv) sanitary sewer discharge with local sewer district approval if there is no other option; or (v) use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.
- D. Highly turbid or contaminated dewatering water shall be handled separately from stormwater.

### **11. Maintain BMPs**

- A. All temporary and permanent erosion and sediment control BMPs shall be inspected, maintained, and repaired as needed to ensure continued performance of their intended function in accordance with BMP specifications.
- B. All temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

### **12. Manage the Project**

- A. Development projects shall be phased to the maximum degree practicable and shall take into account seasonal work limitations.
- B. Construction site operators shall maintain, and repair as needed, all sediment and erosion control BMPs to ensure continued performance of their intended function.
- C. Construction site operators shall periodically inspect their sites. Site inspections shall be conducted by a Certified Erosion and Sediment Control Lead who shall be identified in the Construction SWPPP and shall be present onsite or on call at all times.
- D. Construction site operators shall maintain, update, and implement their Construction SWPPP. Construction site operators shall modify their Construction SWPPP whenever there is a change in design, construction, operation or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

### **13. Protect Low Impact Development BMPs**

- A. Protect all Bioretention and Rain Garden BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into Bioretention and/or Rain Garden BMPs. Restore the BMPs to their fully function condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden Bioretention/rain Garden soils, and replacing the removed soils with soils meeting the design specification.

- B. Prevent compacting Bioretention and Rain Garden BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- C. Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.
- D. Pavements fouled with sediments or no longer passing an infiltration test must be cleaned using procedures from the stormwater manual or the manufacturers' procedures.
- E. Keep all heavy equipment off existing soils under LID BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

## 6.0 Offsite Analysis and Mitigation

### 6.1 Exemptions

A project is exempt from performing an offsite analysis if any of the following three conditions apply:

1. Based on the information in the final stormwater report the county determines that there is sufficient evidence to conclude that the project will not have a significant adverse impact on the downstream and/or upstream drainage system.
2. The project:
  - (a) Adds less than 2,000 square feet of converted impervious surface in the urban area or adds less than 5% of the site as new impervious surface in the rural area; and
  - (b) Adds less than 35,000 square feet of new pervious surface; and
  - (c) Does not construct or modify a drainage pipe/ditch that is 12 inches or more in size/depth or that receives runoff from a drainage pipe/ditch that is 12 inches or more in size/depth; and
  - (d) Does not contain or lie adjacent to a landslide, steep slope or erosion hazard area.
3. The project does not change the rate, volume, duration or location of discharges to and from the project site (e.g., where existing impervious surface is replaced with other impervious surface having similar runoff-generating characteristics or where pipe/ditch modifications do not change existing discharge characteristics).

### 6.2 Offsite Analysis

The developer will provide a storm drainage study for flows coming to and through the development, supplying the following information:

1. Storm Frequency for Design.
  - a. Twenty-five-year flows for primary drainage systems.
  - b. Ten-year flows for secondary drainage systems which provide for local surface drainage generated within or upon the development itself, except if the watershed exceeds 50 acres or the design discharge exceeds 20 cubic feet per second it will be considered as primary drainage.
2. Drainage area will be shown on topographic maps with the acreage specified thereon.
3. Total effect of concentration and increased rate of runoff on the downstream drainage system, i.e., the ability of existing and/or proposed downstream culverts and ditches to handle the run-off.

Plans will be submitted showing:

1. Open Ditch Construction

- a. Proposed cross-section of the channel will be shown with stable side slopes. Side slopes shall not exceed a grade of 3:1 unless paved or stabilized in some other manner as approved by the County Engineer.
  - b. The water surface elevation of the design flow will be indicated on the cross-section.
  - c. The channel width will be well defined and will provide capacity for at least the design flow. A minimum of 15 feet will be provided between any structures and the top of the bank of the defined channel.
2. Closed System
    - a. A closed system will have a capacity for at least the design flow without surcharging the system.
    - b. There will be an easement of at least 10 feet in width for closed system installation and maintenance.
    - c. All buildings and other structures will be a minimum of 10 feet from the closed system.
  3. Computations will be submitted with design plans, i.e., runoff co-efficients based on the ultimate development as set forth in the County Comprehensive Plan and all regulations adopted to implement said plan.

The general design standards are:

- A. The development will receive the drainage onto the tract at the natural occurring location and will discharge from the tract at the natural and existing location with no diversion at these points.
- B. The drainage study shall be made by or under the direct supervision of a professional engineer licensed by the State of Washington.
- C. The drainage study shall meet normal engineering practices and shall be reviewed by the County Engineer. When the County Engineer finds that the study meets the requirements herein, he shall affix his approval.
- D. The County Engineer or his representative shall review all drainage studies and conduct all inspections required to see that construction of drainage facilities meets the requirements of the approved study and plans prepared subsequent thereto.

### **6.3 Mitigation**

If the drainage study shows that the drainage ways and/or drainage facilities downstream from the development are inadequate to handle the increased drainage from the development the developer will make all the necessary improvements to bring the drainage way up to adequate capacity as a part of the development.

The developer shall obtain releases of damage from all affected properties for the flow of storm drainage between the development and a natural drainage way or creek acceptable to the Director.

## **7.0 Additional Requirements**

### **7.1 County Acceptance of Conveyance Facilities**

Any person holding title to property with conveyance facilities resulting from the Minimum Requirements found in section 16.22.060 may offer to the County for dedication said conveyance facilities, together with such easements, tracts and appurtenances as may be reasonably necessary. Any conveyance facility located within public right-of-way shall be dedicated to the County together with such easements, tracts and appurtenances as may be reasonably necessary. The County, at the Department of Public Works' discretion, may accept inspection, operation and maintenance responsibility for conveyance facilities, existing prior to the effective date of this Chapter. Conveyance facilities that are to be owned by the County will be accepted for ownership upon approval of the following conditions:

1. The applicant, at their sole expense, shall provide any document or information requested by the County in order for a decision to be reached on accepting the facilities;
2. The top lift of surfacing has been installed.
3. The conveyance facilities have been inspected and accepted by the County;
4. All easements and dedications required by this chapter entitling the County to access, inspect, operate and maintain the conveyance facilities have been conveyed to Cowlitz County and have been recorded with the Cowlitz County Auditor; and
5. The applicant has provided a complete and accurate set of reproducible as-built record drawings of the conveyance facilities to Cowlitz County. These drawings shall be stamped and certified as accurate by a professional engineer and accompanied by an operations and maintenance manual.

### **7.2 County Acceptance of Stormwater Facilities**

Any person holding title to property with stormwater facilities resulting from Minimum Requirements #6 and #7 found in section 16.22.060, serving single family residential developments, may offer to the County said stormwater facilities for dedication, together with such easements, tracts and appurtenances as may be reasonably necessary. The County, at the Department of Public Works' discretion, may accept inspection, operation and maintenance responsibility for stormwater facilities serving residential developments, existing prior to the effective date of this Chapter. Stormwater facilities that are to be owned by the County will be accepted for ownership upon approval of the following conditions:

1. The applicant, at their sole expense, shall provide any document or information requested by the County in order for a decision to be reached on accepting the facilities;
2. Improvements in residential subdivisions have been made on at least eighty percent of the created lots draining to the facility, unless waived by the County;
3. All stormwater facilities have been in satisfactory operation for at least two years. The two year period begins upon application for County ownership of stormwater facilities;

4. After two years of satisfactory operation and maintenance, the stormwater facilities have been inspected and accepted by the County;
5. All easements and dedications required by this chapter entitling the County to access, inspect, operate and maintain the stormwater facilities have been conveyed to Cowlitz County and have been recorded with the Cowlitz County Auditor; and
6. The applicant has provided a complete and accurate set of reproducible as-built record drawings of the stormwater facilities to Cowlitz County. These drawings shall be stamped and certified as accurate by a professional engineer and accompanied by an operations and maintenance manual.

### **7.3 Maintenance of Stormwater and Conveyance Facilities**

1. In accordance with Minimum Requirement #9 from section 16.22.060, an operations and maintenance manual and covenant will be required for all stormwater and conveyance facilities installed for any new development project that meets the regulatory threshold requirement.
2. Such operations and maintenance manual and covenant shall be submitted with Minimum Requirement #1-Stormwater Site Plan and approved, prior to the County granting final approval for the development under this chapter. The original maintenance manual and covenant shall be recorded in the Cowlitz County Auditor's office and copies shall be attached with the property deed for parcels containing or served by the stormwater facilities referred to in the covenant.
3. A copy of the operations and maintenance manual and covenant and a log of inspections, maintenance activities and repairs shall be retained by the designated responsible party. These records shall be made available to the County upon request and retained onsite or within reasonable access to the site. These records shall be transferred with the property to the new owner or responsible party.
4. The stormwater operations and maintenance covenant shall detail the continued performance of inspection and maintenance obligations required by this chapter. An operations and maintenance manual shall be submitted as an attachment to the actual operations and maintenance covenant. Information required for the operations and maintenance manual and covenant includes:
  - a. Designated Responsible Party. The designated owner or other legally established entity (responsible party), who shall be responsible for the inspection and maintenance of the stormwater and conveyance facilities shall be indicated.
  - b. Successor Responsibility. The agreement shall indicate the succession of inspection and maintenance responsibilities based upon the sale of property (if applicable) or dedication to other entities.
  - c. Right of Entry for Stormwater Authority. The agreement shall grant the County representative or designee the right of entry, at reasonable times and in a reasonable manner, for the purposes of inspecting stormwater and conveyance facilities, for abatement of a public nuisance, or correction of a violation of this chapter.

- d. **Inspection and Maintenance Standards.** The manual shall include inspection and maintenance standards for each stormwater and conveyance facility and BMP, as documented in Volume V, Chapter 4 of the 2019 SWMMWW. In addition, the manual shall include a list of inspection and maintenance tasks, a schedule for routine inspection and maintenance and actions to be taken when maintenance is required. Initial inspection frequencies shall be defined according to the following:
  - i. All stormwater facilities and catch basins for new residential developments that meet the regulatory threshold shall be inspected every six months, until eighty percent of the created parcels are occupied.
  - ii. All stormwater facilities, excluding catch basins, shall be inspected annually, unless maintenance records justify a different frequency. If a revised frequency is requested, approval of the request shall be based upon actual inspection and maintenance records for a period of time twice that of the proposed inspection frequency interval (i.e., if bi-annual maintenance is requested, then four years of maintenance records would be needed to justify the modification).
  - iii. When inspections identify the need for maintenance, such maintenance shall be conducted in accordance with the following timeframes:
    - A. Within one year for wet pool facilities and retention/ detention ponds.
    - B. Within six months for typical system maintenance (i.e. catch basins and ditches).
    - C. Within nine months for revegetation activities.
    - D. Within two years for any maintenance that requires capital construction costs of less than \$25,000.
    - E. Within a timeframe acceptable to the County for any capital construction costs greater than \$25,000.

#### **7.4 County Inspections of Privately Maintained Stormwater Facilities**

1. A County representative or designee shall have authority to conduct periodic inspections of post-construction stormwater facilities in order to ensure continued functioning of the facilities for the purposes for which they were constructed, and to ensure that maintenance is being performed in accordance with the standards set forth in the Operations and Maintenance Manual and Covenant. Inspection procedures shall be as outlined in section 14.60.080E.2.
2. **Inspection Procedure.** Prior to making any inspections, the County representative or designee shall present identification credentials, state the reason for the inspection and request entry of the owner or other person having charge or control of the property, if available, or as provided below:
  - a. **Unoccupied Site.** If the property or structure on the property is unoccupied, the County representative or designee shall first make a reasonable effort to locate the

owner or other person(s) having charge or control of the property or portions of the property and request entry.

- b. **Imminent Hazard.** If, after reasonable effort, the County representative or designee is unable to locate the owner or other person(s) having charge or control of the property, and has reason to believe the condition of the site or of the private stormwater drainage system creates an imminent hazard to persons or property, the inspector may enter.
- c. **Special Inspection Warrant** If the County has been refused access to any part of the premises from which stormwater is discharged, and if the County is able to demonstrate probable cause to believe that there may be a violation of this chapter, or that there is a need to inspect as part of a routine inspection program designed to verify compliance with this chapter or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the County may seek issuance of a search warrant from any court of competent jurisdiction.

## **7.5 Deeds and Easements**

- A. Drainage easements shall be required where the conveyance, storage, or treatment of stormwater is identified in development plans that are not located in public rights of way, and where access to stormwater facilities is required. Drainage easements shall be granted to the persons responsible for providing ongoing maintenance of the drainage systems. Drainage easements through structures are not permitted. Easements shall be of a width and location sufficient to allow access for equipment that would normally perform maintenance activities (minimum 15-ft width).
- B. Stormwater and conveyance facilities that are to be maintained by Cowlitz County, together with maintenance access roads to the facilities, shall be located in the public right-of-way, in separate tracts dedicated to Cowlitz County, or in drainage easements granted to Cowlitz County.
- C. Private home owner deed restrictions and homeowners/building covenants shall be required for all properties with onsite LID features to ensure that the stormwater management applications continue to function as designed. The deed restrictions or covenants shall specifically address and/or append the requirements and responsibilities for long-term management and maintenance of any LID features.