City of Edmonds

Public Works Department, Engineering Division

121 5th Ave N
Edmonds, WA 98020

Checklist 6:
Procedures for Infiltration Trenches and Basins

Per ECDC 18.30, all Category 1 projects must comply with Minimum Requirements No. 1 through No. 5, and all Category 2 projects must comply with Minimum Requirements No. 1 through No. 9. If infiltration facilities are proposed to meet Minimum Requirement Nos. 5, 6, and/or 7, soil infiltration rates must be measured using approved soil infiltration testing procedures. See the Edmonds Stormwater Addendum (Addendum) Appendix B and Checklist 4.

Infiltration facilities shall be designed in accordance with the Department of Ecology's Stormwater Management Manual for Western Washington (SWMMWW), ECDC 18.30, and the requirements in the Addendum. Because the SWMMWW does not always include clear itemization of project procedural and/or submittal requirements, the City of Edmonds developed the following checklist to aid project proponents and plan reviewers in complying with the applicable SWMMWW requirements. In addition, City-specific requirements (i.e., requirements presented in ECDC 18.30 and the Addendum that are not included in the SWMMWW) are also included in the checklist. For clarity, the checklist headings and subheadings are generally organized according to the SWMMWW structure, though some requirements specific to ECDC 18.30 and the Addendum are included under the SWMMWW headings.

This checklist reflects most, but not necessarily all, of the items that shall be performed by the project proponent, and documented for review by the Engineering Division. It is intended to be used as an aid for developers and plan reviewers by providing a foundation for clear and consistent field and design procedures in the City of Edmonds. However, all items may not be applicable to every project, and all items of concern to this office may not be covered on this checklist. Last, the methods and procedures outlined herein can vary depending on the project. The headings outlined below represent the City's recommended process, though variations are acceptable as long as all of the required information is evaluated and documented.

Applicant:

Application #:

Within each blank cell, enter comment codes as follows: C = Complete R = Revise (i.e., make corrections) N/A = Not Applicable M = Missing (i.e., please include) IC = Incomplete	
	DETERMINE METHOD OF ANALYSIS
1	Typically use the Simple Method for the following types of sites (subject to City approval): • For small facilities serving short plats or commercial developments less than 1 acre of contributing area • High infiltration capacity soils (NRCS [SCS] soil types A or B) • Other infiltration facilities performing successfully at nearby locations • No drinking water wells, steep slopes, or other sensitive features within 500 feet • Low risk of flooding and property damage in the event of clogging or other failure of the infiltration system
2	Typically use the Detailed Method for the following types of sites (subject to City approval): • A large contributing drainage area • Low infiltration capacity soils (NRCS [SCS] soil types C or D) • History of unsuccessful infiltration facility performance, or no history of successful infiltration performance at nearby locations • High groundwater levels or depth to low permeability layer less than 10 feet • High risk of flooding in the event of clogging or other failure
	STEPS FOR THE DESIGN OF INFILTRATION FACILITIES SIMPLIFIED APPROACH (SWMMWW Volume III, Section 3.3.4) Applies to Infiltration Ponds/Basins, Trenches, Vaults, and Tanks (Note: does not apply to Downspout Full Infiltration Systems)
	Step 1: Select a Location
3	Location selected based on preliminary surface and sub-surface characterization study (SWMMWW Volume III, Section 3.3.5) and preliminary check of Site Suitability Criteria (SWMMWW Volume III, Section 3.3.7). (See also Step 4.)
	Step 2: Estimate Volume of Stormwater
4	WWHM, MGSFlood, or other approved continuous runoff model is used to generate an influent file to size the infiltration facility. (See also Step 6 for sizing criteria.) Required Puget East 36 long-term precipitation time series is used.
	Step 3: Develop Trial Infiltration Facility Geometry (for initial modeling purposes only, see SWMMWW Volume III, Section 3.3.4, Step 3)
	Step 4: Complete More Detailed Site Characterization Study and Consider Site Suitability Criteria
5	Required information gathered through geotechnical and surface investigations to determine whether infiltration is feasible. (See SWMMWW Volume III, Section 3.3.5 and 3.3.7, and the later portions of this checklist for details.)
	Step 5: Determine the Design Infiltration Rate
6	Test hole or test pit exploration should be conducted between December 1 and April 1. (See also Addendum Checklist 2 for detailed Soils Report requirements that must be considered during the soils testing period.)

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7		Infiltration test methods described in the SWMMWW Volume III, Section 3.3.6, Addendum Appendix B, and Addendum Checklist 4 are used to determine the measured (initial) saturated hydraulic conductivity.
8		Initial infiltration rate adjusted using the appropriate correction factors (refer to Addendum Appendix B and Addendum Checklist 4).
		Step 6: Size the Facility
9		At least 1 foot of freeboard is provided (maximum ponded depth of 6 feet).
10		WWHM, MGSFlood, or other approved continuous runoff model is used to generate an influent file to size the infiltration facility. Required Puget East 36 long-term precipitation time series is used.
11		If sizing a treatment facility, the output files from an approved continuous runoff model show: 1) that the facility infiltrates 91 percent of the influent runoff file; and 2) that the Water Quality Design Storm Volume (indicated by WWHM or MGS Flood) can infiltrate through the infiltration basin surface within 48 hours.
12		If sizing a facility to meet the flow control requirement, the output files of an approved continuous runoff model show that the total of any bypass and overflow meets the applicable flow control standard.
13		If sizing a facility to meet the LID performance standard, the output files show the facility's total of bypass and overflow meets the LID performance standard.
		Step 7: Construct the Facility and Conduct Performance Testing
14		For infiltration basins, the project engineer performs a minimum of two falling head percolation tests.
15		For trenches, the project engineer performs a minimum of two performance tests. The type of performance test depends on specific facility and site constraints, and is determined by the project engineer on a case-by-case basis and approved by the City prior to testing.
16		The City is notified of the scheduled infiltration testing at least 2 working days in advance of the test.
17		If the tests indicated the facility will not function as designed, this information is brought to the immediate attention of the City.
		STEPS FOR DESIGNING INFILTRATION FACILITIES – DETAILED ANALYSIS (IF REQUIRED) (SWMMWW Volume III, Section 3.3.8)
		Steps 1 Through 5
18		Meets requirements described in Step 1 through 5 of the Simplified Approach above.
		Step 6: Calculate Hydraulic Gradient
19		The steady state hydraulic gradient is calculated (see SWMMWW, Section 3.3.8, equation [3]).
20		An appropriate correction factor is used and is determined by the pond size (see SWMMWW, Section 3.3.8, equation [4]).
21		A gradient of no more than 1.0 is used.

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		Step 7: Calculate Preliminary Design Infiltration Rate
22		The preliminary design infiltration rate is calculated using Darcy's Law (see SWMMWW, Section 3.3.8, equation [5]).
		Step 8: Adjust Preliminary Design Infiltration Rate
23		The pond aspect ratio is calculated (see SWMMWW, Section 3.3.8, equation [6]) and is less than 1.4.
24		The preliminary design infiltration rate (Step 7) is adjusted using the hydraulic gradient (Step 6) and pond aspect ratio. See SWMMWW, Section 3.3.8, equation [7].
		Step 9: Size the Facility
25		The facility is sized to ensure that the maximum ponded depth is between 2 and 6 feet with 1-foot-minimum required freeboard.
26		If the infiltration facility is being used to meet treatment requirements, the Water Quality Design Storm Volume (indicated by WWHM or MGS Flood) can infiltrate through the infiltration basin surface within 48 hours (calculated multiplying the horizontal projection of the infiltration basin mid-depth dimensions by the estimated design infiltration rate, and multiplying the result by 48 hours).
		Step 10: Groundwater Mounding Analysis
27		If the infiltration facility has a drainage area exceeding 1 acre and has less than 15 feet of vertical separation to seasonal high ground water or other low permeability stratum (as measured from the bottom of the infiltration basin or trench), a groundwater mounding analysis is performed to determine final design infiltration rate.
28		An approved continuous runoff model is used for initial facilities sizing, then groundwater mounding analysis is completed using MODRET or an alternate groundwater model approved by the City.
		Step 11: Construct the Facility and Conduct Performance Testing
29		Meets requirements described in Step 7 of the Simplified Approach.
		SITE CHARACTERIZATION CRITERIA (SWMMWW Volume III, Section 3.3.5)
		Surface Features Characterization
30		A general site characterization is performed to identify items such as: • Topography within 500 feet of the proposed facility • Anticipated site use (street/highway, residential, commercial, high-use site) • Location of water supply wells within 500 feet of proposed facility • Location of steep slope, erosion hazard, or landslide hazard areas • A description of local site geology, including soil or rock units likely to be encountered, the groundwater regime, and geologic history of the site
		Subsurface Characterization
31		Subsurface explorations (test holes or test pits) are conducted to a depth below the base of the infiltration facility of at least 5 times the maximum design depth of ponded water proposed for the infiltration facility, but not less than 10 feet below the base of the facility.

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32		At sites with shallow groundwater (less than 15 feet from the estimated base of facility) and where groundwater mounding analysis is necessary (drainage area exceeding 1 acre), the thickness of the saturated zone is also determined.
33		Continuous sampling (representative samples from each soil type and/or unit within the infiltration receptor) is conducted to a depth below the base of the infiltration facility of 2.5 times the maximum design ponded water depth, but not less than 10 feet.
34		For large infiltration facilities serving drainage areas of 10 acres or more, soil grain size analysis is performed on layers up to 50 feet deep (or no more than 10 feet below the water table).
35		To estimate infiltration rates, the following minimum number of test pits or test holes are developed (see also Addendum Appendix B): • For infiltration basins, one test pit or test hole per 5,000 square feet of basin infiltrating surface (minimum of two per basin) • For infiltration trenches, one test pit or test hole per 200 feet of trench length (minimum of two per trench)
36		If using the soil grain size analysis method to estimate infiltration rate, a minimum of one grain size analysis per soil stratum is conducted in each test hole within 2.5 times the maximum design water depth, but not less than 10 feet.
37		If using the soil grain size analysis method for estimating infiltration rates, lab test results are included.
38		Detailed logs are prepared for each test pit or test hole, as well as a map showing the location of the test pits or test holes. Logs include at a minimum, depth of pit or hole, soil descriptions, depth to water, presence of stratification. (See also Addendum Checklist 2.)
39		For facilities serving a drainage area less than 1 acre, it is established that the depth to groundwater or other hydraulic restriction layer is at least 10 feet below the base of the facility.
40		For facilities serving a drainage area 1 acre or larger, groundwater monitoring wells are installed to locate the groundwater table and establish its gradient, direction of flow, and seasonal variations, considering both confined and unconfined aquifers.
41		A minimum of three groundwater monitoring wells per infiltration facility are installed, unless the highest groundwater level is known to be at least 50 feet below the proposed base of the infiltration facility. Note: one monitoring well may be sufficient if in the assessment of the site professional, the surrounding site conditions indicate that gradient and flow are not critical.
42		Groundwater levels are monitored at the site during at least one wet season (December 1 through April 1), or equivalent site historical groundwater level data is provided.
43		The design infiltration rate is determined using the acceptable methods in Addendum Appendix B and Addendum Checklist 4.

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		Soil Testing
44		A soils report is prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program); a locally licensed on-site sewage designer; or by other suitably trained persons working under the supervision of a professional engineer licensed in the State of Washington in civil engineering, geologist, hydrogeologist, or licensed engineering geologist registered in the State of Washington.
45		Soils Report is prepared meeting the requirements outlined in Addendum Checklist 2, and including BMP-specific information as required (see items below, as well as the Addendum and other applicable checklists).
46		For infiltration facilities used to provide treatment and flow control, the soil characterization also includes: • Cation exchange capacity (CEC) and organic content for each soil type and strata where distinct changes in soil properties occur to a depth below the base of the facility of at least 2.5 times the maximum design water depth, but not less than 6 feet. • For soils with low CEC and organic content, deeper characterization of soils may be required (see SWMMWW Volume III, Section 3.3.7 Site Suitability Criteria).
		Infiltration Receptor Characterization
47		Assesses the ambient groundwater quality (if of concern).
48		Documents volumetric water holding capacity of the infiltration receptor soils.
49		Determines depth to groundwater and to bedrock/impermeable layers.
50		Describes seasonal variation of the groundwater table based on well water levels and observed mottling of soils.
51		Documents existing groundwater flow direction and gradient.
52		Documents approximation of the lateral extent of infiltration receptor.
53		Documents horizontal hydraulic conductivity of the saturated zone.
54		Describes impact of the infiltration rate and proposed added volume from the project site on local groundwater mounding, flow direction, and water table determined by hydrogeologic methods.
55		Conducts a groundwater mounding analysis if required by the City.
		Consider Site Suitability Criteria (SWMMWW Volume III, Section 3.3.7)
56		SSC-1: The proposed design meets the setbacks for infiltration facilities.
57		SSC-3: Provides sufficient pollutant removal upstream of infiltration facilities in high vehicle traffic areas or industrial sites.
58		SSC-4: For infiltration facilities used for treatment, the measured infiltration rate is 9 inches per hour or less, the design infiltration rate is 3 inches per hour or less, and drawdown time is 48 hours or less.

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59		SSC-5: The base of the proposed infiltration basin or trench is a minimum of 5 feet above the seasonal high groundwater level, bedrock (or hardpan), or other low permeability layer (a separation down to 3 feet may be considered subject to approval by the City).
60		SSC-6: Infiltration facilities used for treatment have soils with the following characteristics: • Cation exchange capacity (CEC) at least 5 milliequivalents per 100 grams of dry soil (Note: soils with lower CEC content may be considered if it is based on a soil loading capacity determination for the target pollutants that is accepted by the City). • Depth of soil is 18 inches. • Minimum organic content of 1.0 percent. • Waste fill materials are not used for infiltration soil media.
61		SSC-7: No adverse impacts caused by seepage zones.
62		SSC-8: Impact from roadway deicers are evaluated and mitigated if needed.

Reviewer: _____

Review Date: _____

Reviewer Phone #: _____

Reviewer Comments: