MADISON SHOPPING CENTER STORMWATER REPORT
PRELIMINARY REVIEW FINDINGS
10/1/2006

ISSUE: Conveyance Sizing

Spot checks verify sufficient capacity of the storm sewer pipes, no surcharge is expected at the 25 year event. The 10 yr event is the standard criteria.

Recommendation 1: request verification from the designer that the in-line pre-treatment swales have the capacity to convey the 10 yr-24 hour event at the minimum (Portland City Code 17.38.030). Recommend using the 25 yr-24 hour event. Note, that many jurisdictions use a much higher design storm for conveyance in biofiltration swales (WA Department of Ecology for example). Also, ensure that 1 ft of freeboard is maintained above the calculated water surface elevation according to criteria listed in the Portland Stormwater Manual (PSM), Page 2-74.

Recommendation 2: request inclusion of data supporting the viability of the infiltration system design. Seasonal high groundwater data as well as subsurface percolation rates should be included in the Stormwater Report. The report should verify that the infiltrating surface is at least 3 to 5 feet above the seasonal high groundwater level. The report should generally show that the 25 year event is fully infiltrated by the drywell system. Request that all assumptions and data necessary to reproduce the calculations are provided in the report. Recommend that a narrative be provided as to what happens during events > 25 year event. At a minimum ensure that adjacent property damage does not occur during the 100 year event.

ISSUE: Flow Control

Should not be an issue with full on-site infiltration

ISSUE: Water quality treatment

A biofilter swale is the proposed pretreatment. A single swale is proposed for ~ 26 acres of contributing area. It is unknown if roof runoff is routed to the swale or not. The performance goal is 70% removal of TSS (solids).

Recommendation 3: Verify (construction plans) that roof runoff is directed to infiltration with out any interaction with runoff from pollution generating surfaces (parking). If interaction does occur, the cumulative runoff should receive water quality treatment prior to infiltration. Infiltration calculations for conveyance will need to account for roof runoff, but water quality facilities (if isolated from the roof) will not.

Recommendation 4: Request documentation or verify that Oregon Department of Environmental Quality and the City of Portland allows or exempts groundwater recharge from the parking lot in this area.

Recommendation 5: Because > 15,000 sq-ft of impervious area is proposed, the presumptive approach must be used when following the Portland Stormwater Manual. Request inclusion of swale

design calculations in the stormwater report which conforms to guidelines and criteria on Page 2-74 (PSM, 2004).

- Ensure that the proper rainfall event is used. From the Portland Stormwater Manual the water quality storm is given as 0.83 inches over 24 hours with a NRCS Type 1a Distribution. The given storm depth of ~0.3 inches is far lower than this value and the SBUH approach was not utilized as stated. Alternatively to the SBUH, use the intensities found in the Portland Stormwater Manual (Page 1-25, 2004) applied within the Rational Equation to obtain the peak flow rate. For the design of biofiltration swales (grassy swales) the water quality volume information is not needed. A quick estimation using the given project area, time of concentration, 0.83" design storm, and a 5 minute time step in the SBUH model yields a peak flow rate on the order of **3 cfs.**

- The stormwater report should show that the swale minimum residence time was obtained. Swales should be sized such that the minimum residence time (based on the peak flow rate from the 0.83 inch water quality storm) is equal to 9 minutes. Refer to Page 2-74 (PSM, 2004).

Recommendation 6: Given the size of the contributing area, Recommend incorporating multiple swales (at least 3) so that total contributing areas to each swale is <10 acres as meeting design criteria for the grassy swale will be difficult given the large contributing area. In the runoff calculations account for both impervious pavements as well as "pervious" landscape areas which will add to the runoff hydrograph. It's not appropriate to discount over 6 acres of landscaped areas (CN = 89) which still has a relatively high runoff rate. If multiple swale facilities can not be sited, recommend using a wet pond to provide treatment for the combined 27 acre contributing area.

Note- These review findings and recommendations are for informational purposes based solely on the provided Stormwater Report. These findings should not be taken as a formal or definitive review of the drainage elements of the project

Grassy Swale

1) The swale width and profile shall be designed to convey runoff from the pollution reduction design storm intensity (see **Section 1.5.2**) at:

   - Maximum design depth of 0.33 feet.
   - Maximum design velocity of 0.9 feet per second.
   - Minimum hydraulic residence time (time for Q_{design} to pass through the swale) of 9 minutes.
   - Minimum longitudinal slope of 0.5 percent, maximum slope of 5 percent. For slopes greater than 5 percent, check dams shall be used (one 6-inch high dam every 10 feet).
   - Designed using a Manning "n" value of 0.25.
   - 4:1 (or flatter) side slopes in the treatment area.
   - Minimum length of 100 feet.

   A minimum of 1 foot of freeboard above the water surface shall be provided for facilities not protected by high-flow storm diversion devices. Swales without high-flow diversion devices shall be sized to safely convey the 25-year storm event, analyzed using the Rational Method (peak 25-year, 5 minute intensity = 3.32 inches per hour).

   Velocity through the facility shall not exceed 3 feet per second (fps) during the high-flow events (i.e., when flows greater than those resulting from the pollution reduction design intensity are not passed around the facility).

2) The swale shall incorporate a flow-spreading device at the inlet. The flow spreader shall provide a uniform flow distribution across the swale bottom. In swales with a bottom width greater than 6 feet, a flow spreader shall be installed at least every 50 feet.

3) To minimize flow channelization, the swale bottom shall be smooth, with uniform longitudinal slope, and with a minimum bottom width of 2 feet for private facilities and 4 feet for public facilities. Maximum bottom width shall be 8 feet.

4) Grasses or sod shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility.

5) Unless vegetation is established, biodegradable erosion control matting appropriate for low-velocity flows (approximately 1 foot per second) shall be installed in the flow area of the swale before allowing water to flow through the swale.

1.5.2 Pollution Reduction Requirements

The City of Portland has a citywide pollution reduction requirement for all development projects with over 500 square feet of impervious development footprint area, and all existing sites that propose to create new off-site stormwater discharges. This requirement is summarized as follows:

- 70 percent removal of total suspended solids[1] is required from 90 percent of the average annual runoff.[2]
- Projects in watersheds that have established total maximum daily loads (TMDLs) must also select and use a pollution reduction facility that is capable of reducing the pollutants of concern, as approved by BES.

[1] See **Appendix B** for a more detailed definition of "70% removal of TSS," which is actually a function of influent TSS concentration.

[2] In Portland, flow rate-based pollution reduction facilities (such as swales and filters) designed to treat runoff generated by a rainfall intensity of 0.19 inches per hour (depending on time of concentration; see chart below), and flow volume-based facilities (such as wet ponds) designed to treat runoff generated by 0.83 inches of rainfall over 24 hours (with NRCS Type 1A rainfall distribution) with a Vb/Vr (volume of basin/ volume of runoff) ratio of 2, will treat roughly 90 percent of the average annual runoff. Facilities that must be sized by routing a hydrograph through the facility (rate-based facilities with a storage volume component) may utilize a continuous simulation program (with a minimum of 20 years of Portland rainfall data) or single-storm hydrograph-based analysis method, such as SBUH (with 0.83 inches of rainfall over 24 hours and NRCS Type 1A rainfall distribution) to demonstrate treatment of 90 percent of the average annual runoff volume. See **Appendix E** for more detailed information regarding the formulation of Portland's pollution reduction standards.

Rainfall intensity needed to treat 90% of the average annual runoff in Portland

Site's Time of Concentration (Minutes)	Rainfall Intensity (Inches per Hour)
5	0.19
10	0.16
20	0.13

One of the three design methodologies from **Chapter 2.0** must be used to design pollution reduction facilities to meet these requirements. The above rainfall intensities are to be used in the Rational Method (Q=CIA) equation to calculate pollution reduction runoff rates. These flow rates are used to size rate-based pollution reduction facilities unless the **Simplified Approach** from Chapter 2.0 is used.