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DRAFT MEMORANDUM

Date: **February 29, 2000**

To: **Keith Smith**

From: **Todd Pollard / Linda Logan**

Subject: **Summary of evidence demonstrating the absence of impacts to Miller and Des Moines Creeks from STIA stormwater**

cc:

Project Number: **556-2912-001 (61)**

Project Name: **Port of Seattle**

The purpose of this memorandum is to describe the testing and monitoring of STIA stormwater conducted thus far and to provide reasonable assurance that stormwater from STIA does not and will not impact aquatic life in Miller and Des Moines Creeks. The testing and monitoring can be divided into three categories, each demonstrating that impacts from STIA stormwater are unlikely. In summary these are:

1) Whole Effluent Toxicity (WET) testing on STIA SDS outfalls has demonstrated a lack of acute toxicity in three of four discharges tested. The source of toxicity identified for the one outfall has been traced and the Port is pursuing source control measures.
2) Water Effect Ratio (WER) range-finding studies determined the approximate magnitude of a WER using simulated site water samples. Based on nominal concentrations for total copper, copper WERs for Miller, Walker and Des Moines Creeks were approximately 16, 7, and 15, respectively. These data demonstrate the mitigating effects of receiving water on the toxicity of copper.
3) Metals monitoring of Miller and Des Moines Creeks downstream of the SDS outfalls during a storm event on January 14, 1999 shows that concentrations of copper fall below water quality criteria and often below detection limits.

These three categories are described in more detail below.

Whole Effluent Toxicity

During 1998 and 1999, the Port of Seattle conducted acute toxicity testing on four SDS outfalls using the water flea (*Daphnia pulex*) and the fathead minnow (*Pimephales promelas*). This testing, required by Section S10 of the Port's NPDES permit for STIA, was conducted on stormwater entering Miller and Des Moines Creeks (i.e. not diluted by creek water). The four outfalls tested, SDS1, SDN4, SDS3, and SDE4, account for 68% of the SDS service area.

Stormwater from outfalls SDS3 and SDN4 was tested during two storm events. Stormwater from outfalls SDN1 and SDE4 was tested during four storm events.

Overall, results of WET testing on outfalls SDS3, SDN4, and SDE4 demonstrate a lack of acute toxicity. While the summation of testing conducted on outfall SDE4 clearly characterizes this discharge as non-toxic, it should be noted that one of eight tests resulted in 63% survival for undiluted sample, just below the minimum performance standard of 65% survival for a single test. Although the results from outfall SDN1 demonstrate toxicity, as described below, the source of toxicity has been traced to metals, primarily zinc, leaching from galvanized sheet metal rooftops.

In May 1999, following three rounds of testing which confirmed toxicity in outfall SDN1, source tracing studies were developed and conducted to identify the toxicant(s) causing toxicity and its source. Because SDN1 had shown higher zinc concentrations than other outfalls, further WET tests were designed to determine if this or other metals were responsible for the toxicity. Toxicity tests using only daphnids, which were most sensitive to SDN1, were conducted on SDN1 stormwater both with and without metal chelating chemicals. Metals chelation, which chemically removes free metals from solution, identifies metals toxicity by a reduction in effluent toxicity when chelating chemicals are present. Results of these tests demonstrated a marked reduction in toxicity when treated with metal chelating chemicals. When compared to the literature, the results of this testing specifically indicate zinc as the source of toxicity in SDN1. The Port is currently pursuing several source control measures. (PORT, DO WE HAVE AN UPDATE ON THIS)

Water Effect Ratio: range finding study

The toxicity of metals, including copper, is highly dependent upon the bioavailability of free metal ions to aquatic organisms. Because hardness, total organic carbon (TOC), and other parameters which affect bioavailability, are generally different in receiving water than in lab water, the toxicity of metals in receiving water and lab water is consequently different. A Water Effect Ratio (WER) study uses toxicity tests to evaluate the relative toxicity of, in this case, copper-spiked site water compared to copper-spiked laboratory water. The ratio of these results is used to adjust the state water quality criterion, which is based on copper-spiked laboratory tests.

On 23 February 1999, receiving water samples from Miller, Walker and Des Moines Creeks were collected during a storm event. In addition, storm water discharge from SDS3 was collected. In the laboratory, the SDS3 storm water sample was diluted with the receiving water samples to represent the concentrations that would be expected in the streams based on flows. These mixtures represented the hypothetical site waters that would exist after the construction of the third runway.

To determine the approximate magnitude of the WERs, range-finding WER studies were conducted using the simulated site water samples and sensitive daphnid species. The objective was to determine if the final WERs would be robust enough to warrant the expense of conducting definitive studies. The range-finding studies consisted of concurrent acute toxicity tests with copper-spiked site water and copper-spiked laboratory water. Unlike a definitive WER study, exposure concentrations were not analytically verified, and the resulting LC50s were based on nominal concentrations only. Although this approach does not fulfill the requirements associated with proposing a site-specific criterion to the state and federal agencies, it does provide an inexpensive estimate of the magnitude of the WER that would be obtained from a definitive study. Based on nominal concentrations for total copper, copper WERs for Miller, Walker and Des Moines Creeks were approximately 16, 7 and 15, respectively. These data clearly show that the

combination of stormwater and creek water reduce the bioavailability and toxicity of copper to sensitive aquatic organisms.

Metals Monitoring

During preliminary WER studies, samples were collected from SDS3, as well as Miller, Walker, and Des Moines Creeks during a storm event and analyzed for copper. (Port, should we include a map showing the sampling locations) In all samples collected, total and dissolved metal concentrations fell below water quality criterion, which is based on dissolved copper, and often fell below the practical quantitation limit (PQL). Since, the dissolved fraction of copper is less than or equal to the total copper concentration, the readings below conservatively represent the in-stream copper concentration. (Port, do we want to tabulate and present the data here?)

Stormwater from outfall SDS3 resulted in the highest total copper reading of 3.6 µg/L with a dissolved fraction that fell below the PQL. The next highest total copper reading (3.3 µg/L) was found in the east branch of Des Moines Creek which does not receive any stormwater from STIA. Total copper concentrations in the west branch of Des Moines Creek, into which SDS3 discharges, were below the PQL. The implications of these results are two-fold:

1) Metals concentrations found in stormwater outfall SDS3 are diluted upon entering Des Moines Creek to levels below the PQL.

2) Non-airport water sources flowing into the east branch of Des Moines Creek exhibit metals concentrations comparable to SDS3 stormwater. (Port-need to discuss further)

CONCLUSIONS

- Whole Effluent Toxicity (WET) testing has demonstrated that three of the four outfalls tested are not toxic to sensitive aquatic organisms.
- Toxicity detected in outfall SDN1 has been traced to uncoated galvanized roofs and will be controlled. Once this source of toxicity is eliminated, SDN1 stormwater is not likely to cause toxicity to sensitive aquatic organisms.
- Water Effect Ratio (WER) range-finding studies demonstrated that copper toxicity in a mixture of stormwater and receiving water is significantly reduced when compared to copper toxicity in laboratory water. Therefore, the water quality criterion, which is based on tests in laboratory water, is conservative for this discharge.
- Metals monitoring in stormwater and receiving water have demonstrated that metals concentrations detected in the SDS discharge do not persist upon entering and mixing with the receiving stream. Indeed, in many cases, the metals could not even be detected.