POLLUTION CONTROL HEARINGS BOARD
FOR THE STATE OF WASHINGTON

PUGET SOUNDKEEPER ALLIANCE, Petitioner, v. STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY, And SEATTLE IRON & METALS CORP., Respondents.	)))))))))))))))	PCHB No. 13-137c FIRST DECLARATION OF ALLAN B. CHARTRAND

I, Allan B. Chartrand, certify and declare under penalty of perjury of the laws of the Washington and the United States that the following to which I am competent to testify:

Qualifications and Experience

1. I am an independent consulting toxicologist, environmental scientist, and an expert in the subject area of environmental fate and effects of PCBs in the aquatic environment as well as related regulatory requirements for PCBs. I provide consulting services in the area of

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toxicology, risk assessment, water quality, and contaminated sediment. My current CV is attached as Attachment 1.

2. I received a Bachelor of Science degree from the University of California, Berkeley, in entomology in 1978 and a Master of Science in Public Health degree in toxicology from the University of California, Los Angeles, in 1982. I was awarded a Pre-Doctoral fellowship in 1982 from the Rotary Foundation International and performed research toward a Doctorate in toxicology at the Hebrew University in Jerusalem, Israel, but did not complete this degree.

3. Since that time I have been continually practicing professionally in the field of toxicology and risk assessment, frequently in a consulting capacity, specializing in ecotoxicological effects of environmental contaminants to fish, wildlife, and within the aquatic and marine environment in general, emphasizing surface water, sediment, and biological tissue. I have been practicing in this field of expertise for well over 30 years. I have consulted on behalf of both industrial and government clients, conducted numerous human health and ecological risk and hazard assessments, and evaluated potential environmental effects associated with exposure to a wide range of contaminants, including toxic metals such as mercury, tributyltin, copper, zinc, lead, arsenic, and many others. I have also conducted risk assessments and toxicity evaluations for nutrients such as nitrates and ammonia and for a variety of pesticides such as phenoxy herbicides, DDT and related compounds, organochlorine and organophosphate insecticides, rodenticides, and herbicides. I have also been involved with many projects related to PCBs, dioxins/furans, persistent organic pesticides, including Agent Orange, and numerous other persistent, bioaccumulative, and toxic (e.g. PBT) compounds. I also have very extensive

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project experience with other organic contaminants such as VOCs, PAHs, and various petroleum derivatives.

4. Earlier in my career (during the 1980's) I also served as a State water quality regulatory scientist for the Los Angeles Regional Water Quality Control Board in California, and this background provided me with valuable experience and allowed me to develop expertise in the areas of water quality and contaminated sediment permitting and regulations, as well as the scientific thinking and rationale behind many of these regulations. I was also an active participant in the Puget Sound interagency regulatory effort on contaminated sediments known as the Puget Sound Dredge Disposal Analysis (PSDDA), which has served as the technical and scientific foundation for establishing enforceable sediment quality standards in Washington State, which directly led to the promulgation of the Washington State Department of Ecology's (Ecology) Sediment Management Standards (SMS, found at WAC 173-204) in 1991. I also served as an expert witness on behalf of the US Department of Justice and National Oceanic and Atmospheric Administration (NOAA) in the Montrose Chemical DDT trial during the early 2000's, testifying in matters relating to toxicity, bioaccumulation, regulations, and environmental fate and transport of DDT, and secondarily of PCBs, within the Southern California Bight.

5. As a result of my expertise and years of experience as a practicing toxicologist I became eligible under the requirements of the American Board of Toxicology (ABT) to sit for the written examination to become a Diplomate (DABT). I passed this exam in 1997 and became certified as a Diplomate, which requires a comprehensive level of understanding of toxicological principles, and confers a high level of legitimacy and peer acceptance to a practicing professional toxicologist.

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Summary of Opinions

6. I have performed an independent analysis on the Seattle Iron & Metals (SIM) treated wastewater effluent and untreated stormwater runoff (subject to numeric effluent limitations in conditions S1.A and S1.B of SIM's current NPDES permit No. WA0031968, respectively) with regard to their discharge to the Lower Duwamish River/Waterway (LDW) in Seattle, Washington, with a particular focus on PCBs and selected metals in these discharges. For the wastewater effluent I have focused on adverse effects to sediment quality, the receiving water environment of the LDW, and the appropriateness of a mixing zone for PCBs under the provisions of the federal Clean Water Act (CWA) and Washington State Department of Ecology's (Ecology) regulations on sediment source control (WAC 173-204 Part IV) and mixing zones (WAC 173-201A-400). For the untreated stormwater discharges my analysis has focused on the reasonable potential that PCBs, as well as copper, mercury, and zinc, in stormwater discharges would cause or contribute to violations of water and/or sediment quality standards in the LDW.

7. My analysis has led me to the following opinions: (1) that SIM's treated and untreated wastewater discharges containing PCBs and other contaminants are likely to cause or contribute to violations of sediment management standards (SMS) and other applicable sediment guidelines; (2) that elevated PCBs in these waste streams are likely to cause or contribute to elevated PCB concentrations in biological tissue, including edible species of fish and shellfish in the LDW; (3) that, with regard to PCBs in the treated wastewater discharge, none of the available information indicates that the mixing zone granted by Ecology "would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing

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or characteristic uses of the [LDW], result in damage to the ecosystem, or adversely affect public health" [WAC 173-201A-400] and in fact, such deleterious effects are a likely result of the mixing zone's effects of increasing the allowable discharges of PCBs by a dilution factor of up to 30.2; and (4) that the PCBs, copper, mercury, and zinc contained in SIM's untreated stormwater discharge are reasonably likely to cause or contribute to violations of applicable water and/or sediment quality standards in the LDW.

Environmental Characteristics of and Regulatory Standards and Guidelines for PCBs

8. The key environmental properties of PCBs, including fate, transport, and effects, have been very well characterized over many years, and the toxicity, bioaccumulation potential, and persistent nature of these compounds have led to a US ban since 1979. PCBs are unique and distinct from other pollutants in that they exhibit a wide range of both short- and long-term adverse environmental effects to aquatic biota, terrestrial wildlife, and humans. They are highly persistent, resistant to weathering and biodegradation (environmental half-lives in sediment and tissue often requiring decades), and highly prone to bioaccumulation in biological tissue. In addition, PCBs are well known to undergo *biomagnification* throughout a food web, which occurs when PCB residues "magnify" or increase with each successive trophic level within a food web, and that a top predator (e.g. bald eagle, seal, orca, or other predator) would harbor and accumulate PCB tissue concentrations that are increasingly higher than those found in lower trophic levels. Few environmental contaminants have actually been shown to biomagnify, and PCBs are among those few. Biomagnification is a significant and highly adverse environmental

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process because it substantially contributes to human health and ecological risks presented by concentrating tissue residues at the highest levels of a food web via trophic transfer.

9. *Partitioning* of PCBs is of paramount importance to the environmental fate and effects of PCBs because partitioning determines what media harbor the PCB residues and the exposure pathways for bioavailability and toxicity to various organisms, including humans. As relates to the SIM discharges to the LDW, partitioning occurs when PCB residues, whether dissolved in water or sorbed (attached) to particulates in the waste stream, enter the receiving waters, and because of their hydrophobic nature, adsorb to organically enriched (i.e. carbon-containing) substrates such as suspended particulates or bottom sediments, or accumulate within biological tissue of marine biota, terrestrial wildlife, and even within human tissue. To measure this propensity for partitioning, the most standard and widely accepted partition coefficient is represented by K_{ow}, the octanol-water partition coefficient. PCBs exhibit a range of log K_{ow} values of approximately 10^{-5} to 10^{-8}, depending on the degree of chlorination, signifying that these compounds strongly preferentially partition to lipid or organically-enriched substrates such as biological tissue and suspended or bottom sediments by a factor of tens of thousands to more than a million. This partitioning takes places in preference to simply dissolving in water (hence the term "hydrophobic").

10. Similar to the K_{ow} coefficient, K_{oc} is an important partition coefficient used to calculate the propensity of PCB residues sorbing to the organic carbon fraction in sediments, and was used to derive the "organic carbon-normalized" SMS values found in WAC 173-204 Part III. PCBs are soluble only in the range of about 30 to 170 µg/L (ppb) concentrations, depending on the degree of chlorination (see Table 4-3 on page 453 of ATSDR 2000). This range is

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regarded as "low solubility" to further underscore the hydrophobic nature of PCBs, and are strongly prone to partition to solid and organically enriched substrates. This is very important to understanding sediment contamination, exposure, and toxicity. A general published range (e.g. in ATSDR 2000; see Tables 4-3 and 4-7, pages 453 and 466, respectively) of log K_{oc} values for PCBs is about 10^{-4} to 10^{-7} (depending on the degree of chlorination), which is highly consistent with measured K_{ow} values and clearly underscores the strong propensity to adsorb to organically enriched sediments.

11. Because PCBs have been discharged from many sources to the LDW over the course of many years in large quantities, elevated biological tissue concentrations in fish, shellfish, wildlife, and even human consumers of fish and shellfish are prevalent, and adverse environmental effects (toxicity) are known to occur in organisms where such elevated concentrations of PCBs occur. This tendency to partition into living aquatic organisms via passive accumulation and/or dietary intake is measured by bioconcentration and bioaccumulation factors (BAF/BCF). In contrast, due to chemical composition, many other organic contaminants such as volatile organic compounds (VOCs), polyaromatic hydrocarbons (PAHs), and other contaminants are not nearly as prone to bioaccumulation or biomagnification. This characteristic makes PCBs especially problematic in the aquatic environment, as these compounds can persist for decades and cause a wide range of toxicity associated with prolonged exposure to PCB residues. Compounds such as PCBs are classified as persistent, bioaccumulative, and toxic (PBT) compounds; characteristics that have strong implications for water quality and mixing zone requirements, as discussed in detail below.

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12. In addition to exhibiting properties that are bioaccumulative, prone to biomagnification, and highly environmentally persistent, PCBs are both acutely and chronically toxic to aquatic life, terrestrial wildlife, and humans. Abundant toxicological research (e.g. summarized in Hayes 1994, Rand and Petrocelli 1985, ATSDR 2000) suggest that in addition to lethality that has been well documented in aquatic organisms, that growth, reproductive function, and other sublethal effects occur as a result of short- and long-term exposure to PCBs in the aquatic environment. In mammals, neurotoxicity, immunotoxicity, endocrine disruption, and developmental (i.e. birth defects initiated *in utero*) toxicity have been documented, and these effects of PCBs are important to understanding short- and long-term effects in the environment. PCBs are also suspected carcinogens to humans based on mostly animal-based toxicological evidence, and have been classified by EPA at "probable human carcinogens".

13. Key environmental regulatory criteria and standards have been developed for PCBs which are reflective of the acute and chronic toxicity, persistence, and bioaccumulation potential discussed above. Ambient marine water quality criteria (AWQC) for PCBs of 10 µg/L and 0.03 µg/L have been developed and adopted by Ecology (WAC 173-201A-240) for acute and chronic exposure, respectively, for protection of marine aquatic life based on direct acute and chronic toxicity (i.e. as opposed to bioaccumulation).

14. Acute and chronic AWQC values for protection of aquatic life have been developed for key trace metals as well. Three key metals of concern for SIM discharges are copper (acute and chronic AWQC of 4.8 and 3.1 µg/L, respectively), mercury (1.8 and 0.025 µg/L), and zinc (90 and 81 µg/L) (WAC 173-201A-240). These values are all reflective of significant potential toxicity to aquatic and marine organisms. Similarly, WAC 173-240-320

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provides the most applicable sediment quality standards (SQS) for these metals of concern, which are 390 mg/kg, 410 mg/kg, and 0.41 mg/kg for copper, zinc, and mercury, respectively.

15. Because of the bioaccumulative nature of PCBs, a much more stringent National Toxics Rule (NTR; found at 40 CFR Part 131.36) AWQC value has been promulgated, developed as a human health criterion based on human seafood consumption. This ambient water quality criterion is 0.00017 µg/L (170 ng/L), a back-calculation reflecting the tendency for PCB residues to partition from seawater into edible fish and shellfish tissues and potentially cause cancer to a human consumer during a lifetime. This value is the most appropriate water quality value for protecting human health from consumption of PCB residues in fish and shellfish, but is not necessarily reflective of toxicity to aquatic life or sediment quality issues.

16. Regarding equivalent standards for PCBs in bottom sediments, in light of the well-established fact that PCBs partition preferentially to sediment as a function of organic enrichment, Ecology (2013; at WAC 173-204) has promulgated enforceable Sediment Management Standards (SMS) based on carbon-normalized concentrations, reflecting PCB partitioning behavior as a class of non-polar, hydrophobic organic compounds. The most relevant SMS value (i.e. Sediment Quality Standard) for the protection of benthic organisms is 12 mg PCBs per kg of organic carbon (mg/kg-oc; WAC 173-204-320[c]). However, use of this value requires that total organic carbon (TOC) be measured in sediment concurrently with the PCB analysis to allow for the carbon-normalized calculation; TOC analysis is not always done and is lacking in much of the data pertaining to SIM. Therefore, EPA and Seattle Public Utilities used the PCB Lowest Apparent Effects Threshold (LAET) of 130 µg/kg dry weight (dw) to evaluate source tracing data at SIM without the need for carbon-normalization (EPA Region 10

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2010) (discussed further at ¶41). The LAET is based on effects to benthic organisms. Subsequently, an LDW-specific dry weight-based Remedial Action Level for total PCBs of 240 µg/kg dw was derived from the SQS (LDWG 2012). EPA, Ecology and SIM used this RAL for evaluation of sediment data adjacent to SIM (discussed further at ¶44).

17. In addition to the SQS, LAET, and RAL sediment quality values discussed above, which are intended to protect benthic organisms, EPA set a sediment Preliminary Remediation Goal (PRG) for total PCBs in LDW sediments for protection of human health via the seafood consumption pathway. This more stringent PRG is 2 µg/kg dw (cited on Table 8, page 46 of EPA (2013)). All of these dry-weight based sediment quality guidelines are useful for comparing PCB concentrations in LDW sediments when TOC data is unavailable for carbon-normalization. As discussed below, sediment data collected at and adjacent to SIM generally exceeds all of these various sediment quality guidelines.

18. The most appropriate biological tissue guideline for protection of human health is the National Toxics Rule (NTR) guideline (found at 40 CFR Part 131.36) of 5.3 µg/kg (ppb) wet weight for edible fish tissue, further discussed in ¶23 of this Declaration.

PCBs in the Lower Duwamish Waterway (LDW)

19. The LDW, approximately 5.5 miles in length, was listed in 2001 under the EPA's National Priorities List and classified as a Superfund site (EPA 2013), and is under a joint order with Washington's Model Toxics Control Act (MTCA). The LDW is the current subject of an injury assessment under NOAA through Natural Resource Damage Assessment (NRDA) regulations (Section 301[c] of CERCLA), which stipulate that key ecological "services" and benefits have been damaged due to waterway contamination. As a consequence of this wide

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range of impairment to this water body and as part of the Superfund cleanup effort, Ecology developed a Source Control Strategy for the LDW (Ecology 2004), which mandates that recontamination of the waterway be reduced and eliminated to the extent possible through stringent source control measures.

20. In summary, abundant environmental data over the course of more than 20 years have documented elevated PCBs in LDW surface water, bottom sediments, and fish/shellfish tissue, collected under CERCLA, MTCA, NRDA, CWA 303(d) listing studies, discharge monitoring requirements, issuing the DOH seafood consumption advisory (further discussed in this Declaration at ¶23), and numerous other data collection efforts. This data makes clear that the LDW has a serious sediment contamination issue, with PCBs among the most significant of contaminants, including a primary threat from this contamination to human health issues associated with seafood consumption from the Waterway. Overall, these surveys are significant in terms of understanding SIM's potential contributions to known exceedances of Ecology's SMS values, the PCB RAL value developed for the LDW, and/or other guidelines or standards.

21. PCBs in sediments and biological tissue have been well characterized throughout the waterway, and significant sediment PCB data has been collected in the vicinity of the SIM outfall as well. Several sections of the LDW, comprising most of its length, have been 303(d) listed for impairment based on exceedances of PCBs, PAHs, mercury, other metals, phthalate esters in sediments, bioassay tests, and violations of PCB fish tissue criteria as well (Ecology 2012). EPA Region 10 (2013) reported that from 1,504 surface sediment samples from the LDW Superfund site, the mean concentration of total PCBs in the Waterway is 2,000 µg/kg dw, which

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was compared against the LDW-specific RAL value for PCBs of 240 µg/kg dw, showing very extensive areas of exceedance along the waterway.

22. A number of investigations have been conducted over the years to address the issue of potential toxic effects of PCBs to marine life, much of it in the LDW. For example, Johnson *et al.* (2007) and Stein *et al.* (1995) documented elevated concentrations of PCBs in tissues of outmigrant juvenile as well as adult salmonids in excess of a proposed NOAA guideline for PCBs (Meador *et al.* 2002) of 2,400 ng/g (ppb) lipid. Cullon *et al.* (2009) documented elevated PCBs in adult Chinook salmon returning to the LDW, as well as in Chinook smolt tissue. It was reported that nearly all fish, including flatfish and Pacific herring, monitored in the LDW exceeded the NTR guideline (found at 40 CFR Part 131.36) of 5.3 µg/kg wet weight for edible fish tissue cited in ¶18). PCBs were also found to be elevated in osprey eggs of the LDW (Johnson *et al.* 2009). These data were addressed in a Puget Sound Partnership report which identified PCBs in tissue as an important "dashboard" indicator for Puget Sound (PSP 2011). A hazard evaluation conducted by Ecology and King County as part of loading estimates documented ecotoxicological effects of PCBs to aquatic life, and bird and mammalian species (heron, osprey, otter, seal) as well within the LDW watershed (Ecology/King County 2011). Another example is the recent baseline ecological risk assessment performed by the Lower Duwamish Waterway Group (LDWG 2007), which also analyzed biological data from the waterway and documented PCB-related risks to various resident species. This body of data strengthens the general conclusion that the waters of the LDW are contaminated and impaired, that resident species of fish, wildlife, and other biota are affected, and that PCBs are a major contributor to this impairment and to degraded beneficial uses of the waterway.

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23. In fact, PCBs have been so consistently elevated in fish and shellfish tissue throughout the Waterway, that the Washington State Department of Health collaborated with the federal Agency for Toxic Substances and Disease Registry (WDOH-ATSDR 2005) to develop a seafood advisory for the LDW in which they recommend no consumption of resident fish or shellfish due to elevated tissue concentrations of PCBs (ranging up to 4,667 µg/kg wet weight [ppb ww], or nearly 5 ppm, in hepatopancreas tissues of locally caught Dungeness crab (see page 6, Table 1 of WDOH-ATSDR 2005). As a point of comparison, the recommended NTR edible tissue guideline is 5.3 µg/kg ww (see discussion at ¶18), and a Canadian tissue guideline for PCBs developed for protection of the endangered Orca is 50 µg/kg ww. This WDOH seafood consumption advisory is especially important because it clearly shows that the LDW does not support the beneficial designated use of seafood (i.e. fish, crabs/shellfish) harvest and consumption.

24. The seafood consumption advisory encompasses a wide range of human consumer groups ranging from tribal and other subsistence fishers to more recreational urban fish consumers. Another key reason that this advisory is significant within the LDW is that the Green River watershed, for which the LDW is the lower reach, has historically served as a tribal "usual and accustomed" fishery, and the US federal government has determined that the tribes must retain a treaty-protected fishery and access to edible fish and shellfish from this historically significant estuary.

25. In addition, several resident salmonid species have been listed as Threatened or Endangered (T&E) species by the federal government (administered and enforced by NOAA's National Marine Fisheries Service; see NOAA DARRP [NOAA 2009]). This includes an

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important requirement not only to protect the vulnerable species themselves, but to protect their habitats as well. There is an intersection between the ESA, developed to protect vulnerable species, and the need to protect edible fish and shellfish for human consumption.

26. The preceding discussion clearly establishes that the water, sediment quality, and resident species of the LDW have been compromised by the presence of PCBs and that designated beneficial uses are not currently attained, including the reach of the LDW where the SIM facility is located (between RM 2.3 and RM 2.6).

SIM Treated and Untreated Discharges to LDW

27. This section discusses the role that SIM's surface water discharges, with particular emphasis on PCBs and selected metals in these discharges, have on the LDW and concludes that SIM's treated and untreated wastewater and stormwater discharges have contributed and continue to contribute to deleterious effects on water quality, sediment, and biological tissue in the LDW.

28. As discussed above, PCBs are water soluble only at relatively low (ppb) concentrations (i.e. are hydrophobic), and have a propensity to partition and sorb to colloidal substances and/or organic matter in effluent and receiving waters. Total Suspended Solids (TSS) is regarded as a representative parameter for addressing partitioning in wastewater effluent, and the general rationale for the TSS effluent limitation in treated wastewater (condition S1.A) in SIM's permit is to reduce the amount of particulates present in the effluent to which PCB residues would adhere, thus ostensibly reducing the likelihood that PCBs could be discharged to LDW receiving waters. However, there is no evidence that Ecology considered or analyzed partitioning in establishing the 10 mg/L limit for TSS, but rather supposes only that low solids

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(as represented by the 10 mg/L limitation) limits the presence of particulate material to "settle out" to bottom sediment following discharge to the LDW.

29. Ecology's position that the 10 mg/L TSS effluent limitation on the wastewater effluent is adequate to ensure that discharges do not contribute to unacceptable sediment contamination lacks a scientific basis, is arbitrary, and is not relevant to the known partitioning behavior of PCBs. In fact, no correlation between TSS and PCB concentrations is evident from the treated wastewater effluent monitoring results submitted by SIM (see Attachment 3). Even before discharge to the LDW, the treated wastewater effluent subject to the TSS S1.A effluent limitation will comingle with other waste streams such as untreated stormwater from the facility and the surrounding city streets, all of which is combined in the single pipe leading to the sole regulated outfall to the LDW. These other streams have much higher TSS levels as evidenced by SIM's DMRs for the roofs/parking lot untreated stormwater discharge, thus rendering the regulated TSS level of 10 mg/L ineffectual once the treated waste stream becomes comingled in the pipe.

30. Once the comingled effluent is discharged to the receiving waters of the Waterway, PCBs are likely to partition to sediments, especially those that are organically enriched, and to biological tissues (fish, shellfish, and other biota), which are high in lipids, rather than to remain entrained in the water column. Although stratification in the water column does occur in the LDW, the force of tides, current, winds, and other factors result in eventual vertical and horizontal mixing of constituents present in effluent with the receiving waters of the LDW. Even where stratification is present, it does not prevent PCBs from sorbing to particulates and settling out into sediments.

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31. A review of SIM's discharge monitoring reports (DMRs) was conducted to support my evaluation of the potential for PCBs and selected metals to cause or contribute to deleterious effects in the LDW. Attachments 2 and 3 are summaries of selected DMR monitoring data (showing copper, zinc, TSS, total PCBs (where available), and effluent flow) from the SIM treated wastewater discharge (subject to Condition S1.A effluent limitations) from 2010 to September 2013 (Attachment 1) and October 2013 to August 2014 (Attachment 2). Data shown on Attachments 2 and 3 clearly indicate consistent exceedances of permit numeric effluent limitations for copper and zinc (8 exceedances for both metals in both 2010 and 2011, 6 and 3 exceedances for 2012 and 2013, respectively). Attachment 2 includes monthly flow data and the updated effluent limits of 5.1 ng/L PCBs and 10 mg/L limit for TSS, and indicates 3 exceedances of both total PCBs and TSS during 2014. Other exceedances for copper, lead, zinc, and TPH are also in evidence for 2014 discharges. Based on this evaluation, SIM's wastewater discharge, even following treatment, appears clearly likely to cause or contribute to a violation of Ecology's SMS values for PCBs and other constituents in LDW receiving waters.

32. Attachment 4 is untreated stormwater quality monitoring data collected for copper, zinc, and total PCBs from April 2011 to March 2014, representing a total of 19 samples. Both copper and zinc exceeded their respective criteria 13 out of 19 times, while the data for PCBs is difficult to interpret, because although PCBs were not detected at the practical quantitation limits shown (0.17 µg/L), this does not necessarily indicate that PCBs are not present in the discharge because reporting limits are well above levels of toxicological significance (see discussion at ¶15 concerning the NTR water quality criterion for PCBs of 0.00017 µg/L, well below the reporting limit of 0.17 µg/L, the PQL for EPA Method 8082. As

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shown on Attachment 4, both copper and zinc exceeded their respective criteria values most of the time, clearly indicating that elevated concentrations of these two metals are being discharged untreated to the LDW. These are two of the better characterized contaminants under SIM's monitoring requirements, and illustrate that even if PCBs are not present above permit limits, that other potentially toxic constituents are present in stormwater and discharging during storm events to the receiving waters of the LDW.

33. Contaminant data (showing total PCBs, copper, mercury, and zinc) from soils and sediments have been collected and compiled from roof drains, gutters, parking lots, catchment basins, sumps, and other upland locations from within and immediately adjoining the SIM facility, and are shown on Attachments 5 and 6 for samples taken between September 2008 and May 2010. These exhibits also show the specific locations from which they were collected as well as the corresponding storm drain outfall discharging to the LDW. This data should be viewed as companion data to the untreated stormwater quality discussed above, and clearly shows that both PCBs and metals from soils and sediments around the facility are very highly elevated relative to their respective sediment quality guidelines (SQS values). Data were collected from 13 upland monitoring locations around the SIM facility that receive and convey discharges from the facility, representing residues that could be transported to LDW receiving waters via untreated stormwater runoff. These would be representative of "source sediments" referred to in Section 1, Part B of the SSCSUM screening process (see detailed discussion at ¶60 to this declaration).

34. PCB concentrations shown on Attachment 5 were present from elevated to very elevated concentrations when compared to both the SQS values for total PCBs as expressed in

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dry weight (DW) and carbon-normalized (OC) as well, as promulgated WAC 173-240-320. TOC data were available for each sample and therefore a comparison with carbon-normalized SQS values was performed. A summary of the results of this comparison follows: for the dry weight-based value, the LAET value of 130 µg/kg dw was used. When compared to this value, exceedances ranged from 1.5 (Sample MH101) to greater than 192-fold (Sample MH240). It is clear that PCBs are present at highly elevated concentrations in storm sewer facilities around the site, indicating a substantial probability to contribute to impacts on sediments in the receiving environment of the LDW. When compared to Ecology's organic carbon-based SQS value of 12 mg/kg oc, exceedances ranged to about 19-fold (Sample MH240). The reason for the discrepancy in Sample MH240 (i.e. between the dry weight-based and the organic carbon-based comparisons) is that these sediments are highly organically enriched, as indicated by the measured TOC value of 18.7%, suggesting that PCBs sorb readily to LDW sediment particulates, although this makes them potentially less bioavailable.

35. Attachment 6 similarly shows representative metals data for copper, mercury, and zinc from the same 13 upland locations collected on the same dates (September 2008 through May 2010) around the SIM facility, similarly representing residues that could be transported to the LDW via untreated stormwater runoff. Similar to PCBs, results were also compared to SQS values as promulgated WAC 173-240-320, also shown on Attachment 6. Results for copper ranged from samples which did not exceed the SQS value (RCB147, RCB148, RCB149) to an exceedance of 25-fold (CB207). All but one sample exceeded the SQS value for mercury (MH101), and the highest exceedance was from MH240 (exceedance of 10.5-fold). All 13 samples exceeded the SQS value for zinc, and the highest two exceedances were from MH240

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(exceedance of 21.9-fold) and RD2 (exceedance of 20.3-fold). Similar to PCBs, it is clear that these metals are present at highly elevated concentrations in the site's discharge conveyance system, and therefore have the potential to contribute to SQS violations in the LDW.

36. Ecology's own contaminant evaluation of SIM's discharges (as reported in SAIC (2008), SAIC (2009), and EPA Region 10 (2010)) clearly indicated the potential for SIM discharges of PCBs and metals to unacceptably affect and cause SMS exceedances in sediments. Further, concerning the NPDES permitting requirements for SIM's discharges, EPA Region 10 issued comments to Ecology concerning the SIM facility clearly stating that "the whole of SIM's site and operation is an ongoing source of contaminants of concern to the LDW", and requested additional engineering analysis to address all sources of industrial wastewater discharging from the SIM facility, to address all potential source control issues at the site, to assure that no undocumented discharges continue to contaminate the LDW, (EPA 2010). Source control of SIM and other discharges to LDW receiving waters is critical, and as part of the LDW Superfund action, EPA Region 10 is collaborating with Ecology (e.g. Ecology 2004) to enforce LDW-wide source control to prevent recontamination of the Waterway. The Source Control Action Plan (SAIC 2009) contains data collected from the LDW receiving environment (including data that I rely on for my opinion), showing elevated PCB and metals concentrations that are relevant to the potential for SIM's discharge to impact the LDW. EPA and SPU have collected substantial surface and subsurface sediment samples at locations adjoining the SIM facility in an effort to conduct "source tracing", and report significant concentrations of PCBs and other constituents that are likely attributable to SIM discharges (see discussion below).

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37. EPA Region 10 (EPA 2010b) performed split sampling for facility soils and sediments in cooperation with Seattle Public Utilities (SPU) in May 2010, also collecting four sediment samples from the facility. This data is significant because it corroborates the data collected and conclusions reached by SPU, as summarized in in the discussion above and by EPA (EPA 2010). Four stormwater drainage system sediment samples were taken from around the SIM facility, including building roof gutters, parking lots, and catchment basins, and measured for PCBs, selected metals, and several other constituents. Total PCB concentrations for these samples ranged from 2,200 to 9,500 µg/kg dw, which can be compared to the LAET value of 130 µg/kg dw (see Attachment 7 for summary of SPU's sediment data). It is noted that data from all four sediment samples exceeded this SQS value for both SPU and EPA. It is also significant that the PCB split sample data between SPU and EPA Region 10 are consistent with each other, as well as passing QA/QC data requirements for validating environmental data. Similar to the PCB data, EPA Region 10 also took samples for selected metals from the same four locations. These data are similar to the SPU data summarized on Attachment 5. For examples, data from both copper and zinc exceeded their respective SQS values (390 and 410 mg/kg, respectively) for all of the samples taken from both EPA and SPU. As with PCBs, split sample data for metals between SPU and EPA Region 10 were validated and are generally consistent with each other. This lends important corroboration to SPU's conclusion, and my own, that SIM represents a significant source of water and sediment contamination and a risk to LDW receiving waters.

38. SIM's 2007 permit required quarterly acute and chronic whole effluent toxicity (WET) testing for the treated effluent and results have been irregular, inconsistent, and difficult

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to interpret. I have reviewed the available results from this testing, and they are summarized as follows: 4 acute tests were performed during 2008 (no acute toxicity reported with one anomalous result; one test performed in 2009 (one reported no acute toxicity reported, with two suspended tests); all tests were suspended in 2010; three tests performed in 2011(no acute toxicity reported in one, with anomalous results in the other two). It is noted that no chronic testing was performed or results reported, even though chronic bioassays are more sensitive and therefore more useful for determining possible toxicity associated with SIM discharges. It is therefore difficult to make conclusions about the potential toxicity associated with SIM's treated wastewater effluent in the context of WET testing.

39. In addition, no toxicity testing has been required or performed for untreated stormwater discharges from SIM's facility, and this testing would be valuable to understanding any potential toxicity occurring in LDW receiving waters in association with these discharges.

40. Because PCBs are so bioaccumulative, I would also recommend that a standard bioaccumulation test (e.g. using *Nephthys* or *Macoma*) for SIM wastewater, stormwater, or both would be useful to understand toxicity associated with highly bioaccumulative PCBs. The SIM permit fact sheet notes that if SIM fails toxicity testing requirements, Ecology will require further testing, submission of a Toxicity Identification/Reduction Plan (TI/RE), or both (p. 49). Consistent with Ecology's guidance under the SMS, biological testing is at least as important as chemical testing in sediments, as this form of testing addresses potential effects rather than only identifying the presence of chemical constituents in sediments or other mixtures. It is likely that if these tests were performed properly that biological effects, including bioaccumulation, would be identified for SIM's effluent and sediments.

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41. In its extensive comments on SIM's stormwater discharges, EPA (2010) noted that SIM has not adequately characterized the receiving environment of its stormwater discharges, including effects to sediment quality and the extent to which SIM's operations contribute contamination through stormwater pathways not necessarily related to Outfall 001. EPA (2010) reports that SIM discharges impact sediments in the Myrtle Street Embayment located directly offshore of its property, correlating with five LDW RI surface sediment samples that exceeded the PCB Lowest Apparent Effects Threshold (LAET, value of 130 µg/kg dry wt) by a range of 5.3 to 28.4, and in the areas of the South Othello Street storm drain outfall as well (correlating with eight LDW RI surface sediment samples, which are similarly elevated). The discussion at ¶60 provides a more quantitative assessment of this data using Ecology's SSCSUM screening process. EPA (2010) also identified levels of sediment contamination requiring sediment cleanup in these areas, which included PCBs, copper, mercury, zinc, and a number of other contaminants of concern. EPA concluded based on these data that the SIM facility clearly represents an ongoing source of contamination to LDW receiving waters. EPA (2010) also noted that SIM's Stormwater Quality Report only describes SIM's surface operations within property boundaries and limits discussion on SIM's potential influence on LDW receiving waters by only focusing on stormwater and solids collected from the facility itself.

42. SPU, in cooperation with Ecology and EPA, also conducted "source-tracing" in an attempt to correlate exceedances in bottom sediment to specific locations in the waterway, specifically focusing on discharges to South Myrtle, South Garden and South Othello Streets. Based on these efforts, it was determined that SIM is a significant source of sediment contamination to the LDW via all three of these municipal outfalls (SAIC 2008, SAIC 2009).

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43. Subsequent SPU source-tracing data in 2010 reported highly elevated concentrations of PCBs, copper, mercury, zinc, and phthalate esters when compared to the appropriate sediment quality guidelines (LAET). The discussion at ¶41 provides a more detailed discussion of this monitoring data. Soil/sediment samples collected by SPU from different locations at the SIM facility in 2010 indicated highly elevated concentrations of total PCBs from rooftops, rain gutters, catchment basins, and storm drains, with consistently elevated concentrations of PCBs, with Aroclors 1242 and 1254, two toxic and persistent PCB mixtures, representing the most consistently elevated among PCB Aroclors. Also noted in these measurements were elevated concentrations of copper, lead, mercury, zinc, and other constituents consistent with the scrapyard-oriented land use at the SIM facility. As an example, one sediment sample collected in June 2009 from the SIM property (Sample MN240 at the South Garden Street storm drain) showed total PCBs of up to 25,000 µg/kg dw, which can be compared to an appropriate sediment LAET value of 130 µg/kg dw (EPA Region 10 2010). Source-tracing in this manner fortifies the link between SIM discharges and elevated PCB concentrations in LDW sediments. As cited in Paragraph ¶21, EPA Region 10 (2013) reported a mean concentration of total PCBs in the Waterway of 2,000 µg/kg dw, which is well above the LDW-specific RAL value for PCBs of 240 µg/kg dw.

44. To understand the contribution of the SIM facility to the overall PCB burden of the LDW, it is helpful to include specific sampling and monitoring of bottom sediments and soils adjoining the SIM facility, representing the most direct impact to receiving waters. As an example of a recent such PCB investigation, Hart Crowser (2012) performed a bank sampling survey, for which 5 cm surface soil/sediment samples were collected at RM 2.5 near the water's

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edge to the vegetation line. Results were reported on an Aroclor-specific basis rather than total PCBs, and indicated that Aroclor 1254 and 1260 concentrations exceeded the most stringent, LDW-specific soil screening levels set by Ecology for PCBs (Hart Crowser 2012 at 26 and Table 28). Another study (Floyd Snider 2012) documented PCB concentrations collected from the south Wharf adjoining the SIM facility, with total PCB concentrations ranging from 700 to 970 µg/kg dw in surface sediments (Floyd Snider 2012 at 3-3). These values were well above the RAL of 240 µg/kg dw for the LDW (LDWG 2012). Even when carbon-normalized to compare directly with Ecology's Sediment Management Standards values (12 mg/kg-oc for the SQS, as cited in ¶16) these concentrations still exceeded SMS standards. This data further strengthens my conclusion that SIM's PCB discharges to the LDW cause or contribute to exceedances of Washington SMS values.

45. Attachment 7 is a compilation of bottom sediment data for locations explicitly linked to the SIM facility whether near the storm drain outfalls, under the south wharf, or adjoining the site generally. Data shown focus on PCBs, copper and zinc in LDW sediments. Although many different types of contaminants in LDW sediments are present in elevated concentrations and are not necessarily attributable to SIM's discharges, this data collection effort was an attempt to determine the source of sediment contamination by virtue of their proximity to the SIM facility via storm drains. Of the 16 samples shown, 9 PCB samples exceeded the respective SQS value, 3 for copper (SQS value of 390 mg/kg), and 2 for zinc (SQS value of 410 mg/kg). It is my opinion that some significant portion of these PCB exceedances and possibly a fraction of the metals exceedances originated from SIM's stormwater discharges, as reflected in the elevated concentrations of PCBs in both treated wastewater and from facility soils and

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sediments (data from Attachment 5, discussed above). The specific contribution of PCBs via this mechanism has not been quantified, but my conclusion closely aligns with that of EPA Region 10 and SPU (as reported in EPA (2010)), which concluded that the SIM facility is a significant contributor of contamination to the waterway via stormwater discharges.

46. EPA Region 10's (EPA 2013) proposed plan for the LDW Superfund site includes a detailed description of various remedial alternatives for the LDW, including preferred alternative 5C. The remedial action plan for this alternative shows proposed remedial action by specific river mile "reaches" of the LDW. This plan shows that the reach that includes the SIM facility (RM 2.3 to 2.6) includes a mixture of dredging, dredging/capping, and a lesser amount of monitored natural recovery for areas that are less contaminated. The degree of planned remedial action highlights the impaired nature of the LDW in the immediate vicinity of SIM, and its lack of assimilative capacity.

Ecology's Mixing Zone for PCBs for Treated Wastewater Effluent

47. Ecology has approved a mixing zone under SIM's NPDES permit (No. WA0031968) for treated wastewater discharge based on a modeling study (Floyd Snider 2010), using EPA's CORMIX model) and based solely on the anticipated behavior of copper in the discharge. This anticipated behavior of copper, however, once discharged to the LDW describes little or nothing about what PCBs will do following such a discharge. Copper exerts toxicity very differently than PCBs, and does not bioaccumulate or biomagnify in aquatic environments. Copper also has very different partitioning characteristics than do PCBs, and is much more likely to remain in solution despite the presence of organic particulates or sediments, that so readily draw hydrophobic PCBs out of solution and cause them to sorb to particulates, bottom

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sediments, and other substrates. For these reason alone, this modeling effort is inapplicable and should not be applied to PCBs. Similarly, the proposed 30.2 dilution factor was based on modeling of copper in SIM's wastewater discharge, and would not be applicable to PCBs. Thus, SIM's CORMIX modeling of copper mixing and dilution does not address concerns that that a mixing zone for PCBs would cause deleterious effects as specified in WAC 173-201A-400(4).

48. In calculating a mixing zone for PCBs under Condition S1.A of SIM's NPDES permit, Ecology properly used the human health-based AWQC value but inappropriately applied a dilution factor of 30.2 to yield a numeric effluent limitation for PCBs (i.e., proposed PCB effluent limitation of 5.1 ng/L based on 0.170 ng/L x 30.2 dilution factor).

49. In their depositions, Ecology designees testified that they based their screening-level assessment conclusions of no "reasonable potential" for SIM's treated wastewater discharges to cause violations of PCB sediment quality standards on the lack of detection of several non-PCB chemicals of concern, and that, as stipulated by Ecology's Permit Writer's Manual (PWM) screening level evaluation (Ecology [2011], page IX-24) that the discharge displays the following three characteristics: (1) it is a freshwater discharge to marine water; (2) it receives the equivalent of secondary wastewater treatment (i.e., that it has low TSS); and (3) that it is discharged to an area with an average tidal velocity of 1 cm/sec or greater. This form of evaluation is overly general and qualitative, lacks scientific basis, and in reaching their conclusions, Ecology did not consider sediment monitoring data for the LDW, facility source contribution data, the seafood advisory for PCBs, serious concerns expressed by EPA Region 10, and the complete list of factors specified at WAC 173-204-400(6). Therefore Ecology's

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conclusion of no reasonable potential to adversely impact LDW sediments is wholly unsupportable.

50. Regarding the applicability of a mixing zone for PCBs in the LDW, my analysis has been twofold. First, I examined whether the Waterway has adequate "assimilative capacity" to accommodate the additional burden of PCBs discharged to these waters, and second, I examined the chemical and toxicological nature of PCBs themselves to determine whether these compounds would be likely to contribute to toxicity, bioaccumulation, or other adverse effects if discharged in elevated concentrations to the receiving waters of the LDW. As shown in this discussion, I have concluded that the assimilative capacity of LDW receiving waters has been exhausted, and that further contamination by PCBs will likely contribute to further problems in the waterway.

51. Under WAC 173-201A-400(4), Ecology is not permitted to grant a mixing zone "unless the supporting information clearly indicates the mixing zone would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem or adversely affect public health as determined by the department". "Damage to the ecosystem" is defined at WAC 173-201A-020 as "any demonstrated or predicted stress to aquatic or terrestrial organisms or communities of organisms which the department reasonably concludes may interfere in the health or survival success or natural structure of such populations. This stress may be due to, but is not limited to, alteration in habitat or changes in water temperature, chemistry, or turbidity, and shall consider the potential build-up of discharge constituents or temporal increases in habitat alteration which may create such stress in the long term." The

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mixing zone for PCBs in SIM's wastewater discharge clearly has the reasonable potential violate these requirements, and it is my opinion that Ecology's allowing a mixing zone for the SIM wastewater discharge, by increasing the amount of PCBs allowed for discharge (by a proposed dilution factor of 30.2), will cause or contribute to the deleterious effects described by WAC 173-201A-400(4).

52. EPA recommends that "mixing zone characteristics be defined on a case-by-case basis after it has been determined that the assimilative capacity of the receiving system can safely accommodate the discharge. This assessment should take into consideration the physical, chemical, and biological characteristics of the discharge and the receiving system, the life history and behavior of organisms in the receiving system; and the desired uses of the water." (*Water Quality Standards Handbook, Second Ed.* (1994) at 5-1). "The assimilative capacity is the difference between the background level of a pollutant and the highest level that would comply with the water quality criterion" (63 Fed. Reg. at 36793). In other words, lack of assimilative capacity means there is no more ability for the receiving waters to accommodate or absorb this additional discharge of toxic constituents, and such a discharge will likely contribute to further toxicity, damage to the ecosystem via bioaccumulation, and other deleterious effects. The WAC 173-201A-400(4) harmful factors, particularly interference with characteristic uses and "damage to the ecosystem," appear to incorporate this EPA recommendation to prohibit mixing zones where there is a lack of assimilative capacity in the receiving waters. Since it has been demonstrated that there is little or no remaining assimilative capacity in LDW receiving waters, a mixing zone for PCBs should be prohibited.

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53. In addition to evaluating concentrations of PCBs in treated or untreated effluent, a key issue is the mass of PCB loading to the LDW, as PCBs are known to persist, bioaccumulate, and even biomagnify, and thus would not be expected to be subject to dilution or attenuation via biodegradation, dispersal or similar processes that may be effective for other classes of compounds. A preliminary loading calculation was performed based on SIM treated wastewater discharge monitoring (DMR) data (shown on Attachments 1 and 2), using a "typical" daily discharge range of 10,000 to 65,230 gallons per day (gpd; or about 25 to 160 minutes per day at the maximum flow of 400 gpm) and a representative PCB concentration of 442 ng/L PCBs (both the gpd and PCB concentration values are from April 2014 DMR data). This yielded an estimated loading range of 1.7 to 10.9 mg/day. Loading of this magnitude creates a probability to exceed the RAL or other appropriate sediment quality guideline. No yearly or annualized calculations were performed due to the intermittent nature of these discharges, although this load of PCBs is a form of recontamination to the waterway, which contravenes the goals guiding the numerous source control activities under way to expressly prevent such discharges. In addition, this preliminary load estimate does not include untreated stormwater runoff but only SIM's treated wastewater effluent, as it was not possible to quantify PCBs in untreated stormwater runoff due to significant data limitations (see discussion at ¶32). Because of the location of this outfall midway through the LDW, due to tidal flux and current action within the LDW, the PCB residues are likely to be transported both up- and down-river from the outfall, thus adding to the already significant contaminant burden of the LDW.

54. These risks are related to and all enhanced by the toxic, persistent, and bioaccumulative characteristics of PCBs. It is my opinion that mixing zones are virtually always

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inappropriate for PBTs, of which PCBs represent a prime example, and that the PBT characteristics of PCBs make it particularly inappropriate to grant a PCB mixing zone in the LDW. Reasons that mixing zones for PBTs such as PCBs should be disallowed relate to the factors specified by WAC 173-201A-400(4) including factors "clearly indicat[ing] the mixing zone would [] have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem or adversely affect public health as determined by the Department". In fact, neither the SIM mixing zone study, the permit's fact sheet, nor any other information that I have examined contradicts my conclusion that the proposed mixing zone would likely cause any or all of these impacts. Indeed, my review of the available information indicates that Ecology did not consider these issues and did not make a determination regarding these factors.

55. The fact sheet includes no information that contradicts my opinion or that "clearly indicates" that the effects described in WAC 173-201A-400(4) will not occur. The explicit discussion of how the mixing zone satisfies -400(4) (Fact Sheet pp. 19 – 20) is cursory and excludes substantive discussion of any of the issues upon which I base my opinion. The fact sheet also lacks any discussion of evaluation of potential sediment impacts [discussed in detail above], as well as Ecology's scientifically unsupported assertion that the 10 mg/L TSS effluent limitation "provid[es] reliable protection of sediment quality." The poor compliance history of SIM's discharges, as documented in the fact sheet, further supports this conclusion.

56. Another compelling argument for prohibiting a mixing zone for PCBs in an LDW discharge such as the SIM discharge is to consider that PCBs are classified as persistent bioaccumulative toxins (PBTs). It has been demonstrated that the LDW is already highly

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impaired, and that addition of a bioaccumulative, persistent and toxic chemical of concern such as PCBs would certainly be among the least appropriate compounds for continuing discharge to the LDW. They are highly persistent, cause toxicity to marine life, wildlife, and humans, and perhaps most harmful of all, they bioaccumulate and biomagnify throughout the food web, and for all these reasons have been banned since the 1970s. They do not readily biodegrade or disperse, and are not subject to volatilization, evaporation, and other environmental processes that less persistent compounds routinely undergo. Abundant environmental data indicate that SIM's wastewater and stormwater discharges add an additional contaminant burden to the LDW, further diminish assimilative capacity that might become available through LDW Superfund remedial actions, contribute to recontamination of the Waterway, and cause or contribute to exceedances of SMS values in LDW sediments.

57. A number of regulatory agencies, at the local, state, national, and even international levels have issued guidance discouraging or prohibiting mixing zones for effluents containing PBTs, representing a strong scientific consensus. Ecology (2000) issued a "draft strategy" to continually reduce the presence of PBTs in the environment, which is consistent with EPA's national strategy, and is designed to limit PBTs in discharges to waters of the State. EPA (2000; also see Section 118[c](2) of the Clean Water Act; 65 FR 67638; also 64 FR 53632), as part of the Great Lakes Initiative, banned mixing zones in the Great Lakes for PBTs, including PCBs. Specific language states that "if the proposed discharge contains bioaccumulative compounds of concern, the discharger must minimize the new or increased loading of the compound by implementing pollution prevention alternatives and techniques (not mixing zones)." Alternatively, the discharger would need to evaluate alternative or enhanced treatment

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techniques rather than being granted a mixing zone. As part of a Great Lakes Initiative mixing zone initiative for PBTs, (e.g. DWSD 2003) agencies have stated that any loophole that allows bioaccumulatives to be discharged should be closed under this guidance. Also, NOAA's National Marine Fisheries Service has issued guidance (NOAA NMFS 2010) stating that mixing zones for PBTs should be avoided as part of a protective strategy for species designated threatened or endangered under the federal Endangered Species Act. The international scientific community has also issued guidance (e.g. European Commission 2011) recommending against allowing mixing zones for PBT compounds.

Untreated Stormwater Reasonable Potential Analysis (RPA)

58. As noted above, it was not possible to quantify concentrations or loading for PCBs in untreated stormwater discharges because PCBs were not detected (Attachment 4). PCBs were not detected at the practical quantitation limit shown (0.17 µg/L), but this does not necessarily indicate that PCBs are not present in the discharge because reporting limits are well above levels of toxicological significance (see discussion at ¶15 concerning the NTR water quality criterion for PCBs of 0.00017 µg/L, well below the reporting limit shown). In fact, even though it was not possible to apply PCB data to Ecology's RPA statistical methodology as described by Ecology's permit writer's manual (Ecology 2004, Section 4), it is indeed still possible to evaluate the reasonable potential for impacts to receiving water and/or setting permit limits without facility-specific monitoring data following guidance provided by EPA (1991, Section 3.2). In addition to the key fact that "non-detects" for PCBs are well above their toxicity-based criteria, this guidance suggests consideration of numerous other factors such as the history

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of the facility's compliance and the presence of other data. Elevated PCBs have been clearly identified in facility soils and sediments, and abundant receiving water and sediment monitoring data for PCBs are available for the LDW adjoining the SIM facility. Thus, a qualitative RPA based on these considerations would conclude that there is clear reasonable potential for PCBs in untreated stormwater to affect the receiving waters of the LDW.

59. Although PCB data were difficult to quantify, copper and zinc monitoring data for untreated stormwater runoff analyses were also available (shown on Attachment 4), and subjected to the statistical RPA procedure recommended by Ecology's Permit Writer's Manual (2004). Attachment 4 shows that both copper and zinc exceeded their respective water quality criteria values most of the time (13 exceedances out of 19 samples for both, often by a significant margin), clearly indicating that elevated concentrations of these two metals are being discharged untreated to the LDW. The RPA was run for copper and zinc using the DMR data for untreated stormwater runoff, using the statistically-based procedure used by Ecology's PWM. The Excel workbook (http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html) was used to perform this calculation. I conducted this calculation for untreated stormwater runoff for copper and zinc using background metals concentrations, and other key assumptions (e.g. coefficient of variation) used by Ecology in its calculations for reasonable potential of the treated wastewater discharges ("outfall 001" subject to the condition S1.A effluent limitations) because Ecology believed they were representative. Results of these calculations indicated that, by a wide margin, there is a reasonable potential for copper and zinc in the untreated stormwater discharge to exceed their respective water quality standards and cause or contribute to deleterious effects in the receiving waters of the LDW.

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60. In addition to the RPA procedure discussed above for untreated stormwater data, Ecology's Sediment Source Control Standards User Manual (Ecology 1993) was also used to provide a screening level evaluation for the purpose of evaluating the potential for impacts to occur to receiving water sediments (e.g. of the LDW) from contaminated stormwater, soils and/or sediments on individual facilities. Part A is a narrative evaluation of the discharge, and I applied this evaluation to the facility soils and sediments data set, including PCBs, copper, mercury, and zinc from SIM's facility (shown on Attachments 5 and 6). The clear determination from this narrative evaluation was that this discharge could cause potential risk or impacts, which merit further evaluation under Part B (technical evaluation). The same facility soils and sediments data set was then subjected to the Part B evaluation, which is further subdivided into information about (1) source sediments, (2) receiving sediment chemistry, (3) sediment biological testing data, and (4) effluent chemistry, using the data for PCBs and specific metals. Each category requests a determination on whether the appropriate SQS values would be exceeded by the subject data (SQS values for each constituent are shown on Attachment 7). Based on this exercise, many of the SQS values were clearly exceeded for both source and receiving sediments. Evaluation of biological testing results was incomplete due to the lack of bioassay test data (see discussion at Paragraph #30). In general, results of this SSCSUM screening evaluation for PCBs, copper, mercury, and zinc indicated that stormwater sediments and effluent would be designated, following Ecology's guidance, as having potential impacts to sediments of the LDW.

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61. Both evaluations described above relate to untreated stormwater discharges and soils and sediments contaminant data from rooftop gutters, catchment basins, drains, parking lots, and other SIM locations in light of both applicable water quality criteria and sediment quality guidelines. Both evaluations clearly indicate that untreated stormwater from the SIM facility may cause or contribute to violations of water quality standards for PCBs, copper, mercury, zinc, and other contaminants, and thus represent a "reasonable potential" that adverse environmental impacts will occur to LDW receiving waters. EPA (2010) reports that SIM's stormwater discharges have not been well characterized, may be contributing to a larger impact on LDW receiving waters, and that the stormwater discharge limit of 0.25 mg/L PCBs is unsubstantiated (and presumably underprotective). I base this opinion about the reasonable potential for the untreated stormwater discharge to cause or contribute to such violations of water quality standards on discharge monitoring data, monitoring of sediments in the SIM and downstream stormwater collection and conveyance features, and characteristics of the LDW. The water quality standards relevant to this evaluation include all numbers for PCBs, copper, and mercury for water WAC 173-201A-240[3]) and National Toxics Rule), sediment (WAC 173-204 Part III), and fish tissue (National Toxics Rule), and the designated uses of the LDW for fish and shellfish harvest (WAC 173-201A-602).

EXECUTED at Seattle, Washington this 2 day of December, 2014.

Allan B. Chartrand

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LIST OF ATTACHMENTS

Attachment 1: Curriculum Vitae, Allan B. Chartrand

Attachment 2: DMR Data Summary for Outfall 001, May 2010 – September 2013

Attachment 3: DMR Data Summary for Outfall 001, October 2013 – March 2014

Attachment 4: Untreated stormwater water quality data for total PCBs, copper and zinc

Attachment 5: Storm drain soils and sediments monitoring data for PCBs at and adjacent to SIM facility

Attachment 6: Storm drain solids monitoring data for copper, mercury, and zinc at and adjacent to SIM Facility

Attachment 7: Bottom sediment from LDW immediately adjoining SIM facility, including total PCBs, copper, and zinc

Attachment 8: Key reference documents

Attachment 9: Other reference documents

Attachment 10: Glossary of Terms

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Attachment 1

Allan B. Chartrand, DABT

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SUMMARY OF EXPERIENCE

Mr. Chartrand has approximately 30 years of experience as a practicing environmental scientist and project manager, performing a wide variety of environmental projects. Mr. Chartrand's technical experience and expertise extends to investigation and evaluation of contaminated sites, risk assessment, ecological restoration, regulatory compliance and permitting, sampling and monitoring of sediment, dredging and water quality projects, project and data QA/QC, and toxicological services. Extensive experience in performing projects under CERCLA, MTCA, NRDA, CWA, OPA, and numerous other regulations, including extensive international experience. Experience with wide-ranging public and private sector clientele, including federal agencies (NOAA, EPA, USACE, USAID, USGS, NAVFAC) and private sector clients. Excellent verbal and written communication, mentorship, and leadership skills. Research background in toxicology, chemistry and life sciences, with foreign language background and over five years of living and working abroad.

PROJECT EXAMPLES (CONTAMINATED SEDIMENT)

Contaminated Sediment Dredge and Remediation Characterization and Planning for Former Pulp and Paper Site in Puget Sound, Port Gardner, WA, 2013 to present. Mr. Chartrand is currently serving as the lead environmental scientist and project toxicologist in support of a confidential industrial client group for the purpose of characterizing sediments that have been contaminated over the course of decades by industrial discharges related to pulp and paper industrial processes. This large waterfront property, contaminated with wood debris and other contaminants, is being prepared for sale by the former owner to an industrial buyers' group. Mr. Chartrand worked with the USACE Seattle District's Dredge Material Management Office representatives to prepare a Sampling and Analysis plan, and he was responsible for oversight of chemical, biological and physical data collection, data analysis, and data interpretation. He works closely with a client working group consisting of managers, attorneys, and other scientists and engineers. He has negotiated specific technical requirements with oversight agencies, and has earned a level of credibility and trust with the agencies because he has worked with them on many projects over the course of years in and around the Puget Sound.

RI/FS Field Sampling Plan and NRDA Injury Assessment Support for Offshore DDT Contamination in Sediment, Palos Verdes Shelf, EPA Region 9 and State Water Resources Control Board, Los Angeles, CA. Provided technical input to the Palos Verdes Shelf offshore sediments DDT project over the course of more than 20 years (intermittently) in various capacities, including expert testimony at the USDOJ trial with Montrose in support of the NRD claim. In 2009-10, Mr. Chartrand served as sediment investigation technical lead and toxicologist for co-designing a Field Sampling Plan for characterizing DDT in surface and subsurface sediments (post-ROD) adjoining the Los Angeles County outfalls and along established monitoring transect isobaths.

Experience and Knowledge

- Recognized expertise in contaminated sediment issues related to both remediation and dredging.
- Has worked on over 100 CERCLA/MTCA RI/FS and risk assessment projects.
- Extensive project management as well as technical leadership experience.
- Extensive background with both private and public sector clients.
- Former water quality regulatory scientist for State of California (RWQCB).
- Expertise in contaminated sediments, water quality, toxicology, chemistry, biology, permitting, planning, restoration and remediation planning.

Education

BS, Entomology, University of California College of Natural Resources, Berkeley, CA.

MSPH, Environmental Toxicology, University of California School of Public Health, Los Angeles, CA.

PhD work (incomplete) in Toxicology, Hebrew University, Jerusalem, Israel

Certifications

- Diplomate, American Board of Toxicology (exp)
- HAZWOPER - 40-Hour OSHA 29 CFR 1910.120 (current since 1990)
- California Department of Fish & Game Scientific Diver Certification Program (through NAUI)

- Negotiated with USEPA and USGS to obtain approval for field sampling plan; data used to support pre-remedial design following evaluation of alternatives; technical approach was innovative, cost-effective, and incorporated historical data base developed as part of sediment investigations.
- During an earlier phase of the project, including NRDA injury assessment, Mr. Chartrand led an interdisciplinary team of scientists to design and perform a comprehensive, multi-year investigation of fate and effects of DDT-contaminated sediment and fish/shellfish in Santa Monica Bay.
- Served as sampling crew leader and principal investigator for multi-year investigation of both sediment and biological sampling in both shallow and deeper basins in Santa Monica Bay (up to 1,000 m in depth) sampling locations.

Lower Duwamish River Superfund Site Injury Assessment in Support of NRDA—NOAA and Muckleshoot Tribe, Seattle, WA. Extensively involved in the investigation and NRDA injury assessment of the Lower Duwamish waterway in Seattle, WA., to develop an injury assessment work plan to investigating injury and potential claims along the waterway associated with extensive sediment contamination of PCBs, PAHs, and numerous other contaminants in waterway sediments and biological tissue. This investigation involved conducting chemical, toxicological, and biological sediment evaluations, characterized fate and effects of sediment-associated contaminants in the waterway, and participating in risk-based cleanup evaluation for sediments. He closely coordinated with other trustee and oversight agencies, especially NOAA, in evaluating resource injury and laying the groundwork for subsequent mitigation and restoration planning. He was also involved in several phases of the ecological risk assessment of contaminated sediments on behalf of King County Department of Natural Resources in the waterway in the vicinity of the Duwamish Diagonal and Norfolk Way CSOs, which was incorporated into the larger context of the subsequent RI/FS and NRDA injury assessment.

Machado Lake Dredging and Rehabilitation Project, City of Los Angeles,, Bureau of Engineering, Los Angeles, CA. Served as the technical lead for a large multidisciplinary team on a hydraulic dredging project, focusing on surface and subsurface characterization of contaminated freshwater sediment and evaluation of placement options as part of CWA Section 404, Section 10, and TMDL State requirements.

- Successful negotiations with oversight agencies led to a streamlined, cost-effective sampling and analysis plan for sediment core sampling.
- Nearshore fill (preferred placement option) would save the client up to $8M; assisted in selecting appropriate polymer and geotube design for optimizing return water quality after dewatering.

Characterization and Remedial Design of Agent Orange in Soil and Sediment, Da Nang Airport, Vietnam, USAID. Lead scientist in preparing a field sampling plan and evaluating the distribution, fate and potential toxicity of 2,3,7,8-TCDD [dioxin] residues (active ingredient of the phenoxy herbicide defoliant Agent Orange) remaining from the Vietnam War.

- Field sampling plan designed to optimize selection of the most effective of three remedial action alternatives candidate remedies.
- Interpreted existing dioxin database developed through previous investigations to enhance understanding of nature and extent of contamination before collecting new field data.
- Co-designed a streamlined, cost-effective investigation of Agent Orange dioxin and served as field team co-leader in collecting soil, sediment, surface water, and groundwater samples for dioxin and other analyses in Da Nang.

Commencement Bay Waterways Superfund Site Injury Assessment in Support of NRDA—Tacoma, WA
Mr. Chartrand represented several private sector PRP clients in providing technical input on injury assessment investigations and planning to investigate resource injury along various waterways within the Commencement Bay Superfund site. Extensive investigation of numerous contaminant mixtures in waterway sediments and biological tissue, including chemical, toxicological, and biological sediment evaluations. Mr Chartrand served on a number of work groups tasked with evaluating data in support of injury assessment and risk-based cleanup evaluation for sediments. He closely coordinated with trustee and oversight agency groups in determining the most effective strategies for evaluating resource injury, remediation, and mitigation and restoration planning.

Tributyltin (TBT), Aquatic Ecological Risk Assessment, Puget Sound Sediments (U.S. Army Corps of Engineers, Seattle District), WA. This risk assessment was conducted as part of the PSDDA process of evaluating contaminated sediments within the Puget Sound. TBT was a new contaminant of concern to PSDDA. This report was used to build the database and support development of guidance documents in Puget Sound for toxicity of specific compounds in sediments.

Ecological Risk Assessment for Contaminated Sediments at Mare Island Naval Station (U.S. Navy CLEAN II Program), EFA West, Vallejo, CA. Served as lead toxicologist for designing field investigations and conducting an ecological risk assessment for PAH-contaminated sediment and other units at the former Mare Island Naval Station in Vallejo, California. Used a unique accelerated cleanup strategy approach, which identified 'presumptive remedies' for contaminated areas, including extensive chemical and biological testing, in effect using the FS evaluation process to drive sediment characterization.

Baseline Water Quality Characterization for Copper Concentrate in Marine Sediment (Phelps Dodge Mining Corporation), Copiapo, Chile, South America. Co- investigator/toxicologist for this marine water/sediments study to determine whether a proposed marine transfer facility would cause harmful effects to the marine environment. Baseline benthic biology, sediment toxicity testing, and water column/sediment chemical measurements were taken and a risk assessment performed to establish baseline conditions at the mine tailings site.

Field Investigation and Ecological Risk Assessment for Contaminated Sediments in Devil's Swamp (NPC, Inc.), LA. Lead toxicologist in supporting NPC on this project, which involved extensive contamination of sediments by petroleum distillates, hexachlorobutadiene, hexachlorobenzene, and other petroleum derivatives. A key focus of the project was the potential for food web effects via bioaccumulation of organic contaminants.

Sediment Characterization and Suitability Determination for Dredge Material Placement in Lower Columbia River, Warrenton, OR. Served as the principal investigator in designing, performing comprehensive sediment data collection, analyzing and interpreting the data, and providing recommendations regarding placement suitability within the Lower Columbia River.

- Wood debris identified as part of the first phase of sediment characterization, which required a subsequent evaluation of the toxicity of wood debris in sediment using current testing techniques.
- Prepared a draft DMMP for placement options near the mouth and on both the Washington and Oregon sides of the Columbia River. Required numerous interagency meetings and negotiation with multiple stakeholders at local, regional, state and federal levels.

Sediment and Water Quality Evaluations for Environmental Dredging Project for Docks 14-20, Port of Stockton, CA. Served as project manager and senior scientist for evaluating surface water and sediment quality, toxicity analysis and potential short- and long-term biological effects associated with a long-term environmental dredging project on the San Joaquin River. Project conducted in support of the Port's plans to expand this portion of the riverfront and involved detailed sediment, dewatering, water quality, and toxicological evaluation of the sediment requiring dredging and monitoring.

Draft Work Plan for Pilot Study of Remedial Cap Design, Sulfur Bank Mercury Mine, USEPA Reign 10, Clear Lake, CA.
Served as the lead sediment toxicologist in preparing a work plan concerning evaluation of contamination potential from the proposed cap (i.e. due to mercury biomethylation) due to pore water seepage in the sediment-water interface to other reaches of Clear Lake, including potential threats to fishing and other beneficial uses.

Draft Dredge Material Management Plan for Lower Willamette River, USACE Portland District, Portland, OR. Assisted in preparing the evaluation of dredge placement alternatives in the Lower Willamette based on sediment characterization from various locations in the federal Navigation Channel. Placement alternatives included unconfined open water, nearshore/beach nourishment placement, upland/CDF placement, and flow-lane placement alternatives.

Contaminated Sediment Evaluation, Lower Willamette Working Group, Portland Harbor Superfund Site, Portland, OR. Provided senior consulting guidance and assistance, including review and interpretation of chemical and toxicological data and preparation of technical memoranda, for private corporate client relating to contaminated sediment issues on or adjoining client property in the Lower Willamette River.

Comprehensive Survey of Contaminated Sediment and Fish/Shellfish in Southern California Bight (Los Angeles Regional Water Quality Control Board), CA. Served as the lead scientist and principal investigator in conducting a multiyear study of the effects of DDTs and PCBs in the southern California marine environment, as a corollary to the Montrose Chemical NRDA action. Sediment, fish, and shellfish samples were taken from Santa Monica Bay and the Channel Islands to conduct this investigation.

Porewater and sediment toxicity associated with groundwater discharge for confidential industrial client, Columbia Slough, Portland, OR. Designed and implemented porewater survey and toxicity evaluation of groundwater and its potential impacts to the receiving waters of the Slough at a former smelting facility in Portland, OR. Current status of project is to evaluate how

groundwater contamination from former sludge ponds can potentially contribute to focused Feasibility Study and assist with designing remedial alternatives for the site.

U.S. Navy Everett Homeport 401 Water Quality Certification Program, EFA Northwest, Silverdale, WA. Served as lead scientist in conducting multi-year environmental monitoring program of surface water, sediment, and biological tissue for the purpose of characterizing baseline conditions in the area of the Homeport prior to construction. This report was incorporated into the 401 Water Quality Certification issued to the Navy from the WA Department of Ecology.

Characterization of Contaminated Sediments in Chena River, Fairbanks, AK. As part of a TMDL study and watershed management plan on behalf of USEPA and in collaboration with Alaska Dept. of Environmental Conservation, Mr. Chartrand served as Project Manager and senior scientist in preparing the QAPP and work plans, in leading field sampling operations, in negotiating requirements with EPA and ADEC, and interpreting the resulting data in light of TMDL requirements for this impaired water body.

Remedial Design/Remedial Action Approaches for Evaluating Contaminated Sediments in Industrial Settings (confidential industrial client), three locations in the US (WA, OR, and MD).
Served as lead sediment specialist and task manager in developing streamlined, cost-effective RD/RA approaches for developing contaminated sediment sampling design for three complex industrial sites throughout US, including grab sampling, coring, chemical, biological, and lithological evaluations. Involved detailed communication and negotiation with regulatory agencies and stakeholders.

RI/FS and Baseline Risk Assessment for Contaminated Sediment Site in Eagle Harbor, Puget Sound, Seattle, WA. Served as toxicologist and risk assessor on behalf of the WA Dept of Transportation in evaluating the long-term effects of creosote, mercury, and other contaminants of potential concern to marine and estuarine communities in subtidal waters of Puget Sound adjoining the former Wyckoff creosote facility.

Ecological Risk Assessment for Columbia Slough Sediments (City of Portland, Bureau of Environmental Services), OR. Served as principal scientist for evaluating existing data and designing a field study for use in human health risk assessment for the site. The focus of this risk assessment was to evaluate the potential for biouptake of petroleum hydrocarbons into edible fish and shellfish organisms in the Columbia Slough. Risk assessment conducted to implement source control and eventual cleanup strategies to protect human health and the environment.

Remedial Investigation/Feasibility Study, Contaminated Sediments Operable Unit (U.S. Navy CLEAN II), Long Beach, CA. As principal investigator, negotiated regulatory requirements with oversight agencies, designed and implemented extensive multi-phased field investigations of the Shipyard, authored the Remedial Investigation report, conducted baseline risk assessment, formulated risk-based remedial strategies for Long Beach Naval Station and Shipyard, managed project team, and presented investigation results and conclusions to internal and external agencies.

Ecological Risk Assessment of Contaminated Sediments at Castro Creek in Chevron Oil Refinery, Richmond, CA. Served as senior scientist in evaluating data and reviewing ecological and human health risk assessment for large, multi-year risk assessment relating to evaluating the potential effects of petroleum-contaminated sediments on Threatened & Endangered and other species. This risk assessment considered the potential bioaccumulation and food web effect of uncommon organic pesticide and petroleum derivatives, important for the FS and remedial alternative evaluation.

Risk-Based Evaluation of Contaminated Freshwater Sediment at Port Quendall Facility (Muckleshoot Indian Tribe), Lake Washington, WA.
Served as lead scientist on behalf of the Tribe in providing oversight on the design and characterization of the contaminated sediments investigation at this facility. Duties included interpreting chemical and biological data with a focus on evaluating potential human health toxicity from the sediments and preliminarily evaluating remedial alternatives for wood waste-containing sediments.

Risk-Based Evaluation of Remedial Alternatives for Contaminated Sediments, Lake Onondaga, NY (confidential industrial client).
Served as senior scientist in toxicologist and risk assessor in evaluating potential remedial alternatives for contaminated sediment based on contamination and risk assessment.

PROJECT EXAMPLES (TOXICOLOGY AND RISK ASSESSMENT, CERCLA/MTCA RI/FS)

On-Call Technical Services Contract for Puget Sound Partnership, Seattle WA.

Served as the technical team lead for a large multidisciplinary team, including assistance as managing sediment specialist for Puget Sound sediment issues. Attended Partnership Science Panel and Leadership Council meetings, Topic Forums, and co-hosted a symposium on multiple key issues affecting the Puget Sound.

Bunker Hill CERCLA Site Operable Units 2 and 3, USEPA Region 10, Kellogg, ID. Prepared post-remediation guidance for O & M, including post-remedial restoration, for key units within OU2 (the "Box") and the Coeur d'Alene River basin. Assisted in preparing work plan for pilot study for characterizing and performing a dredging pilot study for contaminated sediments from depositional zones within the Coeur d'Alene River.

White Paper and Toxicity Reduction Evaluation Work Plan, Puerto Rico Association of Sewage Authorities (PRASA), San Juan, Puerto Rico. Served as the lead sediment toxicologist in researching and evaluating the most effective way to use whole effluent toxicity (WET) testing data to evaluate the most effective approach to using this data to satisfy the EPA requirement for performing Toxicity Reduction Evaluation (TRE) studies when toxicity does occur when monitoring the effluent.

RI/FS for Camp Murray Maintenance Compound, WA Military Department, Camp Murray, WA. Currently serving as project manager and lead environmental scientist in characterizing soil and subsurface contamination for Building 31 maintenance compound on Camp Murray Army National Guard military installation. Involves designing and implementation field sampling plan, preparing RI report, and using findings to support potential remedial action alternatives.

Remedial Investigation and Risk Assessment Work Plan for former Klau-Buena Vista mercury mine, USEPA Region 9, CA. Served as the RI technical lead and ecotoxicologist in preparing a multi-disciplinary field investigation work plan concerning evaluation of mercury discharging from the former mercury mine.

- Emphasis on bioavailability of mercury residues in pore water, tissue, and sediment/soil allowed for streamlining and large-scale reduction in sampling and analysis costs to the client.
- Innovative, screening-based technical approach streamlined the RI and resulted in substantial savings while providing comprehensive data to support the RI and quantitative ecological exposure and risk assessment.

Risk-Based Cleanup Strategy Development for Former U.S. Air Force Airfield (U.S. Army Corps of Engineers, Anchorage District), Alaska. Served as principal scientist for evaluating existing data and designing field study for use in human health risk assessment of petroleum hydrocarbons and pesticides on Native American populations living in the vicinity of this site, located in Northway, Yukon. Studies were conducted for the purpose of identifying cleanup strategies to protect both human health and the environment.

Characterization and restoration studies of mercury-contaminated waterways in Northern California (Calfed), Sacramento, CA. Served as senior scientist and toxicologist for evaluating the toxicity, environmental fate, and bioavailability of mercury in freshwater riverine sediments of former gold mining districts in the Sacramento and American River systems of Northern California. Results were used to using these results to mitigate contamination and construct a restoration plan for part of the Sacramento River delta system.

Ecological Risk Assessment for the Insecticide Chlorpyrifos for Golf Course Applications, Makhteshim-Agan Company, NJ. Performed detailed ecological risk assessment and served as project manager for project required in support of EPA FIFRA pesticide registration requirements. Project involved bench scale toxicity and fate/transport testing of chlorpyrifos and derivatives, exposure modeling (e.g. WASP V) for environmental fate and effects in golf course ponds.

Developing RI/FS and Ecological Risk Assessment Work Plan for characterizing contaminated site at Miramar Marine Corps Air Base, San Diego, CA. Currently serving as lead scientist in designing the RI/FS Work Plan for this large contaminated refuse disposal facility, including surface and subsurface characterization, identification of compounds of potential concern, baseline risk assessment, conceptual site model, and designing the field investigation to support these determinations.

Risk-Based Sediment Evaluation and Risk Assessments for CSOs at Lake Union (King County Dept. of Natural Resources), Seattle, WA. Participated in human health risk assessment to define toxicity and bioaccumulation-related hazards associated with contributions from CSOs to Lake Union in Seattle, WA.

TIE/TRE for Evaluating Unidentified Toxicity of Municipal Wastewater Effluent, City of Stockton, Stockton, CA. Served as project manager and toxicologist specializing in evaluating the toxicity of identified agents to algae observed during wastewater effluent testing. Scope included revisions to TIE/TRE work plan as part of permit revision for submittal to Regional Water

Quality Control Board in Sacramento, CA. Also performed evaluation of chemical and toxicological database and compliance with wastewater discharge permit requirements.

Ecological/Human Health Risk Assessment (Tesoro Oil Company), AK. Served as the lead toxicologist and risk assessor in evaluating potential bioavailability and toxic effects associated with petroleum and its by-products, as well as toxic trace metals, discharged from a Tesoro refinery located on the Kenai Peninsula, AK.

Characterization and Restoration of Contaminated Lake in Sacramento, CA (Sacramento Flood Control District). Served as senior scientist and toxicologist/risk assessor in evaluating potential bioavailability and toxic effects associated with PAHs, metals, and pesticides in lake sediments, evaluating mitigation remediation measures, and using results to construct a restoration plan for the lake (part of the Sacramento River delta system).

Model Toxics Control Act (MTCA) Method A and Method B Human Health and Ecological Risk Assessments, WA. Served as lead scientist and risk assessor in performing numerous small to medium sized human health risk assessments around the State of Washington in compliance with MTCA requirements. These investigations were used to determine the ultimate cleanup or other remedies for various contaminated industrial facilities.

Total Maximum Daily Loads for Various Water Quality Constituents, EPA National Contract, Washington, D.C. Served as water quality specialist and project manager in developing TMDLs in various EPA regions throughout the U.S. This involves data collection, water quality modeling, and preparing detailed technical reports. Recent TMDL development experience includes:

- Various trace metals in Waltz Creek, PA (EPA Region 3);
- Hardness-dependent metals (e.g. copper) and mercury in the Neosho River watershed in southeastern Kansas (EPA Region 7);
- Fecal coliform in various watersheds of South Carolina (EPA Region 4);
- Trace metals in Illinois River watershed, Arkansas (EPA Region 6).

Ecological Risk Assessment of Crude Oil and Drilling Muds/Cuttings on the Tropical Marine Environment (Maxus Oil Corporation), Jakarta, Indonesia. Served as the lead toxicologist for evaluating the potential effects of crude oil and drilling muds/cuttings on marine biota in the Java Sea. These baseline studies were required to determine potential effects associated with oil spillage or other release scenarios, which were part of a larger planning project by the Indonesian government.

Exxon Valdez Post-Spill Offshore Investigations in Support of NRDA Injury Assessment—Exxon Corporation, Prince William Sound, AK
While working for Dames & Moore, Mr. Chartrand worked with Exxon Corporation in helping to develop and execute field investigations that provided very extensive and intensive environmental data in support of the injury assessment claim associated with Exxon during the March 1989 spill in Valdez, AK. These investigations involved short- and long-term post-spill monitoring of sediments and marine biota, including chemical testing of oil derivatives and toxicological investigations of using an oil dispersant such as Corexit to disperse oil residues following the spill. He participated in a number of biological and monitoring assessments in Prince William Sound, including herring, salmonids, intertidal and shallow subtidal invertebrate communities. Data from these studies were incorporated into the massive database that was collected following the spill event and used to support the injury assessment and subsequent damage claim.

Ecological Risk Assessment for Wetland Adjoining Mississippi River (Ilada Energy Corporation), Cape Ghirardeau, IL. Lead scientist and risk assessor for evaluating existing data and designing a field study for use in a risk assessment for this wetland site, which adjoins the Mississippi River. The study was conducted to identify risk-based strategies for cleaning up a contaminated site located in an ecologically sensitive area.

Baseline Human Health/Ecological Risk Assessment for Ross Complex, Bonneville Power Administration, Vancouver, WA. Served as project toxicologist in designing and conducting the baseline human health and ecological risk assessment for different Operable Units at the Ross Complex. Work performed as part of the RI/FS and subsequent RD/RA for the Complex. Results of the multi-pathway risk assessment were used to support risk-based decision-making and evaluate various remedial alternatives related to contaminated soils, groundwater, and air quality.

RI/FS and Risk Assessment for Multiple Operable Units, at Bangor/Silverdale Naval Stations, EFA Northwest, U.S. Navy, Silverdale, WA.
Served as project toxicologist and risk assessor in designing field investigations, evaluating environmental data, preparing RI/FS

reports for multiple Operable Units (Site A, Site F, Manchester Units), conducting multi-pathway environmental and human health risk assessments, and evaluating remedial alternatives for each site.

Restoration of Mercury-Contaminated Guadalupe Creek (Santa Clara Valley Water District), San Jose, CA. Served as senior scientist in using chemical and toxicological data on mercury contamination in Guadalupe Creek to design restoration of creek. Prepared Sampling and Analysis Plan, evaluated mercury bioavailability, bioaccumulation potential, and acute and chronic toxicity associated with mercury contamination. Results of this investigation were integrated into mitigation measures required to prevent harmful exposures of fish and wildlife communities and to design restoration of the waterway.

NPDES 301(h) Marine Biomonitoring Program for City of Los Angeles, Hyperion Wastewater Treatment Plant, Los Angeles, CA. Served as regulatory scientist in co-designing extensive marine permitting and biomonitoring requirements for 301(h) and secondary treated wastewater to the Hyperion Treatment Plant. The key emphasis was evaluating the potential short and long-term toxicological effects of contaminants in wastewater effluent on marine organisms as well as biouptake/bioaccumulation and potential effects on human health. Mr. Chartrand was heavily involved in public meetings concerning the environmental implications of implementing these permitting requirements.

Ecological Risk Assessment (U.S. Department of Agriculture, Denver Wildlife Research Center), CO. Project manager and principal investigator for this ecological risk assessment of 50 chemical pesticides used to control vertebrate pests. This project was conducted as part of a programmatic EIS and focused on potential effects to threatened and endangered aquatic and terrestrial species. The project involved extensive toxicological literature review, derivation of dose-response benchmark values, and quantitative fate and transport modeling for terrestrial, airborne, and aquatic pathways. The approach used for this project was later adopted as a model approach for conducting ecological risk assessment of pesticides by both the USDA and EPA.

Investigating Stormwater Runoff of PAHs in an Urban Environment, Los Angeles, CA. Served as lead scientist in designing and implementing multi-year study focused on evaluating the potential toxicity, bioavailability, and effects of PAHs and other related contaminants in the Los Angeles basin, including the discharge of these materials into the receiving waters of the adjoining marine environment (Santa Monica Bay, CA).

Toxicological Evaluation of Non-Target Environmental Effects of Agricultural Insecticides, Citrus Marketing Board, Rehovot, Israel. Served as entomologist and toxicologist in conducting field and laboratory toxicological studies to determine long-term effects of methyl parathion, azinphos methyl, and other organophosphate insecticides on non-target species.

Evaluating the Toxicity of By-Products formed by Disinfection by Chlorine and Chloramine on Municipal Drinking Water Supply, Hebrew University, Jerusalem, Israel. Served as toxicologist and project scientist in conducting field and laboratory water quality studies to determine the potential fate and effects of chlorine and chloramine by-product formation associated with drinking water disinfection in Lake Kinneret, Israel. Involved HPLC, GC/MS, molecular biological culturing and testing, gel electrophoresis, and other biochemical methods.

Evaluation of Non-Target Environmental Effects of Phenoxy Herbicides on Aquatic Communities, California Department of Food and Agriculture, Sacramento, CA. Served as post-graduate intern scientist in conducting field toxicological surveys in Northern California to determine unintended aquatic effects of 2,4-D, 2,4,5-T, Silvex, and other herbicides associated with “broad-lead suppression” forest spraying operations in Trinity and Humboldt Counties, CA.

Employment History

- Independent Environmental Consulting Scientist, January 2013 to present, Seattle, WA
- Associate Environmental Scientist, Robinson Noble, Inc., Woodinville, WA
- Principal Environmental Scientist, CDM Smith, Bellevue/Seattle, WA
- Senior Environmental Scientist, CH2M Hill, Inc., Bellevue, WA
- Senior Toxicologist, Jones & Stokes, Inc., Bellevue, WA
- Senior Toxicologist, Dames & Moore, Inc., Seattle, WA
- Project Toxicologist/Environmental Scientist, Hart Crowser, Inc., 1989 to 1992, Seattle, WA
- Water Quality Regulatory Scientist, Los Angeles Regional Water Quality Control Board, Los Angeles, CA
- Toxicology Researcher and Graduate Student, Jerusalem/Tel Aviv, Israel

Work Groups and Professional Affiliations

EPA Region 10 Bioaccumulation Work Group, Seattle, WA.

WA Dept of Ecology Sediment Management Standards Implementation Group, Lacey, WA.

Confined Aquatic Dredge Disposal (S-4) Sediment Quality Standards Committee (WA Department of Ecology), Lacey, WA.

Model Toxics Control Act (MTCA) Committee for developing procedures and guidance for conducting Ecological Risk Assessment, Lacey, WA.

Endangered Species Act and Puget Sound Initiative Business Coalition, Seattle, WA.
Chairperson, Northwest Toxicity Assessment Group (1998 - 2003)

Society of Environmental Toxicology and Chemistry (both regional and national)

Publications and Presentations

Chartrand, A.B. 2011. Toward More Effectively Applying Ecotoxicology to Help Formulate Water Quality Regulations and Policy. Presented at Salish Sea Ecosystem Conference, October 2011, Vancouver BC, Canada.

Chartrand, A.B. 2011. Ecotoxicology, the Endangered Species Act, and Contaminated Sediments in the Northwest. Presented at Society for Military Engineers Chapter Meeting, May 2011, Seattle, WA

Chartrand, A.B. 2010. Final Removal Action Sampling and Analysis Plan, for Environmental Remediation Project: Engineering Design and Planning for Dioxin Containment at Da Nang Airport, Vietnam. Prepared for USAID Vietnam, January 2010.

Chartrand, A.B. 2009-2010. Contaminated Sediments and Dredging: Overview of Environmental Issues. Seminar/webinar presented as Sediment Practice Lead for environmental scientists and engineers at CH2M Hill and Robinson Noble, Seattle and Tacoma, WA.

Chartrand, A.B., D. Holmes, T., Hamaker, J. Chen, and M. Rivera. 2007. Interpreting WET Data from *Arbacia punctulata* using Wastewater Treatment Plant Effluent in Puerto Rico. Presented at 26th Annual Meeting of Society of Environmental Toxicology and Chemistry at Milwaukee, WI.

Chartrand, A.B., J. Chen, J. Stockner, and D. Bos. 2006. A Unique Approach to Defining a Nutrient TMDL for Black Lake, Idaho. Presented at the American Water Resources Association Annual Meeting, Missoula, MT, 27 June 2006.

Chartrand, A.B., J. Chen, J. Stockner, D. Bos, and J. Carlin. 2005. Using Paleolimnology to Define a TMDL Target in a Nutrient-Limited Lake. Presented at 26th Annual Meeting of Society of Environmental Toxicology and Chemistry at Baltimore, MD.

Chen, J., A. Chartrand, J. Stockner, D. Bos, and J. Carlin. 2005. Defining a Nutrient-Based TMDL Target at Black Lake, ID. Presented at Annual Meeting of American Water Resources Association, Seattle, WA, Nov. 2005.

Chartrand, A.B., and J. Chen. 2003. Optimizing WET testing Protocols for More Meaningful Routine Testing and TIEs: the *Selenastrum capricornutum* example. Accepted at Society of Environmental Toxicology and Chemistry for Annual Meeting in Austin, Texas.

Chartrand, A.B., and J. Chen. 2003. Optimizing WET testing Protocols for More Meaningful Routine Testing and TIEs: the *Selenastrum capricornutum* example. Presented at Northwest Toxicity Assessment Meeting in Port Townsend, WA.

Chartrand, A.B., and K. Bergmann. 2001. Have we been missing the true mechanisms of PBT chemical toxicity in protecting rare species? Presented to 22nd Annual Society of Environmental Toxicology and Chemistry, Baltimore, MD, November 2001.

Chartrand, A.B. 2000. Summary briefing on Montrose Chemical DDT Trial and Natural Resource Damage Case. Presented to Northwest Toxicity Assessment Group (NWTAG), December 2000, Seattle, WA.

Chartrand, A.B. (Northwest Toxicity Assessment Group Chair) and S. Singleton (Pacific Northwest SETAC), May 11, 2000. Threatened and Endangered Pacific Northwest Species: Aquatic Toxicity Issues Workshop. Co-sponsored by Northwest Toxicity Assessment Group Chair) and Pacific Northwest SETAC, May 11, 2000.

Chartrand, A.B. 1998. 'Towards More Ecologically Relevant Biological Testing in Contaminated Sediments: (1) Concordance of Benthic Bioassessment with Laboratory Chronic Bioassay Data under Washington's Sediment Management Standards.' Presented at the Nineteenth Annual Meeting of the Society of Environmental Toxicology and Chemistry in Charlotte, NC.

Venkatesan, M.I., G.E. Greene, E. Ruth, and A.B. Chartrand. 1996. 'DDTs and Dumpsites in the Santa Monica Basin, California.' (Institute of Geophysics and Planetary Physics, Contribution No. 3981). The Science of the Total Environment 179: 61-71.

Chartrand, A.B. 1995. 'Defining site-specific sediment quality objectives for contaminated marine sediments.' Presented at Society of Environmental Toxicology and Chemistry, Sixteenth annual meeting in Vancouver, B.C., November.

Chartrand, A.B., V.A. Artman, A.D. Every, J.P. Pecoraro, and G. Connolly. 1995. Invited manuscript for 'Refining the Ecological Risk Assessment of Pesticides,' for EPA Office of Pesticide Programs, Washington, D.C.

Chartrand, A.B.. G.S. Reub, S.L. Shaner, J.L. Cameron, J.L. Dudley, and L. Jollan. 1993. 'Using ecological risk techniques to site a mining transfer facility in a marine embayment.' Presented at Fourteenth Annual meeting of Society of Environmental Toxicology and Chemistry, Houston, Texas.

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Chartrand, A.B., K.P Campbell, and L. Faha. 1991. 'Toxicity Evaluation and Ranking of Columbia Slough Sediments.' Presented at Twelfth Annual meeting of Society of Environmental Toxicology and Chemistry, Seattle, WA.

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Attachment 2: 2007 Permit: Seattle Iron & Metals NPDES No. WA0031968 – DMR Data Summary May 2010 – September 2013

Month/Year	**Copper** **Daily Maximum:* 5.8 µg/L**	**Zinc** **Daily Maximum:* 95.1 µg/L**	**Notes on flow (mgd)**
5/2010	**42**	**320**	
6/2010			No reported discharge
7/2010			No reported discharge
8/2010	**32.7**	**218**	
9/2010	**92.9**	**1190**	
10/2010	**58.8**	**505**	Did not sample flow
11/2010	**34.3**	**237**	Did not sample flow
12/2010	**6.4**	**193**	
1/2011	**32**	**971**	
2/2011	**56.5**	**1470**	
3/2011	**42.8**	**1340**	
4/2011	**13**	**205**	
5/2011			No reported discharge
6/2011			No reported discharge
7/2011			No reported discharge
8/2011			No reported discharge
9/2011	**42.2**	**618**	Did not sample flow
10/2011	**20.3**	**584**	
11/2011	**26.5**	**751**	
12/2011	**21.4**	**346**	
1/2012	**20**	**254**	
2/2012	**37.6**	**372.5**	
3/2012	**11.5**	**103**	
4/2012			No reported discharge

5/2012			No reported discharge
6/2012	**36.1**	**700**	0.024537
7/2012	**13**	**218**	0.022283
8/2012			No reported discharge
9/2012			No reported discharge
10/2012	**8.13**	**377**	0.084209
11/2012	ND	12.5	0.171656
12/2012	ND	1.63	0.45858
1/2013	**116**	**1100**	0.027184
2/2013	2.42	21.8	0.021708
3/2013	4.76	49.9	0.49675
4/2013	**23.1**	**275**	0.022782
5/2013	**14.9**	**140**	0.026068
6/2013			“Monitoring not req. this period”
7/2013			No reported discharge
8/2013	1.37	41.8	0.01894
9/2013	**ND**	**ND**	0.095967

Notes:
* 2007 Permit
Bold = exceedances

Attachment 3: 2013 Permit: Seattle Iron & Metals NPDES No. WA0031968 – DMR Data Summary, October 2013 – October 2014

Month/Year	Copper Daily Maximum:* 26.5 13.2 (µg/L)	Lead Daily Maximum:* 119 52 (µg/L)	Zinc Daily Maximum:* 491 245 (µg/L)	TPH Daily Maximum:* 5 5 (mg/L)	TSS Daily Maximum:* 10 10 (mg/L)	PCBs Daily Maximum:* 8.9 5.1 (ng/L)	Flow (gal/mo)
10/2013	2.37	3.56	54.9	**10.7**	8	ND	146,552
11/2013	**79.1**	38.8	**654**	**34.8**	**20**	**592**	438,869
12/2013	**56.1**	**80.4**	**731**	**16.6**	**58**	**622**	110,959
1/2014	**17**	20.6	244	**10.7**	7	ND	364,237
2/2014	10.5	7.14	137	**18.5**	**13**	ND	757,622
3/2014	**18.9**	10.7	165	**71.3**	ND	**442**	810,175
4/2014	1.6	0.9	11.2	**8.4**	6	ND	217,537
5/2014	2.4	1.9	27.2	3.1	ND	ND	259,223
6/2014							no discharge
7/2014	2.3	2.3	33.8	4.1	<10	ND	82,240
8/2014	0.75	<52	3.95	**7.9**	<10	**470**	134,458
9/2014	<13.2	<52	14	4.29	<10	**181**	251,071
10/2014	0.646	0.762	23.2	3.93	<10	**1590**	881,537

Notes:
* 2013 Permit
Bold = exceedances

Attachment 4: Untreated stormwater water quality data for PCBs, copper and zinc

Month/Year	**Sample ID**	**Copper (criterion of 14 µg/L)**	**Zinc (criterion of 117 µg/L)**	**PCBs (criterion of 0.25 µg/L)**	**Data source**
4/2011	APL	**83**	**626**	0.2 U[1]	(3)
5/2011[2]	APL	**80.5**	**686**	0.2 U[1]	(4)
4/2011	RS1	**14.8**	**173**	0.2 U[1]	(3)
5/2011[2]	RS1	**286**	**1120**	0.2 U[1]	(4), (5)
4/2011	RS2	3.5	68.2	0.2 U[1]	(3)
5/2011[2]	RS2	**18.8**	112	0.2 U[1]	(4)
4/2011	RS3	2.6	71.4	0.2 U[1]	(3)
5/2011[2]	RS3	**15.9**	**119**	0.2 U[1]	(4)
4/2011	RS4	7	110	0.2 U[1]	(3)
5/2011[2]	RS4	**21.7**	**156**	0.2 U[1]	(4)
4/2011	RS5	10.8	**141**	0.2 U[1]	(3)
5/2011[2]	RS5	**23**	**249**	0.2 U[1]	(4)
4/2011	RS6	2.3	71	0.2 U[1]	(3)
5/2011[2]	RS6	1.7	43.6	0.2 U[1]	(4)
4/2011	SP1	**13.3**	**208**	0.2 U[1]	(3)
3/(25)/2014	RS2	**76.5**	**444**	0.2 U[1]	(3) (6)
3/(25)/2014	RS5	**53.8**	**266**	0.2 U[1]	(7)
3/(25)/2014	MH1	**104**	**419**	0.2 U[1]	(7)
3/(28)/2014	002	**16.1**	**170**	0.2 U[1]	(6)

Notes:

(1) Analytic method EPA 8082.
(2) May 11, 2011 samples collected during an approximately 24-hour long rainfall event of ~0.51 inches. Rain event preceded by approximately 72 hours without measurable rainfall**.**

(3) Exhibit 46 (Fremont Analytical SIMC000303)
(4) Exhibit 46 (Fremont Analytical SIMC000333)
(5) Exhibit 45 (SIM 2012 NPDES Permit Application)
(6) Exhibit 44 (SIM DMR)
(7) Exhibit 46 (Fremont Analytical SIMC000261)

Bold text indicates concentration in excess of S1>b effluent limits.

Attachment 5: Storm drain soils and sediments monitoring data for PCBs at and adjacent to SIM Facility

Month/Year	**Sample ID**	**Total PCBs (µg/kg dw)**	**TOC (%)**	**PCB OC SQS exceedance by a factor of:**	**PCB dry wt. SQS exceed-ance by a fac-tor of:**	**Location**	**Outfall**	**Data Source**
9/2008	RCB146-091208	2,560	6.9	**3.1**	**19.7**	CB in ROW in front of SI&M property	S. Myrtle St. SD	(1)
9/2008	RCB147-091208	694	5.3	**8.4**	**5.3**	CB at NE corner of intersection 7th Ave S and S Orchard St.	S. Myrtle St. SD	(1)
9/2008	MH100-091208	1,550	6.9	**1.9**	**11.9**	MH at W end S Myrtle St opposite SI&M property	S. Myrtle St. SD	(1)
9/2008	RCB148-091208	3,700	9.4	**3.3**	**28.5**	CB at SE corner of intersection 7th Ave S and S Myrtle St.	S. Myrtle St. SD	(1)
9/2008	RCB149	3,300	3.3	**8.5**	**25.4**	CB at SE corner of 7th Ave S & S Myrtle St.	S. Myrtle St. SD	(1)
9/2008	MH101	328	3.1	0.9	**1.5**	Located NW of SIM property at corner of Fox Ave S and S Brighton St.	--	(1)
6/2009	MN240-060309	25,000	18.7	**18.7**	**192.3**	SI&M property	S. Garden St. SD	(2)
6/2009	CB207-060309	18,300	--	--	**140.8**	MH at inlet to vault on SI&M property	S. Garden St. SD	(2)
5/2010	RD1-10194000	1,930	10.1	**1.6**	**14.8**	Rooftop of SIM office building on S Myrtle St.	S. Garden St. SD	(3)
5/2010	RD1-10194000	2,200	10	**1.8**	**16.9**	Rooftop of SIM office building on S Myrtle St.	S. Garden St. SD	(3)
5/2010	RD2-10194001	4,570	8.4	**4.5**	**351**	Rain gutter on the roof of SIM maintenance building located next to loading/shredder operations	S. Myrtle St. SD	(3)
5/2010	RD2-10194001	2,300	7.5	**2.6**	**17.7**	Rain gutter on the roof of SIM maintenance building located next to loading/shredder operations	S. Myrtle St. SD	(3)
5/2010	CB157S-10194002	4,020	6.7	**6.7**	**30.9**	CB in the SIM employee parking lot on S Myrtle St (collects runoff from	S. Garden St. SD	(3)

						roof drains on office building). Sampled from the CB sump.		
5/2010	CB157F	2,960	4.6	**4.6**	**22.8**	CB in the SIM employee parking lot on S Myrtle St (collects runoff from roof drains on office building). Sampled from the filter sock installed in the CB.	S. Garden St. SD	(3)
5/2010	CB157S-10194002	4,200	8.2	**4.3**	**32.3**	CB in the SIM employee parking lot on S Myrtle St (collects runoff from roof drains on office building). Sampled from the CB sump.	S. Garden St. SD	(3)
5/2010	RB189F	2,950	4.9	**4.9**	**22.7**	CB on S Myrtle St next to SIM main driveway entrance. SPU sampled the filter.	S. Myrtle St. SD	(3)
5/2010	RB189S-10194003	9,500	14.9	**5.3**	**73.1**	CB on S Myrtle St next to SIM main driveway entrance. EPA sampled the sump.	S. Myrtle St. SD	(3)

Notes:

SQS Values
Total PCBs = 12 mg/kg OC (carbon-normalized)
Total PCBs = 130 µg/kg dry wt

Data Sources
(1) Exhibit 48 (Seattle Public Utilities, lab report).
(2) Exhibit 49 (Seattle Public Utilities, map and spreadsheet).
(3) Exhibits 38, 39, 50 (EPA and Seattle Public Utilities split samples)

Attachment 6: Storm drain solids monitoring data for copper, mercury, and zinc at and adjacent to SIM Facility

		Copper		Mercury		Zinc				
Month/ Year	**Sample ID**	**Concen-tration (mg/kg)**	**SQS ex-ceedance**	**Concen-tration (mg/kg)**	**SQS ex-ceedance**	**Concen-tration (mg/kg)**	**SQS ex-ceedance**	**Location**	**Outfall**	**Data Source**
9/2008	RCB146-091208	1,020	2.6	1.08	2.6	2,900	7.1	CB in ROW in front of SI&M property	S. Myrtle St. SD	(1)
9/2008	RCB147-091208	365	0.9	0.97	2.4	1,540	3.7	CB at NE corner of intersection 7th Ave S and S Orchard St.	S. Myrtle St. SD	(1)
9/2008	MH100-091208	500	1.3	1.88	4.6	2,420	5.9	MH at W end S Myrtle St opposite SI&M property	S. Myrtle St. SD	(1)
9/2008	RCB148-091208	386	1	0.74	1.8	1,950	4.8	CB at SE corner of intersection 7th Ave S and S Myrtle St.	S. Myrtle St. SD	(1)
9/2008	RCB149	353	0.9	0.72	1.75	2,040	5	CB at SE corner of 7th Ave S & S Myrtle St.	S. Myrtle St. SD	(1)
9/2008	MH101	220	0.56	0.28	0.7	829	2	Located NW of SIM property at corner of Fox Ave S and S Brighton St.	--	(1)
6/2009	MN240-060309	2,200	5.6	4.29	10.5	8,960	21.9	SI&M property	S. Garden St. SD	(2)
6/2009	CB207-060309	7,990	20.5	2.72	6.6	3,300	8	MH at inlet to vault on SI&M property	S. Garden St. SD	(2)
5/2010	RD1-10194000	1,090	2.8	0.92	2.2	5,370	13.1	Rooftop of SIM office building on S Myrtle St.	S. Garden St. SD	(3)
5/2010	RD1-10194000	1,140	2.9	--	--	4,900	12	Rooftop of SIM office building on S Myrtle St.	S. Garden St. SD	(3)
5/2010	RD2-10194001	975	2.5	2.56	6.2	8,310	20.3	Rain gutter on the roof of SIM maintenance building located next	S. Myrtle St. SD	(3)

								to loading/shredder operations		
5/2010	RD2-10194001	1,050	2.7	--	--	7,520	18.3	Rain gutter on the roof of SIM maintenance building located next to loading/shredder operations	S. Myrtle St. SD	(3)
5/2010	CB157S-10194002	2,240	5.7	1.55	3.8	5,880	14.3	CB in the SIM employee parking lot on S Myrtle St (collects runoff from roof drains on office building). Sampled from the CB sump.	S. Garden St. SD	(3)
5/2010	CB157F	1,890	4.8	0.8	1.9	4,940	12	CB in the SIM employee parking lot on S Myrtle St (collects runoff from roof drains on office building). Sampled from the filter sock installed in the CB.	S. Garden St. SD	(3)
5/2010	CB157S-10194002	1,950	5	--	--	4,780	11.7	CB in the SIM employee parking lot on S Myrtle St (collects runoff from roof drains on office building). Sampled from the CB sump.	S. Garden St. SD	(3)
5/2010	RB189F	3,280	8.4	0.66	1.6	3,890	9.5	CB on S Myrtle St next to SIM main driveway entrance. SPU sampled the filter.	S. Myrtle St. SD	(3)
5/2010	RB189S-10194003	861	2.2	--	--	4,380	10.7	CB on S Myrtle St next to SIM main driveway entrance. EPA sampled the sump.	S. Myrtle St. SD	(3)

Notes:

SQS Values

Copper = 390 mg/kg
Mercury = 0.41 mg/kg
Zinc = 410 mg/kg

Data Sources

(1) Exhibit 48 (Seattle Public Utilities, lab report).
(2) Exhibit 49 (Seattle Public Utilities, map and spreadsheet).
(3) Exhibits 38, 39, 50 (EPA and Seattle Public Utilities split samples)

Attachment 7: Bottom sediment from LDW immediately adjoining SIM facility, including total PCBs, copper, and zinc

Month\Year	Sample ID	Total PCBs (µg/kg dw)	PCB SQS (µg/kg dw)	Copper (mg/kg)	Copper SQS (mg/kg)	Zinc (mg/kg)	Zinc SQS (mg/kg)	Reference/comments
6/2012	SIM-SS-01	**970**	130[2/] 240[1]	DNE	390[2]	DNE	410[2]	South wharf surface sediments adjoining SIM facility (Floyd Snider 2012)
6/2012	SIM-SS-02	**700**	130[2/] 240[1]	DNE	390[2]	DNE	410[2]	South wharf surface sediments adjoining SIM facility
6/2012	SIM-SS-03	60	130[2/] 240[1]	**624**	390[2]	DNE	410[2]	South wharf surface sediments adjoining SIM facility
6/2012	SIM-SS-04	130	130[2/] 240[1]	DNE	390[2]	DNE	410[2]	South wharf surface sediments adjoining SIM facility
6/2012	SIM-SS-100	840	130[2/] 240[1]	DNE	390[2]	DNE	410[2]	South wharf surface sediments adjoining SIM facility
5/2011	SIM-BS-1	**192**	130 (LAET[2]) 240 (RAL[1])	**392**	390[2]	DNE	410[2]	[3]Soil samples collected from river bank adjoining SIM facility. (Hart Crowser 2011)
5/2011	SIM-BS-2	62	130[2/] 240[1]	**422**	390[2]	**690**	410[2]	[3]Soil samples collected from river bank adjoining SIM facility.
5/2011	SIM-BS-3	71	130[2/]240[1]	317	390[2]	220	410[2]	[3]Soil samples collected from river bank adjoining SIM facility.
5/2011	SIM-BS-4	53	130[2/]240[1]	**522**	390[2]	130	410[2]	[3]Soil samples collected from river bank adjoining SIM facility.
SAIC (2008)	RI LDW-SS88	**660**	130[2/]240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Othello Street.
SAIC (2008)	RI LDW-SS87	**720**	130[2/]240[1]	DNE	390[2]	DNE	410[2]	Located in the LDW offshore of the SIM facility.
SAIC (2008)	EPA SI DR174 (740)	**490**	130[2/]240[1]	DNE	390[2]	DNE	410[2]	Located in the LDW offshore of the SIM facility.

SAIC (2008)	EPA SI DR119 (685)	**390**	130[2]/240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Garden Street.
SAIC (2008)	EPA SI DR118 (684)	530	130[2]/240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Garden Street.
SAIC (2008)	EPA SI DR151 (717)	**330**	130[2]/240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Othello Street.
SAIC (2008)	NOAA EST182 (172)	**250**	130[2]/240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Myrtle Street.
SAIC (2008)	EPA SI EST176 (166)	120	130[2]/240[1]	DNE	390[2]	DNE	410[2]	Correlates to the location of Seattle municipal storm drain outfall for S. Othello Street.

Notes:

[1] RAL is Remedial Action Level for total PCBs set specifically for LDW sediments as part of EPA's CERCLA action.
[2] LAET is Lowest Apparent Effects Threshold, a toxicity-based value established for Puget Sound sediments
[3] Soil samples collected from the river bank adjoining SIM facility between the apparent mean higher high water elevation and the vegetation line to a depth of 1 to 5 cm. Chromium levels in each of these samples exceeded the most stringent soil standard and the MTCA Method B human health criteria.

Parentheses("()" denotes revised numbering system as shown in SAIC (2008), Figure 3.
DNE = did not exceed corresponding SQS value.
Bold denotes exceedance of corresponding SQS value.

Attachment 8: Key Documents

Exhibit No.	Document
1	WA Department of Ecology (Ecology). 2013. NPDES Permit No. WA0031968, issuance date of September 16, 2013 (third paragraph, p. 6 under S1.A. This is Section S1 – Discharge Limits and Prohibitions under Subsection A (process wastewater discharges).
2	Ecology 2013. Fact Sheet for NPDES permit WA0031968 for Seattle Iron & Metals (SIM) Corporation, 55 pp.
14	Ecology 2011. Water Quality Program Permit Writer's Manual. December 2011, Publ. No. 92-109, 730 pp. (pp. IX-36, VI-28 at Table VI-3)
15	EPA 2013. Proposed Plan for Lower Duwamish Waterway (LDW) Superfund Site, EPA Region 10, Seattle, WA, February 28, 2013. 121 pp. http://yosemite.epa.gov/r10/cleanup.nsf/sites/lduwamish
19	Lower Duwamish Waterway Group (LDWG) 2012. Final Feasibility Study Lower Duwamish Waterway.
20	Ecology 2004. Lower Duwamish Waterway Source Control Strategy. Ecology Publication No. 04-09-043. WDOE Northwest Regional Office. January 2004. http://www.ecy.wa.gov/pubs/0409043.pdf.
27	SAIC 2009. Source Control Action Plan (SCAP), co-prepared by WDOE with assistance from the City of Seattle, King County and EPA Region 10, June 2009.
28	EPA 2010. Comment Letter from EPA regarding SIM facility (from M. Lidgard, Region 10 NPDES Permits Unit) to E. Abbasi, Ecology Northwest Regional Office, 10 September 2010, 10 pp.
39	Ecology 2012. Current 303(d) listing for Washington State of impaired and threatened water bodies. Lacey, WA. http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html
40	Ecology and King County, 2011. Control of Toxic Chemicals in Puget Sound: Assessment of Selected Toxic Chemical in the Puget Sound Basin, 2007-2011. WDOE Olympia, and King County DNR, Seattle. Ecology Publ. No. 11-03-055. www.ecy.wa.gov/biblio/1103055.html.
41	LDWG 2007. Remedial Investigation Appendix A: Baseline Ecological Risk Assessment for the Lower Duwamish Superfund Site. 681 pp.

http://www.epa.gov/region10/pdf/sites/ldw/remedial_investigation_appxA_ERA_7-31-2007.pdf

42 SAIC 2008. Summary of existing information and identification of data gaps, Lower Duwamish Waterway RM 2.3-2.8 East, Seattle Boiler Works to Slip 4. Prep. for Ecology, 2008.

43 Washington State Department of Health-Agency for Toxic Substances and Disease Registry (WDOH-ATSDR) 2005. Lower Duwamish River Site: Updated Fish Consumption Advisory and Evaluation of Marine Tissues Collected from the LDW in August-September 2004, Seattle, WA. DOH 333-103, 19 pp.

47 EPA Region 10 (2010b). Warning letter to Seattle Iron & Metals Corporation, 3 Nov 2010. 6 pp.

- Agency for Toxic Substances and Disease Registry (ATSDR) 2000. Toxicological Profile for PCBs. November 2000. http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=142&tid=26

- Ecology 2013. Sediment Management Standards. WAC 173-204. [see 173-204-400(6) [a through g] for multiple factors relating to discharge to cause a violation of the SMS] http://www.ecy.wa.gov/programs/tcp/smu/sed_standards.htm

- Ecology 2013. Water Quality Criteria. http://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-240

- Ecology 2006. Ecology's Mixing Zone guidance, WAC 173-201A-400.

- European Commission 2011. Report to the European Parliament and the Council on Priority Substances in the field of Water Policy concerning the review of Annex X under the Water Framework Directive (2000/60/EC). http://ec.europa.eu/environment/water/water-dangersub/pri_substances.htm

Attachment 9: Other Key References

Alava J.J., et al., 2012. Habitat-based PCB environmental quality control for the protection of endangered killer whales (50 ppb ww). American Chemical Society, xo.soi.org/10.102/es202062q.

British Columbia Ministry of Environment, Land and Parks, province of British Columbia, Canada. 1992. Water Quality Criteria for PCBs. http://www.env.gov.bc.ca/wat/wq/BCguidelines/pcbs/pcbs-02.htm

Detroit Water and Sewerage Department (DWSD). 2003. Technical Memorandum: Review of Regulatory Issues for New Wastewater Discharges, rev. September 2003. Part of Wastewater Master Plan, DWSD Project No. CS-1314.

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EPA 2006. Compilation of EPA Mixing Zone documents. EPA Office of Water, July 2006, EPA 823-R-06-003. http://water.epa.gov/scitech/swguidance/standards/mixingzones/

EPA 2000. Final Rule to Amend the Final Water Quality Guidance for the Great Lakes System to Prohibit Mixing Zones for Bioaccumulative Chemicals of Concern. http://www.epa.gov/fedrgstr/EPA-WATER/2000/November/Day-13/w28709.htm

EPA 1991. Technical Support Document for Water Quality-based Toxics Control. EPA\505\2-90-001, USEPA, Office of Water. Washington, DC, March 1991.

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Attachment 10: Glossary of Terms

ATSDR – Agency for Toxic Substances and Disease Registry

AWQC – Ambient Water Quality Criteria

BAF – Bioaccumulation Factor

BCF – Bioconcentration Factor

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act

CFR – Code of Federal Regulations

CWA – Clean Water Act

DABT – Diplomate, American Board of Toxicology

DARRP – Damage Assessment Remediation and Restoration Program

DDT – dichlorodiphenyltrichloroethane

DMR – Discharge Monitoring Reports

DOH – Department of Health

dw (DW) – Dry Weight

Ecology – Washington Department of Ecology

EPA – US Environmental Protection Agency

ESA – Endangered Species Act

FR – Federal Register

K_{oc} – Organic-Carbon partition coefficient

K_{ow} – Octanol-water partition coefficient

LAET – Lowest Apparent Effects Threshold

LDW – Lower Duwamish Waterway

LDWG – Lower Duwamish Working Group

mg/L – milligrams per liter (parts per million)

mg/kg – milligrams per kilogram (parts per million)

µg/L – micrograms per liter (parts per billion)

µg/kg – micrograms per kilogram (parts per billion)

ng/L – nanograms per liter (parts per trillion)

MTCA – Model Toxics Control Act

NOAA - National Oceanic and Atmospheric Administration

NMFS – National Marine Fisheries Service

NPDES – National Pollutant Discharge Elimination System

NRDA – Natural Resource Damage Assessment

NTR – National Toxics Rule

oc (OC) – Organic Carbon

PAHs – polycyclic aromatic hydrocarbons

PBTs – Persistent Bioaccumulative Toxins

PCBs – polychlorinated biphenyls

ppm – parts per million

ppb – parts per billion

pptr – parts per trillion

PQL – Practical Quantitation Limit

PSDDA – Puget Sound Dredge Disposal Analysis

PWM – Permit Writer's Manual

QA/QC – Quality Assurance/Quality Control

RAL – Remedial Action Level

RM – River Mile

RPA – Reasonable Potential Analysis

SIM – Seattle Iron & Metals

SMS – Sediment Management Standards

SPU – Seattle Public Utility

SQS – Sediment Quality Standards

SSCSUM – Sediment Source Control Standards User Manual

T&E – Threatened and Endangered

TI/RE – Toxicity Identification/Reduction Evaluation

TOC – Total Organic Carbon

TPH – Total Petroleum Hydrocarbons

TSS – Total Suspended Solids

US – United States

VOCs – Volatile Organic Compounds

WAC – Washington Administrative Code

WDOH – Washington Department of Health

WET – Whole Effluent Toxicity

Ww (WW) – Wet Weight