February 3, 2012

2012 Draft Stormwater Manual Comments
WA Department of Ecology
Water Quality Program
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Via Email: wwswmancmnts@ecy.wa.gov

Re: Comments
2012 Draft Stormwater Management Manual for Western Washington

To whom it may concern:

Thank you for this opportunity to comment on the 2012 Draft Stormwater Management Manual for Western Washington (Guidance). My comments are primarily focused on the proposed revisions to the guidelines for infiltration testing and analysis.

General Comments

Any revisions to the Guidance based on comments received on the Draft Guidance dated November 4, 2011 should undergo a second round of public comment. It seems unlikely the Guidance will be ready to be finalized based on our review of the proposed revisions.

Section 3-3

1. Use of the term "saturated hydraulic conductivity."

The revised Guidance proposes to substitute the term "saturated hydraulic conductivity" for "infiltration rate." No rationale is provided for using the term "saturated hydraulic conductivity" rather than infiltration rate. We prefer the term infiltration rate for the following reasons.

- Infiltration rate is a traditional term used by stormwater facility designers. The Guidance uses both terms interchangablely. One term should be adopted.

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- The standard stormwater facility design tools typically specify infiltration rate and not hydraulic conductivity.

- The infiltration rate derived from field tests is only a very rough approximation of the vertical saturated hydraulic conductivity.

The use of a hybrid term such as "short-term", "long-term" or "design" saturated hydraulic conductivity should also be avoided. There is no concept in hydrogeology that we are aware of for defining a "short-term or long-term" hydraulic conductivity.

2. PI Test Methodology

We support the use of the pilot infiltration (PI) test method for determining field infiltration rates. We believe that the PI test is an excellent method for determining infiltration rates and superior to other methods for determining infiltration rates.

The main advantages of the PI test are:

- The PI test is simple and little specialized equipment is required to conduct the test.

- The PI test closely mimics real-world infiltration processes.

- PI test is scalable and the test configuration can designed to match the design infiltration facilities.

We recommend that the specific details of PI test methodology be moved into an appendix rather than included in Section 3.3. Section 3.3 should not be cluttered with the mechanics of conducting the test.

We don't see the need for defining "large-scale" and "small-scale" PI test methodologies. The PI test design should be based on the size and scale of the infiltration facility.

The PI test methodology should retain as much flexibility are possible including consideration of the following:

- PI tests should be scalable; the test cell dimension and configuration should be designed to match the proposed infiltration facility.

- A major limitation of a large test system is the availability of water to run long-duration tests. The duration and configuration of the test should take into account the water supply.

- PI tests should be completed at the location of the proposed infiltration facility. The test depth should be as close as possible to the surface of the proposed infiltration facility

- PI tests should consist of a constant head phase and a falling head phase. The constant head phase occurs when the water level in the test cell is kept constant while the rate of water into the cell can vary. The critical value during the constant head phase is the volume of water in volume/time, typically in gallons per minute. The falling head occurs when the water is terminated and the rate of decline in the test cell is monitored. The critical value is the drop rate, which is the head of water in the test cell over time. The drop rate typically varies as a function of the water level in the test cell. We typically run the falling tests several times to provide a measure of the reproducibility of the test. The falling head test is important because it gives a measure of the head dependency of infiltration.

- We believe that the termination of the PI test should be based on obtaining steady state results in a reasonable time frame. In our experience, it is necessary to have a presoak step to have a successful PI test. Once steady conditions are reached there seems to be very little valued gain in extending the test period. In our field experience conducting constant head tests in a wide variety of soil types, we get stabilized flow rates within 4 to 6 hours. Once the water flows stabilizes (our goal is to have a variation of less or equal to 5 percent of the total flow) that there is little value in extending the test more than 2 to 3 hours. We believe that a reliable PI test can be easily conducted within a period of 8 to 10 hours.

- The piping size and the type of measurement used during the test should be suggestions and should not be prescriptive.

- Maintaining a water depth of 3 to 4 feet in the pit is much too high. We recommended a water level no higher than 2 feet. At the least, allow flexibility in the method description regarding the depth of water. We have had no problem conducting PI tests with water levels 1 to 2 feet in test cells when using our shoring system.

- We have switched to a shoring system to prevent fines from sloughing into the test cell. We have seen an order of magnitude reduction in infiltration rate without the use of shoring system.

3. Infiltration Feasibility Process

Evaluating the infiltration feasibility should follow a tiered screening process. Currently the Guidance does not provide for phased approaches to evaluating the feasibility of infiltration. The initial design steps should be used to screen out sites which will be unfavorable for infiltration. In our opinion, sites that are unfavorable for infiltration can be easily recognized based upon grain size analysis, soil structure and stratification. Soils with high fines content and numerous restrictive layers are not feasible for infiltration. Additional characterization and infiltration testing should focus on feasible infiltration sites or providing additional data on sites which borderline sites for infiltration.

We feel that grain size, soil structure, and stratification can be used to provide preliminary screening for locating infiltration facilities. For example, we don't believe that it is necessary to conduct infiltration tests on all sites.

4. Infiltration Terminology

We recommend against the use of the "short-term" and "long-term" infiltration rates and "short-term" and "long-term" saturated hydraulic conductivity. Better alternatives are field infiltration rates and design infiltration rates. Field infiltrations rates are derived from the results of field infiltration testing. Design infiltration rates are field infiltration rates which have been adjusted based on professional judgment by the use of correction factors. Field and design infiltration are in units of length/time, typically defined as inches per hour.

We suggest using the term drop rate to define the change in water levels during a falling head PI test. Drop rate units can varying in time are reported in units of length/time.

5. Pre-Treatment

Pre-treatment in a pre-settling basin should be encouraged, if not required, for all infiltration facilities. The purpose of the pre-settling basin is to prevent sediment from plugging the infiltration facility. Plugging is a major cause of infiltration systems failure.

Specific Comments

Section 3.3.4, Page 3-67.

An introductory paragraph should be added describing the basis for selecting whether to use the simplified or detailed design approaches.

Section 3.3.5. Step 5, Page 3-69.

Design infiltration rates should be determined with PI tests. Grain size analysis should not be used as the basis for determining design infiltration rates.

Section 3.3.5, Item 4. Page 3-73.

This section implies that monitoring should be installed at each infiltration facility or at a minimum on each site. It is not necessary to install monitoring wells at every infiltration facility. The Guidance should provide additional criteria for implementation of a groundwater monitoring program or-better yet-leave the decision about whether to conduct groundwater monitoring to the design professional.

Section 3.3.5 Item 5, Page 3-73.

The value of grain size analysis is to provide preliminary infiltration rates and to identify sites that are unfavorable for infiltration. The site characterization section is missing soil criteria for identifying sites unfavorable for infiltration. We suggest that sites where soils have a fines content of greater than 30 percent should, in general, not be used for infiltration facilities.

We recommend that a minimum of two samples or one from each soil stratum from each test hole be submitted for laboratory grain size analysis.

Section 3.3.5 Soil Testing, Page 3-74.

Visual grain size classification should be included as a bullet item.

What is the scientific basis for CEC as a means of assessing treatment potential? We can find no scientific basis for using CEC as measure of treatment performance.

Section 3.3.5 Infiltration Receptor, Page 3-74.

We believe that evaluating the capacity of the infiltration receptor is an important but underappreciated part of the infiltration design process. We believe the scope of evaluating the infiltration receptor depends on the scale of the infiltration system and the risk of failure for an individual infiltration facility. The requirement to implement groundwater monitoring and mounding should be based on the risk of failure and the scale of the infiltration facility.

Page 3-82.

We recommend that the specific details of the PI methodology should remain in an Appendix rather in the main text. The PI test methodology needs to be as flexible as possible in areas which do not affect the test results. See our suggestions presented above.

Page 3-84.

Delete reference to Small-Scale Pilot Infiltration Tests.

Item 3, Page 3-85.

We find little value in this section on grain size analysis. We believe that grain size analysis should be used in initial screening to identify favorable or unfavorable soils for infiltration. Because the Massmann method is not based on any known physical property of the soil, we recommend against using this system. Infiltration rates should be based on the results of field infiltration testing.

Page 3-86.

The discussion of compaction seems most applicable to a construction section. The infiltration estimates from grain size should be based on native, relatively undisturbed soils. Correction factors should be used to address compaction during construction.

SSC-8, Page 3-94.

Provide reference for "D. Caraco and R. Claytor"

Figure 3.27, Page 3-97.

Our suggestion is to substitute Groundwater Model for MODRET. MODRET should not be specified as the model of choice for groundwater mounding analysis for the reasons provided below.

Section 10, Section 3-102.

The section of groundwater mounding analysis needs to be reworked. A variety of programs could be used, depending on the level of site-specific information. Analytical solutions based on Hantush or similar method should not be excluded for mounding analysis. Models such as MODFLOW and HYDRUS and similar models should only be used if sufficient data is available to justify their use. We object to use of the MODRET as the sole tool for use in groundwater mounding analysis.

MODRET is a proprietary one-layer model based on MODFLOW. Since MODRET is based on MODFLOW, then MODFLOW should be specified as an appropriate model to use for groundwater mounding analysis.

Appendix III-D.

The discussion of the PI test methodology should be retained as an Appendix.

Please don't hesitate to contact me by email (roy.jensen@hartcrowser.com) or phone (206.826.4223) if you should have any questions.

Sincerely,

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Associate

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