July 2016 Errata Overview

This document provides a redline version of the changes made to the July 7, 2016 City of Tacoma Stormwater Management Manual. Page Numbers used in this document reference the January 7, 2016 Edition.

Preface

Page P-15

Glossary…………………………………………………………………………1G1

Page P-16

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Page P-23

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Volume 1

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Page 1-5

http://www.ecy.wa.gov/~~apps/watershed/wirapages~~water/wria

Page 1-37: Volume 1, Section 3.4.5.3

- BMP L605: Collect and convey to the City system (Vol 3, Sec 2.6), only if infiltration, dispersion, ~~and~~ or perforated stubout connections are not feasible.

Page 1-38: Volume 1, Section 3.4.5.3

- BMP L605: Collect and convey to the City system (Vol 3, Sec 2.6), only if concentrated flow dispersion ~~and~~ or sheet flow dispersion are not feasible.

Page 1-43: Volume 1, Section 3.4.7.3.1

- Projects that increase the surface area and/or increase the surface area converted from pervious to impervious contributing to the downstream system by less than 5,000 square feet, or
- Projects that increase the surface area and/or increase the surface area converted from pervious to impervious contributing to the downstream system by less than 10,000 square

feet and discharge to a pipe system that has a pipe that is 12" in diameter or greater within ¼ mile from the discharge location.

<u>Page 1-43: Volume 1, Section 3.4.7.3.2</u>

The applicant ~~is not required to match flow durations but can match flowrates for all flow frequencies analyzed by WWHM~~ can match flow durations or match all flow frequencies analyzed by WWHM.

<u>Page 1-45: Volume 1, Section 3.4.7.6</u>

Flow control facilities shall be sized for the entire flow that is directed to them~~,~~; however, bypass may be allowed as described ~~below~~ in Volume 3, Section 1.5.

~~Offsite inflow may be bypassed around the flow control facility provided the existing 100-year return period flowrate from any upstream offsite areas is no greater than 50% of the 100-year developed return period flowrate (undetained) from the project site. The bypass of offsite inflow shall be designed to achieve the following:~~

- ~~Any existing contribution of flows to onsite wetlands must be maintained.~~
- ~~Offsite inflows that are naturally attenuated by the project site under predeveloped or existing conditions must remain attenuated, either by natural means or by providing additional onsite detention so that flows do not increase.~~
- ~~Bypassed stormwater shall not cause damage to downstream systems or properties and shall meet the requirements of Volume 1, Section 3.4.4.2.~~

~~Stormwater runoff created by surfaces that require detention may bypass the flow control facility provided all the following conditions are met:~~

- ~~Runoff from both the bypass areas and the flow control facility shall converge within ¼ mile downstream of the project site discharge point.~~
- ~~The flow control facility shall be designed to compensate for the uncontrolled bypass area such that the net downstream discharge is the same with or without bypass.~~
- ~~The 100-year return period flowrate from the bypass area will not exceed 0.4 cfs.~~
- ~~Runoff from the bypass area will not create a significant adverse impact to the downstream systems or drainage and shall meet the requirements of Volume 1, Section 3.4.4.2.~~

~~Water quality is applied to the bypass areas as applicable.~~

<u>Page 1-47: Volume 1, Section 3.4.10.1</u>

All project applicants required to submit a Stormwater Site Plan shall perform and submit a qualitative analysis of each upstream system entering a site (run-on) and each downstream system leaving a site (run-off) unless stormwater runoff is fully infiltrated or fully dispersed such that no stormwater runoff is discharged from the project site.

<u>Page 1-47: Volume 1, Section 3.4.10.2</u>

Environmental Services may require different or additional analyses than those represented in Table 1-1 based upon project impacts such as conversions from pervious surfaces to hard surfaces, underdrained facilities, and/or lined facilities.

Page 1-48: Table 1-1

Increase in Surface Area and/or Increase in Surface Area Converted from Pervious to Impervious Contributing to Downstream System	Pipe Size within ¼ mile downstream of the project	Required Analysis
<5,000 SF	Any Size	None
≥5,000 SF and <10,000 SF	≥12” ϕ	None
≥5,000 SF and <10,000 SF	<12” ϕ	Single Segment Capacity Analysis (Vol. 3, Sec. 9.3.2) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5) (as applicable), OR City-Wide Capacity Model* (Vol. 1, Sec. 3.4.10.3) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5) (as applicable)
≥10,000 SF	≥12” ϕ	Single Segment Capacity Analysis (Vol. 3, Sec. 9.3.2) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5) (as applicable), OR City-Wide Capacity Model* (Vol. 1, Sec. 3.4.10.3) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5) (as applicable)
≥10,000 SF	<12” ϕ	Full Backwater Analysis (Vol. 3, Sec. 9.3.3) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5), OR City-Wide Capacity Model* (Vol. 1, Sec. 3.4.10.3) and Inlet and Gutter Capacity Analyses (Vol. 3, Sec. 9.4 and 9.5)
Any Size	Connecting to a City-owned and identified trunk main	None

*For City-owned Pipes Only

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Page 1-53: Volume 1, Section 4.1 Stormwater Site Plan Checklist

The City recommends the design engineer follow the order and structure of the checklist to facilitate review, which in turn will expedite permit issuance. Because every project is different, this checklist might not contain all items applicable to every project. Additional items may be requested by Environmental Services.

Page 1-57: Volume 1, Chapter 4, Table 1-2 (Full Table with Footnotes has not been included in errata for simplicity)

Description	Onsite	Offsite	Total
Existing Conditions			
Total Project Area			
Existing hard surface			
Existing vegetation area			
~~Existing~~ Proposed Conditions			
Total Project Area			
Amount of new hard surface			

Page 1-59: Volume 1, Chapter 4, Onsite Stormwater Management

☐Include calculations for all onsite stormwater management BMPs as applicable. If using presized tables, describe how the final facility size was determined.

☐Vegetated Flowpath

☐Location and type of soil amendment used to meet BMP L613

Page 1-62: Volume 1, Chapter 4, Required Drawings

☐~~Building Permit Number (an 11 digit number staring with 40000___) or Work Order Permit Number (an 11 digit number starting with 60000_____).~~ City of Tacoma Permit number associated with the proposed work (typically the Right of Way or Site Development Permit Number).

☐Permit number for other City of Tacoma Permits associated with the project (~~Work Order, Grade and Fill, Building, Demolition, Final Plat, etc.~~ Land Use, Commercial Building, Residential Building, etc.)

Page 1-63: Volume 1, Chapter 4, Required Drawings

☐Existing stormwater facilities including water quality facilities, flow control facilities, and onsite stormwater management facilities.

Page 1-64: Volume 1, Chapter 4, Required Drawings

Location of and details associated with all stormwater mitigation facilities including onsite stormwater management BMPs. For dispersion systems, clearly label the vegetated flowpath. For BMP L613, clearly hatch or otherwise label the location and type of amendment. If the predesigned systems from the SWMM are used, the details from the SWMM shall be included.

Page 1-66: Volume 1, Section 4.2.2

See the ~~work order~~ Right-of-Way Permitting general notes for record drawing requirements for ~~work order~~ right-of-way projects.

Page 1-68: Volume 1, Chapter 4, Table 1-3 (Full Table with Footnotes has not been included in errata for simplicity)

Description	Onsite	Offsite	Total
Existing Conditions			
Total Project Area			
Existing hard surface			
Existing vegetation area			
~~Existing~~ Proposed Conditions			
Total Project Area			
Amount of new hard surface			

Page 1-69: Volume 1, Appendix A, Chapter 1

~~Work Order/Building~~ City of Tacoma Site Development or Right of Way Permit Number(s): ________________

Associated City of Tacoma Permit Number(s) (e.g. land use permits, ~~work order~~ residential building permits): ____________________________

Page 1-70: Volume 1, Appendix A, Table 1-4 (Full Table with Footnotes has not been included in errata for simplicity)

Description	Onsite	Offsite	Total
Existing Conditions			
Total Project Area			
Existing hard surface			
Existing vegetation area			
~~Existing~~ Proposed Conditions			
Total Project Area			
Amount of new hard surface			

Page 1-75: Volume 1, Appendix A, MR #3

For commercial or industrial facilities, complete the~~,~~ "Worksheet for Commercial and Industrial Activities" contained in Volume ~~3~~4, Chapter 2 of the 2016 City of Tacoma Stormwater Management Manual.

Page 1-75: Volume 1, Appendix A, MR# 5

Include how the facility size was determined including any calculations. Show the amount of surface area mitigated for each surface type and each facility. Include sizing calculations as attachment to this SSP. See Volume 3, Appendix B to determine if a soils report is required for the facility type chosen. Include soils report as an attachment to this SSP.

Page 1-76

Remove duplicate checkbox for concentrated flow dispersion.

Page 1-77

- All proposed improvements (show locations and details on the plan set)
  - For compliance with BMP L613: Post-Construction Soil Quality and Depth, hatch or otherwise clearly mark the location of soils amendments and the type of amendment.
  - Provide a proposed landscape plan, as applicable which may include a planting plan for any proposed rain gardens (see Volume 6, Section 2.2.2.1.2.9).

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Page 1-82

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Page 1-196

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Page 1-197: Appendix D

Portions of the Tacoma Municipal Code 13.11 may supersede requirements of this section.

This appendix consists of ~~six~~ three sections:

Page 1-200 to 1-204: Volume 1, Appendix D, Guide Sheet 3B & Guide Sheet 3C

Guide Sheet 3B: Protecting wetlands from impacts of changes in water flows

Protecting wetland plant and animal communities depends on maintaining the existing wetland's hydroperiod. ~~This means maintaining the annual fluctuation in water depth and its timing as closely as possible.~~ The risk of impacts to functions and values increases as the changes in water regime deviate more from the existing conditions. These changes often result from development.

~~Hydrologic modeling is useful to measure or estimate the aspects of the hydroperiod under existing pre-project and anticipated post-project conditions. Post-project estimates of the water regime in a watershed and wetland hydroperiod must include the cumulative effect of all anticipated watershed and wetland modifications. Perform this assessment with the aid of a qualified hydrologist.~~

~~*Provisions in these guidelines pertain to the full anticipated build out of the wetland's watershed as well as changes resulting from an individual development. See Volume 3, Table 3-1 for full build out conditions.*~~

~~Unfortunately, attempts to modify and use the standard hydrologic models for describing the flow and fluctuations of water in a stormwater pond have failed to adequately model the hydrodynamics in wetlands. It is difficult to estimate if stormwater discharges to a wetland will meet the criteria for protection developed by the Puget Sound Wetland and Stormwater Research Program. The criteria developed by that program apply only to depressional wetlands. They are not applicable to riverine,~~

~~slope, or lake-fringe wetlands. Ecology does not have any hydrologic model available to characterize the hydrodynamics in these types of wetlands.~~

~~As a result, it is difficult to predict the direct impacts of changes in water flows resulting from a development. In the absence of hydrologic models that characterize all types of wetlands, criteria have to be set using information that is readily available. These criteria are based on risk to the resource rather than an actual understanding of impacts.~~

~~The following criteria will provide some protection for the valuable wetland types listed in Guide Sheet 1, but it cannot be determined if the result will completely protect a wetland's functions and values. The risk to wetland functions will increase as the water volumes into the wetland diverge from this modeling to the criterion below.~~

~~Use the Western Washington Hydrology Model (WWHM) for estimating the increases or decreases in total flows (volume) into a wetland that can result from the development project. These total flows can be modeled for individual days or on a monthly basis. Compare the results from this modeling to the criterion below.~~

Hydrologic modeling shall be used to estimate the hydrologic impacts on the wetland caused by the proposed new or redevelopment project. The applicant shall compare the existing pre-project hydroperiod to the post-project site. The proposed project site is typically only a portion of the entire wetland contributing area. The Western Washington Hydrology Model (WWHM) may be used to estimate the increase or decrease in total flows (volume) that might result from the project.

The WWHM wetland module was developed for depressional wetlands; not riverine, slope, or lake-fringe wetlands. However, applicants may use WWHM to model any type of wetland in order to meet the intent of Minimum Requirement #8. Where an applicant chooses not to use WWHM, a hydrologic report shall be prepared by a wetland specialist. The hydrologic report shall:

- describe the effects the proposed development will have on the wetland hydrology,
- include a discussion of the appropriate methods for modeling changes in wetland hydroperiod,
- include the modeling results showing that Criterion 1 and Criterion 2 have been met, and
- describe the proposed mitigation techniques.

Criterion 1: Post-project total volume of water into a wetland during a single precipitation event should not be more than 20% higher or lower than the pre-project volumes during that same precipitation event.

WWHM 2012 calculates the average daily volumes for pre-project and post-project scenarios and provides the 20% comparison. ~~If using an alternative continuous simulation model, additional calculations may be required by the applicant to prove Criterion 1 is met.~~

~~Modeling algorithm for Criterion 1~~

- ~~Daily volumes can be calculated for each day over 50 years for Pre- and Post-project scenarios. Volumes are to be calculated at the inflow to the wetland or the upslope edge where surfaces runoff, interflow, and groundwater are assumed to enter.~~
- ~~Calculate the average of Daily Volume for each day for Pre- and Post-project scenarios. There will be 365 values for the Pre-project scenario and 365 for the Post-project.~~

~~Example calc for each day in a year (e.g., April 1):~~

- ~~If you use 50 years of precipitation data, there will be 50 values for April 1. Calculate the average of the 50, April 1, Daily Volumes for Pre and Post-project scenarios.~~
- ~~Compare the average Daily Volumes for Pre- versus Post-project scenarios for each day. The average Post-project Daily Volume for April 1 must be within +/- 20% of the Pre-project Daily Volume for April 1.~~

o ~~Check compliance with the 20% criterion for each day of the year.~~ Criterion 1 is met/passed if ~~none~~ each of the 365 post-project (Mitigated) daily volumes ~~varies by more than~~ is within 20% ~~from~~ (more or less) of the pre-project (Predeveloped) daily volume for that day.

Criterion 2: Post-project t~~T~~otal volume of water into a wetland on a monthly basis should not be more than 15% higher or lower than the pre-project monthly volumes.

WWHM 2012 calculates the average monthly volumes for pre-project and post-project scenarios and provides the 15% comparison. ~~If using an alternative continuous simulation model, additional calculations may be required by the applicant to prove Criterion 2 is met.~~

~~This needs to be calculated based on the average precipitation for each month of the year. This criterion is especially important for the summer months when a development may reduce the monthly flows rather than increase them because of reduced infiltration and recharging of ground water.~~

~~Modeling algorithm for Criterion 2~~

- ~~Monthly Volumes can be calculated for each calendar month over 50 years for Pre- and Post-project scenarios. Volumes are to be calculated at the inflow to the wetland or the upslope edge where surface runoff, interflow, and ground water are assumed to enter.~~
- ~~Calculate the average of Monthly Volume for each calendar month for Pre- and Post-project scenarios.~~

~~Example calc for each calendar month in a year (e.g. April):~~

  - ~~If you use 50 years of precipitation data, there will be 50 values for the moth of April Calculate the average of the 50, April, Monthly Volumes for Pre- and Post-project scenarios.~~
  - ~~Compare the Monthly Volumes for Pre- versus Post-project scenarios. Post-project Monthly Volume for April must be within +/- 15% of the Pre-project Monthly Volume for April.~~

- ~~Check compliance with the 15% criterion for each calendar month of year.~~ Criterion 2 is met/passed if ~~none~~ each of the post-project (Mitigated) ~~M~~monthly ~~V~~volumes ~~varies by more than~~ is within 15% (more or less) of ~~from~~ the pre-project (Predeveloped) ~~M~~monthly ~~V~~volumes for every month.

WWHM Modeling Assumptions and Approach

Assumption – Flow components feeding the wetland under both Pre- and Post-project scenarios are assumed to be the sum of the surface, interflow, and groundwater flows from the project site.

Approach ~~– Assign the wetland a point of compliance #1 (POC) number such as POC1 downstream of the project area.~~

~~A. Pre-project scenario – Connect all flow components to the wetland/POC1~~

- Pre-project Total Flows to POC1 = Surface + Interflow + Groundwater

B. Post-project scenario – Identify flows to the wetland/POC1

- Impervious surfaces send flows to wetland via (1) – surface flow.
  - WWHM sub-flows to POC1 = Surface flow (+ Interflow default set in WWHM)

- Pervious surfaces send flows to wetland via (1) surface, (2) interflow, and (3) ground
  - WWHM sub-flow to POC1 = Surface + Interflow + Groundwater

C. Infiltrating facilities send flows to wetland via ground water, and surface overflows.

- Groundwater – Connect infiltrated water (Outlet 2) to groundwater component of the area between facility and wetland. Use Lateral Basin downstream of the infiltrating facility and connect Outlet 2 to the ground water component of the Lateral Basin. If this area is the same area modeled in Step (b) above, use the Lateral Basin element in Step (b).
  - WWHM sub-flows to POC1 = infiltrated flows

- Surface Overflow – Connect the surface flow (Outlet 1) to wetland/POC1
  - WWHM sub-flows to POC1 = facility surface flows (Outlet 1)
  - Post-project Total Flows to POC1 = Sum of flows in (A), (B), and (C).

In WWHM, assign the wetland as the point of compliance (POC). Connect the point of compliance (POC) to surface flow, interflow, and groundwater.

For projects that propose installation of a facility designed to infiltrate before the wetland:

- Connect the infiltrated water to the groundwater component. To do this, connect the Land Use Basin to the element that will be used to represent the infiltration BMP then connect that element to the Lateral Basin Element connecting Outlet 2 (the infiltrated water) to groundwater and Outlet 1 to surface flow. Connect the Lateral Basin Element to the POC – connecting the POC to surface flow, interflow, and groundwater.

If it is expected that increased stormwater runoff could hydrologically affect the wetland the limits stated above could be exceeded, consider the following strategies to reduce the volume of surface flows:

- Reducing of the level of development by reducing the amount of impervious surface and/or increasing the retention of natural forest or vegetation cover.
- Increasing infiltration through the use of LID BMPs and LID principles.
- Increasing storage capacity for surface runoff.
- Using selective runoff bypass around the wetland. Bypassed flow must still comply with other applicable stormwater requirements.

Monitoring – Modifications that alter the structure of a wetland or its soils will require permits. Conduct monitoring as required by local, state, or federal permits. Monitoring may be required as described in City, state, or federal permits. Additional monitoring beyond that described in permits may be imposed by Environmental Services on a case by case basis.

Guide Sheet 3C: Guidelines for protecting wetlands from pollutants

Protecting a wetland from pollutants generated by a development should include the following measures:

- Use effective erosion control at construction sites in the wetland's drainage catchment. Refer to Volume 2 of this manual ~~II this manual and local jurisdiction requirements~~.
- Institute a program of source control BMPs and minimize the pollutants that will enter storm runoff that drains to the wetland.
- For wetlands ~~the~~ that meet the criteria in Guide Sheet 1, provide a water quality control facility consisting of one or more treatment BMPs to treat runoff entering the wetland.
    - If the wetland is a Category I wetland because of special conditions (forested, bog, estuarine, Natural Heritage, coastal lagoon), the facility should include a BMP with the most advanced ability to ~~control~~ remove nutrients.

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Volume 2

Page 2-13: Volume 2, Element #13

Protect lawn and landscaped areas from compaction due to construction equipment and material stockpiles.

Page 2-104: Volume 2, Section 3.2.10.3

See Volume 3; ~~Section 3.5~~ Chapter 11 for permanent outlet protection.

Page 2-154

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Page 2-159: Volume 2, Appendix B, Table 2-16 (Full Table with Footnotes has not been included in errata for simplicity)

Description	Onsite	Offsite	Total
Existing Conditions			
Total Project Area			
Existing hard surface			
Existing vegetation area			
~~Existing~~ Proposed Conditions			
Total Project Area			
Amount of new hard surface			

Page 2-184

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Volume 3

Volume 3, Page viii

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Page 3-2

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Page 3-5: Volume 3, Section 1.5 ~~Bypass and Offsite Inflow – Considerations for Flow Control Facilities~~ Additional Sizing Considerations

Flow control facilities shall be sized for the entire flow that is directed to them; however, bypass may be allowed as described in Section 1.5.1 below.

Facilities must be sized to include increased volumes and/or flowrates created by fields and/or vegetated areas (natural or artificial) with underdrains. In WWHM, model these areas using the permeable pavement element. A default porosity of 0.3 may be used or an applicant can provide supporting material to justify WWHM inputs. Infiltration can only be included if a soils report is provided to justify the infiltration rate used.

1.5.1 Bypass

Stormwater runoff created by surfaces that require detention may bypass the flow control facility (unless using Equivalent Areas per Volume 1, Section 3.3.3) provided all the following conditions are met:

~~Bypass occurs when a portion of the development does not drain to a stormwater facility. Runoff may bypass the facility provided all the following conditions are met (unless using Equivalent Areas per Volume 1, Section 3.3.3):~~

1. Runoff from both the bypass area and the flow control facility converges within ¼ mile downstream of the project site discharge point.
2. Any existing contributions or flows to an onsite wetland must be maintained (See Minimum Requirement #8 and Tacoma Municipal Code 13.11)
3. The flow control facility is designed to compensate for the uncontrolled bypass areas such that the net effect at the point of convergence downstream is the same with or without bypass.
4. The 100-year return period flowrate from the bypass area will not exceed 0.4 cfs.
5. Runoff from the bypass area will not create a significant adverse impact to downstream drainage systems or properties and shall meet the requirements of Volume 1, Section 3.4.4.2.
6. Water quality requirements applicable to the bypass area are met.

~~1.5.2 Offsite Inflow~~

Offsite inflow occurs when an upslope area outside the project area drains to the stormwater facility ~~in the development~~. If the existing 100-year peak return period flowrate from any upstream offsite area is greater than 50% of the 100-year developed return period flowrate (undetained) for the project site, then the runoff from the offsite area ~~must~~ shall not flow to the onsite flow control facility and must be bypassed around the facility. The bypass of offsite runoff must be designed to achieve ~~all of the following~~ the following in addition to the conditions above:

- ~~Any existing contributions or flows to an onsite wetland must be maintained.~~
- Offsite flows that are naturally attenuated by the project site under predeveloped conditions must remain attenuated, either by natural means or by providing additional onsite detention so that return period flowrates do not increase. The system shall be modeled in WWHM.

Page 3-8

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Page 3-9: Volume 3, Section 2.3.1

See Volume 3, Appendix ~~A~~B to determine if a soils report if required for your project. Volume 3, Appendix ~~A~~B also provides the minimum required components of a soils report.

Page 3-41, Volume 3, Section 4.1.5

Soil that already meets the depth and organic matter quality standards, and is not compacted, does not need to be amended. On the plan set clearly hatch or otherwise mark the locations where this BMP will be employed. On the plan set, include the method that will be used to meet this BMP.

Page 3-86, Figure 3-20

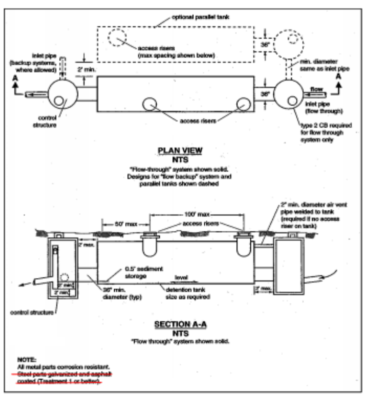


Figure 3 - 20. Typical Detention Tank

Page 3-87, Figure 3-21

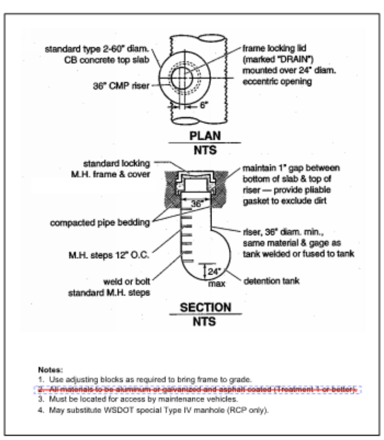


Figure 3 - 21. Detention Tank Access Detail

Page 3-88, Volume 3, Section 7.3.1.1 General

- ~~The minimum thickness for CMP shall be 12 gauge.~~ The minimum thickness for CMP shall be as follows:
    - 16 gage for pipe diameters up to 84”
    - 14 gage for pipe diameters 96”-120”
    - 12 gage for pipe diameters 126”-138”
    - 10 gage for pipe diameter 144”

Page 3-88, Volume 3, Section 7.3.1.2 Materials

Acceptable materials for stormwater facilities include thermoplastics, iron, steel, aluminum, ~~stainless steel~~, and concrete. Steel and iron shall be aluminum coated (aluminized Type 2). Zinc coated (galvanized) materials are prohibited. ~~Galvanized metals pipes may only be used it they employ asphalt coating.~~ Pipe material, joints, and protective treatment ~~for tanks~~ shall be in accordance with Section 9.05 of the *WSDOT/APWA Standard Specification* with the exception that zinc coated materials are prohibited.

Page 3-90, Figure 3-22

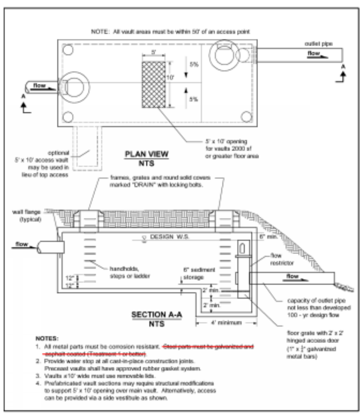


Figure 3 - 22. Typical Detention Vault

Page 3-91 Volume 3, Section 7.4.1.2 Materials

Minimum 3,000 psi structural reinforced concrete may be used for detention vaults. Acceptable materials for stormwater facilities include thermoplastics, iron, steel, aluminum, ~~stainless steel~~, and concrete. Steel and iron shall be aluminum coated (aluminized Type 2). Zinc coated (galvanized) materials are prohibited. ~~Galvanized metals pipes may only be used it they employ asphalt coating or other Environmental Services approved coating.~~

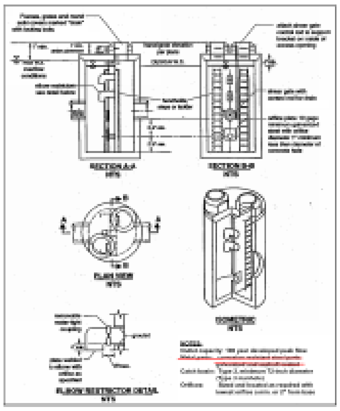
Page 3-93 – Volume 3, Section 7.5.1.4 Materials

Acceptable materials for stormwater facilities include thermoplastics, iron, steel, aluminum, ~~stainless steel~~, and concrete. Steel and iron shall be aluminum coated (aluminized Type 2). Zinc coated (galvanized) materials are prohibited. ~~Galvanized metals pipes may only be used it they employ asphalt coating.~~

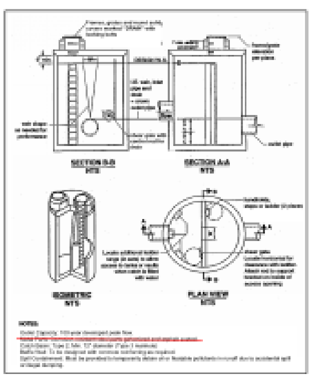
Page 3-94

The rectangular sharp-crested weir design shown in Figure 3-27 may be analyzed using standard weir equations for the fully contracted condition. The Francis formula is shown below and requires use of Imperial units.

Page 3-98, Figure 3-24



Page 3-99, Figure 3-25



Page 3-100, Figure 3-26

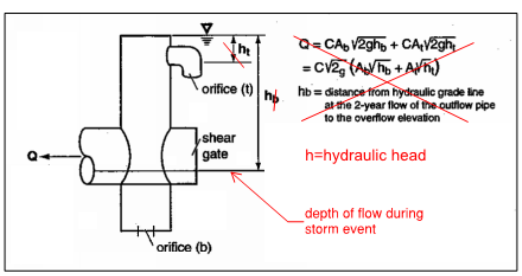


Figure 3 - 26. Simple Orifice

Page 3-104

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Page 3-106

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Page 3-108: Volume 3, Section 9.2.2.2

A quantitative downstream analysis is required for projects that meet the flow control thresholds as described in Minimum Requirement #7 Vol 1, Sec 3.4.7.3, except those required to provide detention per the ~~Standard~~ Freshwater Protection Requirement.

Page 3-109: Volume 3, Section 9.3.2

The discharge rate from the increase in ~~impervious~~ surface area or increase in surface area converted from pervious to impervious coverage from a 25-year, 24-hour storm event shall be less than 5% of the discharge capacity in the most constrained pipe segment or channel of the existing downstream system within ¼ mile from the site's discharge location at 90% full.

Page 3-132

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Page 3-133: Volume, 3, Section 10.1

Pipe systems are networks of storm drain pipes, catch basins, manholes, inlets, and outfalls, designed and constructed to convey stormwater. See individual best management practices for specifications for specific stormwater facilities.

Page 3-133 to 3-134, Table 3-18 (Full Table with Footnotes has not been included in errata for simplicity)

Pipe Material	Minimum SDR/Class	Reference	Specification Reference	Applicability
Solid Wall PVC 12" diameter or less	SDR 18	AWWA ~~C905~~C900	WSDOT 9-30.1(5)A	Shallow or Deep Cover, Non-Standard Separation from Water Main
Lined Ductile Iron	Special Thickness Class: 50 Minimum Pressure Class: 350 (If joined using bolted flanged joints – Special Thickness Class 53 required)	ANSI A21.51 or AWWA C151	WSDOT 9-0~~1~~5.13	Shallow or Deep Cover, Non-Standard Separation from Water Main, above ground installations in vertical applications or steep slopes
Solid Wall High Density Polyethylene (~~HPDE~~HDPE) Pipe, Heat Welded, Butt	SDR 17	ASTM D3350	~~WSDOT~~ City Special Provision 9-05.23	Pipe Bursting ~~or Steep Slope Installation~~; above ground

Fused				installation in vertical applications or steep slopes

Page 3-135, Volume 3, Section 10.1.1.2 Private Pipes Outside the Right-of-Way

- Smooth interior, watertight, corrugated high-density polyethylene pipe (CPEP). Smooth interior CPEP shall have watertight joints meeting ASTM D3212 with gaskets meeting the requirements of ASTM F477. 4-inch through 10-inch pipe shall meet AASHTO M252, Type S; and 12-inch through 60-inch pipe shall meet AASHTO M294, Type S or ASTM F2306. All CPEP fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306.

Page 3-140: Volume 3, Section 10.3.3

Channel cross-section geometry shall be trapezoidal, triangular, parabolic, or segmental ~~as shown in Figure 3-38 through Figure 3-40~~.

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Page 3-171: Volume 3, Appendix B, Section B.1

See Section B.~~8~~7 for soils reports requirements.

Page 3-171: Volume 3, Appendix B, Section B.2

If the setback and site constraint criteria per Volume 3, Section 2.3.3.2 or the design standards per BMP L602a – Infiltration Trenches (Volume 3, Section 2.3.3.4) or BMP L602b – Dry Wells (Volume 3, Section 2.3.3.5) can be met assuming the minimum trench length per Table 3-2 or the minimum dry well size per Table 3-3, a soils report is required to determine if an infiltration facility is infeasible~~,~~.

Page 3-173: Volume 3, Appendix B, Section B.6

A soils report per Section B.~~8~~7 below is required for all bioretention facilities.

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Page 4-11: Volume 4, ~~Section 3.1.2.1 At Home~~:

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Page 4-12: Volume 4, ~~Section 3.1.2.2 Away from Home~~

~~Go to fundraising car washes where sponsors use Tacoma's Clean Bay Car Wash loaner kits. Look for the Clean Bay Car Wash logo. Use a Clean Bay Car Wash loaner kit. If you group is planning a car wash in Tacoma, call 253-502-2220 or refer to the City of Tacoma website to reserve a Clean Bay Car Wash loaner kit.~~

Page 4-75, Volume 4, Section 4.8.8.2

Bare galvanized metal shall not be used for materials that convey stormwater, such as roofs, canopies, siding, gutters, downspouts, roof drains, and pipes. See Volume 3, Chapter 9 for acceptable pipe types. Any galvanized materials shall have an inert, non-leachable finish, such as a baked enamel, fluorocarbon paint (such as Kynar® or Hylar®), factory-applied epoxy, pure aluminum, or asphalt coating. Acrylic paint, polyester paint, field-applied, and part zinc (such as Galvalume®) coatings are not acceptable. ~~See Ecology Publication #08-10-025 for additional information concerning practices to reduce zinc concentrations.~~

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Page 5-14, Volume 5, Section 3.1.3 Flows Requiring Treatment

Runoff from pollution-generating hard or ~~pervious surfaces~~ converted vegetation areas exceeding the thresholds outlined in Minimum Requirement #6 (Volume 1, Chapter 2) must be treated using one or more of the water quality facilities in this ~~volume~~ manual. Facilities must be sized for the entire area that drains to the facility even if some of the area is non-pollution generating and/or if some of the area was not included in the project threshold determination.

Facilities must be sized to include increased volumes and/or flowrates created by fields and/or vegetated areas (natural or artificial) with underdrains. In WWHM, model these areas using the permeable pavement element. A default porosity of 0.3 may be used for all layers or an applicant can provide supporting material to justify WWHM inputs. Infiltration can only be included if a soils report is provided to justify the infiltration rate used.

~~If runoff from non-pollution generating surfaces flows into a runoff treatment BMP, flows from those areas must be included in the sizing calculations for this facility.~~ ~~Once runoff from non-pollution generating areas is mixed with runoff from pollution-generating areas, it cannot be separated before treatment~~.

Stormwater treatment facilities installed to provide treatment of pollution generating surfaces for street sections within the right-of-way shall size those facilities ~~for fully developed conditions~~ to include stormwater runoff that enters the street through existing through-curb connections from onsite properties to the street and to include the potential for onsite properties to fully develop and connect to the street system via through-curbs in the future ~~existing onsite drainage which may connect to the City system if it not currently connected~~. The onsite fully developed condition assumed to reach the facility shall be derived from the following percentages of impervious area:

- In commercial areas, the percent impervious shall be 85%
- In industrial areas, the percent impervious shall be 70%.
- In residential areas, the percent impervious shall be 60%.

If an applicant proposes to ~~connect~~ collect and convey onsite stormwater discharges to the City system the applicant shall ensure that any existing downstream stormwater facilities are appropriately sized for the additional flow. If the facilities are not sized to handle additional stormwater discharges; modification to the facility or onsite treatment may be required to mitigate for the proposed impact. It is not the City's intent to require applicants to install regional stormwater treatment facilities. Environmental Services will determine the extent to which to this requirement applies to each project.

Page 5-16, Volume 5, Section 3.5 Materials

Acceptable materials for stormwater facilities include thermoplastics, iron, steel, aluminum, ~~stainless steel~~, and concrete. Steel and iron shall be aluminum coated (aluminized Type 2). Zinc coated (galvanized) materials are prohibited. ~~Galvanized metals pipes may only be used it they employ asphalt coating.~~

Page 5-19, Volume 5, Section 4.2.3

Geomembrane liners shall ~~be ultraviolet (UV) resistant and~~ have a minimum thickness of 30 mils.

Page 5-21, Volume 5, Section 5.1.2 Materials

All metals parts must be corrosion resistant. ~~Examples of preferred materials include aluminum, stainless steel, and plastic.~~ ~~Zinc and galvanized materials are prohibited unless coated as approved by Environmental Services~~. Zinc coated (galvanized) materials are prohibited. Painted metal parts shall not be used because of poor longevity.

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Page 5-102, Volume 5, Section 11.2.1.7

- All metals parts shall be corrosion-resistant. Do not use zinc coated (galvanized) materials.

Page 5-110, Volume 5, Section 11.2.2.5

~~Bare galvanized materials shall not be used.~~ All metal parts must be corrosion resistant. Zinc coated (galvanized) materials are prohibited. Painted metal parts shall not be used because of poor longevity.

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Page 6-9: Volume 6, Section 2.2.2.1.2.3

Soils testing shall comply with Volume ~~6~~3, Section 6.5.2 – Small Scale PIT Test.

Page 6-18: Volume 6, Section 2.2.2.2.6 Correction Factors

Table 6-2: Measured Hydraulic Saturated Conductivity Rate Reduction Factors

Issue	Partial Correction Factor
Site Variability and Number of Locations Tested	CF_v = 0.33 to 1.0
Test Method	
• Large-Scale PIT	CF_t = 0.75
• Small-Scale PIT	CF_t = 0.50
• Grain Size Method	CF_t = 0.45
Siltation and Biofouling	CF_m = 1.0

Total Correction Factor, $CF_T = CF_v * CF_t * CF_m$

$K_{sat\ design} = K_{sat\ initial} * CF_T$

Site variability and number of locations tested (CF_v)

The number of locations tested must be capable of producing a picture of the subsurface conditions that fully represents the conditions throughout the facility site. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low – for example, conditions are known to be uniform through previous exploration and site geological factors – one pilot infiltration test (or grain size analysis location) may be adequate to justify a partial correction factor at the high end of the range.

If the level of uncertainty is high, a partial correction factor near the low end of the range may be appropriate. This might be the case where the site conditions are highly variable due to conditions such as a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests (or several grain size test locations), the level of uncertainty may still be high.

A partial correction factor near the flow end of the range could be assigned where conditions have a more typical variability, but few explorations and only one pilot infiltration test (or one grain size analysis locations) is conducted. That is, the number of explorations and tests conducted do not match the degree of site variability anticipated.

Uncertainty of Test Method (CF_t)

This correction factor accounts for uncertainties in the testing methods. These values are intended to represent the differences in each test's ability to estimate the actual saturated hydraulic conductivity. The assumption is the larger the scale of the test, the more reliable the result.

Siltation and Biofouling (CF_m)

Because correction factors are applied to the bioretention soil mix to account for siltation and biofouling, a correction factor of 1 (no correction factor) may be used.

Page 6-35: Volume 6, Section 2.2.2.5.8 Permeable Pavement Correction Factors

Table 6-6 Measured Hydraulic Saturated Conductivity Rate Reduction Factors

Issue	Partial Correction Factor
Site Variability and Number of Locations Tested	CF_v = 0.33 to 1.0
Test Method	
• Large-Scale PIT	CF_t = 0.75
• Small-Scale PIT	CF_t = 0.50
• Grain Size Method	CF_t = 0.45
Quality of Pavement Aggregate Base Material	CF_m = 0.9 to 1

Total Correction Factor, $CF_T = CF_v * CF_t * CF_m$

$K_{sat\ design} = K_{sat\ initial} * CF_T$

Site variability and number of locations tested (CF_v)

The number of locations tested must be capable of producing a picture of the subsurface conditions that fully represents the conditions throughout the facility site. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low – for example, conditions are known to be uniform through previous exploration and site geological factors – one pilot infiltration test (or grain size analysis location) may be adequate to justify a partial correction factor at the high end of the range.

If the level of uncertainty is high, a partial correction factor near the low end of the range may be appropriate. This might be the case where the site conditions are highly variable due to conditions such as a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests (or several grain size test locations), the level of uncertainty may still be high.

A partial correction factor near the flow end of the range could be assigned where conditions have a more typical variability, but few explorations and only one pilot infiltration test (or one grain size analysis locations) is conducted. That is, the number of explorations and tests conducted do not match the degree of site variability anticipated.

Uncertainty of Test Method (CF_t)

This correction factor accounts for uncertainties in the testing methods. These values are intended to represent the differences in each test's ability to estimate the actual saturated hydraulic conductivity. The assumption is the larger the scale of the test, the more reliable the result.

Quality of Pavement Aggregate Base Material (CF_m)

If the aggregate base is clean washed material with 1% or less fines passing the 200 sieve, a correction factor of 1 is appropriate, otherwise use a correction factor of 0.9.

Page 6-37: Volume 6, Section 2.2.2.5.9.4 Permeable Ballast Base Course

For pervious concrete sidewalks the minimum ballast thickness shall be 4 inches. For ballasted sidewalks the minimum ballast thickness shall be 6 inches.

Page 6-39: Volume 6, Section 2.2.2.5.12 Ballasted Sidewalks

Ballasted sidewalks can be used as an alternative to permeable pavement sidewalks on private property and in the City right-of-way. Ballasted sidewalks shall be designed per City of Tacoma Standard Plan SU-04a with a minimum 6" permeable ballast section below the sidewalk.

Limit run-on to permeable surfaces to the maximum extent practicable. Run-on shall only be allowed from fully stabilized areas.

See Volume 1, Appendix C for specific maintenance requirements for ballasted sidewalks.

Modeling in WWHM is required to obtain flow credits. Model the facility using the gravel trench bed element.

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