Dept of Ecology Review of/Comments on the Top 12 Ranked Proposals for Effectiveness Studies

April 7, 2014

Sound project with greatest potential benefit:

"Redmond Paired Basin Receiving Water Study":
This is a study that could influence the long range strategies and goals of urban stormwater management. The scope of the project, the increased likelihood of significant investment within a relatively accelerated time frame, and the commitment of the proponents all contribute to the potential for this project to provide useful lessons. This project would study the influence of a coordinated stormwater retrofit strategy across an entire (but probably small) watershed, as contrasted with the other watershed-level proposals that would study receiving water improvements only as a result of retrofitting a small part of a watershed.

Useful projects with some concerns about scope (not in priority order):

"LID Sizing Study":
The concept of establishing a feedback loop concerning the hydrologic performance of bioretention systems is critical. Bioretention will likely be increasingly relied upon for achieving watershed protection and restoration. Yet our accuracy in predicting performance of infiltrating facilities could be improved. We suggest that the focus of such an effort be on comparing not only the actual hydraulic performance to the expected performance, but also on looking for correlations of actual performance with design criteria, site evaluation methods (especially estimating infiltration rates), and site specific characteristics (e.g., depth to groundwater, soil type, bottom area to side slope area). Note that comparing actual stormwater inputs to estimated (modeled) inputs in addition to comparing actual overflow amounts with estimated overflow amounts is necessary. Improving our ability to accurately estimate hydrologic performance is the target. The proposal should not focus on "correct sizing." There isn't a correct size for bioretention.

Multiple facilities built to current/acceptable standards will have to be monitored and evaluated in order to detect trends. Therefore, the cost estimate for this study seems very low.

NOTE: We would rename this "Bioretention Hydrologic Performance Study"

"Catch Basin Study":
Because catch basin maintenance is a common burden that can demand significant resources, a study to

identify ways to reduce costs and improve the efficiency of program implementation is a worthwhile endeavor.

To ensure that the results of the evaluation are broadly applicable to municipal stormwater permittees throughout Western Washington, the data and other information compiled for evaluation should represent jurisdictions of different sizes and locations across Western Washington. There is a risk that this study, if too narrowly scoped, would produce useful information for only a small number of permittees.

"Combined Source Control Projects":
Exploring more effective and efficient methods for reducing pollutants from commercial facilities will pay dividends in improved water quality and efficient use of municipal resources. Additionally, it has the potential to deliver better government service to businesses. It is our understanding that two types of business inspections are relevant to this study: 1) application of source control BMPs (operational, minor structural), and 2) stormwater facility maintenance. The results of this study will be broadly applicable to all permittees. Furthermore, the Phase II permits may eventually expand to include a "source control program for existing development" that is similar to that required of Phase I permittees.

Note that Ecology's 2011 report on "Toxics in Surface Runoff to Puget Sound" (http://www.ecy.wa.gov/biblio/1103025.html) confirmed that "organic pollutants and metals were generally detected more frequently and at higher concentrations in the commercial/industrial basins compared to other land uses."

Projects with merit that may be best implemented by Piggybacking

Fungal Cultivation:
Adding a significant fungal component to bioretention is worth exploring. Bacteria control BMPs are needed to support bacteria TMDL implementation. However, there are currently three separate state funded efforts that are already monitoring the treatment performance of multiple soil mixes. Those efforts are:

- WSU Puyallup: Monitoring 3 soil mixes with 4 replicates of each within 5 foot diameter mesocosms
- Redmond: Monitoring 3 soil mixes with design variations that make 5 different regimes in full scale facilities
- Kitsap Co: Monitoring up to 24 soil mixes in laboratory columns

Starting another separate project looking only at fungal additions does not seem to be timely nor the most efficient use of these dollars. We suggest that as a first option, the municipalities explore the possibility of providing money to add a fungal component to one of the existing efforts listed above.

"PCB Cycling" (and PAH Removal):
A project focused solely on the fate of one pollutant – PCBs – seems too narrow for the RSMP. Given the concerns with PCBs cycling through the environment, analyzing how bioretention systems affect that cycling is of interest. Additionally, more than one proposal offers to monitor bioretention performance in PAH removal. These proposals reflect a growing interest in understanding how treatment affects toxic pollutants in stormwater and the long-term fate of those toxic pollutants following treatment. Ecology shares this interest. We suggest that as a first option, permittees explore the possibility of providing money to add PCBs and PAHs to the list of analytes in one or more of the three efforts listed above.

Projects with merit that have Scope, Timing, and/or Cost Complications

"Pre-spawn Mortality":
Preliminary results have indicated a reduction in urban stormwater toxicity to adult salmon after passing through a bioretention soil mix. The proposal does not clearly indicate what this project would add to the technical credibility of that observation. In addition, we are concerned about the representativeness of the imported stormwater. If this project is selected, it should include a thorough chemical analysis of the stormwater input to and output from the bioretention soil mix. Though the analysis might only yield possible reasons for differences in pre- and post-treatment toxicity, it is important to know the chemical characterization of the stormwater used so that it can be compared to stormwater concentrations from various land uses and situations.

It seems prudent to wait for any recommendations in bioretention soil mixes that could emerge from the three soil mix monitoring projects listed above. If those projects identify one or more changes in our recommended soil mix, that/those would be the mix/mixes to use in this study. [This may suggest that this study be undertaken in 2015 or later.]

"Episodic Exposure":
This project would add to our understanding of the lethal and sub-lethal impacts of untreated and treated urban stormwater on stream biology.

In the near future, bioretention systems may be the most commonly used BMP in new development, redevelopment, and retrofit situations. Initial data indicate that bioretention systems may be the most effective BMP in reducing stormwater toxicants (WSU Puyallup, Tacoma, and Redmond studies) and the effects (biosasssays at WSU Puyallup on macroinvertebrates, juvenile coho, daphnids, zebrafish) of toxicants that are in the dissolved and particulate fractions of urban stormwater. The planned "Status and Trends" studies will tell us the general condition of stream and nearshore habitats and whether they are improving or worsening over time. But there could be various reasons for the observed results. This study could isolate and identify the potential impacts of stormwater toxicants on the biological communities of our receiving waters. The study could further identify whether the widespread use of bioretention systems will help reduce those impacts. It will use native organisms with realistic exposures to toxicants in our urban stormwater.

Similar to our comment on the pre-spawn mortality study, we are concerned about the representativeness of the imported stormwater. If this project is selected, it should include a thorough chemical analysis of the stormwater used for the project.

It seems prudent to wait for any recommendations in bioretention soil mixes that could emerge from the soil mix monitoring projects listed above. If those projects identify one or more changes in our recommended soil mix, that/those would be the mix/mixes to use in this study. [This may suggest that this study be undertaken in 2015 or later.]

This study will likely have a significant cost. Permittees would have to consider the financial impact on their ability to fund other useful but less costly projects. Permittee support through supplemental funds for a more broadly funded study may be appropriate.

Projects with Significant Concerns

"King County Community Rain Gardens":
Our understanding is that this project was withdrawn and replaced with a project entitled: "Effectiveness of bioretention in reducing flows and pollutants." That proposal would evaluate the benefits of installing two large rain gardens serving a 23 acre commercial drainage area in a single location. The proposal includes Influent and effluent flow and pollutant monitoring, receiving water monitoring, and possibly toxicity testing.

Ecology has multiple concerns with this project.

The description indicates that the "rain gardens" have been built to facilitate monitoring. The plan sheet provided at the workshops indicates underdrains for both rain gardens. If the rain gardens have been under-drained to collect effluent, their hydrologic benefit has been significantly compromised. The monitoring of flow may indicate some dampening of peak flow rates, but that is not likely to be information that would have broader significance or be transferable to other sites or design procedures.

Other features that could limit the lessons learned from this project include the presence of a "wetland pond" whose function was not explained, and the methods used to create the "rain garden." Ecology defines rain gardens as depressions where compost materials are mixed into a native soil profile. The pollutant reduction benefits and the hydrologic benefits of such facilities are variable depending upon the native soil and the amount of compost used. So, defining the benefits from this site will not provide us with information transferable to other sites.

If the facility was actually designed as a bioretention facility in accordance with the design specifications in Chapter 7 of Volume V of the Stormwater Management Manual for WWA, and if the facility is underdrained, then the study would primarily be an evaluation of the project's treatment capability. Ecology suggests that we already have sufficient information from the monitoring of multiple bioretention sites (WSU Puyallup, Tacoma, Redmond) to estimate the treatment effectiveness of bioretention using a 60/40 mix for the typically-analyzed suite of pollutants.

If the facility was not under-drained, (i.e., the amount of water loss being dependent on infiltration into the native soil), and if it was designed as a bioretention facility (i.e., in accordance with Chapter 7 of Volume V), then there could be some benefit in monitoring the overflow quantity and quality. But the overflow quantity information may only be useful if used as one of the sites for the "LID Sizing Study" listed above.

In regard to receiving water monitoring, it seems unlikely that useful information would be forthcoming. The smaller the ratio of the 23 acre area to the total area draining to a stream monitoring site below the "rain garden" discharge, the less likely differences in pre- and post-implementation will be seen, or could be attributed solely to the project.

"Echo Lake Hwy 99 Retrofit":

This project also has limitations in regard to its potential to add to our knowledge about LID, and the broader applicability of lessons learned.

If bioretention facilities are under-drained, the same comments made about the "Effectiveness of Bioretention in Reducing Flows and Pollutants" project apply. We don't need more information about treatment performance of bioretention, other than for PAH and PCB removal. But that information is best collected through one of the existing test sites described above which have exercised higher levels of quality control in design and construction than this project could achieve.

Though this project may be able to document reductions in various pollutants loading to the lake (whether underdrained or not) as a result of stormwater projects serving Hwy 99, that information is of limited value outside of the Echo Lake basin. Within the Echo Lake Basin, the Hwy 99 runoff is likely a fraction of the total runoff to the Lake. Monitoring for improvements in lake water quality could yield conclusions about the relative benefit of those Hwy 99 projects to the lake, but that information is not of value outside of that basin.

The project scope did not include an acknowledgement or assessment of in-lake recycling of pollutants.

"Plant/soil mix: pollutant reduction through combos":

As explained above under "Fungal cultivation," there are three concurrent projects collecting information about multiple bioretention soil mixes. Now is not the time to start another project with yet more variations in soil mixes. Upon conclusion of the existing studies, it may be timely to do more evaluation of the recommended soil mix(es) and the role/influence of plants in that/those mix(es).

"Stewardship Partners":

The description is big on goals, and short on details. The description should be clarified concerning whether it would focus on rain gardens, bioretention, or both.

The implementation methods described suggest that this project would not have the technical rigor to evaluate performance of bioretention or rain gardens in sufficient detail to give us constructive feedback for changing design or construction methods.

The “citizen science” implementation approach is of interest, however, and may be more suitable in a reduced scope of work focused on documenting long-term plant health, some aspects of soil health, levels of and quality of maintenance, general public attitudes and “buy-in” toward proper operation and maintenance. The project could then make recommendations in these subject areas to improve the chances of long-term functionality of rain gardens. We caution however that using the Stewardship Partners rain gardens alone may bias results, as these rain gardens were installed voluntarily and we expect that the property owners are more supportive of the BMPs than the rest of the population.