Addendum to Sampling and Analysis Plan To Include Organics Verification Study

Sediment Metals Verification Study for Sinclair and Dyes Inlet, Washington

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Prepared by:

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Water Body Numbers
WA-15-0040 Sinclair Inlet
WA-15-0050 Dyes Inlet

REVIEW AND APPROVALS

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Introduction

One of the goals of the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF) Project Environmental Reinvestment (Project ENVVEST) is to address contaminants in Sinclair and Dyes Inlet water body segments that are listed on the State of Washington's 1998 303(d) list (Ecology 2003). Many of the 303(d) listings are for contaminants in sediments, but many of the data on which the listings are based were collected prior to significant cleanup and source control efforts in those water bodies. The priority contaminants were trace metals, followed by organic contaminants and mercury.

In 2003, a detailed Sampling and Analysis Plan (SAP) (Kohn et al. 2003) was developed for a Metals Verification Study to address present-day levels of metals in Sinclair and Dyes Inlet sediment and to determine whether concentrations had decreased since cleanup and source reduction, and whether concentrations exceeded Washington state sediment quality standards (SQS). One of the elements of the Metals Verification Study SAP was to archive an aliquot of each sediment sample for later organics analysis. This was done when the Metals Verification Study was conducted in 2003-2004. This Addendum to the SAP addresses the selection of archived sediment samples from Sinclair and Dyes Inlets and the proposed analyses for organic contaminants. The main SAP document addresses the sampling design, sample collection methods, sample handling and custody procedures, and program quality assurance and quality control (QA/QC) procedures.

Organics Verification Objectives and Approach

The objectives of the Organics Verification Study are similar to the Metals Verification Study: to provide present-day sediment contaminant concentrations in Sinclair and Dyes Inlet segments that are listed for organics in sediment, and 2) to provide data at a spatial distribution throughout Sinclair and Dyes Inlets that supports modeling of contaminant loading and transport. The Metals Verification Study was designed at an appropriate sampling density and distribution to meet these goals for all 303(d) contaminants of concern including organics, for which samples were archived during the Metals Verification Study. The results of both verification studies are expected to help prioritize management actions if sediment remains a source of impairment.

The Organics Verification Study approach is also similar to the Metals Verification study in that all samples undergo a rapid screening analysis to detect the presence and magnitude of polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in sediment, followed by confirmatory quantitative laboratory analysis of 20-25% of the samples. If there is good correlation between screening and quantitative results, the relationship equation will be used to estimate contaminant concentrations for the 75% of samples that were not quantitatively analyzed.

In addition to quantitative organics measurements, total organic carbon (TOC) data will be provided for all verification study samples. TOC content is critical in controlling bioavailability of sediment-associated organic contaminants, most of the SQS concentrations for organics are normalized to TOC, and TOC content is typically correlated with fine particle distribution; therefore, it is important to have sediment TOC data for both comparisons to SQS and contaminant transport modeling. In Sinclair Inlet, TOC data are already available for all samples through the PSNS Operable Unit B (OUB) Marine Monitoring program. ENVVEST will measure TOC in all Dyes Inlet, Port Orchard Passage, and Rich Passage samples, and will confirm approximately 15% of the Sinclair Inlet samples.

Sample Collection

The samples for organics verification were all collected during the Metals Verification Study (August 2003) and OUB-Marine Monitoring Program (October 2003). Station location maps are provided in Attachment 1. Field sampling information is provided in the Metals Verification Study report (Kohn et al. 2004). Homogenized sediment samples have been archived frozen since collection.

Rapid Screening

Rapid screening analyses for PAHs and PCBs were conducted by the Navy's Space and Naval Warfare Systems Center (SPAWAR) in San Diego, CA. Both classes of analytes were screened using enzyme-linked immunosorbent assay (ELISA) methods. Sample aliquots for PCB screening were extracted with methanol and measured by immunoassay techniques using a modification of EPA Method 4020 (EPA, 1996). Sample aliquots for Total PAH screening were extracted with methanol and measured by immunoassay techniques using a modification of EPA Method 4035 (EPA, 1996). The screening methods report only total PCBs and total PAHs rather than individual constituents.

Confirmatory Sample Selection for Organics Analysis

The following information was used to inform sample selection for confirmatory organics analysis:

- Existing sediment PAH, PCB, and TOC data for Sinclair and Dyes Inlet extracted from the Washington State Department of Ecology (Ecology) SEDQUAL sediment quality database
- Reference TOC levels provided in the state SQS documentation
- Draft 2003 OUB-Marine Monitoring PCB and TOC data for Sinclair Inlet (provided in Attachment 1)
- PAH and PCB rapid screening results for all verification study samples (provided in Attachment 1)
- 1998 303(d) list of impacted waterbodies (specifically segments in Sinclair and Dyes Inlets)
- 2004 update to 303(d) list of impacted waterbodies which divides listed segments into categories depending on factors such as present level of site management and quantity of available data (http://www.ecy.wa.gov/programs/wq/303d/2002/contam_seds.html)
- Sampling design for Ecology's Ostrich Bay Sediment Toxicity Evaluation (Blakley 2004)

The primary organic contaminants of concern are PAHs and PCBs. However, a number of segments were assigned to Category 2 ("sample exceeds applicable sediment quality standard, but not the contaminated sediment level") for other semivolatile organics such as phthalates and chlorobenzenes. These analytes can be measured using the same methods as PAHs; therefore, any samples selected for quantitative PAH analysis will also be analyzed for phthalates and chlorobenzenes. Approximately 25% of archived Metals Verification Study samples for quantitative PAH and PCB analysis were selected independently (because sources, distribution, and fate are not necessarily similar) using the following criteria:

- Inside Sinclair Inlet, select at least 3 samples in segments listed for organics on either the 1998 303(d) list or the 2004 Category 5 or 4b lists; these are segments F6F3 (PCBs, PAH, chlorobenzene) and F6F4 (PAH, chlorobenzene).

- Outside Sinclair Inlet, select at least 1 sample in segments listed for organics on either the 1998 303(d) list or the 2004 Category 5 or 4b lists; these are segments F6I8 and F6J8 in Ostrich Bay (PAH, chlorobenzene). This lower density is justified because Ecology recently (Fall 2004, Blakley 2004) conducted a comprehensive sediment survey of Ostrich Bay in which data for all organic contaminants of concern will be measured at adequate density for 303(d) evaluation. Therefore, the ENVVEST study will simply provide additional recent data for Ostrich Bay as part of spatially distributed samples in Dyes Inlet and Port Orchard Passage.
- Select samples to represent areas where there appears to be potential for PAH or PCB to exceed SQS. This was done using the OUB-Marine monitoring data, rapid screening data, and measured or estimated TOC values (Attachment 1).
- Select at least 1 sample in segments on the 2004 Category 2 listed segments. These are segments in which organic analytes were measured and not detected, but the detection limit was higher than the SQS.
- Select additional samples to
    - represent distribution over range of screening values.
    - represent spatial distribution over range of sediment types throughout Sinclair Inlet, Dyes Inlet, Port Orchard Passage, and Rich Passage, to support contaminant transport modeling
    - provide quantitative data for samples with apparent discrepancies between screening and existing data (OUB-Marine samples only)

Because the screening methods only provide total PAH rather than individual constituent concentrations, they are limited in their application to state sediment quality standards, which exist for individual PAHs, total low molecular weight PAH (LPAH), and total high molecular weight PAH (HPAH). However, a conservative approach was taken by assuming the screening total PAH concentration was all LPAH or all HPAH. Because TOC data were not available for samples outside Sinclair inlet, further assumptions had to be made regarding TOC levels in order to calculate carbon-normalized values for comparison with SQS. Two approaches were used: the range of TOC values obtained from the SEDQUAL database for Sinclair and Dyes Inlet samples, and the reference TOC values provided in the Washington Administrative Code (WAC), which were developed through relationships between TOC and grain size distribution in a number of Puget Sound reference site sediments. In Attachment 1, screening PAH and PCB values were normalized to the following organic carbon values:

- WAC reference TOC, assigned to each sample based on its grain size distribution (% fines) as measured for ENVVEST by GeoSea (for 0-20% fines, reference TOC is 0.5%; for 20-50% fines, reference TOC is 1.7%; for 50-80% fines, reference TOC is 3.2%; and for 80-100% fines, reference TOC is 2.6%)
- 1% TOC: the 15th percentile of all SEDQUAL values for Sinclair and Dyes Inlet samples was 0.95% TOC, so 1% TOC was selected as a conservative estimator of TOC: 85% of samples would be expected to have more than 1% TOC and therefore less than the corresponding carbon-normalized PAH or PCB value
- Measured TOC from OUB-Marine Monitoring Program, 2003 (Sinclair Inlet samples only)

All estimates of carbon-normalized screening values are provided in Attachment 1. Values that exceed SQS or cleanup screening/minimum cleanup level (MCUL) are highlighted.

Samples selected for quantitative analysis for PAH, PCB, and TOC are listed in Table 1 and shown graphically in Figures 1 and 2. As noted earlier, all verification study samples collected outside of Sinclair Inlet will be analyzed for TOC, and approximately 15% of samples from inside Sinclair Inlet will be analyzed for TOC. The 15% confirmatory TOC samples from inside Sinclair Inlet consist of samples that are being analyzed for both PAH and PCB in this Organics Verification Study, and samples for which OUB-Marine Monitoring TOC results were different than what would be expected for the sample's grain size distribution (Table 1).

Analytical Methods and QC

Battelle MSL will perform clean-up procedures according to the low-level methods developed for the National Oceanic and Atmospheric Administration (NOAA) Status and Trends Program (Lauenstein and Castillo 1993). Analysis of organic analytes will be according to the MSL SOPs MSL-O-015 (Identification and Quantification of Polynuclear Aromatic Hydrocarbons by Gas Chromatography/Mass Spectrometry Following EPA Method 8270B Quality Control Criteria) and MSL-O-016 (Analysis of PCBs and Chlorinated Pesticides by Gas Chromatography with Electron Capture Detection Following EPA METHOD 8080A Quality Control Criteria). Both MSL methods are modifications of SW-846 EPA Methods 8270Band 8080A. Specific analytes and their respective detection and reporting limits are provided in Table 2. The following quality control samples will be analyzed with each batch of up to 20 samples: procedural blanks, analytical duplicate, matrix spike/matrix spike duplicate, laboratory control sample, and standard reference material (if available).

Data Analysis/Reporting

In quantitatively analyzed samples, sums of total PAH and PCBs will be calculated in the same manner as for SQS to facilitate comparison with SQS and MCUL. When there are both detected and undetected analytes, only the detected values are included in the sum. If all analytes are undetected, SQS uses the single highest detection limit to represent the sum. Results for Organics Verification Study confirmatory samples will be reported on a dry weight basis; measured TOC concentration will be used to calculate carbon-normalized PAH and PCB concentrations. Carbon-normalized concentrations will be tabulated and compared with SQS and MCUL. Results will be plotted, and samples that exceed SQS or MCUL will be clearly indicated on the plots.

The total PAH and PCB concentrations detected using quantitative techniques will be compared with the screening values detected in the same samples to determine whether there is a correlation between methods. If a strong relationship exists, it can be used to estimate total PAH and/or PCB concentrations in samples that were not quantitatively analyzed. Estimated PAH and PCB concentrations will be carbon-normalized, compared with SQS and MCUL, and plotted similarly to the quantitative results.

Table 1. Samples for Quantitative Analysis, ENVVEST Organics Verification Study

Station or OUB Grid	303(d) Segment	Quantitative Analysis			Selection Comments
		PCBs	PAHs[a]	TOC	
MVS-009		Y	Y	All non-OUB samples will get TOC	Spatial distribution, Dyes Inlet
MVS-011		No	Y		Spatial distribution, Dyes Inlet
MVS-034		Y	Y		Spatial distribution, Dyes Inlet
MVS-049		Y	Y		Spatial distribution, Port Orchard Passage
MVS-038	F5H8 (closest)	No	Y		
MVS-041	F6F1	Y	Y		Sand, low TOC
MVS-022	F6I8	No	No		
MVS-026	F6I8	No	Y		
MVS-028	F6I8	No	No		
MVS-019	F6J8	No	No		
MVS-023	F6J8	No	No		
MVS-024	F6J8	Y	Y		
MVS-025	F6J8	No	No		
MVS-001	G6A8 (closest?)	Y	Y		
MVS-020		No	Y		Spatial distribution, Dyes Inlet
OOUB-G1	F6C9	Y	Y	Y	Spatial distribution, Sinclair Inlet
OOUB-G9	F6D6	Y	Y	Y	Spatial distribution, Sinclair Inlet
OOUB-G21	F6E4	No	Y	No	
OOUB-G17	F6E5	Y	Y	Y	
OUBM-G1	F6E6	Y	No	No	High OUB-M PCB
OUBM-G66	F6F2	Y	Y	Y	Much higher screening PCB than OUB-M PCB
OUBM-G69	F6F2	Y	No	Y	OUB-M TOC higher than expected for grain size distribution
OOUB-G28	F6F2	Y	Y	Y	
OUBM-G61	F6F2, F6F3	Y	Y	Y	
OUBM-G52	F6F3	Y	No	No	
OUBM-G55	F6F3	Y	Y	Y	
OUBM-G56	F6F3	Y	Y	Y	
OUBM-G60	F6F3	Y	Y	Y	
OUBM-G63	F6F3	No	Y	Y	OUB-M TOC higher than expected for grain size distribution
OUBM-G64	F6F3	No	No	No	
OUBM-G34	F6F4	Y	Y	Y	
OUBM-G35	F6F4	Y	No	No	
OUBM-G41	F6F4	No	Y	No	
OUBM-G45	F6F4	Y	Y	Y	
OUBM-G46	F6F4	Y	No	No	
OUBM-G22	F6F5	Y	No	No	
OUBM-G25	F6F5	Y	No	No	
OUBM-G39	F6F5	Y	Y	Y	
OUBM-G71	F6G2	No	Y	Y	OUB-M TOC lower than expected for grain size distribution
TOTAL		**25**	**26**	**15**	

a. PAH analysis will include selected phthalates and chlorobenzenes.

Table 2. Detection and Reporting Limits for Organic Analytes, ENVVEST Organics Verification Study

Analytes	Laboratory Values for Sediment Analysis	
	Method Detection Limit (µg/kg dry wt)	Reporting Limit (µg/kg dry wt)
PAHs		
Naphthalene	0.28	4
2-Methyl naphthalene	0.54	4
Acenaphthylene	0.45	4
Acenaphthene	0.43	4
Fluorene	0.54	4
Phenanthrene	0.70	4
Anthracene	0.76	4
Fluoranthene	0.62	4
Pyrene	0.60	4
Benzo(a)anthracene	0.55	4
Chrysene	0.66	4
Benzo(a)pyrene	0.81	4
Total Benzofluoranthenes	NA[a]	NA
Indeno(1,2,3-c,d)pyrene	1.05	4
Dibenz(a,h)anthracene	0.80	4
Benzo(g,h,i)perylene	0.89	4
Other Semivolatile Organics		
Di-n-butyl Phthalate	NA	8
Butylbenzyl Phthalate	NA	8
Bis (2-ethylhexyl) Phthalate	NA	8
1,2-Dichlorobenzene[b]	NA	4
1,4-Dichlorobenzene[b]	NA	4
1,2,4-Trichlorobenzene[b]	NA	4
Hexachlorobenzene[b]	NA	4
PCBs		
PCB Congeners (NOAA NS&T 20 congeners)	0.075	0.4
Aroclor 1268	1.5	8

a. Traditionally analyzed via GC/MS (MSL-O-015). However, if more sensitivity is necessary, ECD analysis (MSL-O-016) should be performed.
b. NA Not available/not applicable.

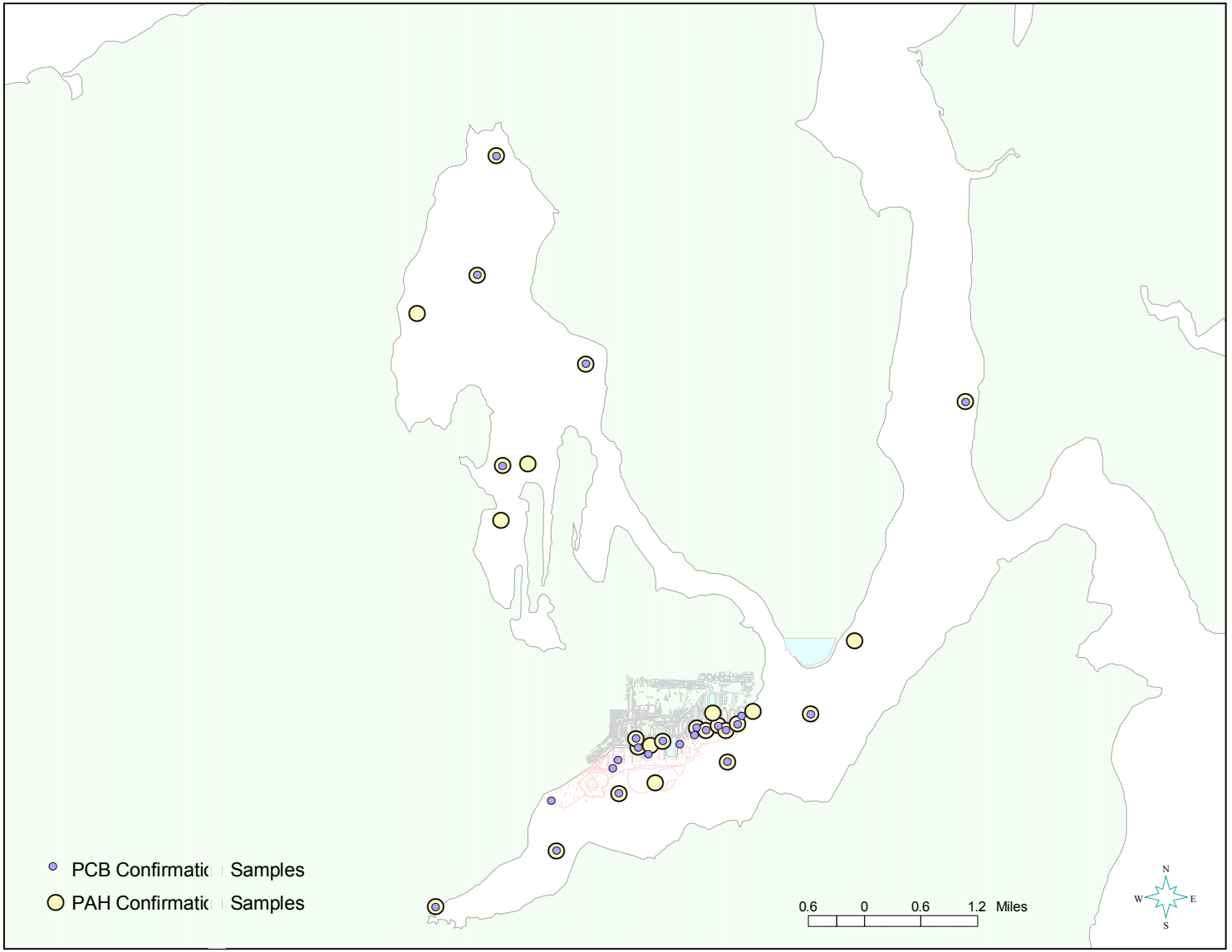

Figure 1. Sinclair Inlet, Dyes Inlet, and Port Orchard Passage Stations Selected for Quantitative PCB and PAH Analysis

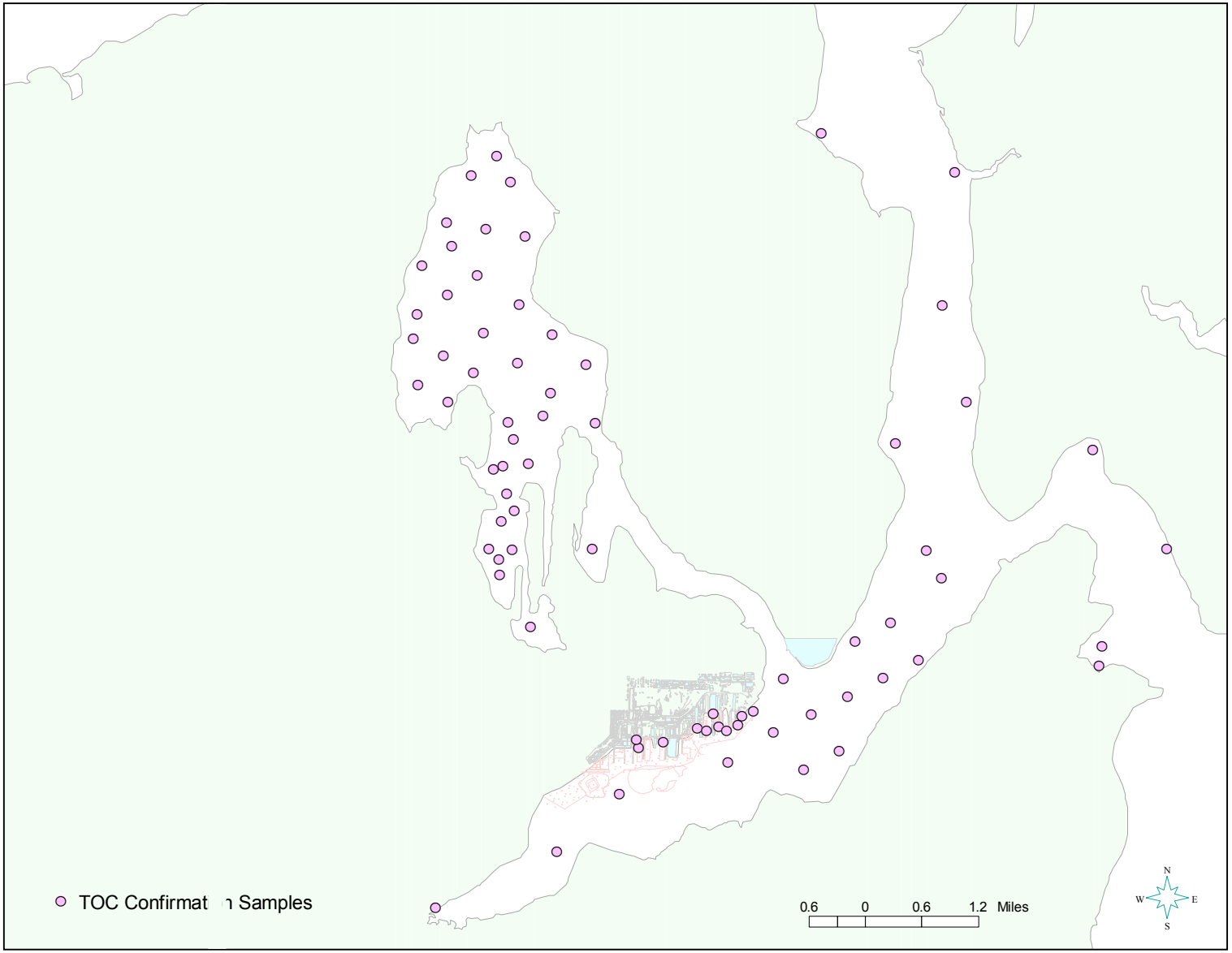

Figure 2. Sinclair Inlet, Dyes Inlet, and Port Orchard Passage Stations Selected for TOC Analysis

References

Blakley, N. 2004. Quality Assurance Project Plan, Ostrich Bay Sediment Toxicity Evaluation. Publication Number 04-03-117. Washington State Department of Ecology, Environmental Assessment Program, Olympia, Washington. http://www.ecy.wa.gov/biblio/0403117.html

EPA. U.S. Environmental Protection Agency. 1996. Test Methods for Evaluating Solid Waste (SW846 Chapter 4.4).

Kohn, N. P., M.C. Miller, H. L. Diefenderfer, R.K. Johnston, G. M. Sherrell, and B. Beckwith. 2003. Sampling and Analysis Plan, Metals Verification Study for Sinclair and Dyes Inlets, Washington. Prepared for Puget Sound Naval Shipyard Project ENVVEST. Pacific Northwest National Laboratory, Richland, WA.

Kohn, N. P., M.C. Miller, J.M. Brandenberger, and R.K. Johnston. 2004. Metals Verification Study for Sinclair and Dyes Inlets, Washington . PNNL-14872. Pacific Northwest National Laboratory, Richland, WA.

Lauenstein, G.G. and A.Y. Cantillo, ed. 1993. Sampling Analytical Methods of the National Status and Trends Program National Benthic Surveillance and Mussel Watch Projects 1984 – 1992; Volume IV: Comprehensive Descriptions of Trace Organic Analytical Methods. NOAA Technical memorandum NOS ORCA 71, Silver Spring, MD

ATTACHMENT A

Verification Study Sample Location Maps, PAH and PCB Rapid Screening Results, Estimates of Carbon-Normalized Concentrations, and Comparisons to SQS

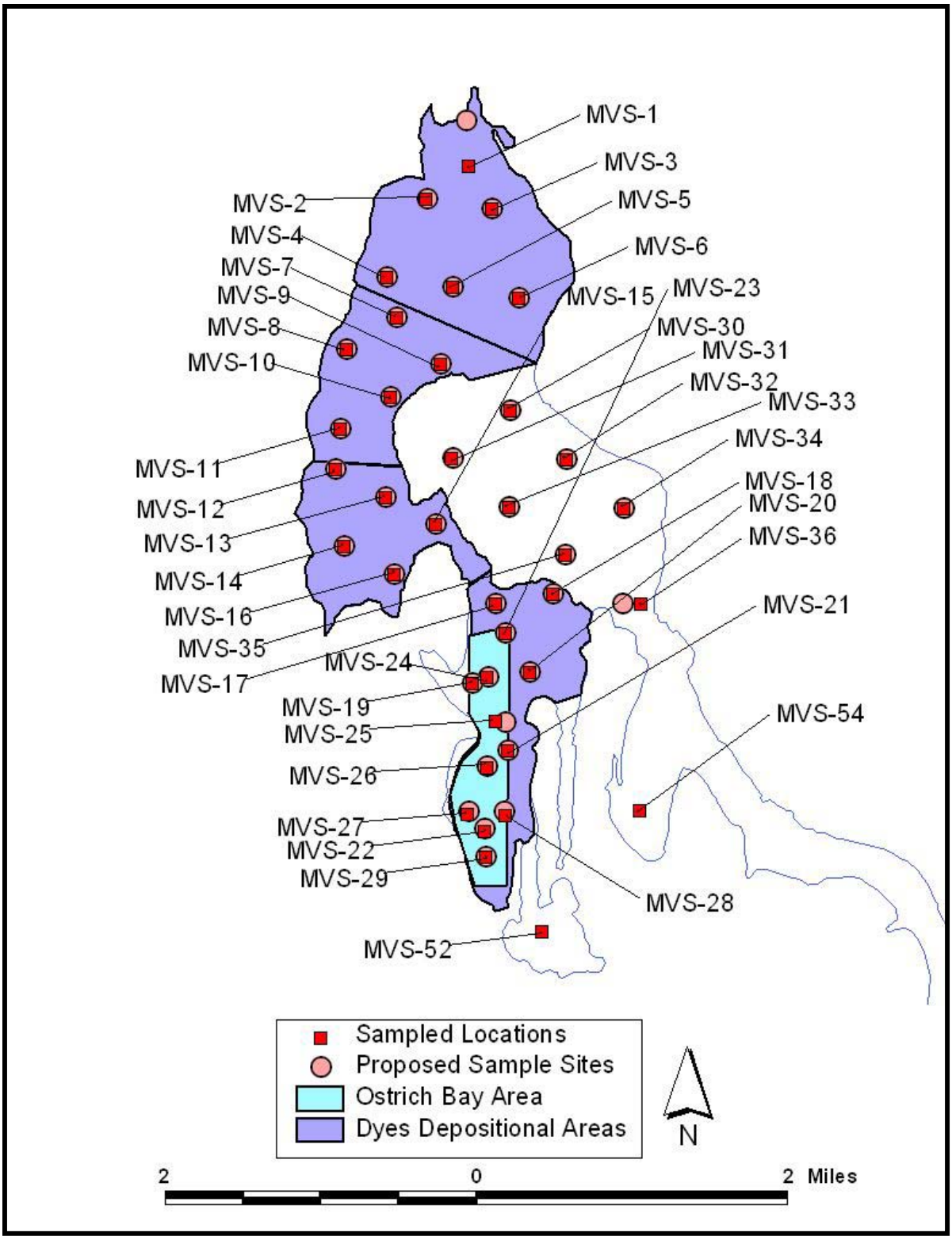

Figure A1-1. Metals Verification Study Stations Sampled in Dyes Inlet, Including Ostrich Bay

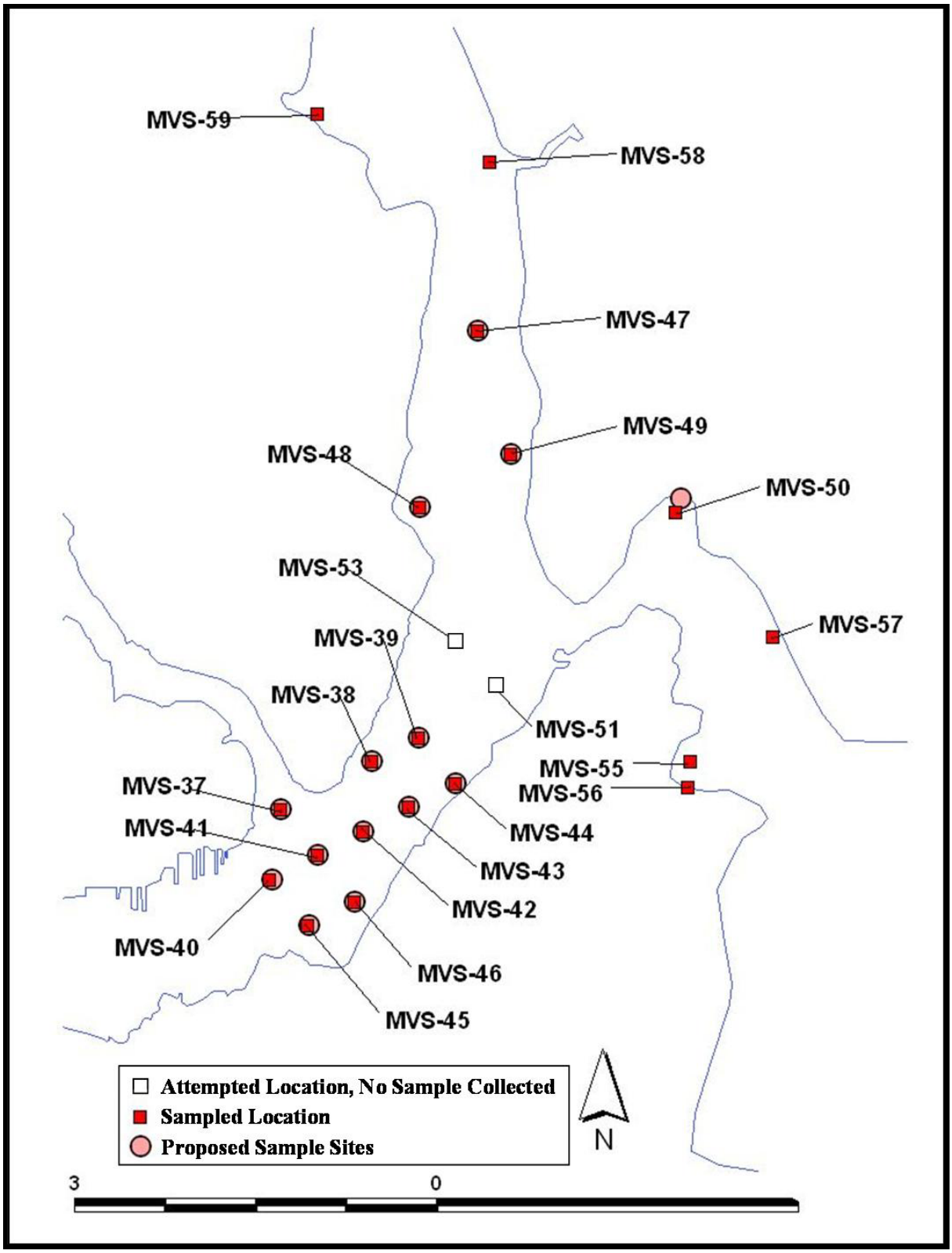

Figure A1-2. Metals Verification Study Stations Sampled in Port Orchard Passage and Rich Passage

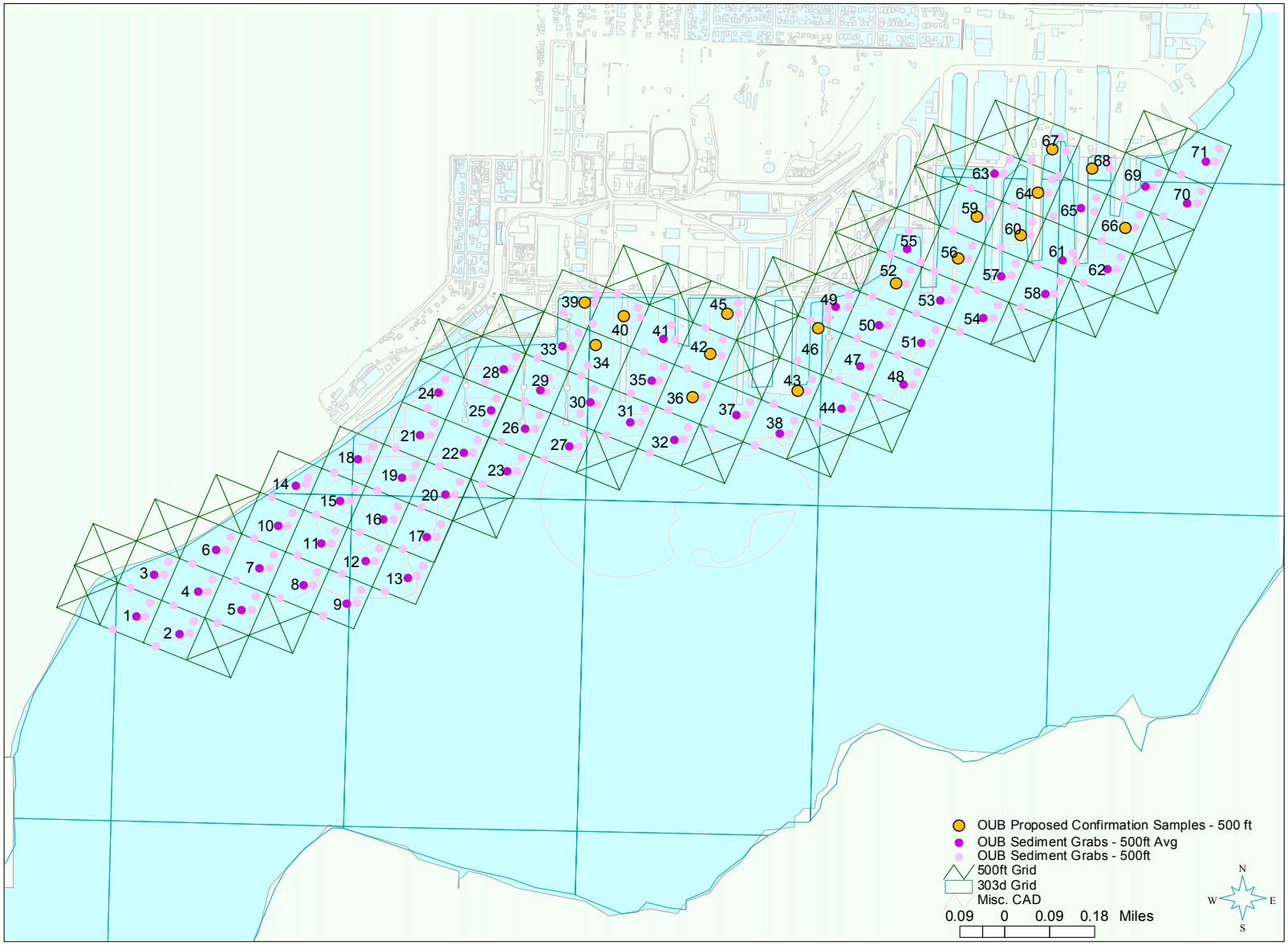

Figure A1-3. OU B Marine monitoring stations in 500-ft grid within OU B Marine boundary (OUBM)

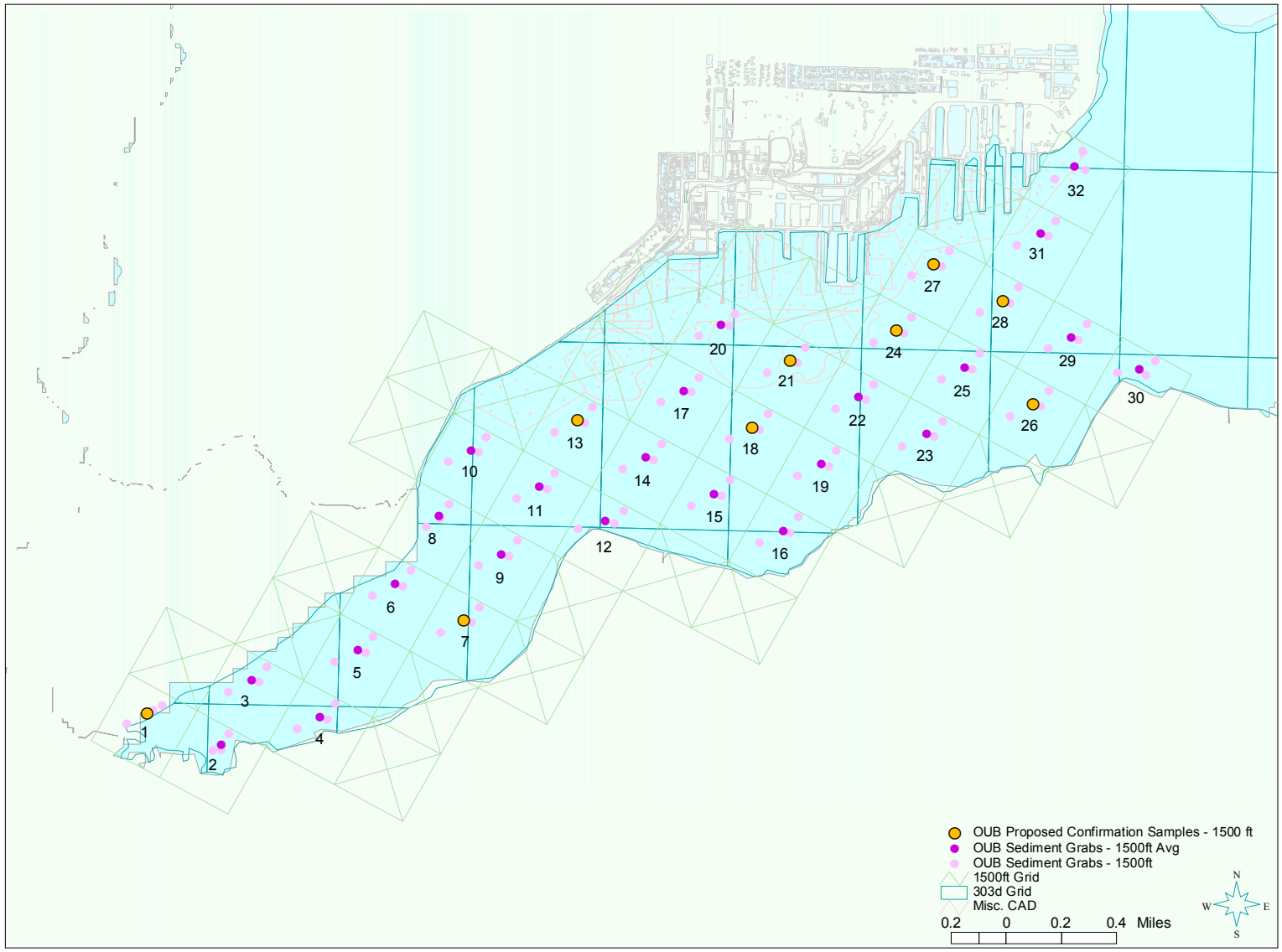

Figure A1-4. OU B Marine monitoring stations in 1500-ft grid outside OU B Marine boundary (OOUB)

Table A-1. PAH Rapid Screening Results, Estimated Carbon-Normalized Concentrations, and Comparison to SQS

Station or OUB Grid	Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
	PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
							LPAH	HPAH	
						SQS	370 ppm OC	960 ppm OC	
						90% SQS	333 ppm OC	864 ppm OC	
						SQS-SIZ	780 ppm OC	5300 ppm OC	
MVS-001	2066	2.07		NA[c]	3.2	65	NA	207	Y
MVS-002	1054	1.05	J	NA	1.7	62	NA	105	
MVS-003	2252	2.25		NA	2.6	87	NA	225	
MVS-004	2577	2.58		NA	2.6	99	NA	258	
MVS-005	2430	2.43		NA	2.6	93	NA	243	
MVS-006	1089	1.09	J	NA	1.7	64	NA	109	
MVS-007	3158	3.16		NA	2.6	121	NA	316	
MVS-008	2362	2.36		NA	3.2	74	NA	236	
MVS-009	3354	3.35		NA	3.2	105	NA	335	Y
MVS-010	3683	3.68		NA	3.2	115	NA	368	
MVS-011	3934	3.93		NA	3.2	123	NA	393	Y
MVS-012	2766	2.77		NA	3.2	86	NA	277	
MVS-013	3847	3.85		NA	3.2	120	NA	385	
MVS-014	1178	1.18	J	NA	1.7	69	NA	118	
MVS-015	823	0.82	U	NA	0.5	165	NA	82	
MVS-016	1559	1.56	J	NA	3.2	49	NA	156	
MVS-017	3197	3.20		NA	3.2	100	NA	320	
MVS-018	4372	4.37		NA	3.2	137	NA	437	
MVS-019	1216	1.22	J	NA	1.7	72	NA	122	
MVS-020	2488	2.49		NA	2.6	96	NA	249	Y
MVS-021	2026	2.03		NA	3.2	63	NA	203	
MVS-022	2205	2.21		NA	2.6	85	NA	221	
MVS-023	2921	2.92		NA	3.2	91	NA	292	
MVS-024	2173	2.17		NA	3.2	68	NA	217	Y

Table A-1. PAH Screening Results (continued)

Station or OUB Grid	Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
	PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
MVS-025	1901	1.90	J	NA	2.6	73	NA	190	
MVS-026	1958	1.96	J	NA	3.2	61	NA	196	Y
MVS-027	1895	1.89	J	NA	3.2	59	NA	189	
MVS-028	871	0.87	U	NA	0.5	174	NA	87	
MVS-029	1784	1.78	J	NA	2.6	69	NA	178	
MVS-030	745	0.74	U	NA	0.5	149	NA	74	
MVS-031	1196	1.20	J	NA	1.7	70	NA	120	
MVS-032	873	0.87	U	NA	0.5	175	NA	87	
MVS-033	2723	2.72		NA	1.7	160	NA	272	
MVS-034	1069	1.07	J	NA	0.5	214	NA	107	Y
MVS-035	930	0.93	U	NA	0.5	186	NA	93	
MVS-036	863	0.86	U	NA	0.5	173	NA	86	
MVS-037	946	0.95	U	NA	0.5	189	NA	95	
MVS-038	877	0.88	U	NA	0.5	175	NA	88	Y
MVS-039	764	0.76	U	NA	0.5	153	NA	76	
MVS-040	2214	2.21		NA	1.7	130	NA	221	
MVS-041	1587	1.59	J	NA	0.5	317	NA	159	Y
MVS-042	2034	2.03		NA	1.7	120	NA	203	
MVS-043	900	0.90	U	NA	0.5	180	NA	90	
MVS-044	997	1.00	U	NA	0.5	199	NA	100	
MVS-045	2101	2.10		NA	1.7	124	NA	210	
MVS-046	1937	1.94	J	NA	1.7	114	NA	194	
MVS-047	2205	2.20		NA	3.2	69	NA	220	
MVS-048	1449	1.45	J	NA	1.7	85	NA	145	
MVS-049	2812	2.81		NA	3.2	88	NA	281	Y
MVS-050	701	0.70	U	NA	0.5	140	NA	70	
MVS-052	2131	2.13		NA	3.2	67	NA	213	
MVS-054	2614	2.61		NA	1.7	154	NA	261	
MVS-055	724	0.72	U	NA	0.5	145	NA	72	
MVS-056	500	0.50	U	NA	0.5	100	NA	50	
MVS-057	500	0.50	U	NA	0.5	100	NA	50	
MVS-058	500	0.50	U	NA	0.5	100	NA	50	

Table A-1. PAH Screening Results (continued)

Station or OUB Grid		Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
		PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
MVS-059		500	0.50	U	NA	1.7	29	NA	50	
OUBM-G	01	3054	3.05		2.9	3.2	95	105	305	
OUBM-G	02	2339	2.34		3.1	2.6	90	76	234	
OUBM-G	03	1894	1.89	J	1.6	3.2	59	120	189	
OUBM-G	04	2301	2.30		2.8	2.6	88	81	230	
OUBM-G	05	3497	3.50		2.7	2.6	135	128	350	
OUBM-G	06	1969	1.97	J	2.5	2.6	76	78	197	
OUBM-G	07	2267	2.27		2.5	2.6	87	91	227	
OUBM-G	08	1892	1.89	J	2.4	2.6	73	80	189	
OUBM-G	09	2537	2.54		2.7	2.6	98	95	254	
OUBM-G	10	1747	1.75	J	1.2	3.2	55	142	175	
OUBM-G	11	1984	1.98	J	2.2	2.6	76	89	198	
OUBM-G	12	1842	1.84	J	3.1	2.6	71	60	184	
OUBM-G	13	1878	1.88	J	3.1	2.6	72	61	188	
OUBM-G	14	2177	2.18		1.3	1.7	128	173	218	
OUBM-G	15	1420	1.42	J	2.2	2.6	55	65	142	
OUBM-G	16	1813	1.81	J	2.3	2.6	70	78	181	
OUBM-G	17	2512	2.51		2.6	2.6	97	96	251	
OUBM-G	18	2206	2.21		2.5	3.2	69	88	221	
OUBM-G	19	1572	1.57	J	2.1	3.2	49	76	157	
OUBM-G	20	2409	2.41		2.5	2.6	93	96	241	
OUBM-G	21	2077	2.08		1.7	3.2	65	125	208	
OUBM-G	22	1930	1.93		2.8	2.6	74	70	193	
OUBM-G	23	3007	3.01		2.7	2.6	116	113	301	
OUBM-G	24	2837	2.84		2.7	2.6	109	104	284	
OUBM-G	25	2646	2.65		2.7	3.2	83	97	265	
OUBM-G	26	2557	2.56		2.7	3.2	80	95	256	
OUBM-G	27	2058	2.06		2.9	2.6	79	71	206	
OUBM-G	28	3260	3.26		2.0	3.2	102	165	326	
OUBM-G	29	2613	2.61		3.4	3.2	82	78	261	
OUBM-G	30	3355	3.35		3.0	3.2	105	112	335	
OUBM-G	31	2278	2.28		2.9	2.6	88	79	228	

Table A-1. PAH Screening Results (continued)

Station or OUB Grid		Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
		PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
OUBM-G	32	2594	2.59		2.7	2.6	100	98	259	
OUBM-G	33	3464	3.46		3.1	3.2	108	111	346	
OUBM-G	34	4417	4.42		2.3	3.2	138	190	442	Y
OUBM-G	35	3694	3.69		2.7	3.2	115	135	369	
OUBM-G	36	2504	2.50		2.9	3.2	78	86	250	
OUBM-G	37	5176	5.18		2.8	3.2	162	188	518	
OUBM-G	38	2083	2.08		2.3	3.2	65	91	208	
OUBM-G	39	**43927**	**43.9**		1.8	1.7	2584	2440	4393	Y
OUBM-G	40	3261	3.26		2.5	3.2	102	133	326	
OUBM-G	41	5300	5.30		2.6	3.2	166	204	530	
OUBM-G	42	2696	2.70		2.6	2.6	104	105	270	
OUBM-G	43	2459	2.46		3.5	3.2	77	70	246	
OUBM-G	44	2432	2.43		2.8	3.2	76	87	243	
OUBM-G	45	**22583**	**22.6**		3.0	3.2	706	750	2258	Y
OUBM-G	46	2123	2.12		1.2	1.7	125	173	212	
OUBM-G	47	2307	2.31		2.2	3.2	72	104	231	
OUBM-G	48	2326	2.33		3.0	2.6	89	79	233	
OUBM-G	49	7236	7.24		2.6	3.2	226	284	724	
OUBM-G	50	2719	2.72		2.6	3.2	85	105	272	
OUBM-G	51	3190	3.19		3.3	2.6	123	96	319	
OUBM-G	52	7098	7.10		2.5	3.2	222	283	710	
OUBM-G	53	2776	2.78		2.5	3.2	87	111	278	
OUBM-G	54	2597	2.60		3.3	3.2	81	78	260	
OUBM-G	55	**20968**	**21.0**		2.1	3.2	655	994	2097	Y
OUBM-G	56	7331	7.33		3.2	3.2	229	229	733	Y
OUBM-G	57	2733	2.73		5.1	3.2	85	54	273	
OUBM-G	58	3673	3.67		2.9	3.2	115	126	367	
OUBM-G	59	4143	4.14		3.6	3.2	129	115	414	
OUBM-G	60	**28403**	**28.4**		3.1	3.2	888	905	2840	Y
OUBM-G	61	**14017**	**14.0**		1.9	1.7	825	758	1402	Y
OUBM-G	62	4237	4.24		3.1	3.2	132	138	424	
OUBM-G	63	**19148**	**19.1**		5.0	3.2	598	386	1915	Y

Table A-1. PAH Screening Results (continued)

Station or OUB Grid		Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
		PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
OUBM-G	64	7382	7.38		3.6	3.2	231	207		
OUBM-G	65	3123	3.12		2.7	3.2	98	117	312	
OUBM-G	66	7825	7.83		3.3	3.2	245	239	783	Y
OUBM-G	67	7180	7.18		4.5	3.2	224	158	718	
OUBM-G	68	3552	3.55		2.8	3.2	111	129	355	
OUBM-G	69	5193	5.19		2.4	1.7	305	216	519	
OUBM-G	70	2792	2.79		2.6	3.2	87	106	279	
OUBM-G	71	1974	1.97	J	0.9	1.7	116	232	197	Y
OOUB-G	01	1220	1.22	J	1.3	1.7	72	94	122	Y
OOUB-G	02	897	0.90	U	0.9	1.7	53	104	90	
OOUB-G	03	1159	1.16	J	1.6	1.7	68	73	116	
OOUB-G	04	997	1.00	U	0.9	1.7	59	106	100	
OOUB-G	05	1620	1.62	J	2.8	3.2	51	58	162	
OOUB-G	06	2998	3.00		3.6	2.6	115	84	300	
OOUB-G	07	2003	2.00		4.1	3.2	63	49	200	
OOUB-G	08	1970	1.97	J	3.6	2.6	76	55	197	
OOUB-G	09	2896	2.90		3.8	3.2	90	77	290	Y
OOUB-G	10	2346	2.35		3.4	2.6	90	70	235	
OOUB-G	11	2535	2.53		3.5	2.6	97	73	253	
OOUB-G	12	1145	1.14	J	0.8	1.7	67	149	114	
OOUB-G	13	2541	2.54		3.0	2.6	98	84	254	
OOUB-G	14	1904	1.90	J	3.6	2.6	73	54	190	
OOUB-G	15	2824	2.82		3.3	3.2	88	87	282	
OOUB-G	16	3946	3.95		3.6	3.2	123	109	395	
OOUB-G	17	2849	2.85		3.2	2.6	110	90	285	Y
OOUB-G	18	2167	2.17		3.2	2.6	83	67	217	
OOUB-G	19	2258	2.26		3.0	2.6	87	75	226	
OOUB-G	20	2030	2.03		2.8	2.6	78	73	203	
OOUB-G	21	2315	2.31		2.6	3.2	72	88	231	Y
OOUB-G	22	1845	1.85	J	2.7	3.2	58	68	185	
OOUB-G	23	2350	2.35		2.4	3.2	73	98	235	
OOUB-G	24	2282	2.28		2.7	3.2	71	85	228	

Table A-1. PAH Screening Results (continued)

Station or OUB Grid		Total PAH Rapid Screening Result			TOC Values (% dry wt)		Carbon-Normalized Total PAH Estimates (ppm OC)			Select for Quantitative?
		PAH ppb	PAH ppm	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC	
OOUB-G	25	2197	2.20		1.6	3.2	69	135	220	
OOUB-G	26	929	0.93	U	0.5	0.5	186	172	93	
OOUB-G	27	1960	1.96	J	3.5	3.2	61	56	196	
OOUB-G	28	2321	2.32		2.5	3.2	73	94	232	Y
OOUB-G	29	2014	2.01		1.5	3.2	63	133	201	
OOUB-G	30	845	0.84	U	0.4	0.5	169	241	84	
OOUB-G	31	2510	2.51		2.4	3.2	78	104	251	
OOUB-G	32	2228	2.23		1.4	1.7	131	155	223	

a. Washington Administrative Code Reference TOC values based on grain size distribution are as follows:

% Fines	% TOC
0-20	0.5
20-50	1.7
50-80	3.2
80-100	2.6

b. Qualifier codes: U = None-Detect, J = Estimated, E = Outside Linear Range

c. NA Not available/not applicable.

Table A-2. PCB Rapid Screening Results, Estimated Carbon-Normalized Concentrations, and Comparison to SQS

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
						90% SQS	10.8 ppm OC		
						SQS	12 ppm OC		
						SQS-SIZ	65 ppm OC		
MVS-001	53	U	NA[c]	3.2	2	NA	5	NA	Y
MVS-002	30	U	NA	1.7	2	NA	3	NA	
MVS-003	79	U	NA	2.6	3	NA	8	NA	
MVS-004	70	U	NA	2.6	3	NA	7	NA	
MVS-005	69	U	NA	2.6	3	NA	7	NA	
MVS-006	40	U	NA	1.7	2	NA	4	NA	
MVS-007	82	U	NA	2.6	3	NA	8	NA	
MVS-008	44	U	NA	3.2	1	NA	4	NA	
MVS-009	76	U	NA	3.2	2	NA	8	NA	Y
MVS-010	55	U	NA	3.2	2	NA	6	NA	
MVS-011	67	U	NA	3.2	2	NA	7	NA	
MVS-012	79	U	NA	3.2	2	NA	8	NA	
MVS-013	64	U	NA	3.2	2	NA	6	NA	
MVS-014	38	U	NA	1.7	2	NA	4	NA	
MVS-015	29	U	NA	0.5	6	NA	3	NA	
MVS-016	45	U	NA	3.2	1	NA	5	NA	
MVS-017	73	U	NA	3.2	2	NA	7	NA	
MVS-018	79	U	NA	3.2	2	NA	8	NA	
MVS-019	43	U	NA	1.7	3	NA	4	NA	
MVS-020	78	U	NA	2.6	3	NA	8	NA	
MVS-021	48	U	NA	3.2	1	NA	5	NA	
MVS-022	62	U	NA	2.6	2	NA	6	NA	
MVS-023	63	U	NA	3.2	2	NA	6	NA	

Table A-2. PCB Screening Results (continued)

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
MVS-024	64	U	NA	3.2	2	NA	6	NA	Y
MVS-025	60	U	NA	2.6	2	NA	6	NA	
MVS-026	35	U	NA	3.2	1	NA	3	NA	
MVS-027	43	U	NA	3.2	1	NA	4	NA	
MVS-028	19	U	NA	0.5	4	NA	2	NA	
MVS-029	52	U	NA	2.6	2	NA	5	NA	
MVS-030	9	U	NA	0.5	2	NA	1	NA	
MVS-031	38	U	NA	1.7	2	NA	4	NA	
MVS-032	19	U	NA	0.5	4	NA	2	NA	
MVS-033	69	U	NA	1.7	4	NA	7	NA	
MVS-034	17	U	NA	0.5	3	NA	2	NA	Y
MVS-035	20	U	NA	0.5	4	NA	2	NA	
MVS-036	22	U	NA	0.5	4	NA	2	NA	
MVS-037	40	U	NA	0.5	8	NA	4	NA	
MVS-038	23	U	NA	0.5	5	NA	2	NA	
MVS-039	18	U	NA	0.5	4	NA	2	NA	
MVS-040	36	U	NA	1.7	2	NA	4	NA	
MVS-041	71	U	NA	0.5	14	NA	7	NA	Y
MVS-042	65	U	NA	1.7	4	NA	7	NA	
MVS-043	28	U	NA	0.5	6	NA	3	NA	
MVS-044	43	U	NA	0.5	9	NA	4	NA	
MVS-045	82	U	NA	1.7	5	NA	8	NA	
MVS-046	69	U	NA	1.7	4	NA	7	NA	
MVS-047	87	U	NA	3.2	3	NA	9	NA	
MVS-048	46	U	NA	1.7	3	NA	5	NA	
MVS-049	92	U	NA	3.2	3	NA	9	NA	Y
MVS-050	11	U	NA	0.5	2	NA	1	NA	
MVS-052	84	U	NA	3.2	3	NA	8	NA	
MVS-054	46	U	NA	1.7	3	NA	5	NA	
MVS-055	24	U	NA	0.5	5	NA	2	NA	
MVS-056	39	U	NA	0.5	8	NA	4	NA	

Table A-2. PCB Screening Results (continued)

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
MVS-057	49	U	NA	0.5	10	NA	5	NA	
MVS-058	34	U	NA	0.5	7	NA	3	NA	
MVS-059	58	U	NA	1.7	3	NA	6	NA	
OUBM-G 01	201		2.9	3.2	6	7	20	101	Y
OUBM-G 02	133	J	3.1	2.6	5	4	13	2	
OUBM-G 03	73	U	1.6	3.2	2	5	7	7	
OUBM-G 04	102	J	2.8	2.6	4	4	10	2	
OUBM-G 05	142	J	2.7	2.6	5	5	14	3	
OUBM-G 06	85	U	2.5	2.6	3	3	9	4	
OUBM-G 07	83	U	2.5	2.6	3	3	8	3	
OUBM-G 08	132	J	2.4	2.6	5	6	13	6	
OUBM-G 09	110	J	2.7	2.6	4	4	11	4	
OUBM-G 10	57	U	1.2	3.2	2	5	6	6	
OUBM-G 11	120	J	2.2	2.6	5	5	12	6	
OUBM-G 12	123	J	3.1	2.6	5	4	12	3	
OUBM-G 13	147	J	3.1	2.6	6	5	15	8	
OUBM-G 14	93	U	1.3	1.7	5	7	9	10	
OUBM-G 15	72	U	2.2	2.6	3	3	7	4	
OUBM-G 16	103	J	2.3	2.6	4	4	10	6	
OUBM-G 17	160	J	2.6	2.6	6	6	16	6	
OUBM-G 18	115	J	2.5	3.2	4	5	12	4	
OUBM-G 19	99	U	2.1	3.2	3	5	10	9	
OUBM-G 20	131	J	2.5	2.6	5	5	13	7	
OUBM-G 21	56	U	1.7	3.2	2	3	6	9	
OUBM-G 22	172	J	2.8	2.6	7	6	17	7	Y
OUBM-G 23	138	J	2.7	2.6	5	5	14	10	
OUBM-G 24	124	J	2.7	2.6	5	5	12	14	
OUBM-G 25	177		2.7	3.2	6	6	18	21	Y
OUBM-G 26	99	U	2.7	3.2	3	4	10	10	
OUBM-G 27	122	J	2.9	2.6	5	4	12	10	
OUBM-G 28	189		2.0	3.2	6	10	19	12	

Table A-2. PCB Screening Results (continued)

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
OUBM-G 29	120	J	3.4	3.2	4	4	12	10	
OUBM-G 30	214		3.0	3.2	7	7	21	12	
OUBM-G 31	128	J	2.9	2.6	5	4	13	7	
OUBM-G 32	161	J	2.7	2.6	6	6	16	6	
OUBM-G 33	129	U	3.1	3.2	4	4	13	19	
OUBM-G 34	388		2.3	3.2	12	17	39	31	Y
OUBM-G 35	325		2.7	3.2	10.1	12	32	8	Y
OUBM-G 36	98	U	2.9	3.2	3	3	10	9	
OUBM-G 37	232		2.8	3.2	7	8	23	8	
OUBM-G 38	60	U	2.3	3.2	2	3	6	9	
OUBM-G 39	313		1.8	1.7	18	17	31	23	Y
OUBM-G 40	298		2.5	3.2	9	12	30	26	
OUBM-G 41	212		2.6	3.2	7	8	21	11	
OUBM-G 42	143	J	2.6	2.6	5	6	14	11	
OUBM-G 43	83	U	3.5	3.2	3	2	8	5	
OUBM-G 44	99	U	2.8	3.2	3	4	10	5	
OUBM-G 45	260		3.0	3.2	8	9	26	8	Y
OUBM-G 46	230		1.2	1.7	14	19	23	43	Y
OUBM-G 47	68	U	2.2	3.2	2	3	7	7	
OUBM-G 48	78	U	3.0	2.6	3	3	8	4	
OUBM-G 49	256		2.6	3.2	8	10	26	32	
OUBM-G 50	106	J	2.6	3.2	3	4	11	7	
OUBM-G 51	81	U	3.3	2.6	3	2	8	4	
OUBM-G 52	215		2.5	3.2	7	9	21	29	Y
OUBM-G 53	304		2.5	3.2	9	12	30	10	Y
OUBM-G 54	82	U	3.3	3.2	3	2	8	6	
OUBM-G 55	264		2.1	3.2	8	13	26	17	Y
OUBM-G 56	290		3.2	3.2	9	9	29	20	Y
OUBM-G 57	139	J	5.1	3.2	4	3	14	7	
OUBM-G 58	153	J	2.9	3.2	5	5	15	6	
OUBM-G 59	169	J	3.6	3.2	5	5	17	10	

Table A-2. PCB Screening Results (continued)

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
OUBM-G 60	281		3.1	3.2	9	9	28	14	Y
OUBM-G 61	224		1.9	1.7	13	12	22	12	Y
OUBM-G 62	183		3.1	3.2	6	6	18	7	
OUBM-G 63	173	J	5.0	3.2	5	3	17	21	
OUBM-G 64	301		3.6	3.2	9	8	30	16	
OUBM-G 65	169	J	2.7	3.2	5	6	17	15	
OUBM-G 66	12965		3.3	3.2	405	396	1297	12	Y
OUBM-G 67	245		4.5	3.2	8	5	24	11	
OUBM-G 68	111	J	2.8	3.2	3	4	11	17	
OUBM-G 69	173	J	2.4	1.7	10.2	7	17	8	Y
OUBM-G 70	103	J	2.6	3.2	3	4	10	2	
OUBM-G 71	89	U	0.9	1.7	5	10	9	5	
OOUB-G 01	287		1.3	1.7	17	22	29	19	Y
OOUB-G 02	32	U	0.9	1.7	2	4	3	5	
OOUB-G 03	33	U	1.6	1.7	2	2	3	6	
OOUB-G 04	28	U	0.9	1.7	2	3	3	3	
OOUB-G 05	66	U	2.8	3.2	2	2	7	4	
OOUB-G 06	147	J	3.6	2.6	6	4	15	5	
OOUB-G 07	96	U	4.1	3.2	3	2	10	6	
OOUB-G 08	93	U	3.6	2.6	4	3	9	4	
OOUB-G 09	100	J	3.8	3.2	3	3	10	5	Y
OOUB-G 10	139	J	3.4	2.6	5	4	14	7	
OOUB-G 11	131	J	3.5	2.6	5	4	13	7	
OOUB-G 12	40	U	0.8	1.7	2	5	4	6	
OOUB-G 13	142	J	3.0	2.6	5	5	14	7	
OOUB-G 14	104	J	3.6	2.6	4	3	10	6	
OOUB-G 15	141	J	3.3	3.2	4	4	14	5	
OOUB-G 16	142	J	3.6	3.2	4	4	14	14	
OOUB-G 17	145	J	3.2	2.6	6	5	14	12	Y
OOUB-G 18	99	U	3.2	2.6	4	3	10	7	
OOUB-G 19	77	U	3.0	2.6	3	3	8	21	

Table A-2. PCB Screening Results (continued)

Station or OUB Grid	Total PCB Rapid Screening Result		TOC Values (% dry wt)		Carbon-Normalized Total PCB Estimates (ppm OC)			Sinclair Inlet OUB-Marine PCB (ppm OC)	Select for Quantitative?
	PCB (mg/Kg)	Q[b]	OUB-Marine Monitoring	WAC[a] Reference	Using WAC TOC	Using OUB TOC	Using 1% TOC		
OOUB-G 20	82	U	2.8	2.6	3	3	8	6	
OOUB-G 21	96	U	2.6	3.2	3	4	10	10	
OOUB-G 22	58	U	2.7	3.2	2	2	6	7	
OOUB-G 23	77	U	2.4	3.2	2	3	8	6	
OOUB-G 24	76	U	2.7	3.2	2	3	8	6	
OOUB-G 25	55	U	1.6	3.2	2	3	6	7	
OOUB-G 26	12	U	0.5	0.5	2	2	1	4	
OOUB-G 27	56	U	3.5	3.2	2	2	6	6	
OOUB-G 28	77	U	2.5	3.2	2	3	8	5	Y
OOUB-G 29	48	U	1.5	3.2	2	3	5	9	
OOUB-G 30	22	U	0.4	0.5	4	6	2	6	
OOUB-G 31	65	U	2.4	3.2	2	3	6	10	
OOUB-G 32	65	U	1.4	1.7	4	5	6	7	

a. Washington Administrative Code Reference TOC values based on grain size distribution are as follows:

% Fines	% TOC
0-20	0.5
20-50	1.7
50-80	3.2
80-100	2.6

b. Qualifier codes: U = None-Detect, J = Estimated, E = Outside Linear Range

c. NA Not available/not applicable.

Response to Comments Received from Nigel Blakely (Ecology) on Organics Verification Study Plan (Received 31 JAN 2005).

Comment	Response
This document is timely, since I have recently been reviewing results from a similar type of study, involving analysis of sediments with an ELISA method (EPA Method 4025, for 2378-TCDD TEQ), with follow-up analysis of selected samples with high resolution GC/MS. My findings summarized below may or may not apply to the ELISA methods used for PAHs and PCBs, but raise some issues to consider. Although there was a high correlation (r = 0.93) between the ELISA and GC/MS results, this was only for log-transformed data. (Interestingly, the literature available to me for this method also relies on log-log plots to compare the ELISA and GC/MS results.) For untransformed data, the correlation is low, and the plot suggests a non-linear relationship. Moreover, even with log transformed data, the high correlation is influenced by the fit to the ends of the data range and does not signify a close agreement between ELISA and GC/MS data within order of magnitude ranges. These observations suggest that this ELISA method may only be reliable for order-of-magnitude level screening. Does this also apply to the PAH and PCB ELISA methods? If so, how will the PAH and PCB ELISA data be used?	Thank you for your comments. In other studies we have found good linear correlations between the immunosorbant assay (IA) results and laboratory analysis of total PCBs and total PAHs for relatively low ranges levels of contamination. (Please see attached figures.) We would expect similar results for the Organics Verification Study (OVS). The screening analysis results are being used to better select which samples to perform the confirmation GC analysis on. Based on the number of samples selected for confirmation analysis, we should have sufficient quantitative organics data to make a TMDL decision (study plan needed or not needed), without estimating concentrations from screening data for other samples. There will be an uncertainty about estimating the "actual" PCB and PAH concentrations in the other samples from the screening analysis because they are mixtures of organic compounds and the immunoassay methods are not sensitive to individual compounds. Based on the quantitative PCB results from OUB stations, there was not a very good correlation between the IA results even when log transformed (even after removing 3 "outliers" with measured PCBs way higher (2) or way lower (1) than screening level.). However, the IA results do give a good indication of the samples that have relatively higher concentrations present.

Second, will the QA data for the organics study answer questions about the level of resolution achieved in the PAH and PCB ELISA analyses? For example, will data be available from field and laboratory duplicates? Will sediment SRM measurements be made?	The laboratory analysis will include laboratory duplicates and SRMs. For the screening data, results are reported for laboratory and field duplicates. In general, the duplicate analysis agrees pretty well but there are always exceptions, and it is difficult to say whether there are method-related or from sample heterogeneity (ie high RPDs occur in samples from OUB where there is higher variability between samples as well).
Third, how will the ELISA results be evaluated for acceptability? The SAP Addendum states (p. 1): "If there is good correlation between screening and quantitative results, the relationship equation will be used to estimate contaminant concentrations for the 75% of samples that were not quantitatively analyzed." Does this apply to the raw data or transformed data? Will the correlation be evaluated over the full range of reported concentrations, or a narrower concentration range around the regulatory value? Are there other criteria that should be considered? (For example, the screening and quantitative data might be used to estimate false positive and false negative rates for ELISA screening at different screening values. What are acceptable failure rates?)	Currently, we are using the screening data "as is" to select the samples for confirmatory GC analysis. We will have to evaluate the results of the confirmation analysis to determine whether it is feasible to estimate the concentrations of the other samples and how best to conduct the analysis. Based on the results obtained from the GC analysis, we could develop more specific criteria for estimating concentrations from the screening data. For example, specifying that a minimum number of PAH or PCB compounds be detected before calculating total PAH or total PCB, and determining whether the resulting regression slope is statistically significant. More importantly, the quantitative GC results will be directly applicable to supporting 303(d) determinations, while the screening results can provide supporting information on the relative contamination levels within the Inlets, which can be used to support future monitoring and modeling studies.

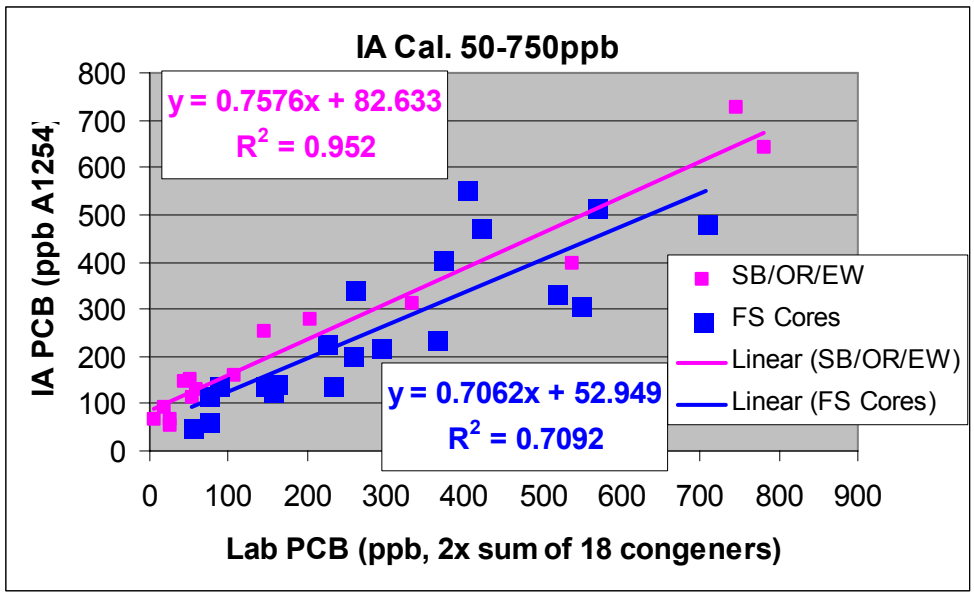

Figure 1. Linear relationship between immunosorbent assay (IA) for PCB (as total Aroclor 1254) and total PCB determined by GC/ECD of individual congeners for samples with PCB levels between 50 – 700 ppb (Jim Leather, SSC-SD, personal communication).

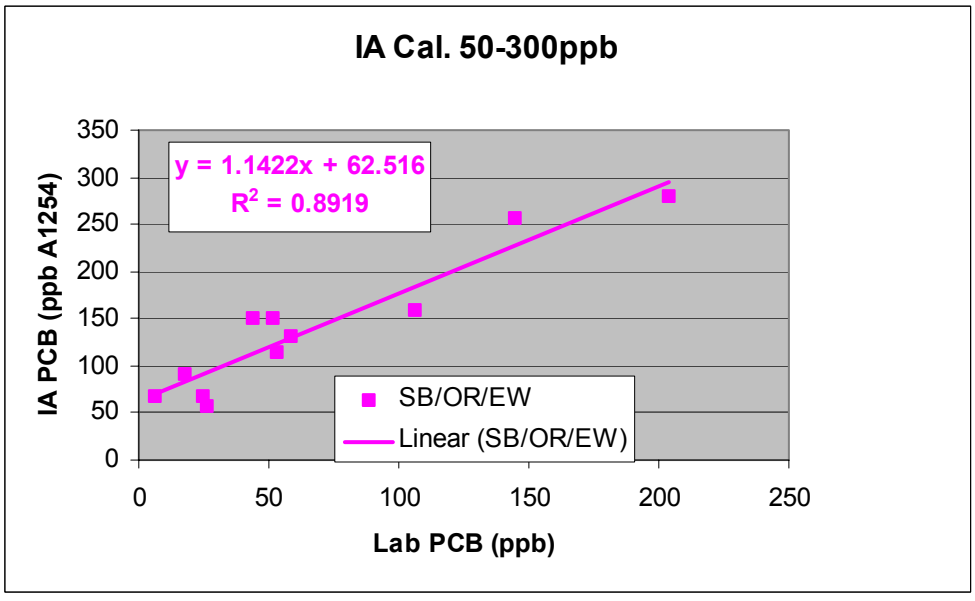

Figure 2. Linear relationship between immunosorbent assay (IA) for PCB (as total Aroclor 1254) and total PCB determined by GC/ECD of individual congeners for samples with PCB levels between 50 – 300 ppb (Jim Leather, SSC-SD, personal communication).

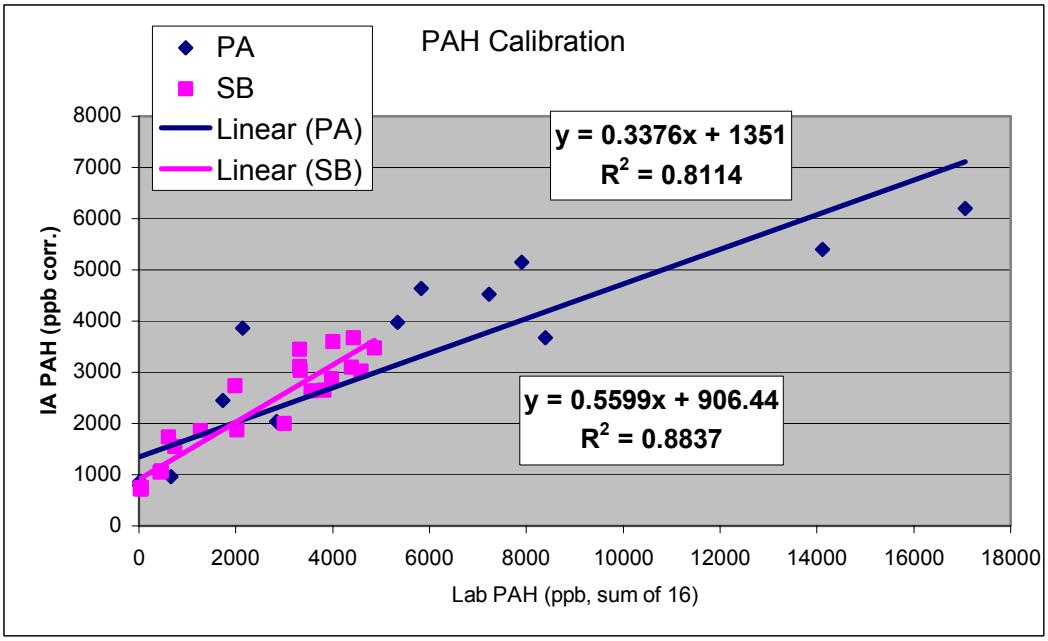

Figure 3. Linear relationship between immunosorbent assay (IA) for PAHs (as total PAH) and total PAH determined by GC/MS for the sum of 16 individual PAH (parent) compounds for samples with PAH levels between 0.5 to 18.0 ppm (Jim Leather, SSC-SD, personal communication).