



SPR Quarterly Progress Report
October 1, 2008 through December 31, 2008

Date January 5, 2009

TO: Technical Advisory Committee Members:

Miguel Estrada, ODOT
Michele Eraut, FHWA
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FROM: Matthew Mabey, Research Coordinator (ph: (503) 986-2847)

1. Project

Copper Toxicity and ESA Listed Salmon
SPR # 663

2. Key Dates

Start Date for ODOT: September 10, 2007
Completion Date for ODOT: October 31, 2009

3. Principal Investigator

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4. Progress

- During the last quarter, we installed a continuous monitoring site on Hwy 20 just north of Corvallis. The site consists of an automated sampler and a rain gauge. The sampler is installed in an HDPE enclosure anchored to a concrete pad. Stormwater is collected from a 12 inch outfall pipe that discharges to Dixon Creek just upstream of the Willamette River. The flow rate of stormwater is measured using the combination of a bubbler flow meter and a v-notch weir installed inside the pipe.
- Over the past three months, we collected 4 grab samples and 3 composite samples from the Corvallis site. The grab samples were collected before the automated sampler was fully installed. For each storm after the installation, discrete, 1 liter

samples were collected throughout each storm based on flow. Upon collection, aliquots of the discrete samples were used to generate a flow-weighted composite sample. We have performed water quality analysis on both the composite samples and a selected set of the discrete samples to investigate how the water quality varies during the storm. For the last two storms, we set up the sampler to collect a first flush sample in addition to the discrete, flow-paced samples. Each of these samples has been analyzed for everything except copper speciation. As described below, we are still working on perfecting the analytical method.

- We also received and analyzed samples from the sites managed by Herrera. We analyzed 4 composite samples from the I-5 site and 2 composite samples from the Wemme site. Again, we have performed all water quality analyses with the exception of copper speciation via voltammetric titration. Overall, comparisons of values determined by Herrera's analytical lab and our work match up well. There were a few discrepancies that we are currently looking into.
- We have continued to work on perfection of the analytical method for determining ionic copper concentration and copper speciation using the voltammetric technique. As indicated in the last report, we had narrowed in on a promising set of operational conditions. The sensitivity of the analytical method is greatest at pH values greater than approximately 7.8. However, samples that we have received are typically in the 6.8-7 range. In an effort to ensure that the results from these analyses are representative of actual conditions, we are currently investigating some modifications of the technique to allow the measurements to be made at pH values closer to the ambient levels we have found in actual samples. Because we are limited with respect to the sample volumes that we have from each storm, we have frozen the remaining samples and have chosen to perfect the method prior to making these measurements.
- Based on the data collected to date, we are able to draw some preliminary conclusions related to copper in stormwater. (1) There does appear to be significantly higher concentrations of copper (total and dissolved) in the stormwater runoff from the I-5 site compared with the Corvallis and Wemme sites. The average annual daily traffic (AADT) at the I-5 site is approximately 130,000 where the AADT is 10-12,000 at Corvallis and Wemme. There is also the urban/rural distinction between I-5 and the other two sites (more so for Wemme). (2) There also appears to be a higher concentration of hardness, alkalinity, and TSS at the I-5 site when compared to the Corvallis and Wemme sites. We believe that these differences in the concentrations of competing cations and complexing anions will have an effect on copper speciation. (3) There does not appear to be a significant difference in the concentration of dissolved organic carbon (DOC) between sites. Again, with DOC likely being the primary ligand complexing copper, this trend suggests that the total dissolved copper may play a large part in determining the ionic copper concentrations. (4) In the storms where we have collected multiple samples and first flush samples, it does appear that there is a first flush phenomenon with respect to many constituents including copper (total and dissolved), hardness and dissolved organic carbon.

5. Problems

- As stated above, we are still working on perfecting the analytical method and as such, we have not made any measurements of copper speciation from the collected stormwater. This has continued to be the most challenging part of this work and has taken longer than expected. However, we are continuing to make progress and hope to have this finalized in the coming months.
- We have had some trouble with accurately measuring low flow rates using the automated sampler/bubbler flowmeter. We are currently looking into solutions to this problem.
- We had a battery die during the last rainstorm prior to Christmas. As such, we were not able to collect any data from that storm. This was unfortunate, but it is likely that the data would have been difficult to interpret as that storm turned to snow shortly after it started.

6. **Work Planned for Next Quarter**

- Continued collection and analysis of samples from the continuous site in Corvallis, along with the three sites operated by Herrera. Already this year we have received a sample from the Wemme site and one from the Bend site.
- Finalization of the testing and calibration of the voltammetric technique for measurement of copper speciation.
- Continued analysis of the data and preliminary writing of the project report
- Preliminary equilibrium modeling using the bulk water quality characteristics measured at the four sites. This task has been pushed back due to the continued work on the experimental measurement of copper speciation. Model predictions will be compared with speciation measurements when completed

7. **Finances** SPR Project Summary

VENDOR	FY'08	FY'09	FY'10	FY11	TOTALS
ORIGINAL BUDGET	\$ 120,000	\$ 240,000	\$ 28,000		\$ 388,000
REVISED BUDGET	\$ 89,592	\$ 180,846	\$ 117,766		\$ 388,204
EXPENDITURES - VENDOR	\$ 89,592	\$ 31,528	\$ -	\$ -	\$ 121,120
BALANCE	\$ -	\$ 149,318	\$ 117,766	\$ -	\$ 267,084

ODOT	FY'08	FY'09	FY'10	FY11	TOTALS
ORIGINAL BUDGET	\$ 4,000	\$ 5,000	\$ 3,000		\$ 12,000
REVISED BUDGET	\$ 5,044	\$ 5,000	\$ 3,000		\$ 13,044
EXPENDITURES - ODOT	\$ 5,044	\$ 740	\$ -	\$ -	\$ 5,784
BALANCE	\$ -	\$ 4,260	\$ 3,000	\$ -	\$ 7,260

PROJECT	FY'08	FY'09	FY'10	FY11	TOTALS
ORIGINAL BUDGET	\$ 124,000	\$ 245,000	\$ 31,000	\$ -	\$ 400,000
REVISED BUDGET	\$ 94,636	\$ 185,846	\$ 120,766	\$ -	\$ 401,248
EXPENDITURES - PROJECT	\$ 94,636	\$ 32,268	\$ -		\$ 126,904
BALANCE	\$ -	\$ 153,578	\$ 120,766	\$ -	\$ 274,344