

APPENDIX F

STATUS OF SOURCE CONTROL ACTIVITIES WITHIN STORM DRAINAGE BASINS AND CSO BASINS

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F.1 INTRODUCTION

This appendix describes actions taken to control sources identified based on results from the City of Seattle, King County, and Port of Seattle source tracing activities in storm drain (SD) and combined sewer overflow (CSO) systems that discharge to the East Waterway (EW). Source control actions have typically involved removing contaminated solids from SDs and sanitary/combined sewer lines that have accumulated from past, and in some cases ongoing, activities, as well as requiring changes in business practices to eliminate or reduce potential sources. Updates to the chemical characterizations of these basins based on data collected subsequent to source control actions will be conducted in the feasibility study.

This appendix summarizes source control actions taken as of 2012 and is organized by basin (or areas within a basin). For each basin where an action has been taken, a focused summary of the data that triggered an action (e.g., polychlorinated biphenyl [PCB] concentration in grab sample) is presented. This discussion is generally limited to contaminants of concern (COCs), as discussed in Section 9 of the main document, with some exceptions, such as bis (2-ethylhexyl) phthalate (BEHP). BEHP is not discussed in this appendix because source tracing activities are not based on this compound alone given its ubiquitous nature in urban environments. In addition, if a specific compound that was unique to source tracing was identified in a given basin (e.g., silver), that compound is discussed. A more detailed summary of all data associated with SD and combined sewer solids samples are included in Section 9 of the main document.

There are no regulatory standards for solids collected from catch basins or in the lines of SD or CSO conveyance systems. For the purpose of this appendix, SD and combined sewer solids data are compared with the Washington State Sediment Management Standards (SMS) to provide a rough indication of overall quality. The SMS-based SD screening levels that were used included SMS dry weight sediment values (e.g., for metals) or the lowest apparent effect thresholds (LAETs) (for organics), which are dry weight equivalents of the organic carbon-normalized SMS values. Source control investigations were often undertaken when COCs were greater than the second-lowest apparent effect threshold (2LAET) in storm drain solids and greater than two times the 2LAET for combined sewer lines.

Following a discussion of the data, a summary of any action taken (e.g., line cleaning, issuance of King County industrial waste permit, operational change for area), the results of

the action, and the identification of any future activities planned to confirm if source control action was sufficient to prevent re-contamination are discussed. Map F-1 shows the general areas or specific basins that are discussed in the following subsections.

F.1.1 Hanford #2 CSO Basin/Rainier Commons

The Rainier Commons property (formerly the Rainier Brewery) is located at 3100 Airport Way S in Seattle. The northern portion of the Rainier Commons property drains to the Lower Duwamish Waterway (LDW), and the southern portion of the site drains to King County's Hanford #2 CSO system in the EW. Source tracing activities conducted by Seattle Public Utilities (SPU) in 2004 identified the Rainier Commons property as a source of total PCBs. An investigation revealed that elevated concentrations of PCBs (9.5 to 23 mg/kg dry weight [dw]) in right-of-way catch basin samples were caused by leaching and wear of the exterior building paint, which contained high levels of PCBs. Samples collected by the U.S. Environmental Protection Agency (EPA) indicated that paint on the buildings at the Rainier Commons property contained up to 18,000 mg/kg dw total PCBs (Kissinger, 2010). EPA has assumed the lead role, under the authority of the Toxic Substances Control Act (TSCA), to oversee the remediation of the affected buildings and the proper disposal of PCB-laden materials.

In 2008, SPU jetted and cleaned approximately 900 ft of SD lines on Airport Way S (which discharges to the Diagonal Avenue S CSO/SD in the LDW), and Rainier Commons jetted and cleaned the onsite SDs on the north end of the property to remove PCB-contaminated material.

In 2008, King County collected inline whole water composite samples from a portion of the Rainier Commons property that drains to the Hanford #2 CSO system, to assess the status of PCB source control activities at the site. Samples were collected from one location on the Rainiers Commons property (Locator A00709) during three different sampling events: January 10, March 13, and June 3, 2008.¹ Samples at Locator A00709 were collected from a maintenance hole on the combined sewer line (stormwater/sanitary) on the Rainier Commons property that discharges to the Hanford trunk line. Total PCBs, as the sum of

¹ All sampling events were conducted during periods of precipitation. Further details on the sampling can be found in King County (2009).

detected Aroclors, were detected during two of the three sampling events. PCBs were not detected in the samples collected on January 10, 2008, at an individual Aroclor method detection limit of 0.24 µg/L. Total PCBs were detected in composite samples at concentrations of 0.062 µg/L (< RDL) on March 13, 2008, and 1.24 µg/L on June 3, 2008.

In October 2009, King County collected two inline solids grab samples from a combined sewer line at two maintenance holes (Locators A00929 and A00709) located on the Rainier Commons property (Map F-2). The two samples had total PCB concentrations of 178 and 347 mg/kg dw, respectively. At King County's request, Ariel Development, the owner of the Rainier Commons property, contracted with Clean Harbors Environmental Services for the removal of solids that had accumulated in the property's drainage structures (i.e., trenches, catch basins, pipes, and maintenance holes²). This cleanup was completed on May 24, 2010.

On March 14, 2011, King County issued a control document (Major Discharge Authorization No. 4201-01) to Rainier Commons, LLC. The control document requires that the permittee implement source control best management practices (BMPs) to capture, collect, and properly dispose of PCB-bearing paint chips. The control document also requires that the permittee annually collect and analyze solids and aqueous PCBs and submit the results to King County. An aqueous sample collected by the permittee on December 28, 2011, at Locator A00709, had a total PCB concentration of 0.35 µg/L (0.21 µg/L of Aroclor 1254 and 0.14 µg/L of Aroclor 1260).³ In response to these results and a joint SPU/KCIW site inspection conducted on March 29, 2012, King County requested that Rainier Commons improve its stormwater source control BMPs to control PCB inputs to stormwater that discharges from the property to the combined sewer system. King County also has requested that Rainier Commons collect additional aqueous and solids samples, if available, to demonstrate that any newly implemented source control activities are successful. Subsequent inline whole water grab samples collected at Locator A00709 by Rainier Commons on May 3, 2012, indicated a total PCBs concentration below the method detection limit (0.1 µg/L). Additional inline whole water grab samples collected by King County on October 22, 2012, and January 9, 2013, indicated total PCBs concentrations of 0.061 µg/L (<RDL) and below the

² All structures and lines are private property and therefore not all are indicated on the map; the main lines cleaned are labeled on Map F-2.

³ The permittee reported that an inline solids sample was not collected because of a lack of material in the line.

method detection limit (0.05 µg/L), respectively. King County’s attempts to collect inline sediment samples during these events have been unsuccessful due to the absence of material. While King County will continue to work with Rainier Commons to ensure that source control activities are successfully limiting PCB inputs to the combined sewer system, the remediation of the affected buildings and the proper disposal of PCB-laden materials is under the oversight of EPA TSCA.

F.1.2 Hanford #2 CSO Basin/4th Avenue S Combined Sewer Line

In 2009, King County collected inline solids grab samples from two maintenance holes on the City of Seattle combined sewer line along 4th Avenue S: Locators A00918 (September 2, 2009) and A00818 (October 14, 2009) (Map F-3). The sample from Locator A00818, which is located upstream from the Seattle City Light South Yard site connection to the combined sewer line, had a total PCB concentration of 1,640 µg/kg dw and a high-molecular-weight polycyclic aromatic hydrocarbon (HPAH) concentration of 51,400 µg/kg dw (Table F-1). Samples from Locator A00918,⁴ which is located downstream from the Seattle City Light South Yard site and closer to the Hanford trunk connection, had total PCB concentrations of 12,063 and 36,650 µg/kg dw and HPAH concentrations of 17,332 and 22,163 µg/kg dw. Concentrations of mercury were quite variable, ranging from 0.50 to 17.1 mg/kg dw (Table F-1).

Table F-1
Chemicals of Interest Based on 4th Avenue S
Source Tracing Inline Grab Samples Collected in 2009

Station ID/Locator	Sample Type	Date	Total PCBs (µg/kg dw)	Total HPAHs (µg/kg dw)	Mercury (mg/kg dw)
A00818	inline grab	10/14/2009	1,640	51,400 J	0.77
A00918	inline grab	9/2/2009	12,063 J	17,332	0.50 J ^a
A00918 (duplicate)	inline grab	9/2/2009	36,650 J	22,163	17.1 J ^a

^a Concentration was based on average of result and two laboratory duplicate runs.

dw – dry weight

J – estimated value

ID – identification

PCB – polychlorinated biphenyl

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

⁴ A field duplicate was collected at this location.

SPU conducted additional source tracing in the drainage and wastewater system on the Seattle City Light South Yard site and in catch basins on the adjacent combined sewer line along 4th Avenue S (Map F-3). The drainage and wastewater lines on the South Yard are plumbed to two onsite combined sewer lines on the north and south ends of the property, which then connect to the public combined sewer system on 4th Ave S. Elevated concentrations of total PCBs (41,300 µg/kg dw), arsenic (80 mg/kg), mercury (6.6 mg/kg), and HPAHs (38,240 µg/kg dw) were found in a sample collected from the onsite combined sewer (MH114) on the south side of the Seattle City Light property (Table F-2). This sample was considered to represent historical contributions because the material was scraped from the sidewall of the pipe. As presented in Table F-2, elevated concentrations of PCBs (1,470 µg/kg dw), HPAHs (18,630 µg/kg dw), and mercury (9.2 mg/kg) were also found in the combined sewer on the north side of the Seattle City Light South Yard (MH115). Catch basins sampled in the right-of-way along 4th Avenue S and on other properties adjacent to 4th Avenue S (i.e., RCB187, RCB188, CB1, and CB164) had relatively low levels of these contaminants, indicating that contamination was associated with the onsite drainage/wastewater system and not stormwater runoff in the area.

Table F-2
Chemicals of Interest Based on 4th Avenue S Additional Source Tracing Samples

Station ID	Sample Type	Date	Total PCBs (µg/kg dw)	Total HPAHs (µg/kg dw)	Arsenic (mg/kg dw)	Mercury (mg/kg dw)
MH114	inline grab	5/06/2010	41,300	38,240 J	80	6.6
MH115	inline grab	5/25/2010	1,470	18,630	32	9.2
RCB187	right-of-way catch basin	5/0520/10	56	2,823 J	7 U	0.04
RCB188	right-of-way catch basin	5/05/2010	63	5,295	7 U	0.06
CB1	onsite catch basin	8/21/2003	160	7,140	10 U	0.3
CB164	onsite catch basin	8/25/2010	69	5,710	6	0.07

dw – dry weight

ID – identification

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

J – estimated value

PCB – polychlorinated biphenyl

U – not detected at given concentration

In 2010, the City of Seattle cleaned all of the onsite drainage and wastewater lines on Seattle City Light property and the entire combined sewer line along 4th Avenue S, from the upstream end to the point where it connects to the King County Hanford trunk line, to remove the contaminated material. Approximately 5,400 ft of side sewer and 2,300 ft of

sewer mainline were cleaned. An estimated 37 tons of material were removed from the system. The material was incinerated at the Clean Harbors Aragonite facility in Utah.

On March 14, 2011, King County issued a renewed control document (Major Discharge Authorization No. 4194-01) to Seattle City Light. The control document required that the permittee effectively maintain its drainage system infrastructure to ensure proper sediment separation. The control document also required that the permittee collect and analyze aqueous samples for PCBs and submit the results to King County. Seattle City Light collected two composite aqueous samples from two industrial wastewater point sources on January 25 and 27, 2011. The two samples were collected from Locators A41965 (the outlet from the oil/water separator near the Salvage Building) and A41967 (the outlet from the sump in Building E). The sampling analysis identified non-detectable concentrations of PCBs (practical quantitation limit was equal to 0.049 µg/L). King County continues to monitor Seattle City Light's operation and maintenance procedures to determine if additional steps are required to control chemical inputs to stormwater and industrial wastewater that discharges from the property to the combined sewer system. The combined line will be re-sampled once sufficient material has accumulated in the line for sampling. SPU attempted to sample four maintenance holes on the 4th Ave S combined sewer line in December 2012, as well as MH114 and MH115 in January 2013, but there was insufficient material to sample.

F.1.3 Hanford #2 CSO Basin/6th Avenue S Combined Sewer Line

Both combined sewer and separated SD lines are located along 6th Avenue S (Map F-4). The combined sewer line is connected to the King County Hanford trunk line at S Hanford Street. The separated SD line flows south and is connected to the Diagonal Avenue S CSO/SD, which discharges to the LDW. On Map F-4, catch basins that discharge to the Hanford trunk line are shown in orange; those connected to the separated SD line are shown in blue.

In September 2009, King County collected inline solids grab samples from the combined sewer line on 6th Avenue S (Locator A00920) for source tracing characterization (Map F-4). The solids samples had elevated concentrations of silver, chromium, copper, and mercury (Table F-3); all were greater than the benchmark of two times the SMS cleanup screening level (CSL).

Table F-3
Chemicals of Interest Based on 6th Avenue S Source Tracing
Inline Grab Solids Samples Collected in 2009

Station ID/Locator	Sample Type	Date	Silver (mg/kg dw)	Chromium (mg/kg dw)	Copper (mg/kg dw)	Mercury (mg/kg dw)
A00920	inline grab	9/2/2009	98.7 J	1,750	1,140	2.3 J

dw – dry weight
 ID -- identification
 J – estimated value

In 2010, SPU conducted additional business inspections and collected additional source tracing samples along 6th Avenue S to aid in the identification of potential sources of silver, chromium, copper, and mercury. SPU inspects businesses that engage in pollution-generating activities (e.g., manufacturing, outdoor chemical and product storage, and vehicle and equipment fueling) to ensure that City Stormwater Code requirements for stormwater pollution prevention are being employed. Business inspections are one way SPU and the County evaluate if businesses are following codes for stormwater runoff or industrial discharges to combined sewer, and to evaluate if BMPs are being followed. These inspections help the City and County evaluate the potential for a business to contribute unacceptable levels of contaminants to the drainage basin. The businesses that were inspected and sampling locations are identified on Map F-4. There were limited opportunities to collect samples from catch basins plumbed to the combined sewer system in this area because most of the right-of-way catch basins in this area are connected to the separated storm drain system, which discharges to the Duwamish Waterway via the Diagonal Ave S CSO/SD system. Additionally, most of the surface runoff entering the combined sewer comes from roof drains that are plumbed directly into the combined sewer system. Therefore, other samples that have been collected from the adjacent SD system are also identified on Map F-4. These samples were included, because they provide information about the quality of stormwater solids and aid in the evaluation of potential contributions from atmospheric deposition and vehicle emissions in this area. SPU does not typically analyze samples for silver, but samples CB161, CB162, RCB186, and RCB187 were analyzed for silver because of the relatively high concentration found in the combined sewer line sample (Table F-3). Results presented in Table F-4 indicate that stormwater runoff does not appear to be a source of the silver found in the combined sewer system.

Table F-4
Chemicals of Interest Based on 6th Avenue S Source Tracing
Catch Basin Samples Collected in 2008 and 2010

Station ID	Sample Type	Date	Silver (mg/kg dw)	Chromium (mg/kg dw)	Copper (mg/kg dw)	Mercury (mg/kg dw)
CB161	onsite catch basin	7/27/2010	0.9 U	135	175	0.02 U
CB162	onsite catch basin	7/27/2010	0.6 U	62.6	76	0.1
RCB140 ^a	right-of-way catch basin	5/14/2008	na	na	129	0.04 U
RCB141 ^a	right-of-way catch basin	5/14/2008	na	na	224	0.05 U
RCB186	right-of-way catch basin	5/05/2010	1.0	92.6	168	0.29
RCB187	right-of-way catch basin	5/05/2010	0.4 U	88.3	118	0.04

dw – dry weight

na – not analyzed

U – not detected at given value

- a. Catch basin connected to the separated storm drain system which drains to the Lower Duwamish Waterway via the Diagonal Ave S CSO/SD outfall.

Based on source investigations completed to date, no obvious sources of copper or mercury to the combined sewer system on 6th Avenue S were found. As shown in Table F-4, metals concentrations in the catch basin samples were low,

Based on the catch basin sample results and because the material sampled in the combined sewer on 6th Ave S (A00920) was compacted in the line and had to be scraped from the bottom of the pipe, the sample from the combined line is considered to represent historical contributions of these chemicals. However, in 2011, King County identified a potential source of silver and chromium at Alaskan Copper Works (3200 6th Avenue S). Alaskan Copper Works fabricates stainless steel pipe and fittings and currently holds a King County waste discharge permit. The potential source of silver is an X-ray processing machine that discharges 100 to 150 gallons per day of treated process solutions and wash water. This waste stream was not previously known to King County. Silver-rich solutions are pumped to a silver recovery pretreatment system before being discharged to the sewer. King County collected a grab sample of the discharge from the pretreatment system on March 22, 2011, and analyzed it for metals. The sample had a silver concentration of 0.26 mg/L, which is in compliance with King County's local discharge limits⁵ of 3.0 mg/L for grab samples. The

⁵ King County local discharge limits were developed in accordance with EPA guidelines and are based on treatment plants effluent standards, biosolids quality standards, worker safety, and treatment plant activated-sludge inhibition. These local limits are not related to ambient water quality criteria.

sample also had a chromium concentration of 2.84 mg/L, which, although unexpected, is also in compliance with King County's discharge limit of 5.0 mg/L for grab samples. Alaskan Copper Works indicated that the source of chromium was from the base material (X-ray film) used for photoprocessing. King County is revising Alaskan Copper Works' control document (Waste Discharge Permit No. 7238-04) to require that Alaskan Copper Works monitor this waste stream for silver and chromium in the future.

F.1.4 Hanford #2 CSO Basin/E Marginal Way S and S Hinds Street Combined Sewer Line and Northwest Cascade

In 2007 and 2008, CSO water quality data collected during CSO discharges from the Hanford #2 CSO had much higher concentrations of 1,4-dichlorobenzene (1,4-DCB) relative to those of other CSO basins in the Duwamish River basin (King County 2011) and compared with CSO water quality data collected from this location in the mid-1990s. Because of the concentrations, King County began a source tracing investigation for 1,4-DCB in the Hanford #2 CSO basin. First, in 2008, whole water grab samples from various locations in both the Hanford and Lander trunk lines were collected during both dry and wet weather events followed by additional sampling in 2009 in combined sewer lines along S Hinds Street and E Marginal Way S in the Hanford #2 CSO system (King County 2009). Non-detect results for 1,4-DCB were found for the majority of samples taken from Lander and Hanford trunk lines. Detections occurred during all three sampling events at the Hanford #2 Regulator station, Locator A00801; concentrations ranged from 48.6 to 768 µg/L. Only one of the three sampling events at the Lander Regulator Station (Locator A00808) had a detection (10.3 µg/L)⁶. 1,4-DCB was only detected at two locations in the Hanford Trunk: locators A00805 (15.3 µg/L) and A00816⁷ (61.9 µg/L). The highest concentrations were found along combined sewer lines on E Marginal Way S, Locator A00817 (37,600 µg/L) and on S Hinds Street, Locator A00903 (2,840 µg/l), as well as in the sample collected from A45341 (4,570 µg/L), which is the industrial wastewater being discharged to the combined sewer from operations at Northwest Cascade, Inc.

⁶ Note that there is a line that connects Hanford and Lander Trunk lines to increase the storage capacity of the system.

⁷ Locator A00816 is located where the E Marginal Way combined sewer line connects with the Hanford Trunk.

In 2008 and 2009, inline solids grab samples were collected from the Hanford trunk line and from local combined sewer lateral lines connected to the trunk line. Elevated levels of 1,4-DCB (i.e., those greater than two times the 2LAET) were detected in the combined sewer line along E Marginal Way S (Table F-5). Even higher concentrations of 1,4-DCB (2,680,000 and 44,500,000 µg/kg dw) were detected in samples collected from the S Hinds Street combined sewer line, which connects to the E Marginal Way S combined sewer line.

Table F-5
Chemicals of Interest Based on E Marginal Way S and S Hinds Street
Source Tracing Samples Collected in 2009 and 2010

Station ID	Sample Type	Date	1,4-Dichlorobenzene (µg/kg dw)	Copper (mg/kg dw)	Lead (mg/kg dw)	Mercury (mg/kg dw)
A00817	inline grab	9/1/2009	1,370,000	742	1,190	1.8 J
A00904	inline grab	9/2/2009	2,680,000	1,700	1,860	6.1 J
A00903	inline grab	9/2/2009	44,500,000	81.2	38.6	0.33 J
A00905	inline grab	9/2/2009	1,520	71.2	256	0.09 J
A01009	inline grab	8/10/2010	na	393	390	0.06 J
A01010	inline grab	8/10/2010	na	189	68.9	0.42 J
A01011	inline grab	8/10/2010	na	31.2	7.63	0.02 J

dw – dry weight
 ID -- identification
 na – not analyzed
 J – estimated value

Both the whole water grab samples and the inline solids grab samples indicated that the source of 1,4-DCB was industrial wastewater that was being discharged to the sewer from operations at Northwest Cascade (3414 2nd Avenue S). Northwest Cascade disposes of chemical toilet waste at this location. The chemical deodorizing blocks used in the toilets were found to contain 1,4-DCB. Northwest Cascade has found a substitute product that is free of 1,4-DCB and replaced the blocks in all of their portable toilets. In addition, they have cleaned the wastewater pretreatment system and lines on their property. In late 2012, the company installed an additional solids separation vault and grinder pump to optimize solids separation and prevent solids build-up in the downstream combined lines. King County has revised Northwest Cascade’s control document (Major Discharge Authorization No. 4008-03)

and placed a 1,4-DCB discharge screening level of 25 µg/L⁸ on the discharge from Northwest Cascade and will require Northwest Cascade to monitor this wastewater in the future.

King County performed additional source tracing in August 2010 for three other chemicals that were greater than two times the CSL in samples collected from S Hinds Street (Locator A00904). These included copper (1,700 mg/kg dw), lead (1,860 mg/kg dw) and mercury (6.1 mg/kg dw). Additional samples were collected at Locators A01009, A01010, A01011 (Map F-5). Concentrations of copper, lead, and mercury were all much lower in these samples (Table F-5). No additional action was taken based on these findings. Because of the planned cleaning of the combined sewer line on S Hinds Street, no further source tracing actions were taken for these metals. Re-sampling will occur sometime after line cleaning to see if these metals continue to be found at elevated levels or if they were based on historical inputs.

In January 2012, SPU cleaned the combined sewer lines along S Hinds Street and E Marginal Way S (2,900 ft) to remove contaminated sediment in the lines (Map F-5). Approximately 6 cubic yards (9 tons) of material were removed. Confirmation sampling has been completed, and the material was classified as hazardous waste under 40 Code of Federal Regulations (CFR) 261. The material was incinerated at the Clean Harbors Aragonite facility in Utah. The combined line will be resampled once sufficient material has accumulated in the line for sampling.

F.1.5 S Hinds Street Storm Drain

In 2008, as part of routine source tracing sampling activities, SPU identified elevated levels of mercury (0.69 mg/kg) and total PCBs (1,140 µg/kg dw) above the 2LAET in an inline grab sample (RCB138) collected from the S Hinds Street SD system (Map F-6). Because these concentrations exceeded the screening levels used to assess when source tracing is needed, SPU conducted additional sampling in this system to identify potential sources. Sampling locations are shown in Map F-6. Samples results for mercury and PCBs are provided in Table F-6.

⁸ In comparison, the concentration of 14-DCB in a sample collected by King County in April 2009 was 4,570 µg/L. After the company removed the product and cleaned their lines, samples collected at this same location range from non-detected (method detection limit of 20 µg/L) to 60 µg/L.

Table F-6
Chemicals of Interest Based on S Hinds Street
Source Tracing Samples Collected in 2005, 2008, and 2009

Station ID	Sample Type	Date	Mercury (mg/kg dw)	Total PCBs (µg/kg dw)
RCB138	inline grab	5/01/2008	0.69	1,140
MH104	inline grab	7/27/2009	0.12	20 U
MH107	inline grab	11/12/2009	0.16 J	705
MH109	inline grab	11/12/2009	0.52 J	208
MH113	inline grab	5/03/2010	0.7	260
CB59	onsite catch basin	3/03/2005	0.18	760
CB132	onsite catch basin	12/16/2008	0.1	72 J
CB134	onsite catch basin	3/27/2009	0.06 J	20
CB135	onsite catch basin	3/27/2009	0.06 J	178
RCB46	right-of-way catch basin	8/24/2005	0.05 J	250
RCB168	right-of-way catch basin	4/10/2009	0.04	20U
RCB174	right-of-way catch basin	11/12/2009	0.04 J	530

dw – dry weight

J –estimated value

PCB – polychlorinated biphenyl

U – not detected at given concentration

No obvious trends or sources were identified. Therefore, SPU considered the contaminants to be the result of historical sources and elected to clean the entire SD line (Map F-6). The line (approximately 5,200 ft) and associated structures (approximately 35 maintenance holes and 50 catch basins) were jetted and cleaned in 2009, which involved the removal of approximately 100 tons of sediment. SPU will continue to monitor this system to determine whether concentrations of mercury and PCBs are present in the future (no additional sampling has been conducted as of this time).

F.1.6 Terminal 102 Basin 1 Storm Drain

Basin 1 is used for vehicle parking at the Harbor Island Marina. A near-end-of-pipe solids sample collected in 2010 was submitted for dioxin/furan analysis, which resulted in a dioxin/furan concentration of 148 ng toxic equivalent (TEQ)/kg. The maintenance hole from which this sample was collected (MH 5510) was cleaned out in August 2011. To date, no new data have been collected from this SD. Cleanout of the associated line is planned for 2013.

Following cleanout, additional samples will be collected from the line to determine the nature of the source in this area.

F.1.7 Terminal 18 Basin 11 Storm Drain

Basin 11 primarily consists of container storage for Terminal 18, with a small bermed area used for truck fueling. In 2009, the Port of Seattle collected a sediment trap sample and co-located inline grab from Basin 11. Sampled accumulated solids were found to have concentrations of PCBs and copper above the 2LAET/CSL. In 2010, additional inline grab source tracing samples and a second round of sediment trap samples were collected to determine the extent of elevated concentrations in the line. Based on these results, it was determined that elevated PCB and copper concentrations were limited to the first lateral line of this drainage system (Map F-7). Total PCB concentrations in inline grab samples from the first lateral line ranged from 320 to 86,000 mg/kg dw. Copper concentrations ranged from 300 to 3,600 mg/kg dw (Map F-7). No ongoing source was identified based on data distribution and upland site use. Historically, this area was the site of the Seattle Iron and Metals facilities, which moved in 1997. In 1991, the City of Seattle jetted and cleaned the SD line and associated structures within the street right-of-way. In 2010, the archived samples from the sediment trap and co-located inline grab were combined and analyzed for dioxins/furans; the detected concentration was 82.4 ng TEQ/kg dw.

Based on these results, the lateral line and associated catch basins were slated for cleanout. Cleanout is currently scheduled for 2013. Following cleanout, additional samples will be collected from this system once sediment has re-accumulated to determine if source control actions are complete.

F.1.8 Terminal 18 Basin 7 Storm Drain

Basin 7 (B-7) primarily encompasses the southern truck entrance and trailer parking for Terminal 18, with a small portion of an intermodal container yard. A composite sample from Basin 7 (B-7) was initially collected and analyzed in December 2008. The composite sample was created by mixing equal portions of volume from CB01 through 06 (shown on Map F-8); this sample had concentrations of HPAHs and zinc above the 2LAET/CSL (Table F-7). In December 2009, the Port of Seattle conducted a cleanout of the catch basins in Basin 7 (B-7) (Map F-8). Post-cleanout catch basin composite solids samples were collected in June 2010.

For comparison, Table F-7 also presents the near-end-of-pipe inline grab sample from this same basin (Map F-8).

Table F-7
Chemicals of Interest Based on Basin 7
Source Tracing Samples Collected in 2008 and 2010

Station ID	Sample Type	Date	Zinc (mg/kg dw)	Total HPAHs (µg/kg dw)
EW08-B7-CB-COMP01 (pre-cleanout)	catch basin composite	12/7/2008	1,660	17,300
EW-10-B7-CBC01 (post-cleanout)	catch basin composite	6/4/2010	616	4,500 J
EW10-B7-MH01	inline	4/22/2010	296	1400 J

dw – dry weight

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

J – estimated concentration

A comparison of the December 2008 pre-cleanout results and the June 2010 post-cleanout results from Basin 7 (B-7) indicates that the cleanout was effective in reducing concentrations of HPAHs to below the LAET and concentrations of zinc below the CSL. The cleaning of drainage lines of Basin 7 (B-7) was completed in October 2010 (Map F-8). Approximately 5 tons of material was removed. No new data have been collected from the line since the cleanout was completed.

F.1.9 Terminal 104 Basin 37 and Basin 39 Storm Drains

Basins 37 and 39 are located at Terminal 104. These basins currently drain the area leased by Pacific Coast Container Logistics for cargo transloading. A near--of-pipe inline grab sample was collected from Basin 37 in April 2010 (Map F-9). Zinc was detected at a concentration (1,100 mg/kg dw). This sample was also submitted for dioxin/furan analysis; the dioxin/furan concentration was 110 ng TEQ/kg dw. No samples were collected from Basin 39 because no sediment was observed in the lines.

As part of tenant lease and construction activities on the E Marginal Way S Grade Separation Project in 2011, the SDs at Terminal 104 were dye tested and mapped, and all structures and lines from Basins 37 and 39 were cleaned out in February of that year (Map F-9). The amount of material removed is not available. No new data have been collected from these lines since cleanout.

F.1.10 Terminal 25 South Basin 34 Storm Drain

Basin 34 is located at the south end of Terminal 25 (Map F-10). This area is currently used for truck parking. A near-end-of-pipe in-line solids grab sample was collected from Basin 34 in April 2010. Cadmium, lead, mercury, zinc, total PCBs, and 1,2-dichlorobenzene were detected at elevated concentrations (Map F-10). This sample was also submitted for dioxin/furan analysis. The dioxin/furan concentration was 784 ng TEQ/kg dw. Although the site is currently used only for parking, it is the historical site of the former Westinghouse facility). Based on the fact that the site is currently being used for parking only, and the line is intact based on field information during cleanout it is assumed that the source of this contamination was likely historical.

The cleanout of the line and associated catch basins was conducted in October 2010 (Map F-10). Approximately 1.5 tons of solids were removed. Lines have been checked in 2011 and 2012 for accumulated solids. To date, no new data have been collected to determine impact of cleanout because no solids have re-accumulated in the lines. Evaluation of new data, when collected, will be conducted to verify the historical nature of the source in this area.

F.1.11 Terminal 25 North (25N) Basin 32 Storm Drain

Basin 32 is located toward the northern end of Terminal 25 (Map F-10). It is used for container storage and vehicle parking and includes a portion of the truck entrance/exit at Terminal 25N. Historically, this area was used for the transloading of dredged sediment from the Phase 1 dredging. Composite and discrete catch basin grab samples were initially collected and analyzed in December 2008. The December 2008 composite samples from some of the catch basins in Basin 32 had elevated concentrations of cadmium, mercury, and zinc (Table F-8). In December 2009, the Port of Seattle conducted a cleanout of the catch basins and SD lines (Map F-10). Approximately 1 ton of material was removed. Post-cleanout catch basin solids samples were collected and composited in June 2010. In addition, a near-end-of-pipe inline grab sample from this same basin was collected in April 2010.

Table F-8
Chemicals of Interest Based on In-Basin 32
Source Tracing Samples Collected in 2008 and 2010

Sample ID	Sample Type	Date	Mercury (mg/kg dw)	Cadmium (mg/kg dw)	Zinc (mg/kg dw)	Total HPAHs (µg/kg dw)
EWB32 range of discrete CB samples	catch basin	12/7/2008	nd – 12.7	0.7 – 39.2	na	na
EW08-B32-CB-COMP01 (pre-cleanout)	composite catch basin	12/7/2008	2.57	6.4	2,190	6,500 J
EW-10-B2-CBC01 (post-cleanout)	composite catch basin	6/3/2010	0.18 J	12.1	1,140 J	14,400 J
EW10-32-MH01 (near-end-of-pipe sample)	inline grab	4/22/2010	0.04	12.4	1,330	2,480 J

dw – dry weight

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

J – estimated concentration

na – not available

nd – not detected

The sampling results indicated that the cleanout reduced the concentrations of mercury and zincs, suggesting that the source of these chemicals was historical. However, concentrations of cadmium and total HPAHs in the post-cleanout catch basin samples were higher than those in the pre-cleanout samples. These higher post-cleanout results indicate that there may be residual historical material in some of the sampled catch basins or ongoing chemical sources may be affecting the system. However, the catch basin composite represents material that has been trapped in the catch basin and may not represent sediment entering the waterway. The sample from the near-end-of pipe is more representative of material in the line. Zinc and cadmium were detected above the CSL; however, total HPAHs were below the LAET. Given the ubiquitous nature of zinc concentrations in Port SDs, no immediate action was identified based on this data alone. Additional actions may be identified during the FS recontamination evaluation.

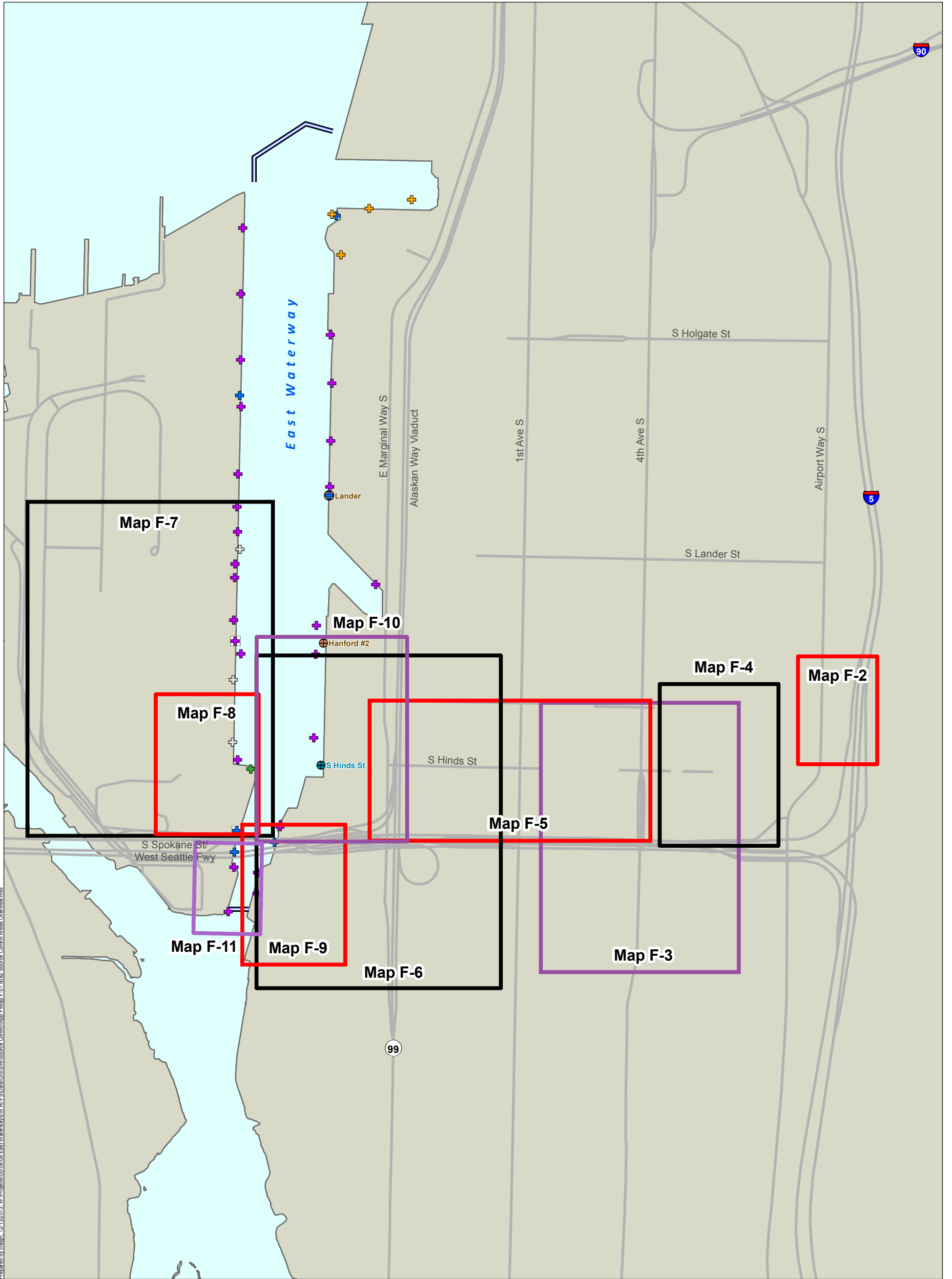
F.2 REFERENCES

Kissinger, L. 2010. Personal communication (April 2, 2010 letter to Scott Downey, U.S. EPA Region 10; Dan Cargill, Washington Department of Ecology; Kris Flint, U.S. EPA Region 10; and Richard Mednick, U.S. EPA Region 10 regarding Health Consultation

for PCBs at Rainier Commons LLC). U.S. Environmental Protection Agency, Seattle, WA.

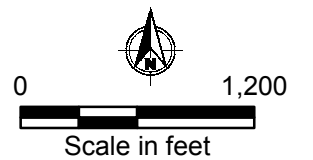
King County. 2009. East Waterway source tracing sampling in combined sewer system draft data report. Prepared by King County Dept of Natural Resources and Parks, Industrial Waste Program/Wastewater Treatment Division, Seattle, WA.

King County. 2011. Duwamish River basin combined sewer overflow data report for samples collected from September 2007 to January 2010. King County Water and Land Resources Division, Department of Natural Resources and Parks, Seattle, WA.

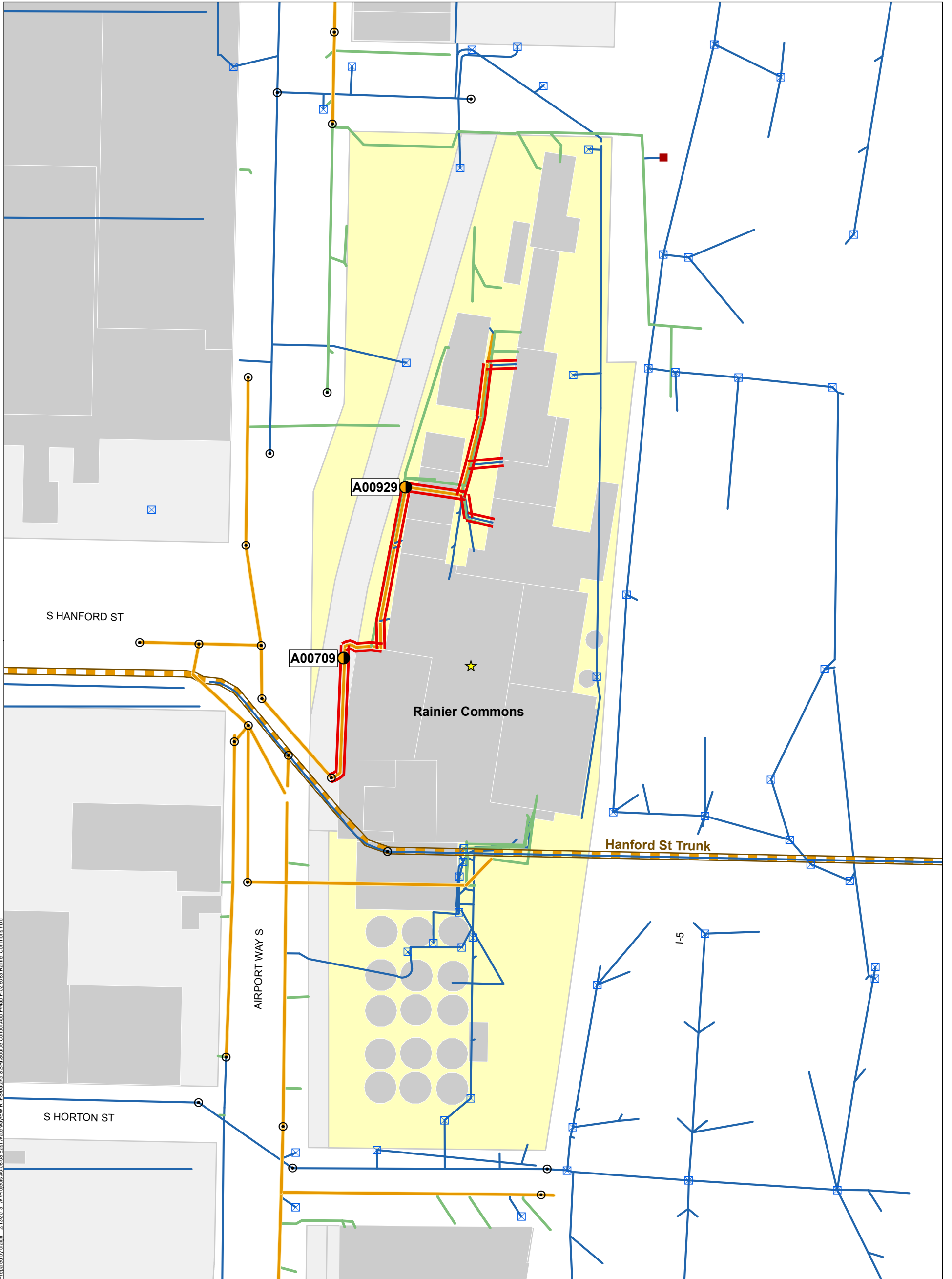


Prepared by caaph, 12/13/2013, W:\Projects\00\06\06_East Waterway\GIS\Source Control\Map F-1 9/18/08 Source Control Areas Overview.mxd

East Waterway Study Area Boundary	Storm Drain Outfalls
Combined Sewer Overflow Outfalls	Port of Seattle
City of Seattle CSO/SD	City of Seattle
King County CSO	US Coast Guard
King County CSO/City of Seattle SD	City EOF/Port SD
	City EOF/City SD
	Private
	Unknown Outfall



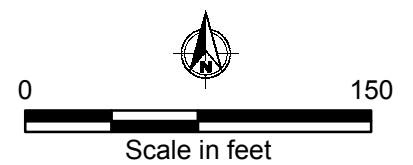
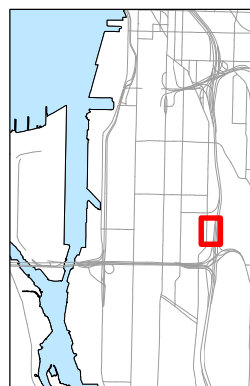
Map F-1
Areas or Specific Basins Highlighted for Source Control Activities in the EW Supplemental Remedial Investigation East Waterway Study Area



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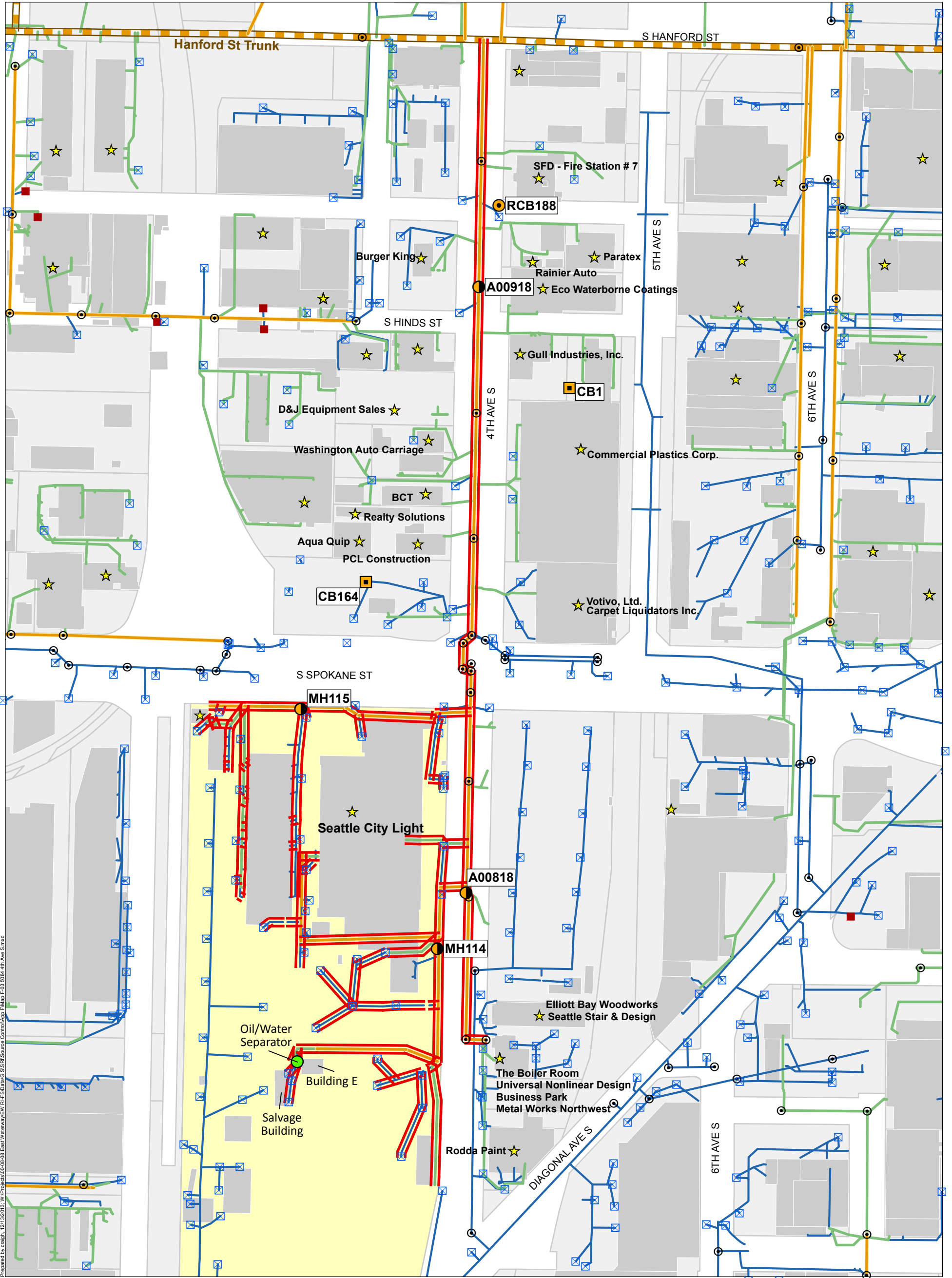
Structures		Samples in Combined/Sanitary Sewer System	
	Catch Basin		Inline Grab
	Sand Box		Business Inspection
	Maintenance Hole		Property of Interest
Utilities			Building
	Storm Drain		Parcel
	Sanitary Sewer		
	Combined Sewer		
	KC-WTD Conveyance		
	Lines Cleaned in 2010		

A00xxx Station ID



Map F-2
 Rainier Commons Area within
 the Hanford #2 CSO Basin
 Supplemental Remedial Investigation
 East Waterway Study Area

Note: The status of lines upstream of Locator A00929 is unknown (i.e., whether they are combined sewer lines or just sewer lines). All lines connected to combined line shown at Locator A00929 discharge to the Hanford Trunk.

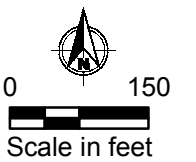
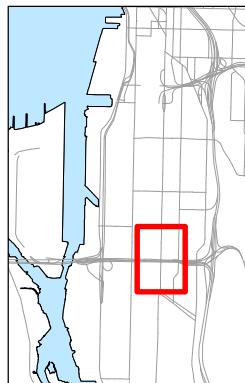


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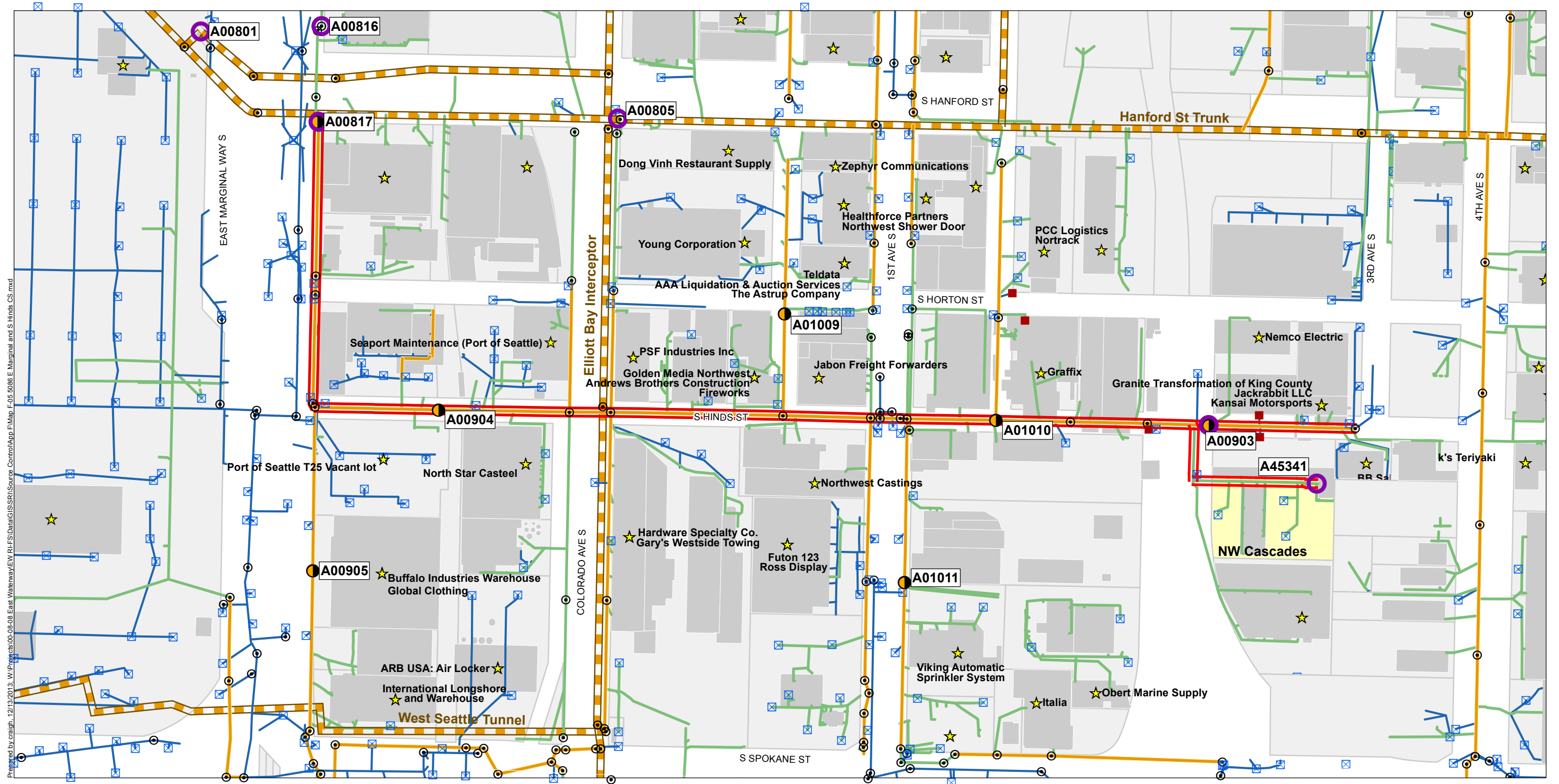
Structures	Samples in Combined/Sanitary Sewer System
Catch Basin	Right-of-Way Catch Basin
Sand Box	Catch Basin
Maintenance Hole	Inline Grab
Utilities	Business Inspection ^a
Storm Drain	Property of Interest
Sanitary Sewer	Building
Combined Sewer	Parcel
KC-WTD Conveyance	
Lines Cleaned in 2010	

A00xxx Station ID

^a Only inspections for businesses that drain to the highlighted lines are labeled.



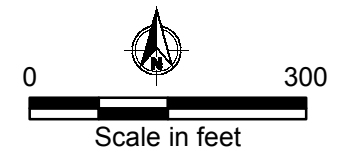
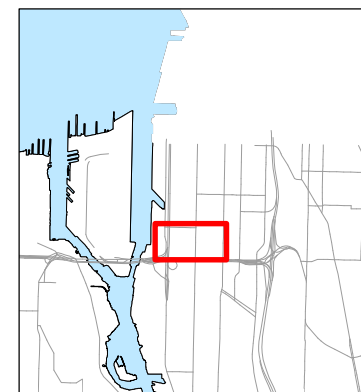
Map F-3
S Hanford Street and 4th Avenue S Combined Sewer Line within the Hanford #2 CSO Basin Supplemental Remedial Investigation East Waterway Study Area



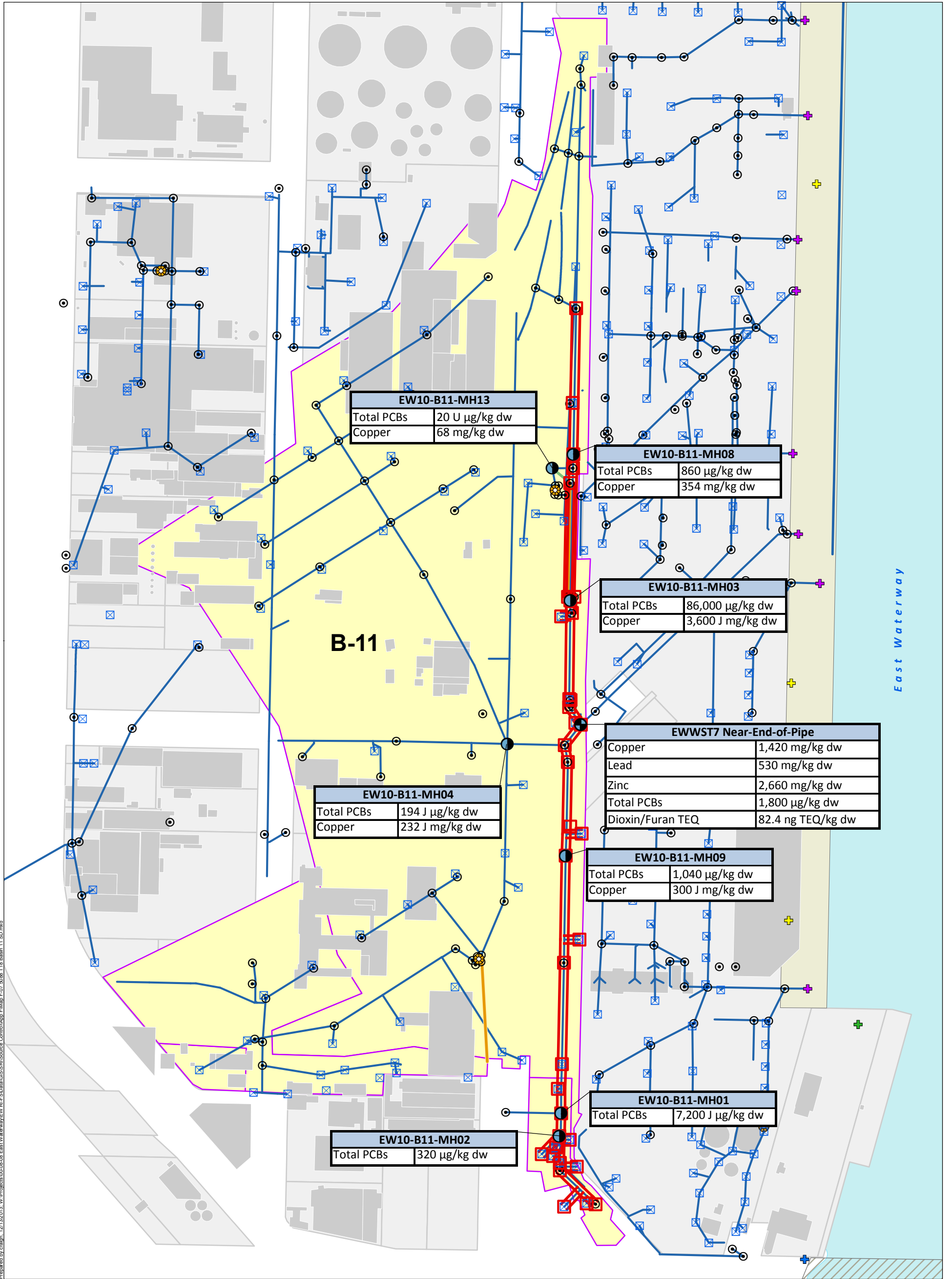
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⊙ Maintenance Hole	○ Whole Water Sample
Utilities	★ Business Inspection ^a
— Storm Drain	■ Property of Interest
— Sanitary Sewer	■ Building
— Combined Sewer	□ Parcel
— KC-WTD Conveyance	
— Lines Cleaned in 2012	
A00xxx Station ID	

^a Only inspections for businesses that drain to the highlighted lines are labeled.

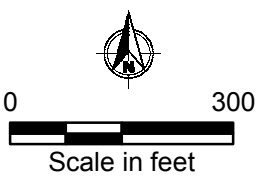
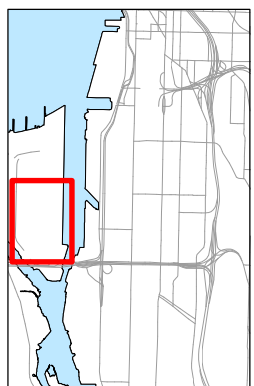


Map F-5
 E Marginal Way S and S Hinds Street Combined Sewer Lines
 and Northwest Cascade Area within the Hanford #2 CSO Basin
 Supplemental Remedial Investigation
 East Waterway Study Area

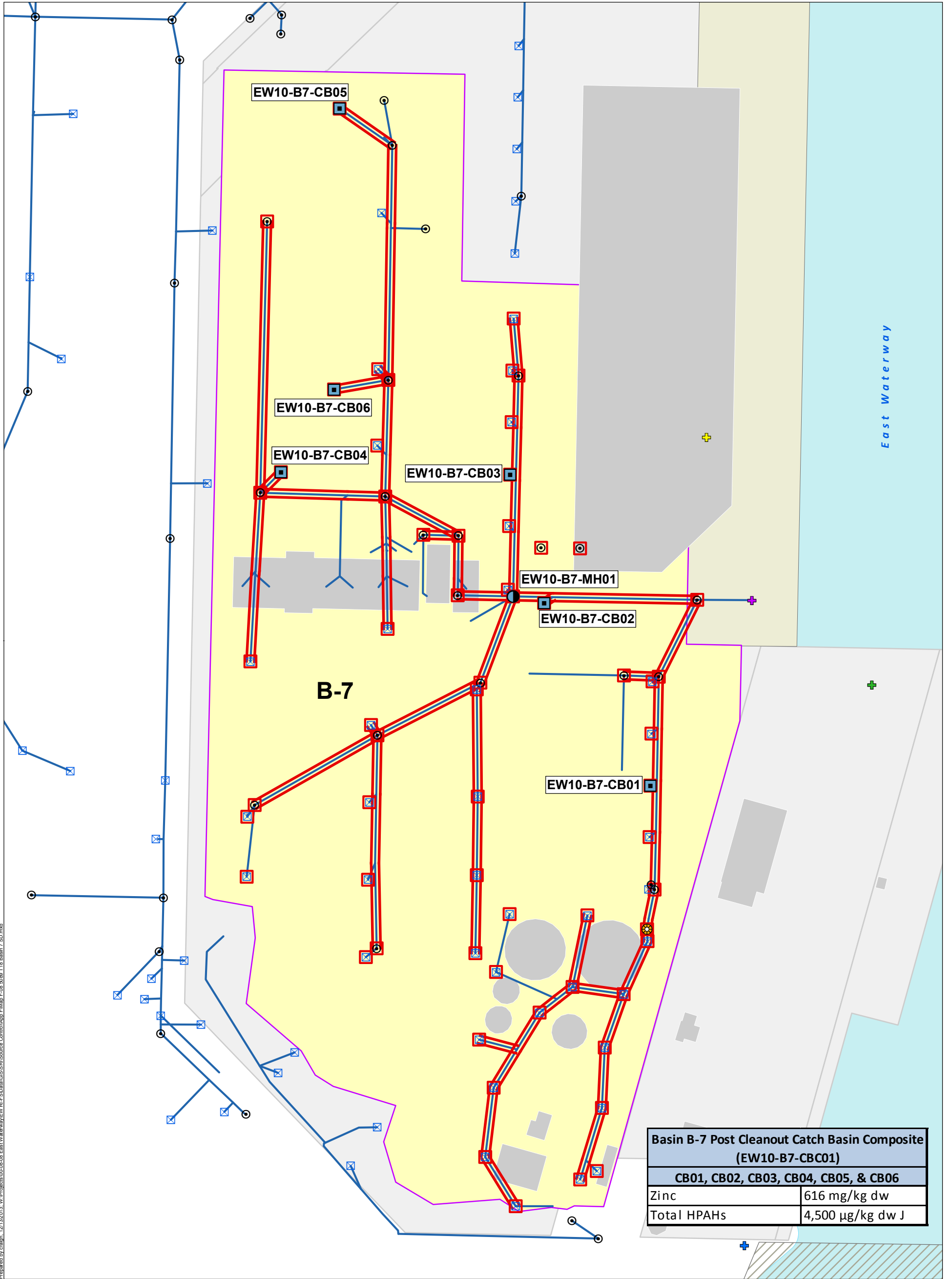


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<p>Structures</p> <ul style="list-style-type: none"> Catch Basin Manhole Oil Water Separator Proposed Structure Cleanout <p>Storm Drain Outfalls</p> <ul style="list-style-type: none"> Port of Seattle SD City of Seattle SD Private SD Unknown Outfall 	<p>Utilities</p> <ul style="list-style-type: none"> Storm Drain Sanitary Sewer Combined Sewer Proposed Line Cleanout <p>Sample Locations</p> <ul style="list-style-type: none"> Inline Grab Sediment Trap Location 	<p> Property of Interest</p> <ul style="list-style-type: none"> Building Dock/Pier Bridge Parcel
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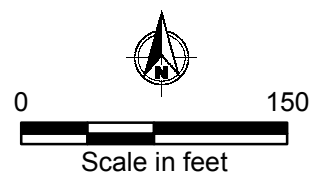
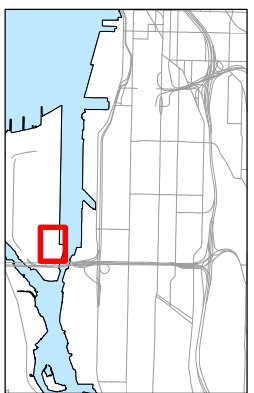


Map F-7
Terminal 18 Basin 11 Storm Drain
Supplemental Remedial Investigation
East Waterway Study Area



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<p>Structures</p> <ul style="list-style-type: none"> ☒ Catch Basin ⊙ Manhole ⊙ Oil Water Separator ☐ Cleaned Structure <p>Storm Drain Outfalls</p> <ul style="list-style-type: none"> ⊕ Port of Seattle SD ⊕ City of Seattle SD ⊕ Private SD ⊕ Unknown Outfall 	<p>Utilities</p> <ul style="list-style-type: none"> — Storm Drain — Sanitary Sewer — Combined Sewer — Line Cleaned in 2010 <p>Sample Locations</p> <ul style="list-style-type: none"> ☐ Catch Basin ● Inline Grab <p>EW10-Bx-xxxx Sample ID</p>	<ul style="list-style-type: none"> ☐ Property of Interest ■ Building ■ Dock/Pier ▨ Bridge ■ Parcel
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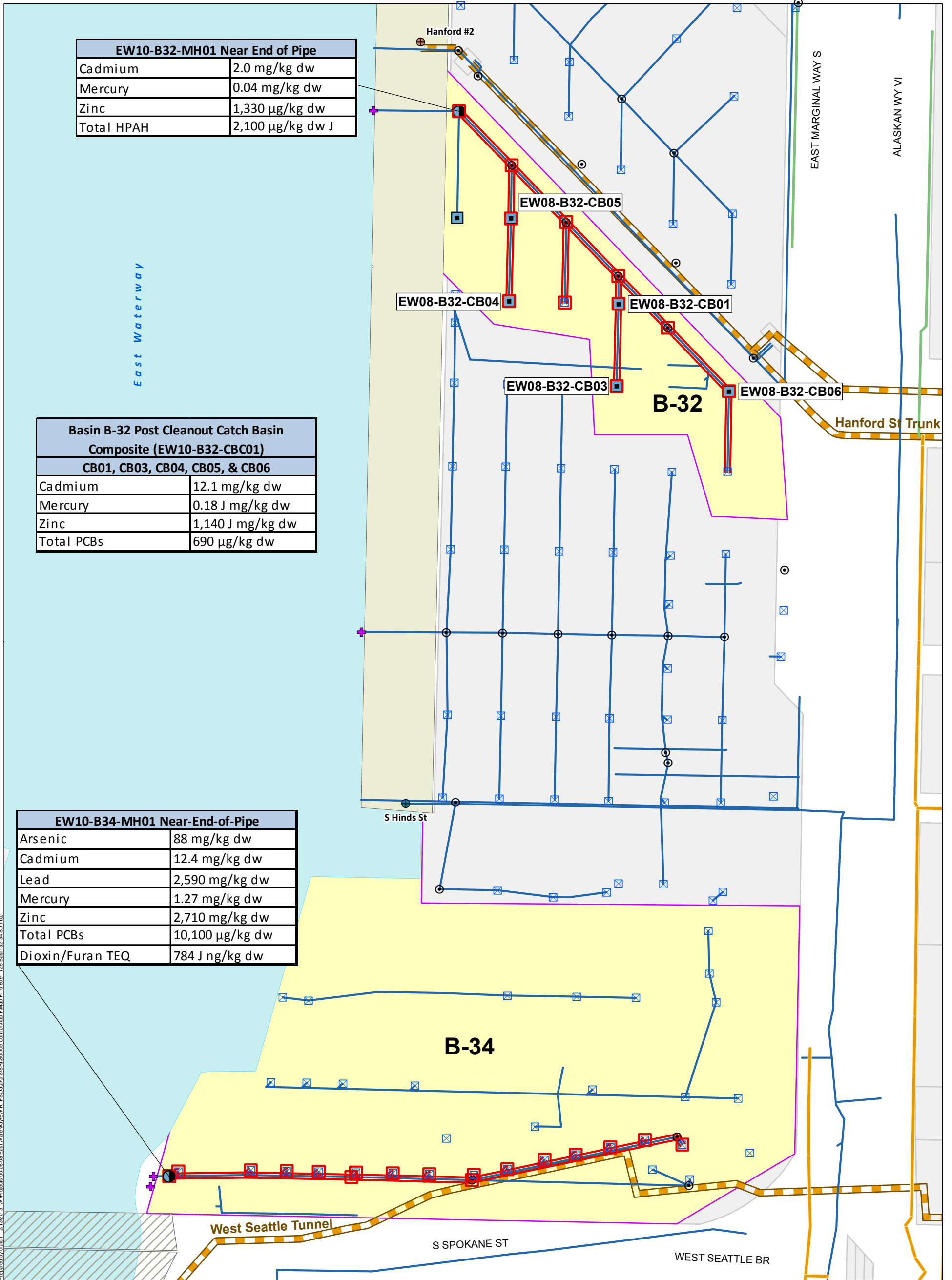


Map F-8
Terminal 18 Basin 7 Storm Drain
Supplemental Remedial Investigation
East Waterway Study Area

EW10-B32-MH01 Near End of Pipe	
Cadmium	2.0 mg/kg dw
Mercury	0.04 mg/kg dw
Zinc	1,330 µg/kg dw
Total HPAH	2,100 µg/kg dw J

Basin B-32 Post Cleanout Catch Basin Composite (EW10-B32-CBC01)	
CB01, CB03, CB04, CB05, & CB06	
Cadmium	12.1 mg/kg dw
Mercury	0.18 J mg/kg dw
Zinc	1,140 J mg/kg dw
Total PCBs	690 µg/kg dw

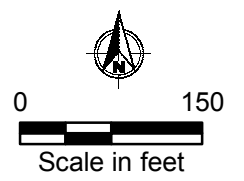
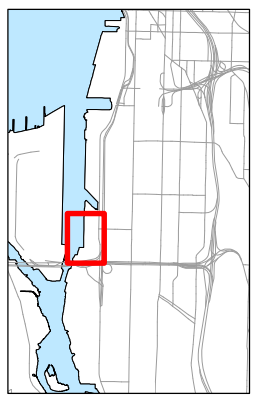
EW10-B34-MH01 Near-End-of-Pipe	
Arsenic	88 mg/kg dw
Cadmium	12.4 mg/kg dw
Lead	2,590 mg/kg dw
Mercury	1.27 mg/kg dw
Zinc	2,710 mg/kg dw
Total PCBs	10,100 µg/kg dw
Dioxin/Furan TEQ	784 J ng/kg dw



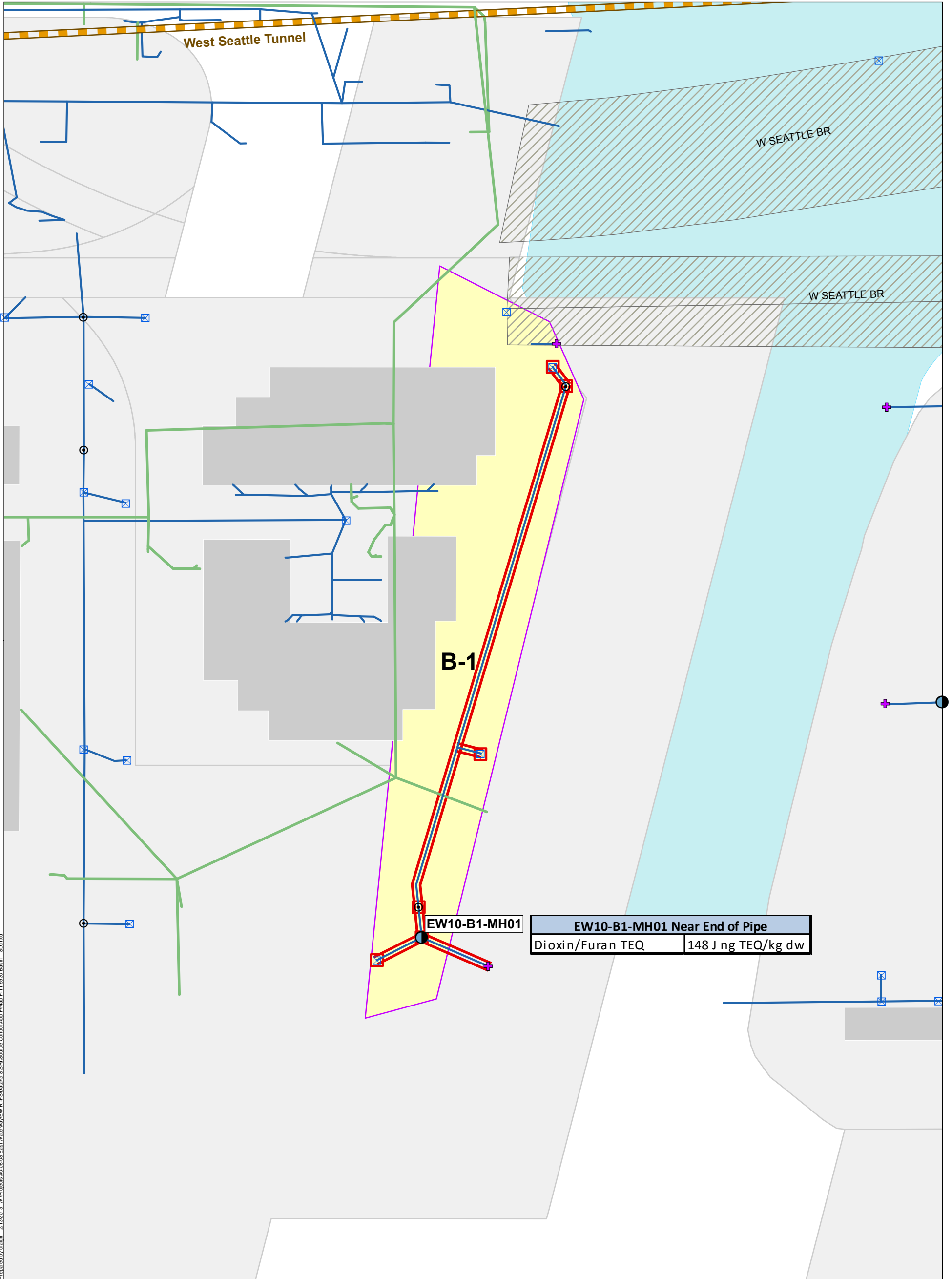
<p>Structures</p> <ul style="list-style-type: none"> X Catch Basin ○ Manhole □ Cleaned Structure^a Storm Drain Outfalls + Port of Seattle SD Combined Sewer Overflow Outfalls ● City of Seattle CSO/SD ● King County CSO 	<p>Utilities</p> <ul style="list-style-type: none"> — Storm Drain — Sanitary Sewer — Combined Sewer — KC-WTD Conveyance — Cleaned Line^a <p>Sample Locations</p> <ul style="list-style-type: none"> □ Catch Basin ● Inline Grab 	<p>□ Property of Interest</p> <ul style="list-style-type: none"> □ Dock/Pier □ Bridge □ Parcel
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^a B-32 lines cleaned in 2009. B-34 lines cleaned in 2010.

EW08-Bx-xxxx Sample ID



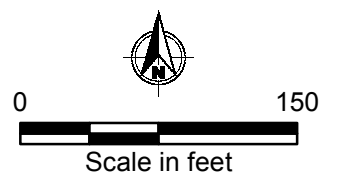
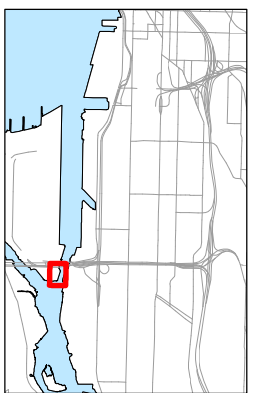
Map F-10
Terminal 25 Basin 32 and Basin 34 Storm Drains
Supplemental Remedial Investigation
East Waterway Study Area



Prepared by caaph_12/13/2013: W:\Projects\00-06-08_East Waterway\EW_RI\FSDrain\GIS\RI\Source Control\Map F-11 05:30 Basin 1 SD.mxd

<p>Structures</p> <ul style="list-style-type: none"> X Catch Basin ● Manhole □ Proposed Structure Cleanout <p>Storm Drain Outfalls</p> <ul style="list-style-type: none"> + Port of Seattle SD <p>Sample Locations</p> <ul style="list-style-type: none"> ● Inline Grab 	<p>Utilities</p> <ul style="list-style-type: none"> — Storm Drain — Sanitary Sewer — Combined Sewer — KC-WTD Conveyance — Proposed Line Cleanout 	<ul style="list-style-type: none"> Property of Interest Building Dock/Pier Bridge Parcel
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EW10-Bx-xxxx Sample ID



Map F-11
Terminal 102 Basin 1 Storm Drain
Supplemental Remedial Investigation
East Waterway Study Area