

STORM DRAINAGE CONSTRUCTION NOTES

TRACER WIRE SHALL BE INSTALLED ALONG THE TOP OF ALL PIPE. EXTEND THE TRACER WIRE INTO MANHOLES AND ALL OTHER STRUCTURES, THEN UP THE INSIDE WALL OF STRUCTURES AND ATTACH THE WIRE TO THE TOP INSIDE OF THE STRUCTURE. PROVIDE 3 FEET OF COILED TRACER WIRE SLACK ATTACHED TO THE TOP INSIDE OF THE STRUCTURE.

MANHOLES AND TYPE 2 CATCH BASINS SHALL BE ADJUSTED TO GRADE FOLLOWING PAVING. ADJUST TO GRADE USING AN APPROVED FOUR-POINT ADJUSTMENT SYSTEM SUCH AS THE RIMRISER SHIMLESS ADJUSTMENT SYSTEM, OR APPROVED EQUAL.

STORM SEWERS AND APPURTENANCES SHALL BE CLEANED, AIR TESTED AND DEFLECTION TESTED AFTER BACKFILLING. THE LOW PRESSURE AIR TEST METHOD SHALL BE USED. TV INSPECTION SHALL BE PERFORMED AFTER CLEANING, TESTING AND CORRECTIONS ARE COMPLETE. CLEANING, AIR TESTING, INFILTRATION TESTING, DEFLECTION TESTING, AND TV INSPECTION SHALL BE COMPLETED PRIOR TO PAVEMENT RESTORATION OF THE TRENCH. AN ELECTRONIC COPY OF THE TV INSPECTION VIDEO AND THE TV INSPECTION REPORT SHALL BE PROVIDED TO THE INSPECTOR. TOP LIFT OF PAVING SHALL NOT BE PLACED UNTIL THE INSPECTOR HAS APPROVED THE TV INSPECTION.

ALL MANHOLES SHALL BE WATERTIGHT. FOLLOWING BACKFILL AND PRIOR TO FINAL PAVING, PERFORM VACUUM TESTING ON MANHOLES PER THE REQUIREMENTS OF THE SUPPLEMENT TO STANDARD PLAN B-15.20-01.

AS-BUILT DRAWINGS AND TV REPORTS SHALL BE PROVIDED PRIOR TO FINAL ACCEPTANCE.

N.T.S.



STORM DRAIN GENERAL NOTES

CITY OF KELSO
DEPARTMENT OF
COMMUNITY DEVELOPMENT
& ENGINEERING

CITY ENGINEER APPROVAL: Michael Kardas, P.E.

x_____

STANDARD PLAN NO.

KSD-000-21

DATE:

MAY 2021

Chapter 2

Storm Drainage, Grading, and Erosion Control

City of Kelso
Engineering Design Manual
Amended May 2021
Effective Date _____

Chapter 2
Storm Drainage, Grading, and Erosion Control

City of Kelso
Engineering Design Manual

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CHAPTER 2 - STORM DRAINAGE, GRADING, AND EROSION CONTROL

2.00 Purpose

This chapter is intended to provide minimum standards for managing storm drainage and controlling erosion and sedimentation with land-disturbing activities, including development, redevelopment, clearing, and grading.

A. Minimum standards are established to:

1. Protect the public health, safety, and welfare by minimizing risk from flood events;
2. Protect property and habitat from increased runoff caused by development;
3. Allow efficient operation, repair, and maintenance of the storm drain system;
4. Reduce discharge of pollutants to the storm drain system and protect water quality;
5. Reduce impacts to hydrology of surface waters;
6. Reduce the erosion of soils on active construction sites and cleared areas; and
7. Limit the discharge of sediment-laden runoff from active construction sites and cleared areas.

B. The requirements of this chapter cannot provide for all situations. They are intended to assist but not to substitute for competent work by design professionals.

2.01 General

A. The KEDM is written to comply with the Department of Ecology's (Ecology's) Phase II Municipal Stormwater National Pollutant Discharge Elimination System (NPDES) Permit, which requires Kelso to adopt the 2019 Stormwater Management Manual for Western Washington (SWMMWW) or an equivalent.

B. This Chapter adopts the SWMMWW. The Chapter references and supplements the SWMMWW and is meant to be used in conjunction with the SWMMWW. An online version of the SWMMWW can be found at:

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

C. When portions of this chapter and the SWMMWW conflict, this chapter shall apply. When provisions of this chapter conflict with other City of Kelso Code or state and federal requirements, the more stringent provisions apply.

- D. This Chapter is intended to represent the minimum Standards for the design and construction of stormwater drainage facilities.
 - 1. Compliance with these Standards does not relieve the designer of the responsibility to apply sound professional judgment to protect the health, safety, and welfare of the general public.
 - 2. Special site conditions and environmental constraints may require a greater level of protection than would be required under these Standards.
 - 3. Site or weather changes or other unforeseen conditions may require modification of a site's erosion and sediment control strategy.
 - 4. The project must be designed (and may require modification) to ensure compliance with the conditions of any permits, codes and regulations, and these Standards.
 - 5. The design of stormwater drainage and/or retention/detention systems will depend on their type and local site conditions.
- E. Erosion and sediment control BMPs shall be implemented prior to initial soil disturbance and until final stabilization following project completion and removal of temporary controls.
- F. The City may temporarily suspend project work or require additional or modified protection measures if it appears to the Director, based upon observed conditions, that the approved plan is insufficient to prevent environmental harm and that such suspension or additional measures will prevent or minimize the harm.
- G. The City may require a construction project to be scheduled to minimize the potential for erosion or other environmental harm.
- H. Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site plan (e.g. subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling.
- I. Clearing and grading shall be prohibited in critical or environmentally sensitive areas unless written variances are secured from all applicable agencies.
- J. Preparation of submittals:
 - 1. All plans, studies, calculations, and reports that require the practice of engineering as defined in RCW 18.43.020(5)(a) shall be prepared by or under the direction of a professional civil engineer registered in the state of Washington. Such plans, studies, calculations, and reports shall be stamped, signed, and dated by the licensed civil engineer(s) responsible for preparation of the Stormwater Site Plans.

2. Unless otherwise specified in these Standards, soils reports shall be prepared by a professional soil scientist certified by the Soil Science Society of America (or equivalent national program) or other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the state of Washington.
 3. Stormwater Site Plans shall be prepared in accordance with the SWMMWW Vol. III, Section 3.2, Preparing a Stormwater Site Plan, as modified in Section 2.05 of the KEDM.
- K. Construction and Industrial Stormwater NPDES Permits. Obtain Ecology's Construction or Industrial Stormwater General Permit if/as required by Ecology. See Ecology website: <http://www.ecy.wa.gov/programs/wq/stormwater/index.html>.
- L. Other State and Federal requirements that could impact stormwater programs are summarized in SWMMWW Vol. I, Section 2.15: Other Requirements.

2.02 Applicability

- A. Development and redevelopment projects that meet the thresholds in the SWMMWW Vol. I, Section 3.3 shall:
1. Apply the Minimum Requirements (MRs) for stormwater management in accordance with the SWMMWW Vol. I, Section 3.4, and as modified in KEDM Section 2.03.
 2. Meet all the requirements of this Chapter.
- B. All land-disturbing projects regardless of size shall comply with KEDM Sections 2.11, 2.12, 2.13, and 2.15.

2.03 Minimum Requirements for Development and Redevelopment

- A. Instructions for complying with each MR are as follows:
1. Preparation of Stormwater Site Plans
 - Consult SWMMWW Vol. I, Section 3.4.1 for requirements for Preparation of Stormwater Site Plans.
 - Consult SWMMWW Vol. III, Section 3.2 for step-by-step requirements for preparing a Stormwater Site Plan, as modified in KEDM Section 2.05.
 - Consult KEDM Chapter 1 for submittal requirements.
 2. Construction Stormwater Pollution Prevention

- Consult SWMMWW Vol. I, Section 3.4.2 and Vol. II for requirements for Erosion Control and Construction Stormwater Pollution Prevention.
 - Consult this KEDM Section 2.04.D for variations from MR 2.
3. Source Control of Pollution
- Consult SWMMWW Vol. I, Section 3.4.3 and Vol. IV for requirements for Source Control of Pollution.
4. Preservation of Natural Drainage Systems and Outfalls
- Consult SWMMWW Vol. I, Section 3.4.4 for requirements for Preservation of Natural Drainage Systems and Outfalls.
 - Supplemental Guidelines for Outfall Protection shall apply.
5. On-Site Stormwater Management
- Consult SWMMWW Vol. I, Section 3.4.5 for requirements for On-Site Stormwater Management.
 - Also, consult SWMMWW Vol. III and V for design of on-site stormwater management facilities.
6. Runoff Treatment
- Consult SWMMWW Vol. I, Section 3.4.6 for requirements for Runoff Treatment.
 - Consult Section 2.04.C of these Standards for additional requirements.
 - Also, consult SWMMWW Vol. V for selection and design of runoff treatment facilities.
7. Flow Control
- Consult SWMMWW Vol. I, Section 3.4.7 for requirements for Flow Control.
 - Consult KEDM Section 2.04.A and B for exemptions and variations from MR 7.
 - Also, consult SWMMWW Vol. III for selection and design of flow control facilities.
8. Wetlands Protection
- Consult SWMMWW Vol. I, Section 3.4.8 for requirements for Wetlands Protection. Note that meeting the requirement of this Chapter does not

substitute for compliance with the Critical Areas requirements of KMC Chapter 17.26.

9. Operation and Maintenance

- Consult SWMMWW Vol. I, Section 3.4.9 for requirements for Operation and Maintenance.
 - Consult KEDM Section 2.20 for additional requirements for long-term operation and maintenance.
- B. Redevelopment projects must rectify any drainage problems upon replacement or refurbishment of the affected system. For example, projects that grind and resurface a parking lot which sheets over a sidewalk shall divert or intercept that runoff to a drainage system or to landscaping.

2.04 Exemptions and Variations to the Minimum Requirements

- A. Development and redevelopment projects are exempt from MRs only as described in the SWMMWW Vol. I, Section 3.2 and in the following circumstances:
1. Minimum Requirement 7; Flow Control. Projects within the Consolidated Diking Improvement District #1 (CDID #1) and Consolidated Diking Improvement District #3 (CDID #3) boundaries and sites discharging to these boundaries via manmade conveyances are exempt from MR 7 if the discharge meets each restriction listed in SWMMWW Vol. I, Section 3.4.7.
 2. Regional Facilities. The requirements for on-site management and against the transfer of runoff from one basin to another may be waived by the Director in areas served by a regional stormwater control facility. Such a waiver must be conditioned on the following provisions:
 - a. Basin Plans. The alternative or regional approach must comply with the Basin Plans provisions of SWMMWW Vol. I, Appendix 1-B.
 - b. Services Contracted. The developer shall provide the City a copy of an executed contract with the regional facility demonstrating full compliance with the applicable standards.
 - c. Conveyance System Capacity. The conveyance system transporting the stormwater from the development to the facility shall be sized to handle the additional runoff. The developer shall be required to demonstrate the adequacy of the conveyance system by an engineer registered in the State of Washington.
 3. Natural Drainage Features. Restoration of flow to natural drainage features may be allowed as an alternative to traditional detention to solve significant, pre-existing (i.e. not otherwise caused by the project) flooding, stream stability, water

quality or habitat problems as determined by the Director. The project shall also satisfy all conditions of SWMMWW Vol. I, Sections 3.4.7 and 3.4.8, be documented by a qualified engineer or wetlands biologist, and receive approval from all relevant regulatory authorities.

B. Flow Control Variations

Flow control facilities shall be designed in accordance with the SWMMWW Vol. III and the following requirements:

1. Tailwater. Pond outfalls shall be analyzed for the tailwater effect on discharge with a backwater analysis. Consideration must be given to the backwater effect of high surface elevations in the downstream conveyance system. High tailwater elevations may affect performance of the upstream facility and reduce live storage volumes.
2. Fencing. Ponds shall be fenced in accordance with the SWMMWW Vol. V, Section V-12, BMP D.1: Detention Ponds, except as follows:
 - a. A pond in which less than 10% of the perimeter has a vertical drop of greater than 30” and the remaining interior side slope is not steeper than 3H:1V may provide guardrail over the vertical drop in lieu of fencing.
 - b. Where chain link fence is required, landscaping shall be installed as screening, unless not feasible.
3. Access.
 - a. Access to flow control facilities shall be provided in accordance with the SWMMWW Vol. V, Section V-12, BMP D.1: Detention Ponds.
 - b. Access roads shall have a durable all-weather surface.

C. Water Quality Variations

Water quality facilities shall be designed in accordance with the SWMMWW Vol. V and the following requirements:

1. All catch basins, inlets, and manholes with grates, shall be stamped “Dump No Pollutants – Outfall to Stream,” or equivalent. Similar-themed markers or stenciling in addition to this minimum requirement are encouraged.
2. Permanent markers or signs, such as those described in the SWMMWW Vol. V, Section V-12, BMP D.1: Detention Ponds, shall be installed for significant aboveground facilities such as ponds, bioswales, pervious streets, bioretention, or developments that rely on numerous dispersed LID BMPs. Signs should identify the feature(s), state the purpose and/or function, provide contact information (for public facilities), and give any advisory message that is key to its proper and

continued performance, such as “Dump no debris or pollutants. For more information or to report littering, vandalism, or other problems, call 360-423-6590.”

D. Construction Stormwater Pollution Prevention Variations

1. Underground utility projects shall comply with MR 2 and the following additional requirements:
 - a. Excavated material shall be placed to minimize runoff into the trench and adjacent roadway consistent with safety and space considerations; and
 - b. Trench dewatering devices shall be managed as described in Element #10 in SWMMWW Vol. I, Section 3.4.2.
2. Diking District Maintenance. Routine dike and channel maintenance activities performed by diking districts must comply with MR 2 but are exempt from the requirement to submit a Construction Stormwater Pollution Prevention Plan.

2.05 Preparation of Stormwater Site Plans

- A. The applicant for a development or redevelopment project that triggers MR 1 shall prepare a Stormwater Site Plan.

Depending on the size and complexity of the development or activity, applicants must prepare either an Abbreviated Stormwater Site Plan or a Full Stormwater Site Plan. The size and complexity are evaluated using the applicability criteria found in Chapter 2 of the KEDM.

1. Abbreviated Stormwater Site Plan

An Abbreviated Stormwater Site Plan shall be prepared for sites that trigger MRs 1-5 in accordance with Chapter 2 of the KEDM. The Abbreviated Stormwater Site Plan meets the requirements of MR 1.

To fulfill this requirement, applicants shall complete the Abbreviated Stormwater Site Plan form available from the City and shall provide the required attachments.

2. Full Stormwater Site Plan

Sites that trigger MRs 1-9 shall prepare a Full Stormwater Site Plan. The Full Stormwater Site Plan fulfills MR 1.

The following four separate documents comprise the Full Stormwater Site Plan:

- a. Site Development Drawings

- b. Drainage Design Report
 - c. Long-Term Stormwater Site Management Plan
 - d. Construction Stormwater Pollution Prevention Plan
- B. The Full Stormwater Site Plan shall be prepared as follows:
- 1. Follow the instructions in the SWMMWW Vol. III, Section 3, except:
 - a. References to “Project required to meet Minimum Requirements 1-5” shall mean and refer to the City’s stormwater submittal type “Abbreviated Stormwater Site Plan,” and references to “Project required to meet Minimum Requirements 1-9” shall mean and refer to the City’s stormwater submittal type “Full Stormwater Site Plan”; and
 - b. Step 6 – Prepare a Construction Stormwater Pollution Prevention Plan may be delayed at the applicant’s option until the Pre-construction Conference; and
 - c. Step 7 – Complete the Stormwater Site Plan shall be replaced with the following text:

The Stormwater Site Plan encompasses the entire submittal for stormwater and drainage review. The Stormwater Site Plan includes the following four separate documents:

- 1. *Stormwater Site Development Drawings*
- 2. *Drainage Design Report*
- 3. *Long-Term Stormwater Site Management Plan*
- 4. *Construction Stormwater Pollution Prevention Plan*

Elements of the Long-Term Stormwater Site Management Plan include those items necessary to assure continued operation and maintenance of the site’s stormwater management facilities. These elements are required as described in Sections 2.16 and 2.20.

2. Stormwater Site Development Drawings

A. The Stormwater Site Development Drawings must meet the requirements of the Civil Site Development Plan in accordance with Section 1.04.C of the KEDM. The Site Development Drawings are engineering drawings that provide sufficient detail to construct the project’s stormwater facilities and conveyances.

- 1. In addition to the requirements of Chapter 1, the following specifications apply to Civil Site Development Plans:
 - a. Include a survey meeting the requirements of the SWMMWW Vol. III, Section 3.2 for projects required to meet MRs 1-9.

- b. Threshold Discharge Areas (TDA) in accordance with Chapter 2 of the KEDM. TDAs shall be identified and labeled consistently in all submittals – plans, reports, and maps. A Threshold Discharge Area is “an on-site area draining to a single discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath). The purpose of this definition is to clarify how the thresholds of the SWMMWW are applied to project sites with multiple discharge points.” See the Glossary in the SWMMWW.
- c. Location of the point of stormwater and surface water discharge from each TDA, which preserves natural drainage patterns.
- d. Location and overflow route for the 100-year, 24-hour storm.
- e. Location of soil logs, test pits, and extents of soils as documented in the Drainage Design Report.
- f. Location of slope instability and steep slopes.
- g. Areas of the site predominantly covered by native vegetation and areas of native vegetation to be preserved.
- h. Existing and proposed stormwater drainage; offsite areas contributing runoff to the site; location and number of stormwater facilities and on-site stormwater BMPs; designated flow paths and dispersion areas; direction of flow; size, type and kind of drainage channels and pipes.
- i. Existing and proposed pollution-generating pervious surfaces (PGPS) and pollution-generating hard surfaces (PGHS).
- j. Location of on-site stormwater BMPs (MR 5).
- k. Include locations of on-site BMPs on individual lots if they are used to meet MRs 6 or 7.
- l. Show areas of disturbed soils to be amended (BMP T5.13)
- m. Location of all runoff treatment facilities (MR 6)
- n. Location of all flow control facilities (MR 7)
- o. Location of structural source control BMPs used to meet MR 3.
- p. Dimension of permeable pavements. Use different hatches for permeable pavement vs. traditional pavement.
- q. Dimensions of setbacks of stormwater facilities and on-site stormwater BMPs from property lines, structures, wells, on-site sewer systems, landfills, slopes, and other natural features as applicable to the facility.
- r. Locations and species of retained trees and newly planted trees for which impervious surface reductions are claimed. Show distance from associated impervious surface.

- s. Show all tracts or easements used to enclose drainage features or stormwater facilities.
 - t. If individual lots will connect to the public stormwater drainage system, locations of approved connections.
 - u. Approved location for storm runoff from building lots (if applicable)
 - v. The Director may require additional site or vicinity information if needed.
 - w. Include in the landscape plan:
 - x. Locations and dimensions of vegetated stormwater facilities and vegetated on-site stormwater management BMPs
 - y. Locations and dimensions of areas of preserved native vegetation
 - z. Locations and species of retained trees Locations and dimensions of any required flow lengths and vegetated flow paths, (e.g. for dispersion BMPs)
 - aa. Detailed planting plan and specifications for trees, vegetated stormwater facilities, and vegetated on-site stormwater management BMPs
2. The following additional Profile specifications apply:
- a. Original surface grade profile
 - b. Proposed surface and storm drain profile
3. The following additional Detail specifications apply:
- a. Details of each bioretention BMP showing the following:
 - i. Width, length, side slopes, and maximum design pond depth. If bioretention is used to meet MR 6 or MR 7, show sufficient details to confirm accurate representation of the facility in the continuous simulation hydrologic model.
 - ii. Descriptions of all materials such as underdrain, drain rock, pipe, filter fabric, outlet structure, irrigation, bioretention soil mix, and mulch
 - iii. Locations, elevations, and slopes of any catch basins and pipes
 - iv. Designs for any retaining walls proposed. Structural walls shall meet City building permit requirements.
 - v. A minimum of two cross-sections showing original property lines, slope catch points and other information to construct the facility
 - b. Details of each permeable pavement installation showing the following:
 - i. Dimensions of permeable pavement

- ii. Dimensions of underground storage layer. If permeable pavement is used to meet MR 6 or MR 7, show sufficient details to confirm accurate representation of the facility in the continuous simulation hydrologic model.
- iii. Pavement section
- iv. Descriptions of all materials such as geotextile; underdrain; base material; storage layer; asphalt, concrete, or pavers
- v. Direction and percentage of slope
- c. Details of each treatment facility showing the following:
 - i. Overall measurements and dimensions
 - ii. Flow direction
 - iii. Location and elevations of inverts, inflow, bypass, and discharge
 - iv. Slope (if applicable)
- d. Details of each flow control facility showing the following:
 - i. Overall measurements and dimensions
 - ii. Measurements necessary to calculate storage volumes
 - iii. Control structure/restrictor placement
 - iv. Details of flow control structures showing size, dimensions, elevations, and orientations of all orifices, weirs, risers, tee-sections, etc.
 - v. A minimum of two cross-sections of each infiltration or detention pond showing original property lines, slope catch points, and other information to construct the facility.
- e. Details of each on-site stormwater BMP used to meet MR 5 sufficient to construct the BMP.
- f. For infiltration facilities and on-site stormwater BMPs used to infiltrate runoff from a pollution-generating hard surface, provide details to confirm accurate representation in the continuous simulation hydrologic model (see Drainage Design Report).

4. Drainage Design Report

The Drainage Design Report contains the technical information to support the site's drainage and stormwater plan. The report shall contain the following sections and components and shall address MRs 1-9.

- A. All sections listed below shall be included in each Drainage Design Report. If a section is not applicable, write "N/A" in the section contents and describe why the section is not applicable.

All page numbers of the report shall be numbered. Appendices shall have page numbers.

1. Cover Page

The Cover Page shall contain the following items:

- a. Name of Report
- b. Project Name
- c. Project Number, if a City project
- d. Situs Address
- e. Applicant's Name and Contact Information
- f. Applicant Engineer's Name and Contact Information
- g. Date of Submittal

2. Seal of the Applicant Engineer with the Applicant Engineer's certification statement. The Applicant Engineer shall certify in a statement that all the required information is included in the Drainage Design Report, the report was prepared by the Applicant Engineer or under his/her supervision, and that the proposed stormwater facilities are feasible.

3. Table of Contents

The Table of Contents shall contain the following items:

- a. List of section headings and their respective page numbers
- b. List of tables with page numbers
- c. List of figures with page numbers
- d. List of attachments and/or appendices, numbered
- e. List of references

4. Maps

All maps shall contain a scale and north arrow. The following maps shall be included:

- a. **Vicinity Map:** All vicinity maps shall clearly show the project site.
- b. **Basin Maps:** Show project boundaries, sub-basin boundaries, TDAs, and off-site contributing areas for both the pre-development and the post-development scenarios. TDAs shall be identified and labeled consistently in all submittals – plans, reports, and maps. Show drainage features, the flow path to and from the project site, and stormwater treatment and flow

- control facilities. Identify the point of compliance of each TDA for modeling site hydrology using an approved continuous simulation hydrologic model.
- c. **Soils Map:** The soils map shall show soils on the site and within the contributing area that drains to the site itself. Information should be consistent with the Soils Report.
 - d. **Other Maps:** The following additional maps shall be required in the situations noted:
 - i. **Wellhead Protection.** If the site lies within the 10-year time-of-travel zone of a public water supply well or within a Category I or II critical aquifer recharge area (CARA), maps showing all of the zones of contribution that overlap the site are required.
 - ii. **Floodplains.** If a floodplain mapped by the Federal Emergency Management Agency (FEMA) exists on or adjacent to the site, a map showing the floodplain is required.
 - iii. **Shoreline Management Area.** If the site requires a shoreline permit, a map showing the boundary of the shoreline management area in relation to the site is required.

5. Section A – Project Overview

The Project Overview is a brief narrative describing and summarizing the site and the proposed project. Most of the information in the Project Overview is discussed or shown in detail in other sections of the Stormwater Site Plan.

- a. Describe the site location, including legal description, address, parcel number, zoning, etc.
- b. List the primary type of permit required for the work and briefly summarize the type of development project.
- c. Summarize the existing conditions including topography, natural drainage patterns, vegetative ground cover, presence of agricultural drain tiles, and presence of critical areas.
- d. List existing onsite stormwater systems and describe their functions.
- e. Summarize site parameters that influence stormwater system design.
- f. List adjacent areas, including streams, lakes, rivers, wetland and buffer areas, residential areas, and roads that might be affected by the construction project.
- g. Generally describe proposed site construction, size of improvements, and proposed methods of mitigating stormwater runoff quantity and quality impacts.

- h. Describe how the proposed project considers the six listed site layout considerations described in SWMMWW, Vol III, Section 3.2, Step 2 – Prepare Preliminary Development Layout.
- i. Describe other permits from City of Kelso and/or other agencies that may affect the design of the stormwater system. Describe how any conflicts will be managed.

6. Section B – Existing Conditions and Soils

Provide a detailed narrative of the site’s survey, using the information gathered in Step 1 – Analyze Existing Site Conditions to Determine LID Feasibility in SWMMWW, Vol. III, Section 3.2.

Provide a detailed narrative of the soils and subsurface investigations also required in SWMMWW, Vol. III, Section 3.2. Describe the soils on the site.

Attach the required Soils Report as an appendix to the Drainage Design Report.

At a minimum, include the following:

- a. Existing ground cover, including pervious and developed areas
- b. Drainage through the site and to and from adjacent properties
- c. Locate and describe point of discharge from the site
- d. State whether the site is located in a Diking District
- e. Describe streams, rivers, ponds, ravines, gullies, steep slopes, springs, and erosion hazards on or downgradient of the site
- f. Describe critical areas on the site and those that receive runoff from the site to a minimum of ¼ mile away from the site boundary
- g. For agricultural sites with drain tiles, discuss the impact on site drainage
- h. Location of or proximity to high groundwater
- i. Location of or proximity to aquifer recharge areas or wellhead protection areas
- j. Describe known drainage problems such as flooding, erosion
- k. Describe location and proximity to structures, basements, property lines, sewers, septic tanks and drain fields, closed or active landfills, and storage tanks, both aboveground and underground
- l. Reference and describe any relevant reports or studies such as geotechnical reports on the site or adjacent to it, environmental impact statements, critical areas reports, flood studies, or basin plans. Describe any conditions imposed on the site or development activity by such reports or studies.

- m. Describe the soils on the site, using information included in the required Soils Report.
- n. Describe the infiltration testing done to assess the feasibility of bioretention and permeable pavement.
- o. State the results of the results of testing for saturated hydraulic conductivity, the results of testing for a hydraulic restriction layer, water table elevations, and results of analysis of shallow lateral flow (if needed).
- p. If full dispersion is proposed for the site, provide a narrative of the native vegetation survey required in SWMMWW, Vol. III, Section 3.2.
 - Attach the survey as an appendix to the Drainage Design Report.

7. Section C – Minimum Requirements Analysis

Following instructions in SWMMWW, Vol. III, Section 3.2 to determine and read the MRs, describe the land-disturbing activity and document the applicable MRs for the project site.

- a. Provide a table to document the totals of land-disturbing activities and surfaces on the post-development site in the following categories:
 - i. The amount of existing hard surface.
 - ii. The amount of new hard surface.
 - iii. The amount of replaced hard surface.
 - iv. The amount of vegetation converted to lawn or landscaping.
 - v. The amount of native vegetation converted to pasture.
 - vi. The total amount of land-disturbing activity.
 - vii. The total amount of PGHS
 - viii. The total amount of PGPS, not including permeable pavements
 - ix. The total amount of effective impervious surface

If the site includes multiple TDAs, provide the same information for each TDA and aggregated for the entire site.

- b. Document through an approved continuous simulation hydrologic model the increase in the 100-year flood frequency from pre-developed to developed conditions for each TDA.
- c. List the proposed commercial or industrial uses of the site, if any.
- d. Based on the information above and on an understanding of the MRs:
 - i. List the TDAs that must meet the on-site stormwater management requirements listed in MR 5.

- ii. List the TDAs that must meet the water quality requirements listed in MR 6.
- iii. List the TDAs that must meet the flow control requirements listed in MR 7. List which, if any, are also Flow Control Exempt.
- iv. List the TDAs that must meet the wetlands protection requirements listed in MR 8.
- v. List the TDAs that must meet the pollutant source control requirements listed in MR 3.

8. Section D – On-Site Stormwater Management Selection and Sizing (MR 5)

Describe how the site meets the requirements of on-site stormwater management listed in MR 5.

Information and calculations in the Drainage Design Report shall support and be consistent with the Site Development Drawings. All on-site stormwater management BMPs shall be shown on the Stormwater Site Development Drawings.

At a minimum, include the following in the Drainage Design Report:

- a. Describe the site's suitability for on-site stormwater management.
- b. For each TDA, state whether MR 5 is being met using List #2 or the LID Performance Standard.
- c. Provide a narrative describing how the project will fulfill the requirement for on-site stormwater management (MR 5) to the extent feasible.
- d. List total area of native vegetation retained.
- e. List the on-site stormwater management BMPs selected.
- f. Show an illustrative sketch of the on-site stormwater plan.
- g. Describe site suitability, including soils, slopes, infiltration rate, and native vegetation, as applicable, for each on-site stormwater management BMP.
- h. Describe how design criteria will be met for each on-site stormwater management BMP.
- i. Describe specifications for amending disturbed soils in accordance with BMP T5.13.
- j. Summarize proposed ownership of on-site stormwater management BMPs. [Additional details to be provided in the Long-Term Stormwater Site Management Plan.]

If Using List #2

- k. Provide justification and documentation, if needed, for any determination that an on-site stormwater management BMP is infeasible. The only acceptable infeasibility criteria are found in the SWMMWW. Site-specific information is required.

If Using the LID Performance Standard

- l. Show calculations for impervious surface reduction credits for retained or newly planted trees, if any.
- m. If full dispersion or full downspout infiltration are proposed, describe how BMP designs meet requirements allowing removal of the associated drainage areas from computer model input.
- n. Complete a detailed hydrologic analysis for existing and developed site conditions, in accordance with the requirements of SWMMWW, Vol. III, Section 2, using an approved continuous simulation hydrologic model. Compute pre-developed and developed flow durations for all TDAs. Provide an output table from the continuous flow model, including the following:
 - i. Flow rates for the 2, 10, and 100-year, 24-hour storm return periods for pre- developed and developed conditions.
 - ii. A table listing the pass/fail rates for each flow level where duration statistics were calculated.
 - iii. A graph showing the flow rate on the y axis and percent time exceeding on the x axis for pre-developed conditions and post-developed mitigated conditions, from 8% of the 2-year through the 50% of the 2-year flow rate.
- o. Provide the electronic computer model input and output files on a CD or a USB flash drive. [Note: the media will not be returned.]

If Using Bioretention

- p. Describe the bioretention soil mix specifications.

If Using Permeable Pavement

- q. Show supporting design calculations showing adequate infiltration rates to accommodate flows from all surfaces directed to the permeable pavement.
- r. Base material gradation.
- s. Asphalt or concrete mix design and void calculations.
- t. Acceptance test procedures.

9. Section E – Runoff Treatment Analysis and Design

Describe how the site meets the requirements for runoff treatment listed in MR 6. Provide a separate analysis for each TDA required to meet MR 6.

Information and calculations in the Drainage Design Report shall support and be consistent with the Stormwater Site Development Drawings. All runoff treatment facilities shall be shown on the Stormwater Site Development Drawings. A detail drawing shall be provided in the Stormwater Site Development Drawings for each runoff treatment facility.

At a minimum, include the following in the Drainage Design Report:

- a. Document the level of treatment required; list the water quality menus used.
- b. Document assumptions about roofs, driveways, and other hard surfaces to be constructed after site development (e.g. in a subdivision)
- c. Provide background and description to support the selection of the treatment BMPs being proposed
- d. List the BMPs used in the design
- e. Show an illustrative sketch of the runoff treatment plan
- f. Complete a detailed analysis and design of all proposed runoff treatment system elements, in accordance with SWMMWW, Vol. V. Reference runoff treatment system elements to labeled points shown on the Stormwater Site Development Drawings.
- g. Show model printouts, calculations, equations, references, and graphs as necessary to show facilities are designed consistent with the SWMMWW, Vol. V and the minimum volume criteria of MR 6.
- h. Summarize the results of the runoff treatment design and describe how the proposed design meets the requirements of the SWMMWW.
- i. If bioretention or infiltration below PGHS are used to meet the treatment requirement the runoff model output file must include the volume of water that has been treated through those BMPs.
- j. If infiltration is used to meet runoff treatment requirements, document how the facility design and the site's soils meet the Site Suitability Criteria as described in the SWMMWW, Vol. V, Section 5.6.
- k. Include and reference in the Appendices all computations, equations, charts, nomographs, detail drawings, and other tabular or graphic aids used to design water quality system elements.
- l. Provide the electronic computer model input and output files on a CD or a USB flash drive. [Note: the media will not be returned.]

10. Section F – Flow Control Analysis and Design

Describe how the site meets the requirements for flow control listed in MR 7 and protection of wetland hydrology from MR 8, if applicable. Provide a separate analysis for each TDA required to meet MR 7 and/or MR 8.

Information and calculations in the Drainage Design Report shall support and be consistent with the Stormwater Site Development Drawings. All flow control facilities shall be shown on the Stormwater Site Development Drawings (1.02.H). A detail drawing shall be provided in the Stormwater Site Development Drawings for each flow control facility.

At a minimum, include the following in the Drainage Design Report:

- a. Describe the assumptions and site parameters used in determining the pre-development site hydrology, including acreage, soil types, and land covers. Include any maps, exhibits, graphics, and references contributing to the analysis.
- b. 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.
- c. Document assumptions about roofs, driveways, and other hard surfaces to be constructed after site development (e.g. in a subdivision)
- d. Describe use of flow control credits from on-site stormwater management BMPs
- e. Reflect the site's suitability for stormwater infiltration for flow control, as described in the Soils Report.
- f. Identify and describe geotechnical or other studies and critical areas reports used to complete the analysis and design
- g. List the flow control facilities used in the design
- h. Show an illustrative sketch of the flow control facilities and their appurtenances and state their storage volumes
- i. Describe the approximate location and sizing of each flow control facility
- j. Include any bioretention and permeable pavement BMPs to be installed on individual lots by subsequent contractors, if those BMPs contribute to meeting the Flow Control Standard
- k. Complete a detailed hydrologic analysis for existing and developed site conditions, in accordance with the requirements of SWMMWW, Vol. III, Section 2, using an approved continuous simulation hydrologic model. Compute pre-developed and developed flow durations for all TDAs.

Provide an output table from the continuous flow model, including the following:

- i. Flow rates for the 2, 10, and 100-year, 24-hour storm return periods for pre- developed and developed conditions.
 - ii. A table listing the pass/fail rates for each flow level where duration statistics were calculated.
 - iii. A graph showing the flow rate on the y axis and percent time exceeding on the x axis for pre-developed conditions and post-developed mitigated conditions, from 50% of the 2-year through the 50-year flow rate.
 - iv. Include models and calculations demonstrating protection of wetland hydrology in accordance with MR 8, if applicable.
- l. 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.
 - m. 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.
 - n. Include all maps, exhibits, graphics, and references used to determine existing and developed site hydrology.
 - o. Summarize the results of the flow control design and describe how the proposed design meets the requirements of the SWMMWW, including MR 7 and, if applicable, MR 8.
 - p. Identify locations and species of newly planted or retained trees for which impervious surface reduction credits are claimed. Show calculations for impervious surface reduction credits.
 - q. If full dispersion or full downspout infiltration are used, describe how BMP designs meet requirements allowing removal of the associated drainage areas from computer model input.
 - r. Attach computer model printouts, calculations, equations, references, and graphs as necessary to show facilities are designed consistent with the SWMMWW, Vol. III and the Flow Control Performance Standard of MR 7.
 - s. Provide the electronic computer model input and output files on a USB flash drive. [Note: the media will not be returned.]

11. Section G – Conveyance System Analysis and Design

Describe how the site meets the requirements for conveyance from KEDM Sections 2.08, 2.09, and 2.10.

Information and calculations in the Drainage Design Report shall support and be consistent with the Stormwater Site Development Drawings. All conveyances shall be shown on the Stormwater Site Development Drawings. A profile drawing of each proposed conveyance shall be provided with the Stormwater Site Development Drawings. A detail drawing of each catch basin, manhole and/or other structures required to construct the project's conveyance, as shown in the City Standard Plans, shall be provided with the Stormwater Site Development Drawings.

At a minimum, include the following in the Drainage Design Report:

- a. An analysis of on-site hydrologic connectivity of surface conveyance channels and pipes and points of concentration
- b. An off-site analysis (SWMMWW Vol. I, Section 3.5.3) is required for developments creating more than 25,000 square feet of new impervious surface. For developments creating 25,000 square feet or less of new impervious surface, an off-site analysis may be required depending on the development location, and the condition of the downstream drainage system, as determined by the Director.
- c. Describe the upstream contributing basin and any assumptions used to determine the full build-out conditions
- d. 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.
- e. Describe locations and dimensions of conveyance features
- f. 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 KEDM Section 2.08 through 2.10. Identify, compute, reference, verify, summarize, and tabulate the following:
 - i. Design flows and velocities and conveyance element capacities for all conveyance elements within the development.
 - ii. The 10-year recurrence interval stage for detention facility outfalls. Provide stage-frequency documentation from the approved continuous simulation hydrologic model.

- iii. The existing 100-year floodplain elevations and lateral limits for all channels, and no net loss of conveyance or storage capacity from development.
 - iv. The conveyance system elements to labeled points shown on the Site Development Drawings.
 - v. 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.
 - vi. 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.
 - vii. The results of system analyses, and how the proposed design meets the requirements of the KEDM.
- g. Document approval of the Diking District to discharge to its facilities, if applicable.

12. Section H – Source Control

If the development activity requires source control (MR 3), identify the source control BMPs to be used.

Show any structural source control BMPs on the Stormwater Site Development Drawings, and include all details needed to construct the facility.

13. Section I – Ongoing Operation and Maintenance

Summarize legal instruments needed to guarantee preservation of the drainage system and access for maintenance. List intended ownership and responsibility for operating and maintaining stormwater treatment and flow control facilities and on-site stormwater management BMPs. Describe dedications, tracts, easements, and agreements.

Additional details and attachments shall be included with the Long-Term Stormwater Site Management Plan.

14. Section J – Groundwater Monitoring Program

Where required by the City, a groundwater monitoring program shall be included in the Drainage Design Report. 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 the KEDM. The Director will review proposed groundwater monitoring programs on a site-specific basis.

15. Section K – Appendices

Provide a technical appendix that includes all computations completed in the preparation of the Drainage Design 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 on-site stormwater management, 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 Drainage Design 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. Additional required subjects of special reports may include, but are not limited to:

- a. Geotechnical
- b. Wetlands
- c. Floodplains and floodways
- d. Groundwater
- e. Structural design
- f. Fluvial geomorphology (erosion and deposition)

5. Specifications for Long-Term Stormwater Site Management Plan

The Long-Term Stormwater Site Management Plan assures continued operation and maintenance of the site's stormwater management facilities to maintain intended function. The sheet size for the Plan shall be 8.5" x 11". The plan shall comply with the recording standards of the Cowlitz County Auditor.

The Long-Term Stormwater Site Management Plan is a standalone plan that must be understandable by a typical property owner and site operator. It includes illustrative and narrative guidance for locating, operating, and maintaining all elements of the site's stormwater management and drainage strategy.

A. All sections listed below shall be included in each Long-Term Stormwater Site Management Plan. All page numbers of the plan shall be numbered. Attachments shall have page numbers.

1. Cover Sheet

The Cover Sheet shall contain the following items:

- a. Name of Plan
- b. Project Name
- c. Project Number, if a City project
- d. Situs Address
- e. Applicant's Name and Contact Information
- f. Applicant Engineer's Name and Contact Information
- g. Date of Submittal

2. Operations and Maintenance Summary

Generally describe the drainage and stormwater management facilities on the site.

Summarize the ownership and operational and maintenance responsibility of the site's drainage and stormwater control features. Describe drainage easements and stormwater tracts, if any. Include all types of on-site stormwater management BMPs used on the site, including retained and newly planted trees, and areas of native vegetation retained for full dispersion. Include treatment and flow control facilities. If MR 3 is applicable, include a summary of pollutant source control measures.

If the site is a subdivision, and if on-site stormwater management BMPs to be located on individual lots contribute to meeting MR 6 or MR 7, then include those BMPs in the summary.

The summary shall be consistent with the attachments that describe ownership and operation and maintenance in detail.

3. Stormwater Improvement Restrictive Covenants

Attach a copy of the Stormwater Improvement Restrictive Covenant required by KEDM Section 2.21.C.

4. Site Stormwater System Manual

Attach the Site Stormwater System Manual, which describes ongoing operation and maintenance of the storm drainage system, required by KEDM Section 2.21.D(1).

5. Individual Lot Operation and Maintenance Instructions

If the site is a subdivision or short subdivision, prepare, but do not attach, simplified maintenance instructions for on-site stormwater management BMPs on individual residential lots as required by KEDM Section 2.21.D(2) for each

lot. These documents shall be recorded with the Stormwater Improvement Restrictive Covenant for each lot.

Write “See recorded Stormwater Improvement Restrictive Covenant for each lot” in this section of the plan.

If the site is not a subdivision, write “N/A” in this section of the plan.

6. Pollution Source Control Plan

If MR 3 is applicable to the site, describe the applicable source control BMPs as described in the SWMMWW, Vol. IV.

7. Inspection

Inspection checklists and logs shall be included in the Management Plan and shall be used to guide and record the site inspections. The checklists and logs shall be provided to the Director on the schedule established by the Stormwater Improvement Restrictive Covenant.

6. Specifications for Construction Stormwater Pollution Prevention Plan

The Construction Stormwater Pollution Prevention Plan (C-SWPPP) describes the operational practices and structural BMPs that prevent erosion on construction sites and prevent sediment from leaving sites and entering into the drainage system.

Submit a C-SWPPP prepared in accordance with the SWMMWW, Vol. II, Section 2. BMPs shall be selected from the SWMMWW, Vol. II, Section 3.

A. At the minimum include the following:

1. Narrative meeting the requirements of SWMMWW, Vol. II, Section 2.4
2. Drawings meeting the requirements of SWMMWW, Vol. II, Section 2.4

2.06 Setbacks

Setbacks for stormwater facilities and on-site stormwater management BMPs shall be according to Table 2.1 below:

Table 2.1: Stormwater Facility Setbacks

	Structure / Foundation	Sensitive Area¹	Property Line	Other
On-Site Infiltration BMP (serving <5,000 sf)	10'	10'	10'	See applications, limitations, suggested setbacks, and infeasibility criteria for each BMP in SWMMWW Vol. V.
Site Dispersion BMP Device (e.g. dispersion trench)²	5'	10'	5'	See applications, limitations, suggested setbacks, and infeasibility criteria for each BMP in SWMMWW Vol. V.
Large Infiltration Facility (serving >5,000 sf)	100', if building is downslope; 20' if building is upslope	20' (from buffer)	20'	See Site Suitability Criteria in SWMMWW Vol. V, Section 5.6. If the facility is bioretention or permeable pavement, also see infeasibility criteria for each BMP in Vol. V.
Detention Facility	20'	20' (from buffer)	20'	See suggested setbacks for each type of detention facility in SWMMWW Vol. V.
Water Quality Facility (e.g. bioswale)	20'	10'	20'	See setbacks for runoff treatment facilities in SWMMWW Vol. V.

¹ Given setbacks to sensitive areas may be used when no specific setback is given in KMC 17.26.

² Setback is from the dispersion device, not from the flowpath. Flowpath may not enter an adjacent property.

2.07 Infiltration

- A. Infiltration facilities must comply with Ecology’s Underground Injection Control (UIC) program, the Washington Department of Health’s (DOH’s) Wellhead Protection Program and other regulatory protections.

2.08 General Conveyance Requirements

- A. Conveyance, collection, culvert, and bridge design shall accommodate the entire contributing drainage area projected under full build-out conditions and not adversely affect existing downstream conveyance elements and flow conditions.
- B. Natural drainage flow routes to streams and wetlands shall be maintained, and discharges from the site shall occur at the natural location(s) and elevation(s), to the maximum extent practicable. See MRs 4 and 8.
- C. Vegetated open-channel conveyance is preferred and should be used wherever feasible and reasonable.
- D. Outfalls shall enter creeks or drainage channels perpendicular to the channel or angled downstream. Outfalls shall use energy dissipation to prevent erosion of the existing

bank and/or channel bottom during the 100-year, 24-hour design storm in accordance with MR 4 Supplemental Guidelines. Energy dissipation shall be designed in accordance with SWMMWW Vol. V, Section 1.4.3, Outfall Systems.

- E. Storm drain conveyance systems shall be installed in accordance with the Kelso Standard Plans (see Appendix A) and the current WSDOT Standard Plans and Specifications for Road, Bridge, and Municipal Construction, with the notations as provided in this Chapter.
- F. Discharge to a diking district facility requires the diking district's approval.
- G. Any standard engineering methodology may be used to design closed conduit and open conveyance systems.
- H. Closed conduit systems shall be designed in accordance with KEDM Section 2.09.
- I. Open conveyance systems shall be designed in accordance with KEDM Section 2.10.

2.09 Closed Conduit Systems

A. Design Requirements

1. The 25-year, 24-hour storm shall show free-flowing conditions through the proposed and/or existing conveyance system.
2. The 100-year, 24-hour storm may overtop the conveyance system, provided:
 - a. The additional flow shall not extend beyond one-half of the width of the outside lane of the traveled way and shall not exceed a 4-inch depth at the deepest point, and
 - b. Waters do not rise to elevations more than one foot below that of the lowest aboveground floor of buildings.
3. Backwater Analysis. At the discretion of the Director, a backwater analysis shall be conducted to determine the hydraulic grade line to ensure a minimum of 1.0-foot freeboard between the water surface and the top of any manhole or catch
4. Pipe. All storm pipes shall be constructed of smooth interior pipe including bell & spigot joints with gaskets and shall be subject to air testing.
 - a. Alternate Materials. Where required for strength, such as for shallow bury (less than 24 inches to top of pipe), Class 52 ductile iron pipe shall be used. Other pipe materials may be used if approved by the Director.
 - b. Location (Tracer) Wire. Non-conductive pipe shall be laid with warning tape and location wire.

5. Size. The minimum pipe size within the public right-of-way shall be 12 inches unless otherwise approved by the City Engineer. Storm laterals from private drains to inlets may be 6 inches and shall have a cleanout installed at the property line.
 6. Velocity. All storm drains shall be on a grade which produces a mean velocity when flowing full of at least three fps, unless prohibited by site conditions. The Director may waive this minimum where existing drainage systems make it impractical to meet the standard.
 - a. If velocities exceed 15 fps during the 25-year storm, anchors shall be provided at bends and junctions.
 - b. Velocities in pipes other than HDPE and iron are limited to 30 fps.
 7. Slope. A uniform slope between structures is required for all installed conveyance pipes. The allowable tolerance for sags or bellies in a newly installed pipe shall be 0.5 inches. For slopes steeper than 20 percent, closed conduit systems shall be designed by accepted engineering practices.
 8. Minimum separations from storm drains to sewers and water lines shall be as required for sanitary sewers, or as approved by the Director. Storm lines shall be laid higher than sanitary sewers where possible.
 9. Pipes over 8 inches in diameter that “daylight” to the surface shall have a protective grate installed that prohibits wildlife and children from entering the storm line. The grate shall be hinged or otherwise designed to allow for cleaning and to reduce accumulation of debris from behind the grate.
- B. Alignment and Cover
1. All changes in pipe direction, slope, size and junctions shall be made at a manhole or other City approved structure.
 2. Storm drain lines shall not be curved between structures unless approved by the Director.
 3. Unless otherwise approved by the Director, a minimum cover of 36 inches of cover is required above the top of the pipe to the top of the ground surface. There shall be a minimum of one 1-foot separation from the top of pipe to the bottom of the roadway section (e.g. laterals from catch basins).
 4. In areas of relatively flat terrain, the design engineer must show that sufficient depth is provided at the boundary of the development to drain the upstream basins.
 5. When necessary to locate drains in easements or tracts, the storm drain shall be centered in the easement. However, drains may be offset due to site conditions.

6. The invert elevation of all upstream pipes shall not be lower than the invert elevation of the downstream pipe.

C. Manholes

1. Manholes shall be located at all changes in slope, alignment, pipe size, and at all pipe junctions with present or future storm drains.
2. Manholes shall be spaced no greater than 300 feet apart.
3. Standard manholes are required when rim to crown of pipe elevations exceed four feet, otherwise flat-top manholes shall be used.
4. The manhole cover shall be stamped “STORM.”
5. Storm drain manholes shall have a sump at least 1’ deep.

D. Collection. Stormwater collection systems shall be designed by accepted engineering practices with the following notes:

1. Catch basins or inlets shall be located in streets at the curb-line to receive stormwater and convey it to the main storm drain.
2. Catch basins or inlets shall be at the following locations, whichever is less, unless otherwise approved by the Director:
 - a. Less than 300 feet apart measured along the drainage flow path;
 - b. In the tangent section immediately in advance of the curb returns on the upstream side of the intersection;
 - c. At all street ends with a descending grade,
 - d. At intermediate locations such that gutter flow does not exceed three 3 feet in width or 3 inches in depth, and
 - e. Catch basins and inlets shall be used with curb and gutter installations up to 8% in tangential grade. Combination curb inlets shall be used for steeper grades and at road “low points.”
3. Catch Basins, inlets, and manholes with grates, shall be stamped on the top or on the top of the curb next to the catch basin or inlet, “Dump no Pollutants - Outfall to Stream,” or equivalent.
4. Catch basins and inlets shall have a sump at least 15 inches below the lowest invert to collect sediment and debris. 5. Herringbone grates shall be used for Type 1, Type 1L, Type 2 catch basins and Combination Inlets, except vaned grates shall be used where the surface slope adjacent to the catch basin exceeds 8%.

2.10 Open Conveyance

- A. The **25-year, 24-hour storm** shall show free-flowing conditions through the proposed and/or existing conveyance system. Culverts with contributing drainage areas greater than 200-acres shall be designed to pass the peak runoff from the 100-year design storm.
- B. The **100-year, 24-hour** storm may flow at bank-full, provided:
 1. Runoff is contained within defined conveyance system elements;
 2. The hydraulic grade line does not exceed the elevation of the roadway subgrade, and;
 3. Waters do not rise to elevations more than one foot below that of the lowest aboveground floor of buildings and no portions of a building will be flooded.
- C. Culverts. Culverts shall be designed in accordance with the current WSDOT Hydraulics Manual. Fish passage culverts shall meet the design criteria specified in the Washington Department of Fish and Wildlife (WDFW) *Design of Road Culverts for Fish Passage*.
- D. Backwater Analysis. A backwater analysis (see the King County Surface Water Design Manual for an example) shall be performed if a flow restriction (such as a bridge or culvert) causes flow to rise above normal depth within a channel reach.
- E. Side Slopes. Channel side slopes shall not exceed 2:1. Depth, safety, and erosion concerns must be considered with slopes steeper than 3:1.
- F. Freeboard. Channels designed for 25-year storm flows of 10 cubic feet per second (cfs) or less shall have at least 0.5 feet of freeboard, and 1.0 feet for greater velocities.
- G. Lining and Armor. Open channels shall be designed to withstand channel erosion and not degrade water quality.
 1. Channels with peak velocities less than 5 fps shall be vegetated.
 2. Channels with velocities above 5 fps shall be sufficiently armored to the maximum water surface elevation.
 3. Channels must be stabilized against erosion at the completion of construction. This may require temporary erosion control practices until the design vegetation is established.

2.11 Private Drainage

- A. Drainage Accessibility. Subdivision lots which drain to the rear should be avoided. But, if drainage to the rear of lots is necessary due to topography to collect roof drains, footing drains, and surface run-off, the Developer shall:
 - 1. Provide a recorded stormwater easement for the City inspection of the private system and/or a recorded stormwater easement for any crossing of private property to reach the approved point of discharge in favor of the upstream landowner.
 - 2. Design and install the system to meet the Uniform Plumbing Code requirements.
- B. Stormwater easement geometry shall be in accordance with KEDM Section 2.16.

2.12 Subsurface Drainage

Underdrains shall be provided at the following locations:

- A. For all existing springs and underdrain pipe intercepted during construction.
- B. Where high ground water exists or when it is necessary to reduce the piezometric surface to an acceptable level to prevent land slippage or under-floor flooding of buildings.
- C. The drainage line installed shall begin at a cleanout and terminate at an approved point of discharge.

2.13 Curb Drains and Perforated Connections

- A. When downspouts and footing drains must be connected to the private or public storm sewer systems, perforated connections (SWMMWW Vol. V, Section V-4) from the home to the property line or curb are required where feasible in accordance with MR 5.
- B. Drainage from residential roofs and footings may drain directly to a street via a curb drain under the following circumstances:
 - 1. If the project is subject to MR 5, MR 5 must be satisfied for roofs;
 - 2. Perforated connections are used and designed in accordance with the SWMMWW.
 - 3. It can be shown that gravity drainage is possible.
 - 4. The existing street is adequately crowned and its drainage system, including curb, gutter, and storm lines, is adequately sized to accept the additional flow.

5. Pressurized outfalls, e.g. sump pumps, shall not be allowed to plume into the street or where they cause standing pools in the gutter, a slip or a vector hazard.
 6. For residential redevelopment, historical installation of curb drains are evident in the immediate neighborhood.
 7. Perforated connections shall not act as a conduit to discharge groundwater or springs to the storm sewer system.
- C. Curb drains will be allowed for residential development and redevelopment as approved by the Director.
- D. Curb drains shall not be allowed for new commercial development. Commercial redevelopment may use curb drains as approved by the Director.

2.14 Stormwater Facility Plantings

Vegetated stormwater facilities shall be planted as described in this section.

- A. Bioretention BMPs and Rain Gardens within a City right-of-way shall:
1. Meet the planting plan requirements of KEDM Section 3.19 and;
 2. Be planted in accordance with KEDM Section 3.19.
- B. There are two options for planting Bioretention BMPs and Rain Gardens on private property or within a stormwater tract dedicated to the City.
1. Optional Schematic Rain Garden Planting Plan and Worksheet for Private Property.
 - a. The applicant may elect to use the Optional Schematic Rain Garden Planting Plan and Worksheet for Private Property to develop the planting plan.
 - b. Fill out the worksheet for each Rain Garden, and submit it with the Site Development Drawings (see KEDM Section 1.04.H).
 2. 2012 LID Technical Guidance Manual for Puget Sound planting guidance.
 - a. Develop a detailed planting plan in accordance with the 2012 LID Technical Guidance Manual for Puget Sound.
 - b. Submit the planting plan with the Site Development Drawings (see KEDM Section 1.04.H).
- C. Detention ponds, biofiltration swales and other vegetated stormwater facilities not listed in paragraphs A or B, above, shall be planted in accordance with recommended planting specifications in the SWMMWW.

2.15 Tracts and Easements

- A. Stormwater treatment and flow control facilities to be owned by the City shall be located in a City right-of-way or on a storm drainage tract dedicated to the City.
- B. Storm drainage conveyances (including watercourses), treatment facilities, flow control facilities, and those on-site stormwater management BMPs used to meet treatment and flow control requirements to be privately maintained shall be located on a drainage easement.

The drainage easement shall grant the City and its representatives the right of entry for the purposes of inspecting and of maintaining, repairing, or restoring storm drainage facilities or BMPs that have not been properly operated and maintained by the property owner. The right shall include the right to charge the property owner for the cost of maintenance, repair, and restoration of BMPs. The right shall include the right to enter a property when the City has a reasonable basis to believe that a violation of this Chapter is occurring or has occurred and to enter when necessary for abatement of a public nuisance or correction of a violation of this Chapter.

- C. Stormwater tracts and drainage easements shall be placed on all plats and property deeds and recorded with the Cowlitz County Auditor, after approval by the City.
- D. A drainage easement shall not be used for any purpose which would interfere with the unrestricted use of the storm drainage facilities or BMP's. No structures that prevent access are permitted within tracts or easements. Fences crossing tracts shall provide gates of sufficient width to provide access for maintenance, but not less than 10 feet wide.
- E. Minimum widths for public easements and/or tracts shall be as follows:
 - 1. Storm lines of all diameters less than ten feet deep: twenty (20) feet, except additional width may be required for pipes larger than thirty-six (36) inches diameter.
 - 2. For pipes ten feet deep and greater, the width of easements shall be equal to or greater than the numerical value of twice the depth of the pipe invert measured from finish grade plus the outside bell diameter of the pipe, but not less than 20 feet.
 - 3. Easement widths for channels with sufficient width to contain the 100-year floodplain line, shall be fifteen feet from the waterway centerline, or ten feet from the top of the recognized bank, whichever is greater. A fifteen-foot-wide access easement shall be provided on both sides of the channel for channel widths greater than fourteen feet at the top of the recognized channel.

4. Where right-of-way (or an easement) is required for access, it shall be a minimum of 15 feet wide and the tract (or easement) shall extend to an acceptable public access location.

2.16 Stormwater Performance Bond

At the discretion of the Director, the Applicant seeking to build a stormwater facility may be required to furnish a stormwater facility performance bond, or equivalent guarantee in lieu of a bond in a form acceptable to the City, in an amount sufficient to cover all costs associated with the construction of the facility. This bond is to secure the installation and performance of the stormwater facilities identified in the approved Stormwater Site Plan. Performance shall include, when applicable, plant establishment, infiltration rate and/or facility drawdown time within parameters established in the design, and all workmanship and materials. The Applicant shall be responsible for any costs incurred by the City to secure performance of the stormwater facilities that are in excess of the amount of the bond.

- A. **Term of Performance Bond.** The stormwater performance bond furnished pursuant to this section, or the unexpended or unobligated portion thereof, shall be released to the Applicant within sixty (60) days of issuance of the final acceptance of the permanent stormwater facilities by the City. A final inspection by the City is required before any performance bond will be released.
- B. **Partial Release of Bond.** The Director shall have the sole discretion to adopt provisions for a partial pro-rata release of the performance bond on the completion of various stages or phases of development.
- C. **Bond Estimation.** The Applicant shall be responsible for determining bond value and submitting the estimation to the Director for approval. If the Director disagrees with the applicant's estimate, the Director shall determine a reasonable estimate. The bond value for public and private facilities shall be 125 percent of the estimated cost for the City to construct the stormwater features and achieve final stabilization.

2.17 Stormwater Maintenance Bond

- A. **Stormwater Maintenance Bond.** The Applicant seeking final acceptance of a stormwater treatment and/or flow control facility for public ownership shall be required to furnish a maintenance bond, or equivalent financial guarantee in a form acceptable to the City, in an amount sufficient to cover costs associated with maintenance or repair in the event the stormwater facility does not meet the maintenance standards of the manufacturer, the SWMMWW, the KEDM, and/or the approved operation and maintenance plan. A finding of deficiency in facility condition shall be based on inspection. For vegetated facilities, a finding of deficiency shall be made if plant survival after two years is less than 90% of the approved design. This bond is to secure the maintenance and repair of the stormwater facilities identified in the approved stormwater site plan. The Applicant shall be responsible

for any costs incurred by the City to bring the facility up to maintenance into compliance with approved standards in the event such costs that are in excess of the amount of the bond.

- B. **Term of Maintenance Bond.** The stormwater maintenance bond furnished pursuant to this section, or the unexpended or unobligated portion thereof, shall be released to the Applicant within ninety days of the City inspection conducted on or after two years after the City's final acceptance of the permanent stormwater facilities.
- C. **Bond Estimation.** The Applicant shall be responsible for submitting the estimation of bond value to the Director for approval. If the Director disagrees with the applicant's estimate, the Director shall determine a reasonable estimate. The bond value for public facilities shall be ten percent of the cost to construct the facility.

2.18 As-Built Plans

As-Built Plans. Applicants shall submit as-built plans for all permanent stormwater treatment and/or flow control facilities, including any on-site stormwater management BMPs that are used to meet treatment or flow control requirements, after final construction is completed. The plans must show the final design specifications for all stormwater management facilities, meet the criteria for as-built plans in KEDM Chapter 1, and be sealed by a registered professional engineer.

2.19 Dedication of Facilities

The City will accept a dedication of a stormwater facility, together with necessary easements and appurtenances, upon a determination and acceptance, as provided herein, except that dedications made during the subdivision platting process shall not be subject to the following process:

- A. **Preliminary Determination by Community Development.** Upon receipt by the City of an offer of dedication of a stormwater facility, the Director shall make a preliminary determination that the dedication of the facility is appropriate to protect the public health, safety and general welfare, and furthers the goals of the City's stormwater management program and/or associated watershed plans. Budgetary implications will be a component of the determination. Prior to making a determination, the Director will inspect the facility to determine whether it has been properly maintained and is in good repair, and may condition the recommendation of acceptance on completion of any necessary maintenance items. The Director will forward his/her determination to the City Council.
- B. **Acceptance by City Council.** City Council may reject or accept the offer of dedication by adoption of a resolution. Upon acceptance, the Owner shall record the document dedicating the stormwater facility with the Cowlitz County Auditor by and at the owner's sole expense.

- C. Owner to Provide Documentation. The Owner, at his or her sole expense, shall provide any document or information requested by the Director and/or the City Council in order for a decision to be reached on whether or not to accept the facility.

2.20 Long-Term Operation and Maintenance

- A. Operation and Maintenance Required. All erosion controls and stormwater facilities (including, but not limited to, structural and operational BMPs, on-site stormwater management BMPs, treatment and flow control facilities, catch basins and other protective devices, necessary access routes, and appurtenances) shall be operated and maintained in accordance with the manufacturer's specifications, the SWMMWW, the KEDM, the approved Stormwater Site Plan, and the stormwater maintenance agreement and plan, as discussed below.
- B. Responsible Party. The Owner shall be responsible for the proper operation and maintenance of the parcel's stormwater facilities and shall pass such responsibility to any successor owner, unless such responsibility is transferred to the City or to another governmental entity as per KEDM Sections 2.16 or 2.20.
- C. Stormwater Improvement Restrictive Covenant. The Applicant shall prepare a Stormwater Improvement Restrictive Covenant that runs with the land for the site (e.g. plat) and for each lot within a subdivision that contains stormwater facilities. Prior to final acceptance of the project, the applicant shall record the covenant(s) with the Cowlitz County Auditor. The Covenant and Long-Term Site Management Plan shall comply with the requirements of the Cowlitz County Auditor's for recording documents. A sample of a Stormwater Improvement Restrictive Covenant is included in Appendix 2-C.
 - 1. Each Stormwater Improvement Restrictive Covenant for the site shall, at a minimum, include the following:
 - a. Designate the responsible party permanently responsible for maintenance.
 - b. Pass the responsibility for such maintenance to successors in title.
 - c. Establish a Stormwater Operation and Maintenance Plan to ensure the continued effectiveness of the stormwater facilities. The specifications of the Operation and Maintenance Plan vary depending on the types of facilities used on the site, as described in KEDM Section 2.21.D.
 - d. Restrict the removal and alteration of stormwater and drainage facilities without approval from the City of Kelso.
 - e. Grant the City and its representatives the right of entry for the purposes of inspecting all stormwater BMPs and of maintaining, repairing, or restoring BMPs that have not been properly operated and maintained by the property owner. The right shall include the right to charge the property owner for the cost of maintenance, repair, and restoration of BMPs.

- f. Require submittal to the City of the preceding year’s inspection and maintenance records by January 31st.
2. Each Stormwater Improvement Restrictive Covenant for individual lots, if required, shall include the following:
 - a. Designate the responsible party permanently responsible for maintenance.
 - b. Pass the responsibility for such maintenance to successors in title.
 - c. Describe and illustrative the operation and maintenance of the on-site stormwater management BMPs as described in KEDM Section 2.21.D.
 - d. Restrict the removal and alteration of on-site stormwater and drainage facilities without approval from the City of Kelso.
- D. Stormwater Operation and Maintenance Plan
 1. Site Stormwater System Manual. The Applicant shall prepare a Site Stormwater System Manual for treatment facilities (MR 6) and flow control facilities (MR 7), including any on-site stormwater management facilities (MR 5) used to help meet MR 6 or MR 7 requirements.

The manual shall be submitted on 8 1/2” x 11” paper.

The Site Stormwater System Manual shall be customized to the particular facilities used on the site and shall contain at the minimum:

- a. An illustrative drawing of all stormwater management facilities, on-site stormwater management BMPs, and conveyances on the site.
- b. A narrative description of each facility, what it does, and how it works using language suitable for a non-technical audience such as an owner or maintenance staff.
- c. An illustration of each facility.
- d. Maintenance tasks and frequencies meeting standards of the SWMMWW.
Pages drawn from the Clark County Stormwater Manual 2015, Book 4, or the City of Olympia 2016 Drainage Design and Erosion Control Manual Appendix IV-J may be used to meet the requirements of items b through d.
- e. Sample inspection form/checklist for each facility.
- f. Sample maintenance activity log.
- g. A prominent notification that the site owner must make the Site Stormwater System Manual and inspection records available for inspection by the City.
- h. A prominent notification that the site owner is required to record inspection and maintenance activities and to submit to the City by January 31 documentation of inspections performed during the previous year.

2. Individual Lot Operation and Maintenance Instructions. The Applicant shall prepare simplified operation and maintenance instructions for each on-site stormwater management BMP (MR 5) on an individual lot or commercial site.

The Individual Lot Operation and Maintenance Instructions shall be customized to the particular facilities used on the lot or site and shall contain at the minimum:

- a. An illustrative drawing of all on-site stormwater management BMPs and conveyances on the site.
- b. A narrative description and maintenance instructions for each BMP on the lot using language suitable for a non-technical audience. The City offers simplified maintenance instruction handouts, which may be used to meet this requirement.
- c. An illustration or design detail of each facility.
- d. If full dispersion is proposed, or if newly planted trees or retained trees were claimed as flow reduction credits, then include a map of trees and vegetation areas to be retained.

E. Maintenance Escrow Requirement

1. At the discretion of the Director, the Applicant will be required to post a cash escrow, letter of credit, or other acceptable form of performance security in an amount that would cover costs associated with maintenance and repair in the event of stormwater facility failure, at least 10% of the project engineer's estimate to construct the facility, in the event the Director determines that such security is necessary to ensure the facility satisfies the maintenance and performance requirements identified in these Standards and the approved Operation and Maintenance Plan. This instrument is required to be posted prior to completion of construction and release of the Stormwater Performance Bond and remain in place for a minimum of two (2) years.
2. At the discretion of the Director, the stormwater performance bond may be extended in lieu of the maintenance escrow account.

- F. Maintenance Records. The responsible party shall keep records of the BMPs' installation and all subsequent maintenance and repairs, and shall retain the records for at least five (5) years. These records shall be made available to the City within 1 week of inspection or upon request by the City.

2.21 Enforcement

Enforcement shall be consistent with KMC 1.50.

- A. Protection of Watercourses and Facilities. It shall be a criminal violation to break, block, damage, destroy, uncover, deface or tamper with any watercourse, stormwater facility, or erosion control system.
- B. Public Nuisance Declared. In addition to other remedies, failure to install and/or maintain watercourses, stormwater facilities, or erosion controls as required in KEDM and applicable permits is declared to be a public nuisance, subject to abatement as provided by KMC 1.50.
- C. Suspension of Work or Access
 - 1. Access to the municipal stormwater drainage system may be suspended if such termination is needed to abate or reduce an illicit discharge.
 - 2. Work shall be suspended for un-permitted clearing and grading, or for projects that fail to provide required runoff controls for land-disturbing activities. After the stop-work period, the Director may allow work on-site to resume, provided that such work is necessary to ensure compliance with this Manual, permits, or an approved stormwater drainage plan or SWPPP.
 - 3. Resumption of work or reinstatement of connection to the municipal stormwater drainage system, without the prior approval of the City, shall be subject to the civil and/or criminal penalties delineated in KMC 1.50.
- D. Financial Liability. The property owner, Applicant, and all persons engaged in development or land-disturbing activity shall be liable, jointly and severally, for all costs incurred by the City in any public nuisance action taken hereunder, or on account of damage or threatened damage to City property or facilities or water bodies, or associated with remedial actions necessitated by the damage or failure to install and/or maintain required stormwater facilities. The City may assess the responsible parties for these costs which shall be a lien on the property, or prorated against the beneficial users of the property, and may be placed on the tax bill and collected as ordinary taxes by the City.

Appendix 1: Standard Plans

Standard Plan Index

Title	Standard Plan No.
Standard Storm Drainage, Grading and Erosion Control Plans	
Storm Drain General Notes	SD-000
Curb Inlet	SD-010
Ditch Inlet	SD-020
Area Drainage Basin or Field Inlet	SD-030
Bioretention Planter	SD-040 LID
Bioretention Curb Extension Plan	SD-050 LID
Bioretention Curb Extension Planting Plan	SD-060 LID
Planter Wall	SD-070 LID
Beehive Outlet Structure	SD-080 LID
Trench Drain to Bioretention Facility	SD-090 LID
Inlet/Outlet for Curb Extensions	SD-100 LID
Side Curb Cut	SD-110 LID
Catch Basin Type 1	WSDOT B-05.20-02
Supplemental to WSDOT B-05.20-02	
Catch Basin Type 1L	WSDOT B-05.40-02
Supplemental to WSDOT B-05.40-02	
Catch Basin Type 2	WSDOT B-10.20-02
Supplemental to WSDOT B-10.20-02	
Manhole Type 1	WSDOT B-15.20-01
Supplemental to WSDOT B-15.20-01	
Combination Inlet	WSDOT B-25.20-02
Supplement to WSDOT B-25.20-02	

Title	Standard Plan No.
Rectangular Frame (Reversible)	WSDOT B-30.10-03
Rectangular Vaned Grate	WSDOT B-30.30-03
Rectangular Herringbone Grate	WSDOT B-30.50-03
Circular Frame (Ring) and Cover	WSDOT B-30.70-04
Supplemental to WSDOT B-30.70-04	
Miscellaneous Details for Drainage Structures	WSDOT B-30.90-02
Supplemental to WSDOT B-30.90-02	
Grate Inlet Type 2	WSDOT B-35.40-00
Supplement to WSDOT B-35.40-00	
Welded Grates for Grate Inlet	WSDOT B-40.20-00
Pipe Zone Bedding and Backfill	WSDOT B-55.20-02
Supplemental to WSDOT B-55.20-02	
Connection Details for Dissimilar Culvert Pipe	WSDOT B-60.20-01
Beveled End Sections, Culverts 30" Diameter or Less	WSDOT B-70.20-00
Supplemental to WSDOT B-70.20-00	
Headwalls for Culvert Pipe and Underpass	WSDOT B-75.20-02
Type 2 Safety Bars for Culvert Pipe or Pipe Arch (On Cross Road)	WSDOT B-75.60-00
Supplemental to WSDOT B-75.60-00	
Silt Fence	WSDOT I-30.15-02
Wattle Installation on Slope	WSDOT I-30.30-02

Title	Standard Plan No.
Compost Sock	WSDOT I-30.40-02
Storm Drain Inlet Protection	WSDOT I-40.20-00
Check Dams	WSDOT I-50.20-01
Biodegradable Erosion Control Blanket Placement for Slopes	I-60.10-01
Biodegradable Erosion Control Blanket Placement for Ditches	I-60.20-01
Miscellaneous Erosion Control Details	I-80.10-02