WRIA 9 Stormwater Meeting

Thursday, January 26, 2012
Tukwila Community Center

Project Management Team Committee Members Present:
Jim Simmonds
Giles Pettifor, King County (KC)
Dino Marshalonis, U.S. Environmental Protection Agency (USEPA)
Dr. Rich Horner, University of Washington (UW)
Chris Knutson, KC
Olivia Wright, UW

Facilitated by Tamie Kellogg, Kellogg Consulting

Meeting Notes Compiled by Emily Santee, of Floyd/Snider

Audience Members Present:
James Rasmussen, Greater Duwamish Watershed Alliance (GDWA)
Jonathan Frodge, Seattle Public Utilities (SPU)
Monica Walker, WRIA 9
Kollin Higgins, WRIA 9
Chris Thorn, City of Auburn (Auburn)
Dan Repp, Auburn
Curtis Delaspers, KC
Dave Jacobs, SPU
Timothy Lowry, SPU
Denise DiSanto, Washington State Department of Ecology (Ecology)
Tiffany McClaskly, WTD
Jo Sullivan, WTD
Mike Milae, Brown & Caldwell (B&C)
Charlie Wisdom, Parametrix
Lee Dorigan, Duwamish River Cleanup Coalition
Jessica Knickerbockis, City of Tacoma (Tacoma)
Jim Glassley, Parametrix
Alice Lancaster, Herrera
Rebecca Dugopolski, Herrera
Nathan Foged, B&C
Dana deLeon, Tacoma
Rachel McCrea, Ecology Northwest Regional Office (NWRO)
Anne Dettelball, Ecology
Tom Putnam, Puget Soundkeeper Alliance (PSA)
Krista Mendelman, USEPA
Stacey Gianas, Stewardship Partners
Holly Coccoli, Muckleshoot Tribes
Ben Parrish, City of Covington
Don Robinett, City of SEATAC
Doug Navetski, KC
Carla Carlson, Muckleshoot Tribes
Kit Paulsen, City of Bellevue
Ed O'Brien, Ecology
Julie Horowitz, HCCC

Larry Jones, KC
Ingrid Wertz, Seattle
Deano Garland, Ecology NWRO
Dan Smith, KC
Andy James, UW
David Funke, KC

Welcome and Introductions – Tamie Kellogg

Project Overview & Update – Jim Simmonds
Presentation describes the need for retrofits, how to implement retrofits in WRIA 9; the benefits of retrofits; participation opportunities and project status.
The Audience had no questions on this presentation.

Water Quality and Flow Targets – Dr. Rich Horner
Presentation discusses the overarching goal of determining ways to minimize human impact on aquatic biota (i.e. benthic invertebrates); the meaning of high pulse rates/ high pulse counts; how to incorporate these into the stormwater retrofit approach; ~~-n~~ecessary but not sufficient" conditions required to meet benthic protection goals; and its converse, conditions which guarantee benthic invertebrate decline; confidence intervals used in modeling; and statistical examples of how water quality parameters are used to predict benthic invertebrate/stream health.
Dr. Horner asks audience members to provide feedback that would help define the goals of the project i.e. should the focus of the modeling be to protect existing conditions? To improve conditions by some factor? To improve conditions to as close to pre-development conditions as possible?
Dr. Horner also asks audience to provide input regarding the confidence intervals used in statistical analysis.

Audience Questions on Presentation:	**Project Team Response**
I have three questions: the first is regarding typical hardness. When looking at dissolved metals, which affect hardness, as a variable do you then lose accuracy in your predictions when metals and toxicity increases?	Toxicity in water is fraught with innumerable variables – when copper increases, does nickel increase as well? What about the temperature of the water? We use water quality criteria standards as they are, with whatever basis was used to develop it as the basis behind it, and then identify if there is an exceedance or not. Within streams analyzed in this study, we used specific hardness data to the extent we have it.
My second question is: Are you coordinating this process with the total maximum daily load (TMDL) program within Ecology?	Members of our project team are involved with the TMDL program in Ecology, but we haven't yet coordinated this work with requirements of the TMDL program.
My third question is about highly urban areas. Are there different drivers in these areas, which means that the findings of the pilot study may not apply? Would total suspended solids (TSS) still be the most relevant criteria?	We drew wide boundaries for our analysis and ruled out the most complex drainage areas, which were within the City of Seattle and corresponded to industrial/commercial land use. These land use areas typically have greater TSS values in stormwater than residential land use areas, which aren't

	erosion dominated. We hope to evaluate the most relevant criteria in industrial/commercial land use areas as part of modeling efforts undertaken later. We would like to note that the relationships presented in the presentation include streams in urban areas; we didn't model the runoff but the data is included in the data set to some extent; for example, Des Moines is an industrial/commercial area that is included in the data set, we just didn't include the Duwamish.
The pulse count concept is interesting: I can't get beyond the ~~"m~~aximum level." Why is there variability in the data, such that even with low pulse counts and pulse count ranges, benthic health is not guaranteed?	Every indicator I've looked at – and I've been looking for 20 years! – has shown the same pattern: at best, an indicator can be demonstrated to be necessary but not sufficient. I tried to find a set of indicators that could be taken together to be more predictive, such that we could guarantee benthic health when a set of conditions was met, but I've never gotten there due to the complexity of the variables and habitats involved. Substrate, the presence of woody debris, whether or not the habitat is riparian, the list goes on and on. A team of grad students started with a list of 70 variables initially; now we're down to just a few good ones.
I like this approach. The threshold analysis is useful for defining goals, and may give us an idea how to apply best management practices (BMPs). If we can understand the range in the threshold, we may be able to choose BMPs that would shrink the variability and improve the response of the benthic community.	
Have you considered the difference between using pulse counts and water quality criteria to evaluate benthic response?	In the examples that I gave, we took the water quality criterion and evaluated whether or not it would be protective given pulse counts observed within that stream – i.e. what's the response under ~~"r~~outine" conditions. Of course, there will always be values that exceed water quality criteria for any given site. We could also evaluate the maximum number of high pulse counts if there is time.
Water quality guidelines and stormwater permits allow you to exceed criteria a certain number of times within a given time period – those exceedances could be evaluated as your conservative ~~"w~~orst case."	That's a good suggestion.
In the examples in your presentation, you gave a baseline existing benthic invertebrate health	50% was picked ~~"o~~ut of the air" for demonstration purposes. We start from where

to maintain (or improve) of 50% of the maximum. What is the basis for that value?	we are and either protect that value or improve it. Each stream will have its own baseline. Streams with a low baseline of 10, 18, or 20% of the max will use those baselines as baselines for improvement, although we probably won't focus on modeling those streams because it's hard to make significant improvements in highly polluted streams, which typically have multiple or pervasive contaminant loads.

Tamie asks if there are any more questions comments on the approach Dr. Horner described.

When you do the modeling, do you extrapolate TSS to metals or are you looking at metals individually?	We use TSS and the statistical methods described in the slides to make a statement about risk; this is a scope question. TSS was found to be the best indicator, so that was what we selected and what was approved by the funding agency.
My name is Tim Lowry, I want to comment that if it is possible to analyze data for a more impervious land use area, that would be useful information for me and relevant to the stream(s) that I manage.	

System for Urban *Stormwater* Treatment and Analysis Integration (SUSTAIN) Sub-basin Scale Pilot Concept – Curtis DeGasperi

Presentation highlights that SUSTAIN identifies areas unsuitable for BMPs and includes: external hydrogeology models; BMP modules to simulate treatment behavior of rain barrels; and estimated cost of various BMPs. Using these factors, it does optimization to identify the optimal cost effective solutions to meet the target goal. Scale is an important consideration.

Mr. DeGasperi has links to reports identifying how SUSTAIN was used in other cities;

http://www.epa.gov/nrmrl/wswrd/wq/models/sustain/

SUSTAIN Case Studies

http://www.epa.gov/nrmrl/pubs/600r09095/600r09095.pdf (Upper North Branch Oak Creek and Little Rocky Run)

\\wlrnt3\share\SWRetrofitPlanforWRIA9\References\DesignStormReport20110629FINALTAC.pdf (LA County)

\\wlrnt3\share\SWRetrofitPlanfor WRIA 9\References\SUSTAIN APM Report Final 09262011-1.pdf (Kansas City and Louisville)

Audience Questions on Presentation:	**Project Team Response**
An important part of the WRIA9 habitat analysis was the cost of NOT doing the project—not just the costs associated with completing the project. The benefits of taking action should be a consideration in your	That's a valuable insight, but that type of analysis may not fit into the scope of our project and our funding.

analysis, particularly if this work is going to be extrapolated to the rest of the Puget Sound. You can look to Chapter Six in the WRIA9 report for a detailed example of what I mean.	
Are you concerned about the possibility that the hydrogeology of the Pilot study area may not be representative of, or applicable to, other basins?	Once we have a system developed and working within the SUSTAIN model, and have worked out the kinds, we have seven other basins with robust data sets to evaluate and compare. These basins are varied, and include outwash-dominated basins. If this Pilot basin were the only area being considered, I might be worried; but because we have other areas identified for study, I don't think this will be a concern.
Geology may not be a driving factor in the Pilot area – the pilot is mostly impervious land.	That's our assumption; again, the data sets from other basins will test this assumption.
How are you deciding infiltration rates? Ballard was involved with a rain garden project. We thought that because the top 10 feet of soil was beautiful, we wouldn't have any problems; but underneath there was clay that prevented draining and complicated analysis.	In this case, we'll have lower infiltration rates because of the impervious-surface dominated nature of the Pilot basin, but the technical team will determine appropriate infiltration rates for each basin modeled.
How does the model embed consideration of total versus effective impervious surfaces?	Effective impervious area is incorporated into the Hydrological Simulation Program – FORTRAN (HSPF) model we are using. This is one of the more nitty gritty details of the model: it includes four different kinds of impervious area. These are high and low density residential; road; and commercial/ industrial.
Have there been studies to show how non-profits and contractors can assist in this effort? What about cost benefit analysis to neighborhood improvements?	This is not something that we're thinking about now, but it may be something that we could explore later in the process (in workshop 4).

BMP Modeling Approach – Curtis DeGasperi

Our modeling approach takes land use categories and determines the amount and type of treatment that is most beneficial on a macro scale. The proposed design takes into account applicable treatments for that land use type.

Audience Questions on Presentation:	**Project Team Response**
The BMPs identified in the presentation fall into four different aggregate levels or ~~–~~types." Does SUSTAIN use each independently or does it always model them as a train?	The train (e.g. rooftop to rain barrel to rain garden) is standard, but through the optimization of the model, it may be most beneficial to omit the rain barrel, or it may be that using exclusively rain barrels is most beneficial. But the model doesn't create new trains or re-order within a train.
How do you size the BMPs? Are you using water quality standards or some other	In Federal Way, the proposal is to use MGS Flood or some other model to do the sizing –

method?	the question we're answering with SUSTAIN is how big a role does the rain barrel or rain garden play in optimization?
Is the land/space available for bioretention taken into account with the model?	Within the SUSTAIN model, we can specify the total area available for BMPs, but the model is not smart enough to know anything else.
The rain barrel concept only works well for yards in summertime, but it doesn't work well for winter, or industrial/commercial sites.	The SUSTAIN model is used to give people a sense of the cost of rain barrels and whether or not they will be effective. The project is trying to give a high level cost estimate – for high density areas, it's likely that rain barrels won't be optimal; if that's the case, the model will be able to identify that.
Are you assuming that the BMPs work at 100% effectiveness over the lifetime of the BMP?	The model doesn't have the ability to decrease effectiveness of the BMP over time. A related question could be whether or not the cost takes into account operating and maintenance costs of the BMP. We correct for inefficiencies in the BMPs by assuming that only a reduced percentage – say 80% – of the total runoff is treated.
When optimizing BMP suites, it looks like you don't have the ability to take into account slope and soil type. Is that correct?	We use the ability to modify the amount of land that's treatable to take into account these factors in a "back of the envelope" way. HSPF does have two different slope types to choose from.
The input on the basins is important: you're saying that there is "this much area" available and then exclude the area that isn't available (i.e. wetland areas are unavailable)?	Wetlands aren't a viable option in yards, and some yards may be too small for other types of BMPs. So we need to be careful not to overstate the effectiveness of the BMPs.
From a feasibility perspective, wouldn't it make sense to do that type of analysis first to narrow the area that's feasible for BMPs? Geographic Information System (GIS) has a broad level tool for this.	Our goal is planning level cost estimates so that's not something we can incorporate; the assumptions we make versus slope and non-slope, and till versus outwash, etc, will hopefully answer these questions. SUSTAIN is capable of incorporating GIS tools, but over the large basins we're looking at, it's not helpful to overly refine areas.
Has there been, or will there be, any attempt to look at restoration of historical wetlands instead of looking to BMPs like rain barrels?	This is another approach to bioretention – to take lands that were once wetlands but are no longer wetlands, and determine the benefits to converting them back to their historic state; this is a good topic for "small group" (table) discussion.

The meeting breaks off into small groups at individual tables to discuss responses to, and suggestions for, the overall approach to BMP Treatment. The written comments provided by each table in response to the three primary questions posed to each group are recorded below.

Question #1: Land Use Categories. What is your input on the proposed categories? Would you suggest something different, what would you suggest and why?
Responses:

1. **Comments in favor of current categories**
    a. No comment; the above categories seem reasonable.
    b. Categories look good.
    c. Generally these categories are supported by other research and other data
2. **Comments on paved areas/transportation categories**
    a. All roads will make a web across other land uses.
    b. What category do parking lots fall into?
    c. Concern/question: if you are applying the pollutant loading rates to the Low Density Residential land use category from studies measuring loads from all land covers within a neighborhood (roofs, roads, lawns), but are separating roads into the transportation category, wouldn't loading for the Low Density Residential land use category be overestimated?
    d. I like that you are separating transportation because different BMP configurations will apply and the cost burden will typically be borne by public agencies.
    e. Transportation inclusion is critical.
    f. Clarification is needed on the transportation category: does it include railroads and other ~~-n~~on-road" forms of transportation? Does it include the shoulder/right of way, where permeability is often different than for the rest of the road?
    g. Surface type is important – some types of pollutant affect some land use categories more than others. How do different surface types within a land use category get addressed? For transportation, freeways have more metals contamination than residential streets; maybe these two categories should be broken out as their own.
3. **Comments on multifamily buildings**
    a. Are residential (apartments or multifamily homes) included in heavy urban?
    b. Multi-family residential should be included under the ~~-H~~igh Residential" land use category rather than the commercial category.
4. **Comments on open space**
    a. Maintaining open spaces is most effective. This is why we focus on retrofits. Beacon Hill has bioretention facilities under playfields.
    b. How and where is non-forested, non-agrarian open space (soccer fields, meadows, etc) included?
    c. Are wetlands and lakes incorporated into the plan? The group would like to see different (expanded) ~~-n~~atural ~~-l~~andscapes (land covers such as shrub/scrub, grass, open spaces, etc…)
5. **Comments on category linkages**
    a. How are the sectors broken down? Are they divided into blocks of roads, residential, forest? How do the sectors interact?
    b. How are the linkages between different land cover types incorporated into the plan as water flows from residential to roads to treatment facilities?
6. **Comments to add more categories**
    a. The group would like to see agriculture broken into more detailed categories given that water flows differently off of pastures than fresh tilled planting lands. The county has land cover maps that break agriculture into 6 or 7 categories.

   b. Do you lose precision and comparability when you limit the number of categories? Can a computer handle more categories if you get more RAM?
   c. It would be timely to consider whether the proposed land use categories are appropriate to apply to all the land use types found within the WRIA 9 study area.
7. We ~~n~~eed goals" created from the results
8. There is no differentiation for ponds.
9. It would be instructive to list environmental impact assessment (EIA) for each land use and land cover change (LUCC).
10. Categories should each have their own characteristic EIA.
11. Public versus private – time horizon concerns regarding cost differential.
12. Add in amended soil

Question #2: What are your thoughts about the proposed BMP's Natural Drainage Treatment Train? Do you agree with the approach, and if so, why? What are your suggestions?

1. **Thoughts related to "green" or "natural" BMPs**
   a. Can reverting land covers back to more ~~n~~atural" landscapes (reestablishing historical wetlands or allowing a more expansive flood plain) be considered in the model as an alternative to ~~m~~an-made" controls and conveyance systems?
   b. Any use of green infrastructure is better than what we have now.
   c. Restoration component – constructed wetland (Thurston County)
   d. No, I don't agree with the approach. I believe that using only ~~n~~atural" BMPs won't result in enough pollutant removal.
   e. I liked the idea to restore historic wetlands.
2. **Thoughts related to permeable pavement**
   a. Will pervious surfaces be incorporated into other land uses other than just parking lots like shown in the diagram?
   b. Working with WSDOT to work with porous pavements. The Department of Transportation Services (DOTS) owns other things, but Puyallup has used porous pavement.
   c. Could add pervious pavement to light and medium urban categories in addition to transportation
3. **Concerns related to rain barrels**
   a. Rain barrels should not be the focus; they are less effective for stormwater management.
   b. Can rain barrels really be an effective option to control storm water? It seems that they fill up during a storm quickly and then are basically ineffective (especially in the winter months) until the rain stops and the rain can be drained.
   c. Call rain barrels small orifice/small detention
   d. Rain barrels are bad. They don't work. But in some areas, like CSO basins. Rename ~~r~~ain barrels" to detention cisterns. Orifice size is an important factor.
   e. Does SUSTAIN model rain barrels as generic small detection systems? This will provide flow control only. It's important to model the orifice size and the contributing area appropriately to optimize the system to provide a benefit for targeted flows.
   f. Percent breakdown: rain barrels are small, which will likely influence optimization.
   g. Remove rain barrel and instead put in cistern to indicate that it's not just rain barrels that are being evaluated (especially because rain barrels are ineffective compared to cisterns and other similar options).
   h. Rain barrels are related to stormwater control. Capturing and using the water on site could be beneficial for commercial land use.

i. I'm concerned about ran barrels being ineffective. Rain barrels are not useless; they are cost effective for certain uses and are helpful for water use but not management.

4. **Thoughts related to bioretention**
    a. Bioretention should include swales, rain gardens, wetlands.
    b. Add bioswales.
    c. If possible, the assumptions regarding the design and performance of bioretention systems should be adjusted for the land use types that they will serve. For instance, because the agriculture land use type includes a significant amount of land related to large animal keeping, the potential fixes to reduce TSS loading will be more along the lines of those advocated by the Conservation Districts (e.g., riparian plantings). If the ~~b~~ioretention" assumptions can be adjusted to more closely represent the benefits likely from those types of practices, that would be preferable to assuming use of—and estimating benefits from—the urban bioretention practice (i.e., a depression with amended soils that allows water to pond and infiltrate). The urban bioretention practice described above is not likely to be used in these agricultural lands.
    d. Does SUSTAIN include bioretention both with and without under drain? With under drain provides water quality treatment only and is feasible where infiltration is not allowed; makes infiltration rate a non-issue. Without under drain provides both water quality treatment and flow control.
    e. Vegetative swales should be used in light and medium urban and agricultural land use categories.
5. **Concerns related to agricultural BMP train**
    a. For agriculture, you will need to use agriculture based BMPs; typical urban BMPs <u>will not work.</u>
    b. Why isn't detention considered in agricultural settings? It seems like a viable option in some settings.
    c. It would seem there could be potential benefit for use of the vegetated swale BMP option (under the routing attenuation category) in the Agriculture areas.
6. **Concerns related to pervious pavement**
    a. Parking lot percentage – where is that accounted for? I.e. driveways. Where are alleyways accounted for?
    b. Make pervious pavement available in residential areas.
    c. Add pervious pavement to BMPs to transportation.
    d. Pervious – low to no treatment.
    e. Pervious pavement could be a BMP for most categories, and it should be an option instead of nearly exclusively using impervious pavement.
7. **Recommendations & concerns related to sizing/general approach**
    a. <u>Optimize for water quality as well as flow control</u>
    b. What performance standards will be used for sizing?
    c. Agricultural areas and low density urban areas won't affect flow in creeks – the problem is high density/urban/commercial land use
8. **Miscellaneous comments on BMPs to include**
    a. Consider green roofs in commercial settings.
    b. I don't see vegetative swales in the table – there should be greater utilization of BMPs in the table.
    c. Infiltration wells could be included – or underground detention.
    d. Filter units could be included, but they don't quite meet the categories of LID (e.g. there are no weep holes in the bottom of the box).

    e. I'd like to see green roofs included for medium/heavy urban and industrial settings – even barns etc in suburban agricultural land use areas.
9. Take information and put it into goals.
10. Are there limits on on-site inception and if so what are they?
11. Amended soil – cost to benefit ratio. Interim treatment step.
12. Operation and maintenance of septic systems.

Question #3: What are your thoughts about using the Natural Drainage Treatment Train and the Natural Drainage Treatment Train plus Grey Infrastructure? Do you agree with the approach, and if so, why? What are your suggestions?

1. **Comments on green vs. grey infrastructure**
    a. It would seem that using the combination of gray and green infrastructure would complicate scenario analyses. For instance, the green infrastructure benefit varies with how many are used, whereas the detention facility benefit varies with overall size.
    b. The group has reservations about calling the treatment train ~~"n~~natural." They think it should be called low impact development (LID).
    c. The preference for natural treatment trains seems to be the preferred alternative but it seems to be consensus that gray infrastructure will be needed in most applications.
    d. I agree. For retrofit, all available BMPs will be needed to achieve pollutant removal. In some instances, only ~~"g~~rey" BMPs will be feasible.
2. **Comments on wet and dry ponds**
    a. Wet ponds and dry ponds could be used across the land use categories; use these first, then go to grey infrastructure when necessary
    b. Are we modeling wet ponds?
    c. Would be interesting to model wet ponds.
    d. Design storm ponds per standards.
    e. Large ponds/sand filters for heavy urban retention.
    f. Add detention (wet ponds) to treatment train
3. **Comments on land use trains**
    a. Again could add pervious pavement to light and medium urban land use categories as well as transportation
    b. Add pervious pavement to other land use trains.
4. **Comments on BMP efficiencies/beneficial uses**
    a. Modifications of population density in relation to the best BMPs in urban areas vs. rural areas.
    b. Different BMP efficiencies for different land use trains.
    c. When it comes to retrofits, don't overlook replacing zinc with plastic drainpipes.
    d. Grey/sand filters save space because they can be vertical, thus achieving the same benefits in less space.
5. **Comments on how BMPs fit into two trains**
    a. Where do green roofs fit in?
    b. Under drains – include - for bioretention.
6. Most pollutants come from streets, not rooftops.
7. Critical and realistic for flood issues.
8. Private facility assumed failure: the cost of operating and maintenance safety factor.
9. Harvesting issue – stormwater intrusion into drinking wells.

Tamie: Does anyone want to sum up how the conversation went at their table, or share a highlight?

1. There should be a greater use of BMPs across categories
2. Cisterns/rain barrels – rename to small scale detention
3. Assumptions for how well BMP works should be different for different land use types

Tamie: Several other organizations have Stormwater Retrofit type of projects underway. We asked them to share a quick status overview.

Ecology's More Localized Cost Estimate for BMPs – Alice Lancaster and Rebecca Dugopolski on behalf of Ecology
Presentation covers SUSTAIN modeling goal of controlling toxics in streams, describes basis for basin selection & use of Soil Water Infiltration and Movement (SWIM) model instead of HSPF model. Their work has a greater water quality focus to optimize based on meeting acute and chronic water quality criteria. After making this determination, they determined cost structure and begun compiling a cost database to better modify cost assumptions based on BMP type.

USEPA SUSTAIN Projects, Scope, Findings, and Outcomes – Dino Marshalonis
WRIA9 is one of three USEPA projects using the SUSTAIN model. USEPA knows the SUSTAIN model has a steep learning curve, and has developed a sustain user group to connect grantees with those who are experienced with the model and all its nuances.

Tamie invites two meeting attendees to give a short informal summary of their related projects.
Hood Canal Coordination Council Project – Julie Horowitz
We are identifying, planning, and prioritizing watersheds related to water quality standards. Our project is a rural project.

Soos Creek Watershed Project – Dave Garland
We are trying to get TetraTech to finish the USEPA effort started in Sioux Creek – hopefully it will be informed by this effort. TMDL's should also be informed by this effort. There is mutual benefit from project interaction.

Other meeting attendees volunteer the following project information:

Stewardship Partners are encouraging rain gardens, and a model is being developed to build them in neighborhood clusters, with the idea being that individuals will be more likely to maintain them if they are involved in the early phases of their creation.

The City of Tacoma used the HSPF model to tie in the sediment data that we have gathered over the years to determine how much, if at all, street sweeping helps to protect the quality of stormwater runoff and sediment.