Proposed Marine Nearshore Sediment Quality Monitoring Options and Recommendations

by

Nearshore Status and Trend Monitoring Subgroup of the Stormwater Work Group

Jim Simmonds, Maggie Dutch, Jim West, Jennifer Lanksbury, Kim Stark, Jonathan Frodge, Tom Putnam, Heather Trim, Kit Paulsen, Tim Determan, Shayne Cothern, Karen Dinicola

September 2, 2011

The Nearshore Status and Trends Monitoring Subgroup of the Stormwater Work Group (Nearshore Subgroup) has begun to refine options and recommendations for implementing nearshore sediment quality monitoring. This monitoring will be a part of the regional stormwater monitoring program to be implemented as a component of the municipal stormwater NPDES permits and also as part of a comprehensive stormwater monitoring program.

1. The Nearshore Subgroup agrees that nearshore sediment quality monitoring is an important component of the monitoring program and continues to recommend that it be included in the regional monitoring program as a permit requirement.

2. The Nearshore Subgroup recommends that to best characterize nearshore sediment quality, the regional monitoring program should characterize the sediment quality triad of parameters, including chemical contamination, toxicity, and condition of sediment-dwelling invertebrates, from 0 to ~2 meters (1 fathom) MLLW within the Urban Growth Area (UGA).

3. The Nearshore Subgroup recommends that nearshore sediment quality monitoring occur once every five years.

4. The Nearshore Subgroup recommends that the sampling and analysis protocols closely mirror those currently conducted for the Puget Sound Assessment and Monitoring Program (PSAMP) for offshore sediments collected from > 2 meters depth. The nearshore sediment monitoring program will address the following objectives:

    a. Characterize the spatial extent of sediment quality inside the nearshore Urban Growth Area sampling frame.

    b. Track changes in sediment quality over time inside the nearshore Urban Growth Area sampling frame.

    c. Compare nearshore UGA sediment quality with offshore (i.e., > 2 m depth) sediment quality.

5. The Nearshore Subgroup recommends that sampling sites in the nearshore UGA sampling frame be randomly selected to allow for extrapolation of the results to the whole UGA sampling frame. A Generalized Random Tessellation Stratified (GRTS) spatially-balanced survey design,

developed by EPA (Stevens (1997), and Stevens and Olsen (1999, 2003, 2004)) and adopted for the PSAMP sediment monitoring program (Dutch, et al., 2009) is recommended for the nearshore sediment monitoring program. This design allows for characterization of the spatial extent of sediment quality in the nearshore UGA sampling frame, comparison of conditions with the deeper (>2 meter depth) PSAMP sediment sampling frame, and when resampled periodically, determination of change over time.

6. The Nearshore Subgroup recommends that 50 samples be collected and analyzed for the same suite of chemical, bioassay, and benthos parameters analyzed by Ecology's PSAMP sediment monitoring program. This sample size was determined and recommended for this design by EPA based on assumptions of the proportion of the data meeting established criteria with desired precision and confidence levels (see EPA sampling design website: http://www.epa.gov/nheerl/arm/surdesignfaqs.htm#samplesize50).

7. The Nearshore Subgroup recommends that the budget for the monitoring program be revised based on estimates necessary to implement the monitoring program as per the recommended design, including data analysis and report writing. Initial cost estimates from Ecology staff in the Environmental Assessment Program (EAP) are that the cost will include hiring 2 FTEs for a full year for each sampling event, plus other program costs. Some members of the Nearshore Subgroup have requested a cost estimate based on level of efforts needed for each task to implement the recommended program. If the project extends across multiple years, then the budget per year is to be estimated.

8. The Nearshore Subgroup identified three possible options for reducing the level of effort to minimize the cost of the recommended nearshore sediment quality monitoring program. It should be noted that none of these options are currently recommended. The three options, in our preferred order, include:

    a. Limit the analyte list to include grain size, total organic carbon, metals, and PAHs from 50 sites. Archive extra sediment from each site for possible future analyses of BNAs, Pest/PCBs, PBDEs, and other organic chemicals. Similarly, collect, rescreen, and store benthic samples, delaying sorting and taxonomic identification until additional funding is secured. Toxicity testing would be eliminated, as samples cannot be stored for long periods of time.

    b. Collect samples from 50 sites, but conduct the full suite of sediment quality triad analyses on only a portion of the sites (e.g., 40 or 30 "Tier 1" sites) to assess spatial extent of sediment quality measures and variability. Decide whether to analyze remaining sites ("Tier 2" sites) based on results from Tier 1 analyses. Again, toxicity testing would be eliminated, as samples cannot be stored for long periods of time.

    c. Conduct only chemical analyses on sediment collected from 50 sites. Eliminate collection of sediments for analysis of sediment toxicity and benthos.

9. The Nearshore Subgroup recommends that cost savings be estimated for the three possible options suggested above for reducing the level of effort for this sampling.

10. The Nearshore Subgroup recommends that funding be sought to complete generation of the new GIS sampling frame, populate the sampling frame with randomly generated sampling sites, prepare budgets for all sampling options, and prepare a Quality Assurance Project Plan for the monitoring program prior to finalizing the next municipal NPDES stormwater permit in July 2012.

11. The Nearshore Subgroup recommends that a sample draw occur, and sites be scouted in advance if necessary to identify all sampleable nearshore locations.

12. The Nearshore Subgroup supports efforts by the Stormwater Work Group, the Department of Ecology, the Department of Fish and Wildlife, and others to seek additional funding for more complete sampling of nearshore sediments, including sampling in the nearshore outside of the UGA, additional chemical parameters, and additional elevations (e.g., the intertidal).

REFERENCES

Dutch, M., V. Partridge, S. Weakland, K. Welch, E. Long. 2009. Quality Assurance Project Plan: The Puget Sound Assessment and Monitoring Program Sediment Monitoring Component. Washington State Department of Ecology Publication No. 09-03-121, 98 pp.

Stevens, D.L., Jr. 1997. Variable density grid-based sampling designs for continuous spatial populations. Environmetrics, 8, 167-95.

------ and Olsen, A.R. 1999. Spatially restricted surveys over time for aquatic resources. Journal of Agricultural, Biological, and Environmental Statistics, 4, 415-28.Page 58

------. 2003. Variance estimation for spatially balanced samples of environmental resources. Environmetrics 14:593-610.

------. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99:262-278.