Duwamish/Diagonal Sediment Remediation Project
2005 Monitoring Report

Elliott Bay/Duwamish Restoration Program Panel

Prepared for:
King County Department of Natural Resources and Parks
Elliott Bay/Duwamish Restoration Program

Prepared by:
Anchor Environmental, L.L.C.

Panel Publication 40

May 2007

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Individuals and organizations needing further information about the Elliot Bay/Duwamish Restoration Program should contact the Administrative Director at the following address and telephone number:

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The Panel of Managers holds regularly scheduled meetings that are open to the public. Technical Working Group and committee meetings are scheduled on an as-needed basis, and are also open to the public. Meetings are generally held at the National Oceanic and Atmospheric Administration, National Marine Fisheries Service – Regional Directorate Conference Room, Building 1, 7600 Sand Point Way NE, Seattle. The Panel recommends that you contact the Administrative Director at the above phone number to confirm meeting schedules and locations. The panel also holds periodic special evening and weekend public information meetings and workshops.

General Schedule for Panel and Committee Meeting Dates

Panel: quarterly, first Thursday of January, April, July, October, 9:30 A.M. – 12:30 P.M.
Habitat Development Technical Working Group: third Thursday of every month, 9:30 A.M. – 12:30 P.M.
Sediment Remediation Technical Working Group: scheduled as needed.
Public Participation Committee: scheduled as needed.
Budget Committee: scheduled as needed.

Environmental Review of Specific Products

Formal hearings and comment periods on appropriate environmental documents for proposed sediment remediation and habitat development projects will be observed. Please contact the Administrative Director for more information.

This information is available in accessible formats on request at
(206) 296-0600 (voice) and 1-800-833-6388 (TTY/TDD users only).

List of Tables

List of Figures

List of Appendices

1 INTRODUCTION

This report presents the results of the March and April 2005 monitoring for the Duwamish/Diagonal Combined Sewer Overflow (CSO)/Storm Drain (SD) 7-acre sediment cap that are specified in the *Duwamish/Diagonal Sediment Remediation Dredging and Capping Operations Sediment Monitoring Sampling and Analysis Plan* (KCDNRP 2003). Note that some additional monitoring stations have been added as a result of the follow-up 4-acre Enhanced Natural Recovery (ENR) remedy site as specified in the *Duwamish/Diagonal Interim Action Residual Remedy Proposal* (KCDNRP 2005; Appendix A). Table 1 shows the relationship of these sampling stations, their monitoring frequency, and the sample types. Figure 1 shows the locations of these stations. Monitoring results include:

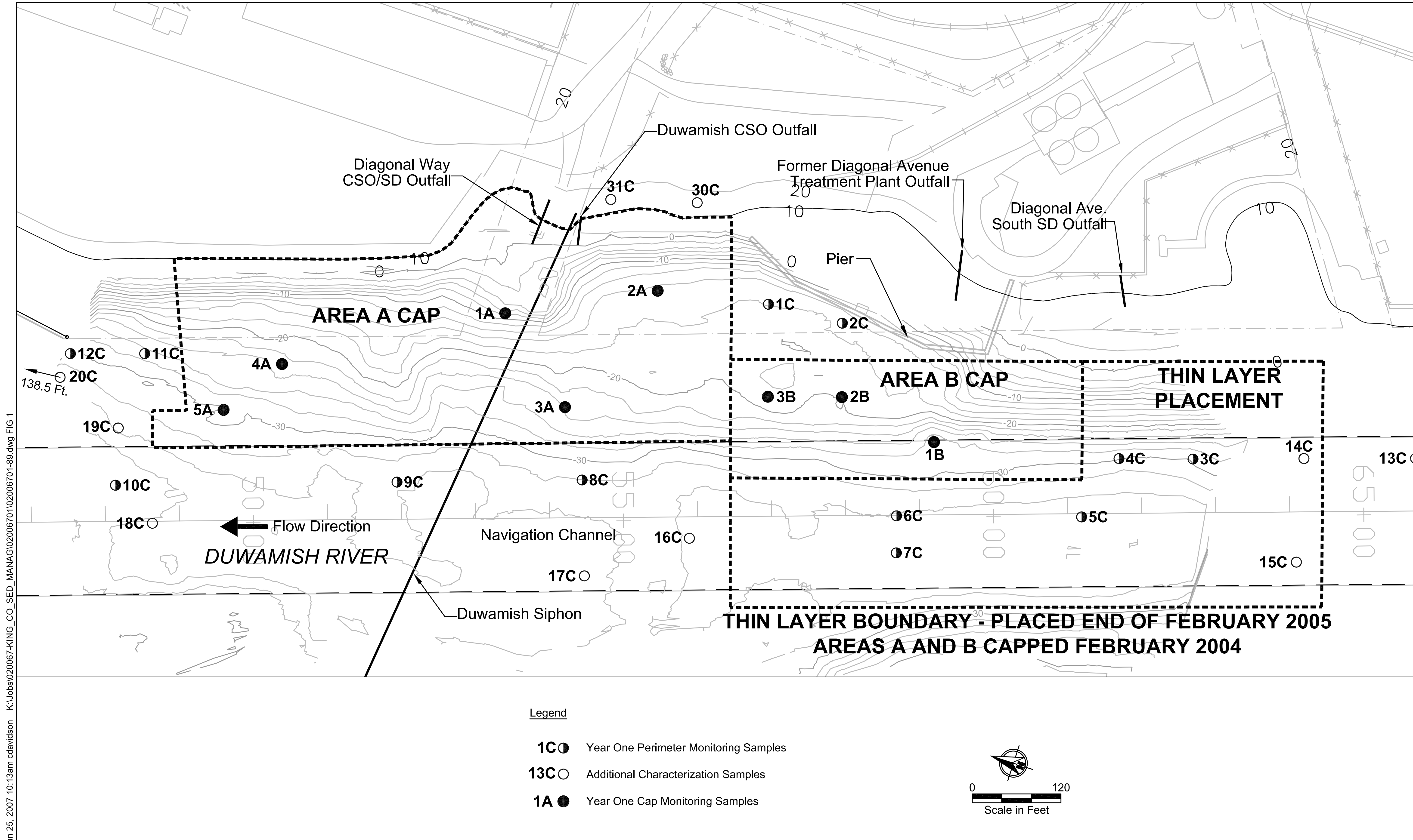
- Year one sediment chemistry at designated stations to evaluate recovery rates of the areas surrounding the 7-acre cap (prior to placement of the sand cover; as specified in the 4-acre ENR monitoring plan)
- Sediment chemistry at eight additional stations to further characterize the area surrounding the 7-acre cap (one-time sampling event specified in the 7-acre sediment cap monitoring plan)
- Year one sediment chemistry at eight stations on the 7-acre cap to evaluate chemistry levels on the remediation site (specified in the 7-acre sediment cap monitoring plan)

Table 1
5-Year Sediment Monitoring Program for Duwamish/Diagonal 4-Acre Thin-Layer ENR

Chemistry Station	SPI Station	Station Position	Bottom Stake Site	Sampling Years							
				2004 Post-Dredge	2005 Before*	2005 After**	2006 Annual	2007 Annual	2008 Annual	2009 Annual	2010 Annual
DUD_1C	DUD_1SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_2C	DUD_2SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_3C	DUD_3SP	On ENR	Yes	CH	CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_4C	DUD_4SP	On ENR	Yes	CH	CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_5C	DUD_5SP	On ENR	Yes	CH	CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_6C	DUD_6SP	On ENR	Yes	CH	CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_7C	DUD_7SP	On ENR	Yes	CH	CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_8C	DUD_8SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_9C	DUD_9SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_10C	DUD_10SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_11C	DUD_11SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_12C	DUD_12SP	Off ENR		CH	CH, SPI		CH	CH	CH	CH	CH
DUD_13C	DUD_13SP	Off ENR			CH, SPI		CH	CH	CH	CH	CH
DUD_14C	DUD_14SP	On ENR	Yes		CH, SPI	CH, SPI, ST	CH, SPI, ST	CH	CH	CH	CH
DUD_15C	DUD_15SP	On ENR	Yes		CH, SPI	CH, SPI, ST	?, SPI, ST	?	?	?	CH
DUD_16C	DUD_16SP	Off ENR			CH, SPI						
DUD_17C	DUD_17SP	Off ENR			CH, SPI						
DUD_18C	DUD_18SP	Off ENR			CH, SPI						
DUD_19C	DUD_19SP	Off ENR			CH, SPI						
DUD_20C	DUD_20SP	Off ENR			CH, SPI						
	DUD_21SP	Off ENR			SPI						
	DUD_22SP	Off ENR			SPI						
	DUD_23SP	Off ENR			SPI						
	DUD_24SP	On ENR	Yes		SPI	SPI, ST	SPI, ST				
	DUD_25SP	Off ENR			SPI						
	DUD_26SP	On ENR	Yes		SPI	SPI, ST	SPI, ST				
	DUD_27SP	On ENR	Yes		SPI	SPI, ST	SPI, ST				
	DUD_28SP	On ENR	Yes		SPI	SPI, ST	SPI, ST				

CH Chemistry Sample
SPI Sediment Profile Imaging
ST Stake Measurement
? Annually if "2005 Before" is greater than Cleanup Screening Level (CSL) or only one time in 2010 if "2005 Before" is greater than Sediment Quality Standards (SQS)
* Chemistry samples collected January 31 to February 2, 2005; SPI performed February 8, 2005
** Chemistry samples collected March 29, 2005; SPI performed March 4, 2005

Note: Results from SPI and chemistry samples collected March 29, 2005 are reported in the *4-Acre Residuals Interim Action Closure Report* (KCDNRP 2007).



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
2005 Monitoring Station Locations
Duwamish/Diagonal Sediment Remediation Project
Seattle, Washington

2 YEAR-ONE SEDIMENT CHEMISTRY AT PERIMETER STATIONS

On January 31, February 1, and February 2, 2005, before placement of the ENR material, King County (the County) sampled the perimeter stations beyond the boundary of Areas A and B (DUD_1C through DUD_12C) for a third time. These samples represent the year-one post-remediation sampling event required under the adopted 7-acre sediment cap monitoring plan (KCDNRP 2003). A 10-grab composite was collected at each station. The complete chemistry data for these samples is contained in Appendix B[1]. Table 2 summarizes concentrations of indicator chemicals (i.e., those chemicals detected most frequently at the site prior to remediation), as generally summarized in the *Duwamish/Diagonal CSO/SD Sediment Remediation Project Closure Report* (EBDRP 2005).

[1] All data presented herein are qualified as detailed in their respective sample data group QA reviews (Appendix B). The QA reviews and narrative (specifically defined as QA1) were conducted in accordance with guidelines established through the Puget Sound Dredged Disposal Analysis (PSDDA) program, Sediment Management Standards (WAC 173-204-610) and the Sediment Sampling and Analysis Appendix (Ecology 2003). Other approaches incorporated in the QA reviews have been established through collaboration between the King County Environmental Laboratory and the Washington State Department of Ecology Sediment Management Unit.

Table 2
Summary of Year-One Surface Sediment Indicator Chemical Concentrations at Perimeter Stations Beyond Area A and B Boundary

Station	Fines (% by vol)	TOC (% dry wt)	Total PCBs		Bis (2-ethylhexyl) phthalate		Benzylbutyl phthalate		Mercury (mg/kg dry wt)
			(µg/kg dry wt)	(mg/kg OC)	(µg/kg dry wt)	(mg/kg OC)	(µg/kg dry wt)	(mg/kg OC)	
DUD 1C	46.4%	1.24%	196	16	877	71	38	3.1	0.16 J
DUD 2C	52.1%	1.65%	340	21	1,040	63	85	5.1	0.23 J
DUD 3C	39.9%	1.14%	820	72	527	46	30	2.6	0.23 J
DUD 4C	45.1%	1.37%	256	19	411	30	38	2.8	0.24 J
DUD 4C (dup)	43.2%	1.26%	181	14	360	29	34	2.7	0.24 J
DUD 5C	49.0%	1.75%	2,189	125	838	48	37	2.1	0.29 J
DUD 6C	35.9%	1.31%	989	75	581	44	30	2.3	0.23 J
DUD 7C	46.2%	1.38%	397	29	516	37	25	1.8	0.26 J
DUD 8C	24.3%	0.97%	737	76	734	75	31	3.2	0.24 J
DUD 8C (dup)	33.2%	1.18%	809	69	792	67	9 U	0.8 U	0.23 J
DUD 9C	37.9%	1.11%	945	85	695	63	9 U	0.8 U	0.27 J
DUD 10C	31.7%	0.86%	328	38	301	35	34	3.9	0.24 J
DUD 11C	2.4%	0.12%	19	N/A	62	N/A	8.8 J	N/A	0.032 J
DUD 12C	31.8%	0.74%	334	45	441	59	23	3.1	0.16 J

SQS (yellow shading)
CSL (orange shading)
NA = Non Applicable Calculation; TOC less than 0.5 percent
J = Estimated value
U = Value undetected at reported method detection limit

Polychlorinated biphenyls (PCBs) were detected at all stations at concentrations ranging between approximately 19 and 2,190 parts per billion (ppb) (dry weight basis). All sediment samples with greater that 0.5 percent total organic carbon (TOC), which is the SMS threshold for TOC normalization, exceeded the SQS criterion of 12 milligrams per kilogram organic carbon (mg/kg OC); many of the pre-construction surface samples also exceeded the SMS CSL for PCBs of 65 mg/kg OC. Bis(2-ethylhexyl)phthalate (BEHP) concentrations ranged from approximately 60 to 1,040 ppb (dry weight basis). Many of the surface sediment samples exceeded the SQS chemical criterion for BEHP of 47 mg/kg OC, but none of the samples exceeded the CSL for this chemical (78 mg/kg OC). One surface sediment sample marginally exceeded the SQS for butylbenzyl phthalate; none of the samples exceeded the SQS for mercury. Based on the sampling data, total PCBs and BEHP are good indicator chemicals to watch at the Duwamish/Diagonal site.

Table 3 provides a summary of the changes in dry weight values for PCBs and BEHP. Sediment chemistry data collected in October 2003 and March 2004 (i.e., immediately before and after completion of dredging and capping actions at the 7-acre Duwamish/Diagonal site, respectively) are presented in the Closure Report (EBDRP 2005) and are not duplicated in Appendix B[2].

[2] All data presented herein are qualified as detailed in their respective sample data group QA reviews (Appendix B). The QA reviews and narrative (specifically defined as QA1) were conducted in accordance with guidelines established through the Puget Sound Dredged Disposal Analysis (PSDDA) program, Sediment Management Standards (WAC 173-204-610) and the Sediment Sampling and Analysis Appendix (Ecology 2003). Other approaches incorporated in the QA reviews have been established through collaboration between the King County Environmental Laboratory and the Washington State Department of Ecology Sediment Management Unit.

Table 3
BEHP and Total PCB Concentrations in the 12 Cap Perimeter Stations Sampled Prior to Dredging, Post-Dredging Baseline and 1 Year Post-Dredging

	BEHP Dry Weight Value					BEHP TOC Normalized Value-SMS					TOC Value (Percent)				
Station No.	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change
DUD_1C	5,940 B	676	-5,264	877	201	177 ** B	99 **	-78	71 *	-28	3.36	0.68	-2.68	1.24	0.56
DUD_2C	2,700 B	896	-1,804	1,040	144	114 ** B	115 **	1	63 *	-52	2.36	0.78	-1.58	1.65	0.87
DUD_3C	1,600 B	1080	-520	527	-553	74 * B	91 **	17	46	-45	2.16	1.19	-0.97	1.14	-0.05
DUD_4C	1,000 B	110	-890	411	301	42 B	LC	NA	30	NA	2.38	0.25 ***	-2.13	1.37	1.12
DUD_4C Rep	1,100 B	182	-918	360	178	52 * B	LC	NA	29	NA	2.12	0.23 ***	-1.89	1.26	1.03
DUD_5C	543 B	1,520	977	838	-682	43 B	88 **	45	48 *	-40	1.27	1.73	0.46	1.75	0.02
DUD_6C	660 B	1,420	760	581	-839	46 B	93 **	47	44	-49	1.43	1.52	0.09	1.31	-0.42
DUD_6C Rep	NS	1,470	810	NS	NS	NS	92 **	46	NS	NS	NS	1.59	0.16	NS	NS
DUD_7C	962 B	823	-139	516	-307	63 * B	54 *	-9	37	-17	1.54	1.51	-0.03	1.38	-0.13
DUD_8C	2,150 B	946	-1,204	734	-212	127 ** B	91 **	-36	76 *	-15	1.70	1.04	-0.66	0.97	-0.07
DUD_8C Rep	2,680 B	1,270	-1,410	792	-478	135 ** B	97 **	-38	67 *	-30	1.98	1.30	-0.68	1.18	-0.12
DUD_9C	473 B	681	208	695	14	61 * B	88 **	27	63 *	-25	0.78	0.77	-0.01	1.11	0.34
DUD_10C	463 B	540	77	301	-239	46 B	52 *	6	35	-17	1.02	1.03	0.01	0.86	-0.17
DUD_11C	1,610 B	52	-1,558	62	10	118 ** B	LC	NA	LC	NA	1.36	<0.05 ***	-1.3	0.12 ***	0.06
DUD_12C	988 B	110	-878	441	331	75 * B	95 **	20	60 *	-35	1.32	0.81	-0.51	0.74	-0.07

	PCB Dry Weight Value					PCB TOC Normalized Value-SMS					TOC Value (Percent)				
Station No.	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change	October 20 and 21, 2003 (before dredge)	March 29 and 30, 2004 (baseline post-dredge/cap)	Change	January 31, February 1 and 2, 2005 (1 year post-dredge/cap)	1 year change
DUD_1C	621	240	-380	196	-44	19 *	35 **	16	16*	-19	3.36	0.68	-2.68	1.24	0.56
DUD_2C	382	368	-14	340	-28	16 *	47 **	31	21*	-26	2.36	0.78	-1.58	1.65	0.87
DUD_3C	327	1270	943	820	-450	15 *	107 **	92	72**	-35	2.16	1.19	-0.97	1.14	-0.05
DUD_4C	492	105	-387	155	50	21 *	42**	21	11	-31	2.38	0.25 ***	-2.13	1.37	1.12
DUD_4C Rep	2,740	235 *	-2,505	181	-54	129 **	LC	NA	14*	NA	2.12	0.23 ***	-1.89	1.26	1.03
DUD_5C	341	2,650	2,309	2,189	-461	27 *	LC	NA	125**	NA	1.27	1.73	0.46	1.75	0.02
DUD_6C	1,290	3,160	1,870	989	-2,171	90 **	208 **	118	76**	-132	1.43	1.52	0.09	1.31	-0.42
DUD_6C Rep	NS	3,390	2,100	NS	NS	NS	213 **	123	NS	NS	NS	1.59	0.16	NS	NS
DUD_7C	427	1,130	703	397	-733	28 *	75 **	47	29*	-46	1.54	1.51	-0.03	1.38	-0.13
DUD_8C	4,180	1,680	-2,500	742	-938	245 **	162 **	-83	77**	-85	1.70	1.04	-0.66	0.97	-0.07
DUD_8C Rep	5,030	2,130	-2,900	809	-1,321	254 **	164 **	-90	69**	-95	1.98	1.30	-0.68	1.18	-0.12
DUD_9C	103	733	631	945	212	13 *	95 **	82	85**	-10	0.78	0.77	-0.01	1.11	0.34
DUD_10C	373	666	292	328	-338	37 *	65 **	28	38*	-27	1.02	1.03	0.01	0.86	-0.17
DUD_11C	378	9	-368	19	10	28 *	LC	NA	LC	NA	1.36	<0.05 ***	-1.3	0.12 ***	0.06
DUD_12C	263	644	381	335	-309	20 *	80 **	60	45*	-35	1.32	0.81	-0.51	0.74	-0.07

* = Exceeds LAET or SQS ** = Exceeds 2LAET or CSL *** = TOC Value Below 0.5 % For Normalization
LC = Low Carbon for Normalization NS = No Sample NA = Non Applicable Calculation
For Total PCBs, LAET/2LAET = 1,300/ 1,900 μg/kg DW; for BEHP, LAET/2LAET = 130/ 1000 μg/kg DW
For BEHP, SQS/ CSL = 12/ 65 mg/kg OC; for Total PCBs, SQS/CSL = 47/78 mg/kg OC

Figure 2 presents the change in PCB dry weight values for each of the 12 perimeter stations that were sampled three times, and Figure 3 presents the SMS TOC normalized values. Figure 2 shows that the transport of residuals from dredging caused PCB dry weight values to increase at seven perimeter stations (DUD_3C, DUD_5C, DUD_6C, DUD_7C, DUD_9C, DUD_10C, and DUD_12C), while the application of capping sand caused the remaining five perimeter stations to decrease or stay the same (DUD_1C, DUD_2C, DUD_4C, DUD_8C, and DUD_11C). When the 12 perimeter stations were sampled again 10 months later, it appears that the natural sedimentation process in the river resulted in reductions at six of the seven stations that had shown increases (not station DUD_9), the resulting PCB values at half of these six stations were down to pre-dredge values (DUD_6C, DUD_7C, and DUD_10C), and one more station was very close to the pre-dredge value (DUD_12C). Of the three station locations where PCB values were still higher than pre-dredge values after 10 months (DUD_3C, DUD_5C, and DUD_9C), the PCB values at the two stations adjacent to Area B (DUD_3C and DUD_5C) were reduced to a very low level when the stations were covered with 6 inches of sand during placement of the ENR sand in February 2005. Only one of the three stations above pre-dredge values was not covered by the ENR sand, because that station was adjacent to Area A (DUD_9C). At the five stations that originally showed a reduction in PCB values due to capping material, it appears that natural river sedimentation processes produced an additional, significant reduction at one station (DUD_8C) and a minor reduction at two more stations (DUD_1C and DUD_2C).

Figure 3 shows that prior to the dredging action, three perimeter stations exceeded the CSL for PCBs of 65 mg/kg OC (DUD_4C rep, DUD_6C, and DUD_8C) and the remaining nine stations exceeded the SQS value of 12 mg/kg OC. After dredging and capping, two stations had too low a TOC value to be used for TOC normalization (DUD_5C and DUD_11C), but seven of the remaining 10 stations all exceeded the CSL value, which was an increase of seven stations. The samples taken after 10 months showed that natural river sedimentation processes reduced the number of stations above the CSL value, down from seven stations to five stations (DUD_3C, DUD_5C, DUD_6C, DUD_8C, and DUD_9C). Six of the remaining seven stations (DUD_1C, DUD_2C, DUD_4C rep, DUD_7C, DUD_10C, and DUD_12C) were above the SQS, as they were pre-dredging, but one station still had too low a TOC value to perform normalization. The reduction in PCB SMS values was created by a reduction in PCB dry weight value and an increase in TOC values over time. It is possible that TOC values could increase more in the future at some stations, but this increase is not likely to be large enough to reduce SMS values below the SQS or CSL, without additional reduction in PCB dry weight.

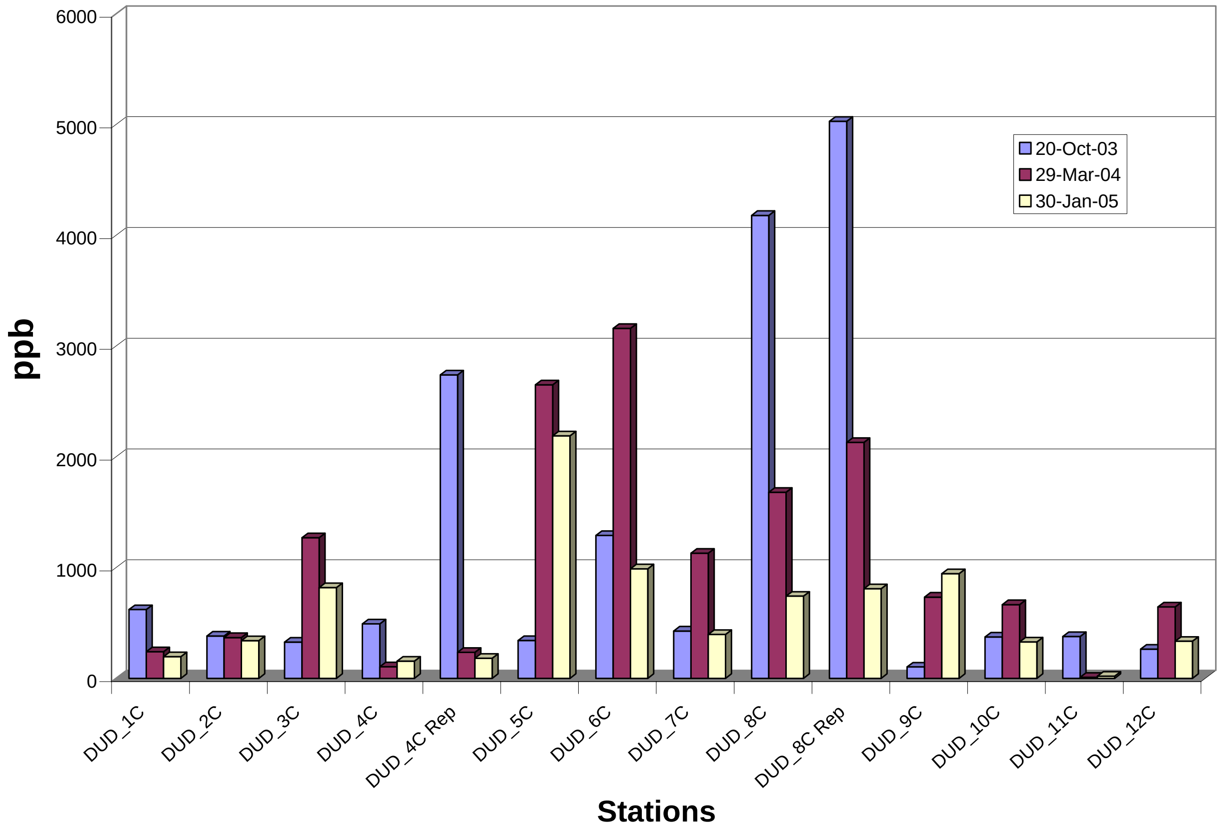


Figure 2
Changes in PCB Concentration (dry weight) at Duwamish/Diagonal Perimeter Stations

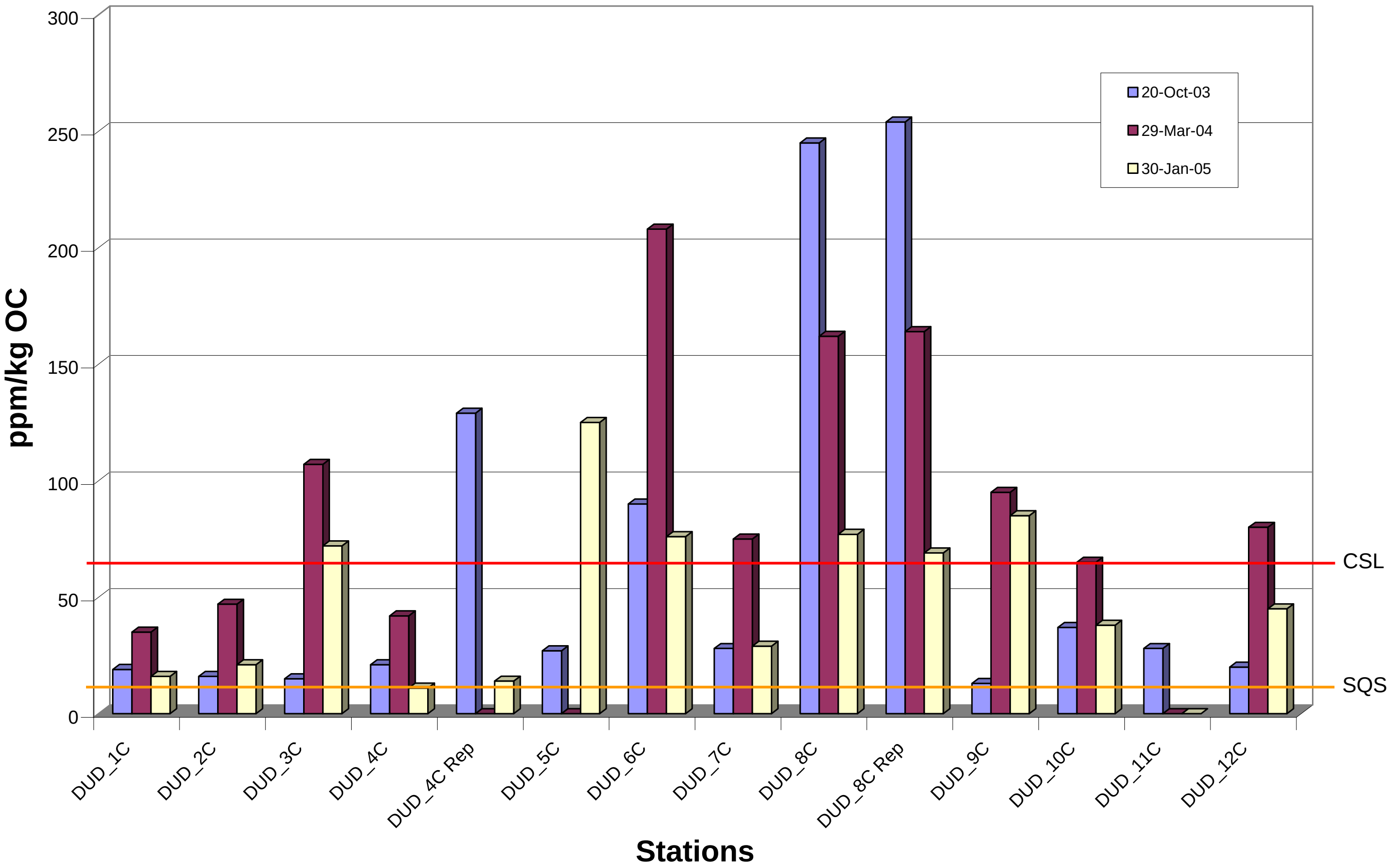


Figure 3
Changes in PCB Concentration (carbon normalized) at Duwamish/Diagonal Perimeter Stations

When the PCB values for all 12 stations are averaged, the pre-dredge value and the 10 month post-remediation value turn out to be nearly the same because the reduction in PCB values at four stations (DUD_1C, DUD_4C, DUD_8C, and DUD_11C) by the addition of capping sand is offset by the elevated PCB values that remained at three stations after 10 months (DUD_3C, DUD_5C, and DUD_9C). Figures 4 and 5 show the average PCB concentrations at all 12 perimeter stations over time. Note that post-construction concentrations increased on average around the outside of the remediation site. After 1 year, on average, PCB concentrations had been reduced to pre-construction levels on a dry weight basis but were still elevated on an OC normalized basis (although significantly lower than immediately post-construction). This suggests that bulk PCB concentrations in the surface sediments are down to pre-construction levels 1 year after the project; although some of this reduction is due to the deposition of cap material off-site, which accounts for the low OC levels (and corresponding relatively high OC normalized values). Over the next several sampling events, it is expected that both PCB measures should approach pre-construction values as natural sedimentation increases OC values in the surface sediments.

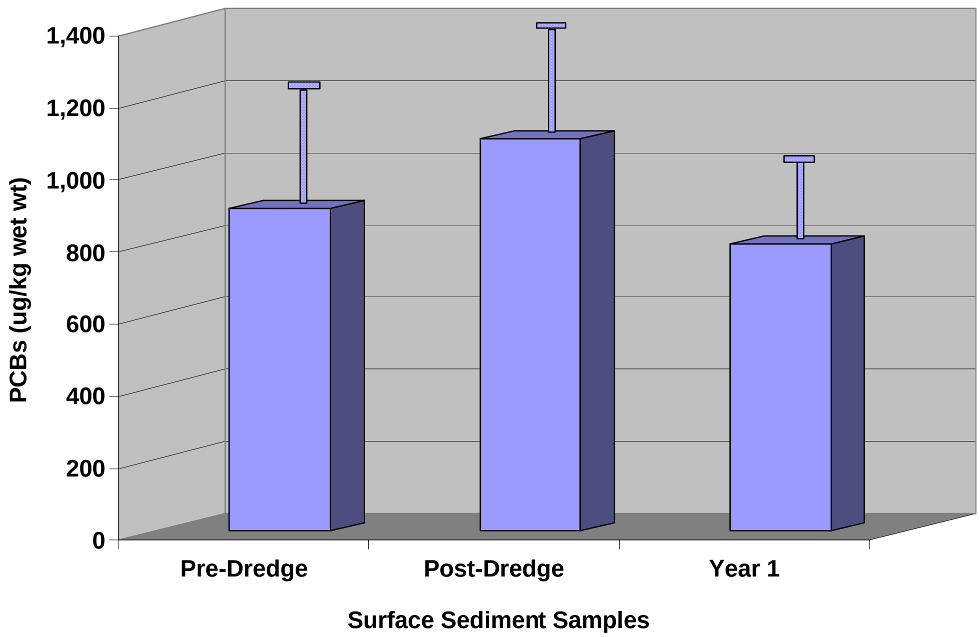


Figure 4
Changes in the Average PCB Concentration (dry weight) at Duwamish/Diagonal Perimeter Stations

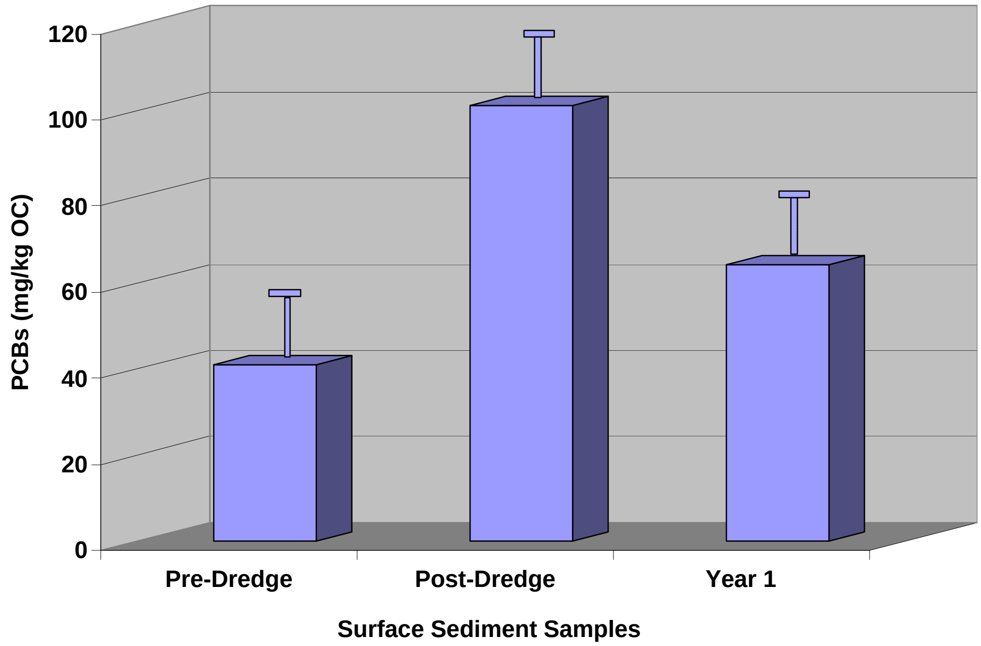


Figure 5
Changes in the Average PCB Concentration (carbon normalized) at Duwamish/Diagonal Perimeter Stations

Figure 6 shows the changes in BEHP dry weight values for each of the 12 perimeter stations that were sampled three times, and Figure 12 shows the SMS TOC normalized values—the results are not exactly the same as observed for PCBs. Figure 6 shows that the transport of residuals from dredging caused BEHP dry weight values to increase at only four perimeter stations (DUD_5C, DUD_6C, DUD_9C, and DUD_10C), instead of seven stations, while the application of capping sand caused the remaining eight perimeter stations to decrease or stay the same (DUD_1C, DUD_2C, DUD_3C, DUD_4C, DUD_7C, DUD_8C, DUD_11C, and DUD_12C). During the first sampling event (2003), all BEHP values had a blank contamination qualifier, but this was the only time BEHP data was qualified during the three sampling events. When the 12 perimeter stations were sampled again in 10 months, it appears that the natural sedimentation process in the river resulted in reductions at three of the four stations that had shown increases (DUD_5C, DUD_6C, and DUD_10C, but not DUD_9) and the resulting BEHP values at two of the three stations were down to pre-dredge values (DUD_6C and DUD_10C). Of the two stations that remained a little above pre-dredge values after 10 months (DUD_5C and DUD_9C), the BEHP values at one of these stations was greatly reduced when the station adjacent to Area B (DUD_5C) was covered with 6 inches of sand during placement of the ENR sand in February 2005.

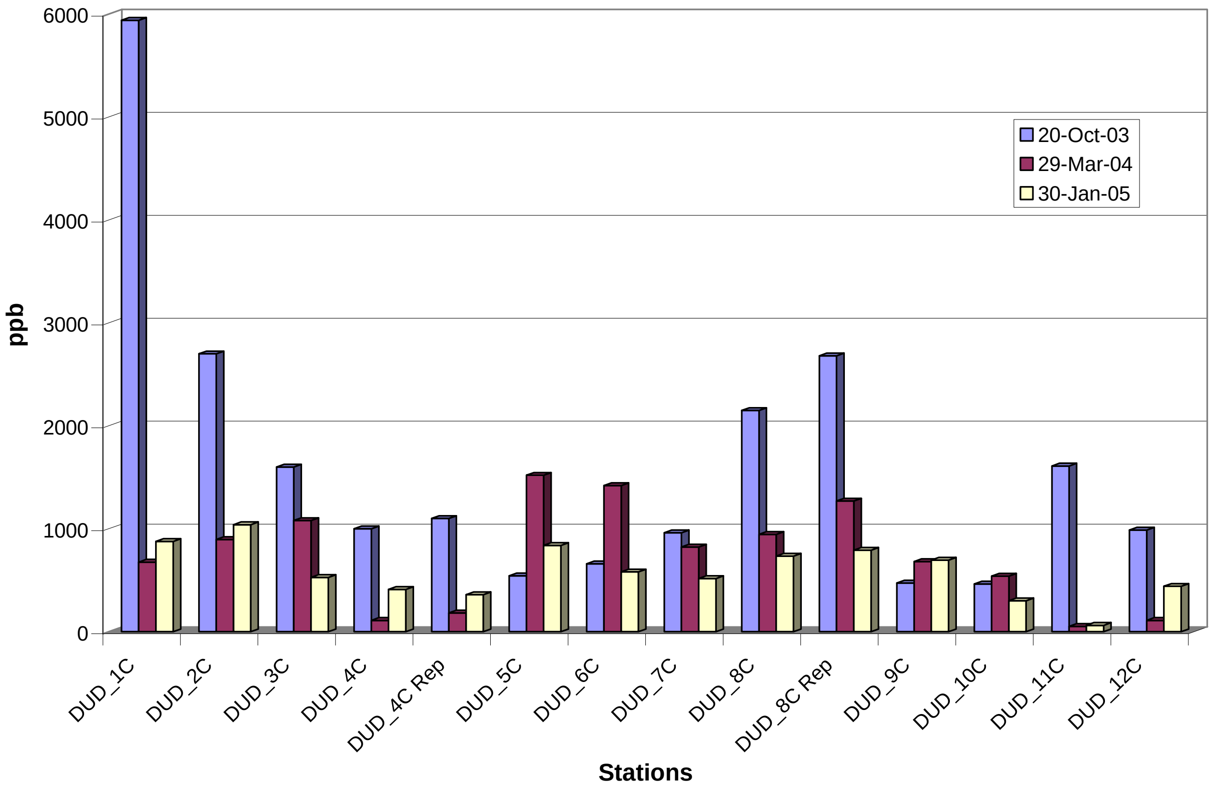


Figure 6
Changes in BEHP Concentration (dry weight) at Duwamish/Diagonal Perimeter Stations

Figure 7 shows that prior to the dredging action, four perimeter stations exceeded the BEHP CSL value of 78 mg/kg OC (DUD_1C, DUD_2C, DUD_8C, and DUD_11C), five stations exceeded the SQS value of 47 mg/kg OC (DUD_3C, DUD_4C, DUD_7C, DUD_9C, and DUD_12C), and the other three stations were less then the SQS value (DUD_5C, DUD_6C, and DUD_10C). After dredging and capping, eight stations exceeded the CSL (DUD_1C, DUD_2C, DUD_3C, DUD_5C, DUD_6C, DUD_8C, DUD_9C, and DUD_12C), which was an increase of four stations. Two stations were above the SQS value (DUD_7C and DUD_10C) and two stations had too low a TOC value to be used for TOC normalization (DUD_4C, and DUD_11C). The samples taken after 10 months showed that natural river sedimentation processes reduced the SMS values for BEHP so all eight stations that had been above the CSL value had dropped below the CSL. Six stations (DUD_1C, DUD_2C, DUD_5C, DUD_8C, DUD_9C, and DUD_12C) remained above the SQS value, but five stations were below the SQS value (DUD_3C, DUD_4C, DUD_6C, DUD_7C, and DUD_10C). One station (DUD_11C) still had too low a TOC value for normalization. The reduction in SMS values for BEHP were created by a reduction in BEHP dry weight values plus an increase in TOC values over time.

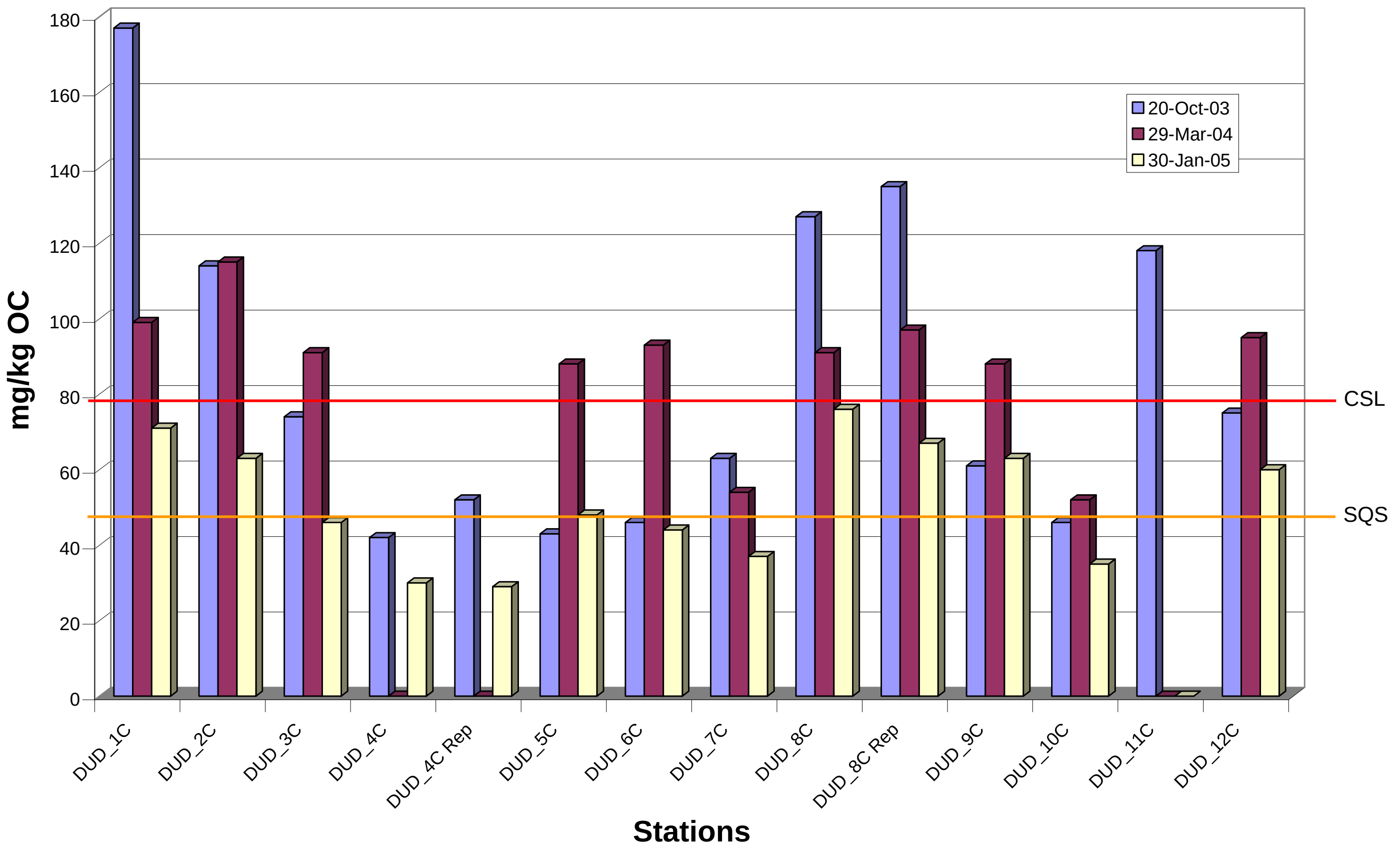


Figure 7
Changes in BEHP Concentration (carbon normalized) at Duwamish/Diagonal Perimeter Stations

3 SEDIMENT CHEMISTRY AT ADDITIONAL CHARACTERIZATION STATIONS

The 7-acre Duwamish/Diagonal sediment cap monitoring plan (KCDNRP 2003) required collection of surface sediment chemistry at eight additional stations beyond Areas A and B to help clarify the distribution of chemical concentrations in this part of the Duwamish River. However, the County collected samples at 10 stations instead of eight stations to cover all areas of interest. The specific locations of these 10 stations were established in cooperation with Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) and included eight stations in the river bottom (DUD_13C through DUD_20C) plus two river bank stations (DUD_30C and DUD_31C). The complete chemistry data for these stations is contained in Appendix B[3]; the data for the stations in the river was provided to the Lower Duwamish Work Group so the data could be included in the Lower Duwamish Waterway Remedial Investigation and Feasibility Study.

The eight subtidal stations are not part of the 7-acre site monitoring program and will not be tracked for natural recovery over time. The two bank samples were collected to evaluate the potential for shoreline erosion to be a potential source of recontamination to the cap. Table 4 summarizes concentrations of indicator chemicals (i.e., those chemicals detected most frequently at the remediation site prior to remediation) at the additional stations.

[3] All data presented herein are qualified as detailed in their respective sample data group QA reviews (Appendix H). The QA reviews and narrative (specifically defined as QA1) were conducted in accordance with guidelines established through the Puget Sound Dredged Disposal Analysis (PSDDA) program, Sediment Management Standards (WAC 173-204-610) and the Sediment Sampling and Analysis Appendix (Ecology 2003). Other approaches incorporated in the QA reviews have been established through collaboration between the King County Environmental Laboratory and the Washington State Department of Ecology Sediment Management Unit.

Table 4
Summary of Surface Sediment Indicator Chemical Concentrations in 10 Additional Stations

Station	Fines (% by vol)	TOC (% dry wt)	Total PCBs (µg/kg dry wt)	Total PCBs (mg/kg OC)	Bis (2-ethylhexyl) phthalate (µg/kg dry wt)	Bis (2-ethylhexyl) phthalate (mg/kg OC)	Benzylbutyl phthalate (µg/kg dry wt)	Benzylbutyl phthalate (mg/kg OC)	Mercury (mg/kg dry wt)
DUD 13C	63.9%	1.87%	709	38	770	41	88	4.7	0.33 J
DUD 14C	61.6%	1.71%	621	36	935	55	46	2.7	0.28 J
DUD 15C	58.2%	1.58%	250	16	425	27	34	2.1	0.25 J
DUD 16C	50.1%	1.66%	700	42	618	37	39	2.4	0.28 J
DUD 17C	57.5%	1.51%	231	15	481	32	27	1.8	0.24 J
DUD 18C	35.2%	1.03%	1,375	133	371	36	19	1.8	0.22 J
DUD 19C	8.8%	0.15%	25	N/A	60	N/A	11 J	N/A	0.033 J
DUD 20C	39.7%	0.85%	458	54	362	43	18	2.1	0.20 J
DUD 30C	30.4%	1.05%	815	77	138	13	32U	0.3U	0.468
DUD 31C	26.2%	0.377%	16.5	4.4	39.3	10	61	16	0.031 J

SQS
CSL

NA = Non Applicable Calculation; TOC less than 0.5 percent
J = Estimated value
U = Value undetected at reported method detection limit

Of the stations pertinent to the thin layer ENR area, PCBs at stations DUD 14C and DUD 15C and BEHP at station DUD 14C exceeded the SQS but not the CSL. The monitoring program for the thin layer ENR based the sampling frequency at station DUD 15C in the ENR area on these sampling results (see Table 1 footnotes). Following the conditions in the monitoring program, station DUD 15C will only be sampled for surface chemistry in 2010.

4 YEAR ONE POST-CONSTRUCTION SAMPLES FROM DUWAMISH/DIAGONAL CAP

Most of the year one post-construction samples from the surface of the 7-acre Duwamish/Diagonal sediment cap were collected by the County on April 27, 2005 (DUD_1A through DUD_5A, DUD_1B, and DUD_3B), 11 months after the year zero samples were collected on June 1, 2004. Station DUD_2B was sampled August 17, 2005, because one of the barges tied to the T-108 pier blocked the sample location in April.

The completion date for capping Area A was the end of February 29, 2004, so the year one samples collected April 27, 2004 had a total elapsed time of 14 months from the completion of Area A. The completion date for capping Area B was about .5 month later because on March 11, 2004, the contractor had to lower the cap surface 1 foot in the part of Area B that extends into the channel. This adjustment involved removing excessive armoring rock, which was then placed inshore of the channel. The year one cap samples collected April 27, 2005, had a total elapsed time of about 13.5 months from the completion of capping Area B. The year zero cap samples collected on June 1, 2005 had an elapsed time of about 2.5 months for Area B and 3 months for Area A. This data was discussed in the previous *Duwamish/Diagonal CSO/SD Sediment Remediation Project Closure Report* (EBDRP 2005). Habitat mix gravel was placed over all but two stations (DUD_4A and DUD_5A). The absence of fine sediment (only gravel was found) prevented samples from being collected at one station during year zero sampling (DUD_3A) and one station during year one sampling (DUD_3B). Only one of the year one samples had to be screened to remove large gravel (DUD_2B), compared to three year zero samples requiring screening (DUD_2A, DUD_1B, and DUD_2B), which removed about 20 percent by volume. This suggests that natural sediments are depositing on the cap and the surface layer is starting to return to grain size distributions more representative of pre-construction conditions.

As noted in the post construction monitoring (KCDNRP 2007), the presence of relatively low concentrations of chemicals in the ENR sand layer suggests that there was limited mixing of the underlying native sediments into (or on top of) the sand layer during placement. This also suggests there was not significant remobilization of contaminated sediments during placement of the ENR sand material. Therefore, most of the chemical concentrations on the cap are from input from sources or general sediment remobilization and transport in the Duwamish River and not from the ENR placement action.

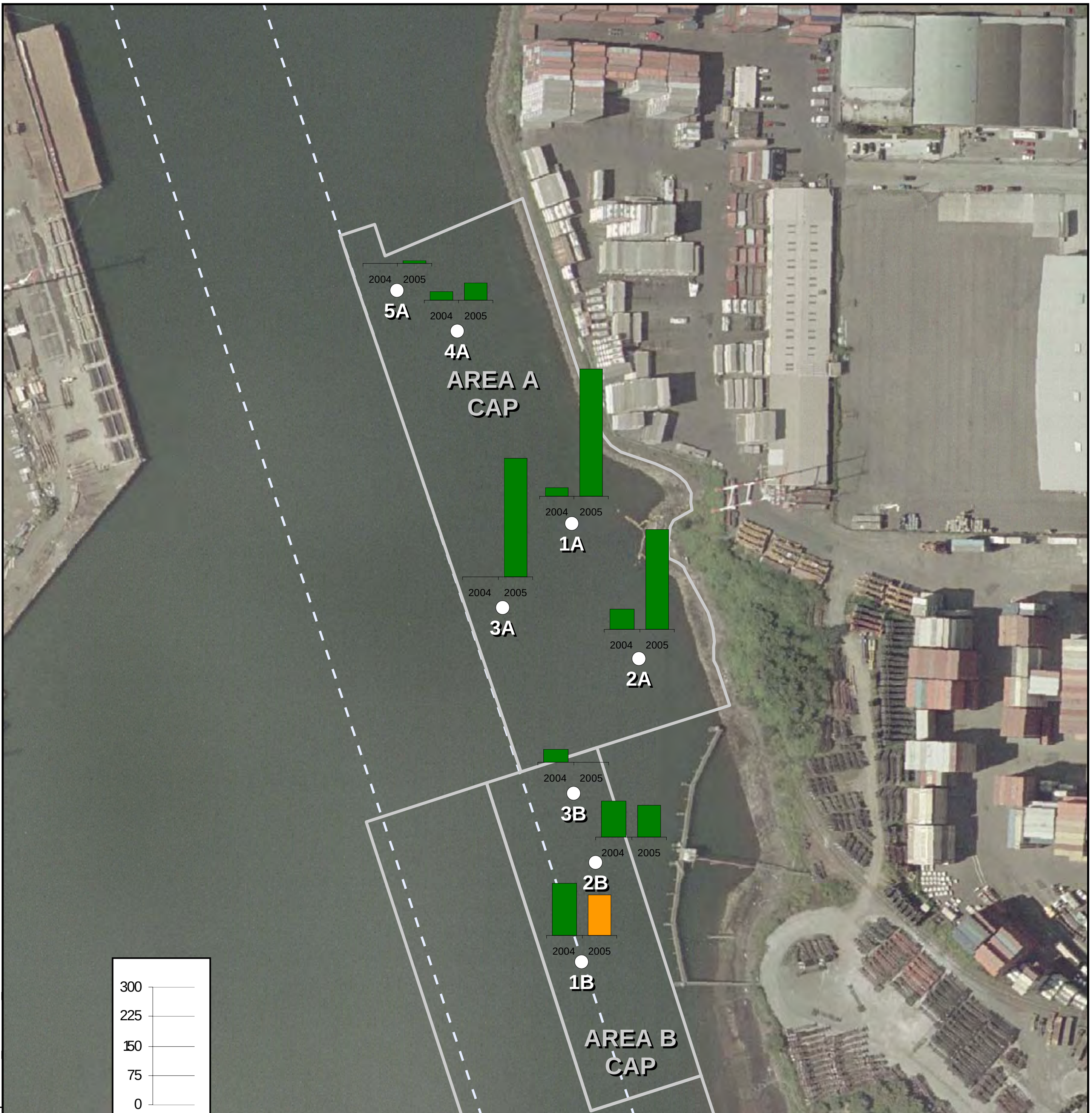
Complete chemical results for year one post-construction cap samples are contained in Appendix B, and Table 5 contains summarized year one and year zero data for selected chemicals. This data indicates that concentrations of PCBs, BEHP, butyl benzyl phthalate (BBP), benzyl alcohol, and some polycyclic aromatic hydrocarbons (PAH) compounds are increasing in the cap area in the vicinity of the outfalls. The year one and year zero chemistry data for BEHP and PCB are shown in Figures 8 and 9 next to the corresponding sampling stations on the Duwamish/Diagonal cap.

Table 5
Surface Chemistry Data for PCB and BEHP From Duwamish/Diagonal Cap

	TOC (%)		BEHP (µg/kg DW)		BEHP (mg/kg OC)		PCB (µg/kg DW)		PCB (mg/kg OC)	
Sta[a]	**Year 0**	**Year 1**	**Year 0**	**Year 1**	**Year 0**	**Year 1**	**Year 0**	**Year 1**	**Year 0**	**Yr 1**
1A	0.34	5.71	442	5,490	130	96	18.5	294	5.4	5.2
2A	0.57	2.95	374	2,360	66	80	46.7	231	8.2	7.8
3A	ns	2.35	ns	1,520	Ns	65	ns	273	ns	11.7
4A	0.11	0.34	140	272	127	80	20	40.8	18.2	12
5A	0.05U	0.05U	34U	26	68U	30	1.6U	11.7	3.4	11
1B	0.21	0.66	158	255	75	38	120.3	94.3	57.3	14.2
2B	0.29	0.13	168	181	58	62	82	74	28	57
3B	0.17	ns	89.2	ns	75	ns	31	ns	57.3	ns
SQS					47	47			12	12
CSL					78	78			65	65

a Stations 1A through 5A are located in Area A (northern area, nearest the Diagonal Ave S CSO/SD outfall) and stations 1B through 3B are located in Area B (southern area).

Exceeds SQS   Exceeds CSL   ns = not sampled   TOC too low for SMS calculation



Below SQS
Above SQS, below CSL
Above CSL
NS No Sample Possible

Note:
Chemistry values for PCBs in ppb dry weight. Exceedances are based on OC-normalized concentrations or dry weight if TOC value is below 0.5%

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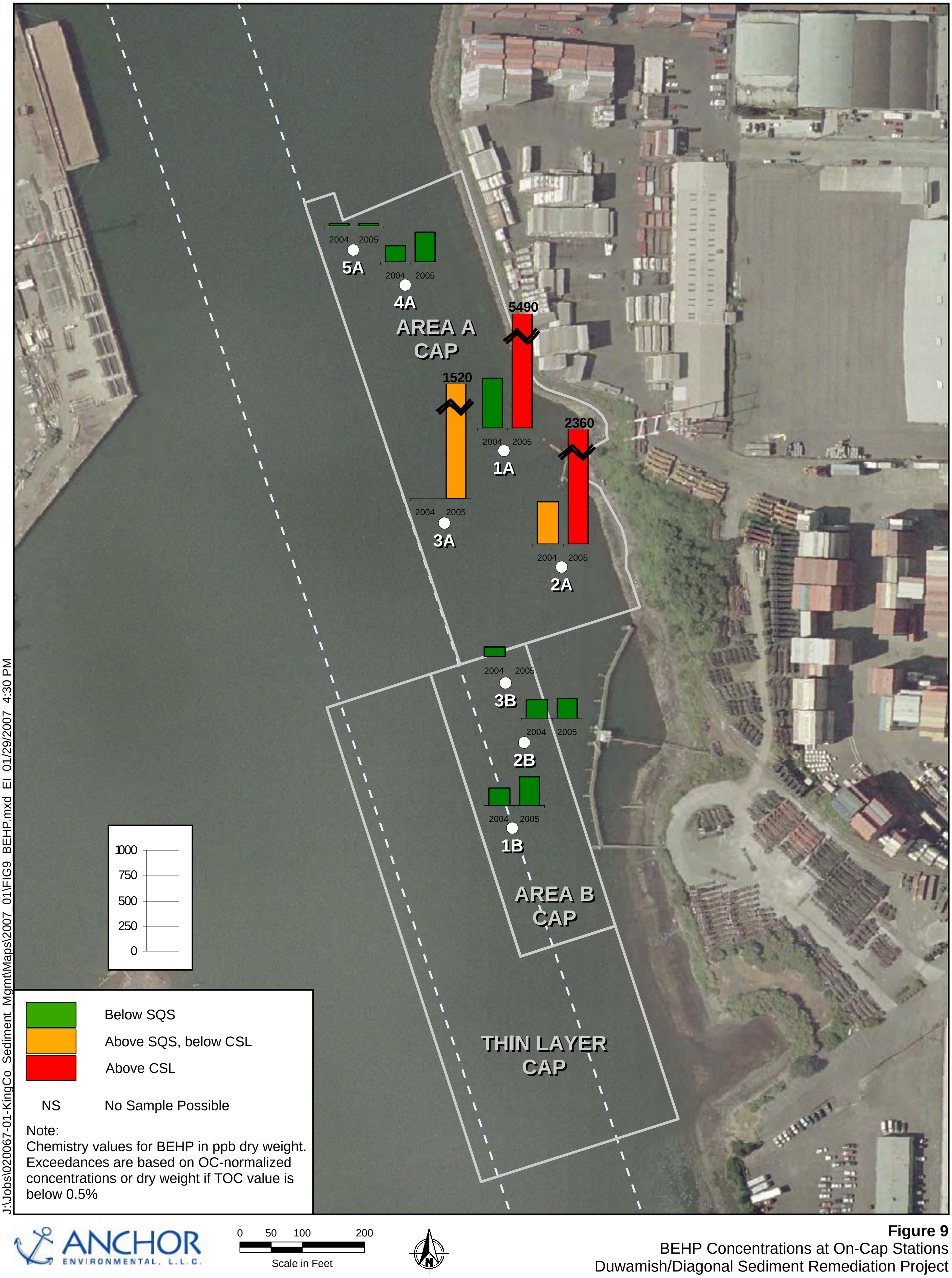
ANCHOR ENVIRONMENTAL, L.L.C.

0 50 100 200
Scale in Feet

Figure 8
PCBs Concentrations at On-Cap Stations
Duwamish/Diagonal Sediment Remediation Project



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ANCHOR ENVIRONMENTAL, L.L.C.

Figure 9
BEHP Concentrations at On-Cap Stations
Duwamish/Diagonal Sediment Remediation Project

4.1 PCB Results and Comparison to Sources

PCB concentrations are approaching the SQS in Area A and exceed the SQS in Area B. Dry weight PCB concentrations on the cap have increased to an average of about 265 micrograms per kilogram dry weight (μg/kg DW) in the three stations closest to the outfall, but have only slightly increased or dropped in other parts of the cap since cleanup was completed in 2004. However, when the data are normalized to organic carbon content (TOC) of the sample, there has not been much change because there was a corresponding increase in TOC concentrations in year one that tended to offset the increase in PCB concentrations. The sample collected from station 1A contained a large amount of organic debris (leaves and twigs) that is typical of a large stormwater discharge.

Although PCBs are detected in many of the different types of source samples collected in the Diagonal/Duwamish basin (55 to 88 percent), most did not exceed the SMS (SPU and KCIW 2005). PCB concentrations in some of the inline sediment traps (22 to 860 μg/kg DW), right-of-way catch basins (less than 19 to 670 μg/kg DW), and onsite catch basins (less than 19 to 940 μg/kg DW) are greater than the concentrations observed in the post-cleanup sediment samples (12 to 294 μg/kg DW). However, the majority of the source samples (79 to 94 percent) contain comparable levels of PCBs as those found in the cap. Therefore, concentrations of PCBs in the cap are not expected to continue to increase significantly in the future.

When Seattle Public Utilities cleaned the Diagonal Way SD/CSO mainline in 2004 and some of the lateral lines in 2005, they removed PCB-contaminated sediment, containing PCB values of less than 62 to 940 μg/kg DW. These levels are in the same range as more recent sampling in the basin, with the majority below the levels found on the cap. PCB levels found in the inlets and the line during the most recent sampling may be similar to levels in the older sediments cleaned out, suggesting that concentrations do not appear to be dropping further.

4.2 BEHP Results and Comparison to Sources

BEHP concentrations exceed the CSL at three stations offshore of the Diagonal Way SD/CSO outfall. Dry weight concentrations have increased by as much as one order of magnitude since the 2004 cleanup at the three stations, though concentrations have less than doubled on the other stations farther away.

BEHP concentrations in source sediment samples range from about 100 to 140,000 µg/kg DW (10 to 900 mg/kg OC). Although the highest concentrations are generally found in onsite catch basins at industrial sites, BEHP concentrations are above the SMS in many of the source samples (38 to 88 percent of the samples) (SPU and KCIW 2005). To date, no specific, controllable source of BEHP has been found. Product testing found BEHP in automotive products, leading to the conclusion that BEHP is associated with vehicular traffic. The County and the City of Seattle (the City) are continuing to investigate potential BEHP sources. Specific activities that are being pursued include:

- Working with Ecology to add BEHP to monitoring requirements for National Pollutant Discharge Elimination System (NPDES)-permitted facilities
- Continuing air deposition studies
- Adding a member of the Puget Sound Clean Air Agency to the Lower Duwamish Work Group source control work group to aid in investigating possible sources from atmospheric deposition
- Researching information about BEHP sources and sediment contamination problems within and outside the Puget Sound area to determine whether BEHP is a regional urban problem

It appears that BEHP concentrations on the cap will undergo some additional increase over time because there are no specific sources in the drainage basin to be controlled that have been identified to date. Concentrations could reach pre-cleanup levels but the area exceeding the SMS would probably be confined to a much smaller area near the outfall.

4.3 Other Chemical Results and Comparison to Sources

Dry weight PAH concentrations increased by up to 1 order of magnitude at four of the five monitoring stations between year zero and year one. The largest increases occurred at the two stations nearest the Diagonal Way SD/CSO outfall (stations 1A and 2A). However, none of the samples exceeded the SMS total low-molecular-weight polycyclic aromatic hydrocarbon (LPAH) or high-molecular-weight polycyclic aromatic hydrocarbon (HPAH) when normalized to organic carbon content.

Although total petroleum hydrocarbons (TPH-oil) concentrations are elevated in most of the source sediment samples in the basin (100 to 72,000 mg/kg DW), elevated concentrations of PAHs have occurred infrequently. About 25 percent of the inline sediment trap samples and 20 percent of the onsite catch basin samples exceeded the SMS, while only one right-of-way sample exceeded SMS for one or more PAH compounds. Source inspections and source tracing activities are effective in controlling oil discharges to area storm drains; a number of potential sources have already been controlled. PAH concentrations in most of the source sediment samples (less than 100 to 800 µg/kg DW) are similar to the concentrations observed in the cap samples (less than 15 to 700 µg/kg DW) at year one. Therefore, PAH concentrations are not expected to continue to increase significantly in the cap.

Few other chemicals were found to be significantly increased on the cap. In 2005, benzyl alcohol was detected at four stations (1A, 2A, 4A, and 5A) and it exceeded the CSL at station 1A (1,200 µg/kg DW). Benzyl butyl phthalate was detected at all stations and although it slightly exceeded the SQS at stations 4A and 5A, these concentrations were lower on the cap. Dibenzofuran and hexachlorobezene were detected at all stations and although they both exceed the SQS at station 5A, the concentrations were substantially lower on the cap. n-Nitrosodiphenylamine was detected at all stations and although it exceeds the CSL at station 5A, this concentration was substantially lower on the cap.

4.4 Summary of Results

All analyses and conclusions for the cap are based on year one data compared to baseline conditions. While these data represent a snapshot at the site, there is not enough information to be conclusive or representative of a trend. Without an understanding of the annual variability at the location, placing these results in context is difficult. Several years of monitoring are needed to truly understand what levels of chemicals are likely to occur on the cap. However, it is apparent that increased concentrations of several chemicals are occurring on the cap, particularly in front of the Duwamish/Diagonal outfalls.

There is no real evidence of specific locations to look for significant sources of PCBs or phthalates. Some specific sources of PAHs (and particularly TPH) were identified, but pre-cleanup levels suggest that these chemicals are not likely to reach SMS. Therefore, general source control activities may provide some minor reductions in these predicted levels but no more than that. Recontamination for PCBs and PAHs above state standards does not appear likely over time. Phthalates will continue to be a problem.

5 REFERENCES

Elliott Bay/Duwamish Restoration Program (EBDRP). 2005. *Duwamish/Diagonal CSO/SD Sediment Remediation Project Closure Report*. Panel Publication 39. Prepared by the EcoChem Team and Anchor Environmental, L.L.C. for the Elliott Bay/Duwamish Restoration Panel. July 2005.

King County Department of Natural Resources and Parks (KCDNRP). 2003. *Duwamish/Diagonal Sediment Remediation Dredging and Capping Operations Sediment Monitoring Sampling and Analysis Plan*. Prepared by King County Department of Natural Resources and Parks, Water and Land Resources Division, Seattle, Washington. October 28, 2003.

KCDNRP. 2005. *Duwamish/Diagonal Interim Action Residual Remedy Proposal*. Memorandum to Washington Department of Ecology. Dated January 21, 2005. King County

KCDNRP. 2007. *Duwamish/Diagonal Sediment Remediation Project 4-Acre Residuals Interim Action Closure Report*. Prepared by Anchor Environmental, L.L.C. for King County Department of Natural Resources and Parks, Wastewater Treatment Division. April 2007.

Seattle Public Utilities and King County Industrial Waste (SPU and KCIW). 2005. King County and Seattle Public Utilities Source Control Program for the Lower Duwamish Waterway – June 2005 Progress Report. Prepared for U.S Environmental Protection Agency and Washington Department of Ecology. Seattle, WA.

APPENDIX A

RESIDUAL REMEDY PROPOSAL

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000

November 16, 2004

RECEIVED BY
NOV 23 2004
NORTH SATELLITE OFFICE

Mr. Don Theiler
Director, Wastewater Treatment Division
King County
Department of Natural Resources and Parks
201 S. Jackson
Seattle, WA 98104

Dear Mr. Theiler:

RE: Requirement for a Continuation of the Duwamish/Diagonal Way Combined Sewer Overflow/Storm Drain (CSO/SD) Interim Sediment Remedial Action

The Department of Ecology has reviewed the pre- and post-action sediment sample results for the Duwamish/Diagonal Way CSO/SD sediment remedial action that was completed in February of 2004. It is clear from this review that concentrations of PCBs have increased significantly in one area of the interim action site. This area is immediately to the west and south of Area B of the original dredge plan. These increases are more than would be expected from dredging operations using best management practices for environmental dredging of contaminated sediments, as required under the US Army Corps of Engineers Nationwide 38 permit issued for this project.

Under authority of the 1991 Natural Resource Damage Assessment Consent Decree between King County, the City of Seattle, the Department of Ecology, and the National Oceanic and Atmospheric Administration, and under authority of the Model Toxics Control Act, Chapter 70.105D RCW and Chapter 173-340 WAC, the Department of Ecology requires a continuation of the interim remedial action in this area, as specified below.

King County will submit an interim action plan to Ecology for its approval to address the issue described above. The interim action plan shall include the following elements:

- a draft project plan, including maps and schedules,
- a draft water quality monitoring plan to be implemented during the action,
- a draft plan to supervise contractor practices during the action, and a draft sediment monitoring plan for the action area that will include pre-action sediment samples to determine extent of contamination, and post-action sediment samples to determine the short- and long-term effectiveness of the action, as well as the extent of any remaining contamination in the area.

Due to the ongoing Superfund investigation of the Lower Duwamish Waterway by the US Environmental Protection Agency, the Department of Ecology and the Lower Duwamish Waterway Group (City of Seattle, Port of Seattle, King County, The Boeing Company), this will be considered a continuation of the interim action, and is not the final remedy for this area. The Lower Duwamish Waterway Group will continue to investigate a full range of long-term cleanup options for this area in the upcoming site Feasibility Study.

In addition, King County will contact the US Army Corps of Engineers, the US Fish and Wildlife Service, and other relevant permitting agencies to pursue any required permits, or conditions under existing permits, for this action. In order to accelerate this project, we recommend that King County contact the Corps of Engineers navigation section as soon as possible to discuss any proposal to place sand or other materials within the navigation channel.

King County will work closely with Ecology to monitor and supervise contractor practices and the implementation of the water quality monitoring plan during the action. This interim action will be completed this season (2004-05), in order to reduce risks from the PCBs as quickly as possible.

We would also like to remind King County that they have agreed to eight additional samples to assess the impact of the remedial action on the surrounding sediments, above and beyond those listed above. We would like to meet with King County as soon as possible to discuss placement of these samples.

For further information, contact Rick Huey, Lower Duwamish Waterway site project manager, at 425-649-7256.

Sincerely,

Steven M. Alexander
Northwest Regional Office
Toxics Cleanup Program

SA:RH:ct

cc: Jim Pendowski, Ecology TCP
Allison Hiltner, USEPA Region 10

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Sediment Management Standards
Cleanup Action Decision Amendment

Duwamish/Diagonal CSO/SD

January 18, 2004

Introduction

The Department of Ecology has reviewed the pre- and post-action sediment sample results for the Duwamish/Diagonal Way CSO/SD sediment remedial action that was completed in February of 2004. It is clear from this review that concentrations of polychlorinated biphenyls (PCBs) have increased significantly in one area of the interim action site. This area is immediately to the West and South of Area B of the original dredge plan. These increases are more than would be expected from dredging operations using best management practices for environmental dredging of contaminated sediments, as required under the US Army Corps of Engineers Nationwide 38 permit issued for this project.

Under authority of the 1991 Natural Resource Damage Assessment Consent Decree between King County, the City of Seattle, the Department of Ecology and the National Oceanic and Atmospheric Administration, and under authority of the Model Toxics Control Act, Chapter 70.105D RCW and Chapter 173-340 WAC, the Department of Ecology requires a continuation of the interim remedial action in this area, as specified below:

- Due to the ongoing Superfund investigation of the Lower Duwamish Waterway by the US Environmental Protection Agency, the Department of Ecology and the Lower Duwamish Waterway Group (City of Seattle, Port of Seattle, King County, The Boeing Company), this will be considered a continuation of the interim action.

- The intent of this action is to immediately lower PCB exposure risks in the southwest portion of Area B, not to achieve a final remedy for this area. Ecology expects the Lower Duwamish Waterway Group to investigate a full range of long-term cleanup options for this area in the upcoming site Feasibility Study.

- In addition, King County will contact the US Army Corps of Engineers, the US Fish and Wildlife Services, and other relevant permitting agencies to pursue any required permits, or conditions under existing permits, for this action.

- Water quality and sediment monitoring will be implemented as proposed in the attached plan. Ecology and EPA will continue to work with King County on the development of the sediment monitoring plan.

- King County will work closely with Ecology to monitor and inspect contractor practices and the implementation of the water quality monitoring plan during the action.

- This interim action will be completed this season (2004-05), in order to reduce risks from the PCBs as quickly as possible.

This action is proceeding under the same legal authority (Model Toxics Control Act, Chapter 70.105D RCW and Chapter 173-340 WAC, and Chapter 173-204 WAC the State Sediment Management Standards) as the action that was completed in February of 2004.

This draft Cleanup Action Decision Amendment has been prepared by Ecology to document that the proposed cleanup method is consistent with the Sediment Management Standards, in accordance with WAC 173-204. Currently, the cleanup action is scheduled for completion by March 1, 2004.

For further information, contact:

Washington State Department of Ecology
Rick Huey
Lower Duwamish Project Manager
Northwest Regional Office
Toxics Cleanup Program
Bellevue, WA 98008-5452
425-649-7256
rhue461@ecy.wa.gov

Memorandum

To Department of Ecology

From: King County

Date: January 21, 2005

Re: Duwamish Diagonal Interim Action Residual Remedy Proposal

Background

The Duwamish/Diagonal Sediment Remediation Project occurred during the 2003-2004 dredging season (November to March). The contractor selected by King County was Miller Contracting. Their initial efforts, which began in the more highly contaminated "Area B" portion of the site, resulted in a higher proportion and of water quality exceedances for total suspended solids (TSS) proximal to the dredging operations than during the remainder of the project. Those exceedances also had much higher exceedance ratios than other TSS exceedances throughout the remainder of the project, and appeared to be the result of relatively high production rates, overfilling of the dredge bucket, and other operations (EBDRP 2004). King County and permit oversight staff notified the contractor that it would enforce the provisions of the contract to require that the contractor follow Best Management Practices (BMPs) to control sediment releases associated with dredging operations. Dredging operations for the remainder of the project, including all dredging in the primary "Area A" region of the site, occurred under much lower production rates and strict time penalties for overfilling among other methods to control operations and lower releases of sediment into the water column during dredging (EBDRP 2004).

Sediment residuals are defined as contaminated sediments that either remain at the dredge site after dredging, or have been spread to adjacent areas as a result of dredging. Residuals have been documented to occur at sediment cleanup sites, though the magnitude of release have rarely been quantified and likely varies widely between projects based on a range of site-specific and operational factors. Immediately prior to initiation of dredging activities (baseline sampling in October 2003), and also shortly following completion of the project in late March 2004, King County collected surface (0 to 10 cm) sediment residuals performance monitoring samples from 12 stations located immediately outside the project area, as described in the agency-approved Sediment Monitoring

Plan (King County 2003). The data revealed that dredging activities had increased surface sediment PCB concentrations around the southwest margin of "Area B" significantly higher than other site margins (Figure 1).

The occurrence of a greater amount of sediment residuals in the southwest margin of "Area B" was consistent with the contractor's initial operations in this area that did not appear to have fully utilized practicable BMPs as required by the Corps Nationwide Permit 38 issued for the project. As a result, the Washington Department of Ecology (Ecology), the U.S. Environmental Protection Agency (EPA), and stakeholders requested that King County examine prospective further remedial actions to address the excess sediment residuals released during this portion of the project, which King County evaluated in summer 2004.

Potential Remedies

Six potential remedies were considered. These included the following supplemental response actions (listed in order of increasing permanence, as this term is generally defined under the Washington State Model Toxics Control Act [MTCA]):

Remedy 1. **Monitored Natural Recovery**. This remedy would rely on natural processes such as sedimentation to reduce risks associated with the sediment residuals, and would require monitoring the sediments over time to verify risk reductions and attainment of cleanup levels. Based on modeling performed during remedial design (EBDRP 2001), updated to reflect the post-construction monitoring data, monitored natural recovery would likely attain State Sediment Quality Standards (SQS) in the region surrounding "Area B" within a period of several years.[1] Monitoring would be performed to document the effectiveness of the natural recovery.

Remedy 2. **Enhanced Natural Recovery**. This remedy includes the placement of a thin layer of clean material (approximately 6 inches) over the sediment residuals to accelerate the natural recovery time frame (e.g., potentially to be accomplished by early 2005). This remedy has been employed for sediment residual management at other similar cleanup sites in Puget Sound, such as in areas immediately adjacent to the Puget Sound Naval Shipyard confined aquatic disposal facility. Enhanced natural recovery actions would provide a layer of clean cover material that would then be bioturbated through natural processes into the existing sediment bed. Monitoring would be performed to document the effectiveness of the thin-layer placement and bioturbation process.

[1]Note: the sediment concentrations measured around "Area A" following the interim action are predicted to fall to pre-remediation levels within one to three years.

Remedy 3. **Thick Cap**. This remedy would include the placement of a relatively thick layer of clean materials that would isolate the sediment residuals to depths well below the biologically active surface sediment zone. Typically, a cap thickness of 3 feet is placed to ensure long-term isolation under worst-case sediment erosion conditions, although site-specific conditions may allow for a thinner cap section in some areas.

Remedy 4. **Thin Removal**. This remedy includes the "precision" removal of the sediment residuals (as defined by the practicable limit of current dredging technologies), potentially with a clean thin backfill layer to address remaining sediment residuals.

Remedy 5. **Dredge and Thick Cap**. This remedy includes removal of existing sediments to make room for the thick (3 foot) cap described above, so that there is no net change to the sediment surface elevation.

Remedy 6. **Deep Removal**. This remedy includes the removal and disposal of all sediment contaminants to the clean native contact, potentially including a clean backfill to address sediment residuals that may result from this action.

Evaluation of Potential Remedies

Remedy 1 – Monitored Natural Recovery would provide the least cost remedy but potentially take the longest to achieve cleanup standards. Monitoring would likely occur over a 2 to 5 year period depending on the results of the preceding rounds of sampling. This remedy could act like a pilot study with the results of the monitoring providing valuable information about the effectiveness of natural recovery as a long-term risk management option within the Lower Duwamish Waterway Superfund site. The total present worth cost of the Monitored Natural Recovery alternative is estimated at about $100,000. This remedy was carried forward for further consideration.

Remedy 2 – Enhanced Natural Recovery could be easily implemented and may be able to be performed in the 2004-2005 dredging window, depending in part on resolution of contracting issues. Clean sand material could be placed at the site using mechanical or hydraulic methods. Based on recent bathymetric surveys of the site area, there is a small portion of the prospective remedial action area within the navigation channel that has currently shoaled to an elevation at or above (shallower than) -30 feet mean lower low water (MLLW), the federally-authorized channel depth. Thus, in order to implement the thin layer placement remedy within this shoaled portion of the waterway, the Corps would likely need to provide authorization under its Section 10 authorities. However, since the site area currently receives approximately 1.5 inches of new sediment deposition each year

(EBDRP 2001), a 6 inch layer placed in this area would only "use" approximately 4 years of channel capacity. Since this portion of the Lower Duwamish Waterway has not been dredged since 1968, potential further shoaling concerns associated with implementation of this remedy are likely to be minor. The cost to design, construct and monitor the effectiveness of this remedy is estimated to range from approximately $500,000 to $600,000, depending on the final size of the area to be covered, and construction methods employed. This remedy was carried forward for further consideration.

Remedy 3 – Thick Cap could likely not be implemented at the site, as most of the area of concern is located within the federal navigation channel. A 3-foot thick cap would raise the elevation of the bottom well above the authorized depth and would likely not be approved by the Corps under its Section 10 authorities. Thus, this remedy was eliminated from further consideration.

Remedy 4 – Thin Removal of only the dredge residuals is not practicable and potentially not technically feasible, as current dredging technologies are not capable of limiting removal to the anticipated depth of the residual layer (nominally 1 inch-thick in the zone surrounding "Area B"). Implementation of this remedy would require the removal of a thin layer of residuals (likely at least 12 inches) by either mechanical or hydraulic means. Mechanically this would be very difficult because dredging contractors would typically employ a bucket that dredges a larger thickness of material. This option would also result in the collection of relatively large amounts of water (requiring treatment and/or disposal), and would likely also remove subsurface materials that currently underlie the sediment residuals. Since existing sediment core data collected in this area reveal that contaminant concentrations increase with depth, implementation of this remedy could potentially expose subsurface contaminated sediments that contain chemical concentrations even higher than the current residual concentrations, also with attendant residuals release concerns (i.e., potentially leading to further spreading of residuals. If hydraulic methods were used, larger amounts of water would be generated. This water would need to be collected, sediments separated from the water, and the water tested prior to disposal in an appropriate location. The ability to remove a layer thin enough to avoid exposing subsurface contamination is also unlikely, leaving a similar problem as with mechanical removal. The unit (and total) cost of this remedy would be relatively high and disproportionate to the degree of protection provided. Leaving higher surface concentrations than pre-remedy levels is likely. Thus, this remedy was eliminated from further consideration.

Remedy 5 – Dredge and Thick Cap is not implementable prior to late 2005 at the earliest but more likely a year later. In order to implement this option a subsurface investigation would need to be performed to characterize the vertical extent of contamination and the concentrations that would be exposed prior to placing the thick cap. As discussed above, the vertical distribution of contamination observed in nearby cores is generally characterized by an increase in chemical concentrations with depth, particularly over the top 3 feet of the sediment column. Peak chemical concentrations are generally reported in cores within the site area at depth between roughly 3 and 6 feet below existing mudline. Thus, it would be important to characterize the location of this peak in order to design the remedy properly. Given the relatively high cost of implementing this action – on the order of $1,000,000 for 10,000 cy of removal – King County would only be interested in implementing such an action as a final cleanup remedy for this part of the site. Since both Ecology and EPA have indicated that final cleanup actions can only be determined following completion of the ongoing remedial investigation/feasibility study (RI/FS) of the Lower Duwamish Waterway Site, this remedy was eliminated from further consideration.

Remedy 6 – Deep Removal has the same general difficulties as Remedy 5. The volume of removal required to achieve the clean native interface is currently not well characterized, and would require a major sampling effort to determine. Similar to the discussion provided above for Remedy 5, such an action will be considered as part of the Lower Duwamish Waterway RI/FS. Preliminary cost estimates for this remedy applied to the prospective sediment residuals cleanup acre are on the order of $1,400,000 for 20,000 cy of removal. This remedy was eliminated from further consideration.

Proposed Remedy

Two different remedies (Remedy 1 – Monitored Natural Recovery and Remedy 2 – Enhanced Natural Recovery) were carried forward as potential supplemental remedies to address "Area B" sediment residuals resulting from the 2003/2004 Duwamish/Diagonal interim cleanup action. King County approached both Ecology and EPA to determine whether they had a preference for one over the other. A key factor for the agencies was to try to implement the supplemental remedy prior to March 2005. The agencies indicated that both Remedy 1 or 2 would: 1) be consistent with the timing concerns and 2) possibly provide benefits that could be applicable to the Lower Duwamish Waterway RI/FS and relevant to the eventual final cleanup decision.

King County is proposing to pursue implementation of Remedy 2 – Enhanced Natural Recovery, subject to confirmation on the extent of the placement area required, placement methods, and resolution of contracting issues. This remedy will provide faster return to pre-dredging sediment levels in the southwest margin of the site. In addition, King County proposes to monitor natural recovery of the other margin areas as a way to gain information about this second remediation technique that could also be applicable to the Lower Duwamish Waterway RI/FS.

Figure 2 (Sheet C-1) defines the proposed project boundaries for the Enhanced Natural Recovery. The intent is to cover the bottom of the navigation channel to the west of "Area B" and 25 feet up the side slope in order to cover the residuals that spread cross-current and to cover the area upstream to the extent that the residual levels are found at concentrations above those around Area A. It is anticipated that those areas further upstream of the cap boundaries should naturally recover at the same time scale as the margins around "Area A". This upstream area will be monitored together with the margins of "Area A" to determine if natural recovery is occurring at an acceptable pace or additional action would be warranted.

The placement of 5500 tons of clean sand will be evenly distributed across the project boundaries resulting in an average 7-inch placement. A placement plan will be developed to ensure even distribution of each bucket of material throughout the boundary by defining each bucket placement box in a grid tied to a WinOps type software system. The placement will be verified by documentation of the software records which will show that each grid cell was covered and placement across each grid was uniform. Coverage on the sediment surface will be verified by measuring stakes placed on bottom at known locations within the placement grid. The stakes will be inspected by a diver survey following placement to determine if additional material needs to be added to areas within the site that have inadequate coverage. Specifications for the sand layer, placement procedures and best management practices (BMPs) are included in the Specification Sections attached.

Contractor Oversight

King County inspection and construction management will be undertaken to ensure that the work is performed and completed per the approved plans and specifications. Not later than 3 days after the effective date of Notice to Proceed, the Contractor shall submit to King County a detailed, written project Placement Plan. It is anticipated that the project will be consistent with the technical specifications for thin layer placement attached. Field oversight will ensure operations will comply with all BMPs, placement is uniform and consistent with the placement plan and verify the WinOps-type system software documentation matches the placement grid. A post-placement diver-survey of measuring stakes in the river bottom will determine placement thickness and require additional placement as necessary.

Monitoring Plan

Monitoring proposed for this remedy is a continuation of the two approved Sampling and Analysis Plans (SAPs) for Water Quality Monitoring and Sediment Monitoring (King County 2003a, b) for the original dredge and capping project implemented from November 2003 to March 2004. These original SAPs provided details of the monitoring conducted before, during and after the dredging and capping, so to expedite the process an Addendum was prepared for each SAP to cover the changes during placement of the enhanced natural recovery layer. Both addendums are attached to this document, but each addendum contains enough information that it can be used as a stand-alone document.

References

EBDRP. 2001. Duwamish/Diagonal CSO/SD Cleanup Study Report. Draft. Prepared by King County, Anchor Environmental and EcoChem for the Elliott Bay/Duwamish Restoration Program (EBDRP), Seattle WA. EBDRP Panel Publication 30.

EBDRP. 2004. Duwamish/Diagonal CSO/SD Sediment Remediation Project Closure Report. Draft. Prepared for the Elliott Bay/Duwamish Restoration Program (EBDRP) and King County Department of Natural Resources, Seattle, WA.

King County . 2003a. Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Water Quality Monitoring Sampling and Analysis Plan, Seattle, Wa.

King County . 2003b. Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Sediment Monitoring, Sampling and Analysis Plan, Seattle, Wa.

ADDENDUM TO WATER QUALITY MONITORING

FOR DUWAMISH/DIAGONAL SEDIMENT REMEDIATION PROJECT

Introduction

The primary work for the Du/Di dredge and cap project was competed in March 2004. However, in November 2004, Ecology notified King County that additional work was needed to reduce PCB levels in the areas offshore and upstream of Area B. After evaluating various alternatives, the County selected enhanced natural recovery (ENR) as the interim remediation method and is proceeding with plans to have a thin layer of sand placed over about 4 acres of river bottom before the current dredge window ends in February 2005. Ecology and EPA requested that both water quality and sediment monitoring be conducted for this new work. To expedite the process, the County intends to provide addendum to the original two Sampling And Analysis Plans (SAPs) previously approved because the construction and monitoring for the ENR will be similar to the methods that were used during the original capping in 2004.

The final approved Water Monitoring SAP was dated October 28, 2003 and titled Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Water Quality Monitoring Sampling and Analysis Plan and includes all details of the monitoring activities. This addendum documents the modifications to that SAP needed to address the monitoring done for this phase of the work.

Monitoring Activities

The enhanced natural recovery method involves placing a layer of clean sand on the river bottom, which is similar to the actions that were previously used to place the clean base capping layer of sand over the original 7-acre capping area. The estimated duration of ENR placement is about one week so monitoring will continue during all daytime placement work. Ecology and other regulatory agencies will be notified prior to starting the ENR placement work. The “Study Objectives” presented on page 6 of the Water Monitoring SAP states that turbidity would be monitored during cap placement, but there is no need to measure chemicals of concern because the capping material consists of clean sand. This objective holds true for the ENR placement as well. Sample collection, handling, analysis and reporting will be the same as described in sections 7 through 10 of the Water Monitoring SAP except as noted below.

Summary of Modifications

Sampling Schedule: no change
Reference Stations Up Current: no change
Water Quality Compliance Station 300 Feet Down Current of ENR: no change
Station 150 Feet Down Current of ENR: drop surface sample and retain bottom sample
New Station 100 Feet Down Current of ENR: collect bottom sample if safe
New Station 50 Feet Down Current of ENR: collect bottom sample if safe
Turbidity Analysis: perform analysis on site instead of at the County lab
Turbidity Data Availability: available within one hour instead of 12 – 24 hours

Water Quality Compliance Station At 300 Feet

The water sampling schedule to collect turbidity for the ENR will be the same as previously used during capping and consists of sampling twice daily with one ebb tide per day and one flood tide per day. At the start of each tidal sampling event of the day, a reference station will be sampled up current from the ENR sand placement work. Sampling at the water quality compliance station located 300 feet down current of the ENR will follow the same sampling procedures used during the previous capping activities and the recording depth sounder will be used to locate the turbidity plume so sampling occurs near the centerline of the plume. Individual water samples will be collected from near the surface (90 cm below surface) and near the bottom (60 cm above the river bottom) with a water sampling bottle lowered on a line from the sampling vessel. However, to speed up the availability of turbidity data, a Hach meter will be used on site to measure turbidity in the water samples instead of sending the samples to the lab as was done previously. The method for measuring turbidity with the Hach meter is standard EPA method number 180.1 and the data is considered as accurate as turbidity data from samples sent to lab for analysis. Measuring turbidity on site should provide results within one hour instead of 12 – 24 hours when samples were previously sent to the lab. Turbidity data will be reported for each water sample and a determination made whether the water sample exceeds the applicable standard that allows an increase of 10 NTU above background.

Stations Closer Then 300 Feet

The applicable turbidity standard that allows an increase of 10 NTU above background at the edge of the mixing zone (300 feet) was established primarily to protect fish from the detrimental effects of high turbidity in the water column. However, regulatory agencies also previously requested that turbidity be measured at the closer distance of 150 feet as a way of determining how much sediment was being disturbed into the water column. At this time EPA has requested that bottom sampling be conducted at progressively closer distances of 150 feet, 100 feet and 50 feet to determining whether placement of sand for the ENR will displace a significant amount of the contaminated bottom sediments, which could cause a redistribution of the contaminated sediment on the river bottom. The County will collect bottom samples at these closer distances as long as the work can be accomplished safely without the risk of coming in contact with the contractors bucket or sand that is being spread. Surface samples are not needed at these stations as the process targeted occurs along the bottom.

Coordination and approval must be obtained from the contractor to insure safety and that the contractor's work of spreading the sand evenly is not compromised by having the sampling vessel work so close to the moving bucket. The turbidity values that are obtained from these closer stations are not water quality compliance samples but an attempt to detect if placement activities are generating turbidity waves along the bottom. They will be reported to the regulatory agencies for their use and will not be judged based on the water quality standard that allows an increase of 10 NTU.

In addition to collecting the water sample for turbidity analysis at these closer stations, the County also plans to lower a probe to the bottom station to measure the changes in field turbidity and dissolved oxygen over time. To maximize the potential for detecting turbidity plumes generated by sand impacting the bottom, both turbidity and dissolved oxygen readings will be collected over the period of time it takes the contractor to spread 3 to 5 buckets of sand. The turbidity and dissolved oxygen data from the field probe will be reported to regulatory agencies along with the turbidity data for the water sample.

References

King County. 2003. Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Water Quality Monitoring Sampling and Analysis Plan, Seattle, Wa.

ADDENDUM TO SURFACE SEDIMENT CHEMISTRY MONITORING

FOR DUWAMISH/DIAGONAL SEDIMENT REMEDIATION PROJECT

Introduction

The primary work for the Du/Di dredge and cap project was competed in March 2004. However, in November 2004, Ecology notified King County that additional work was needed to reduce PCB levels in the areas offshore and upstream of Area B. After evaluating various alternatives, the County selected enhanced natural recovery (ENR) as the interim remediation method and is proceeding with plans to have a thin layer of sand placed over about 4 acres of river bottom before the current dredge window ends in February 2005. Ecology and EPA requested that both water quality and sediment monitoring be conducted for this new work. To expedite the process, the County intends to provide addendum to the original two Sampling And Analysis Plans (SAPs) previously approved because the construction and monitoring for the ENR will be similar to the methods that were used during the original capping in 2004.

The final approved Sediment Monitoring SAP was dated October 28, 2003 and titled Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Sediment Monitoring Sampling and Analysis Plan, and includes all details of the monitoring activities. This addendum documents the modifications to that SAP needed to address the monitoring done for this phase of the work.

Monitoring Activities

The ENR method involves placing a layer of clean sand on the river bottom, which is similar to the actions that were previously used to place the clean base-capping layer of sand over the original 7-acre capping area. The following "Study Objectives" that apply to constructing the cap and to defining existing and future chemical conditions both on and around the cap also apply for the ENR:

- 3.1 Measuring … Cap Thickness,
- 3.3 Capping Material Monitoring,
- 3.4 Before and After Chemistry Beyond Boundary; and
- 3.6 Long-Term Monitoring of Chemical Concentrations on Cap Surface.

Prior to constructing the ENR, the County will also complete the remaining sediment sampling at eight stations that were included in the Sediment Monitoring SAP under Section 3.5, Additional Sediment Survey Beyond Boundary. Sample collection, handling, analysis and reporting will be the same as described in sections 7 through 12 of the Sediment Monitoring SAP except as noted below.

<u>Summary of Modifications</u>

Monitoring Activities Conducted Prior to ENR Placement
Measuring Chemistry in ENR sand prior to placement: no change
Resample 12 Pre- and Post-Dredging Chemistry Stations: collect stations DUD 1C to 12C prior to ENR
Add 2 New Chemistry Stations Upstream: sample stations DUD 13C and 14C prior to ENR
Collect Remaining 6 Survey Chemistry Stations Beyond Boundary: no change; DUD 15C to 20C
Add Collection Of Sediment At One Station For LDWG: new
Add 20 Sediment Profile Images at 20 Chemistry Stations Listed Above: new; 1C-SPI to 20C-SPI
Add 5 Sediment Profile Images at Non-Chemistry Stations; new; DUD 21C-SPI to 25C-SPI
Add Placing Bottom Stakes To Measure Thickness of ENR: new

Monitoring Activities Conducted After ENR Placement
Add Monitoring ENR Thickness Using Bottom Stakes: bottom stakes replace bathymetric surveys

Add Measuring Baseline Chemistry On Surface of ENR: DUD 3C-7C and 14C-15C
Add Taking 11 Sediment Profile Images At Stations Within ENR Boundary: new

Monitoring Activities Conducted Annually up to Five Years After ENR Placement
Sample 14 Pre- and Post-Dredge Stations: DUD 1C-14C (3C-7C, 14C within ENR)

Complete Description of Monitoring Plan Activities

Measuring Chemistry in ENR sand prior to placement:
Prior to placement of ENR a sample of the sand will be obtained from the contractor and submitted to the County lab for chemical testing to verify the material is chemically clean and suitable to use as ENR material.

Resample 12 Pre- and Post-Dredging Stations
In the months since the post-dredging samples were collected there is the potential that concentrations at these stations could change due to natural recovery processes in the river. Prior to placing the ENR, surface sediment chemistry will be monitored at the original 12 pre- and post-dredging surface sediment chemistry stations to document potential changes at all stations and to provide a starting baseline concentration for stations within the footprint of the ENR (3C-7C). Sample collection methods for the pre-ENR will repeat the 10 grab composites per station used previously to maximize comparability of data.

Add 2 New Chemistry Stations Upstream:
Two additional pre-ENR surface sediment chemistry samples will be added upstream of station C3 to help define residual concentrations in this area (stations DUD 13C and 14C; Figure 3). Station 13C is located 150 feet upstream from the edge of the ENR and in line with stations C3 and C4. Station 14C is located about 150 feet upstream from 3C and in line with the first three stations. However, 14C is located within the footprint of the ENR and will provide the sixth station for which there is baseline information prior to placement of the ENR. The initial round of sampling at these 2 pre-ENR stations will use the 10 grab composites per station to provide best comparability with the original 12 pre- and post-dredge stations.

Collect Remaining 6 Survey Chemistry Stations Beyond Boundary
The original sediment SAP included collecting sediment chemistry data at eight additional stations beyond the site boundary for a total of 20 stations. The locations for six of the eight additional surface stations are shown as 15C-20C in Figure 3. These 6 stations are not part of the long-term monitoring plan but will improve the understanding of the distribution of chemical concentrations in the area. The final 2 sediment stations will be located along the bank and inshore of Area A. The purpose of these samples is to collect bank material from upland soils that could erode onto the cap (a potential source of recontamination). The samples will be collected by hand at an elevation of +10ft MLLW at two locations with exposed soil that are subject to erosion by high tides. The exact locations will be determined in the field during collection and the locations fixed by hand held DGPS at that time.

Add Collection Of Sediment At One Station For LDWG:
The sediment sampling program for the Lower Duwamish Work Group (LDWG) identified one station near Duwamish/Diagonal site to perform dioxin analysis in addition to standard chemical analysis. The station selected is located offshore from station DUD 9C and the sediment sample will be collected by the County and provided to LDWG contract laboratory for analysis. Data will be reported directly to LDWG by their contract lab and be reported there. In addition, sub-samples at DUD 1C and 11C will be collected for dioxin analysis by LDWG. The two dioxin sub-samples will be provided to LDWG. LDWG will provide all sample jars.

Add 20 Sediment Profile Images at 20 Chemistry Stations Listed Above
In an attempt to gain additional understanding about the distribution of residuals prior to placing the ENR, a grid of locations will be sampled by sediment profile imaging (SPI) methods. SPI sampling will be co-located with all 20 of the pre-ENR sediment chemistry monitoring stations (stations DUD 1SP – 20SP; Figure 4).

Add 5 Sediment Profile Images at Non-Chemistry Stations

Additional SPI measurements will be collected at one station within the ENR (DUD 24SP) and 4 stations (DUD 21SP to 23SP, 25SP) located at greater distance from the cap then first 20 SPI stations (Figure 4). Station 24SP is located offshore from 5C. Station 25SP is located offshore from 13C and is 150 feet upstream of ENR boundary. Station 23SP is located offshore from 9C at the LDWG dioxin station. Station 22SP is located 200 feet downstream of 10C and 21SP is located 150 feet downstream of 20C.

Add Placing Bottom Stakes To Measure Thickness of ENR
Because the thickness of the ENR is only six inches, the standard bathymetric survey instruments cannot accurately measure the thickness. In order to accurately measure the thickness of the ENR it is necessary to use measuring stakes, which are placed into the river bottom. Flexible stakes are desired to minimize potential to snag fishing gill nets used by tribal fisherman. However, if stakes are to flexible and weak they will collapse when sand is added. Stakes made from thin-walled plastic water pipe that is ½ inch in diameter have the advantage of being strong enough to withstand placement of the sand but also weak enough to break or dislodge if snagged without damaging fishing nets. The white colored plastic pipe improves the diver's ability to locate the measuring stake under poor visibility conditions on the river bottom. Installation of stakes would either be by diver hammering stakes into bottom or other means. Stakes would be installed so that only about 10 inches of each stake would be extending above the surface of the ENR after it is installed. The stakes will have markings every 1 inch and be surveyed by diver after placement to provide a zero elevation prior to ENR placement. Stakes will be co-located with the seven stations used to measure chemistry on the ENR and four other non-chemistry SPI stations on the ENR (Figure 5) so that depth information collected will also be useful in interpreting the chemistry data collected on the ENR.

Add Monitoring ENR Thickness Using Bottom Stakes
Thickness of the ENR will be determined by diver surveys of stakes driven into the bottom prior to placement of the ENR. Each stake will be surveyed by diver after placement of the ENR to document how thick a layer of ENR sand was placed at each stake. Any stakes that have less than six inches of sand will be identified. The contractor will be instructed to add the calculated amount of sand needed to produce a final ENR thickness of six inches based on the first round placement records and results. After the additional sand is placed, the County will consult with Ecology to determine whether a second application of additional sand is warranted.

Add Measuring Baseline Chemistry On Surface of ENR
Shortly after placing the ENR, the six surface sediment stations located within the boundary and footprint of the ENR (stations 3C-7C and 14C) will be re-sampled to provide a year 0 baseline for that area. To document changes in chemical levels on the ENR over time, these six stations on the ENR will be monitored yearly for a period of up to five years or until 1) the sediment concentrations reach pre-action levels or 2) a final remedial action for the area is initiated, whichever comes first.

Add Taking Sediment Profile Images At 11 Stations Within ENR Boundary
A short time after the ENR is placed additional SPI measurements will be taken at stations within the ENR so it is possible to correlation the SPI reading with the ENR thickness measurements taken at stake locations co-located with 7 chemistry stations (DUD 3C-7C, 14C-15C) and 4 non-chemistry stake locations within the ENR (DUD 24C-SPI, 26C-SPI to 28C-SPI). Station 24C-SPI is located offshore from 5C. Station 28C-SPI is located offshore of 3C and down stream of 15C. Station 26C-SPI is located about 150 feet downstream of 6C and 27C-SPI is located about 150 feet downstream of 7C. The post-ENR SPI monitoring will be collected shortly after ENR placement in order to determine whether SPI measurements could be used effectively to measure the ENR thickness instead of using bottom stakes. Also, the 11 post-ENR SPI stations will be monitored again after one year to document benthic recolonization of the ENR.

Add Annual Monitoring
The 14 surface sediment stations DUD 1C - 14C will be sampled yearly after the ENR is installed to evaluate the effectiveness of the ENR remedy and the natural recovery of the other areas not treated by ENR. Monitoring will continue yearly for a period up to 5 years or until 1) the sediment concentrations reach pre-action levels or 2) a final remedial action for the area is initiated, whichever comes first. Sample collection methods for the post-ENR monitoring will repeat the 10 grab composites per station used previously to maximize comparability of data at all stations located off of the ENR itself. Note that the on-ENR sampling will not be able

to use the 10-grab composite sampling used previously because over time the 10 grab composite from each station would significantly remove a portion of the thin layer that we are trying to monitor. All post-construction sampling on the ENR will use a single grab sample for each station if possible.

References

King County. 2003. Duwamish/Diagonal Sediment Remediation, Dredging and Capping Operations, Sediment Monitoring Sampling and Analysis Plan, Seattle, Wa.

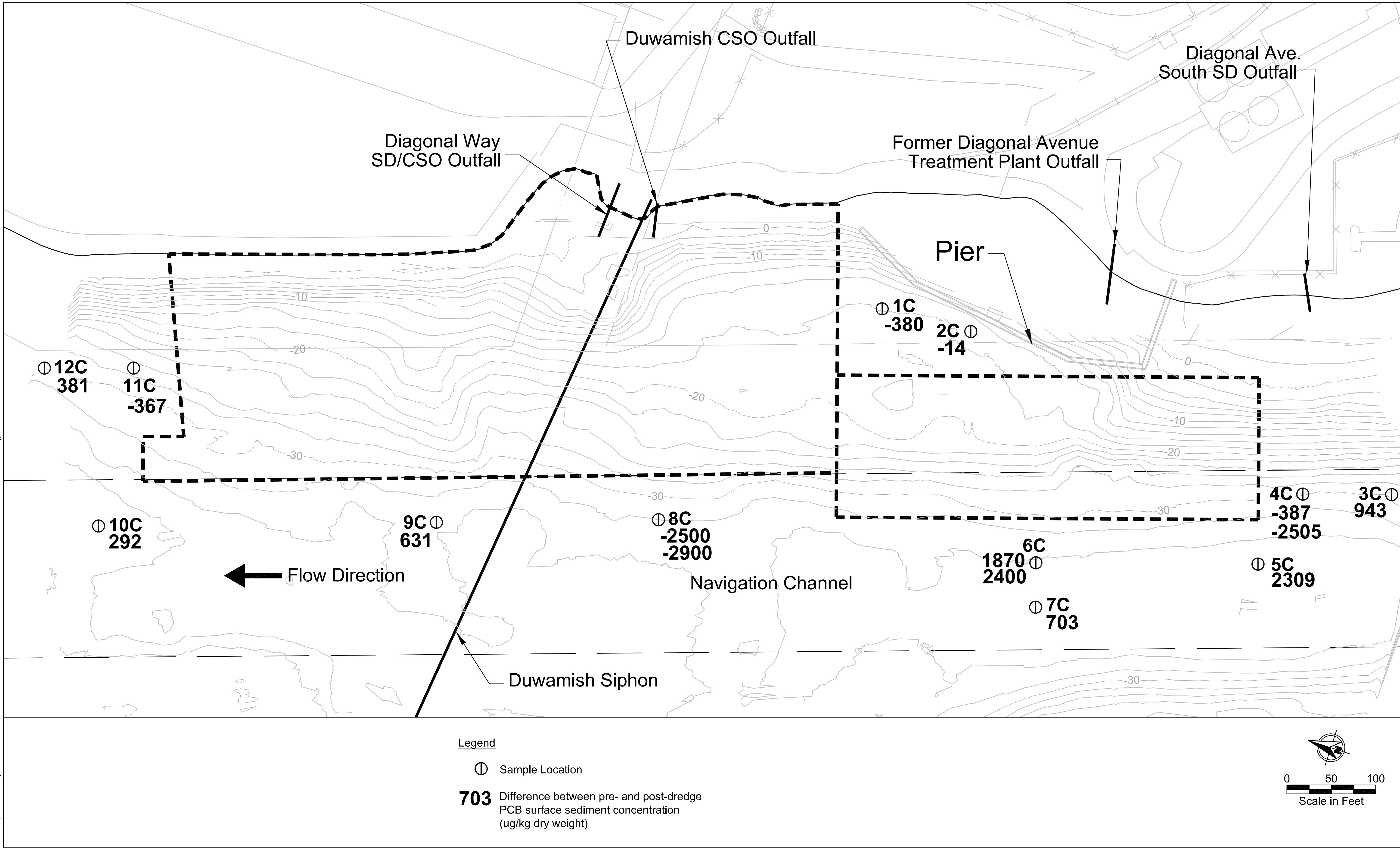

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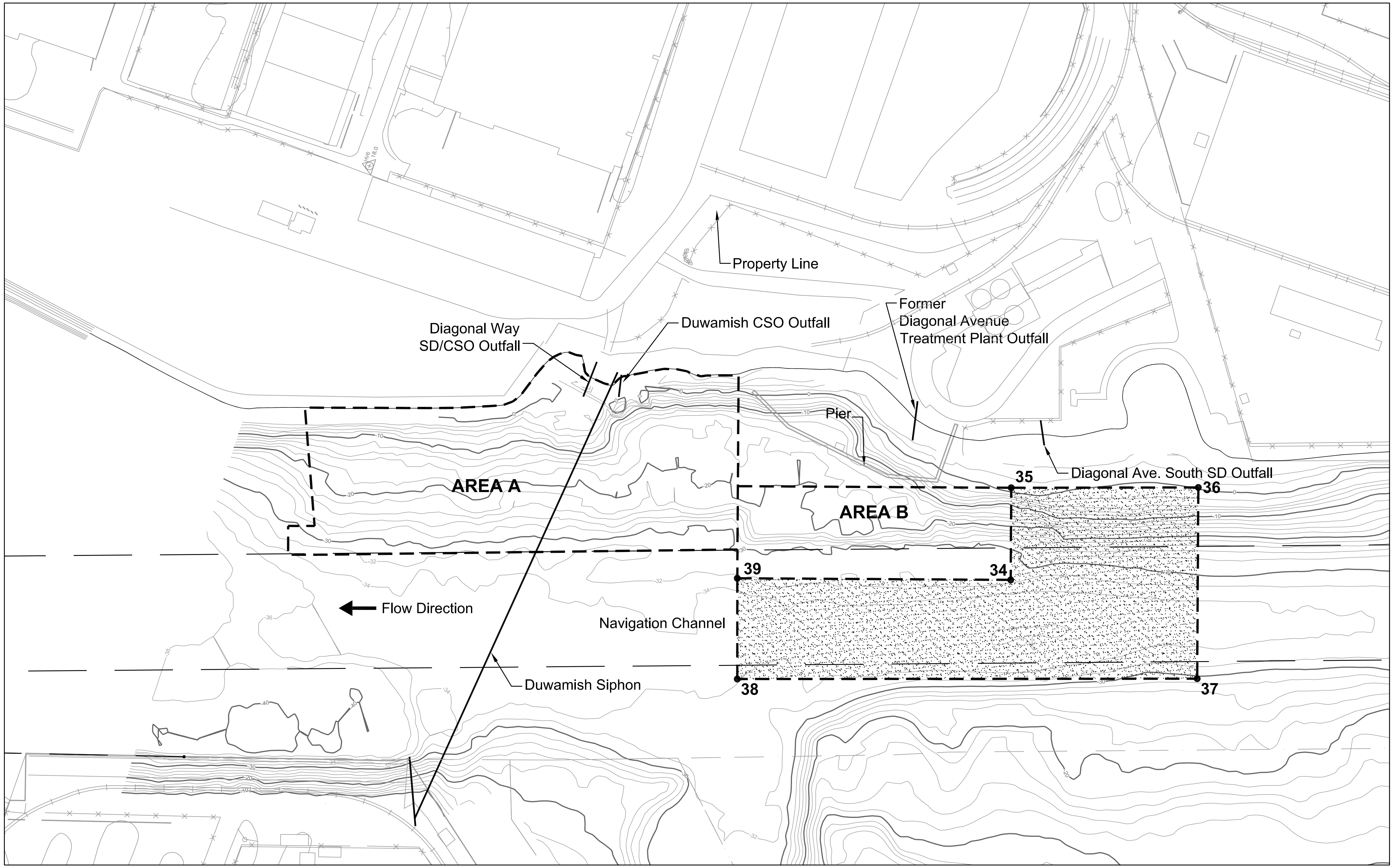
Figure 1
Difference Between Pre- and Post-dredge PCB Surface Sediment Concentration
Duwamish/Diagonal
Seattle, Washington

Capping Coordinates:

Point	Easting	Northing
34	1267073.00	208278.15
35	1267225.46	208326.69
36	1267326.45	208017.77
37	1267009.92	207916.98
38	1266762.45	208676.68
39	1266928.89	208730.76



— -10 — Bathymetry Elevation Contours in Feet (2-Foot Interval)

Notes:
1. Topography/Basemap provided by the Port of Seattle (1994). This data is to be used for visual reference only.
2. Bathymetric contours created by Anchor Environmental from BWE (March 2004), Miller (March 2004), and David Evans (August 2003) surveys referenced to MLLW (NOS).

5,500 Tons of Base Cap placed evenly in this location.

37● Control point location and number

0 200
Scale in Feet

DRAFT

K:\Jobs\020067-KING_CO_SED_MANAG\02006701\Capping 100-Percent\02006701-PLACE02.dwg SHEET C-1

Dec 10, 2004 3:05pm dholmer

ANCHOR ENVIRONMENTAL, L.L.C.

BRUCE G. McDONALD, STATE OF WASHINGTON, 32805, REGISTERED PROFESSIONAL ENGINEER
EXPIRES: 10/30/04

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

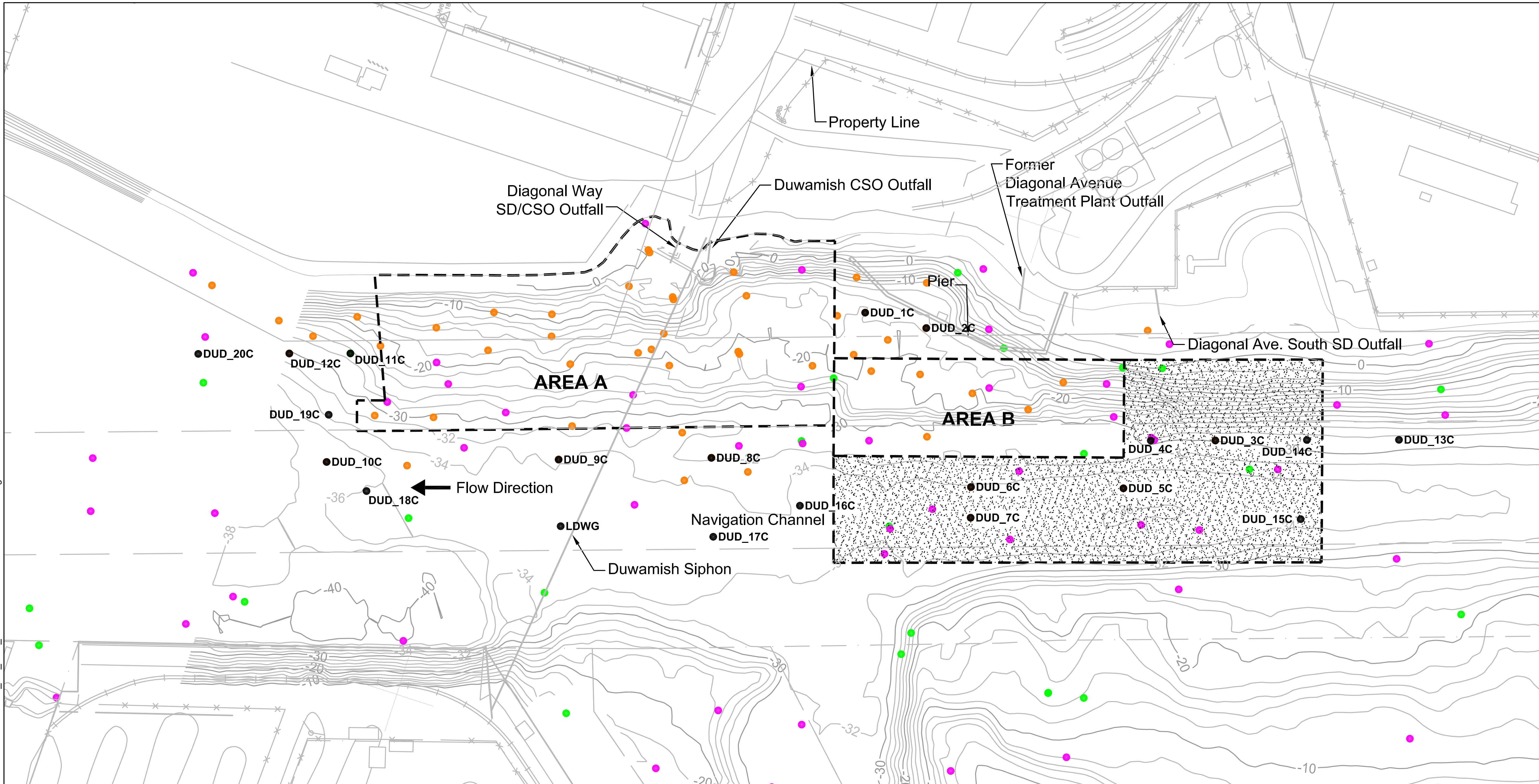
DESIGNED BY: B. MCDONALD
DRAWN BY: D. HOLMER
CHECKED BY: J. VERDUIN
APPROVED BY:
FILE:
DATE: DECEMBER 2, 2004

D/D THIN LAYER PLACEMENT PROJECT

THIN LAYER PLACEMENT PLAN

DRAWING NO. 02006701-CAP02
PROJECT NO. 020067-01
SHEET NO. 2 OF 2
SHEET C-1

Figure 2



DUD_20C ● Proposed Chemistry Sample Location and Number

● >=SQS, <CSL, Detect Sample Location and Number

● >=CSL, Detect Sample Location and Number

● < SQS Sample Location and Number

— -10 — Bathymetry Elevation Contours in Feet (2-Foot Interval)

5,500 Tons of Base Cap placed evenly in this location

Notes:
1. Topography/Basemap provided by the Port of Seattle (1994). This data is to be used for visual reference only.
2. Bathymetric contours created by Anchor Environmental from BWE (March 2004), Miller (March 2004), and David Evans (August 2003) surveys referenced to MLLW (NOS).

0 160
Scale in Feet

K:\Jobs\020067-KING_CO_SED_MANAG\020067\01\02006701-10.dwg FIG 3

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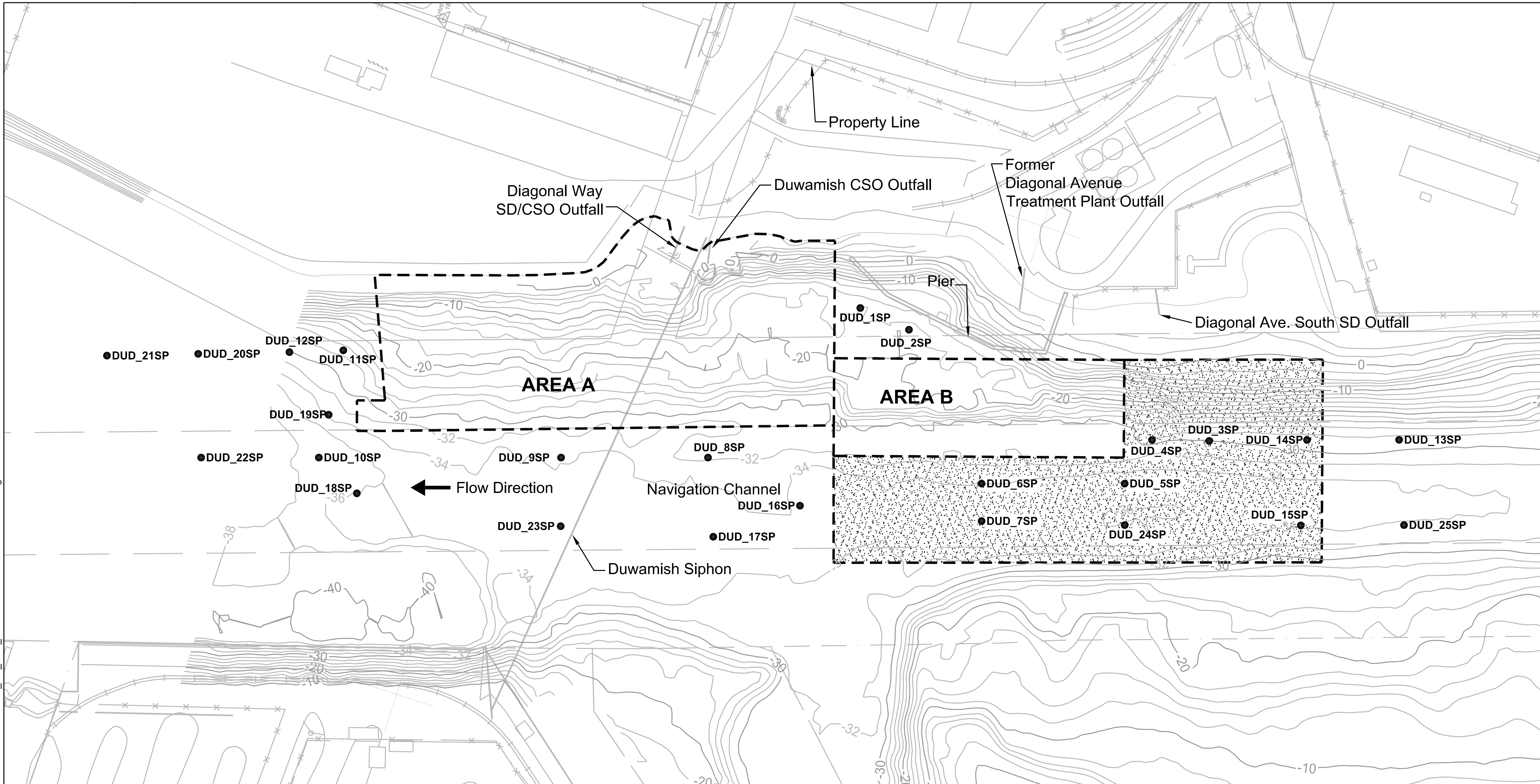
Figure 3
Proposed Chemistry Sample Locations
Duwamish Diagonal
Seattle, Washington



DUD_20SP ● Proposed Sediment Profile Imaging Sample Location and Number

— -10 — Bathymetry Elevation Contours in Feet (2-Foot Interval)

5,500 Tons of Base Cap placed evenly in this location

Notes:
1. Topography/Basemap provided by the Port of Seattle (1994). This data is to be used for visual reference only.
2. Bathymetric contours created by Anchor Environmental from BWE (March 2004), Miller (March 2004), and David Evans (August 2003) surveys referenced to MLLW (NOS).
3. Horizontal Datum: SP NAD83 WA N.

Jan 20, 2005 11:19am cdavidson K:\Jobs\020067-KING_CO_SED_MANAG\02006701\02006701-11.dwg FIG 4

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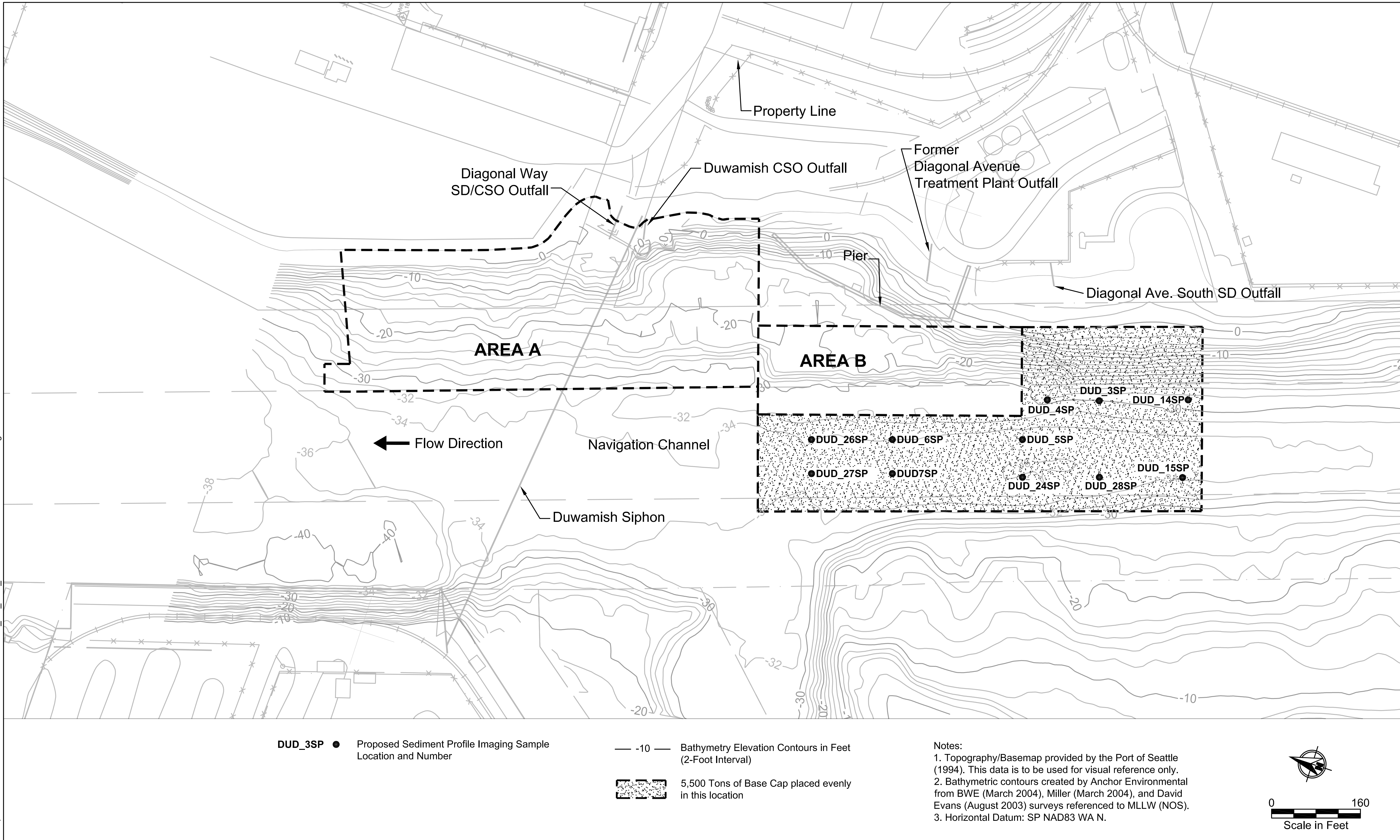
Figure 4
Proposed Sediment Profile Imaging Sample Locations
Duwamish Diagonal
Seattle, Washington



Jan 20, 2005 11:19am cdavidson K:\Jobs\020067-KING_CO_SED_MANAG\02006701\02006701-11.dwg FIG 5

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 5
Proposed Stake and Sediment Profile Imaging Sample Locations
Duwamish Diagonal
Seattle, Washington

APPENDIX B

SEDIMENT CHEMISTRY DATA AND DATA QUALITY REVIEWS

Summary of Analytical Chemistry (dry weight) - AET Screening[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_1C	DUD_1C	DUD_1C	DUD_2C	DUD_2C	DUD_2C	DUD_3C	DUD_3C	DUD_3C	DUD_3C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_5C	DUD_5C	DUD_5C	DUD_5C	DUD_6C	DUD_6C	DUD_6C	DUD_6C	DUD_6C	DUD_7C	DUD_7C	DUD_7C
Sample ID			L29990-1	L31520-1	L34524-1	L29990-2	L31520-2	L34524-2	L29990-3	L31520-3	L34524-3	L34971-3	L29990-4	L29990-5	L31520-4	L31520-5	L34524-4	L34524-5	L34971-4	L34971-5	L29990-6	L31520-6	L34524-6	L34971-6	L29990-7	L31520-15	L31520-7	L34524-7	L34971-7	L29990-8	L31520-8	L34524-8
Sample Date			10/20/2003	3/29/2004	2/1/2005	10/20/2003	3/29/2004	1/31/2005	10/20/2003	3/29/2004	1/31/2005	3/16/2005	10/20/2003	10/20/2003	3/29/2004	3/29/2004	1/31/2005	1/31/2005	3/16/2005	3/16/2005	10/20/2003	3/29/2004	1/31/2005	3/24/2005	10/20/2003	3/30/2004	3/30/2004	1/31/2005	3/24/2005	10/20/2003	3/30/2004	1/31/2005
Depth Interval			0-10 cm	0-10 cm	0-6 cm	0-10 cm	0-10 cm	0-9 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-7 cm	0-9 cm	0-9 cm	0-10 cm	0-10 cm	0-10 cm		0-10 cm	0-10 cm	0-10 cm	0-9 cm		0-10 cm	0-10 cm	0-9 cm
Sample Matrix			SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS-AET	CSL-AET	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																																
Total solids	--	--	45.6	72.2	62	50.4	67.3	57.6	49.5	62.6	61.5	86.4	48.3	50.1	76.3	76.4	54.5	55.3	84.1	83.6	60.2	57	56.1	87.7	61.1	59.1	61.1	60.8	88.3	54.6	58.9	57.8
Total Organic Carbon	--	--	3.36	0.681	1.24	2.36	0.779	1.65	2.16	1.19	1.14	0.054 U	2.38	2.12	0.248	0.232	1.37	1.26	0.05 U	0.05 U	1.27	1.73	1.75	0.05 U	1.43	1.59	1.52	1.31	0.051 U	1.54	1.51	1.38
Grain Size (%)																																
Gravel	--	--	0.6	0.7 J	0.8 J	0.6 J	0.4 J	0.3 J	1.2 J	2.9 J	0.7 J	57.9	0.6 J	1 J	4	4.3	2.7	4.4	24.3	29.6	6.3 J	1.9 J	0.8 J	47.3	6.7 J	6.8 J	3.4 J	4.1	48.8	3.5 J	2.5 J	3.7
Sand	--	--	36.9	64.9	46.4	23.1	58.4	38.2	32.4	54	57.3	41.4	32.4	33.2	76.7	81.7	46.2	49.3	74.5	69.9	52.3	43.5	46.9	50.3	50.8	49.6	54.9	57.2	49.9	34.9	40.5	43
Silt	--	--	56.8	23.4	32.8	69.9	28	35.9	52.8	31.3	29.5	0.6	54.5	53.7	11.2	9.2	35.7	30.6	1.2	0.5 U	30.5	34.9	34.1	0.6	37.5	29	32	27.8	0.5	51	38.9	33.8
Clay	--	--	5.6	10.7	13.6	6.4	13.6	16.2	13.5	14.1	10.4	2.3	12.2	12	6.3	6.7	9.4	12.6	1.2	0.5 U	10.8	21.3	14.9	0.5 U	5.1	14.9	14	8.1	0.5 U	10.7	16.7	12.4
Fines	--	--	62.4	34.1	46.4	76.3	41.6	52.1	66.3	45.4	39.9	2.9	66.7	65.7	17.5	15.9	45.1	43.2	2.4	0.5 U	41.3	56.2	49	0.5 U	42.6	43.9	46	35.9	0.5 U	61.7	55.6	46.2
Metals (mg/kg)																																
Arsenic	57	93	29	3.6 U	6.1 J	28 L	3.7 U	7.5 J	24 JL	4.2 U	6.2 J	3 U	25 JL	26.1 L	3.4 U	3.1 U	8.3 J	7.1 J	2.9 U	3.1 U	24.8 L	7.2 J	12 J	2.7 U	26 L	14 J	6.7 J	8.2 J	2.8 U	33.9 L	9.2 J	11 J
Cadmium	5.1	6.7	1.96	0.4 J	0.55 J	1.2 J	0.65 J	0.92 J	0.73 J	0.97 J	0.75 J	0.17 U	0.7 J	0.78 J	0.22	0.3	0.5 J	0.47 J	0.17 U	0.18 U	0.61 J	1.48	1.7	0.16 U	1.41	0.9 J	1.98	0.77 J	0.17 U	0.88 J	1.1 J	0.67 J
Chromium	260	270	52.4	24.2	31	39.7	24.5	36.1	37.2	31.2	35.3	15.6	38.1	38.5	18.3	19.2	31.6	30.6	13.6	13.5	33.6	47	48.5	14.1	35.7	24	47.8	33.2	15.3	34.6	34	32
Copper	390	530	139	84.3	102	104	94.5	102	96.4	79.4	79.8	24.9	98.1	95.8	84.5	56.4	89.4	96.4	24.4	24.8	83.1	165	89.1	26.5	73	45.7	79.4	71.5	28.3	124	95.8	81.7
Lead	450	530	96.7	19.8	37.6	66.5	27.3	59	67.9	50	47.6	1.7 U	66	71.9	6.9	10.1	48.3	38	1.7 U	1.8 U	92.2	74.4	76.6	1.6 U	129	49.4	104	54.1	1.7 U	145	78.1	69.7
Mercury	0.41	0.59	0.29	0.064 J	0.16 J	0.22 J	0.085 J	0.23 J	0.24 J	0.21 J	0.23 J	0.023 U	0.29 J	0.3 J	0.035	0.041	0.24 J	0.24 J	0.024 U	0.024 U	0.27 J	0.3 J	0.29 J	0.024 U	0.411 *	0.32 J	0.26 J	0.23 J	0.023 U	0.394	0.25 J	0.26 J
Zinc	410	960	303	62.6	120	204	78	144	164	106	105	22.9	166	198	41.4	61.3	112	103	24.4	23.1	152	182	145	19.7	201	92.4	260	118	25.1	203	161	138
PCBs (µg/kg)																																
Aroclor 1016	--	--	2.9 U	1.8 UL	27 U	2.6 UL	9.4 UL	69 U	2.6 UL	10 UL	200 U	1.5 U	2.7 UL	2.6 UL	1.7 U	1.7 U	62 U	31 U	1.5 U	1.6 U	2.2 UL	11 UL	700 U	1.5 U	2.1 UL	22 UL	10 UL	260 U	1.5 U	2.4 UL	11 UL	62 U
Aroclor 1221	--	--	5.5 U	3.5 U	4 U	5 U	19 U	4.3 U	5.1 U	21 U	4.1 U	2.9 U	5.2 U	5 U	3.3 U	3.3 U	4.6 U	4.5 U	3 U	3 U	4.2 U	23 U	4.5 U	2.9 U	4.1 U	42 U	21 U	4.1 U	2.8 U	4.6 U	22 U	4.3 U
Aroclor 1232	--	--	5.5 U	3.5 U	53 U	5 U	19 U	170 U	5.1 U	21 U	460 U	2.9 U	5.2 U	5 U	3.3 U	3.3 U	130 U	63 U	3 U	3 U	4.2 U	23 U	1600 U	2.9 U	4.1 U	42 U	21 U	640 U	2.8 U	4.6 U	22 U	130 U
Aroclor 1242	--	--	2.9 U	1.8 U	31 U	2.6 U	9.4 U	78 U	2.6 U	10 U	230 U	1.5 U	2.7 U	2.6 U	1.7 U	1.7 U	70 U	33 U	1.5 U	1.6 U	2.2 U	11 U	770 U	1.5 U	2.1 U	22 U	10 U	310 U	1.5 U	2.4 U	11 U	74 U
Aroclor 1248	--	--	189	69.4	55.8 J	106	126	112 J	75.6	473	311 J	1.5 U	107	1850	40	76.4	92.7 J	55.9 J	1.5 U	1.6 U	86	1050	875 J	1.5 U	394	810	1120	439 J	1.5 U	95.6	387	108 J
Aroclor 1254	--	--	246	119	91.6	183	168	145	170	562	254	1.5 U	242	693	43.3	95	101	78.3	2.7	1.6 U	169	1120	995	3	656	954	1470	390	2	216	480	159
Aroclor 1260	--	--	186	52.4 JL	48.1 J	93.3	74 JL	82.6 J	81.6	236 JL	255 J	1.5 U	143	189	21.5	63.2	62.6 J	47 J	1.5 U	1.6 U	85.9	481 JL	319 J	1.5 U	239	1620 JL	571 JL	160 J	1.5 U	116	263 JL	130 J
Total PCBs (SMS)	130	1000	621 *	241 *	196 *	382 *	368 *	340 *	327 *	1271 * #	820 *	2.9 U	492 *	2732 * #	105	235 *	256 *	181 *	2.7	3 U	341 *	2651 * #	2189 * #	3	1289 * #	3384 * #	3161 * #	989 *	2	428 *	1130 * #	397 *
LPAH (µg/kg)																																
Naphthalene	2100	2400	1200 U	78 UG	23 U	1100 UG	83 UG	24 U	1100 UG	89 UG	23 U	16 U	1200 UG	1100 UG	73 U	73 U	26 U	25 U	17 U	17 U	93 UG	98 UG	25 U	16 U	92 UG	95 UG	92 UG	23 U	16 U	100 UG	95 UG	24 U
Acenaphthylene	1300	1300	1300 U	83 U	24 U	1200 U	89 U	35 J	1200 U	96 U	24 U	17 U	1200 U	1200 U	79 U	79 U	28 U	27 U	18 U	18 U	100 U	110 U	27 U	17 U	98 U	100 U	98 U	25 U	17 U	110 U	100 U	26 U
Acenaphthene	500	730	610 U	39 U	16 J	560 U	104	78.6	570 U	45 U	14 J	8.1 U	580 U	560 U	37 U	37 U	15 J	16 J	8.3 U	8.4 U	47 U	49 U	17 J	8 U	46 U	47 U	46 U	13 J	7.9 U	51 U	48 U	17 J
Fluorene	540	1000	1100 U	72 U	29 J	1000 U	77 U	69.8 J	1100 U	83 U	21 UJ	15 U	1100 U	1000 U	68 U	68 U	24 UJ	24 UJ	15 U	16 U	86 U	91 U	25 J	15 U	85 U	88 U	85 U	28 J	15 U	95 U	88 U	24 J
Phenanthrene	1500	5400	530	76.2 G	210 J	685 JLG	361 G	396 J	240 JLG	166 G	103 J	4.6 U	270 JLG	240 JLG	21 U	26	121 J	121 J	4.8 U	4.8 U	169 JLG	225 G	141 J	6.5	155 JLG	164 G	275 G	142 J	4.5 U	203 JLG	200 G	148 J
Anthracene	960	4400	220	22 UG	85.8	520 JG	66.6 G	124	120 JG	68.1 G	50.7	4.6 U	120 JG	140 JG	21 U	21 U	70.3	59.7	4.8 U	4.8 U	58 G	105 G	67.7	4.8	72.5 G	85.4 G	94.4 G	72.7	4.5 U	70.3 G	82.5 G	82.4
2-Methylnaphthalene	670	1400	1200 U	78 U	23 U	1100 U	83 U	42 J	1100 U	89 U	23 U	16 U	1200 U	1100 U	73 U	73 U	26 U	25 U	17 U	17 U	93 U	98 U	25 U	16 U	92 U	95 U	92 U	23 U	16 U	100 U	95 U	24 U
Total LPAH	5200	13000	750	76.2	340.8	1205	531.6	703.4	360	234.1	167.7	17 U	390	380	79 U	26	206.3	196.7	18 U	18 U	227	330	250.7	11.3	227.5	249.4	369.4	255.7	17 U	273.3	282.5	271.4
HPAH (µg/kg)																																
Fluoranthene	1700	2500	1300	177	808	1750 L *	508	1340	670 JL	454	259	9.3 U	750 JL	660 JL	46	73	343	316	9.5 U	9.6 U	505 L	600	410	11	340 L	475	635	331	9.1 U	564 L	516	388
Pyrene	2600	3300	1380	219 G	613	2320 L	527 G	995	731 L	447 G	307	5.2	749 L	723 L	46.9	71.6	312	275	7.7	5.1	600 L	575 G	439	11.6	630 L	557 G	617 G	329	6.3	852 L	577 G	438
Benzo(a)anthracene	1300	1600	691	85	235	780 L	178	484	465 L	190	138	3.2	431 L	413 L	26.1	32.7	171	149	4.5	2.8	251 L	281	191	6.17	195 L	213	239	153	3.5	264 L	260	209
Chrysene	1400	2800	1090	104	437	984 L	204	507	630 JL	238	205	4.6 U	640 JL	677 L	39	41	279	230	5.9	4.8 U	334 L	288	264	8.1	304 L	259	298	234	5.7	344 L	311	330
Benzo(b)fluoranthene	--	--	787	104	303	756	198	451	537	233	200	3.5 U	526	613	36.4	54.6	272	212	4.4	3.6 U	297	300	262	7.17	309	269	308	232	4.4	465	438	284
Benzo(k)fluoranthene	--	--	811	58.9	253	806 L	146	359	661 L	151	174	3.5 U	430 JL	440 JL	16 U	16 U	177	172	5.2	3.6 U	289 L	284	196	5.6	280 L	178	177	155	4.4	388 L	224	242
Benzo(a)pyrene	1600	3000	645	106	221	629 L	186	333	511 L	222	169	3.5 U	410 JL	440 JL	53.6	60.6	198	167	4.4	3.6 U	277 L	270	203	4.9	270 L	247	264	171	3.9	392 L	353	239
Indeno(1,2,3-cd)pyrene	600	690	420	50 U	116	320 J	92 J	154	280 J	110 J	85	10 U	270 J	300 J	47 U	47 U	102	85.4	11 U	11 U	165	131	101	10 U	147	95 J	137	82.4	10 U	225	185	125
Dibenzo(a,h)anthracene	230	540	610 U	39 U	58.4	560 UL	42 U	74.5	570 UL	45 U	42.9	8.1 U	580 UL	560 UL	37 U	37 U	48.8	43.6	8.3 U	8.4 U	55 JL	49 U	49.2	8 U	46 UL	47 U	46 U	46.5	7.9 U	62 JL	56 J	65.9
Benzo(g,h,i)perylene	670	720	460	44 UG	138	340 J	86 JG	170	280 J	96 JG	97.9	9.3 U	310 J	320 J	42 U	42 U	116	98.6	9.5 U	9.6 U	171	119 G	116	9.1 U	151	112 G	131 G	97.2	9.1 U	229	182 G	133
Total benzofluoranthenes (SMS)	3200	3600	1598	162.9	556	1562	344	810	1198	384	374	3.5 U	956	1053	36.4	54.6	449	384	9.6	3.6 U	586	584	458	12.77	589	447	485	387	8.8	853	662	526
Total HPAH (SMS)	12000	17000	7584	853.9	3182.4	8685	2125	4867.5	4765	2141	1677.8	8.4	4516	4586	248	333.5	2018.8	1748.6	32.1	7.9	2944	2848	2231.2	54.54	2626	2405	2806	1831.1	28.2	3785	3102	2453.9
Chlorinated Hydrocarbons (µg/kg)																																
1,3-Dichlorobenzene	--	--	24 U	1.5 U	0.42 U	22 U	1.6 U	0.45 U	22 U	1.8 U	0.42 U	0.3 U	23 U	22 U	1.4 U	1.4 U	0.48 U	0.47 U	0.31 U	0.31 U	1.8 U	1.9 U	0.46 U	0.3 U	1.8 U	1.9 U	1.8 U	0.43 U	0.29 U	2 U	1.9 U	0.45 U
1,4-Dichlorobenzene	110	120	12 U	0.73 U	6.92	11 U	0.79 U	8.66	11 U	0.85 U	7.24	0.15 U	11 U	11 U	0.69 U	0.69 U	0.24 U	5.84	0.15 U	0.16 U	0.88 U	0.93 U	10.1	0.15 U	296 * #	0.9 U	10.5	6.66	0.15 U	0.97 U	0.9 U	5.67
1,2-Dichlorobenzene	35	50	24 U	1.5 U	0.42 U	22 U	1.6 U	0.45 U	22 U	1.8 U	5.77	0.3 U	23 U	22 U	1.4 U	1.4 U	0.48 U	0.47 U	0.31 U	0.31 U	1.8 U	9.91	10.3	0.3 U	1.8 U	9.39	9.25	6.79	0.29 U	2 U	2.5 J	0.45 U
1,2,4-Trichlorobenzene	31	51	24 U	1.5 U	0.42 U	22 U	1.6 U	0.45 U	22 U	1.8 U	0.42 U	0.3 U	23 U	22 U	1.4 U	1.4 U	0.48 U	0.47 U	0.31 U	0.31 U	1.8 U	1.9 U	0.46 U	0.3 U	1.8 U	1.9 U	1.8 U	0.43 U	0.29 U	2 U	1.9 U	0.45 U
Hexachlorobenzene	22	70	59 U	3.7 U	1.1 U	54 U	4 U	1.1 U	55 U	4.3 U	1.1 U	0.76 U	56 U	54 U	3.5 U	3.5 U	1.2 U	1.2 U	0.78 U	0.79 U	4.5 U	4.7 U	1.2 U	0.75 U	4.4 U	4.6 U	4.4 U	1.1 U	0.75 U	4.9 U	4.6 U	1.1 U
Phthalates (µg/kg)																																
Dimethylphthalate	71	160	960 U	61 U	18 U	870 U	65 U	19 U	890 U	70 U	18 U	13 U	910 U	880 U	58 U	58 U	20 U	24 J	13 U	13 U	73 U	77 U	20 U	13 U	72 U	74 U	72 U	18 U	12 U	81 U	75 U	19 U
Diethylphthalate	200	1200	530 U	33 U	9.7 U	480 U	36 U	10 U	480 U	38 U	9.8 U	6.9 U	500 U	480 U	31 U	31 U	11 U	11 U	7.1 U	7.2 U	40 U	42 U	11 U	6.8 U	39 U	41 U	39 U	9.9 U	7.8	44 U	41 U	10 U
Di-n-butylphthalate	1400	5100	440 U	28 U	56.9 B	400 U	30 U	58.5 B	400 U	32 U	44.2 B	14.4	410 U	400 U	26 U	26 U	51 B	44.1 B	14.3	16	33 U	35 U	50.4 B	13.6	33 U	34 U	33 U	59.4 B	13	37 U	34 U	49.5 B
Butylbenzylphthalate	63	900	530 U	154 *	37.9	480 U	55 J	84.5 *	480 U	67 J *	30.2	13	500 U	480 U	31 U	31 U	37.8	34	7.1 U	7.3	40 U	77 J *	36.5	6.8 U	39 U	122 *	88.1 *	29.8	6.8 U	44 U	76 J *	24.6
bis(2-Ethylhexyl)phthalate	1300	1900	5940 * #	676	877	2700 B * #	896	1040	1640 B *	1080	527	9.1	1000 JB	1100 JB	110	182	411	360	14	11	543 B	1520 *	838	15	660 B	1470 *	1420 *	581	12	962 B	823	516
Di-n-octylphthalate	6200	--	700 U	44 U	13 U	630 U	48 U	14 U	650 U	51 U	13 U	9.3 U	660 U	640 U	42 U	42 U	15 U	14 U	9.5 U	9.6 U	53 U	56 U	14 U	9.1 U	52 U	54 U	52 U	13 U	9.1 U	59 U	54 U	14 U
Phenols (µg/kg)																																
Phenol	420	1200	790 U	50 U	96.6 J	710 UG	53 U	65.3 J	730 UG	146	23 J	10 U	750 UG	720 UG	47 U	47 U	26 J	24 J	11 U	11 U	60 U	132	27 J	10 U	59 U	61 U	59 U	18 J	10 U	66 U	61 U	19 J
2-Methylphenol	63	72	1400 U	89 U	26 U	1300 UG	95 U	28 U	1300 UG	100 U	26 U	19 U	1300 UG	1300 UG	84 U	84 U	29 U	29 U	19 U	19 U	110 U	110 U	29 U	18 U	100 U	110 U	100 U	26 U	18 U	120 U	110 U	28 U
4-Methylphenol	670	1800	1400 U	89 U	26 U	1300 ULG	95 U	28 U	1300 ULG	100 U	26 U	19 U	1300 ULG	1300 ULG	84 U	84 U	29 U	29 U	19 U	19 U	110 UL	110 U	29 U	18 U	100 UL	110 U	100 U	26 U	18 U	120 UL	110 U	28 U
2,4-Dimethylphenol	29	72	610 U	39 UG	11 U	560 ULG	42 UG	12 U	570 ULG	45 UG	11 U	8.1 U	580 ULG	560 ULG	37 U	37 U	13 U	13 U	8.3 U	8.4 U	47 UL	49 UG	12 U	8 U	46 UL	47 UG	46 UG	12 U	7.9 U	51 UL	48 UG	12 U
Pentachlorophenol	360	690	590 U	37 U	11 U	540 UG	40 U	12 U	550 UG	43 U	11 U	7.8 U	560 UG	540 UG	35 U	35 U	12 U	12 U	8 U	8 U	45 U	47 U	12 U	7.6 U	44 U	46 U	44 U	11 U	7.6 U	49 U	46 U	12 U
Misc Extractables (µg/kg)																																
Benzyl alcohol	57	73	530 U	33 UG	9.7 U	480 U	36 UG	17 J	480 U	38 UG	9.8 U	6.9 U	500 U	480 U	31 U	31 U	11 U	11 U	7.1 U	7.2 U	40 U	42 UG	11 U	6.8 U	39 U	41 UG	39 UG	9.9 U	6.8 U	44 U	41 UG	10 U
Benzoic acid	650	650	1200 U	240 J	323 J	1100 UG	250 J	264 J	1100 UG	300 J	143 J	36	1100 UG	1100 UG	180	180	183 J	150 J	27	33	88 U	350 J	194 J	27	87 U	250 J	290 J	149 J	24	97 U	270 J	180 J
Dibenzofuran	540	700	1200 U	78 U	23 UJ	1100 U	83 U	57.1 J	1100 U	89 U	23 UJ	16 U	1200 U	1100 U	73 U	73 U	26 UJ	25 UJ	17 U	17 U	93 U	98 U	25 UJ	16 U	92 U	95 U	92 U	23 UJ	16 U	100 U	95 U	24 UJ
Hexachloroethane	--	--	1300 U	83 U	24 U	1200 U	89 U	26 U	1200 U	96 U	24 U	17 U	1200 U	1200 U	79 U	79 U	28 U	27 U	18 U	18 U	100 U	110 U	27 U	17 U	98 U	100 U	98 U	25 U	17 U	110 U	100 U	26 U
Hexachlorobutadiene	11	120	66 U	4.2 U	1.2 U	60 U	4.5 U	1.3 U	61 U	4.8 U	1.2 U	0.87 U	62 U	60 U	3.9 U	3.9 U	1.4 U	1.4 U	0.89 U	0.9 U	5 U	5.3 U	1.3 U	0.86 U	4.9 U	5.1 U	4.9 U	1.2 U	0.85 U	5.5 U	5.1 U	1.3 U
n-Nitrosodiphenylamine	28	40	1800 U	110 U	32 U	1600 U	120 U	35 U	1600 U	130 U	33 U	23 U	1700 U	1600 U	100 U	100 U	37 U	36 U	24 U	24 U	130 U	140 U	36 U	23 U	130 U	140 U	130 U	33 U	23 U	150 U	140 U	35 U

Notes:

Bold: Detected.
* Exceeds SQS-AET dry wt criteria.
\# Exceeds CSL-AET dry wt criteria.
Italics: TOC <0.5% or >3%.
Shaded: Exceeds TOC applicable criteria.

a Note chemicals are compared to dry weight AETs when TOC is <0.5% or >3% (except for metals, phenols and some miscellaneous extractable organics which are always compared to dry weight AETs).

Summary of Analytical Chemistry (dry weight) - AET Screening[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_7C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_9C	DUD_9C	DUD_9C	DUD_10C	DUD_10C	DUD_10C	DUD_11C	DUD_11C	DUD_11C	DUD_12C	DUD_12C	DUD_12C
Sample ID			L34971-8	L29990-10	L29990-9	L31520-10	L31520-9	L34524-10	L34524-9	L29990-11	L31520-11	L34524-11	L29990-12	L31520-12	L34524-12	L29990-13	L31520-13	L34524-13	L29990-14	L31520-14	L34524-14
Sample Date			3/24/2005	10/21/2003	10/21/2003	3/30/2004	3/30/2004	2/1/2005	2/1/2005	10/21/2003	3/30/2004	1/31/2005	10/21/2003	3/30/2004	2/1/2005	10/21/2003	3/30/2004	2/1/2005	10/21/2003	3/30/2004	2/2/2005
Depth Interval				0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-6 cm	0-10 cm	0-10 cm	0-7 cm	0-10 cm	0-10 cm	0-8 cm	0-10 cm	0-10 cm	0-7 cm	0-10 cm	0-10 cm	0-9 cm
Sample Matrix			SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS-AET	CSL-AET	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																					
Total solids	--	--	86.8	54.5	55.7	65.2	66.8	66.4	66.5	69.4	70.5	66.8	65.6	65.2	67.8	59	79.4	84.5	58.8	69.1	69.2
Total Organic Carbon	--	--	0.052 U	1.98	1.7	1.3	1.04	1.18	0.973	0.777	0.773	1.11	1.02	1.03	0.861	1.36	0.054 U	0.122	1.32	0.808	0.743
Grain Size (%)																					
Gravel	--	--	50.7	0.8 J	2.3 J	1.4 J	8.3 J	1.2	3.2	2.8 J	1.1 J	0.4 J	3.6 J	1 J	1.2 J	0.5 J	8.4	34.9	1 J	0.4 J	0.3 J
Sand	--	--	47.9	25.6	32	60.8	61.4	66.1	70.3	79.3	70	59	54.7	55.9	62.9	45.5	85.9	59.4	45.4	58.9	63.3
Silt	--	--	0.6	65.1	60	30.7	24	23.4	18.2	12.9	19	26.7	29.2	27.7	22.7	40.6	3	1.8	38.8	29	22.7
Clay	--	--	0.5 U	8.5	5.8	11.7	11.7	9.8	6.1	4.9	11.5	11.2	12.7	15	9	13.4	5.5	0.6	14.9	14.1	9.1
Fines	--	--	0.5 U	73.6	65.8	42.4	35.7	33.2	24.3	17.8	30.5	37.9	41.9	42.7	31.7	54	8.5	2.4	53.7	43.1	31.8
Metals (mg/kg)																					
Arsenic	57	93	2.9 U	40.7 L	30.7 L	3.8 U	3.7 U	7.1 J	5.6 J	14 JL	3.5 U	7.9 J	24.4 L	7.4 J	10 J	23.9 L	3.3 U	3 U	23.1 L	3.5 U	4.8 J
Cadmium	5.1	6.7	0.17 U	6.73 * #	3.57	1.26	1.12	1 J	0.75 J	0.4 J	0.74 J	1.24	0.67 J	0.97 J	0.77 J	0.68 J	0.19 U	0.18 U	0.8 J	0.74 J	0.68 JL
Chromium	260	270	13.2	139	81.7	37.6	35.5	35.7	31	21	27	37.7	28.7	31.6	28.6	36.4	17.5	20.5	34.5	27.5	32.8
Copper	390	530	25.1	141	85.3	79.8	78	67.9	69.3	37.2	72.1	69.3	70	78.1	59.9	91.4	54.8	48.6	94.7	104	70.2
Lead	450	530	1.7 U	139	87.3	78.1	63.9	69.4	45.6	33.3	43.7	82.2	94.1	64.7	98.1	113	4.3	5.7	102	59.8	59
Mercury	0.41	0.59	0.022 U	0.912 * #	0.803 * #	0.2 J	0.356 J	0.23 J	0.24 J	0.14 J	0.12 J	0.27 J	0.27 J	12.2 J * #	0.24 J	0.27 J	0.025 U	0.032	0.408	0.14 J	0.16 J
Zinc	410	960	21	268	177	123	117	122	101	76.2	88.1	137	133	123	150	167	33.8	37.8	162	99	110
PCBs (µg/kg)																					
Aroclor 1016	--	--	1.5 U	2.4 UL	2.3 UL	9.7 UL	9.4 UL	240 U	200 U	1.9 ULG	8.9 UL	270 U	2 UL	9.7 UL	66 U	2.2 UL	1.6 U	1.5 U	2.2 UL	9.1 UL	82 U
Aroclor 1221	--	--	2.9 U	4.6 U	4.5 U	20 UL	19 U	3.8 U	3.8 U	3.6 UG	18 U	3.7 U	3.8 U	20 U	3.7 U	4.2 U	3.1 U	3 U	4.3 U	19 U	3.6 U
Aroclor 1232	--	--	2.9 U	4.6 U	4.5 U	20 UL	19 U	1100 U	420 U	3.6 UG	18 U	570 U	3.8 U	20 U	130 U	4.2 U	3.1 U	3 U	4.3 U	19 U	170 U
Aroclor 1242	--	--	1.5 U	2.4 U	2.3 U	9.7 UL	9.4 U	270 U	230 U	1.9 UG	8.9 U	300 U	2 U	9.7 U	72 U	2.2 U	1.6 U	1.5 U	2.2 U	9.1 U	92 U
Aroclor 1248	--	--	1.5 U	1520	1450	983 L	629	333 J	292 J	30.1 G	257	385 J	128	230	118 J	86.6	3.56	6.45	75.3	234	128 J
Aroclor 1254	--	--	1.5 U	2550	2050	771 L	754	354	334	38.5 G	349	406	150	291	141	200	5.64	7.17	107	281	143
Aroclor 1260	--	--	1.5 U	956	679	374 JL	292 JL	122 J	111 J	34.3 G	128 JL	154 J	95	144 JL	68.7 J	91.2	2.8	5.2	80.4	129 JL	63.4 J
Total PCBs (SMS)	130	1000	2.9 U	5026 * #	4179 * #	2128 * #	1675 * #	809 *	737 *	103	734 *	945 *	373 *	665 *	328 *	378 *	12	18.8	263 *	644 *	334 *
LPAH (µg/kg)																					
Naphthalene	2100	2400	16 U	100 UG	100 UG	86 UG	84 UG	21 U	21 U	81 UG	79 UG	21 U	85 UG	86 UG	21 U	95 UG	71 U	17 U	95 UG	81 UG	23 J
Acenaphthylene	1300	1300	17 U	110 U	110 U	92 U	90 U	23 U	23 U	86 U	85 U	22 U	91 U	92 U	22 U	100 U	76 U	18 U	100 U	87 U	22 U
Acenaphthene	500	730	8.1 U	51 U	50 U	43 U	42 U	12 J	13 J	40 U	40 U	12 J	43 U	43 U	13 J	47 U	35 U	8.3 U	48 U	41 U	17 J
Fluorene	540	1000	15 U	95 U	93 U	80 U	78 U	21 J	20 J	75 U	74 U	19 UJ	79 U	80 U	19 J	88 U	65 U	15 U	88 U	75 U	27 J
Phenanthrene	1500	5400	4.6 U	145 JLG	77.6 JLG	153 G	103 G	101 J	104 J	88 JLG	94.3 G	76.9 J	135 JLG	118 G	101 J	234 JLG	20 U	8.3	187 JLG	99 G	184 J
Anthracene	960	4400	4.6 U	112 G	76.7 G	66.9 G	47.9 JG	50	50.7	42 JG	45.5 G	45.8	60.4 G	62.9 G	47.2	79 G	20 U	6.6	81.6 G	46.5 G	54.8
2-Methylnaphthalene	670	1400	16 U	100 U	100 U	86 U	84 U	21 U	21 U	81 U	79 U	21 U	85 U	86 U	21 U	95 U	71 U	17 U	95 U	81 U	20 U
Total LPAH	5200	13000	17 U	257	154.3	219.9	150.9	184	187.7	130	139.8	134.7	195.4	180.9	180.2	313	76 U	14.9	268.6	145.5	305.8
HPAH (µg/kg)																					
Fluoranthene	1700	2500	9.2 U	556 L	397 L	357	269	277	242	265 L	220	220	303 L	317	298	534 L	40 U	19.5	473 L	281	290
Pyrene	2600	3300	4.8	851 L	510 L	416 G	274 G	340	274	346 L	230 G	328	485 L	313 G	341	766 L	20 U	19.6	660 L	310 G	314
Benzo(a)anthracene	1300	1600	2.5	246 L	164 L	163	104	136	122	147 L	106	115	189 L	149	144	314 L	10 U	16.6	248 L	134	117
Chrysene	1400	2800	4.6 U	310 L	205 L	195	134	184	171	174 L	126	150	221 L	201	204	393 L	20 U	24.5	340 L	179	153
Benzo(b)fluoranthene	--	--	3.5 U	306	163	201	137	185	165	190	135	169	273	210	221	436	18	24.7	417	216	175
Benzo(k)fluoranthene	--	--	3.5 U	246 L	151 L	133	90	150	137	189 L	62.7	118	267 L	136	164	475 L	15 U	19.8	378 L	127	129
Benzo(a)pyrene	1600	3000	3.5 U	233 L	143 L	196	141	158	137	174 L	133	140	229 L	195	167	381 L	36	21.4	325 L	198	140
Indeno(1,2,3-cd)pyrene	600	690	10 U	134	84 J	89 J	60 J	70.6	68.6	92 J	64 J	72.3	131	89 J	88.9	256	45 U	12	216	104	77.6
Dibenzo(a,h)anthracene	230	540	8.1 U	51 UL	50 UL	43 U	42 U	39.6	31	40 UL	40 U	32.2	49 JL	43 U	45.9	63 JL	35 U	8.3 U	58 JL	41 U	36.4
Benzo(g,h,i)perylene	670	720	9.2 U	160	93 J	84 JG	48 UG	88.4	80.2	99.3	45 UG	80.2	129	77 JG	94.5	283	40 U	13	230	96.7 G	88.4
Total benzofluoranthenes (SMS)	3200	3600	3.5 U	552	314	334	227	335	302	379	197.7	287	540	346	385	911	18	44.5	795	343	304
Total HPAH (SMS)	12000	17000	7.3	3042	1910	1834	1209	1628.6	1427.8	1676.3	1076.7	1424.7	2276	1687	1768.3	3901	54	171.1	3345	1645.7	1520.4
Chlorinated Hydrocarbons (µg/kg)																					
1,3-Dichlorobenzene	--	--	0.3 U	2 U	2 U	1.7 U	1.6 U	0.39 U	0.39 U	1.6 U	1.6 U	0.39 U	1.7 U	1.7 U	0.38 U	1.9 U	1.4 U	0.31 U	1.9 U	1.6 U	0.38 U
1,4-Dichlorobenzene	110	120	0.15 U	0.97 U	0.95 U	0.81 U	0.79 U	9.52	6.98	0.76 U	6.81	7.43	0.81 U	0.81 U	0.19 U	0.9 U	0.67 U	0.15 U	0.9 U	6.48	6.75
1,2-Dichlorobenzene	35	50	0.3 U	2 U	2 U	1.7 U	1.6 U	0.39 U	0.39 U	1.6 U	1.6 U	0.39 U	1.7 U	1.7 U	0.38 U	1.9 U	1.4 U	0.31 U	1.9 U	1.6 U	0.38 U
1,2,4-Trichlorobenzene	31	51	0.3 U	2 U	2 U	1.7 U	1.6 U	0.39 U	0.39 U	1.6 U	1.6 U	0.39 U	1.7 U	1.7 U	0.38 U	1.9 U	1.4 U	0.31 U	1.9 U	1.6 U	0.38 U
Hexachlorobenzene	22	70	0.76 U	5 U	4.8 U	4.1 U	4 U	0.99 U	0.99 U	3.9 U	3.8 U	0.99 U	4.1 U	4.1 U	0.97 U	4.6 U	3.4 U	0.78 U	4.6 U	3.9 U	0.95 U
Phthalates (µg/kg)																					
Dimethylphthalate	71	160	13 U	81 U	79 U	67 U	66 U	17 U	17 U	63 U	62 U	16 U	67 U	67 U	16 U	75 U	55 U	13 U	75 U	64 U	16 U
Diethylphthalate	200	1200	6.9 U	44 U	43 U	37 U	36 U	9 U	9 U	35 U	34 U	9 U	37 U	37 U	8.8 U	41 U	30 U	7.6	41 U	35 U	8.7 U
Di-n-butylphthalate	1400	5100	14.5	37 U	36 U	31 U	30 U	59.8 B	41.4 B	134	28 U	7.5 UB	30 U	31 U	43.8 B	34 U	25 U	29.8	34 U	33 J	18.6 B
Butylbenzylphthalate	63	900	6.9 U	44 U	43 U	76.4 *	58 J	9 U	31.3	35 U	44 J	9 U	37 U	46 J	33.9	95 J *	30 U	8.8	41 U	64 J *	23
bis(2-Ethylhexyl)phthalate	1300	1900	9	2680 B * #	2150 B * #	1270	946	792	734	473 B	681	695	463 B	540	301	1610 B *	52	62.2	988 B	770	441
Di-n-octylphthalate	6200	--	9.2 U	59 U	57 U	49 U	48 U	12 U	12 U	46 U	45 U	12 U	49 U	49 U	12 U	54 U	40 U	9.5 U	54 U	46 U	12 U
Phenols (µg/kg)																					
Phenol	420	1200	10 U	66 U	65 U	55 U	54 U	18 J	14 UJ	52 U	51 U	13 UJ	55 U	55 U	13 UJ	61 U	45 U	11 U	61 U	52 U	13 UJ
2-Methylphenol	63	72	18 U	120 U	110 U	98 U	96 U	24 U	24 U	92 U	91 U	24 U	98 U	98 U	24 U	110 U	81 U	19 U	110 U	93 U	23 U
4-Methylphenol	670	1800	18 U	120 UL	110 UL	98 U	96 U	24 U	24 U	92 UL	91 U	24 U	98 UL	98 U	24 U	110 UL	81 U	19 U	110 UL	93 U	23 U
2,4-Dimethylphenol	29	72	8.1 U	51 UL	50 UL	43 UG	42 UG	11 U	11 U	40 UL	40 UG	10 U	43 UL	43 UG	10 U	47 UL	35 U	8.3 U	48 UL	41 UG	10 U
Pentachlorophenol	360	690	7.7 U	50 U	48 U	41 U	40 U	10 U	10 U	39 U	38 U	10 U	41 U	41 U	9.9 U	46 U	34 U	7.9 U	46 U	39 U	9.7 U
Misc Extractables (µg/kg)																					
Benzyl alcohol	57	73	6.9 U	44 U	43 U	37 UG	36 UG	9 U	9 U	35 U	34 UG	9 U	37 U	37 UG	8.8 U	41 U	30 U	7.1 U	41 U	35 UG	8.7 U
Benzoic acid	650	650	26	97 U	95 U	250 J	220 J	161 J	137 J	76 U	210 J	159 J	81 U	230 J	136 J	90 U	180	96.3	90 U	230 J	122 J
Dibenzofuran	540	700	16 U	100 U	100 U	86 U	84 U	21 UJ	21 UJ	81 U	79 U	21 UJ	85 U	86 U	21 UJ	95 U	71 U	17 U	95 U	81 U	20 J
Hexachloroethane	--	--	17 U	110 U	110 U	92 U	90 U	23 U	23 U	86 U	85 U	22 U	91 U	92 U	22 U	100 U	76 U	18 U	100 U	87 U	22 U
Hexachlorobutadiene	11	120	0.86 U	5.5 U	5.4 U	4.6 U	4.5 U	1.1 U	1.1 U	4.3 U	4.3 U	1.1 U	4.6 U	4.6 U	1.1 U	5.1 U	3.8 U	0.89 U	5.1 U	4.3 U	1.1 U
n-Nitrosodiphenylamine	28	40	23 U	150 U	140 U	120 U	120 U	30 U	30 U	120 U	110 U	30 U	120 U	120 U	29 U	140 U	100 U	24 U	140 U	120 U	29 U

Notes:

Bold: Detected.

* Exceeds SQS-AET dry wt criteria.

\# Exceeds CSL-AET dry wt criteria.

Italics: TOC <0.5% or >3%.

Shaded: Exceeds TOC applicable criteria.

a Note chemicals are compared to dry weight AETs when TOC is <0.5

Summary of Analytical Chemistry (organic carbon normalized) - SMS Screeing[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_1C	DUD_1C	DUD_1C	DUD_2C	DUD_2C	DUD_2C	DUD_3C	DUD_3C	DUD_3C	DUD_3C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_4C	DUD_5C	DUD_5C	DUD_5C	DUD_5C	DUD_6C	DUD_6C	DUD_6C	DUD_6C	DUD_6C	DUD_7C	DUD_7C
Sample ID			L29990-1	L31520-1	L34524-1	L29990-2	L31520-2	L34524-2	L29990-3	L31520-3	L34524-3	L34971-3	L29990-4	L29990-5	L31520-4	L31520-5	L34524-4	L34524-5	L34971-4	L34971-5	L29990-6	L31520-6	L34524-6	L34971-6	L29990-7	L31520-15	L31520-7	L34524-7	L34971-7	L29990-8	L31520-8
Sample Date			10/20/2003	3/29/2004	2/1/2005	10/20/2003	3/29/2004	1/31/2005	10/20/2003	3/29/2004	1/31/2005	3/16/2005	10/20/2003	10/20/2003	3/29/2004	3/29/2004	1/31/2005	1/31/2005	3/16/2005	3/16/2005	10/20/2003	3/29/2004	1/31/2005	3/24/2005	10/20/2003	3/30/2004	3/30/2004	1/31/2005	3/24/2005	10/20/2003	3/30/2004
Depth Interval			0-10 cm	0-10 cm	0-6 cm	0-10 cm	0-10 cm	0-9 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-7 cm	0-9 cm	0-9 cm	0-10 cm	0-10 cm	0-10 cm		0-10 cm	0-10 cm	0-10 cm	0-9 cm		0-10 cm	0-10 cm
Sample Matrix	SMS	SMS	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS	CSL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																															
Total solids	--	--	45.6	72.2	62	50.4	67.3	57.6	49.5	62.6	61.5	86.4	48.3	50.1	76.3	76.4	54.5	55.3	84.1	83.6	60.2	57	56.1	87.7	61.1	59.1	61.1	60.8	88.3	54.6	58.9
Total Organic Carbon	--	--	3.36	0.681	1.24	2.36	0.779	1.65	2.16	1.19	1.14	0.054 U	2.38	2.12	0.248	0.232	1.37	1.26	0.05 U	0.05 U	1.27	1.73	1.75	0.05 U	1.43	1.59	1.52	1.31	0.051 U	1.54	1.51
Grain Size (%)																															
Gravel	--	--	0.6	0.7 J	0.8 J	0.6 J	0.4 J	0.3 J	1.2 J	2.9 J	0.7 J	57.9	0.6 J	1 J	4	4.3	2.7	4.4	24.3	29.6	6.3 J	1.9 J	0.8 J	47.3	6.7 J	6.8 J	3.4 J	4.1	48.8	3.5 J	2.5 J
Sand	--	--	36.9	64.9	46.4	23.1	58.4	38.2	32.4	54	57.3	41.4	32.4	33.2	76.7	81.7	46.2	49.3	74.5	69.9	52.3	43.5	46.9	50.3	50.8	49.6	54.9	57.2	49.9	34.9	40.5
Silt	--	--	56.8	23.4	32.8	69.9	28	35.9	52.8	31.3	29.5	0.6	54.5	53.7	11.2	9.2	35.7	30.6	1.2	0.5 U	30.5	34.9	34.1	0.6	37.5	29	32	27.8	0.5	51	38.9
Clay	--	--	5.6	10.7	13.6	6.4	13.6	16.2	13.5	14.1	10.4	2.3	12.2	12	6.3	6.7	9.4	12.6	1.2	0.5 U	10.8	21.3	14.9	0.5 U	5.1	14.9	14	8.1	0.5 U	10.7	16.7
Fines	--	--	62.4	34.1	46.4	76.3	41.6	52.1	66.3	45.4	39.9	2.9	66.7	65.7	17.5	15.9	45.1	43.2	2.4	0.5 U	41.3	56.2	49	0.5 U	42.6	43.9	46	35.9	0.5 U	61.7	55.6
Metals (mg/kg)																															
Arsenic	57	93	29	3.6 U	6.1 J	28 L	3.7 U	7.5 J	24 JL	4.2 U	6.2 J	3 U	25 JL	26.1 L	3.4 U	3.1 U	8.3 J	7.1 J	2.9 U	3.1 U	24.8 L	7.2 J	12 J	2.7 U	26 L	14 J	6.7 J	8.2 J	2.8 U	33.9 L	9.2 J
Cadmium	5.1	6.7	1.96	0.4 J	0.55 J	1.2 J	0.65 J	0.92 J	0.73 J	0.97 J	0.75 J	0.17 U	0.7 J	0.78 J	0.22	0.3	0.5 J	0.47 J	0.17 U	0.18 U	0.61 J	1.48	1.7	0.16 U	1.41	0.9 J	1.98	0.77 J	0.17 U	0.88 J	1.1 J
Chromium	260	270	52.4	24.2	31	39.7	24.5	36.1	37.2	31.2	35.3	15.6	38.1	38.5	18.3	19.2	31.6	30.6	13.6	13.5	33.6	47	48.5	14.1	35.7	24	47.8	33.2	15.3	34.6	34
Copper	390	390	139	84.3	102	104	94.5	102	96.4	79.4	79.8	24.9	98.1	95.8	84.5	56.4	89.4	96.4	24.4	24.8	83.1	165	89.1	26.5	73	45.7	79.4	71.5	28.3	124	95.8
Lead	450	530	96.7	19.8	37.6	66.5	27.3	59	67.9	50	47.6	1.7 U	66	71.9	6.9	10.1	48.3	38	1.7 U	1.8 U	92.2	74.4	76.6	1.6 U	129	49.4	104	54.1	1.7 U	145	78.1
Mercury	0.41	0.59	0.29	0.064 J	0.16 J	0.22 J	0.085 J	0.23 J	0.24 J	0.21 J	0.23 J	0.023 U	0.29 J	0.3 J	0.035	0.041	0.24 J	0.24 J	0.024 U	0.024 U	0.27 J	0.3 J	0.29 J	0.024 U	0.411 *	0.32 J	0.26 J	0.23 J	0.023 U	0.394	0.25 J
Silver	6.1	6.1	2.54	1.2 JL	1.79 L	1.6 JL	1.3 JL	2.14 L	1.4 JL	1.87 L	2.08 L	0.78	1.3 JL	1.4 JL	1	1.1	1.7 JL	1.79 JL	0.99	0.97	1.2 JL	2.95 L	2.8 L	0.8	1.6 JL	1.67 L	2.55 L	1.97 L	0.87	1.83 L	2.05 L
Zinc	410	960	303	62.6	120	204	78	144	164	106	105	22.9	166	198	41.4	61.3	112	103	24.4	23.1	152	182	145	19.7	201	92.4	260	118	25.1	203	161
PCBs (mg/kg-OC)																															
Total PCBs (SMS)	12	65	18.5 *	35.4 *	15.8 *	16.2	47.2 *	20.6 *	15.1 *	107 * #	71.9 * #	--	20.7 *	129 * #	42.3 *	101 * #	18.7 *	14.4 *	--	--	26.8 *	153 * #	125 * #	--	90.1 * #	213 * #	208 * #	75.5 * #	--	27.8 *	74.8 * #
LPAH (mg/kg-OC)																															
Naphthalene	99	170	35.7 U	11.5 UG	1.85 U	46.6 UG	10.7 UG	1.45 U	50.9 UG	7.48 UG	2.02 U	--	50.4 UG	51.9 UG	29.4 U	31.5 U	1.9 U	1.98 U	--	--	7.32 UG	5.66 UG	1.43 U	--	6.43 UG	5.97 UG	6.05 UG	1.76 U	--	6.49 UG	6.29 UG
Acenaphthylene	66	66	38.7 U	12.2 U	1.94 U	50.8 U	11.4 U	2.12 J	55.6 U	8.07 U	2.11 U	--	50.4 U	56.6 U	31.9 U	34.1 U	2.04 U	2.14 U	--	--	7.87 U	6.36 U	1.54 U	--	6.85 U	6.29 U	6.45 U	1.91 U	--	7.14 U	6.62 U
Acenaphthene	16	57	18.2 U	5.73 U	1.29 J	23.7 U	13.4	4.76	26.4 U	3.78 U	1.23 J	--	24.4 U	26.4 U	14.9 U	15.9 U	1.09 J	1.27 J	--	--	3.7 U	2.83 U	0.971 J	--	3.22 U	2.96 U	3.03 U	0.992 J	--	3.31 U	3.18 U
Fluorene	23	79	32.7 U	10.6 U	2.34 J	42.4 U	9.88 U	4.23 J	50.9 U	6.97 U	1.84 UJ	--	46.2 U	47.2 U	27.4 U	29.3 U	1.75 UJ	1.9 UJ	--	--	6.77 U	5.26 U	1.43 J	--	5.94 U	5.53 U	5.59 U	2.14 J	--	6.17 U	5.83 U
Phenanthrene	100	480	15.8	11.2 G	16.9 J	29 JLG	46.3 G	24 J	11.1 JLG	13.9 G	9.04 J	--	11.3 JLG	11.3 JLG	8.47 U	11.2	8.83 J	9.6 J	--	--	13.3 JLG	13 G	8.06 J	--	10.8 JLG	10.3 G	18.1 G	10.8 J	--	13.2 JLG	13.2 G
Anthracene	220	1200	6.55	3.23 UG	6.92	22 JG	8.55 G	7.52	5.56 JG	5.72 G	4.45	--	5.04 JG	6.6 JG	8.47 U	9.05 U	5.13	4.74	--	--	4.57 G	6.07 G	3.87	--	5.07 G	5.37 G	6.21 G	5.55	--	4.56 G	5.46 G
2-Methylnaphthalene	38	64	35.7 U	11.5 U	1.85 U	46.6 U	10.7 U	2.55 J	50.9 U	7.48 U	2.02 U	--	50.4 U	51.9 U	29.4 U	31.5 U	1.9 U	1.98 U	--	--	7.32 U	5.66 U	1.43 U	--	6.43 U	5.97 U	6.05 U	1.76 U	--	6.49 U	6.29 U
Total LPAH (SMS)	370	780	22.3	11.2	27.5	51.1	68.2	42.6	16.7	19.7	14.7	--	16.4	17.9	31.9 U	11.2	15.1	15.6	--	--	17.9	19.1	14.3	--	15.9	15.7	24.3	19.5	--	17.7	18.7
HPAH (mg/kg-OC)																															
Fluoranthene	160	1200	38.7	26	65.2	74.2 L	65.2	81.2	31 JL	38.2	22.7	--	31.5 JL	31.1 JL	18.5	31.5	25	25.1	--	--	39.8 L	34.7	23.4	--	23.8 L	29.9	41.8	25.3	--	36.6 L	34.2
Pyrene	1000	1400	41.1	32.2 G	49.4	98.3 L	67.7 G	60.3	33.8 L	37.6 G	26.9	--	31.5 L	34.1 L	18.9	30.9	22.8	21.8	--	--	47.2 L	33.2 G	25.1	--	44.1 L	35 G	40.6 G	25.1	--	55.3 L	38.2 G
Benzo(a)anthracene	110	270	20.6	12.5	19	33.1 L	22.8	29.3	21.5 L	16	12.1	--	18.1 L	19.5 L	10.5	14.1	12.5	11.8	--	--	19.8 L	16.2	10.9	--	13.6 L	13.4	15.7	11.7	--	17.1 L	17.2
Chrysene	110	460	32.4	15.3	35.2	41.7 L	26.2	30.7	29.2 JL	20	18	--	26.9 JL	31.9 L	15.7	17.7	20.4	18.3	--	--	26.3 L	16.6	15.1	--	21.3 L	16.3	19.6	17.9	--	22.3 L	20.6
Benzo(a)pyrene	99	210	19.2	15.6	17.8	26.7 L	23.9	20.2	23.7 L	18.7	14.8	--	17.2 JL	20.8 JL	21.6	26.1	14.5	13.3	--	--	21.8 L	15.6	11.6	--	18.9 L	15.5	17.4	13.1	--	25.5 L	23.4
Indeno(1,2,3-cd)pyrene	34	88	12.5	7.34 U	9.35	13.6 J	11.8 J	9.33	13 J	9.24 J	7.46	--	11.3 J	14.2 J	19 U	20.3 U	7.45	6.78	--	--	13	7.57	5.77	--	10.3	5.97 J	9.01	6.29	--	14.6	12.3
Dibenzo(a,h)anthracene	12	33	18.2 U	5.73 U	4.71	23.7 UL	5.39 U	4.52	26.4 UL	3.78 U	3.76	--	24.4 UL	26.4 UL	14.9 U	15.9 U	3.56	3.46	--	--	4.33 JL	2.83 U	2.81	--	3.22 UL	2.96 U	3.03 U	3.55	--	4.03 JL	3.71 J
Benzo(g,h,i)perylene	31	78	13.7	6.46 UG	11.1	14.4 J	11 JG	10.3	13 J	8.07 JG	8.59	--	13 J	15.1 J	16.9 U	18.1 U	8.47	7.83	--	--	13.5	6.88 G	6.63	--	10.6	7.04 G	8.62 G	7.42	--	14.9	12.1 G
Total benzofluoranthenes (SMS)	230	450	47.6	23.9	44.8	66.2	44.2	49.1	55.5	32.3	32.8	--	40.2	49.7	14.7	23.5	32.8	30.5	--	--	46.1	33.8	26.2	--	41.2	28.1	31.9	29.5	--	55.4	43.8
Total HPAH (SMS)	960	5300	226	125	257	368	273	295	221	180	147	--	190	216	100	144	147	139	--	--	232	165	127	--	184	151	185	140	--	246	205
Chlorinated Hydrocarbons (mg/kg-OC)																															
1,4-Dichlorobenzene	3.1	9	0.357 U	0.107 U	0.558	0.466 U	0.101 U	0.525	0.509 U	0.0714 U	0.635	--	0.462 U	0.519 U	0.278 U	0.297 U	0.0175 U	0.463	--	--	0.0693 U	0.0538 U	0.577	--	20.7 * #	0.0566 U	0.691	0.508	--	0.063 U	0.0596 U
1,2-Dichlorobenzene	2.3	2.3	0.714 U	0.22 U	0.0339 U	0.932 U	0.205 U	0.0273 U	1.02 U	0.151 U	0.506	--	0.966 U	1.04 U	0.565 U	0.603 U	0.035 U	0.0373 U	--	--	0.142 U	0.573	0.589	--	0.126 U	0.591	0.609	0.518	--	0.13 U	0.166 J
1,2,4-Trichlorobenzene	0.81	1.8	0.714 U	0.22 U	0.0339 U	0.932 U	0.205 U	0.0273 U	1.02 U	0.151 U	0.0368 U	--	0.966 U	1.04 U	0.565 U	0.603 U	0.035 U	0.0373 U	--	--	0.142 U	0.11 U	0.0263 U	--	0.126 U	0.119 U	0.118 U	0.0328 U	--	0.13 U	0.126 U
Hexachlorobenzene	0.38	2.3	1.76 U	0.543 U	0.0887 U	2.29 U	0.513 U	0.0667 U	2.55 U	0.361 U	0.0965 U	--	2.35 U	2.55 U	1.41 U	1.51 U	0.0876 U	0.0952 U	--	--	0.354 U	0.272 U	0.0686 U	--	0.308 U	0.289 U	0.289 U	0.084 U	--	0.318 U	0.305 U
Phthalates (mg/kg-OC)																															
Dimethylphthalate	53	53	28.6 U	8.96 U	1.45 U	36.9 U	8.34 U	1.15 U	41.2 U	5.88 U	1.58 U	--	38.2 U	41.5 U	23.4 U	25 U	1.46 U	1.9 J	--	--	5.75 U	4.45 U	1.14 U	--	5.03 U	4.65 U	4.74 U	1.37 U	--	5.26 U	4.97 U
Diethylphthalate	61	110	15.8 U	4.85 U	0.782 U	20.3 U	4.62 U	0.606 U	22.2 U	3.19 U	0.86 U	--	21 U	22.6 U	12.5 U	13.4 U	0.803 U	0.873 U	--	--	3.15 U	2.43 U	0.629 U	--	2.73 U	2.58 U	2.57 U	0.756 U	--	2.86 U	2.72 U
Di-n-butylphthalate	220	1700	13.1 U	4.11 U	4.59 B	16.9 U	3.85 U	3.55 B	18.5 U	2.69 U	3.88 B	--	17.2 U	18.9 U	10.5 U	11.2 U	3.72 B	3.5 B	--	--	2.6 U	2.02 U	2.88 B	--	2.31 U	2.14 U	2.17 U	4.53 B	--	2.4 U	2.25 U
Butylbenzylphthalate	4.9	64	15.8 U	22.6 *	3.06	20.3 U	7.06 J *	5.12 *	22.2 U	5.63 J *	2.65	--	21 U	22.6 U	12.5 U	13.4 U	2.76	2.7	--	--	3.15 U	4.45 J	2.09	--	2.73 U	7.67 *	5.8 *	2.27	--	2.86 U	5.03 J *
bis(2-Ethylhexyl)phthalate	47	78	177 * #	99.3 * #	70.7 *	114 B * #	115 * #	63 *	75.9 B *	90.8 * #	46.2	--	42 JB	51.9 JB *	44.4	78.4 * #	30	28.6	--	--	42.8 B	87.9 * #	47.9 *	--	46.2 B	92.5 * #	93.4 * #	44.4	--	62.5 B *	54.5 *
Di-n-octylphthalate	58	4500	20.8 U	6.46 U	1.05 U	26.7 U	6.16 U	0.848 U	30.1 U	4.29 U	1.14 U	--	27.7 U	30.2 U	16.9 U	18.1 U	1.09 U	1.11 U	--	--	4.17 U	3.24 U	0.8 U	--	3.64 U	3.4 U	3.42 U	0.992 U	--	3.83 U	3.58 U
Misc Extractables (mg/kg-OC)																															
Dibenzofuran	15	58	35.7 U	11.5 U	1.85 UJ	46.6 U	10.7 U	3.46 J	50.9 U	7.48 U	2.02 UJ	--	50.4 U	51.9 U	29.4 U	31.5 U	1.9 UJ	1.98 UJ	--	--	7.32 U	5.66 U	1.43 UJ	--	6.43 U	5.97 U	6.05 U	1.76 UJ	--	6.49 U	6.29 U
Hexachlorobutadiene	3.9	6.2	1.96 U	0.617 U	0.0968 U	2.54 U	0.578 U	0.0788 U	2.82 U	0.403 U	0.105 U	--	2.61 U	2.83 U	1.57 U	1.68 U	0.102 U	0.111 U	--	--	0.394 U	0.306 U	0.0743 U	--	0.343 U	0.321 U	0.322 U	0.0916 U	--	0.357 U	0.338 U
n-Nitrosodiphenylamine	11	11	53.6 U	16.2 U	2.58 U	67.8 U	15.4 U	2.12 U	74.1 U	10.9 U	2.89 U	--	71.4 U	75.5 U	40.3 U	43.1 U	2.7 U	2.86 U	--	--	10.2 U	8.09 U	2.06 U	--	9.09 U	8.81 U	8.55 U	2.52 U	--	9.74 U	9.27 U
Phenols (µg/kg)																															
Phenol	420	1200	790 U	50 U	96.6 J	710 UG	53 U	65.3 J	730 UG	146	23 J	10 U	750 UG	720 UG	47 U	47 U	26 J	24 J	11 U	11 U	60 U	132	27 J	10 U	59 U	61 U	59 U	18 J	10 U	66 U	61 U
2-Methylphenol	63	63	1400 U	89 U	26 U	1300 UG	95 U	28 U	1300 UG	100 U	26 U	19 U	1300 UG	1300 UG	84 U	84 U	29 U	29 U	19 U	19 U	110 U	110 U	29 U	18 U	100 U	110 U	100 U	26 U	18 U	120 U	110 U
4-Methylphenol	670	670	1400 U	89 U	26 U	1300 ULG	95 U	28 U	1300 ULG	100 U	26 U	19 U	1300 ULG	1300 ULG	84 U	84 U	29 U	29 U	19 U	19 U	110 UL	110 U	29 U	18 U	100 UL	110 U	100 U	26 U	18 U	120 UL	110 U
2,4-Dimethylphenol	29	29	610 U	39 UG	11 U	560 ULG	42 UG	12 U	570 ULG	45 UG	11 U	8.1 U	580 ULG	560 ULG	37 U	37 U	13 U	13 U	8.3 U	8.4 U	47 UL	49 UG	12 U	8 U	46 UL	47 UG	46 UG	12 U	7.9 U	51 UL	48 UG
Pentachlorophenol	360	690	590 U	37 U	11 U	540 UG	40 U	12 U	550 UG	43 U	11 U	7.8 U	560 UG	540 UG	35 U	35 U	12 U	12 U	8 U	8 U	45 U	47 U	12 U	7.6 U	44 U	46 U	44 U	11 U	7.6 U	49 U	46 U
Misc Extractables (µg/kg)																															
Benzyl alcohol	57	73	530 U	33 UG	9.7 U	480 U	36 UG	17 J	480 U	38 UG	9.8 U	6.9 U	500 U	480 U	31 U	31 U	11 U	11 U	7.1 U	7.2 U	40 U	42 UG	11 U	6.8 U	39 U	41 UG	39 UG	9.9 U	6.8 U	44 U	41 UG
Benzoic acid	650	650	1200 U	240 J	323 J	1100 UG	250 J	264 J	1100 UG	300 J	143 J	36	1100 UG	1100 UG	180	180	183 J	150 J	27	33	88 U	350 J	194 J	27	87 U	250 J	290 J	149 J	24	97 U	270 J

Notes:

Bold: Detected.
* Exceeds SQS-AET dry wt criteria.
# Exceeds CSL-AET dry wt criteria.
Italics: TOC <0.5% or >3%.
Shaded: Exceeds TOC applicable criteria.
-- TOC undetected; not normalized

a Note metals, phenols and some miscellaneous extractable organics are not compared to organic carbon normalized values but only to dry weight AETs regardless of the organic carbon value.

Summary of Analytical Chemistry (organic carbon normalized) - SMS Screeing[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_7C	DUD_7C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_8C	DUD_9C	DUD_9C	DUD_9C	DUD_10C	DUD_10C	DUD_10C	DUD_11C	DUD_11C	DUD_11C	DUD_12C	DUD_12C	DUD_12C
Sample ID			L34524-8	L34971-8	L29990-10	L29990-9	L31520-10	L31520-9	L34524-10	L34524-9	L29990-11	L31520-11	L34524-11	L29990-12	L31520-12	L34524-12	L29990-13	L31520-13	L34524-13	L29990-14	L31520-14	L34524-14
Sample Date			1/31/2005	3/24/2005	10/21/2003	10/21/2003	3/30/2004	3/30/2004	2/1/2005	2/1/2005	10/21/2003	3/30/2004	1/31/2005	10/21/2003	3/30/2004	2/1/2005	10/21/2003	3/30/2004	2/1/2005	10/21/2003	3/30/2004	2/2/2005
Depth Interval			0-9 cm		0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-6 cm	0-10 cm	0-10 cm	0-7 cm	0-10 cm	0-10 cm	0-8 cm	0-10 cm	0-10 cm	0-7 cm	0-10 cm	0-10 cm	0-9 cm
Sample Matrix	SMS	SMS	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS	CSL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																						
Total solids	--	--	57.8	86.8	54.5	55.7	65.2	66.8	66.4	66.5	69.4	70.5	66.8	65.6	65.2	67.8	59	79.4	84.5	58.8	69.1	69.2
Total Organic Carbon	--	--	1.38	0.052 U	1.98	1.7	1.3	1.04	1.18	0.973	0.777	0.773	1.11	1.02	1.03	0.861	1.36	0.054 U	0.122	1.32	0.808	0.743
Grain Size (%)																						
Gravel	--	--	3.7	50.7	0.8 J	2.3 J	1.4 J	8.3 J	1.2	3.2	2.8 J	1.1 J	0.4 J	3.6 J	1 J	1.2 J	0.5 J	8.4	34.9	1 J	0.4 J	0.3 J
Sand	--	--	43	47.9	25.6	32	60.8	61.4	66.1	70.3	79.3	70	59	54.7	55.9	62.9	45.5	85.9	59.4	45.4	58.9	63.3
Silt	--	--	33.8	0.6	65.1	60	30.7	24	23.4	18.2	12.9	19	26.7	29.2	27.7	22.7	40.6	3	1.8	38.8	29	22.7
Clay	--	--	12.4	0.5 U	8.5	5.8	11.7	11.7	9.8	6.1	4.9	11.5	11.2	12.7	15	9	13.4	5.5	0.6	14.9	14.1	9.1
Fines	--	--	46.2	0.5 U	73.6	65.8	42.4	35.7	33.2	24.3	17.8	30.5	37.9	41.9	42.7	31.7	54	8.5	2.4	53.7	43.1	31.8
Metals (mg/kg)																						
Arsenic	57	93	11 J	2.9 U	40.7 L	30.7 L	3.8 U	3.7 U	7.1 J	5.6 J	14 JL	3.5 U	7.9 J	24.4 L	7.4 J	10 J	23.9 L	3.3 U	3 U	23.1 L	3.5 U	4.8 J
Cadmium	5.1	6.7	0.67 J	0.17 U	6.73 * #	3.57	1.26	1.12	1 J	0.75 J	0.4 J	0.74 J	1.24	0.67 J	0.97 J	0.77 J	0.68 J	0.19 U	0.18 U	0.8 J	0.74 J	0.68 JL
Chromium	260	270	32	13.2	139	81.7	37.6	35.5	35.7	31	21	27	37.7	28.7	31.6	28.6	36.4	17.5	20.5	34.5	27.5	32.8
Copper	390	390	81.7	25.1	141	85.3	79.8	78	67.9	69.3	37.2	72.1	69.3	70	78.1	59.9	91.4	54.8	48.6	94.7	104	70.2
Lead	450	530	69.7	1.7 U	139	87.3	78.1	63.9	69.4	45.6	33.3	43.7	82.2	94.1	64.7	98.1	113	4.3	5.7	102	59.8	59
Mercury	0.41	0.59	0.26 J	0.022 U	0.912 * #	0.803 * #	0.2 J	0.356 J	0.23 J	0.24 J	0.14 J	0.12 J	0.27 J	0.27 J	12.2 J * #	0.24 J	0.27 J	0.025 U	0.032	0.408	0.14 J	0.16 J
Silver	6.1	6.1	1.78 L	0.85	8.11 L * #	4.27 L	2.39 L	2.2 L	2.23 L	1.98 L	0.81 JL	1.57 L	2.29 L	1.3 JL	1.5 JL	1.78 L	1.5 JL	0.84	1.21	1.5 JL	2.08 L	2.04 L
Zinc	410	960	138	21	268	177	123	117	122	101	76.2	88.1	137	133	123	150	167	33.8	37.8	162	99	110
PCBs (mg/kg-OC)																						
Total PCBs (SMS)	12	65	28.8 *	--	254 * #	246 * #	164 * #	161 * #	68.6 * #	75.7 * #	13.2 *	95 * #	85.1 * #	36.6 *	64.6 *	38.1 *	27.8 *	--	15.4 *	19.9 *	79.7 * #	45 *
LPAH (mg/kg-OC)																						
Naphthalene	99	170	1.74 U	--	5.05 UG	5.88 UG	6.62 UG	8.08 UG	1.78 U	2.16 U	10.4 UG	10.2 UG	1.89 U	8.33 UG	8.35 UG	2.44 U	6.99 UG	--	13.9 U	7.2 UG	10 UG	3.1 J
Acenaphthylene	66	66	1.88 U	--	5.56 U	6.47 U	7.08 U	8.65 U	1.95 U	2.36 U	11.1 U	11 U	1.98 U	8.92 U	8.93 U	2.56 U	7.35 U	--	14.8 U	7.58 U	10.8 U	2.96 U
Acenaphthene	16	57	1.23 J	--	2.58 U	2.94 U	3.31 U	4.04 U	1.02 J	1.34 J	5.15 U	5.17 U	1.08 J	4.22 U	4.17 U	1.51 J	3.46 U	--	6.8 U	3.64 U	5.07 U	2.29 J
Fluorene	23	79	1.74 J	--	4.8 U	5.47 U	6.15 U	7.5 U	1.78 J	2.06 J	9.65 U	9.57 U	1.71 UJ	7.75 U	7.77 U	2.21 J	6.47 U	--	12.3 U	6.67 U	9.28 U	3.63 J
Phenanthrene	100	480	10.7 J	--	7.32 JLG	4.56 JLG	11.8 G	9.9 G	8.56 J	10.7 J	11.3 JLG	12.2 G	6.93 J	13.2 JLG	11.5 G	11.7 J	17.2 JLG	--	6.8	14.2 JLG	12.3 G	24.8 J
Anthracene	220	1200	5.97	--	5.66 G	4.51 G	5.15 G	4.61 JG	4.24	5.21	5.41 JG	5.89 G	4.13	5.92 G	6.11 G	5.48	5.81 G	--	5.41	6.18 G	5.75 G	7.38
2-Methylnaphthalene	38	64	1.74 U	--	5.05 U	5.88 U	6.62 U	8.08 U	1.78 U	2.16 U	10.4 U	10.2 U	1.89 U	8.33 U	8.35 U	2.44 U	6.99 U	--	13.9 U	7.2 U	10 U	2.69 U
Total LPAH (SMS)	370	780	19.7	--	13	9.08	16.9	14.5	15.6	19.3	16.7	18.1	12.1	19.2	17.6	20.9	23	--	12.2	20.3	18	41.2
HPAH (mg/kg-OC)																						
Fluoranthene	160	1200	28.1	--	28.1 L	23.4 L	27.5	25.9	23.5	24.9	34.1 L	28.5	19.8	29.7 L	30.8	34.6	39.3 L	--	16	35.8 L	34.8	39
Pyrene	1000	1400	31.7	--	43 L	30 L	32 G	26.3 G	28.8	28.2	44.5 L	29.8 G	29.5	47.5 L	30.4 G	39.6	56.3 L	--	16.1	50 L	38.4 G	42.3
Benzo(a)anthracene	110	270	15.1	--	12.4 L	9.65 L	12.5	10	11.5	12.5	18.9 L	13.7	10.4	18.5 L	14.5	16.7	23.1 L	--	13.6	18.8 L	16.6	15.7
Chrysene	110	460	23.9	--	15.7 L	12.1 L	15	12.9	15.6	17.6	22.4 L	16.3	13.5	21.7 L	19.5	23.7	28.9 L	--	20.1	25.8 L	22.2	20.6
Benzo(a)pyrene	99	210	17.3	--	11.8 L	8.41 L	15.1	13.6	13.4	14.1	22.4 L	17.2	12.6	22.5 L	18.9	19.4	28 L	--	17.5	24.6 L	24.5	18.8
Indeno(1,2,3-cd)pyrene	34	88	9.06	--	6.77	4.94 J	6.85 J	5.77 J	5.98	7.05	11.8 J	8.28 J	6.51	12.8	8.64 J	10.3	18.8	--	9.84	16.4	12.9	10.4
Dibenzo(a,h)anthracene	12	33	4.78	--	2.58 UL	2.94 UL	3.31 U	4.04 U	3.36	3.19	5.15 UL	5.17 U	2.9	4.8 JL	4.17 U	5.33	4.63 JL	--	6.8 U	4.39 JL	5.07 U	4.9
Benzo(g,h,i)perylene	31	78	9.64	--	8.08	5.47 J	6.46 JG	4.62 UG	7.49	8.24	12.8	5.82 UG	7.23	12.6	7.48 JG	11	20.8	--	10.7	17.4	12 G	11.9
Total benzofluoranthenes (SMS)	230	450	38.1	--	27.9	18.5	25.7	21.8	28.4	31	48.8	25.6	25.9	52.9	33.6	44.7	67	--	36.5	60.2	42.5	40.9
Total HPAH (SMS)	960	5300	178	--	154	112	141	116	138	147	216	139	128	223	164	205	287	--	140	253	204	205
Chlorinated Hydrocarbons (mg/kg-OC)																						
1,4-Dichlorobenzene	3.1	9	0.411	--	0.049 U	0.0559 U	0.0623 U	0.076 U	0.807	0.717	0.0978 U	0.881	0.669	0.0794 U	0.0786 U	0.0221 U	0.0662 U	--	0.123 U	0.0682 U	0.802	0.908
1,2-Dichlorobenzene	2.3	2.3	0.0326 U	--	0.101 U	0.118 U	0.131 U	0.154 U	0.0331 U	0.0401 U	0.206 U	0.207 U	0.0351 U	0.167 U	0.165 U	0.0441 U	0.14 U	--	0.254 U	0.144 U	0.198 U	0.0511 U
1,2,4-Trichlorobenzene	0.81	1.8	0.0326 U	--	0.101 U	0.118 U	0.131 U	0.154 U	0.0331 U	0.0401 U	0.206 U	0.207 U	0.0351 U	0.167 U	0.165 U	0.0441 U	0.14 U	--	0.254 U	0.144 U	0.198 U	0.0511 U
Hexachlorobenzene	0.38	2.3	0.0797 U	--	0.253 U	0.282 U	0.315 U	0.385 U	0.0839 U	0.102 U	0.502 U	0.492 U	0.0892 U	0.402 U	0.398 U	0.113 U	0.338 U	--	0.639 U	0.348 U	0.483 U	0.128 U
Phthalates (mg/kg-OC)																						
Dimethylphthalate	53	53	1.38 U	--	4.09 U	4.65 U	5.15 U	6.35 U	1.44 U	1.75 U	8.11 U	8.02 U	1.44 U	6.57 U	6.5 U	1.86 U	5.51 U	--	10.7 U	5.68 U	7.92 U	2.15 U
Diethylphthalate	61	110	0.725 U	--	2.22 U	2.53 U	2.85 U	3.46 U	0.763 U	0.925 U	4.5 U	4.4 U	0.811 U	3.63 U	3.59 U	1.02 U	3.01 U	--	6.23	3.11 U	4.33 U	1.17 U
Di-n-butylphthalate	220	1700	3.59 B	--	1.87 U	2.12 U	2.38 U	2.88 U	5.07 B	4.25 B	17.2	3.62 U	0.676 UB	2.94 U	3.01 U	5.09 B	2.5 U	--	24.4	2.58 U	4.08 J	2.5 B
Butylbenzylphthalate	4.9	64	1.78	--	2.22 U	2.53 U	5.88 *	5.58 J *	0.763 U	3.22	4.5 U	5.69 J *	0.811 U	3.63 U	4.47 J	3.94	6.99 J *	--	7.21 *	3.11 U	7.92 J *	3.1
bis(2-Ethylhexyl)phthalate	47	78	37.4	--	135 B * #	126 B * #	97.7 * #	91 * #	67.1 *	75.4 *	60.9 B *	88.1 * #	62.6 *	45.4 B	52.4 *	35	118 B * #	--	51 *	74.8 B *	95.3 * #	59.4 *
Di-n-octylphthalate	58	4500	1.01 U	--	2.98 U	3.35 U	3.77 U	4.62 U	1.02 U	1.23 U	5.92 U	5.82 U	1.08 U	4.8 U	4.76 U	1.39 U	3.97 U	--	7.79 U	4.09 U	5.69 U	1.62 U
Misc Extractables (mg/kg-OC)																						
Dibenzofuran	15	58	1.74 UJ	--	5.05 U	5.88 U	6.62 U	8.08 U	1.78 UJ	2.16 UJ	10.4 U	10.2 U	1.89 UJ	8.33 U	8.35 U	2.44 UJ	6.99 U	--	13.9 U	7.2 U	10 U	2.69 J
Hexachlorobutadiene	3.9	6.2	0.0942 U	--	0.278 U	0.318 U	0.354 U	0.433 U	0.0932 U	0.113 U	0.553 U	0.556 U	0.0991 U	0.451 U	0.447 U	0.128 U	0.375 U	--	0.73 U	0.386 U	0.532 U	0.148 U
n-Nitrosodiphenylamine	11	11	2.54 U	--	7.58 U	8.24 U	9.23 U	11.5 U	2.54 U	3.08 U	15.4 U	14.2 U	2.7 U	11.8 U	11.7 U	3.37 U	10.3 U	--	19.7 U	10.6 U	14.9 U	3.9 U
Phenols (µg/kg)																						
Phenol	420	1200	19 J	10 U	66 U	65 U	55 U	54 U	18 J	14 UJ	52 U	51 U	13 UJ	55 U	55 U	13 UJ	61 U	45 U	11 U	61 U	52 U	13 UJ
2-Methylphenol	63	63	28 U	18 U	120 U	110 U	98 U	96 U	24 U	24 U	92 U	91 U	24 U	98 U	98 U	24 U	110 U	81 U	19 U	110 U	93 U	23 U
4-Methylphenol	670	670	28 U	18 U	120 UL	110 UL	98 U	96 U	24 U	24 U	92 UL	91 U	24 U	98 UL	98 U	24 U	110 UL	81 U	19 U	110 UL	93 U	23 U
2,4-Dimethylphenol	29	29	12 U	8.1 U	51 UL	50 UL	43 UG	42 UG	11 U	11 U	40 UL	40 UG	10 U	43 UL	43 UG	10 U	47 UL	35 U	8.3 U	48 UL	41 UG	10 U
Pentachlorophenol	360	690	12 U	7.7 U	50 U	48 U	41 U	40 U	10 U	10 U	39 U	38 U	10 U	41 U	41 U	9.9 U	46 U	34 U	7.9 U	46 U	39 U	9.7 U
Misc Extractables (µg/kg)																						
Benzyl alcohol	57	73	10 U	6.9 U	44 U	43 U	37 UG	36 UG	9 U	9 U	35 U	34 UG	9 U	37 U	37 UG	8.8 U	41 U	30 U	7.1 U	41 U	35 UG	8.7 U
Benzoic acid	650	650	180 J	26	97 U	95 U	250 J	220 J	161 J	137 J	76 U	210 J	159 J	81 U	230 J	136 J	90 U	180	96.3	90 U	230 J	122 J

Notes:

Bold: Detected.

* Exceeds SQS-AET dry wt criteria.

Exceeds CSL-AET dry wt criteria.

Italics: TOC <0.5% or >3%.

Shaded: Exceeds TOC applicable criteria.

-- TOC undetected; not normalized

a Note metals, phenols and some miscellaneous extractable organics a

Summary of Analytical Chemistry (dry weight) - AET Screening[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_13C	DUD_14C	DUD_14C	DUD_15C	DUD_15C	DUD_16C	DUD_17C	DUD_18C	DUD_19C	DUD_20C	DUD_30C	DUD_31C
Sample ID			L34524-15	L34524-16	L34971-16	L34524-17	L34971-17	L34524-18	L34524-19	L34524-20	L34524-21	L34524-22	L36565-1	L36565-2
Sample Date			2/2/2005	2/2/2005	3/16/2005	2/2/2005	3/16/2005	2/2/2005	2/2/2005	2/2/2005	2/1/2005	2/2/2005	8/17/2005	8/17/2005
Depth Interval			0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-5 cm	0-8 cm	0-3 cm	0-3 cm
Sample Matrix			SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS-AET	CSL-AET	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)														
Total solids	--	--	50.8	53.5	81.8	55.7	88.3	57.1	55.1	66.9	81.5	69	83.2	95.3
Total Organic Carbon	--	--	1.87	1.71	0.297	1.58	0.049 U	1.66	1.51	1.03	0.152	0.848	1.05	0.377
Grain Size (%)														
Gravel	--	--	0.1 UJ	0.1 UJ	32.9	1.9 J	56.1	1.4 J	0.4 J	4.7 J	17.2	0.3 J	9.6	31.7
Sand	--	--	29.5	34.1	61.5	34.7	44.4	41.6	32.8	59.6	73.7	63.2	59.3	39.2
Silt	--	--	47.1	46.7	2.3	41.8	0.5 U	36.4	40.3	23.5	4.7	24.7	21.9	20.4
Clay	--	--	16.8	14.9	1.1	16.4	0.5 U	13.7	17.2	11.7	4.1	15	8.5	5.8
Fines	--	--	63.9	61.6	3.4	58.2	0.5 U	50.1	57.5	35.2	8.8	39.7	30.4	26.2
Metals (mg/kg)														
Arsenic	57	93	10 J	8.6 J	2.9 U	14 J	2.9 U	10 J	8 J	8.4 J	3.1 U	8.6 J	6 JL	2.6 U
Cadmium	5.1	6.7	1.3 JL	0.9 JL	0.17 U	0.79 JL	0.18 U	0.98 JL	0.64 JL	0.46 JL	0.18 U	0.91 JL	0.18 U	0.28
Chromium	260	270	43.1	40.7	16	33	13.7	40.5	35.2	28.7	20.9	34.3	55.9	31
Copper	390	530	101	96.3	32.3	95	30.6	88.3	75	55.3	64.3	60.6	61.8	158
Lead	450	530	77.6	78.7	5.4	110	1.8 U	88.3	55.7	98.2	7.7	79.3	94.4	7.8
Mercury	0.41	0.59	0.33 J	0.28 J	0.024 U	0.25 J	0.024 U	0.28 J	0.24 J	0.22 J	0.033	0.2 J	0.468 *	0.031
Zinc	410	960	165	148	32	165	27.7	153	129	106	39.4	130	61.9 J	85.8
PCBs (µg/kg)														
Aroclor 1016	--	--	160 U	140 U	6.1 U	32 U	1.5 U	190 U	36 UH	19 U	3.7 U	91 U	170 U	1.4 U
Aroclor 1221	--	--	4.9 U	4.7 U	3.1 U	4.5 U	2.8 U	4.4 U	4.5 UH	3.7 U	3.1 U	3.6 U	30 U	2.6 U
Aroclor 1232	--	--	330 U	300 U	17 U	70 U	2.8 U	400 U	76 UH	37 U	18 U	190 U	470 U	2.6 U
Aroclor 1242	--	--	180 U	160 U	15 U	38 U	1.5 U	210 U	140 UH	19 U	5 U	200 U	400 U	1.4 U
Aroclor 1248	--	--	250 J	224 J	11.3	72.4 J	1.5 U	275 J	73.7 JH	19 UJ	7.25	151 J	315	2
Aroclor 1254	--	--	303	275	13	114	1.5 U	301	106 H	205	10.8	203	303	5.22
Aroclor 1260	--	--	156 J	122 J	8.12	63.4 J	1.5 U	124 J	51.5 JH	1170 J	7.2	104 J	197	9.32
Total PCBs (SMS)	130	1000	709 *	621 *	32.4	250 *	2.8 U	700 *	231 *	1375 * #	25.3	458 *	815 *	16.5
LPAH (µg/kg)														
Naphthalene	2100	2400	28 U	26 U	17 U	25 U	16 U	25 U	25 U	21 U	17 U	20 U	16 U	2.8 U
Acenaphthylene	1300	1300	33 J	28 J	18 U	27 U	17 U	26 U	27 U	22 U	18 U	22 U	16 U	2.8 U
Acenaphthene	500	730	20 J	22 J	8.6 U	25.7	7.9 U	16 J	20 J	16 J	8.6 U	11 J	16 U	2.8 U
Fluorene	540	1000	37 J	30 J	16 U	29 J	15 U	23 J	27 J	33 J	16 U	19 UJ	16 U	2.8 U
Phenanthrene	1500	5400	209 J	171 J	24.3	205 J	4.5 U	147 J	156 J	178 J	12.9	60.3 J	43.8	8.84
Anthracene	960	4400	132	104	13.3	70.4	4.5 U	67.1	76.6	102	8.5	27.5	16 U	2.8 U
2-Methylnaphthalene	670	1400	28 U	26 U	17 U	25 U	16 U	25 U	25 U	21 U	17 U	20 U	16 U	2.8 U
Total LPAH (SMS)	5200	13000	431	355	37.6	330.1	17 U	253.1	279.6	329	21.4	98.8	43.8	8.84
HPAH (µg/kg)														
Fluoranthene	1700	2500	563	475	55.6	476	9.1 U	410	397	498	34.8	170	112	22.6
Pyrene	2600	3300	634	544	50.9	562	4.5 U	492	448	767	32.1	246	98.8	19.5
Benzo(a)anthracene	1300	1600	325	236	25.1	212	2.3 U	168	221	229	22.5	80.1	41	8.36
Chrysene	1400	2800	478	402	39.9	285	4.5 U	240	298	435	32.1	116	55	14.8
Benzo(b)fluoranthene	--	--	398	320	35.5	321	3.4 U	252	336	378	40.4	137	53	13.6
Benzo(k)fluoranthene	--	--	348	273	26.7	291	3.4 U	219	254	272	25.6	130	54.9	15.5
Benzo(a)pyrene	1600	3000	321	308	26.3	282	3.4 U	217	272	315	28.6	118	47.4	13.7
Indeno(1,2,3-cd)pyrene	600	690	175	162	17	145	10 U	111	133	134	16	61.4	38.9	10.9
Dibenzo(a,h)anthracene	230	540	85.4	68.8	8.6 U	70.2	7.9 U	50.8	59.9	65.8	8.6 U	28	16 U	3.3
Benzo(g,h,i)perylene	670	720	187	175	17	165	9.1 U	127	144	143	17	69	45.8	13.2
Total benzofluoranthenes (SMS)	3200	3600	746	593	62.2	612	3.4 U	471	590	650	66	267	107.9	29.1
Total HPAH (SMS)	12000	17000	3514.4	2963.8	294	2809.2	10 U	2286.8	2562.9	3236.8	249.1	1155.5	546.8	135.46
Chlorinated Hydrocarbons (µg/kg)														
1,3-Dichlorobenzene	--	--	0.51 U	0.49 U	0.32 U	0.47 U	0.29 U	0.46 U	0.47 U	0.39 U	0.32 U	0.38 U	1.6 U	0.28 U
1,4-Dichlorobenzene	110	120	7.81	8.13	0.16 U	6.18	0.15 U	8.21	5.43	26	0.16 U	9.32	1.6 U	0.28 U
1,2-Dichlorobenzene	35	50	0.51 U	6.58	0.32 U	0.47 U	0.29 U	0.46 U	0.47 U	0.39 U	0.32 U	0.38 U	7.21	0.28 U
1,2,4-Trichlorobenzene	31	51	0.51 U	0.49 U	0.32 U	0.47 U	0.29 U	0.46 U	0.47 U	0.39 U	0.32 U	0.38 U	1.6 U	0.28 U
Hexachlorobenzene	22	70	1.3 U	1.2 U	0.81 U	1.2 U	0.75 U	1.2 U	1.2 U	0.99 U	0.81 U	0.96 U	3.2 U	0.56 U
Phthalates (µg/kg)														
Dimethylphthalate	71	160	22 U	21 U	13 U	20 U	12 U	19 U	20 U	16 U	13 U	16 U	32 U	5.6 U
Diethylphthalate	200	1200	12 U	11 U	7.3 U	12 J	6.8 U	11 U	11 U	11 J	8.3	9.3 J	32 U	5.6 U
Di-n-butylphthalate	1400	5100	35.8 B	28.4 B	22	23 B	12.5	21.2 B	32.8 B	19.1 B	12.5	19.1 B	38 J	9.1
Butylbenzylphthalate	63	900	88 *	46	11	33.9	6.8 U	39.4	26.7	18.8	11	17.8	32 U	61.1
bis(2-Ethylhexyl)phthalate	1300	1900	770	935	70	425	8.7	618	481	371	59.9	362	138	39.3
Di-n-octylphthalate	6200	--	16 U	15 U	9.8 U	14 U	9.1 U	14 U	15 U	12 U	9.8 U	12 U	32 U	5.6 U
Phenols (µg/kg)														
Phenol	420	1200	22 J	17 UJ	11 U	27 J	10 U	28 J	22 J	15 J	12	19 J	1300 J * #	14.7
2-Methylphenol	63	72	31 U	30 U	20 U	29 U	18 U	28 U	29 U	24 U	20 U	23 U	32 U	5.6 U
4-Methylphenol	670	1800	31 U	30 U	20 U	29 U	18 U	28 U	29 U	24 U	20 U	23 U	32 U	5.6 U
2,4-Dimethylphenol	29	72	14 U	13 U	8.6 U	13 U	7.9 U	12 U	13 U	10 U	8.6 U	10 U	16 U	2.8 U
Pentachlorophenol	360	690	13 U	13 U	8.2 U	12 U	7.6 U	12 U	12 U	10 U	8.2 U	9.7 U	81 U	14 U
Misc Extractables (µg/kg)														
Benzyl alcohol	57	73	12 U	11 U	7.3 U	11 U	6.8 U	11 U	11 U	9 U	7.4 U	8.7 U	32 U	5.6 U
Benzoic acid	650	650	203 J	182 J	60	140 J	27	149 J	146 J	132 J	93.5	137 J	846 J *	116
Dibenzofuran	540	700	28 UJ	26 UJ	17 U	25 UJ	16 U	25 UJ	25 UJ	21 UJ	17 U	20 UJ	16 U	2.8 U
Hexachloroethane	--	--	30 U	28 U	18 U	27 U	17 U	26 U	27 U	22 U	18 U	22 U	--	--
Hexachlorobutadiene	11	120	1.5 U	1.4 U	0.92 U	1.3 U	0.85 U	1.3 U	1.4 U	1.1 U	0.92 U	1.1 U	8.1 U	1.4 U
n-Nitrosodiphenylamine	28	40	39 U	37 U	24 U	36 U	23 U	35 U	36 U	30 U	25 U	29 U	32 U	5.6 U

Notes:
Bold: Detected.
* Exceeds SQS-AET dry wt criteria.
# Exceeds CSL-AET dry wt criteria.
Italics: TOC <0.5% or >3%.
Shaded: Exceeds TOC applicable criteria.
a Note chemicals are compared to dry weight AETs when TOC is <0.5% or >3% (except for metals, phenols and some miscellaneous extractable organics which are always compared to dry weight AETs).

Summary of Analytical Chemistry (organic carbon normalized) - SMS Screeing[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_13C	DUD_14C	DUD_15C	DUD_16C	DUD_17C	DUD_18C	DUD_19C	DUD_20C	DUD_30C	DUD_31C
Sample ID			L34524-15	L34524-16	L34524-17	L34524-18	L34524-19	L34524-20	L34524-21	L34524-22	L36565-1	L36565-2
Sample Date			2/2/2005	2/2/2005	2/2/2005	2/2/2005	2/2/2005	2/2/2005	2/1/2005	2/2/2005	8/17/2005	8/17/2005
Depth Interval			0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-7 cm	0-5 cm	0-8 cm	0-3 cm	0-3 cm
Sample Matrix	SMS	SMS	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS	CSL	N	N	N	N	N	N	N	N	N	N
Conventionals (%)												
Total solids	--	--	50.8	53.5	55.7	57.1	55.1	66.9	81.5	69	83.2	95.3
Total Organic Carbon	--	--	1.87	1.71	1.58	1.66	1.51	1.03	0.152	0.848	1.05	0.377
Grain Size (%)												
Gravel	--	--	0.1 UJ	0.1 UJ	1.9 J	1.4 J	0.4 J	4.7 J	17.2	0.3 J	9.6	31.7
Sand	--	--	29.5	34.1	34.7	41.6	32.8	59.6	73.7	63.2	59.3	39.2
Silt	--	--	47.1	46.7	41.8	36.4	40.3	23.5	4.7	24.7	21.9	20.4
Clay	--	--	16.8	14.9	16.4	13.7	17.2	11.7	4.1	15	8.5	5.8
Fines	--	--	63.9	61.6	58.2	50.1	57.5	35.2	8.8	39.7	30.4	26.2
Metals (mg/kg)												
Arsenic	57	93	10 J	8.6 J	14 J	10 J	8 J	8.4 J	3.1 U	8.6 J	6 JL	2.6 U
Cadmium	5.1	6.7	1.3 JL	0.9 JL	0.79 JL	0.98 JL	0.64 JL	0.46 JL	0.18 U	0.91 JL	0.18 U	0.28
Chromium	260	270	43.1	40.7	33	40.5	35.2	28.7	20.9	34.3	55.9	31
Copper	390	390	101	96.3	95	88.3	75	55.3	64.3	60.6	61.8	158
Lead	450	530	77.6	78.7	110	88.3	55.7	98.2	7.7	79.3	94.4	7.8
Mercury	0.41	0.59	0.33 J	0.28 J	0.25 J	0.28 J	0.24 J	0.22 J	0.033	0.2 J	0.468 *	0.031
Silver	6.1	6.1	2.64 L	2.54 L	2.24 L	2.35 L	2 L	1.57 L	1.24	1.91 L	2.62 JG	0.79
Zinc	410	960	165	148	165	153	129	106	39.4	130	61.9 J	85.8
PCBs (mg/kg-OC)												
Total PCBs (SMS)	12	65	37.9 *	36.3 *	15.8 *	42.2 *	15.3 *	133 * #	16.6 *	54 *	77.6 * #	4.39
LPAH (mg/kg-OC)												
Naphthalene	99	170	1.5 U	1.52 U	1.58 U	1.51 U	1.66 U	2.04 U	11.2 U	2.36 U	1.52 U	0.743 U
Acenaphthylene	66	66	1.76 J	1.64 J	1.71 U	1.57 U	1.79 U	2.14 U	11.8 U	2.59 U	1.52 U	0.743 U
Acenaphthene	16	57	1.07 J	1.29 J	1.63	0.964 J	1.32 J	1.55 J	5.66 U	1.3 J	1.52 U	0.743 U
Fluorene	23	79	1.98 J	1.75 J	1.84 J	1.39 J	1.79 J	3.2 J	10.5 U	2.24 UJ	1.52 U	0.743 U
Phenanthrene	100	480	11.2 J	10 J	13 J	8.86 J	10.3 J	17.3 J	8.49	7.11 J	4.17	2.34
Anthracene	220	1200	7.06	6.08	4.46	4.04	5.07	9.9	5.59	3.24	1.52 U	0.743 U
2-Methylnaphthalene	38	64	1.5 U	1.52 U	1.58 U	1.51 U	1.66 U	2.04 U	11.2 U	2.36 U	1.52 U	0.743 U
Total LPAH (SMS)	370	780	23	20.8	20.9	15.2	18.5	31.9	14.1	11.7	4.17	2.34
HPAH (mg/kg-OC)												
Fluoranthene	160	1200	30.1	27.8	30.1	24.7	26.3	48.3	22.9	20	10.7	5.99
Pyrene	1000	1400	33.9	31.8	35.6	29.6	29.7	74.5	21.1	29	9.41	5.17
Benzo(a)anthracene	110	270	17.4	13.8	13.4	10.1	14.6	22.2	14.8	9.45	3.9	2.22
Chrysene	110	460	25.6	23.5	18	14.5	19.7	42.2	21.1	13.7	5.24	3.93
Benzo(a)pyrene	99	210	17.2	18	17.8	13.1	18	30.6	18.8	13.9	4.51	3.63
Indeno(1,2,3-cd)pyrene	34	88	9.36	9.47	9.18	6.69	8.81	13	10.5	7.24	3.7	2.89
Dibenzo(a,h)anthracene	12	33	4.57	4.02	4.44	3.06	3.97	6.39	5.66 U	3.3	1.52 U	0.875
Benzo(g,h,i)perylene	31	78	10	10.2	10.4	7.65	9.54	13.9	11.2	8.14	4.36	3.5
Total benzofluoranthenes (SMS)	230	450	39.9	34.7	38.7	28.4	39.1	63.1	43.4	31.5	10.3	7.72
Total HPAH (SMS)	960	5300	188	173	178	138	170	314	164	136	52.1	35.9
Chlorinated Hydrocarbons (mg/kg-OC)												
1,4-Dichlorobenzene	3.1	9	0.418	0.475	0.391	0.495	0.36	2.52	0.105 U	1.1	0.152 U	0.0743 U
1,2-Dichlorobenzene	2.3	2.3	0.0273 U	0.385	0.0297 U	0.0277 U	0.0311 U	0.0379 U	0.211 U	0.0448 U	0.687	0.0743 U
1,2,4-Trichlorobenzene	0.81	1.8	0.0273 U	0.0287 U	0.0297 U	0.0277 U	0.0311 U	0.0379 U	0.211 U	0.0448 U	0.152 U	0.0743 U
Hexachlorobenzene	0.38	2.3	0.0695 U	0.0702 U	0.0759 U	0.0723 U	0.0795 U	0.0961 U	0.533 U	0.113 U	0.305 U	0.149 U
Phthalates (mg/kg-OC)												
Dimethylphthalate	53	53	1.18 U	1.23 U	1.27 U	1.14 U	1.32 U	1.55 U	8.55 U	1.89 U	3.05 U	1.49 U
Diethylphthalate	61	110	0.642 U	0.643 U	0.759 J	0.663 U	0.728 U	1.07 J	5.46	1.1 J	3.05 U	1.49 U
Di-n-butylphthalate	220	1700	1.91 B	1.66 B	1.46 B	1.28 B	2.17 B	1.85 B	8.22	2.25 B	3.62 J	2.41
Butylbenzylphthalate	4.9	64	4.71	2.69	2.15	2.37	1.77	1.83	7.24 *	2.1	3.05 U	16.2 *
bis(2-Ethylhexyl)phthalate	47	78	41.2	54.7 *	26.9	37.2	31.9	36	39.4	42.7	13.1	10.4
Di-n-octylphthalate	58	4500	0.856 U	0.877 U	0.886 U	0.843 U	0.993 U	1.17 U	6.45 U	1.42 U	3.05 U	1.49 U
Misc Extractables (mg/kg-OC)												
Dibenzofuran	15	58	1.5 UJ	1.52 UJ	1.58 UJ	1.51 UJ	1.66 UJ	2.04 UJ	11.2 U	2.36 UJ	1.52 U	0.743 U
Hexachlorobutadiene	3.9	6.2	0.0802 U	0.0819 U	0.0823 U	0.0783 U	0.0927 U	0.107 U	0.605 U	0.13 U	0.771 U	0.371 U
n-Nitrosodiphenylamine	11	11	2.09 U	2.16 U	2.28 U	2.11 U	2.38 U	2.91 U	16.4 U	3.42 U	3.05 U	1.49 U
Phenols (µg/kg)												
Phenol	420	1200	22 J	17 UJ	27 J	28 J	22 J	15 J	12	19 J	1300 J * #	14.7
2-Methylphenol	63	63	31 U	30 U	29 U	28 U	29 U	24 U	20 U	23 U	32 U	5.6 U
4-Methylphenol	670	670	31 U	30 U	29 U	28 U	29 U	24 U	20 U	23 U	32 U	5.6 U
2,4-Dimethylphenol	29	29	14 U	13 U	13 U	12 U	13 U	10 U	8.6 U	10 U	16 U	2.8 U
Pentachlorophenol	360	690	13 U	13 U	12 U	12 U	12 U	10 U	8.2 U	9.7 U	81 U	14 U
Misc Extractables (µg/kg)												
Benzyl alcohol	57	73	12 U	11 U	11 U	11 U	11 U	9 U	7.4 U	8.7 U	32 U	5.6 U
Benzoic acid	650	650	203 J	182 J	140 J	149 J	146 J	132 J	93.5	137 J	846 J * #	116

Notes:

Bold: Detected.

* Exceeds SQS-AET dry wt criteria.

Exceeds CSL-AET dry wt criteria.

Italics: TOC <0.5% or >3%.

Shaded: Exceeds TOC applicable criteria.

-- TOC undetected; not normalized

a Note metals, phenols and some miscellaneous extractable organics are not compared to organic carbon normalized values but only to dry weight AETs regardless of the organic carbon value.

Summary of Analytical Chemistry (dry weight) - AET Screening[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_1A	DUD_1A	DUD_2A	DUD_2A	DUD_3A	DUD_4A	DUD_4A	DUD_5A	DUD_5A	DUD_5A	DUD_5A	DUD_1B	DUD_1B	DUD_2B	DUD_2B	DUD_3B
Sample ID			L32085-1	L35394-1	L32085-2	L35394-2	L35394-3	L32085-4	L35394-4	L32085-5	L32085-6	L35394-5	L35394-6	L32085-7	L35394-7	L32085-8	L36565-3	L32085-9
Sample Date			6/1/2004	4/27/2005	6/1/2004	4/27/2005	4/27/2005	6/1/2004	4/27/2005	6/1/2004	6/1/2004	4/27/2005	4/27/2005	6/1/2004	4/27/2005	6/1/2004	8/17/2005	6/1/2004
Depth Interval			0-6 cm	0-8 cm	0-5 cm	0-5 cm	0-6 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-8 cm	0-7 cm	0-6 cm	0-10 cm	0-5 cm	0-3 cm	0-6 cm
Sample Matrix			SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS-AET	CSL-AET	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																		
Total solids	--	--	83.7	45.9	81.2	45.8	50.5	79.1	76.7	78.9	78.7	82.7	81.5	85.5	70.2	83.4	76.3	93.5
Total Organic Carbon	--	--	0.344	5.71	0.573	2.95	2.34	0.11	0.34	0.049 U	0.051 U	0.053 U	0.105	0.218	0.665	0.293	1.31	0.166
Grain Size (%)																		
Gravel	--	--	40.9	15.1	67	6	21.3	4.1	13.2	6.3	7.3	4.7	11	66.5	0.1 U	69.4	73.3	82.8
Sand	--	--	52.8	62.8	22.8	26.4	34.1	85.9	73	90.5	89	89.2	82	24.6	74.9	20.8	16.6	13.4
Silt	--	--	6.7	17.3	8.3	46.7 J	33.9 J	7	6.3	1.8	1.9	1.8	3	5.6	16.6 J	7	9.8	3.2
Clay	--	--	2.4	13	3.4	21	20.8	4.4	6.3	2.4	2.5	3.6	3	3.3	9.1	4.5	5.2	2.3
Fines	--	--	9.1	30.2	11.7	67.7	54.7	11.4	12.7	4.2	4.4	5.4	5.9	8.9	25.7	11.5	15	5.5
Metals (mg/kg)																		
Arsenic	57	93	3 U	5.7	3 U	11 J	9.9 J	3 U	3.3 U	3.2 U	3 U	2.9 U	3.2 U	3.5	4.7 J	5.9	6.8 JL	2.6 U
Cadmium	5.1	6.7	0.18 U	1.2	0.2 J	0.79 J	0.53 J	0.18 U	0.2 U	0.19 U	0.18 U	0.18 U	0.18 U	0.18	0.23 J	0.25	0.28 J	0.15 U
Chromium	260	270	16.6	36.6	18.7	37.3	30.7	18.7	19	22.8	21.9	15.4	16.8	19.4	18.9	21.3	20.6	18.1
Copper	390	530	54.7	91.3	68.2	113	87.9	57.4	68.4	41.8	39.1	32.3	43.2	68.7	44.6	70.5	59.8	122
Lead	450	530	5.9	89.3	11.3	69	57.8	4.8	12.2	1.9 U	2	2.3	2.9	14.4	18.7	27.7	27.9	4.2
Mercury	0.41	0.59	0.024 U	0.22	0.037 J	0.28 J	0.3 J	0.025 U	0.052	0.025 U	0.025 U	0.024 U	0.025 U	0.025	0.11 J	0.032	0.092 J	0.022
Zinc	410	960	43.8	305	48.3	202	156	37.8	56.3	26.5	32.9	29.6	31	48.1	59.7	67.5	81.3 J	38.4
PCBs (µg/kg)																		
Aroclor 1016	--	--	1.6 U	52 U	1.6 U	37 U	32 U	1.6 U	4.2 U	1.6 U	1.7 U	1.6 U	1.6 U	1.5 U	12 U	1.6 U	8.3 U	1.4 U
Aroclor 1221	--	--	3 U	5.4 U	3.1 U	5.5 U	5 U	3.2 U	3.3 U	3.2 U	3.2 U	3 U	3.1 U	2.9 U	3.6 U	3 U	3.3 U	2.7 U
Aroclor 1232	--	--	3 U	100 U	3.1 U	55 U	48 U	3.2 U	9.5 U	3.2 U	3.2 U	3 U	3.1 U	2.9 U	23 U	3 U	14 U	2.7 U
Aroclor 1242	--	--	1.6 U	98 U	1.6 U	85 U	87 U	1.6 U	11 U	1.6 U	1.7 U	1.6 U	1.6 U	1.5 U	28 U	1.6 U	1.7 U	1.4 U
Aroclor 1248	--	--	4.25	61	11.3	59.6	61	4.31	9.36	1.6 U	1.7 U	1.6 U	3.1	37.8	24.4	21.3	16.8	7.97
Aroclor 1254	--	--	10.5	108	25.2	102	137	10.5	16.8	1.6 U	1.7 U	1.6 U	4.64	65.5	42.7	40.8	32.2	16.9
Aroclor 1260	--	--	3.79	125	10.2	69.4	74.5	5.16	14.6	1.6 U	1.7 U	1.6 U	3.95	17	27.2	20	25.3	5.94
Total PCBs (SMS)	130	1000	18.5	294 *	46.7	231 *	273 *	20	40.8	3.2 U	3.2 U	3 U	11.7	120	94.3	82.1	74.3	30.8
LPAH (µg/kg)																		
Naphthalene	2100	2400	67 U	99.1	69 UG	31 U	28 U	71 U	18 U	71 U	71 U	17 U	17 U	65 U	20 U	67 U	3.5 U	60 U
Acenaphthylene	1300	1300	72 U	35	74 U	33 U	30 U	76 U	20 U	76 U	76 U	18 U	18 U	70 U	21 U	72 U	6.8 J	64 U
Acenaphthene	500	730	33 U	58.8	34 U	26 J	31.7	35 U	9.1 U	35 U	36 U	8.5 U	8.6 U	33 U	10 U	34 U	7.46	30 U
Fluorene	540	1000	62 U	133	64 U	46 J	50.1	66 U	17 U	66 U	66 U	16 U	16 U	61 U	19 U	62 U	14.2	56 U
Phenanthrene	1500	5400	45.5	1360	47.8 G	354 JX	497 JX	27	72.6	20 U	20 U	4.8 U	15.2	30	103 JX	35	147	17 U
Anthracene	960	4400	19 U	399	20 UG	119	152	20 U	32.1	20 U	20 U	4.8 U	8.5	19 U	54.8	19 U	26.1	17 U
2-Methylnaphthalene	670	1400	67 U	623	69 U	31 UX	28 UX	71 U	18 U	71 U	71 U	17 U	17 U	65 U	20 UX	67 U	3.5 U	60 U
Total LPAH (SMS)	5200	13000	45.5	2084.9	47.8	545	730.8	27	104.7	76 U	76 U	18 U	23.7	30	157.8	35	201.56	64 U
HPAH (µg/kg)																		
Fluoranthene	1700	2500	88.4	1910 *	114	910 JX	966 JX	57	154	41 U	41 U	10	22.3	75.1	234 JX	92.2	417	36
Pyrene	2600	3300	82.1	1400	85 G	753 X	800 X	49.3	133	20 U	20 U	10.4	19.8	65.7	205 X	75.4	256	34.2
Benzo(a)anthracene	1300	1600	36.8	695	52.3 G	450	374	27.2	66.6	12	10 U	5.07	10.9	42	121	49	70.5	20.1
Chrysene	1400	2800	59.7	684	112	472	547	43.1	102	20 U	20 U	6.9	15.7	61.6	174	77.3	138	34.2
Benzo(b)fluoranthene	--	--	53.3	468	64.8	395	463	36.9	81.2	15 U	15	5.9	12.2	61.5	151	66.5	107	28.3
Benzo(k)fluoranthene	--	--	40	471	62.2 L	308	358	34.8	64.7	15 U	15 U	6.8	11.1	56.7	147	57.9	105	27.1
Benzo(a)pyrene	1600	3000	42.4	427	57.5 G	308 G	388 G	37.3	61	15 U	15 U	6.7	11.5	61.2	127 G	54.9	81.1	27.2
Indeno(1,2,3-cd)pyrene	600	690	43 U	253	44 UG	204	226	46 U	38.2	46 U	46 U	11 U	11 U	42 U	70.7	43 U	47.8	39 U
Dibenzo(a,h)anthracene	230	540	33 U	113	34 UL	57.4	65.1	35 U	14	35 U	36 U	8.5 U	8.6 U	33 U	31.6	34 U	13.8	30 U
Benzo(g,h,i)perylene	670	720	38 U	333	44 J	231	251	40 U	42.4	41 U	41 U	9.7 U	9.8 U	37 U	79.5	38 U	50.9	34 U
Total benzofluoranthenes (SMS)	3200	3600	93.3	939	127	703	821	71.7	145.9	15 U	15	12.7	23.3	118.2	298	124.4	212	55.4
Total HPAH (SMS)	12000	17000	402.7	6754	591.8	4088.4	4438.1	285.6	757.1	12	15	51.77	103.5	423.8	1340.8	473.2	1287.1	207.1
Chlorinated Hydrocarbons (µg/kg)																		
1,3-Dichlorobenzene	--	--	1.3 U	0.57 U	1.4 U	0.57 U	0.51 U	1.4 U	0.34 U	1.4 U	1.4 U	0.31 U	0.32 U	1.3 U	0.37 U	1.3 U	0.35 U	1.2 U
1,4-Dichlorobenzene	110	120	0.63 U	65.1	0.65 U	8.97	18.6	0.67 U	3.61	0.67 U	0.67 U	0.16 U	0.16 U	0.62 U	0.19 U	0.64 U	0.35 U	0.57 U
1,2-Dichlorobenzene	35	50	1.3 U	0.57 U	1.4 U	0.57 U	0.51 U	1.4 U	0.34 U	1.4 U	1.4 U	0.31 U	0.32 U	1.3 U	0.37 U	1.3 U	0.35 U	1.2 U
1,2,4-Trichlorobenzene	31	51	1.3 U	0.57 U	1.4 U	0.57 U	0.51 U	1.4 U	0.34 U	1.4 U	1.4 U	0.31 U	0.32 U	1.3 U	0.37 U	1.3 U	0.35 U	1.2 U
Hexachlorobenzene	22	70	3.2 U	1.4 U	3.3 U	1.4 U	1.3 U	3.4 U	0.86 U	3.4 U	3.4 U	0.8 U	0.81 U	3.2 U	0.94 U	3.2 U	0.69 U	2.9 U
Phthalates (µg/kg)																		
Dimethylphthalate	71	160	53 U	81.7 *	54 U	24 U	22 U	56 U	14 U	56 U	56 U	13 U	13 U	51 U	16 U	53 U	6.9 U	47 U
Diethylphthalate	200	1200	29 U	13 U	30 U	13 U	12 U	30 U	7.8 U	30 U	30 U	7.3 U	7.4 U	28 U	8.5 U	29 U	6.9 U	26 U
Di-n-butylphthalate	1400	5100	24 U	99.3	25 U	60.9 B	69.7 B	25 U	51.9	25 U	25 U	15.8	19.8	23 U	36.2 B	24 U	16.3	21 U
Butylbenzylphthalate	63	900	29 U	13 U	30 U	147 *	197 *	30 U	20.1	30 U	30 U	7.3 U	8.5	28 U	24.4	29 U	23.7	26 U
bis(2-Ethylhexyl)phthalate	1300	1900	442	5490 * #	374	2360 X * #	1520 X *	140	272	34 U	34 U	16.9	30.3	158	255 X	168	181	89.2
Di-n-octylphthalate	6200	--	38 U	17 U	39 U	17 U	16 U	40 U	10 U	41 U	41 U	9.7 U	9.8 U	37 U	11 U	38 U	6.9 U	34 U
Phenols (µg/kg)																		
Phenol	420	1200	43 U	20 U	44 U	37 J	18 UJ	46 U	12 U	46 U	46 U	11 U	11 U	42 U	13 UJ	43 U	43.6 J	39 U
2-Methylphenol	63	72	76 U	35 U	79 UG	35 U	32 U	81 U	21 U	81 U	81 U	19 U	20 U	75 U	23 U	77 U	6.9 U	68 U
4-Methylphenol	670	1800	76 U	35 U	79 U	35 U	32 U	81 U	21 U	81 U	81 U	19 U	20 U	75 U	23 U	77 U	6.9 U	68 U
2,4-Dimethylphenol	29	72	33 U	15 U	34 UX	15 U	14 U	35 U	9.1 U	35 U	36 U	8.5 U	8.6 U	33 U	10 U	34 U	3.5 U	30 U
Pentachlorophenol	360	690	32 U	15 U	33 U	15 U	13 U	34 U	8.7 U	34 U	34 U	8.1 U	8.2 U	32 U	9.5 U	32 U	17 U	29 U
Misc Extractables (µg/kg)																		
Benzyl alcohol	57	73	29 U	1200 * #	30 U	29.7 X	12 UX	30 U	7.8 U	30 U	30 U	7.3 U	7.4 U	28 U	8.5 UX	29 U	6.9 U	26 U
Benzoic acid	650	650	270	28 U	270 J	177	143	67 U	56	67 U	67 U	30	33	62 U	57 J	260	257 J	210
Dibenzofuran	540	700	67 U	57	69 U	31 U	28 U	71 U	18 U	71 U	71 U	17 U	17 U	65 U	20 U	67 U	7.54	60 U
Hexachloroethane	--	--	72 U	33 U	74 U	33 U	30 U	76 U	20 U	76 U	76 U	18 U	18 U	70 U	21 U	72 U	--	64 U
Hexachlorobutadiene	11	120	3.6 U	1.6 U	3.7 U	1.6 U	1.5 U	3.8 U	0.98 U	3.8 U	3.8 U	0.91 U	0.92 U	3.5 U	1.1 U	3.6 U	1.7 U	3.2 U
n-Nitrosodiphenylamine	28	40	96 U	44 U	99 U	44 U	40 U	100 U	26 U	100 U	100 U	24 U	25 U	94 U	28 U	96 U	6.9 U	86 U

Notes:

Bold: Detected.
* Exceeds SQS-AET dry wt criteria.
# Exceeds CSL-AET dry wt criteria.
Italics: TOC <0.5% or >3%.
Shaded: Exceeds TOC applicable criteria.

a Note chemicals are compared to dry weight AETs when TOC is <0.5% or >3% (except for metals, phenols and some miscellaneous extractable organics which are always compared to dry weight AETs).

Summary of Analytical Chemistry (organic carbon normalized) - SMS Screeing[a]
Duwamish Diagonal Monitoring Data

Location ID			DUD_1A	DUD_1A	DUD_2A	DUD_2A	DUD_3A	DUD_4A	DUD_4A	DUD_5A	DUD_5A	DUD_5A	DUD_5A	DUD_1B	DUD_1B	DUD_2B	DUD_2B	DUD_3B
Sample ID			L32085-1	L35394-1	L32085-2	L35394-2	L35394-3	L32085-4	L35394-4	L32085-5	L32085-6	L35394-5	L35394-6	L32085-7	L35394-7	L32085-8	L36565-3	L32085-9
Sample Date			6/1/2004	4/27/2005	6/1/2004	4/27/2005	4/27/2005	6/1/2004	4/27/2005	6/1/2004	6/1/2004	4/27/2005	4/27/2005	6/1/2004	4/27/2005	6/1/2004	8/17/2005	6/1/2004
Depth Interval			0-6 cm	0-8 cm	0-5 cm	0-5 cm	0-6 cm	0-10 cm	0-10 cm	0-10 cm	0-10 cm	0-8 cm	0-7 cm	0-6 cm	0-10 cm	0-5 cm	0-3 cm	0-6 cm
Sample Matrix	SMS	SMS	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Sample Type	SQS	CSL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Conventionals (%)																		
Total solids	--	--	83.7	45.9	81.2	45.8	50.5	79.1	76.7	78.9	78.7	82.7	81.5	85.5	70.2	83.4	76.3	93.5
Total Organic Carbon	--	--	0.344	5.71	0.573	2.95	2.34	0.11	0.34	0.049 U	0.051 U	0.053 U	0.105	0.218	0.665	0.293	1.31	0.166
Grain Size (%)																		
Gravel	--	--	40.9	15.1	67	6	21.3	4.1	13.2	6.3	7.3	4.7	11	66.5	0.1 U	69.4	73.3	82.8
Sand	--	--	52.8	62.8	22.8	26.4	34.1	85.9	73	90.5	89	89.2	82	24.6	74.9	20.8	16.6	13.4
Silt	--	--	6.7	17.3	8.3	46.7 J	33.9 J	7	6.3	1.8	1.9	1.8	3	5.6	16.6 J	7	9.8	3.2
Clay	--	--	2.4	13	3.4	21	20.8	4.4	6.3	2.4	2.5	3.6	3	3.3	9.1	4.5	5.2	2.3
Fines	--	--	9.1	30.2	11.7	67.7	54.7	11.4	12.7	4.2	4.4	5.4	5.9	8.9	25.7	11.5	15	5.5
Metals (mg/kg)																		
Arsenic	57	93	3 U	5.7	3 U	11 J	9.9 J	3 U	3.3 U	3.2 U	3 U	2.9 U	3.2 U	3.5	4.7 J	5.9	6.8 JL	2.6 U
Cadmium	5.1	6.7	0.18 U	1.2	0.2 J	0.79 J	0.53 J	0.18 U	0.2 U	0.19 U	0.18 U	0.18 U	0.18 U	0.18	0.23 J	0.25	0.28 J	0.15 U
Chromium	260	270	16.6	36.6	18.7	37.3	30.7	18.7	19	22.8	21.9	15.4	16.8	19.4	18.9	21.3	20.6	18.1
Copper	390	390	54.7	91.3	68.2	113	87.9	57.4	68.4	41.8	39.1	32.3	43.2	68.7	44.6	70.5	59.8	122
Lead	450	530	5.9	89.3	11.3	69	57.8	4.8	12.2	1.9 U	2	2.3	2.9	14.4	18.7	27.7	27.9	4.2
Mercury	0.41	0.59	0.024 U	0.22	0.037 J	0.28 J	0.3 J	0.025 U	0.052	0.025 U	0.025 U	0.024 U	0.025 U	0.025	0.11 J	0.032	0.092 J	0.022
Silver	6.1	6.1	0.84	1.8	0.76 JL	1.7 J	1.5 J	0.97	1.2	0.84	0.91	1.1	1.1	1	1.2 J	0.96	0.38 JG	0.65
Zinc	410	960	43.8	305	48.3	202	156	37.8	56.3	26.5	32.9	29.6	31	48.1	59.7	67.5	81.3 J	38.4
PCBs (mg/kg-OC)																		
Total PCBs (SMS)	12	65	5.39	5.15	8.15	7.83	11.6	18.2 *	12	--	--	--	11.1	55.2 *	14.2 *	28 *	5.67	18.6 *
LPAH (mg/kg-OC)																		
Naphthalene	99	170	19.5 U	1.74	12 UG	1.05 U	1.2 U	64.5 U	5.29 U	--	--	--	16.2 U	29.8 U	3.01 U	22.9 U	0.267 U	36.1 U
Acenaphthylene	66	66	20.9 U	0.613	12.9 U	1.12 U	1.28 U	69.1 U	5.88 U	--	--	--	17.1 U	32.1 U	3.16 U	24.6 U	0.519 J	38.6 U
Acenaphthene	16	57	9.59 U	1.03	5.93 U	0.881 J	1.35	31.8 U	2.68 U	--	--	--	8.19 U	15.1 U	1.5 U	11.6 U	0.569	18.1 U
Fluorene	23	79	18 U	2.33	11.2 U	1.56 J	2.14	60 U	5 U	--	--	--	15.2 U	28 U	2.86 U	21.2 U	1.08	33.7 U
Phenanthrene	100	480	13.2	23.8	8.34 G	12 JX	21.2 JX	24.5	21.4	--	--	--	14.5	13.8	15.5 JX	11.9	11.2	10.2 U
Anthracene	220	1200	5.52 U	6.99	3.49 UG	4.03	6.5	18.2 U	9.44	--	--	--	8.1	8.72 U	8.24	6.48 U	1.99	10.2 U
2-Methylnaphthalene	38	64	19.5 U	10.9	12 U	1.05 UX	1.2 UX	64.5 U	5.29 U	--	--	--	16.2 U	29.8 U	3.01 UX	22.9 U	0.267 U	36.1 U
Total LPAH (SMS)	370	780	13.2	36.5	8.34	18.5	31.2	24.5	30.8	--	--	--	22.6	13.8	23.7	11.9	15.4	38.6 U
HPAH (mg/kg-OC)																		
Fluoranthene	160	1200	25.7	33.5	19.9	30.8 JX	41.3 JX	51.8	45.3	--	--	--	21.2	34.4	35.2 JX	31.5	31.8	21.7
Pyrene	1000	1400	23.9	24.5	14.8 G	25.5 X	34.2 X	44.8	39.1	--	--	--	18.9	30.1	30.8 X	25.7	19.5	20.6
Benzo(a)anthracene	110	270	10.7	12.2	9.13 G	15.3	16	24.7	19.6	--	--	--	10.4	19.3	18.2	16.7	5.38	12.1
Chrysene	110	460	17.4	12	19.5	16	23.4	39.2	30	--	--	--	15	28.3	26.2	26.4	10.5	20.6
Benzo(a)pyrene	99	210	12.3	7.48	10 G	10.4 G	16.6 G	33.9	17.9	--	--	--	11	28.1	19.1 G	18.7	6.19	16.4
Indeno(1,2,3-cd)pyrene	34	88	12.5 U	4.43	7.68 UG	6.92	9.66	41.8 U	11.2	--	--	--	10.5 U	19.3 U	10.6	14.7 U	3.65	23.5 U
Dibenzo(a,h)anthracene	12	33	9.59 U	1.98	5.93 UL	1.95	2.78	31.8 U	4.12	--	--	--	8.19 U	15.1 U	4.75	11.6 U	1.05	18.1 U
Benzo(g,h,i)perylene	31	78	11 U	5.83	7.68 J	7.83	10.7	36.4 U	12.5	--	--	--	9.33 U	17 U	12	13 U	3.89	20.5 U
Total benzofluoranthenes (SMS)	230	450	27.1	16.4	22.2	23.8	35.1	65.2	42.9	--	--	--	22.2	54.2	44.8	42.5	16.2	33.4
Total HPAH (SMS)	960	5300	117	118	103	139	190	260	223	--	--	--	98.6	194	202	162	98.3	125
Chlorinated Hydrocarbons (mg/kg-OC)																		
1,4-Dichlorobenzene	3.1	9	0.183 U	1.14	0.113 U	0.304	0.795	0.609 U	1.06	--	--	--	0.152 U	0.284 U	0.0286 U	0.218 U	0.0267 U	0.343 U
1,2-Dichlorobenzene	2.3	2.3	0.378 U	0.00998 U	0.244 U	0.0193 U	0.0218 U	1.27 U	0.1 U	--	--	--	0.305 U	0.596 U	0.0556 U	0.444 U	0.0267 U	0.723 U
1,2,4-Trichlorobenzene	0.81	1.8	0.378 U	0.00998 U	0.244 U	0.0193 U	0.0218 U	1.27 U	0.1 U	--	--	--	0.305 U	0.596 U	0.0556 U	0.444 U	0.0267 U	0.723 U
Hexachlorobenzene	0.38	2.3	0.93 U	0.0245 U	0.576 U	0.0475 U	0.0556 U	3.09 U	0.253 U	--	--	--	0.771 U	1.47 U	0.141 U	1.09 U	0.0527 U	1.75 U
Phthalates (mg/kg-OC)																		
Dimethylphthalate	53	53	15.4 U	1.43	9.42 U	0.814 U	0.94 U	50.9 U	4.12 U	--	--	--	12.4 U	23.4 U	2.41 U	18.1 U	0.527 U	28.3 U
Diethylphthalate	61	110	8.43 U	0.228 U	5.24 U	0.441 U	0.513 U	27.3 U	2.29 U	--	--	--	7.05 U	12.8 U	1.28 U	9.9 U	0.527 U	15.7 U
Di-n-butylphthalate	220	1700	6.98 U	1.74	4.36 U	2.06 B	2.98 B	22.7 U	15.3	--	--	--	18.9	10.6 U	5.44 B	8.19 U	1.24	12.7 U
Butylbenzylphthalate	4.9	64	8.43 U	0.228 U	5.24 U	4.98 *	8.42 *	27.3 U	5.91 *	--	--	--	8.1 *	12.8 U	3.67	9.9 U	1.81	15.7 U
bis(2-Ethylhexyl)phthalate	47	78	128 * #	96.1 * #	65.3 *	80 X * #	65 X *	127 * #	80 * #	--	--	--	28.9	72.5 *	38.3 X	57.3 *	13.8	53.7 *
Di-n-octylphthalate	58	4500	11 U	0.298 U	6.81 U	0.576 U	0.684 U	36.4 U	2.94 U	--	--	--	9.33 U	17 U	1.65 U	13 U	0.527 U	20.5 U
Misc Extractables (mg/kg-OC)																		
Dibenzofuran	15	58	19.5 U	0.998	12 U	1.05 U	1.2 U	64.5 U	5.29 U	--	--	--	16.2 U	29.8 U	3.01 U	22.9 U	0.576	36.1 U
Hexachlorobutadiene	3.9	6.2	1.05 U	0.028 U	0.646 U	0.0542 U	0.0641 U	3.45 U	0.288 U	--	--	--	0.876 U	1.61 U	0.165 U	1.23 U	0.13 U	1.93 U
n-Nitrosodiphenylamine	11	11	27.9 U	0.771 U	17.3 U	1.49 U	1.71 U	90.9 U	7.65 U	--	--	--	23.8 U	43.1 U	4.21 U	32.8 U	0.527 U	51.8 U
Phenols (µg/kg)																		
Phenol	420	1200	43 U	20 U	44 U	37 J	18 UJ	46 U	12 U	46 U	46 U	11 U	11 U	42 U	13 UJ	43 U	43.6 J	39 U
2-Methylphenol	63	63	76 U	35 U	79 UG	35 U	32 U	81 U	21 U	81 U	81 U	19 U	20 U	75 U	23 U	77 U	6.9 U	68 U
4-Methylphenol	670	670	76 U	35 U	79 U	35 U	32 U	81 U	21 U	81 U	81 U	19 U	20 U	75 U	23 U	77 U	6.9 U	68 U
2,4-Dimethylphenol	29	29	33 U	15 U	34 UX	15 U	14 U	35 U	9.1 U	35 U	36 U	8.5 U	8.6 U	33 U	10 U	34 U	3.5 U	30 U
Pentachlorophenol	360	690	32 U	15 U	33 U	15 U	13 U	34 U	8.7 U	34 U	34 U	8.1 U	8.2 U	32 U	9.5 U	32 U	17 U	29 U
Misc Extractables (µg/kg)																		
Benzyl alcohol	57	73	29 U	1200 * #	30 U	29.7 X	12 UX	30 U	7.8 U	30 U	30 U	7.3 U	7.4 U	28 U	8.5 UX	29 U	6.9 U	26 U
Benzoic acid	650	650	270	28 U	270 J	177	143	67 U	56	67 U	67 U	30	33	62 U	57 J	260	257 J	210

Notes:

Bold: Detected.
* Exceeds SQS-AET dry wt criteria.
# Exceeds CSL-AET dry wt criteria.
Italics: TOC <0.5% or >3%.
Shaded: Exceeds TOC applicable criteria.
-- TOC undetected; not normalized

a Note metals, phenols and some miscellaneous extractable organics are not compared to organic carbon normalized values but only to dry weight AETs regardless of the organic carbon value.

Laboratory data and data quality reviews
provided on CD