United States
Environmental Protection
Agency

Region 10
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Seattle WA 98101

Alaska
Idaho
Oregon
Washington

Environmental Services Division

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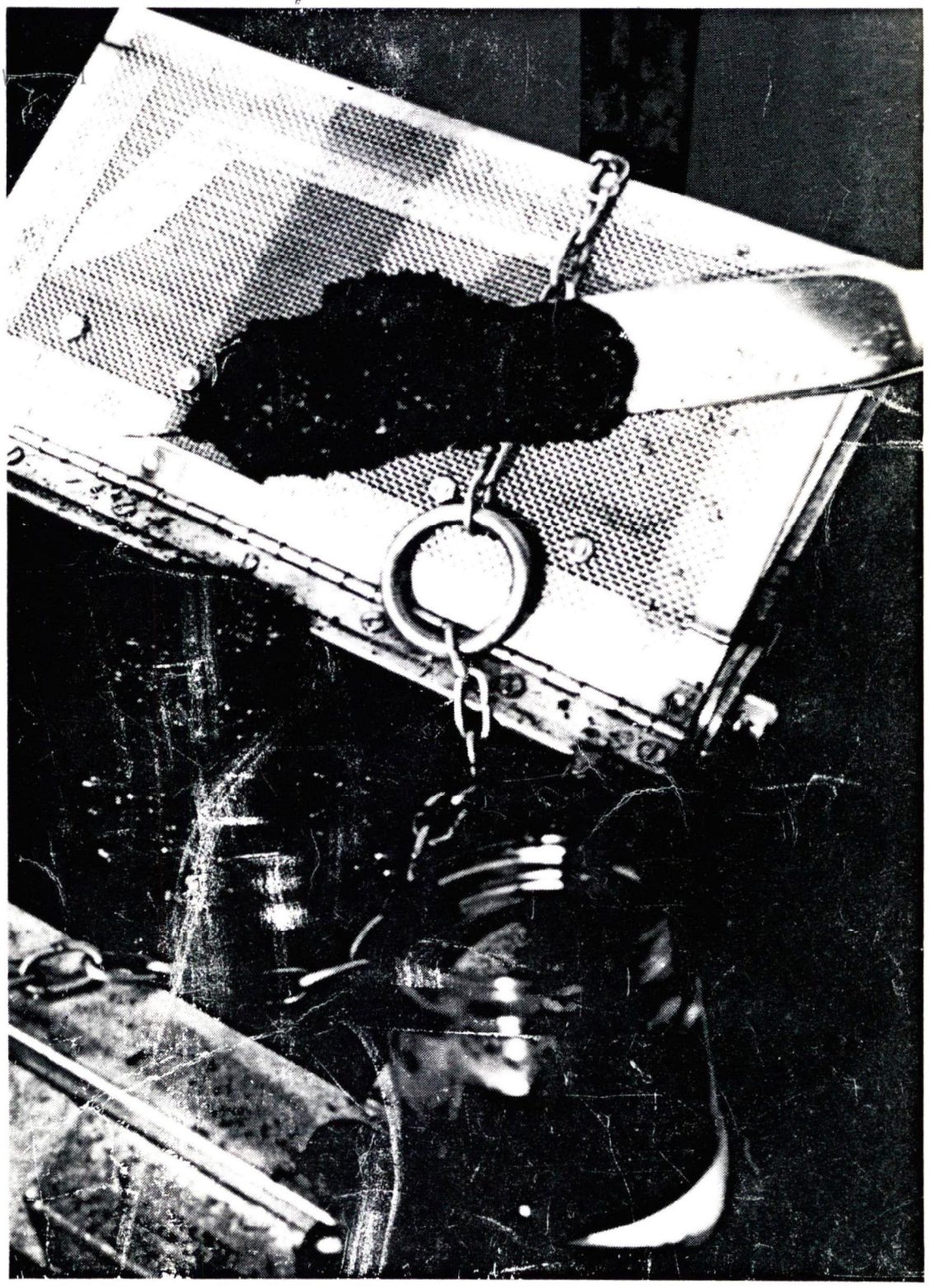
EPA

Lake Union Sediment Investigation

Seattle, Washington
March 20-21, 1984



INTRODUCTION

1/ Lake Union is an inland, freshwater lake located in the heart of the City of Seattle. To the northwest, it is connected to Puget Sound via the Fremont cut of the Lake Washington Ship Canal. To the northeast it is joined to Portage Bay, whose waters mix with those of Union Bay and Lake Washington through the Montlake cut.

The Montlake channel was completed in 1916 as part of a plan to promote better flushing of Lake Washington and simultaneously provide a navigable waterway between Lake Washington and the Sound. As part of the plan, the Cedar River was diverted to the southern end of Lake Washington, and the Hiram M. Chittenden Locks were constructed at the mouth of Salmon Bay.

Today, this interconnected system of lakes and channels is a much utilized passageway and recreational area. Numerous commercial and pleasure craft ply its waters and are moored along its shores. Particularly in Lake Union, marinas, houseboats, and commercial docks abound; extensive morage and drydock facilities of the West Coast fleet of the National Oceanic and Atmospheric Administration occupy its southeastern shore.

The area immediately surrounding the lake is heavily industrialized. A 1943 report (Foster, 1943 2/) published by the Washington State Pollution Commission listed 45 industries on the shores of Lake Union and the Lake Washington Ship Canal, in addition to the previously mentioned marinal and boatyards (20 of which were listed as sources of pollution). These included 10 machine shops and metal foundaries; 10 lumber and plywood mills; 12 fuel and oil storage and service facitities; 8 companies dealing in sand, gravel, concrete or asphalt; the Seattle City Light Power Plant on the southeastern shore; and the Seattle Gas Plant on the northern shore. The last-mentioned establishment was listed as one of the worst sources of lake water pollution, routinely discharging oily wastes through inadequate filters and occasionally spilling large quantities of oil so that the surface of the water was covered and fish were killed in its vicinity. Today, it is no longer in operation, having been turned over to the city in 1963 for conversion to a public park.

1/ Tomlinson, R.D., et al. 1977. A baseline study of the water quality, sediment, and biota of Lake Union. METRO, Seattle

2/ Foster, Richard F. 1943. Sources of pollution in Lake Washington Canal and Lake Union. Wash. State Poll. Comm., Poll. Series Bull. No. 28, 24 pp.

Concern over the past activities at Gas Works initiated a limited preliminary field investigation of the surface soils. Results from this survey confirmed high levels of polynuclear aromatic hydrocarbons. Due to the close association of Gas Works and Lake Union the Lake Union sediment investigation was therefore initiated. The obhective of this study was to sample the surface sediments of Lake Union and to determine the level and extent of contamination, if any.

STUDY SCOPE

The study covered the area within Lake Union with special emphasis given to the bottom sediments just south of Gas Works Park. The survey area and station locations are shown in Figures 1, 2 and 3. Twenty sediment samples were collected along seven transects radiating out from Gas Works Park. Three water and sediment samples were collected along the southeast shore of Gas Works Park. Ten additional sediment samples were collected from other locations of interest within Lake Union.

During the period of March 20 to 21, 1984, 33 sediments and 3 water samples were collected from Lake Union. This study was conducted to obtain data on the concentration and distribution of contaminants in the Lake Union bottom sediments.

The results are presented in appendices of this report.

SAMPLING AND ANALYTICAL PROCEDURES

SAMPLING PROCEDURE

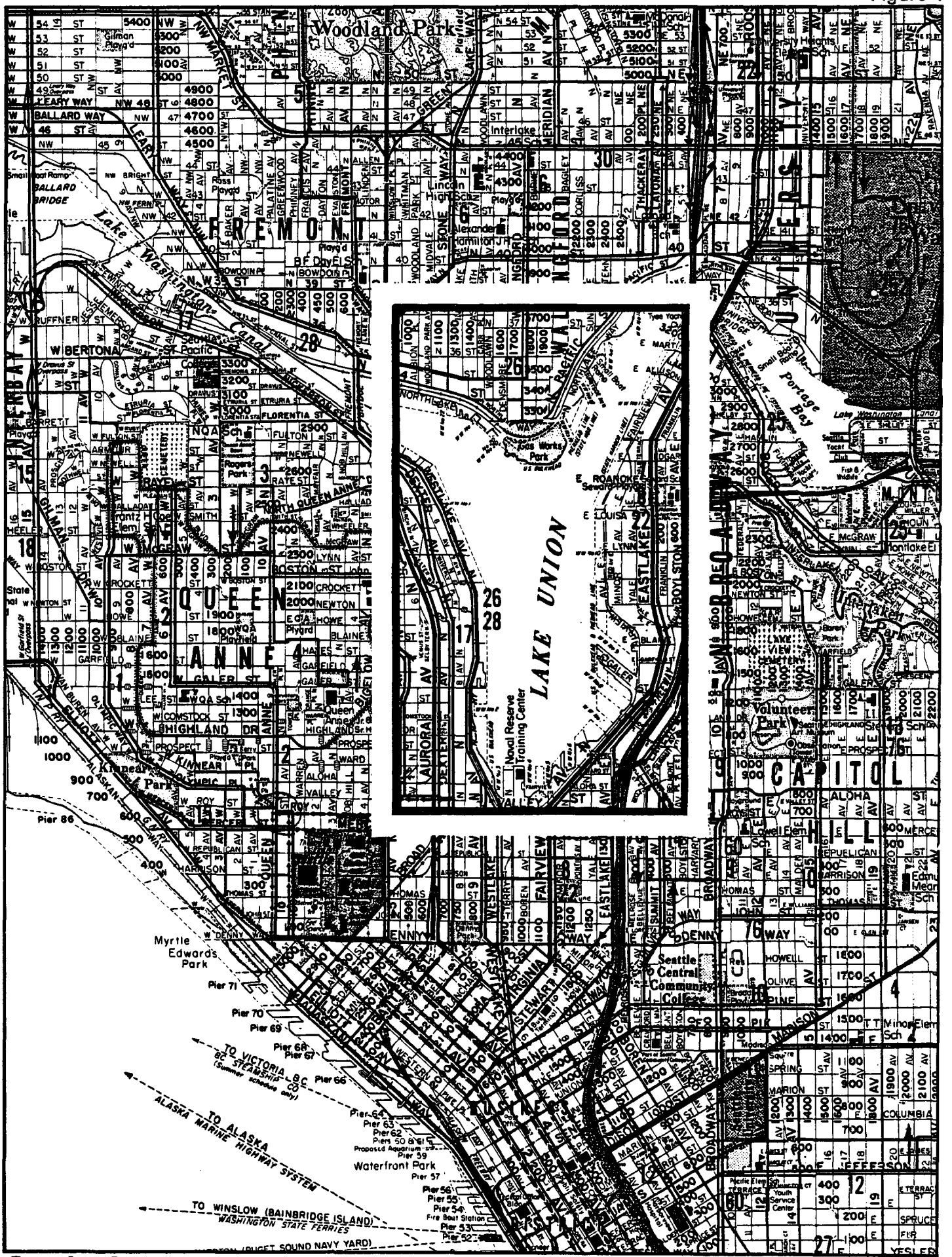
Two sediment samples were collected per station using a .1 meter Van Veen grab sampler. The sediment (approximately the top 10 cm.), not in direct contact with the interior of the sampler was transferred to the sample containers with stainless steel spatulas.

The grab sampler was thoroughly rinsed with Lake Union water between stations and the spatulas were rinsed with deionized water between samples. The samples were then sealed in pint glass containers with teflon lined lids. At the end of the survey one set of samples was shipped to the EPA Lab located at Manchester, Washington to be analyzed for metals, the second sample set was shipped to Meed Compuchem for organic analyses.

SUMMARY OF ANALYTICAL METHODS

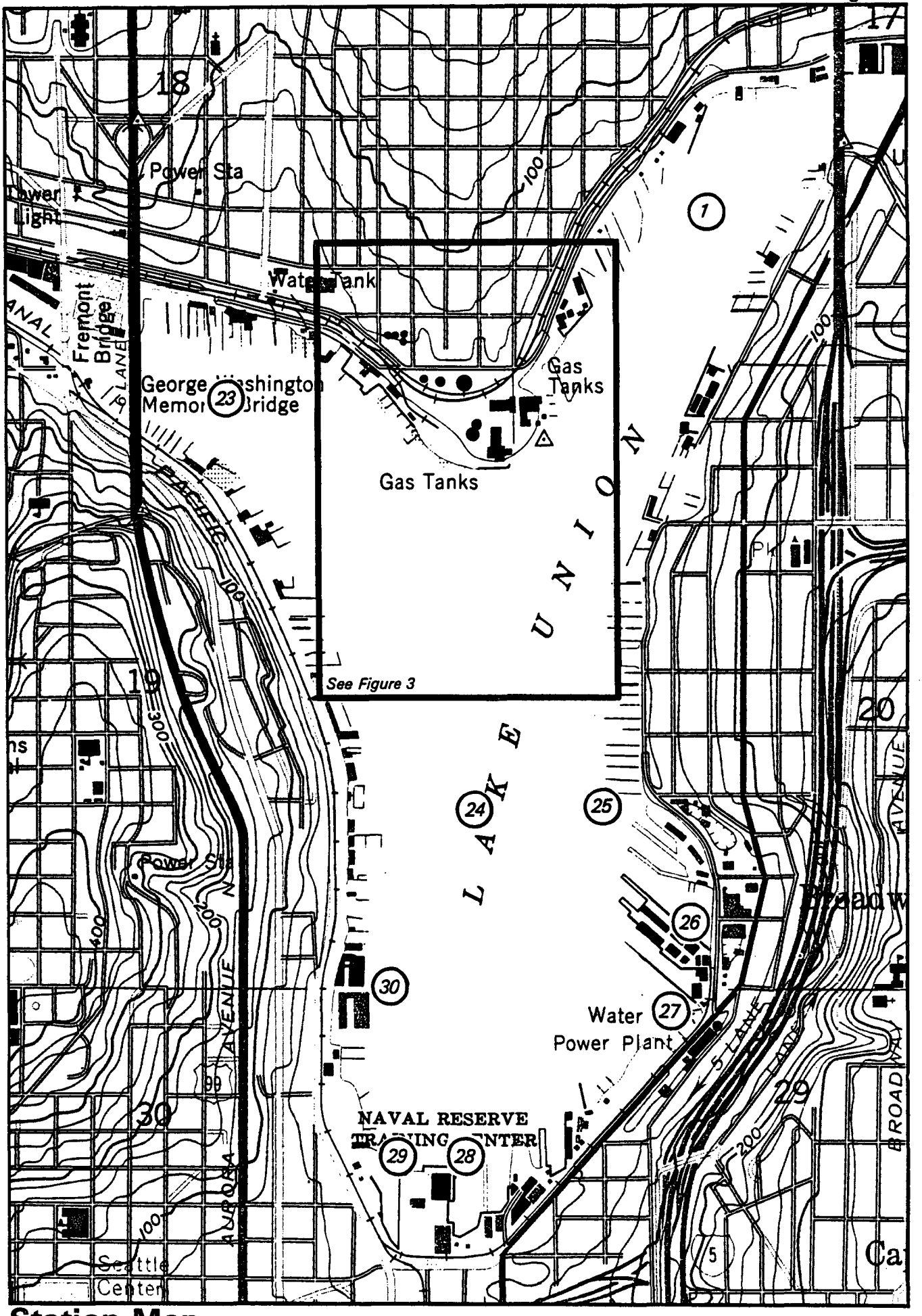
Procedures for metals. Samples of dry sediment were digested with a mixture of nitric acid and hydrogen peroxide until the organic matter was destroyed. The metals were determined by Atomic Absorption Spectrometry using a graphite furnace or flame following EPA methods. Mercury was determined on a wet sample by manual cold vapor technique, similar to that described by EPA METHOD 245.5.

Figure 1

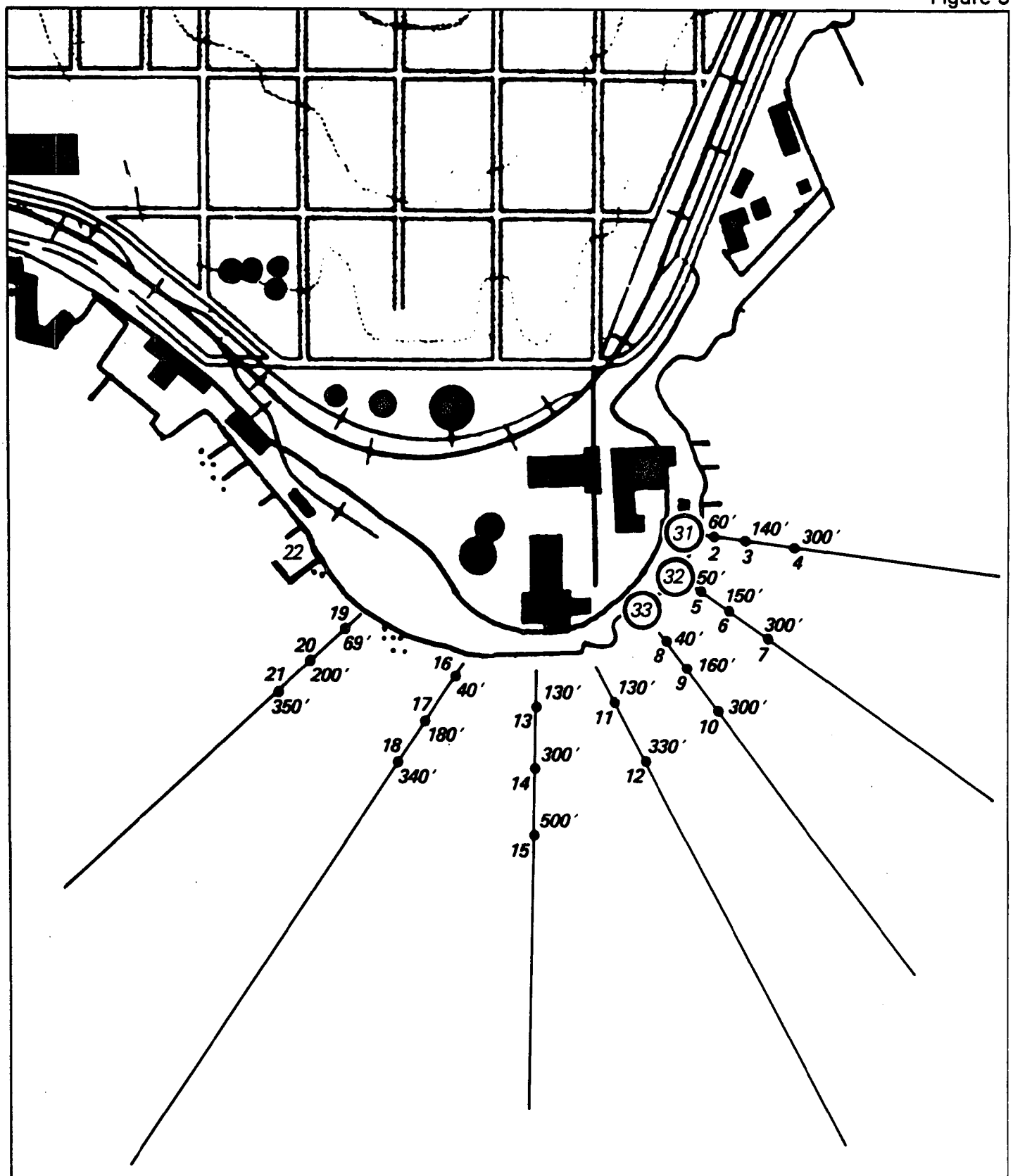


Study Area

Figure 2



Station Map



Note: *Distances in feet from shore are given for stations 2 through 21.*

○ *Near shore stations, water and sediment samples collected.*

Station Map

Procedures for cyanides. Cyanides were distilled, and the distillate analyzed by automated spectrophotometery following EPA METHODS.

Procedures for solids (percent). Samples were dried at 103-105 degrees C according to EPA METHODS.

Procedures for organic compounds. Samples were analysed at an EPA contract lab using approved EPA methods.

RESULTS

All of the sediment samples collected were analyzed for inorganic and organic chemicals. The concentration of selected chemicals are reported in Appendices A and B. Appendix A contains a complete listing of all results including the minimum quantifiable limits for chemicals that were not detected. Appendix B contains the same data as Appendix A with the exclusion of those below the minimum quantifiable limits. All data are displayed on a dry weight basis.

Appendix C contains the depth, percent solids and a qualitative description of the sediment found at each station.

PROPOSED ADDITIONAL STUDIES

There is considerable concern about the level of total polynuclear aromatic hydrocarbons (PNA's) found in the sediments of Lake Union. Observed values of PNA's, obtained during the March 20-21, 1984 field survey, were evaluated to determine if they were adequate to characterize the extent of the problem. The evaluation of these data, described in detail in Appendix F, focused on two aspects of the monitoring program. The first was the value of the data for determining the nature of the process leading to the present distribution of total PNA's. The second was determining the uncertainty associated with estimated levels.

The results of the evaluation show that the monitoring design used in the original study was reasonably good in terms of identifying the underlying process. The design would, however, be improved by extending the spatial coverage to the south and west, as shown in Figure F-11. For the measurements obtained during the March 1984 field study, the uncertainty of estimated values within the sampled area was found to be fairly high. The estimated standard deviation of the log-transformed data was on the order of one. This means that one standard deviation of the actual (untransformed) estimates is about one order of magnitude. That is, an upper bound of an estimate would be ten times the estimated value, while a lower bound would be one-tenth of the estimate. The uncertainty of the average value at a point, for the type of error found in the data, can be reduced by taking replicates at each station. In the log-transformed space, the reduction in the standard deviation is proportional to $1/\sqrt{n}$, where n is the number of replicates.

In summary, an adequate monitoring program for identifying the underlying process would include the spatial coverage shown in Figure F-11. Reduction of

uncertainty of the estimated average value at any point would require the collection of replicate samples.

To determine the depth of contaiminated sediments Acoustic sub-bottom profiling of the Lake Union bottom sediments is recommended. Using a 3.5 kHz acoustic profiler sub-bottom tracklines would be run the length of Lake Union. Data from the tracklines would be used to construct contour maps that would show sediment thickness, density changes and areas of high accumulation. A radar raging system would be used for navigational control. Navigational accuracy would be +- 2 meters. Deep cores should be collected at several locations to establish ground truth for the sub-bottom contours.

APPENDIX A

COMPLETE LISTING OF CHEMICAL CONCENTRATIONS ON A DRY WEIGHT BASIS INCLUDING THE MINIMUM QUANTIFIABLE LIMITS

INORGANICS -- METALS

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS PARAMETERS AL*	CR	BA*	BE	CO*	CU	FE*	NI
#01			S	12151	840320	0808		55.5		.45		168		62.7
#02			S	12152	840320	0830		55.1		.39		192		291
#03			S	12153	840320	0845		52.3		.35		205		71.0
#04			S	12154	840320	0900		61.5		.48		162		73.3
#05			S	12155	840320	0913		32.9		.33		134		265
#06			S	12156	840320	0925		57.0		.45		174		97.6
#07			S	12157	840320	0938		54.1		.33		169		56.4
#08			S	12158	840320	0955		35.9		.31		79		223
#09			S	12159	840320	1030		48.5		.34		158		94.5
#10			S	12160	840320	1045		53.8		.40		163		64.0
#11			S	12161	840320	1120		32.4		.26		72		202
#12			S	12162	840320	1135		47.6		.35		152		125
#13			S	12163	840320	1325		22.1		.20		24		47.1
#14			S	12164	840320	1340		47.6		.41		138		130
#15			S	12165	840320	1345		61.6		.42		250		72.8
#16			S	12166	840320	1355		26.0		.21		104		88.0
#17			S	12167	840320	1410		36.3		.34		120		162
#18			S	12168	840320	1420		56.7		.46		171		132
#19			S	12169	840320	1430		47.4		.31		186		91.6
#20			S	12170	840320	1445		62.6		.48		181		85.8
#21			S	12171	840320	1455		45.2		.37		175		141
#22			S	12172	840320	1515		59.2		.50		301		70.8
#23			S	12173	840320	1525		64.8		.50		230		110
#24			S	12174	840320	1530		83.7		.51		375		94.5
#25			S	12175	840320	1545		86.6		.50		484		92.0
#26			S	12176	840320	1555		74.4		.44		587		69.1
#27			S	12177	840320	1600		75.1		.80		124		93.2
#28			S	12178	840320	1612		65.5		.62		184		78.6
#29			S	12179	840320	1620		67.6		.56		242		71.4
#30			S	12180	840320	1630		70.3		.55		121		84.8
#31 OFF LEFT BUSH			S	12181	840321	0810		17.4		.22		23		98.9
#31 OFF LEFT BUSH			W	12182	840321	0810		.001		.0002 U		.058		.062
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		13.9		.15		88		89.7
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		13		.2 U		200		220
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		18.1		.25		32		206
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		.013		.0002 U		.078		.613
TRANSPORT BLANK				12187	840321			.0001U		.0002 U		.037		.012

INORGANICS -- METALS

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS PARAMETERS MN*	ZN	B*	V*	AG	AS	SB	SE
#01			S	12151	840320	0808		456			2.45	34.5	.9	.4
#02			S	12152	840320	0830		431			0.27	284	.3	.2
#03			S	12153	840320	0845		482			1.21	53.5	.5	.2
#04			S	12154	840320	0900		450			0.60	27.6	.3	.3
#05			S	12155	840320	0913		293			0.18	39.0	.1	.2
#06			S	12156	840320	0925		427			1.82	36.5	.4	.5
#07			S	12157	840320	0938		416			3.02	55.5	.4	.5
#08			S	12158	840320	0955		210			0.33	12.8	.1	.2 U
#09			S	12159	840320	1030		352			1.15	26.9	.4	.3
#10			S	12160	840320	1045		420			0.31	33.1	.3	.4
#11			S	12161	840320	1120		153			0.47	21.7	.2	.2 U
#12			S	12162	840320	1135		336			2.45	35.0	.2	.2
#13			S	12163	840320	1325		70			0.06	3.6	.1 U	.2 U
#14			S	12164	840320	1340		327			2.49	27.5	.3	.3
#15			S	12165	840320	1345		485			3.77	31.9	.1 U	.5
#16			S	12166	840320	1355		175			0.61	11.7	.3	.2 U
#17			S	12167	840320	1410		250			1.59	22.1	.3	.2
#18			S	12168	840320	1420		382			2.68	26.2	.1 U	.2 U
#19			S	12169	840320	1430		350			2.64	31.0	.5	.2
#20			S	12170	840320	1445		454			3.99	28.7	.1 U	.7
#21			S	12171	840320	1455		285			1.04	18.3	.7	.6
#22			S	12172	840320	1515		648			2.23	85.0	.1	.2
#23			S	12173	840320	1525		476			1.53	23.0	.1	.6
#24			S	12174	840320	1530		708			0.54	42.5	.1 U	.8
#25			S	12175	840320	1545		740			1.95	33.0	.1 U	.2
#26			S	12176	840320	1555		1058			3.18	168	6.4	.5
#27			S	12177	840320	1600		177			1.02	10.4	.2	.6
#28			S	12178	840320	1612		512			6.91	20.2	.3	.2 U
#29			S	12179	840320	1620		668			5.65	28.0	.2	.4
#30			S	12180	840320	1630		276			4.47	12.6	.1	.4
#31 OFF LEFT BUSH			S	12181	840321	0810		71			.02 U	5.7	4.9	.2 U
#31 OFF LEFT BUSH			W	12182	840321	0810		.047			.0002 U	.001 U	.001	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		51			.02 U	13.2	25.0	.2 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		100			.2 U	25	7	U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		75			.02 U	6.7	.1	.2 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		.071			.0002 U	.048	.001	
TRANSPORT BLANK				12187	840321			.001			.0002 U	.001 U	.0001 U	

INORGANICS -- METALS

U NOT DETECTED
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS TL		METALS HG		PARAMETERS SN*	PARAMETERS CD		PARAMETERS PB		PHENOLIC	CN	
#01			S	12151	840320	0808	.1	U	1.136			2.1		397			.78	U
#02			S	12152	840320	0830	.1	U	2.626			11.5		416			1680	
#03			S	12153	840320	0845	.1		1.483			2.2		541			168	
#04			S	12154	840320	0900	.1		1.418			2.1		324			5.8	
#05			S	12155	840320	0913	.1	U	1.114			11.4		296			1190	
#06			S	12156	840320	0925	.1		1.356			2.0		288			96.6	
#07			S	12157	840320	0938	.1	U	1.398			2.3		512			17.7	
#08			S	12158	840320	0955	.1	U	.587			1.0		158			6.5	
#09			S	12159	840320	1030	.2		.983			1.7		471			21.7	
#10			S	12160	840320	1045	.1		1.325			2.4		377			.78	M
#11			S	12161	840320	1120	.1		.494			0.2		101			3.8	
#12			S	12162	840320	1135	.2		.780			2.1		319			16.5	
#13			S	12163	840320	1325	.1	U	.051			0.3		28			.24	
#14			S	12164	840320	1340	.1	U	.798			1.9		263			1.4	
#15			S	12165	840320	1345	.1		1.255			2.0		466			.83	M
#16			S	12166	840320	1355	.2		.311			0.8		284			8.0	
#17			S	12167	840320	1410	.1	U	.570			1.0		199			5.3	
#18			S	12168	840320	1420	.3		1.177			0.3		277			4.6	
#19			S	12169	840320	1430	.1	U	.775			1.5		403			7.3	
#20			S	12170	840320	1445	.1	U	1.060			2.3		311			4.1	
#21			S	12171	840320	1455	.1	U	1.389			0.4		185			1.4	
#22			S	12172	840320	1515	.2		1.032			1.8		508			3.9	
#23			S	12173	840320	1525	.1	U	1.162			0.6		304			1.5	
#24			S	12174	840320	1530	.1	U	3.173			2.2		455			1.2	
#25			S	12175	840320	1545	.1	U	4.293			0.5		441			.72	
#26			S	12176	840320	1555	.1		2.619			0.2		720			1.2	
#27			S	12177	840320	1600	.2		.458			0.1		60			.43	
#28			S	12178	840320	1612	.1		1.555			2.0		381			1.1	
#29			S	12179	840320	1620	.1	U	2.316			2.3		572			1.9	
#30			S	12180	840320	1630	.2		1.227			1.2		262			.93	
#31 OFF LEFT BUSH			S	12181	840321	0810	.1	U	.034			.2		126			15	
#31 OFF LEFT BUSH			W	12182	840321	0810	.001	U				.0002		.078			.43	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	.1	U	.757			.1		962			215	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		U	1.48			.2	U	1225			7.2	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	.1	U	.059			.3		37			5.0	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	.001	U				.0002		.078			.05	
TRANSPORT BLANK				12187	840321		.001	U				.0002	U	.019			.005	U

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	ACID COMPOUNDS: 2,4,6 TRI CHLORO PHENOL	P-CHLORO -M- CRESOL	2-CHLORO PHENOL	2,4,DI CHLORO PHENOL	2,4,DI METHYL PHENOL	2-NITRO PHENOL	4-NITRO PHENOL	2,4,DI NITRO PHENOL
#01			S	J3101	840320	0808	3100 U	6200 U	3100 U	3100 U	3100 U	6200 U	31000 U	15500 U
#02			S	J3102	840320	0830	21000 U	42000 U	21000 U	21000 U	21000 U	42000 U	210000 U	105000 U
#03			S	J3103	840320	0845	6700 U	13400 U	6700 U	6700 U	6700 U	13400 U	67000 U	33500 U
#04			S	J3104	840320	0900	5000 U	10000 U	5000 U	5000 U	5000 U	10000 U	50000 U	25000 U
#05			S	J3105	840320	0913	2500 U	5000 U	2500 U	2500 U	2500 U	5000 U	25000 U	12500 U
#06			S	J3106	840320	0925	5000 U	10000 U	5000 U	5000 U	5000 U	10000 U	50000 U	25000 U
#07			S	J3107	840320	0938	5300 U	10600 U	5300 U	5300 U	5300 U	10600 U	53000 U	26500 U
#08			S	J3108	840320	0955	2200 U	4400 U	2200 U	2200 U	2200 U	4400 U	22000 U	11000 U
#09			S	J3109	840320	1030	4560 U	9120 U	4560 U	4560 U	4560 U	9120 U	45600 U	22800 U
#10			S	J3110	840320	1045	5200 U	10400 U	5200 U	5200 U	5200 U	10400 U	52000 U	26000 U
#11			S	J3111	840320	1120	70000 U	140000 U	70000 U	70000 U	70000 U	140000 U	700000 U	350000 U
#12			S	J3112	840320	1135	4720 U	9440 U	4720 U	4720 U	4720 U	9440 U	47200 U	23600 U
#13			S	J3113	840320	1325	1000 U	2000 U	1000 U	1000 U	1000 U	2000 U	10000 U	5000 U
#14			S	J3114	840320	1340	23000 U	46000 U	23000 U	23000 U	23000 U	46000 U	230000 U	115000 U
#15			S	J3115	840320	1345	2200 U	4400 U	2200 U	2200 U	2200 U	4400 U	22000 U	11000 U
#16			S	J3116	840320	1355	37000 U	74000 U	37000 U	37000 U	37000 U	74000 U	370000 U	185000 U
#17			S	J3117	840320	1410	43000 U	86000 U	43000 U	43000 U	43000 U	86000 U	430000 U	215000 U
#18			S	J3118	840320	1420	2200 U	4400 U	2200 U	2200 U	2200 U	4400 U	22000 U	11000 U
#19			S	J3119	840320	1430	3730 U	7460 U	3730 U	3730 U	3730 U	7460 U	37300 U	18650 U
#20			S	J3120	840320	1445	5600 U	11200 U	5600 U	5600 U	5600 U	11200 U	56000 U	28000 U
#21			S	J3121	840320	1455	50000 U	100000 U	50000 U	50000 U	50000 U	100000 U	500000 U	250000 U
#22			S	J3122	840320	1515	6000 U	12000 U	6000 U	6000 U	6000 U	12000 U	60000 U	30000 U
#23			S	J3123	840320	1525	5100 U	10200 U	5100 U	5100 U	5100 U	10200 U	51000 U	25500 U
#24			S	J3124	840320	1530	5100 U	10200 U	5100 U	5100 U	5100 U	10200 U	51000 U	25500 U
#25			S	J3125	840320	1545	5500 U	11000 U	5500 U	5500 U	5500 U	11000 U	55000 U	27500 U
#26			S	J3126	840320	1555	3100 U	6200 U	3100 U	3100 U	3100 U	6200 U	31000 U	15500 U
#27			S	J3127	840320	1600	900 U	1800 U	900 U	900 U	900 U	1800 U	9000 U	4500 U
#28			S	J3128	840320	1612	1480 U	2960 U	1480 U	1480 U	1480 U	2960 U	14800 U	7400 U
#29			S	J3129	840320	1620	2300 U	4600 U	2300 U	2300 U	2300 U	4600 U	23000 U	16500 U
#30			S	J3130	840320	1630	1300 U	2600 U	1300 U	1300 U	1300 U	2600 U	13000 U	6500 U
#31 OFF LEFT BUSH			S	12181	840321	0810	100 U	10 U	20 U	50 U	50 U	50 U	300 U	300 U
#31 OFF LEFT BUSH			W	12182	840321	0810	1 U	.1U	.2U	.5U	.5U	.5U	3 U	3 U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	1000 U	100 U	200 U	500 U	500 U	500 U	3000 U	3000 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	3 U	.3U	.6U	2 U	2 U	2 U	6 U	6 U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	500 U	50 U	100 U	250 U	250 U	250 U	1500 U	1500 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	20 U	2 U	4 U	10 U	10 U	10 U	60 U	60 U
TRANSPORT BLANK			S	J3134	840321		400 U	800 U	400 U	400 U	400 U	800 U	4000 U	2000 U
TRANSPORT BLANK				12187	840321		.3U	.1U	.1U	.2U	.2U	.2U	1 U	1 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	ACID COMPOUNDS: 4,6,DI NITRO O CRESOL		PENTA CHLORO PHENOL		PHENOL	
#01			S	J3101	840320	0808	6200	U	6200	U	3100	U
#02			S	J3102	840320	0830	42000	U	42000	U	21000	U
#03			S	J3103	840320	0845	13400	U	34000	U	6700	U
#04			S	J3104	840320	0900	10000	U	10000	U	5000	U
#05			S	J3105	840320	0913	5000	U	5000	U	20922	
#06			S	J3106	840320	0925	10000	U	10000	U	5000	U
#07			S	J3107	840320	0938	10600	U	375560		5300	U
#08			S	J3108	840320	0955	4400	U	4400	U	2200	U
#09			S	J3109	840320	1030	9120	U	9120	U	4560	U
#10			S	J3110	840320	1045	10400	U	10400	U	5200	U
#11			S	J3111	840320	1120	140000	U	140000	U	70000	U
#12			S	J3112	840320	1135	9440	U	9440	U	4720	U
#13			S	J3113	840320	1325	2000	U	2000	U	1000	U
#14			S	J3114	840320	1340	46000	U	46000	U	23000	U
#15			S	J3115	840320	1345	4400	U	4400	U	2200	U
#16			S	J3116	840320	1355	74000	U	74000	U	37000	U
#17			S	J3117	840320	1410	86000	U	86000	U	43000	U
#18			S	J3118	840320	1420	4400	U	4400	U	2200	U
#19			S	J3119	840320	1430	7460	U	7460	U	3730	U
#20			S	J3120	840320	1445	11200	U	11200	U	5600	U
#21			S	J3121	840320	1455	100000	U	100000	U	50000	U
#22			S	J3122	840320	1515	12000	U	12000	U	6000	U
#23			S	J3123	840320	1525	10200	U	10200	U	5100	U
#24			S	J3124	840320	1530	10200	U	10200	U	5100	U
#25			S	J3125	840320	1545	11000	U	11000	U	5500	U
#26			S	J3126	840320	1555	6200	U	6200	U	3100	U
#27			S	J3127	840320	1600	1800	U	1800	U	900	U
#28			S	J3128	840320	1612	2960	U	2960	U	1480	U
#29			S	J3129	840320	1620	4600	U	4600	U	2300	U
#30			S	J3130	840320	1630	2600	U	2600	U	1300	U
#31 OFF LEFT BUSH			S	12181	840321	0810	500	U	30	U	20	U
#31 OFF LEFT BUSH			W	12182	840321	0810	5	U	.3	U	.2	U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	5000	U	300	U	200	U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	20	U	.9	U	.6	U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	2500	U	150	U	100	U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	100	U	6	U	4	U
TRANSPORT BLANK			S	J3134	840321		800	U	800	U	400	U
TRANSPORT BLANK				12187	840321		2	U	.1	U	.1	U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PESTICIDES								
							ALDRIN	DIELDRIN	CHLORDANE	4,4'-DDT	4,4'-DDE	4,4'-DDD	A-ENDOSULFAN	B-ENDOSULFAN	
#01			S	J3101	840320	0808	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	
#02			S	J3102	840320	0830	624 U	624 U	624 U	624 U	624 U	624 U	624 U	624 U	
#03			S	J3103	840320	0845	336 U	336 U	336 U	336 U	336 U	336 U	336 U	336 U	
#04			S	J3104	840320	0900	40 U	40 U	40 U	40 U	143 M	40 U	40 U	40 U	
#05			S	J3105	840320	0913	488 U	488 U	488 U	488 U	488 U	488 U	488 U	488 U	
#06			S	J3106	840320	0925	504 U	504 U	504 U	504 U	504 U	504 U	504 U	504 U	
#07			S	J3107	840320	0938	36.64 U	36.64 U	36.64 U	36.64 U	36.64 U	36.64 U	36.64 U	36.64 U	
#08			S	J3108	840320	0955	18 U	18 U	18 U	18 U	18 U	18 U	18 U	18 U	
#09			S	J3109	840320	1030	456 U	456 U	456 U	456 U	456 U	456 U	456 U	456 U	
#10			S	J3110	840320	1045	116 U	116 U	116 U	116 U	116 U	116 U	116 U	116 U	
#11			S	J3111	840320	1120	348 U	348 U	348 U	348 U	348 U	348 U	348 U	348 U	
#12			S	J3112	840320	1135	236 U	236 U	236 U	236 U	236 U	236 U	236 U	236 U	
#13			S	J3113	840320	1325	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	
#14			S	J3114	840320	1340	180 U	180 U	180 U	180 U	853 M	180 U	180 U	180 U	
#15			S	J3115	840320	1345	176 U	176 U	176 U	176 U	176 U	176 U	176 U	176 U	
#16			S	J3116	840320	1355	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	
#17			S	J3117	840320	1410	216 U	216 U	216 U	216 U	216 U	216 U	216 U	216 U	
#18			S	J3118	840320	1420	21.5 U	21.5 U	21.5 U	21.5 U	21.5 U	21.5 U	21.5 U	21.5 U	
#19			S	J3119	840320	1430	388 U	388 U	388 U	388 U	388 U	388 U	388 U	388 U	
#20			S	J3120	840320	1445	488 U	488 U	488 U	488 U	488 U	488 U	488 U	488 U	
#21			S	J3121	840320	1455	26.4 U	26.4 U	26.4 U	26.4 U	26.4 U	26.4 U	26.4 U	26.4 U	
#22			S	J3122	840320	1515	31 U	31 U	31 U	31 U	31 U	31 U	31 U	31 U	
#23			S	J3123	840320	1525	25.6 U	25.6 U	25.6 U	25.6 U	25.6 U	25.6 U	25.6 U	25.6 U	
#24			S	J3124	840320	1530	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	
#25			S	J3125	840320	1545	25.3 U	25.3 U	25.3 U	25.3 U	25.3 U	25.3 U	25.3 U	25.3 U	
#26			S	J3126	840320	1555	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	30.8 U	
#27			S	J3127	840320	1600	10.6 U	10.6 U	10.6 U	10.6 U	10.6 U	10.6 U	10.6 U	10.6 U	
#28			S	J3128	840320	1612	14.8 U	14.8 U	777 I	14.8 U	14.8 U	14.8 U	14.8 U	14.8 U	
#29			S	J3129	840320	1620	23.3 U	23.3 U	23.3 U	23.3 U	23.3 U	23.3 U	23.3 U	23.3 U	
#30			S	J3130	840320	1630	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	
#31 OFF LEFT BUSH			S	12181	840321	0810	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	
#31 OFF LEFT BUSH			W	12182	840321	0810	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
TRANSPORT BLANK			S	J3134	840321		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	
TRANSPORT BLANK				12187	840321		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PESTICIDES									
							ENDO SULFAN SULFATE	ENDRIN	ENDRIN ALDEHYDE	HEPTA CHLOR	HEPTA CHLOR EPOXIDE	A-BHC	B-BHC	D-BHC	G-BHC LINDANE	
#01			S	J3101	840320	0808	30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U
#02			S	J3102	840320	0830	624	U 624	U 624	U 624	U 624	U 624	U 624	U 624	U 624	U
#03			S	J3103	840320	0845	336	U 336	U 336	U 336	U 336	U 336	U 336	U 336	U 336	U
#04			S	J3104	840320	0900	40	U 40	U 40	U 40	U 40	U 40	U 40	U 40	U 40	U
#05			S	J3105	840320	0913	488	U 488	U 488	U 488	U 488	U 488	U 488	U 488	U 488	U
#06			S	J3106	840320	0925	504	U 504	U 504	U 504	U 504	U 504	U 504	U 504	U 504	U
#07			S	J3107	840320	0938	36.64	U 36.64	U 36.64	U 36.64	U 36.64	U 36.64	U 36.64	U 36.64	U 36.64	U
#08			S	J3108	840320	0955	18	U 18	U 18	U 18	U 18	U 18	U 18	U 18	U 18	U
#09			S	J3109	840320	1030	456	U 456	U 456	U 456	U 456	U 456	U 456	U 456	U 456	U
#10			S	J3110	840320	1045	116	U 116	U 116	U 116	U 116	U 116	U 116	U 116	U 116	U
#11			S	J3111	840320	1120	348	U 348	U 348	U 348	U 348	U 348	U 348	U 348	U 348	U
#12			S	J3112	840320	1135	236	U 236	U 236	U 236	U 236	U 236	U 236	U 236	U 236	U
#13			S	J3113	840320	1325	100	U 100	U 100	U 100	U 100	U 100	U 100	U 100	U 100	U
#14			S	J3114	840320	1340	180	U 180	U 180	U 180	U 180	U 180	U 180	U 180	U 180	U
#15			S	J3115	840320	1345	176	U 176	U 176	U 176	U 176	U 176	U 176	U 176	U 176	U
#16			S	J3116	840320	1355	40	U 40	U 40	U 40	U 40	U 40	U 40	U 40	U 40	U
#17			S	J3117	840320	1410	216	U 216	U 216	U 216	U 216	U 216	U 216	U 216	U 216	U
#18			S	J3118	840320	1420	21.5	U 21.5	U 21.5	U 21.5	U 21.5	U 21.5	U 21.5	U 21.5	U 21.5	U
#19			S	J3119	840320	1430	388	U 388	U 388	U 388	U 388	U 388	U 388	U 388	U 388	U
#20			S	J3120	840320	1445	488	U 488	U 488	U 488	U 488	U 488	U 488	U 488	U 488	U
#21			S	J3121	840320	1455	26.4	U 26.4	U 26.4	U 26.4	U 26.4	U 26.4	U 26.4	U 26.4	U 26.4	U
#22			S	J3122	840320	1515	31	U 31	U 31	U 31	U 31	U 31	U 31	U 31	U 31	U
#23			S	J3123	840320	1525	25.6	U 25.6	U 25.6	U 25.6	U 25.6	U 25.6	U 25.6	U 25.6	U 25.6	U
#24			S	J3124	840320	1530	25	U 25	U 25	U 25	U 25	U 25	U 25	U 25	U 25	U
#25			S	J3125	840320	1545	25.3	U 25.3	U 25.3	U 25.3	U 25.3	U 25.3	U 25.3	U 25.3	U 25.3	U
#26			S	J3126	840320	1555	30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U 30.8	U
#27			S	J3127	840320	1600	10.6	U 10.6	U 10.6	U 10.6	U 10.6	U 10.6	U 10.6	U 10.6	U 10.6	U
#28			S	J3128	840320	1612	14.8	U 14.8	U 14.8	U 14.8	U 14.8	U 14.8	U 14.8	U 14.8	U 14.8	U
#29			S	J3129	840320	1620	23.3	U 23.3	U 23.3	U 23.3	U 23.3	U 23.3	U 23.3	U 23.3	U 23.3	U
#30			S	J3130	840320	1630	13.4	U 13.4	U 13.4	U 13.4	U 13.4	U 13.4	U 13.4	U 13.4	U 13.4	U
#31 OFF LEFT BUSH			S	12181	840321	0810	20	U 20	U 20	U 20	U 20	U 20	U 20	U 20	U 20	U
#31 OFF LEFT BUSH			W	12182	840321	0810	1	U 1	U 1	U 1	U 1	U 1	U 1	U 1	U 1	U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	20	U 20	U 20	U 20	U 20	U 20	U 20	U 20	U 20	U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U 10	U
TRANSPORT BLANK			S	J3134	840321		4.0	U 4.0	U 4.0	U 4.0	U 4.0	U 4.0	U 4.0	U 4.0	U 4.0	U
TRANSPORT BLANK				12187	840321		1	U 1	U 1	U 1	U 1	U 1	U 1	U 1	U 1	U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PCB		PCB-1254		PCB-1221		PCB-1232		PCB-1248		PCB-1260		PCB-1016		TOXAPHENE		TCDD DIOXIN
#01			S	J3101	840320	0808	30.8	U	4466		30.8	U	30.8	U	30.8	U	30.8	U	30.8	U	30.8	U	
#02			S	J3102	840320	0830	624	U	624	U	624	U	624	U	624	U	624	U	624	U	624	U	
#03			S	J3103	840320	0845	336	U	336	U	336	U	336	U	336	U	336	U	336	U	336	U	
#04			S	J3104	840320	0900	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	
#05			S	J3105	840320	0913	488	U	488	U	488	U	488	U	488	U	488	U	488	U	488	U	
#06			S	J3106	840320	0925	504	U	504	U	504	U	504	U	504	U	504	U	504	U	504	U	
#07			S	J3107	840320	0938	36.64	U	36.64	U	36.64	U	36.64	U	36.64	U	36.64	U	36.64	U	36.64	U	
#08			S	J3108	840320	0955	18	U	18	U	18	U	18	U	18	U	18	U	18	U	18	U	
#09			S	J3109	840320	1030	456	U	456	U	456	U	456	U	456	U	456	U	456	U	456	U	
#10			S	J3110	840320	1045	116	U	116	U	116	U	116	U	116	U	116	U	116	U	116	U	
#11			S	J3111	840320	1120	348	U	348	U	348	U	348	U	348	U	348	U	348	U	348	U	
#12			S	J3112	840320	1135	236	U	236	U	236	U	236	U	236	U	236	U	236	U	236	U	
#13			S	J3113	840320	1325	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	
#14			S	J3114	840320	1340	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U	
#15			S	J3115	840320	1345	176	U	176	U	176	U	176	U	176	U	176	U	176	U	176	U	
#16			S	J3116	840320	1355	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	
#17			S	J3117	840320	1410	216	U	216	U	216	U	216	U	216	U	216	U	216	U	216	U	
#18			S	J3118	840320	1420	21.5	U	21.5	U	21.5	U	21.5	U	21.5	U	21.5	U	21.5	U	21.5	U	
#19			S	J3119	840320	1430	388	U	388	U	388	U	388	U	388	U	388	U	388	U	388	U	
#20			S	J3120	840320	1445	488	U	488	U	488	U	488	U	488	U	488	U	488	U	488	U	
#21			S	J3121	840320	1455	26.4	U	26.4	U	26.4	U	26.4	U	26.4	U	26.4	U	26.4	U	26.4	U	
#22			S	J3122	840320	1515	31	U	31	U	31	U	31	U	31	U	31	U	31	U	31	U	
#23			S	J3123	840320	1525	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	
#24			S	J3124	840320	1530	25	U	25	U	25	U	25	U	25	U	25	U	25	U	25	U	
#25			S	J3125	840320	1545	25.3	U	25.3	U	25.3	U	25.3	U	25.3	U	25.3	U	25.3	U	25.3	U	
#26			S	J3126	840320	1555	30.8	U	1550		30.8	U	30.8	U	30.8	U	30.8	U	30.8	U	30.8	U	
#27			S	J3127	840320	1600	10.6	U	10.6	U	10.6	U	10.6	U	638.4		10.6	U	10.6	U	10.6	U	
#28			S	J3128	840320	1612	14.8	U	14.8	U	14.8	U	14.8	U	14.8	U	814		14.8	U	14.8	U	
#29			S	J3129	840320	1620	23.3	U	23.3	U	23.3	U	23.3	U	23.3	U	1807		23.3	U	23.3	U	
#30			S	J3130	840320	1630	13.4	U	1002		13.4	U	13.4	U	13.4	U	13.4	U	13.4	U	13.4	U	
#31 OFF LEFT BUSH			S	12181	840321	0810	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
#31 OFF LEFT BUSH			W	12182	840321	0810	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	
TRANSPORT BLANK			S	J3134	840321		4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	
TRANSPORT BLANK				12187	840321		10	U	10	U	10	U	10	U	10	U	10	U	10	U	40	U	

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: ACENAPHTHENE	BENZIDINE	1,2,4-TRICHLOROBENZENE	HEXACHLOROBENZENE	HEXACHLOROETHANE	BIS 2-CHLOROEHTYL) ETHER	2-CHLORONAPHTHALENE	1,2-DICHLOROBENZENE	1,3-DICHLOROBENZENE
#01			S	J3101	840320	0808	6200 U	24800 U	6200 U	6200 U	6200 U	6200 U	6200 U	6200 U	6200 U
#02			S	J3102	840320	0830	42000 U	168000 U	42000 U	42000 U	42000 U	42000 U	42000 U	42000 U	42000 U
#03			S	J3103	840320	0845	13000	52000 U	13000 U	13000 U	13000 U	13000 U	13000 U	13000 U	13000 U
#04			S	J3104	840320	0900	5000 U	20000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U
#05			S	J3105	840320	0913	22190	10000 U	2500 U	2500 U	2500 U	2500 U	2500 U	2500 U	2500 U
#06			S	J3106	840320	0925	69410	20000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 U
#07			S	J3107	840320	0938	11000 U	44000 U	11000 U	11000 U	11000 U	11000 U	11000 U	11000 U	11000 U
#08			S	J3108	840320	0955	22080	8800 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U
#09			S	J3109	840320	1030	4560 M	18240 U	4560 U	4560 U	4560 U	4560 U	4560 U	4560 U	4560 U
#10			S	J3110	840320	1045	5200 U	20800 U	5200 U	5200 U	5200 U	5200 U	5200 U	5200 U	5200 U
#11			S	J3111	840320	1120	70000 M	280000 U	70000 U	70000 U	70000 U	70000 U	70000 U	70000 U	70000 U
#12			S	J3112	840320	1135	76570	18880 U	4720 U	4720 U	4720 U	4720 U	4720 U	4720 U	4720 U
#13			S	J3113	840320	1325	1890 M	50.4U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
#14			S	J3114	840320	1340	967300	92000 U	23000 U	23000 U	23000 U	23000 U	23000 U	23000 U	23000 U
#15			S	J3115	840320	1345	2200 M	8800 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U
#16			S	J3116	840320	1355	37000 U	148000 U	37000 U	37000 U	37000 U	37000 U	37000 U	37000 U	37000 U
#17			S	J3117	840320	1410	4498600	520000 U	130000 U	130000 U	130000 U	130000 U	130000 U	130000 U	130000 U
#18			S	J3118	840320	1420	129360	8800 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U	2200 U
#19			S	J3119	840320	1430	73050	14920 U	3730 U	3730 U	3730 U	3730 U	3730 U	3730 U	3730 U
#20			S	J3120	840320	1445	280140	22400 U	5600 U	5600 U	5600 U	5600 U	5600 U	5600 U	5600 U
#21			S	J3121	840320	1455	100000 M	400000 U	100000 U	100000 U	100000 U	100000 U	100000 U	100000 U	100000 U
#22			S	J3122	840320	1515	238700	24000 U	6000 U	6000 U	6000 U	6000 U	6000 U	6000 U	6000 U
#23			S	J3123	840320	1525	5100 U	20400 U	5100 U	5100 U	5100 U	5100 U	5100 U	5100 U	5100 U
#24			S	J3124	840320	1530	5100 U	20400 U	5100 U	5100 U	5100 U	5100 U	5100 U	5100 U	5100 U
#25			S	J3125	840320	1545	5500 U	22000 U	5500 U	5500 U	5500 U	5500 U	5500 U	5500 U	5500 U
#26			S	J3126	840320	1555	3100 U	12400 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U
#27			S	J3127	840320	1600	900 U	3600 U	900 U	900 U	900 U	900 U	900 U	900 U	900 U
#28			S	J3128	840320	1612	1480 U	5920 U	1480 U	1480 U	1480 U	1480 U	1480 U	1480 U	1480 U
#29			S	J3129	840320	1620	2300 U	9200 U	2300 U	2300 U	2300 U	2300 U	2300 U	2300 U	2300 U
#30			S	J3130	840320	1630	1300 U	5200 U	1300 U	1300 U	1300 U	1300 U	1300 U	1300 U	1300 U
#31 OFF LEFT BUSH			S	12181	840321	0810	34	300 U	20 U	50 U	40 U	20 U	20 U	20 U	20 U
#31 OFF LEFT BUSH			W	12182	840321	0810	.2	3 U	.2U	.5U	.4U	.2U	.2U	.2U	.2U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	270	3000 U	200 U	500 U	400 U	200 U	200 U	200 U	200 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	.7	9 U	.6U	2 U	1 U	.6U	.6U	.6U	.6U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	220	1500 U	100 U	250 U	200 U	100 U	100 U	100 U	100 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	6.6	60 U	4 U	10 U	8 U	4 U	4 U	4 U	4 U
TRANSPORT BLANK			S	J3134	840321		400 U	1600 U	400 U	400 U	400 U	400 U	400 U	400 U	400 U
TRANSPORT BLANK				12187	840321		.1U	1 U	.1U	.2U	.1U	.1U	.1U	.1U	.1U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: 1,4-DICHLOROBENZENE	3,3'-DICHLOROBENZIDINE	2,4-DINITROTOLUENE	2,6-DINITROTOLUENE	1,2-DIPHENYLHYDRAZAINE	FLUORANTHENE	4-CHLOROPHENYL PHENYL ETHER	4-BROMOPHENYL PHENYL ETHER	BIS(2-CHLOROISOPROPYL) ETHER
#01			S	J3101	840320	0808	6200 U	12400 U	12400 U	12400 U	12400 U	161700	6200 U	6200 U	12400 U
#02			S	J3102	840320	0830	42000 U	84000 U	84000 U	84000 U	84000 U	260000	42000 U	42000 U	84000 U
#03			S	J3103	840320	0845	13000 U	26000 U	26000 U	26000 U	26000 U	438880	13000 U	13000 U	26000 U
#04			S	J3104	840320	0900	5000 U	10000 U	10000 U	10000 U	10000 U	40430	5000 U	5000 U	10000 U
#05			S	J3105	840320	0913	2500 U	5000 U	5000 U	5000 U	5000 U	317000	2500 U	2500 U	5000 U
#06			S	J3106	840320	0925	5000 U	10000 U	10000 U	10000 U	10000 U	208230	5000 U	5000 U	10000 U
#07			S	J3107	840320	0938	11000 U	22000 U	22000 U	22000 U	22000 U	210680	11000 U	11000 U	22000 U
#08			S	J3108	840320	0955	2200 U	4400 U	4400 U	4400 U	4400 U	506000	2200 U	2200 U	4400 U
#09			S	J3109	840320	1030	4560 U	9120 U	9120 U	9120 U	9120 U	524400	4560 U	4560 U	9120 U
#10			S	J3110	840320	1045	5200 U	10400 U	10400 U	10400 U	10400 U	22000	5200 U	5200 U	10400 U
#11			S	J3111	840320	1120	70000 U	140000 U	140000 U	140000 U	140000 U	1839600	70000 U	70000 U	140000 U
#12			S	J3112	840320	1135	4720 U	9440 U	9440 U	9440 U	9440 U	1472500	4720 U	4720 U	9440 U
#13			S	J3113	840320	1325	1000 U	2000 U	2000 U	2000 U	2000 U	21420	1000 U	1000 U	2000 U
#14			S	J3114	840320	1340	23000 U	46000 U	46000 U	46000 U	46000 U	3414000	23000 U	23000 U	46000 U
#15			S	J3115	840320	1345	2200 U	4400 U	4400 U	4400 U	4400 U	18282	2200 U	2200 U	4400 U
#16			S	J3116	840320	1355	37000 U	74000 U	74000 U	74000 U	74000 U	295740	37000 U	37000 U	74000 U
#17			S	J3117	840320	1410	130000 U	260000 U	260000 U	260000 U	260000 U	29810000	130000 U	130000 U	260000 U
#18			S	J3118	840320	1420	2200 U	4400 U	4400 U	4400 U	4400 U	646800	2200 U	2200 U	4400 U
#19			S	J3119	840320	1430	3730 U	7460 U	7460 U	7460 U	7460 U	730500	3730 U	3730 U	7460 U
#20			S	J3120	840320	1445	5600 U	11200 U	11200 U	11200 U	11200 U	1827000	5600 U	5600 U	11200 U
#21			S	J3121	840320	1455	100000 U	200000 U	200000 U	200000 U	200000 U	2636000	100000 U	100000 U	200000 U
#22			S	J3122	840320	1515	6000 U	12000 U	12000 U	12000 U	12000 U	553846	6000 U	6000 U	12000 U
#23			S	J3123	840320	1525	5100 U	10200 U	10200 U	10200 U	10200 U	93750	5100 U	5100 U	10200 U
#24			S	J3124	840320	1530	5100 U	10200 U	10200 U	10200 U	10200 U	298450	5100 U	5100 U	10200 U
#25			S	J3125	840320	1545	5500 U	11000 U	11000 U	11000 U	11000 U	75840	5500 U	5500 U	11000 U
#26			S	J3126	840320	1555	3100 U	6200 U	6200 U	6200 U	6200 U	19231	3100 U	3100 U	6200 U
#27			S	J3127	840320	1600	900 U	1800 U	1800 U	1800 U	1800 U	900 U	900 U	900 U	1800 U
#28			S	J3128	840320	1612	1480 U	2960 U	2960 U	2960 U	2960 U	5550	1480 U	1480 U	2960 U
#29			S	J3129	840320	1620	2300 U	4600 U	4600 U	4600 U	4600 U	2300 M	2300 U	2300 U	4600 U
#30			S	J3130	840320	1630	1300 U	2600 U	2600 U	2600 U	2600 U	14696	1300 U	1300 U	2600 U
#31 OFF LEFT BUSH			S	12181	840321	0810	20 U	40 U	100 U	100 U	100 U	4500	40 U	100 U	20 U
#31 OFF LEFT BUSH			W	12182	840321	0810	.2U	.4U	1 U	1 U	1 U	25	.4U	1 U	.2U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	200 U	400 U	1000 U	1000 U	1000 U	3200	400 U	1000 U	200 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	.6U	1 U	3 U	3 U	3 U	19	1 U	3 U	.6U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	100 U	200 U	500 U	500 U	500 U	34000	200 U	500 U	100 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	4 U	8 U	20 U	20 U	20 U	510	8 U	20 U	4 U
TRANSPORT BLANK			S	J3134	840321		400 U	800 U	800 U	800 U	800 U	400 U	400 U	400 U	800 U
TRANSPORT BLANK				12187	840321		.1U	.1U	.3U	.3U	.3U	.1U	.1U	.3U	.1U

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BIS 2-CHLORO ETHOXY METHANE	HEXA CHLORO BUTA DIENE	HEXA CHLOROCY CLOPENT ADIENE	ISO PHORONE	NAPH THALENE	NITRO BENZENE	N-NITROSO DIMETHYL AMINE	N-NITROSO DIPHENYL AMINE	N-NITROSO DIPROPYL AMINE
#01			S	J3101	840320	0808	12400 U	6200 U	6200 U	6200 U	6200 U	6200 U		6200 U	12400 U
#02			S	J3102	840320	0830	84000 U	42000 U	42000 U	42000 U	42000 M	42000 U		42000 U	84000 U
#03			S	J3103	840320	0845	26000 U	13000 U	13000 U	13000 U	109720	13000 U		13000 U	26000 U
#04			S	J3104	840320	0900	10000 U	5000 U	5000 U	5000 U	5000 U	5000 U		5000 U	10000 U
#05			S	J3105	840320	0913	5000 U	2500 U	2500 U	2500 U	887600	2500 U		2500 U	5000 U
#06			S	J3106	840320	0925	10000 U	5000 U	5000 U	5000 U	5000 M	5000 U		5000 U	10000 U
#07			S	J3107	840320	0938	22000 U	11000 U	11000 U	11000 U	11000 U	11000 U		11000 U	22000 U
#08			S	J3108	840320	0955	4400 U	2200 U	2200 U	2200 U	64400	2200 U		2200 U	4400 U
#09			S	J3109	840320	1030	9120 U	4560 U	4560 U	4560 U	62700	4560 U		4560 U	9120 U
#10			S	J3110	840320	1045	10400 U	5200 U	5200 U	5200 U	5200 U	5200 U		5200 U	10400 U
#11			S	J3111	840320	1120	140000 U	70000 U	70000 U	70000 U	70000 U	70000 U		70000 U	140000 U
#12			S	J3112	840320	1135	9440 U	4720 U	4720 U	4720 U	88350	4720 U		4720 U	9440 U
#13			S	J3113	840320	1325	2000 U	1000 U	1000 U	1000 U	1638 M	1000 U		1000 U	2000 U
#14			S	J3114	840320	1340	46000 U	23000 U	23000 U	23000 U	221910	23000 U		23000 U	46000 U
#15			S	J3115	840320	1345	4400 U	2200 U	2200 U	2200 U	17174	2200 U		2200 U	4400 U
#16			S	J3116	840320	1355	74000 U	37000 U	37000 U	37000 U	37000 M	37000 U		37000 U	74000 U
#17			S	J3117	840320	1410	260000 U	130000 U	130000 U	130000 U	355000	130000 U		130000 U	260000 U
#18			S	J3118	840320	1420	4400 U	2200 U	2200 U	2200 U	53900	2200 U		2200 U	4400 U
#19			S	J3119	840320	1430	7460 U	3730 U	3730 U	3730 U	58440	3730 U		3730 U	7460 U
#20			S	J3120	840320	1445	11200 U	5600 U	5600 U	5600 U	121800	5600 U		5600 U	11200 U
#21			S	J3121	840320	1455	200000 U	100000 U	100000 U	100000 U	100000 U	100000 U		100000 U	200000 U
#22			S	J3122	840320	1515	12000 U	6000 U	6000 U	6000 U	423500	6000 U		6000 U	12000 U
#23			S	J3123	840320	1525	10200 U	5100 U	5100 U	5100 U	5100 U	5100 U		5100 U	10200 U
#24			S	J3124	840320	1530	10200 U	5100 U	5100 U	5100 U	5100 M	5100 U		5100 U	10200 U
#25			S	J3125	840320	1545	11000 U	5500 U	5500 U	5500 U	5500 M	5500 U		5500 U	11000 U
#26			S	J3126	840320	1555	6200 U	3100 U	3100 U	3100 U	3100 U	3100 U		3100 U	6200 U
#27			S	J3127	840320	1600	1800 U	900 U	900 U	900 U	900 U	900 U		900 U	1800 U
#28			S	J3128	840320	1612	2960 U	1480 U	1480 U	1480 U	1480 U	1480 U		1480 U	2960 U
#29			S	J3129	840320	1620	4600 U	2300 U	2300 U	2300 U	2300 U	2300 U		2300 U	4600 U
#30			S	J3130	840320	1630	2600 U	1300 U	1300 U	1300 U	1300 U	1300 U		1300 U	2600 U
#31 OFF LEFT BUSH			S	12181	840321	0810	20 U	50 U	400 U	20 U	1400	20 U		300 U	200 U
#31 OFF LEFT BUSH			W	12182	840321	0810	.2U	.5U	4 U	.2U	5	.2U		3 U	2 U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	200 U	500 U	4000 U	200 U	18300	200 U		3000 U	2000 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	.6U	2 U	12 U	.6U	23	.6U		9 U	6 U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	100 U	250 U	2000 U	100 U	4000	100 U		1500 U	1000 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	4 U	10 U	80 U	4 U	100	4 U		60 U	40 U
TRANSPORT BLANK			S	J3134	840321		800 U	400 U	400 U	400 U	400 U	400 U		400 U	800 U
TRANSPORT BLANK				12187	840321		.1U	.2U	1 U	.1U	.1U	.1U		1 U	1 U

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS								
							BIS 2-ETHYL HEXYL PHTHALAT	BENZYL BUTYL PHTHALAT	DI-N-BUTYL PHTHALAT	DI-N-OCTYL PHTHALAT	DIETHYL PHTHALAT	DIMETHYL PHTHALAT	BENZO A ANTHRACENE	BENZO A PYRENE	BENZO B FLUORANTHENE
#01			S	J3101	840320	0808	6200U	6200 U	6200 U	6200 U	6200 U	6200 U	6200 M	12400 U	12400U
#02			S	J3102	840320	0830	42000U	42000 U	42000 U	42000 U	42000 U	42000 U	42000 M	84000 U	84000U
#03			S	J3103	840320	0845	13000U	13000 U	13000 U	13000 U	13000 U	13000 U	44120	26000 U	26000U
#04			S	J3104	840320	0900	5000U	5000 U	5000 U	5000 U	5000 U	5000 U	5000 M	10000 U	10000U
#05			S	J3105	840320	0913	2500M	2500 U	2500 U	2500 U	2500 U	2500 U	26800	77520	209220
#06			S	J3106	840320	0925	5000U	5000 U	5000 U	5000 U	5000 U	5000 U	757201	132510	473250
#07			S	J3107	840320	0938	11000U	11000 U	11000 U	11000 U	11000 U	11000 U	11000 M	22000 U	22000U
#08			S	J3108	840320	0955	20240	2200 U	2200 U	2200 U	2200 U	2200 U	262200	170200	322000
#09			S	J3109	840320	1030	4560U	4560 U	4560 U	4560 U	4560 U	4560 U	313500	444600	1311000
#10			S	J3110	840320	1045	5200U	5200 U	5200 U	5200 U	5200 U	5200 U	56936	77640	10400M
#11			S	J3111	840320	1120	70000U	70000 U	70000 U	70000 U	70000 U	70000 U	569400	876000	1007400
#12			S	J3112	840320	1135	4720U	4720 U	4720 U	4720 U	4720 U	4720 U	706800	706800	765700
#13			S	J3113	840320	1325	1000U	1000 U	1000 U	1000 U	1000 U	1000 U	9198	12348	15120
#14			S	J3114	840320	1340	23000U	23000 U	23000 U	23000 U	23000 U	23000 U	1024200	796600	2105300
#15			S	J3115	840320	1345	2200U	2200 U	2200 U	14404	2200 U	2200 U	60940	25484	37672
#16			S	J3116	840320	1355	37000U	37000 U	37000 U	37000 M	37000 U	37000 U	37000 M	74000 U	74000U
#17			S	J3117	840320	1410	4390200	130000 U	130000 U	130000 U	130000 U	130000 U	8672000	14092000	8672000
#18			S	J3118	840320	1420	45276	19943	118580	2200 U	22638	2200 U	188650	4400 U	24794
#19			S	J3119	840320	1430	3730U	3730 U	3730 U	3730 U	3730 U	3730 U	287330	433430	394470
#20			S	J3120	840320	1445	5600U	5600 U	5600 U	5600 U	5600 U	5600 U	913500	1035300	913500
#21			S	J3121	840320	1455	100000U	100000 U	100000 U	100000 U	100000 U	100000 U	790800	200000 M	200000M
#22			S	J3122	840320	1515	6000U	6000 U	6000 U	6000 U	6000 U	6000 U	169400	238700	169400
#23			S	J3123	840320	1525	5100U	5100 U	5100 U	5100 U	5100 U	5100 U	5100 M	10200 M	10200U
#24			S	J3124	840320	1530	5100U	5100 U	5100 U	5100 U	5100 U	5100 U	114300	146050	114300
#25			S	J3125	840320	1545	5500U	5500 U	5500 U	5500 U	5500 U	5500 U	5500 M	11000 U	5500U
#26			S	J3126	840320	1555	3100U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 M	6200 U	6200U
#27			S	J3127	840320	1600	900U	900 U	900 U	3724	900 U	900 U	900 U	1800 U	1800U
#28			S	J3128	840320	1612	1480U	1480 U	1480 U	3700 M	1480 U	1480 U	1480 U	2960 U	2960U
#29			S	J3129	840320	1620	2300U	2300 U	2300 U	32065	2300 U	2300 U	2300 U	4600 U	4600U
#30			S	J3130	840320	1630	1300U	1300 U	1300 U	1300 U	1300 U	1300 U	7348	2600 M	2600U
#31 OFF LEFT BUSH			S	12181	840321	0810	690U	20 U	50 U	20 U	20 U	20 U	2100	760	
#31 OFF LEFT BUSH			W	12182	840321	0810	110U	.2U	30 U	2 U	2 U	2 U	7.9	5.6	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	400U	200 U	200 U	200 U	200 U	200 U	2200	1200	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	26U	.6U	1.5U	.6U	.6U	.6U	7.6	1 U	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	400U	100 U	100 U	100 U	100 U	100 U	12000	22000	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	22U	4 U	6 U	4 U	4 U	4 U	210	270	
TRANSPORT BLANK			S	J3134	840321		400U	400 U	400 U	760	400 U	400 U	400 U	800 U	800U
TRANSPORT BLANK				12187	840321		64	.1U	13	.7	.1U	.1U	.1U	.1U	

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BENZO K FLUORANTHENE	CHRYSENE	ACENAPHTHYLENE	ANTHRACENE	BENZO GHI PERYLENE	FLUORENE	PHENANTHRENE	DIBENZO A,H ANTHRACENE	INDENO 1,2,3-CD PYRENE
#01			S	J3101	840320	0808	12400U	6200 M	6200 U	6200 U	12400 U	6200 U	6200 U	12400 U	12400U
#02			S	J3102	840320	0830	84000U	42000 M	42000 U	42000 M	84000 U	42000 U	42000 M	84000 U	84000U
#03			S	J3103	840320	0845	26000U	13000 U	13000 U	13000 U	26000 U	13000 U	278520	26000 U	26000U
#04			S	J3104	840320	0900	10000U	5000 M	5000 M	5000 M	10000 U	5000 U	40430	10000 U	10000U
#05			S	J3105	840320	0913	126800	2500 U	34870	69740	177900	38040	221900	41210	145820
#06			S	J3106	840320	0925	473250	100960	5000 M	50480	10000 U	31550	164060	10000 U	10000U
#07			S	J3107	840320	0938	22000U	11000 U	11000 U	11000 U	22000 U	11000 U	11000 M	22000 U	22000U
#08			S	J3108	840320	0955	354200	285200	42320	73600	303600	16100	19320	59800	262200
#09			S	J3109	840320	1030	1311000	290700	49590	79800	684000	4560 U	165300	9120 U	547200
#10			S	J3110	840320	1045	10400M	18116	5200 U	5200 M	10400 U	5200 U	71170	10400 U	84110
#11			S	J3111	840320	1120	1007400	657000	70000 U	398580	963600	70000 U	963600	140000 U	140000M
#12			S	J3112	840320	1135	765700	535990	52421	318060	883500	38874	824600	9440 U	559550
#13			S	J3113	840320	1325	15120	8190	1000 M	10602	1386 M	1000 M	7308	2000 U	8820M
#14			S	J3114	840320	1340	2105300	1251800	23000 M	853500	910400	352780	3812300	23000 U	967300
#15			S	J3115	840320	1345	55400	72020	2200 M	2200 U	4400 U	2200 M	42658	4400 U	72028
#16			S	J3116	840320	1355	74000U	37000 U	37000 U	37000 M	74000 U	37000 U	235320	74000 U	74000U
#17			S	J3117	840320	1410	9214000	7588000	130000 M	5365800	9756000	2276400	18970000	26000 U	15718000
#18			S	J3118	840320	1420	258720	379400	59620	156310	4400 U	64680	495880	4400 U	4400U
#19			S	J3119	840320	1430	253240	243500	39447	87660	214280	36038	272720	7460 U	199670
#20			S	J3120	840320	1445	669900	913500	66990	578550	475070	188790	1583400	140070	444570
#21			S	J3121	840320	1455	200000U	988500	100000 U	724900	200000 M	100000 U	2833700	200000 U	200000M
#22			S	J3122	840320	1515	154000	223300	50820	154000	215600	6000 M	554400	12000 U	130900
#23			S	J3123	840320	1525	10200U	38125	5100 U	5100 U	10200 U	10200 U	5100 M	10200 U	10200U
#24			S	J3124	840320	1530	101600	152400	5100 U	5100 M	133350	5100 U	48895	10200 U	120650
#25			S	J3125	840320	1545	5500U	5500 M	5500 U	5500 U	11000 U	5500 U	5500 U	11000 U	11000U
#26			S	J3126	840320	1555	6200U	3100 M	3100 U	3100 U	6200 U	3100 U	3100 M	6200 U	6200U
#27			S	J3127	840320	1600	1800U	900 U	900 U	900 U	1800 U	900 U	900 U	1800 U	1800U
#28			S	J3128	840320	1612	2960U	1480 M	1480 U	1480 U	2960 U	1480 U	1480 U	2960 U	2960U
#29			S	J3129	840320	1620	4600U	2300 U	2300 U	2300 U	4600 U	2300 U	2300 M	4600 U	4600U
#30			S	J3130	840320	1630	2600U	7014	1300 U	1300 U	2600 U	1300 U	1300 M	2600 U	2600U
#31 OFF LEFT BUSH			S	12181	840321	0810		2700	130	290	2000	98	3200	1500	1800
#31 OFF LEFT BUSH			W	12182	840321	0810		14	.7	1.3	9.5	.3	8.6	45	12
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		7900	200 U		1800	480	2800	2000 U	1500
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		14	.8	3.4	6 U	.6U	8.3	6 U	6U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		18000	850	5400	18000	510	18000	8900	13000
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		410	33	190	290	24	600	40 U	200
TRANSPORT BLANK			S	J3134	840321		800U	400 U	400 U	400 U	800 U	400 U	400 U	800 U	800U
TRANSPORT BLANK				12187	840321			.1U	.1U	.1U	1 U	.1U	.1U	.1U	1U

LAKE UNION SEDIMENT INVESTIGATION

SEATTLE, WASHINGTON

MARCH 20 - 21, 1984

James Hileman
John Yearsley
Jenny Anderson

U.S. ENVIRONMENTAL PROTECTION AGENCY, 1200 SIXTH AVENUE
SEATTLE, WASHINGTON, 98101

JANUARY 1985

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LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

							BASE / NEUTRALS		
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PYRENE	BENZO(A)ANTHRACENE/ CHRYSENE	BENZO(B)FLUORANTHENE/ BENZO(K)FLUORANTHENE	ANTHRACENE/ PHENANTHRENE
#01			S	J3101	840320	0808	169400			
#02			S	J3102	840320	0830	327600			
#03			S	J3103	840320	0845	416936			
#04			S	J3104	840320	0900	74640			
#05			S	J3105	840320	0913	494520			
#06			S	J3106	840320	0925	31550			
#07			S	J3107	840320	0938	265640			
#08			S	J3108	840320	0955	966000			
#09			S	J3109	840320	1030	1140000			
#10			S	J3110	840320	1045	207040			
#11			S	J3111	840320	1120	2496600			
#12			S	J3112	840320	1135	1825900			
#13			S	J3113	840320	1325	28980			
#14			S	J3114	840320	1340	4039900			
#15			S	J3115	840320	1345	12742			
#16			S	J3116	840320	1355	413400			
#17			S	J3117	840320	1410	34688000			
#18			S	J3118	840320	1420	1185800			
#19			S	J3119	840320	1430	827900			
#20			S	J3120	840320	1445	2618700			
#21			S	J3121	840320	1455	3558600			
#22			S	J3122	840320	1515	600600			
#23			S	J3123	840320	1525	93750			
#24			S	J3124	840320	1530	450850			
#25			S	J3125	840320	1545	61936			
#26			S	J3126	840320	1555	27477			
#27			S	J3127	840320	1600	900 U			
#28			S	J3128	840320	1612	8510			
#29			S	J3129	840320	1620	14575			
#30			S	J3130	840320	1630	23046			
#31 OFF LEFT BUSH			S	12181	840321	0810	4900		2000	
#31 OFF LEFT BUSH			W	12182	840321	0810	27		13	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	11000		2900	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	22		11	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	40000		13000	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	390		220	
TRANSPORT BLANK			S	J3134	840321		400 U			
TRANSPORT BLANK				12187	840321		.1U		.1U	

ORGANIC ANALYSES

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LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	VOLATILES: ACROLEIN	ACRYLONITRILE	BENZENE	CARBON TETRACHLORIDE	CHLOROBENZENE	1,2-DICHLOROETHANE	1,1,1-TRICHLORETHANE	1,1-DICHLOROETHANE	1,1,2-TRICHLORETHANE
#01			S	J3101	840320	0808	385 U	385 U	19.25U	19.25 U	19.25 U	19.25 U	19.25U	19.25 U	19.25 U
#02			S	J3102	840320	0830	520 U	520 U	196	26 U	26 U	26 U	26 U	26 U	26 U
#03			S	J3103	840320	0845	353 U	353 U	17.65U	17.65 U	17.65 U	17.65 U	1367	17.65 U	17.65 U
#04			S	J3104	840320	0900	305 U	305 U	15.25U	15.25 U	15.25 U	15.25 U	15.25U	15.25 U	15.25 U
#05			S	J3105	840320	0913	515 U	515 U	23458	25.75 U	25.75 U	25.75 U	25.75M	25.75 U	25.75 U
#06			S	J3106	840320	0925	631 U	631 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U
#07			S	J3107	840320	0938	455 U	455 U	22.75U	22.75 U	22.75 U	22.75 U	22.75U	22.75 U	22.75 U
#08			S	J3108	840320	0955	220 U	220 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
#09			S	J3109	840320	1030	285 U	285 U	14.25U	14.25 U	14.25 U	14.25 U	14.25U	14.25 U	14.25 U
#10			S	J3110	840320	1045	305.5 U	305.5 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U
#11			S	J3111	840320	1120	206 U	206 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U
#12			S	J3112	840320	1135	443 U	443 U	22.15U	22.15 U	22.15 U	22.15 U	22.15U	22.15 U	22.15 U
#13			S	J3113	840320	1325	58.5 U	58.5 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
#14			S	J3114	840320	1340	280 U	280 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U
#15			S	J3115	840320	1345	264 U	264 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
#16			S	J3116	840320	1355	159 U	159 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U
#17			S	J3117	840320	1410	271 U	271 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U
#18			S	J3118	840320	1420	257 U	257 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U
#19			S	J3119	840320	1430	240 U	240 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U
#20			S	J3120	840320	1445	282 U	282 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U
#21			S	J3121	840320	1455	325 U	325 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U
#22			S	J3122	840320	1515	370 U	370 U	18.5 M	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U
#23			S	J3123	840320	1525	294 U	294 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U
#24			S	J3124	840320	1530	301 U	301 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U
#25			S	J3125	840320	1545	316 U	316 U	15.8 U	15.8 U	15.8 U	15.8 U	114	15.8 U	15.8 U
#26			S	J3126	840320	1555	191 U	191 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
#27			S	J3127	840320	1600	127 U	127 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U
#28			S	J3128	840320	1612	185 U	185 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
#29			S	J3129	840320	1620	265 U	265 U	13.25U	13.25 U	13.25 U	13.25 U	13.25U	13.25 U	13.25 U
#30			S	J3130	840320	1630	156.5 U	156.5 U	7.8 U	7.8 U	7.8 U	7.8 U	7.8 MI	7.8 U	7.8 U
#31 OFF LEFT BUSH			S	12181	840321	0810	12 U	6 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
#31 OFF LEFT BUSH			W	12182	840321	0810	10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	700 U	350 U	140 M	140 U	140 U	140 U	140 U	140 U	140 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	12 U	6 U	2.3 MI	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TRANSPORT BLANK			S	J3134	840321		50 U	50 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
TRANSPORT BLANK				12187	840321		10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	VOLATILES: 1,1,2,2-TETRA CHLORO ETHANE	CHLORO ETHANE	2-CHLORO ETHYL VINLY ETHER	CHLORO FORM	1,1-DICHLORO ETHENE	TRANS-1,2-DICHLORO ETHENE	1,2-DICHLORO PROPANE	TRANS-1,3-DICHLORO PROPENE	CIS-1,3-DICHLORO PROPENE
#01			S	J3101	840320	0808	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	38.5 U
#02			S	J3102	840320	0830	26 U	26 U	26 U	26 U	26 U	26 U	26 U	26 U	52 U
#03			S	J3103	840320	0845	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	35.3 U
#04			S	J3104	840320	0900	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	30.5 U
#05			S	J3105	840320	0913	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	51.5 U
#06			S	J3106	840320	0925	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	63.1 U
#07			S	J3107	840320	0938	22.75 U	22.75 U	22.75 U	22.75 U	22.75 U	22.75 U	22.75 U	22.75 U	45.5 U
#08			S	J3108	840320	0955	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	22 U
#09			S	J3109	840320	1030	14.25 U	14.25 U	14.25 U	14.25 U	14.25 U	14.25 U	14.25 U	14.25 U	28.5 U
#10			S	J3110	840320	1045	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	15.3 U	30.5 U
#11			S	J3111	840320	1120	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	20.6 U
#12			S	J3112	840320	1135	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	44.3 U
#13			S	J3113	840320	1325	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	5.8 U
#14			S	J3114	840320	1340	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	28 U
#15			S	J3115	840320	1345	13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	26 U
#16			S	J3116	840320	1355	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	16 U
#17			S	J3117	840320	1410	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	27 U
#18			S	J3118	840320	1420	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	25 U
#19			S	J3119	840320	1430	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	24 U
#20			S	J3120	840320	1445	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	28 U
#21			S	J3121	840320	1455	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	32.6 U
#22			S	J3122	840320	1515	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	37 U
#23			S	J3123	840320	1525	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	29.4 U
#24			S	J3124	840320	1530	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	30 U
#25			S	J3125	840320	1545	15.8 U	15.8 U	15.8 U	15.8 U	15.8 U	15.8 U	15.8 U	15.8 U	31.6 U
#26			S	J3126	840320	1555	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	19.1 U
#27			S	J3127	840320	1600	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	12.8 U
#28			S	J3128	840320	1612	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	18.5 U
#29			S	J3129	840320	1620	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	26.5 U
#30			S	J3130	840320	1630	7.8 U	7.8 U	7.8 U	7.8 U	7.8 U	7.8 U	7.8 U	7.8 U	15.6 U
#31 OFF LEFT BUSH			S	12181	840321	0810	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
#31 OFF LEFT BUSH			W	12182	840321	0810	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
TRANSPORT BLANK			S	J3134	840321		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
TRANSPORT BLANK				12187	840321		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

ORGANIC ANALYSES

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	VOLATILES									
							ETHYL BENZENE	METHYL LENE CHLORIDE	CHLORO METHANE	BROMO METHANE	BROMO FORM	BROMO DICHLORO METHANE	FLUORO TRICHLOR METHANE	DICHLORO DIFLUORO METHANE	CHLORO DIBROMO METHANE	
#01			S	J3101	840320	0808	19.25 U	19.25M	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	19.25 U	
#02			S	J3102	840320	0830	26 M	52 U	52 U	52 U	52 U	52 U	52 U	52 U	52 U	
#03			S	J3103	840320	0845	17.65 U	17.65U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	17.65 U	
#04			S	J3104	840320	0900	15.25 U	1244	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	15.25 U	
#05			S	J3105	840320	0913	621	25.75U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	25.75 U	
#06			S	J3106	840320	0925	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	31.6 U	
#07			S	J3107	840320	0938	22.75 U	3664	22.75 U	22.75 U	22.75 U	22.75 U	22.75 M	22.75 U	22.75 U	
#08			S	J3108	840320	0955	11 U	83	11 U	11 U	11 U	11 U	11 U	11 U	11 U	
#09			S	J3109	840320	1030	14.25 U	14.25M	14.25 U	14.25 U	14.25 U	14.25 U	14.25 M	14.25 U	14.25 U	
#10			S	J3110	840320	1045	15.3 U	1035	15.3 U	15.3 U	15.3 U	15.3 U	15.3 M	15.3 U	15.3 U	
#11			S	J3111	840320	1120	10.3 U	52.6	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	10.3 U	
#12			S	J3112	840320	1135	22.15 U	22.15U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	22.15 U	
#13			S	J3113	840320	1325	3 U	3 M	3 U	3 U	3 U	3 U	3 U	3 U	3 U	
#14			S	J3114	840320	1340	14 U	159	14 U	14 U	14 U	14 U	14 M	14 U	14 U	
#15			S	J3115	840320	1345	13 U	13 M	13 U	13 U	13 U	13 U	13 U	13 U	13 U	
#16			S	J3116	840320	1355	8 U	51	8 U	8 U	8 U	8 U	8 M	8 U	8 U	
#17			S	J3117	840320	1410	13.5 U	3957	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	13.5 U	
#18			S	J3118	840320	1420	12.8 U	1132	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	
#19			S	J3119	840320	1430	12 U	1023	12 U	12 U	12 U	12 U	12 M	12 U	12 U	
#20			S	J3120	840320	1445	14 U	1035	14 U	14 U	14 U	14 U	14 U	14 U	14 U	
#21			S	J3121	840320	1455	16.3 U	507	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	16.3 U	
#22			S	J3122	840320	1515	454	1155	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	18.5 U	
#23			S	J3123	840320	1525	14.7 U	15360	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	14.7 U	
#24			S	J3124	840320	1530	15 U	15 M	15 U	15 U	15 U	15 U	15 U	15 U	15 U	
#25			S	J3125	840320	1545	15.8 U	15.8 M	15.8 U	15.8 U	15.8 U	15.8 U	158	15.8 U	15.8 U	
#26			S	J3126	840320	1555	9.5 U	57	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	
#27			S	J3127	840320	1600	6.4 U	193.0	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	
#28			S	J3128	840320	1612	9.3 U	99.9	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	
#29			S	J3129	840320	1620	13.25 U	187	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	13.25 U	
#30			S	J3130	840320	1630	7.8 U	127	7.8 U	7.8 U	7.8 U	7.8 U	7.8 M	7.8 U	7.8 U	
#31 OFF LEFT BUSH			S	12181	840321	0810	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	
#31 OFF LEFT BUSH			W	12182	840321	0810	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	
TRANSPORT BLANK			S	J3134	840321		5.0 U	2300	2.5 U	2.5 U	2.5 U	2.5 U	2.5 M	2.5 U	2.5 U	
TRANSPORT BLANK				12187	840321		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

U NOT DETECTED -- VALUE SHOWN IS THE MINIMUM QUANTIFIABLE LIMIT
M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	VOLATILES			
							TETRA CHLORO ETHENE	TOLUENE	TRICHLOR ETHENE	VINYL CHLORIDE
#01			S	J3101	840320	0808	19.25 U	19.25 U	19.25 U	19.25 U
#02			S	J3102	840320	0830	52 U	52 U	52 U	52 U
#03			S	J3103	840320	0845	17.65 U	17.65 U	17.65 U	17.65 U
#04			S	J3104	840320	0900	15.25 U	15.25 U	15.25 U	15.25 U
#05			S	J3105	840320	0913	25.75 U	25.75 U	25.75 U	25.75 U
#06			S	J3106	840320	0925	31.6 U	31.6 U	31.6 U	31.6 U
#07			S	J3107	840320	0938	22.75 U	22.75 U	22.75 U	22.75 U
#08			S	J3108	840320	0955	11 U	11 U	11 U	11 U
#09			S	J3109	840320	1030	14.25 U	14.25 U	14.25 U	14.25 U
#10			S	J3110	840320	1045	15.3 U	15.3 U	15.3 U	15.3 U
#11			S	J3111	840320	1120	10.3 U	10.3 U	10.3 U	10.3 U
#12			S	J3112	840320	1135	22.15 U	22.15 U	22.15 U	22.15 U
#13			S	J3113	840320	1325	3 U	3 U	3 U	3 U
#14			S	J3114	840320	1340	14 U	14 U	14 U	14 U
#15			S	J3115	840320	1345	13 U	13 U	13 U	13 U
#16			S	J3116	840320	1355	8 U	8 U	8 U	8 U
#17			S	J3117	840320	1410	13.5 U	13.5 U	13.5 U	13.5 U
#18			S	J3118	840320	1420	12.8 U	12.8 U	12.8 U	12.8 U
#19			S	J3119	840320	1430	12 U	12 U	12 U	12 U
#20			S	J3120	840320	1445	14 U	14 U	14 U	14 U
#21			S	J3121	840320	1455	16.3 U	16.3 U	16.3 U	16.3 U
#22			S	J3122	840320	1515	18.5 U	18.5 M	18.5 U	18.5 U
#23			S	J3123	840320	1525	14.7 U	14.7 U	14.7 U	14.7 U
#24			S	J3124	840320	1530	15 U	15 U	15 U	15 U
#25			S	J3125	840320	1545	15.8 U	15.8 U	15.8 U	15.8 U
#26			S	J3126	840320	1555	9.5 U	9.5 U	9.5 U	9.5 U
#27			S	J3127	840320	1600	6.4 U	6.4 U	6.4 U	6.4 U
#28			S	J3128	840320	1612	9.3 U	9.3 U	9.3 U	9.3 U
#29			S	J3129	840320	1620	13.25 U	13.25 U	13.25 U	13.25 U
#30			S	J3130	840320	1630	7.8 U	7.8 U	7.8 U	7.8 U
#31 OFF LEFT BUSH			S	12181	840321	0810	2.4 U	2.4 U	2.4 U	2.4 U
#31 OFF LEFT BUSH			W	12182	840321	0810	2 U	2 U	2 U	2 U
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	140 U	140 U	140 U	140 U
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	2 U	2 U	2 U	2 U
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	2.3 U	2.3 U	2.3 U	2.3 U
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	2 U	2 U	2 U	2 U
TRANSPORT BLANK			S	J3134	840321		2.5 U	2.5 U	2.5 U	2.5 U
TRANSPORT BLANK				12187	840321		2 U	2 U	2 U	2 U

APPENDIX B

COMPLETE LISTING OF CHEMICAL CONCENTRATIONS ON A DRY WEIGHT BASIS EXCLUDING THOSE BELOW THE MINIMUM QUANTIFIABLE LIMIT

INORGANICS -- METALS

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS PARAMETERS AL*	CR	BA*	BE	CO*	CU	FE*	NI
#01			S	12151	840320	0808		55.5		.45		168		62.7
#02			S	12152	840320	0830		55.1		.39		192		291
#03			S	12153	840320	0845		52.3		.35		205		71.0
#04			S	12154	840320	0900		61.5		.48		162		73.3
#05			S	12155	840320	0913		32.9		.33		134		265
#06			S	12156	840320	0925		57.0		.45		174		97.6
#07			S	12157	840320	0938		54.1		.33		169		56.4
#08			S	12158	840320	0955		35.9		.31		79		223
#09			S	12159	840320	1030		48.5		.34		158		94.5
#10			S	12160	840320	1045		53.8		.40		163		64.0
#11			S	12161	840320	1120		32.4		.26		72		202
#12			S	12162	840320	1135		47.6		.35		152		125
#13			S	12163	840320	1325		22.1		.20		24		47.1
#14			S	12164	840320	1340		47.6		.41		138		130
#15			S	12165	840320	1345		61.6		.42		250		72.8
#16			S	12166	840320	1355		26.0		.21		104		88.0
#17			S	12167	840320	1410		36.3		.34		120		162
#18			S	12168	840320	1420		56.7		.46		171		132
#19			S	12169	840320	1430		47.4		.31		186		91.6
#20			S	12170	840320	1445		62.6		.48		181		85.8
#21			S	12171	840320	1455		45.2		.37		175		141
#22			S	12172	840320	1515		59.2		.50		301		70.8
#23			S	12173	840320	1525		64.8		.50		230		110
#24			S	12174	840320	1530		83.7		.51		375		94.5
#25			S	12175	840320	1545		86.6		.50		484		92.0
#26			S	12176	840320	1555		74.4		.44		587		69.1
#27			S	12177	840320	1600		75.1		.80		124		93.2
#28			S	12178	840320	1612		65.5		.62		184		78.6
#29			S	12179	840320	1620		67.6		.56		242		71.4
#30			S	12180	840320	1630		70.3		.55		121		84.8
#31 OFF LEFT BUSH			S	12181	840321	0810		17.4		.22		23		98.9
#31 OFF LEFT BUSH			W	12182	840321	0810		.001				.058		.062
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		13.9		.15		88		89.7
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		13				200		220
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		18.1		.25		32		206
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		.013				.078		.613
TRANSPORT BLANK				12187	840321							.037		.012

INORGANICS -- METALS

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS PARAMETERS MN*	ZN	B*	V*	AG	AS	SB	SE
#01			S	12151	840320	0808		456			12.45	34.5	.9	.4
#02			S	12152	840320	0830		431			10.27	284	.3	.2
#03			S	12153	840320	0845		482			11.21	53.5	.5	.2
#04			S	12154	840320	0900		450			10.60	27.6	.3	.3
#05			S	12155	840320	0913		293			10.18	39.0	.1	.2
#06			S	12156	840320	0925		427			11.82	36.5	.4	.5
#07			S	12157	840320	0938		416			13.02	55.5	.4	.5
#08			S	12158	840320	0955		210			10.33	12.8	.1	
#09			S	12159	840320	1030		352			11.15	26.9	.4	.3
#10			S	12160	840320	1045		420			10.31	33.1	.3	.4
#11			S	12161	840320	1120		153			10.47	21.7	.2	
#12			S	12162	840320	1135		336			12.45	35.0	.2	.2
#13			S	12163	840320	1325		70			10.06	3.6		
#14			S	12164	840320	1340		327			12.49	27.5	.3	.3
#15			S	12165	840320	1345		485			13.77	31.9		.5
#16			S	12166	840320	1355		175			10.61	11.7	.3	
#17			S	12167	840320	1410		250			11.59	22.1	.3	.2
#18			S	12168	840320	1420		382			12.68	26.2		
#19			S	12169	840320	1430		350			12.64	31.0	.5	.2
#20			S	12170	840320	1445		454			13.99	28.7		.7
#21			S	12171	840320	1455		285			11.04	18.3	.7	.6
#22			S	12172	840320	1515		648			12.23	85.0	.1	.2
#23			S	12173	840320	1525		476			11.53	23.0	.1	.6
#24			S	12174	840320	1530		708			10.54	42.5		.8
#25			S	12175	840320	1545		740			11.95	33.0		.2
#26			S	12176	840320	1555		1058			13.18	168	6.4	.5
#27			S	12177	840320	1600		177			11.02	10.4	.2	.6
#28			S	12178	840320	1612		512			16.91	20.2	.3	
#29			S	12179	840320	1620		668			15.65	28.0	.2	.4
#30			S	12180	840320	1630		276			14.47	12.6	.1	.4
#31 OFF LEFT BUSH			S	12181	840321	0810		71				5.7	4.9	
#31 OFF LEFT BUSH			W	12182	840321	0810		.047					.001	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		51				13.2	25.0	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		100				25	7	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		75				6.7	.1	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		.071				.048	.001	
TRANSPORT BLANK				12187	840321			.001						

INORGANICS -- METALS

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: EPA LAB -- MANCHESTER
UNITS: SEDIMENT MG/KG (PPM) DRY WEIGHT BASIS
WATER MG/L (PPM)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	ITR NUM	DATE	TIME	METALS TL	METALS HG	PARAMETERS SN*	PARAMETERS CD	PARAMETERS PB	PHENOLIC	CN
#01			S	12151	840320	0808		1.136		2.1	397		
#02			S	12152	840320	0830		2.626		1.5	416		1680
#03			S	12153	840320	0845	.1	1.483		2.2	541		168
#04			S	12154	840320	0900	.1	1.418		2.1	324		5.8
#05			S	12155	840320	0913		1.114		1.4	296		1190
#06			S	12156	840320	0925	.1	1.356		2.0	288		96.6
#07			S	12157	840320	0938		1.398		2.3	512		17.7
#08			S	12158	840320	0955		.587		1.0	158		6.5
#09			S	12159	840320	1030	.2	.983		1.7	471		21.7
#10			S	12160	840320	1045	.1	1.325		2.4	377		.78 M
#11			S	12161	840320	1120	.1	.494		0.2	101		3.8
#12			S	12162	840320	1135	.2	.780		2.1	319		16.5
#13			S	12163	840320	1325		.051		0.3	28		.24
#14			S	12164	840320	1340		.798		1.9	263		1.4
#15			S	12165	840320	1345	.1	1.255		2.0	466		.83 M
#16			S	12166	840320	1355	.2	.311		0.8	284		8.0
#17			S	12167	840320	1410		.570		1.0	199		5.3
#18			S	12168	840320	1420	.3	1.177		0.3	277		4.6
#19			S	12169	840320	1430		.775		1.5	403		7.3
#20			S	12170	840320	1445		1.060		2.3	311		4.1
#21			S	12171	840320	1455		1.389		0.4	185		1.4
#22			S	12172	840320	1515	.2	1.032		1.8	508		3.9
#23			S	12173	840320	1525		1.162		0.6	304		1.5
#24			S	12174	840320	1530		3.173		2.2	455		1.2
#25			S	12175	840320	1545		4.293		0.5	441		.72
#26			S	12176	840320	1555	.1	2.619		0.2	720		1.2
#27			S	12177	840320	1600	.2	.458		0.1	60		.43
#28			S	12178	840320	1612	.1	1.555		2.0	381		1.1
#29			S	12179	840320	1620		2.316		2.3	572		1.9
#30			S	12180	840320	1630	.2	1.227		1.2	262		.93
#31 OFF LEFT BUSH			S	12181	840321	0810		.034		.2	126		15
#31 OFF LEFT BUSH			W	12182	840321	0810				.0002	.078		.43
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		.757		.1	962		215
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		1.48			1225		7.2
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		.059		.3	37		5.0
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840				.0002	.078		.05
TRANSPORT BLANK				12187	840321						.019		

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

							ACID COMPOUNDS		
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	4,6,DI NITRO O CRESOL	PENTA CHLORO PHENOL	PHENOL
#05			S	J3105	840320	0913			20922
#07			S	J3107	840320	0938		375560	

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

							PESTICIDES									
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	ALDRIN	DIELDRIN	CHLOR-DANE		4,4'-DDT		4,4'-DDE		4,4'-DDD		A-ENDO SULFAN		B-ENDO SULFAN	
#04			S	J3104	840320	0900									143	M				
#14			S	J3114	840320	1340									853	M				
#28			S	J3128	840320	1612			777											

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PCB							TOXAPHENE	TCDD DIOXIN
							PCB-1242	PCB-1254	PCB-1221	PCB-1232	PCB-1248	PCB-1260	PCB-1016		
#01			S	J3101	840320	0808		4466							
#26			S	J3126	840320	1555		11550							
#27			S	J3127	840320	1600					638.4				
#28			S	J3128	840320	1612						814			
#29			S	J3129	840320	1620						1807			
#30			S	J3130	840320	1630		1002							

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: ACENAPHTHENE	BENZIDINE	1,2,4-TRICHLOROBENZENE	HEXACHLOROBENZENE	HEXACHLOROETHANE	BIS 2-CHLOROEHTYL) ETHER	2-CHLORONAPHTHALENE	1,2-DICHLOROBENZENE	1,3-DICHLOROBENZENE
#03			S	J3103	840320	0845	13000								
#05			S	J3105	840320	0913	22190								
#06			S	J3106	840320	0925	69410								
#08			S	J3108	840320	0955	22080								
#09			S	J3109	840320	1030	4560 M								
#11			S	J3111	840320	1120	70000 M								
#12			S	J3112	840320	1135	76570								
#13			S	J3113	840320	1325	1890 M								
#14			S	J3114	840320	1340	967300								
#15			S	J3115	840320	1345	2200 M								
#17			S	J3117	840320	1410	4498600								
#18			S	J3118	840320	1420	129360								
#19			S	J3119	840320	1430	73050								
#20			S	J3120	840320	1445	280140								
#21			S	J3121	840320	1455	100000 M								
#22			S	J3122	840320	1515	238700								
#31 OFF LEFT BUSH			S	12181	840321	0810	34								
#31 OFF LEFT BUSH			W	12182	840321	0810	.2								
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	270								
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	.7								
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	220								
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	6.6								

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: 1,4-DI CHLORO BENZENE	3,3'-DICHLORO BENZI DINE	2,4-DINITRO TOLUENE	2,6-DINITRO TOLUENE	1,2-DI PHENYLHY DRAZAINE	FLUOR ANTHENE	4-CHLORO PHENYL PHENYL ETHER	4-BROMO PHENYL PHENYL ETHER	BIS(2-CHLOROISO PROPYL) ETHER
#01			S	J3101	840320	0808						161700			
#02			S	J3102	840320	0830						260000			
#03			S	J3103	840320	0845						438880			
#04			S	J3104	840320	0900						40430			
#05			S	J3105	840320	0913						317000			
#06			S	J3106	840320	0925						208230			
#07			S	J3107	840320	0938						210680			
#08			S	J3108	840320	0955						506000			
#09			S	J3109	840320	1030						524400			
#10			S	J3110	840320	1045						22000			
#11			S	J3111	840320	1120						1839600			
#12			S	J3112	840320	1135						1472500			
#13			S	J3113	840320	1325						21420			
#14			S	J3114	840320	1340						3414000			
#15			S	J3115	840320	1345						18282			
#16			S	J3116	840320	1355						295740			
#17			S	J3117	840320	1410						29810000			
#18			S	J3118	840320	1420						646800			
#19			S	J3119	840320	1430						730500			
#20			S	J3120	840320	1445						1827000			
#21			S	J3121	840320	1455						2636000			
#22			S	J3122	840320	1515						553846			
#23			S	J3123	840320	1525						93750			
#24			S	J3124	840320	1530						298450			
#25			S	J3125	840320	1545						75840			
#26			S	J3126	840320	1555						19231			
#28			S	J3128	840320	1612						5550			
#29			S	J3129	840320	1620						2300 M			
#30			S	J3130	840320	1630						14696			
#31 OFF LEFT BUSH			S	12181	840321	0810						4500			
#31 OFF LEFT BUSH			W	12182	840321	0810						25			
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820						3200			
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820						19			
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840						34000			
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840						510			

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BIS 2-CHLORO ETHOXY METHANE	HEXA CHLORO BUTA DIENE	HEXA CHLOROCY CLOPENT ADIENE	ISO PHORONE	NAPH THALENE	NITRO BENZENE	N-NITROSO DIMETHYL AMINE	N-NITROSO DIPHENYL AMINE	N-NITROSO DIPROPYL AMINE
#02			S	J3102	840320	0830					42000 M				
#03			S	J3103	840320	0845					109720				
#05			S	J3105	840320	0913					887600				
#06			S	J3106	840320	0925					5000 M				
#08			S	J3108	840320	0955					64400				
#09			S	J3109	840320	1030					62700				
#12			S	J3112	840320	1135					88350				
#13			S	J3113	840320	1325					1638 M				
#14			S	J3114	840320	1340					221910				
#15			S	J3115	840320	1345					17174				
#16			S	J3116	840320	1355					37000 M				
#17			S	J3117	840320	1410					1355000				
#18			S	J3118	840320	1420					53900				
#19			S	J3119	840320	1430					58440				
#20			S	J3120	840320	1445					121800				
#22			S	J3122	840320	1515					423500				
#24			S	J3124	840320	1530					5100 M				
#25			S	J3125	840320	1545					5500 M				
#31 OFF LEFT BUSH			S	12181	840321	0810					1400				
#31 OFF LEFT BUSH			W	12182	840321	0810					5				
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820					18300				
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820					23				
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840					4000				
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840					100				

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS								
							BIS 2-ETHYL HEXYL PHTHALAT	BENZYL BUTYL PHTHALAT	DI-N-BUTYL PHTHALAT	DI-N-OCTYL PHTHALAT	DIETHYL PHTHALAT	DIMETHYL PHTHALAT	BENZO A ANTHRACENE	BENZO A PYRENE	BENZO B FLUORANTHENE
#01			S	J3101	840320	0808							6200 M		
#02			S	J3102	840320	0830							42000 M		
#03			S	J3103	840320	0845							144120		
#04			S	J3104	840320	0900							5000 M		
#05			S	J3105	840320	0913	2500M						126800	177520	209220
#06			S	J3106	840320	0925							757201	132510	473250
#07			S	J3107	840320	0938							11000 M		
#08			S	J3108	840320	0955	20240						262200	170200	322000
#09			S	J3109	840320	1030							313500	444600	1311000
#10			S	J3110	840320	1045							56936	77640	10400M
#11			S	J3111	840320	1120							569400	876000	1007400
#12			S	J3112	840320	1135							706800	706800	765700
#13			S	J3113	840320	1325							9198	12348	15120
#14			S	J3114	840320	1340							1024200	796600	2105300
#15			S	J3115	840320	1345				14404			60940	25484	37672
#16			S	J3116	840320	1355				37000 M			37000 M		
#17			S	J3117	840320	1410	4390200						8672000	14092000	8672000
#18			S	J3118	840320	1420	45276	19943	118580		22638		188650		24794
#19			S	J3119	840320	1430							287330	433430	394470
#20			S	J3120	840320	1445							913500	1035300	913500
#21			S	J3121	840320	1455							790800	200000 M	200000M
#22			S	J3122	840320	1515							169400	238700	169400
#23			S	J3123	840320	1525							5100 M	10200 M	
#24			S	J3124	840320	1530							114300	146050	114300
#25			S	J3125	840320	1545							5500 M		
#26			S	J3126	840320	1555							3100 M		
#27			S	J3127	840320	1600				3724					
#28			S	J3128	840320	1612				3700 M					
#29			S	J3129	840320	1620				32065					
#30			S	J3130	840320	1630							7348	2600 M	
#31 OFF LEFT BUSH			S	12181	840321	0810							2100	760	
#31 OFF LEFT BUSH			W	12182	840321	0810							7.9	5.6	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820							2200	1200	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820							7.6		
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840							12000	22000	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840							210	270	
TRANSPORT BLANK			S	J3134	840321					760					
TRANSPORT BLANK				12187	840321		64		13	.7					

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	BASE / NEUTRALS: BENZO K FLUORANTHENE	CHRYSENE	ACENAPHTHYLENE	ANTHRACENE	BENZO GHI PERYLENE	FLUORENE	PHENANTHRENE	DIBENZO A,H ANTHRACENE	INDENO 1,2,3-CD PYRENE
#01			S	J3101	840320	0808		6200 M							
#02			S	J3102	840320	0830		42000 M		42000 M			42000 M		
#03			S	J3103	840320	0845							278520		
#04			S	J3104	840320	0900		5000 M	5000 M	5000 M			40430		
#05			S	J3105	840320	0913	126800		34870	69740	177900	38040	221900	41210	145820
#06			S	J3106	840320	0925	473250	100960	5000 M	50480		31550	164060		
#07			S	J3107	840320	0938							11000 M		
#08			S	J3108	840320	0955	354200	285200	42320	73600	303600	16100	19320	59800	262200
#09			S	J3109	840320	1030	1311000	290700	49590	79800	684000		165300		547200
#10			S	J3110	840320	1045	10400M	18116		5200 M			71170		84110
#11			S	J3111	840320	1120	1007400	657000		398580	963600		963600		140000M
#12			S	J3112	840320	1135	765700	535990	52421	318060	883500	38874	824600		559550
#13			S	J3113	840320	1325	15120	8190	1000 M	10602	1386 M	1000 M	7308		8820M
#14			S	J3114	840320	1340	2105300	1251800	23000 M	853500	910400	352780	3812300		967300
#15			S	J3115	840320	1345	55400	72020	2200 M			2200 M	42658		72028
#16			S	J3116	840320	1355				37000 M			235320		
#17			S	J3117	840320	1410	9214000	7588000	130000 M	5365800	9756000	2276400	18970000		15718000
#18			S	J3118	840320	1420	258720	379400	59620	156310		64680	495880		
#19			S	J3119	840320	1430	253240	243500	39447	87660	214280	36038	272720		199670
#20			S	J3120	840320	1445	669900	913500	66990	578550	475070	188790	1583400	140070	444570
#21			S	J3121	840320	1455		988500		724900	200000 M		2833700		200000M
#22			S	J3122	840320	1515	154000	223300	50820	154000	215600	6000 M	554400		130900
#23			S	J3123	840320	1525		38125					5100 M		
#24			S	J3124	840320	1530	101600	152400		5100 M	133350		48895		120650
#25			S	J3125	840320	1545		5500 M							
#26			S	J3126	840320	1555		3100 M					3100 M		
#28			S	J3128	840320	1612		1480 M							
#29			S	J3129	840320	1620							2300 M		
#30			S	J3130	840320	1630		7014					1300 M		
#31 OFF LEFT BUSH			S	12181	840321	0810		2700	130	290	2000	98	3200	1500	1800
#31 OFF LEFT BUSH			W	12182	840321	0810		14	.7	1.3	9.5	.3	8.6	45	12
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820		7900			1800	480	2800		1500
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820		14	.8	3.4			8.3		
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840		18000	850	5400	18000	510	18000	8900	13000
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840		410	33	190	290	24	600		200

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

							BASE / NEUTRALS		
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	PYRENE	BENZO(A)ANTHRACENE/ CHRYSENE	BENZO(B)FLUORANTHENE/ BENZO(K)FLUORANTHENE	ANTHRACENE/ PHENANTHRENE
#01			S	J3101	840320	0808	169400			
#02			S	J3102	840320	0830	327600			
#03			S	J3103	840320	0845	416936			
#04			S	J3104	840320	0900	74640			
#05			S	J3105	840320	0913	494520			
#06			S	J3106	840320	0925	31550			
#07			S	J3107	840320	0938	265640			
#08			S	J3108	840320	0955	966000			
#09			S	J3109	840320	1030	1140000			
#10			S	J3110	840320	1045	207040			
#11			S	J3111	840320	1120	2496600			
#12			S	J3112	840320	1135	1825900			
#13			S	J3113	840320	1325	28980			
#14			S	J3114	840320	1340	4039900			
#15			S	J3115	840320	1345	12742			
#16			S	J3116	840320	1355	413400			
#17			S	J3117	840320	1410	34688000			
#18			S	J3118	840320	1420	1185800			
#19			S	J3119	840320	1430	827900			
#20			S	J3120	840320	1445	2618700			
#21			S	J3121	840320	1455	3558600			
#22			S	J3122	840320	1515	600600			
#23			S	J3123	840320	1525	93750			
#24			S	J3124	840320	1530	450850			
#25			S	J3125	840320	1545	61936			
#26			S	J3126	840320	1555	27477			
#28			S	J3128	840320	1612	8510			
#29			S	J3129	840320	1620	14575			
#30			S	J3130	840320	1630	23046			
#31 OFF LEFT BUSH			S	12181	840321	0810	4900		2000	
#31 OFF LEFT BUSH			W	12182	840321	0810	27		13	
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820	11000		2900	
#32 NEAR CONCRETE BLOCK			W	12184	840321	0820	22		11	
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840	40000		13000	
#33 MIDWAY BLOCK & PIER			W	12186	840321	0840	390		220	

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	VOLATILES: ACROLEIN	ACRYLO NITRILE	BENZENE	CARBON TETRA CHLORIDE	CHLORO BENZENE	1,2-DICHLORO ETHANE	1,1,1-TRICHLOR ETHANE	1,1-DICHLORO ETHANE	1,1,2-TRICHLOR ETHANE
#02			S	J3102	840320	0830			1196						
#03			S	J3103	840320	0845							1367		
#05			S	J3105	840320	0913			23458				25.75M		
#22			S	J3122	840320	1515			18.5 M						
#25			S	J3125	840320	1545							114		
#30			S	J3130	840320	1630							7.8 M		
#32 NEAR CONCRETE BLOCK			S	12183	840321	0820			140 M						
#33 MIDWAY BLOCK & PIER			S	12185	840321	0840			2.3 M						

ORGANIC ANALYSES

LAKE UNION SEDIMENT SURVEY
SEATTLE, WASHINGTON

M COMPOUND PRESENT BUT BELOW THE MINIMUM QUANTIFIABLE LIMIT
ANALYSES: MEED COMPUCHEM
UNITS: SEDIMENT UG/KG (PPB) DRY WEIGHT BASIS
WATER (UG/L (PPB)

							VOLATILES							
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	ETHYL BENZENE	METHYL LENE CHLORIDE	CHLORO METHANE	BROMO METHANE	BROMO FORM	BROMO DICHLORO METHANE	FLUORO TRICHLOR METHANE	DICHLORO DIFLUORO METHANE	CHLORO DIBROMO METHANE
#01			S	J3101	840320	0808		19.25M							
#02			S	J3102	840320	0830	26 M								
#04			S	J3104	840320	0900		1244							
#05			S	J3105	840320	0913	621								
#07			S	J3107	840320	0938		3664					22.75 M		
#08			S	J3108	840320	0955		83							
#09			S	J3109	840320	1030		14.25M					14.25 M		
#10			S	J3110	840320	1045		1035					15.3 M		
#11			S	J3111	840320	1120		52.6							
#13			S	J3113	840320	1325		3 M							
#14			S	J3114	840320	1340		159					14 M		
#15			S	J3115	840320	1345		13 M							
#16			S	J3116	840320	1355		51					8 M		
#17			S	J3117	840320	1410		3957							
#18			S	J3118	840320	1420		1132							
#19			S	J3119	840320	1430		1023					12 M		
#20			S	J3120	840320	1445		1035							
#21			S	J3121	840320	1455		507							
#22			S	J3122	840320	1515	454	1155							
#23			S	J3123	840320	1525		15360							
#24			S	J3124	840320	1530		15 M							
#25			S	J3125	840320	1545		15.8 M					158		
#26			S	J3126	840320	1555		57							
#27			S	J3127	840320	1600		193.0							
#28			S	J3128	840320	1612		99.9							
#29			S	J3129	840320	1620		187							
#30			S	J3130	840320	1630		127					7.8 M		
TRANSPORT BLANK			S	J3134	840321			2300					2.5 M		

							VOLATILES			
STATION DESCRIPTION	STA NUM	WELL DEPTH	M	OTR NUM	DATE	TIME	TETRA CHLORO ETHENE	TOLUENE	TRICHLOR ETHENE	VINYL CHLORIDE
#22			S	J3122	840320	1515		18.5 M		

APPENDIX C

DEPTH, PERCENT SOLIDS, SEDIMENT DESCRIPTION

LAKE UNION
SEDIMENT INVESTIGATION

Station Number	% Solids	Depth (Feet)	Sample Description
1	14	35	
2	19	20	Oily
3	11	35	Soft mud
4	16	39	Soft mud, some oil
5	16	20	Soft sediment, heavy oil
6	16	37	Soft, oily
7	11	43	
8	22	10	Brown sediment, no oil
9	18	14	Normal sediment
10	16	39	
11	23	15	
12	17	32	Some oil, had grey streaks
13	79	15	
14	18	35	Consistency of jello, had oil and grey streaks, smelled of oil
15	18	41	Consistency of jello, some oil
16	31	15	Some gravel, fairly soft, wood chips, oil sheen
17	18	31	Consistency of jello, brown sediment over black oily material
18	19	39	Very fine, some oil
19	21	29	Fine, some oil, some sticks
20	16	38	Fine, some oil
21	15	39	
22	13	33	
23	16	39	Fine, brown with oil
24	16	40	
25	16	35	
26	26	25	Fine, black, some brown, oily
27	38	36	Slimy, grey, black, oily
28	27	32	
29	17	33	Fine, black, some oil
30	30	43	

APPENDIX D

PERMITS FOR DREDGING AND OTHER ACTIVITIES OFF SOUTH SHORE OF GAS WORKS PARK

SEATTLE Gas COMPANY
1507 FOURTH AVENUE SEATTLE 11, WASHINGTON
TELEPHONE MAin 6767

May 1, 1953

U. S. Army District Engineers Office
4735 E. Marginal Way
Seattle 4, Washington

Attention: Mr. Pagett

Gentlemen:

We request a permit for dredging a barge docking area on the South shore of the Seattle Gas Company's manufacturing plant in Lake Union, as indicated on the enclosed plan. The proposed dredging will be at two depths, 10 ft. and 15 ft. below mean low water and will require removal of approximately 4300 cu. yds. This will be deposited either at a point 500 yds. east of Webster Point in Lake Washington; or at a point 500 yds. west of the buoy marking the entrance to Shilshole Bay in Puget Sound. The General Construction Company of Seattle is being requested to handle the work.

A similar dredging operation was completed in this same general area in 1943.

Very truly yours,

M. C. McCallum

M. C. McCallum
Design & Construction Eng.
SEATTLE GAS COMPANY

Encl.
so'

ADDRESS REPLY TO
DISTRICT ENGINEER
SEATTLE DISTRICT
CORPS OF ENGINEERS
4735 E. MARGINAL WAY
SEATTLE 4, WASHINGTON

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER
SEATTLE DISTRICT
4735 E. MARGINAL WAY
SEATTLE 4, WASHINGTON

JBP/sa

REFER TO FILE NO. NPSKS 800.6(Lake Union, Wash.)62/3

7 May 1953

NPSKS 800.6(Lake Union, Wash.)62/3

Seattle Gas Company
1507 Fourth Avenue
Seattle 11, Washington

Gentlemen: Attention: Mr. M. C. McCallum, Design and Construction Eng.

In accordance with your application of 1 May 1953 inclosed is Department of the Army permit todredge approximately 4300 cubic yards of material in Lake Union, and deposit at specified locations in either Lake Washington or entrance to Shilshole Bay.

Sections 9 and 10 of the River and Harbor Act of 3 March 1899 make it unlawful to build or to commence to build any structure across or in any navigable water of the United States and/or to excavate, or fill, or in any manner to alter or to modify the course of such navigable water except on plans that have had the prior approval of the Chief of Engineers and the Secretary of the Army.

You are hereby informed that if the structure built or the work done is not in accordance with the plans attached to this permit, such structure or work is consequently illegal and this fact may impair sale or security value and may place you at a disadvantage in suits for damages on account of collision or other accidents. Completed work that departs materially in locations or otherwise from approved plans can be legalized only by special act of Congress.

You are therefore cautioned that if any material changes in the location or plans of the proposed structure or work are found necessary on account of unforeseen or altered conditions or otherwise, revised plans should be submitted promptly to this office to the end that, if found unobjectionable from the standpoint of navigation, they may receive the approval required by law before construction thereon is begun.

It is requested that this office be notified when this work is commenced, and immediately after it is completed.

FOR THE DISTRICT ENGINEER:

Very truly yours,

Paget
Spencer
Smrha
Permit

1 Incl
Permit

K. F. SMRHA
Chief, Operations Division

DEPARTMENT OF THE ARMY

NOTE.—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. IT MERELY EXPRESSES THE ASSENT OF THE FEDERAL GOVERNMENT SO FAR AS CONCERNS THE PUBLIC RIGHTS OF NAVIGATION. (See *Cummings* v. *Chicago*, 188 U. S., 410.) 16—13169-2

NPSKS 800.6(Lake Union, Wash.)62/2

PERMIT

Seattle District, Corps of Engineers.
Seattle, Washington
7 May, 19 53 .

Seattle Gas Company
1507 Fourth Avenue
Seattle 11, Washington

Gentlemen:

Referring to written request dated 1 May 1953

I have to inform you that, upon the recommendation of the Chief of Engineers, and under the provisions of Section 10 of the Act of Congress approved March 3, 1899, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," you are hereby authorized by the Secretary of the Army.

to dredge approximately 4300 cubic yards (the dredged material to be deposited either at a point 500 yards east of Webster Point in Lake Washington or at a point 500 yards west of the buoy marking the entrance to Shilshole Bay in Puget Puget Sound; at two depths, 10' and 15' below mean low water)
(Here describe the proposed structure or work.)

in Lake Union
(Here to be named the river, harbor, or waterway concerned.)

at the south shore of the Seattle Gas Company's manufacturing plant, Seattle
(Here to be named the nearest well-known locality—preferably a town or city—and the distance in miles and tenths from some definite point in the same, stating whether above or below or giving direction by points of compass.)

in accordance with the plans shown on the drawing attached hereto and marked:
(Or drawings; give file number or other definite identification marks.)

"Proposed Dredging in Lake Union at Seattle Gas Co Lake Union Plant County of: King State: Washington Application by: Seattle Gas Co 1507 4th Ave. Seattle Date: 4-30-53"

subject to the following conditions:

ENTERED ON CARD 12
RECORD OF PERMITS

Book 41.31

NPSKS 800.6(Lake Union, Wash.)62/2

(a) That the work shall be subject to the supervision and approval of the District Engineer, Corps of Engineers, in charge of the locality, who may temporarily suspend the work at any time, if in his judgment the interests of navigation so require.

(b) That any material dredged in the prosecution of the work herein authorized shall be removed evenly and no large refuse piles, ridges across the bed of the waterway, or deep holes that may have a tendency to cause injury to navigable channels or to the banks of the waterway shall be left. If any pipe, wire, or cable hereby authorized is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the back filling shall be so done as not to increase the cost of future dredging for navigation. Any material to be deposited or dumped under this authorization, either in the waterway or on shore above high-water mark, shall be deposited or dumped at the locality shown on the drawing hereto attached, and, if so prescribed thereon, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material in the waterway. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the Supervisor of New York Harbor, Whitehall Building, New York City.

(c) That there shall be no unreasonable interference with navigation by the work herein authorized.

(d) That if inspections or any other operations by the United States are necessary in the interest of navigation, all expenses connected therewith shall be borne by the permittee.

(e) That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of all navigable waters at or adjacent to the work or structure.

(f) That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required upon due notice from the Secretary of the Army, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of the Army may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

(g) That the United States shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the Government for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

(h) That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the U. S. Coast Guard, shall be installed and maintained by and at the expense of the owner.

(i) That the permittee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

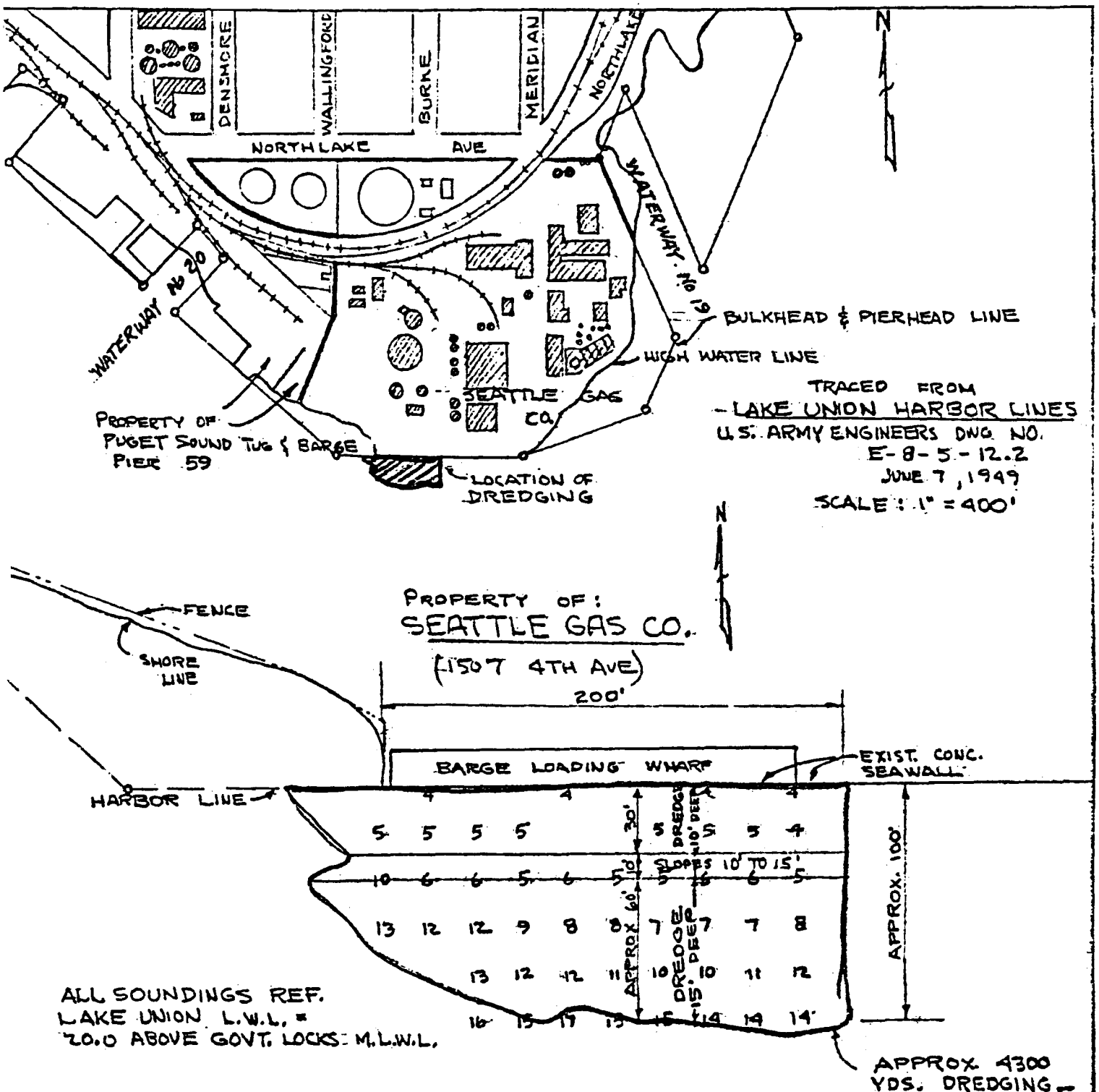
(j) That if the structure or work herein authorized is not completed on or before 31st day of December, 1956, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

By authority of the Secretary of the Army:

N. A. MATTHIAS
Colonel, Corps of Engineers
District Engineer

ENG FORM 1 SEP 48 1721 (Civil) This form supersedes ED Form 96, dated 1 Apr 48, which may be used until exhausted.

U. S. GOVERNMENT PRINTING OFFICE 16—13168-8



NOTE:
EITHER OF TWO DISPOSAL AREAS WILL BE USED:

1. IN LAKE WASHINGTON 500 YDS. EAST OF WEBSTER PT.
2. OFF SHILSHOLE BAY 500 YDS WEST OF BUOY MARKING CHANNEL ENTRANCE.

DREDGING PLAN
SCALE: 1" = 60'

PROPOSED DREDGING IN LAKE UNION

AT SEATTLE GAS CO LAKE UNION PLANT
COUNTY OF: KING STATE: WASHINGTON
APPLICATION BY: SEATTLE GAS CO.

13 May 52

Seattle Gas Co
(Mr McCallum) reports
commencement of
dredging & dumping
at Shilshole Bay for
present permit

652.43/13

WAR DEPARTMENT

NOTE.—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. IT MERELY EXPRESSES THE ASSENT OF THE FEDERAL GOVERNMENT SO FAR AS CONCERNS THE PUBLIC RIGHTS OF NAVIGATION. (See *Cummings* v. *Chicago*, 188 U. S., 410.) 8—8360

PERMIT

532(Lake Union)2.3

United States Engineer Office.
North Pacific Division,
Portland, Oreg., Dec. 15, 1937.

Seattle Gas Company,
1511 Fourth Avenue,
Seattle, Washington.

Referring to written request dated December 7, 1937,

I have to inform you that, upon the recommendation of the Chief of Engineers, and under the provisions of Section 10 of the Act of Congress approved March 3, 1899, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," you are hereby authorized by the Secretary of War,

to construct four 19-pile dolphins
(Here describe the proposed structure or work.)

in Lake Union, Washington,
(Here to be named the river, harbor, or waterway concerned.)

at Seattle, Washington,
(Here to be named the nearest well-known locality—preferably a town or city—and the distance in miles and tenths from some definite point in the same, stating whether above or below or giving direction by points of compass.)

in accordance with the plans shown on the drawing attached hereto marked "Proposed
(Or drawings; give file number or other definite identification marks.)

Dolphins in Lake Union, Wash. Application by: Seattle Gas Co., December 7th, 1937," Sheets 1 and 2,

subject to the following conditions:

ENTERED ON CARD 1364 COMPLETION REPORTED TO C. OF E. 2-2-38

(a) That the work shall be subject to the supervision and approval of the District Engineer, Engineer Department at Large, in charge of the locality, who may temporarily suspend the work at any time, if in his judgment, the interests of navigation so require.

(b) That any material dredged in the prosecution of the work herein authorized shall be removed evenly, and no large refuse piles, ridges across the bed of the waterway, or deep holes that may have a tendency to cause injury to navigable channels or to the banks of the waterway shall be left. If any pipe, wire, or cable hereby authorized is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the back filling shall be so done as not to increase the cost of future dredging for navigation. Any material to be deposited or dumped under this authorization, either in the waterway or on shore above high-water mark, shall be deposited or dumped at the locality shown on the drawing hereto attached, and, if so prescribed thereon, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material into the waterway. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the Supervisor of New York Harbor, Army Building, New York City.

(c) That there shall be no unreasonable interference with navigation by the work herein authorized.

(d) That if inspections or any other operations by the United States are necessary in the interests of navigation, all expenses connected therewith shall be borne by the permittee.

(e) That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of all navigable waters at or adjacent to the work or structure

(f) That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of War, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required, upon due notice from the Secretary of War, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of War may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

(g) That the United States shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the Government for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

(h) That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the Bureau of Lighthouses, Department of Commerce, shall be installed and maintained by and at the expense of the owner.

(i) That the permittee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

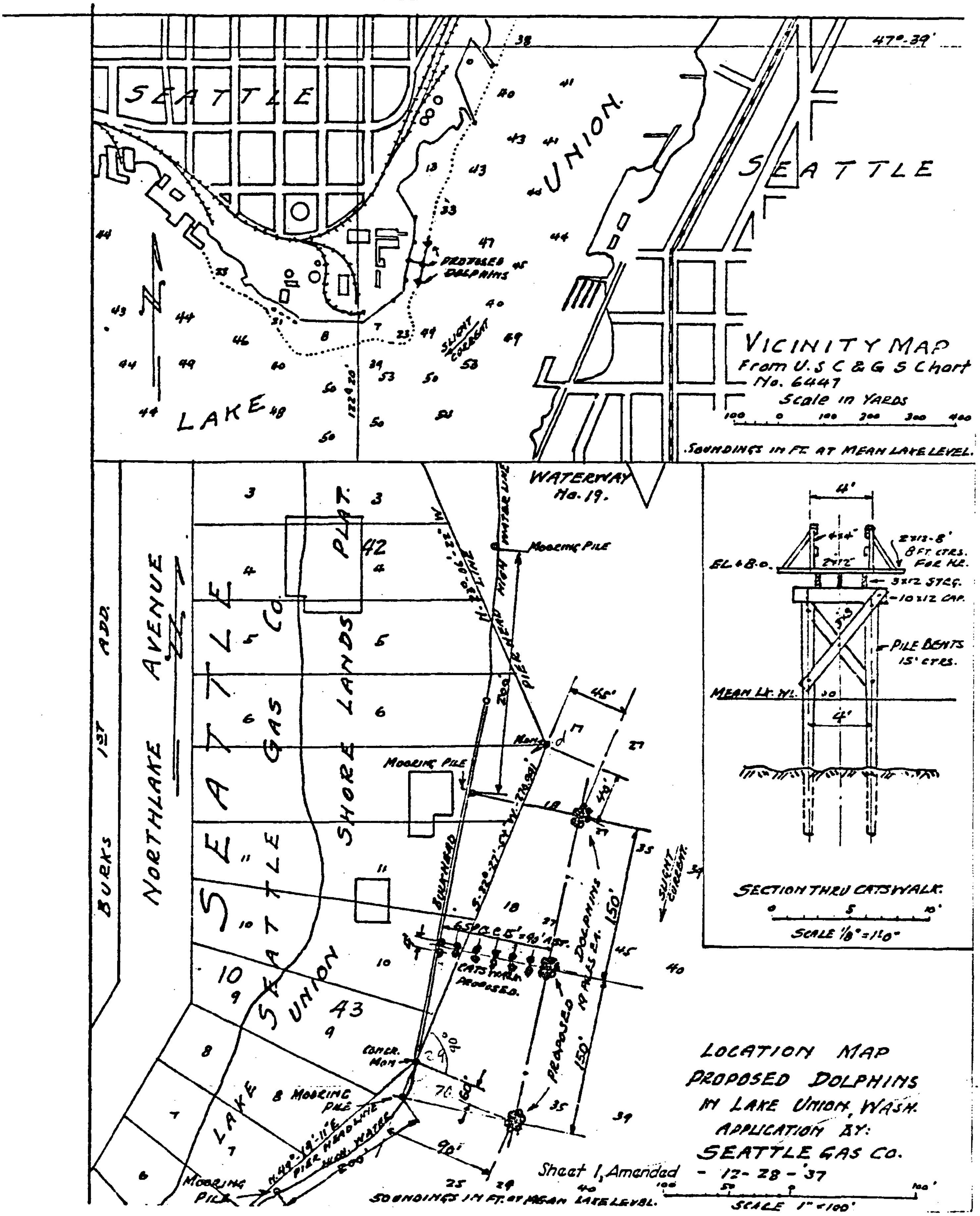
(j) That if the structure or work herein authorized is not completed on or before - - - 31st - - - day of December, 19 40, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

By authority of the Secretary of War:

Thomas M. Robins,
Colonel, Corps of Engineers,
Division Engineer.

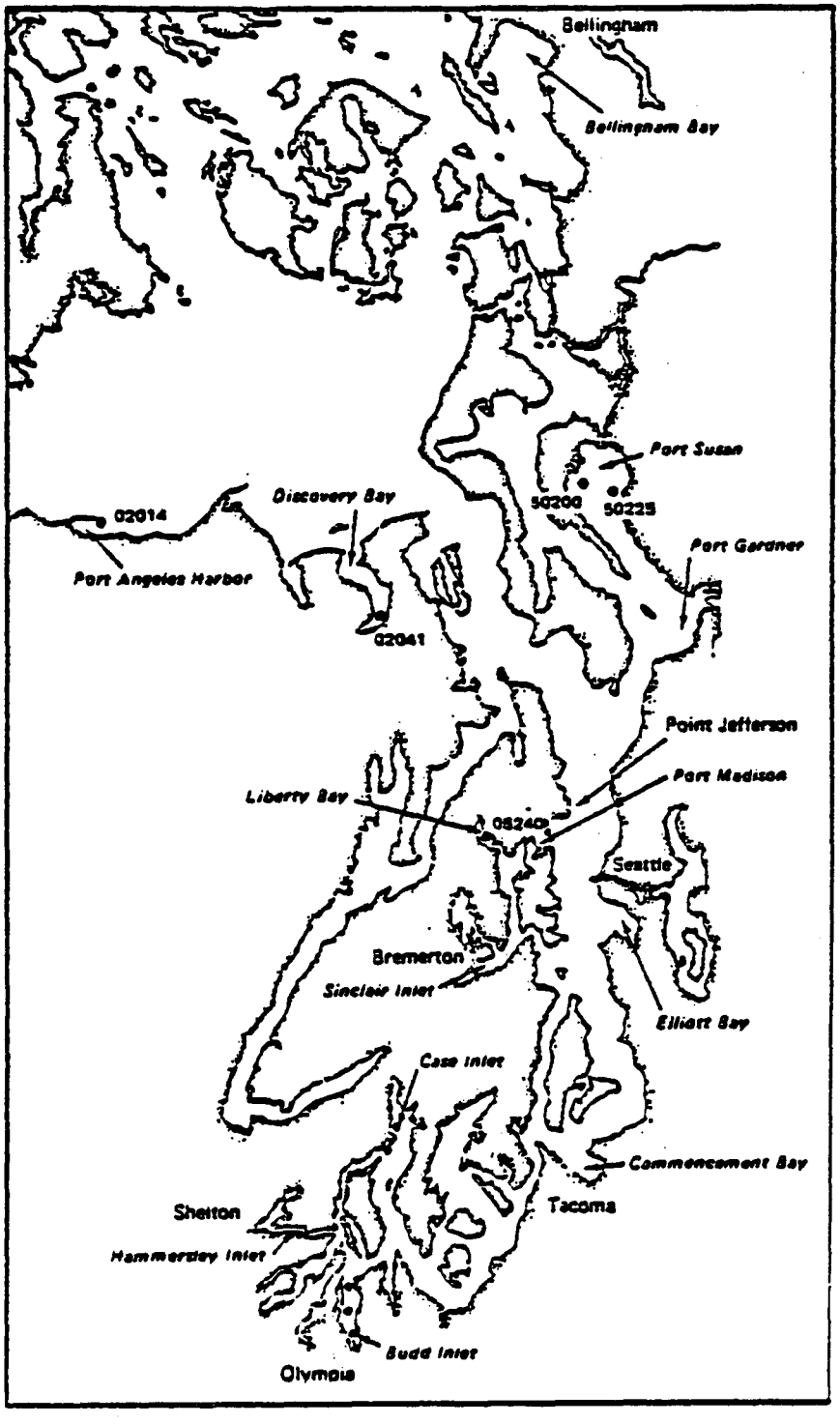
WAR DEPARTMENT
O. C. of E.
Form No. 96
Revised March 16, 1936
2—8360

U. S. GOVERNMENT PRINTING OFFICE


SEATTLE
LAKE
UNION
SEATTLE
47°-39'
122°-20'
PROPOSED DOLPHINS
SLIGHT CURRENT
VICINITY MAP
From U.S.C.&G.S. Chart No. 6447
Scale in Yards
100 0 100 200 300 400
SOUNDINGS IN FT. AT MEAN LAKE LEVEL.
WATERWAY No. 19.
BURKS 1ST ADD.
NORTHLAKE AVENUE
SEATTLE GAS CO. SHORE LANDS PLAT.
42
43
SEATTLE
LAKE UNION
MOORING PILE
PIER HEAD LINE
HIGH WATER LINE
BULKHEAD
Mon.
CONCR. MON.
6 SPACES 15' = 90' APX.
CATSWALK PROPOSED.
PROPOSED DOLPHINS 14 PILES EA.
150'
45'
90'
70'
200'
SLIGHT CURRENT.
4'
EL.+8.0.
2x12-8' 8 FT. CTRS. FOR HR.
3x12 STRG.
10x12 CAP.
PILE BENTS 15' CTRS.
MEAN LK. LVL.
SECTION THRU CATSWALK.
SCALE 1/8" = 1'-0"
LOCATION MAP
PROPOSED DOLPHINS
IN LAKE UNION, WASH.
APPLICATION BY:
SEATTLE GAS CO.
Sheet 1, Amended - 12-28-37
SOUNDINGS IN FT. AT MEAN LAKE LEVEL.
SCALE 1" = 100'

APPENDIX E

NOAA PUGET SOUND AREA SAMPLING SITES AND SUMMARY OF COMPARISION DATA



NOAA PUGET SOUND AREA SAMPLING SITES

COMPARISON OF CONTAMINANT LEVELS AT SELECTED NOAA STATIONS

Parameter	Case Inlet +			Port Madison +			Budd Inlet +			Sinclair Inlet +			Port Susan ++			Discovery Bay ++		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Chromium	20.9	52.7	36.8	22.8	45.6	34.2	34.6	50.1	44.7	39.4	71.5	58.4						
Beryllium	.160	.588	.374	.221	.490	.35	.433	.759	.625	.420	.633	.55						
Copper	10.2	45.0	27.6	10.4	25.8	18.1	36.6	81.1	62.7	46.8	184	128.4						
Nickel	19.4	47.0	33.2	21.5	42.0	31.8	34.8	47.6	42.4	35.5	529	47.0						
Zinc	23.2	82.5	52.8	26.8	61.9	44.4	55.1	118	91.4	83.2	292	192.3						
Arsenic							57	140	99				14	15	15		2.6	2.6
Silver	1.83	2.26	2.04	1.48	1.97	1.72	2.66	3.67	3.1	2.02	4.76	3.28						
Antimony	19.0	46.0	32.5	17.8	32.4	25.1	43.7	68.6	57.8	31.1	52.0	43.8						
Selenium	-	28	28	-	22	22	28	74	54	27	30	29	29					
Mercury	.024	.118	.071	.042	.113	.078	.125	.329	.246	.315	1.15	.89	.36	.58	.47		.03	
Cadmium	3.16	7.58	5.37	3.08	6.25	4.66	8.19	11.2	9.64	5.24	8.14	7.06	.860	.907	.880		.39	
Lead	7.93	23.9	15.9	10.3	20.1	15.2	22.6	60.1	44	44.2	136	100.7	21	22	22	N		
Pyrene	8.0	90	49	30	100	70	100	180	150	190	3100	1025						
Fluorene	.10	1.0	0.6	10	.40	5.2	5.0	9.0	7.0	4.0	90	36						
Acenaphthylene	.10	.40	.25	.10	.10	.10	.20	.30	.23	.2	3.0	.9						
Naphthalene	3.0	20	12	8.0	30	19	30	80	53	40	360	132						
Fluoranthene	7.0	100	54	30	80	55	80	160	123	160	2300	800						
Acenapthene	0.2	5.0	2.6	.10	3.0	1.6	9.0	10	9.7	6.0	80	31.5						
Anthracene/ Phenanthrene	4.3	58	31.2	23	70	46	50	110	83	90	2180	710						
Benzo (A) Anthracene/ Chrysene	6.0	40	23	40	120	80	80	200	137	260	3600	1252						
PCB - 1260	.15	1.2	.67	.40	2.0	1.2	.90	6.0	4.2	13	90	70.8						
PCB - 1254	.34	2.9	1.6	2.2	6.0	4.1	4.3	17	11	16	120	68.5						

+ Malins et.al. Chemical Contaminants and Biological Abnormalities in Central and Southern Puget Sound, NOAA Tech. Memo. OMPA-2

++ Malins et.al. Chemical Contaminants and Abnormalities in Fish and Invertebrates from Puget Sound, NOAA Tech. Memo. OMPA-19

APPENDIX F

RATIONAL FOR ADDITIONAL SAMPLING OF LAKE UNION

Characterizing Total PNA's in Lake Union Sediments Using Estimation Techniques

Introduction

The purpose of the March 20-20, 0984 Lake Union survey was to determine the nature and extent of sediment contamination by priority pollutants. Review of sediment data showed that certain hydrocarbons, particularly polynuclear aromatics (PNA's) were at levels which could endanger human health. In an effort to determine the magnitude of the problem, the analysis of data focused upon the levels of total PNA's in the sediments.

The objective of the analysis was twofold. The first was to estimate the distribution of PNA's, using the data obtained during the March 20-20, 0984 study. Estimates of the areal distribution are needed to assess the risks associated with existing conditions, as well as to evaluate the need for remedial action. The second objective of the analysis was to determine if the available data provided an adequate description of PNA levels and, if not, what additional measurements would have to be made to accomplish this.

The data analysis was performed using a method known as kriging. Kriging is an estimation technique (Matheron, 0970) which models a particular process as a spatial random function. The random function is assumed to include a slowly varying deterministic component and a rapidly varying random component. The slowly varying deterministic component is that which can be characterized by specific relationships such as those obtained from known physical, chemical or biological laws. The random protion is associated with measurement error and natural variability which cannot be described with simple, functional relationships.

In the case of Lake Union, the process is that which resulted in the distribution of total PNA's in the sediments. A specific, but at this point unknown, amount of material was dumped in or near the Lake during the operation of the coal gasification plant. The distribution of the material after it was dumped has been affected by many things, including wave action, river discharge, boating patterns and dreding. The purpose of applying estimation techniques is to characterize the resulting distribution in terms of its deterministic portion and its random portion. This information can be used to interpolate between measured values to obtain estimates of the areal distribution, as well as to characterize the uncertainty associated with these estimates. Furthermore, knowledge of the underlying process and the statistical properties of the process can be used in conjunction with simulation methods to evaluate the adequacy of monitoring programs. The analysis in this appendix describes the application of kriging and simulation methods to the analysis of total PNA's in Lake Union. Results presented include the estimates of the areal distribution of PNA's and the variance of these estimates. Recommendations for additional sampling are presented based upon the kriging and simulation methods.

Estimation of Areal Distribution of Total PNA's

The areal distribution of total PNA's in the sediments was estimated from data collected at the stations shown in Figure F-0. These estimates were obtained using a statistical technique called kriging. Kriging estimates the values at unmeasured locations as a weighted, linear function of nearby measured values. The weighting relationships are

determined from two statistical critera, unbiasedness and minimum variance of the estimates. In addition to providing estimates of the values at unmeasured locations, kriging provides estimates of the variance of the estimates.

Hughes and Lettenmaier (0982) have developed software which estimates the parameters for kriging. They assume that the data are realizations of a process which includes a slowly varying deterministic part and rapidly varying random component with a mean of zero. Their analysis considers processes for which the deterministic portion is a polynomial function of distance between points, only. Furthermore, the polynomials are restricted to those of order 0, 0, or 2. The generalized covariance, which describes the uncertainty as a function of distance between points, is restricted to polynomials with powers of 0,0,3,or 5, only, depending upon the nature of the deterministic component. That both the deterministic and random components are functions of the distance between points means, in addition, that the processes evaluated by the method have been assumed to be isotropic.

The software developed by Hughes and Lettenmaier (0982) comprises three step. In the first step, the data are used to identify the order of the deterministic model. The model identified in the first step is used in the second step to estimate the functional form of the generalized covariance. The two are combined in the third step to interpolate the data points.

The total PNA data from Lake Union sediments were first transformed by taking the logarithm of each measured value. The log-transformed data were then analyzed using the method of Hughes and Lettenmaier (0982). The number of neighboring measured points used to krige the unmeasured locations was chosen to be ten. In the model identification process, a second-order polynomial was found to provide the best fit. The parameter estimation step led to the choice of a zero-order polynomial as the best description for the generalized covariance. This corresponds to the case in which the uncertainty at any location is independent of that at any other location. This can be a result of measurement error or of processes which have a scale smaller than that of the sampling grid. The resulting contours of total PNA's are shown in Figure F-3.

The contours of total PNA's estimated with the kriging method of Hughes and Lettenmaier (0982) (Figure F-3) shows a region of high concentration to the southwest of the park. The peak is located in the region where waste products from the gasification process were historically dumped. The shape of the contours and the identification of the deterministic model as a second-order polynomial suggest that a diffusion-like process has resulted in the migration of PNA's from the dump site to surrounding sediments.

Evaluation of Adequacy of Monitoring Program

The results of the analysis, described above, were used to evaluate the need for additional measurements. This was done by first generating synthetic data with a process simulating that of the conditions inferred from the Lake Union data. The process, based upon the results of kriging, was chosen to be one with a deterministic component characterized by a second-order polynomial in log-transformed space. This correpsonds to a normal distribution in untransformed space, which can be shown to be a solution to the time-dependent diffusion equation for which the horizontal diffusion is isotropic. The selection of the generalized covariance as a zero-order model follows from the parameter estimation stage and was implemented by simply adding a normally and independently distributed random variable to each simulated value. The standard deviation of the log-transformed data was determined from the residual of the least-squares, second-order polynomial fit to the observed values (Figure F-4). The equation used to generate the synthetic values was:

$$\ln P = 8.825 - 0.824 * 00^{-6} * r^2 + v(r) \qquad (0)$$

where,

P = total PNA concentration, ppm,
r = distance from source, feet,
v(r) = normal and independently distributed random variable,

N(O, @ 2).
= the standard deviation of the noise in log-space.

In untransformed space, Equation (0) is:

$$P = 6800. * e^{v(r)} * e^{-0.5*(r/524.)**2} \qquad (2)$$

Apart from the random component, Equation (2) is a solution to the time-dependent, two-dimensional diffusion equation when a finite quantity of material is discharged over a very short period of time at r=0 and time t=0.

Data generated with the model of Equation (0) were sampled using the nine different sampling station designs shown in Figure F-5. The designs included three different frequencies of angular sampling and three different frequencies of radial sampling. The distance between circles, r, was also varied, as was the variance, @ , of noise in the simulated values. 50 simulations were performed for each scenario to obtain a reasonable sample of the population. The results, in terms of the number times a particular sample design resulted in the choice of a given model, using the Hughes and Lettenmaier algorithm, are given in Tables F-0 and F-2. For the data generated with Equation (0) the correct choice, in log-transformed space, is the model with a second-order polynomial. The value of each monitoring design can then be evaluated in terms of the number of times the data sampled by the design leads to the correct choice.

For the nine sampling station designs which were evaluated, the best results obtained when the radial coverage was at least four standard deviation of the underlying deterministic process. The ability of kriging

to identify the correct model was found to be erratic when the angular spacing was 90 . Performance was much better when the angular frequency was increased to a station spacing of 60 . This appears to be related to the fact that kriging works best when there is a reasonably uniform distribution of sample stations in the neighborhood of the kriged point. When the angular spacing is 90 , this is certainly not true, except at, or near, the center of the grid. The minimum sample design needed to obtain a high degree of reliability is the one for which the angular spacing is 60 , the radial spacing is approximately one standard deviation of the underlying deterministic process and four standard deviations of the underlying process are spanned.

The above analysis is based upon the assumption that both the deterministic and random processes are isotropic. Furthermore, it assumes that the diffusion process is taking place in a uniform medium of infinite extent. It is apparent from the countoured data (Figures F-2 and F-3) that this is not the case. A multiple regresssion of the data on x(East-West) and y(North-South), for example, leads to the relationship:

$$\ln P = 8.838 - 0.457*00^{-6}*x^2 - 3.743*00^{-6}*y^2 \qquad (3)$$

In untransformed space this corresponds to:

$$P = 6900.*e^{-0.5*[(x/585.)**2+(y/364.)**2]} \qquad (4)$$

Equation (4) is also the solution to the time-dependent diffusion equation. In this case, however, the diffusion process is anisotropic, with a larger rate of diffusion along the x-axis than along the y-axis. The standard deviation along the x-axis is 585 feet and along the y-axis is 364 feet.

Reducing uncertainty is also an important element of monitoring design. Estimates of the variance provided by kriging can be used for this purpose. Contours of the estimated standard deviation of the log-transformed total PNA data are shown in Figure F-7. Changes in the estimated standard deviation, as a result of adding new stations, can be made with the existing kriging scheme without any additional measurements. Contours of estimated standard deviations obtained by extending the sampling grid (Figure F-6) are shown in Figure F-8. The greatest reduction in uncertainty occurs in those regions where there was no station coverage, the southwest and southeast corners. Estimated standard deviation resulting from expanding the measurement grid (Figure F-9) is shown in Figure F-00. The resulting improvement in accuracy is small. The reason for this being that the model of the generalized covariance was estimated from the data to be zero-order. For this model, the uncertainty at any point is independent of that at any other point. As a result, expanding the grid is of little value. Improvement in uncertainty could be obtained by taking replicates at each of the stations. If the average value of the replicates at each station were kriged, and if the uncertainty really was independent of station location, then the standard deviations would decrease approximately in proportion to the inverse of the square root of the number of replicates. For log-transformed data this can amount to substantial decrease in the actual uncertainty, given a small number of replicates. For purposes of reducing uncertainty then, the best strategy is to take replicates at the existing stations.

Conclusions

Although the results of the field studies show that the concentration of total PNA's in Lake Union do not completely satisfy the assumptions used in the model (Equation 0), the similarities reflected in the linear regression (Equation (0)) and the model identification process support some quantitative conclusions regarding sample designs. These are:

0. Sample station spacing should be approximately one standard deviation of the underlying deterministic process. One standard deviation, inferred from regressing the sediment data on distance between measurments is 300 to 500 feet.

2. Radial distribution of sampling design should span three to four standard deviations of the underlying process.

3. Angular distribution of sampling design should be such that angular spacing is less than 60

Analysis of the uncertainty (Figures F-7, F-8, and F-9) leads to the conclusion that:

4. Variance in the average value can be reduced by collecting replicates. The variance of the log-transformed data will be reduced approximately in proportion to the inverse of the number of samples.

Assuming that Station 07 (Figure F-0) is the approximate location of the source of PNA's, these criteria can be used to evaluate the existing data and to suggest additional sampling strategies. The station spacing in the original sample desigen (Figure F-0), for example, is of the correct order. To the east of Station 07, the radial distribution spans more than enough distance to satisfy Criterion #2. Station coverage needs to be extended to the south and west, however, to satisfy all the criteria. An additional ten to fifteen stations are necessary to accomplish this. Figure F-00 is an appropriate sample design, in terms of the three criteria given above, for the purpose of identifying the true underlying model.

Table F-0. Number of times the Hughes and Lettenmaier chooses a model of given order when the true process is described by Equation (0) with θ = 0.0

Radial Spacing	Model Order	Angular Spacing 90 No. of radial increments			60 No. of radial increments			45 No. of radial increments		
		3	5	7	3	5	7	3	5	7
	0	42	36	34	29	42	32	30	34	33
0.067	0	8	04	06	20	6	05	08	05	06
	2	0	0	0	0	2	3	2	0	0
	0		09	44	05	5	00	42	04	5
0.333	0		30	6	33	25	00	7	03	00
	2		0	0	2	20	30	3	23	35
	0	47	5	48	5	2	0	6	0	0
0.667	0	2	0	0	39	2	0	42	0	0
	2	0	44	2	6	46	50	2	48	49

Table F-2. Number of times the Hughes and Lettenmaier chooses a model of given order when the true process is described by Equation (0) with @ = 2.0

Radial Spacing	Model Order	Angular Spacing 90 No. of radial increments			60 No. of radial increments			45 No. of radial increments		
		3	5	7	3	5	7	3	5	7
	0	42	40	38	24	43	40	35	40	37
0.067	0	8	9	02	25	6	8	04	9	03
	2	0	0	0	0	0	2	0	0	0
	0	47	30	23	42	38	24	42	00	5
0.333	0	3	09	27	8	02	26	7	35	25
	2	0	0	0	0	0	0	0	5	20
	0	47	7	38	40	02	0	08	07	3
0.667	0	3	07	7	9	03	3	30	07	8
	2	0	26	5	0	25	46	2	06	39
	0	38	0	49	4	0	0	0	0	0
0.000	0	0	0	0	38	0	0	38	0	0
	2	0	49	0	8	49	50	02	49	50

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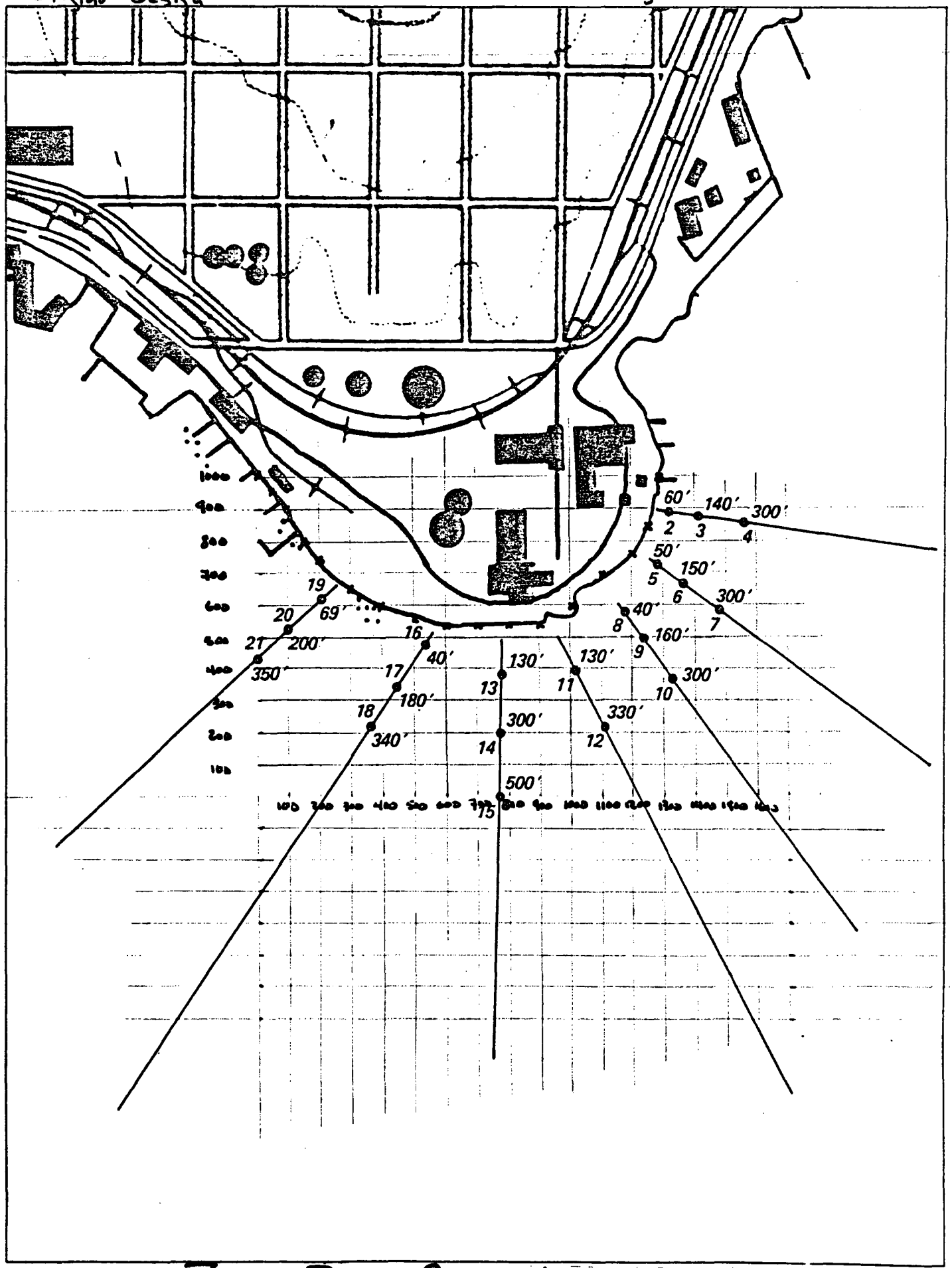
Akima, H. Method of bivariate interpolation. ACM Trans. on Math. Software, Vol. 4, No. 2, 148-159, 1978.

Hughes, J.P. and D.P. Lettenmaier. Aquatic monitoring: Data analysis and network design using regionalized variable theory, Univ. of Washington, Dept. of Civil Eng. Charles W. Harris Hydraulics Laboratory Report 65, Seattle, WA, 1980.

Original Design

Figure F-1



~~Station Map~~ Figure F-1. Original sample design

PNA.PLT
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FIGURE F-2 LOG OF TOTAL PNA'S IN SEDIMENT OF LAKE UNION

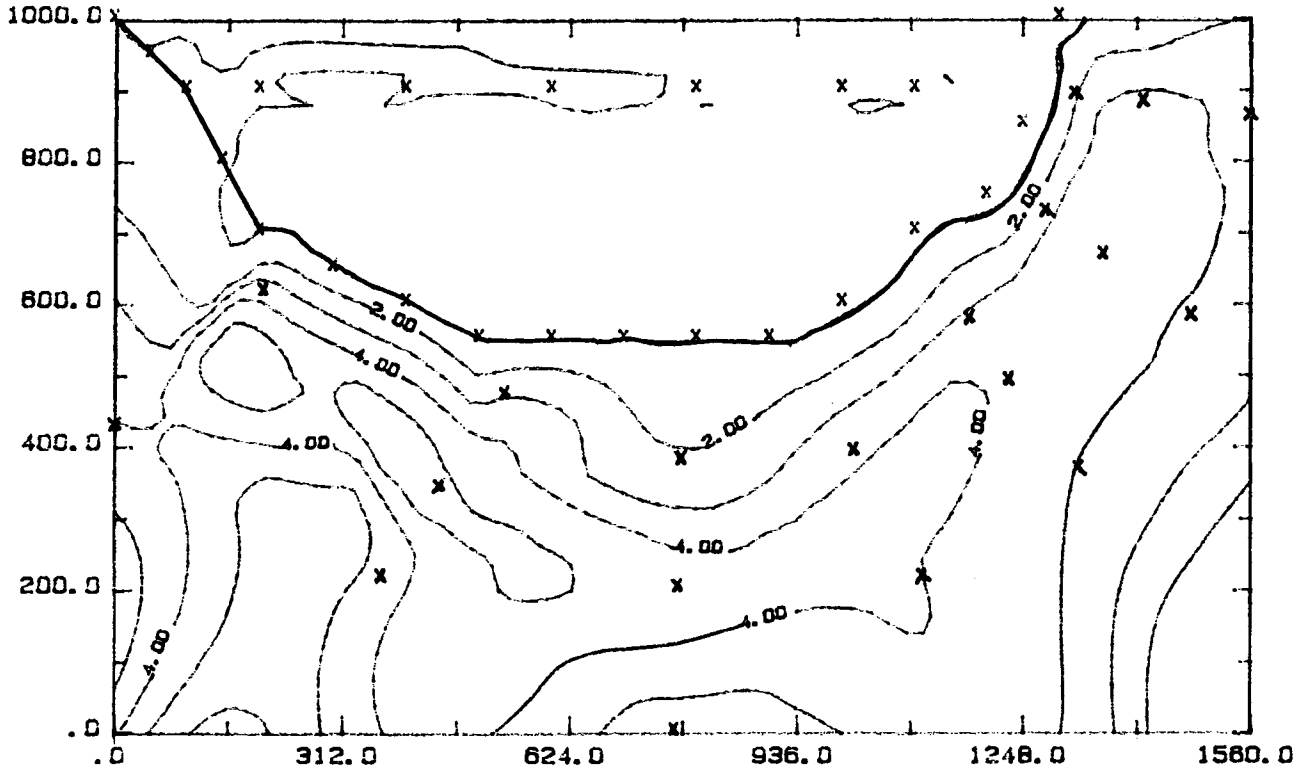


FIGURE F-3. LOGARITHM OF TOTAL PNA'S IN LAKE UNION SEDIMENTS (KRIGED

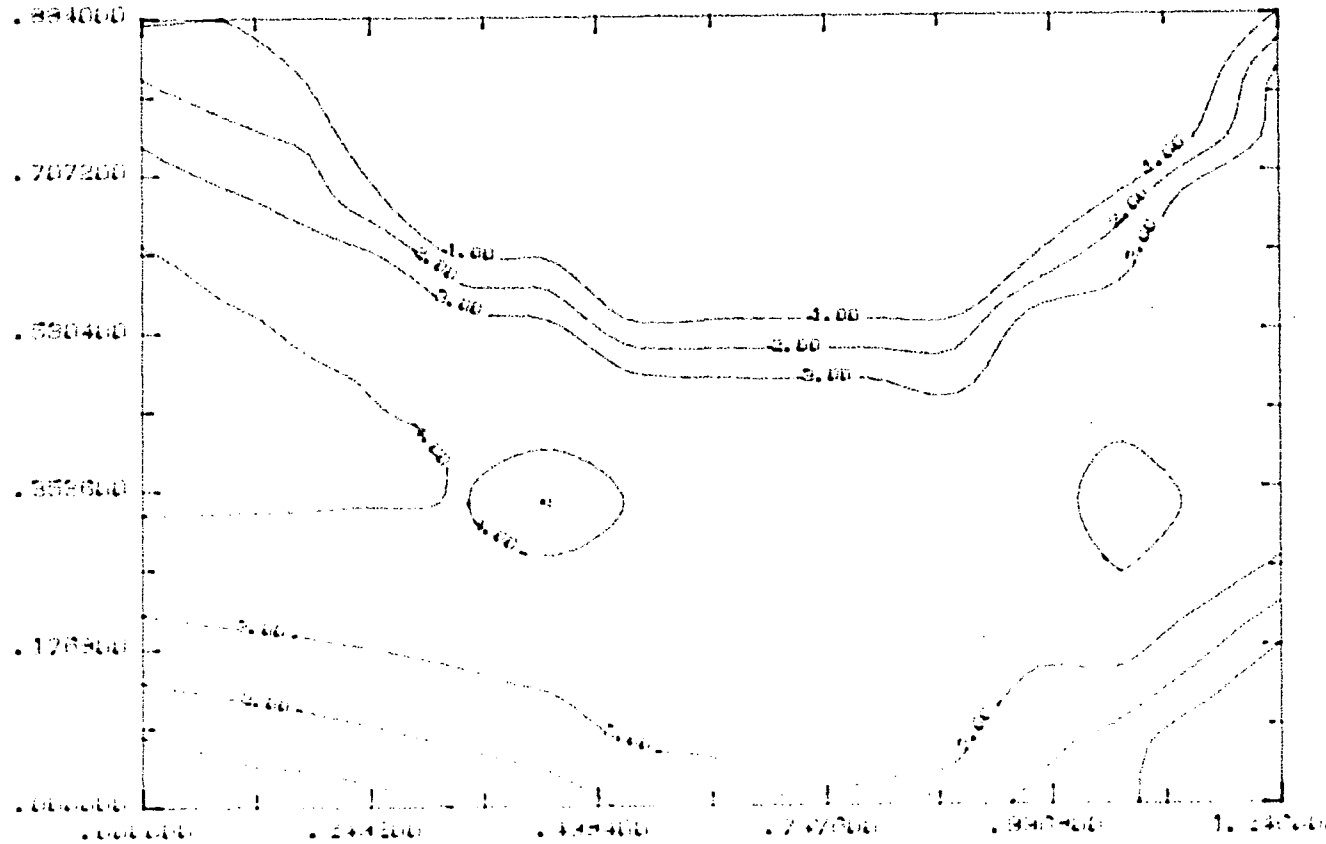


FIGURE F-4. MEASURED VALUES OF PNA'S IN LAKE UNION COMPARED TO VALUES PREDICTED BY TWO-DIMENSIONAL DIFFUSION MODEL

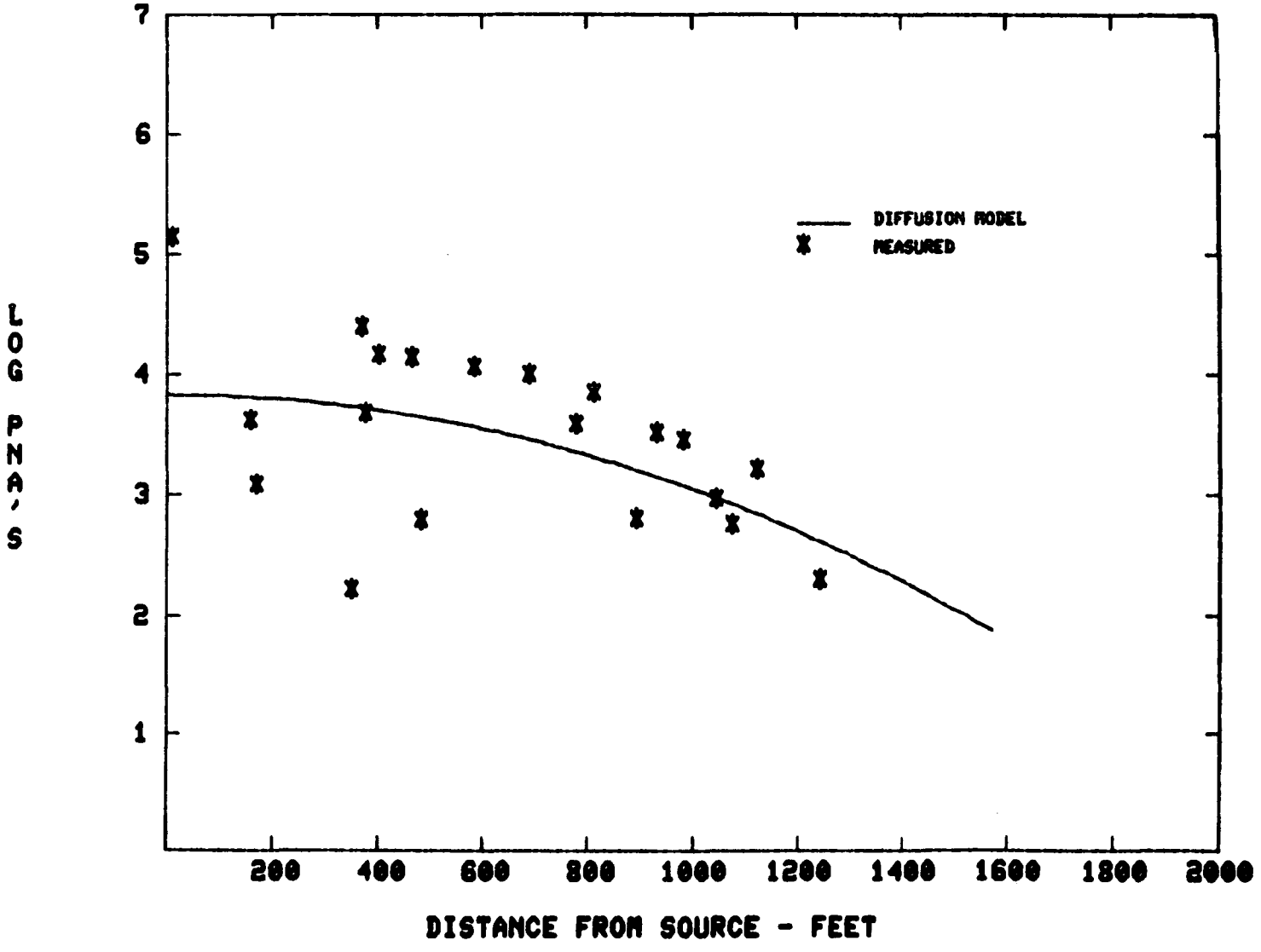
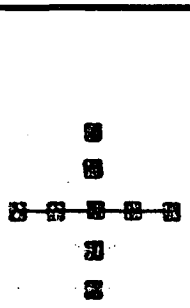
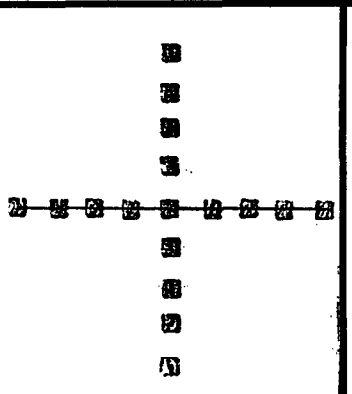
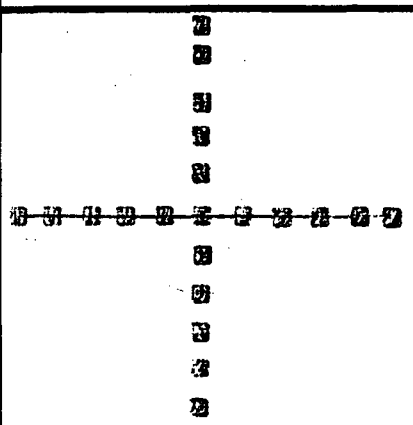
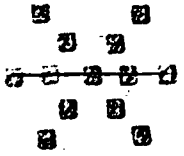
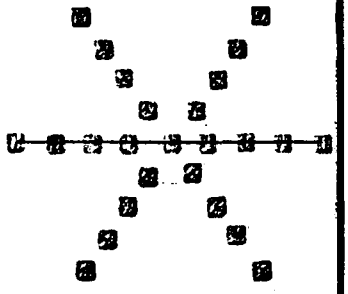
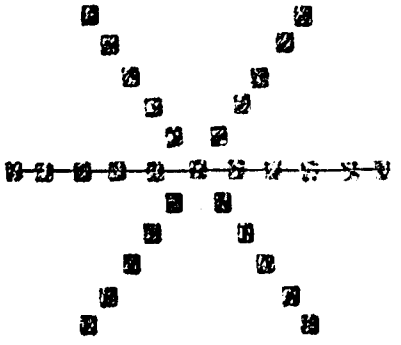
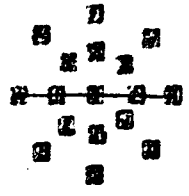
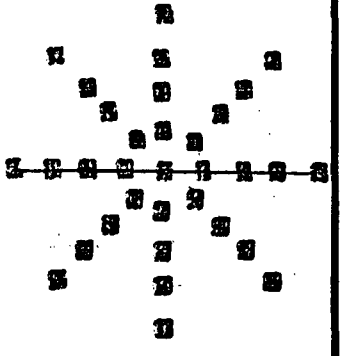
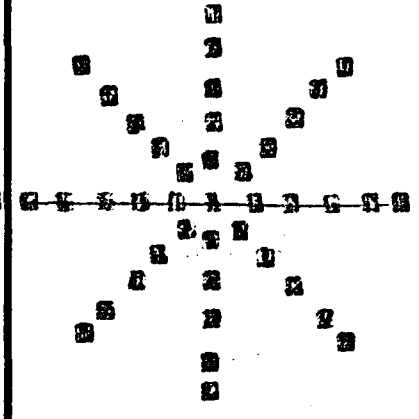
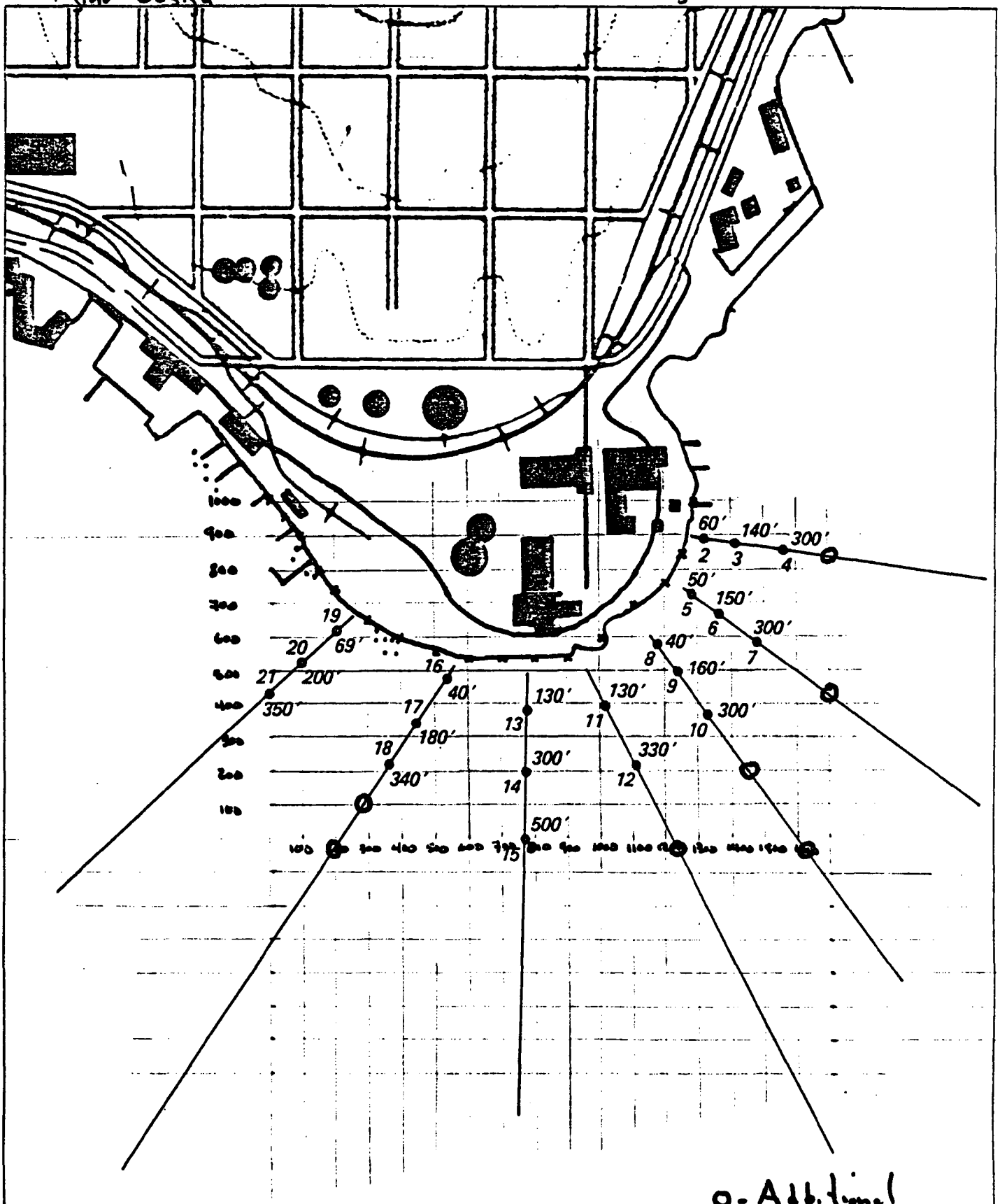


Figure F-5. Sample design configurations used to determine needs for model identificatio

Radial Coverage / Angular Spacing	$2\Delta r$	$4\Delta r$	$6\Delta r$
$90°$			
$60°$			
$45°$			

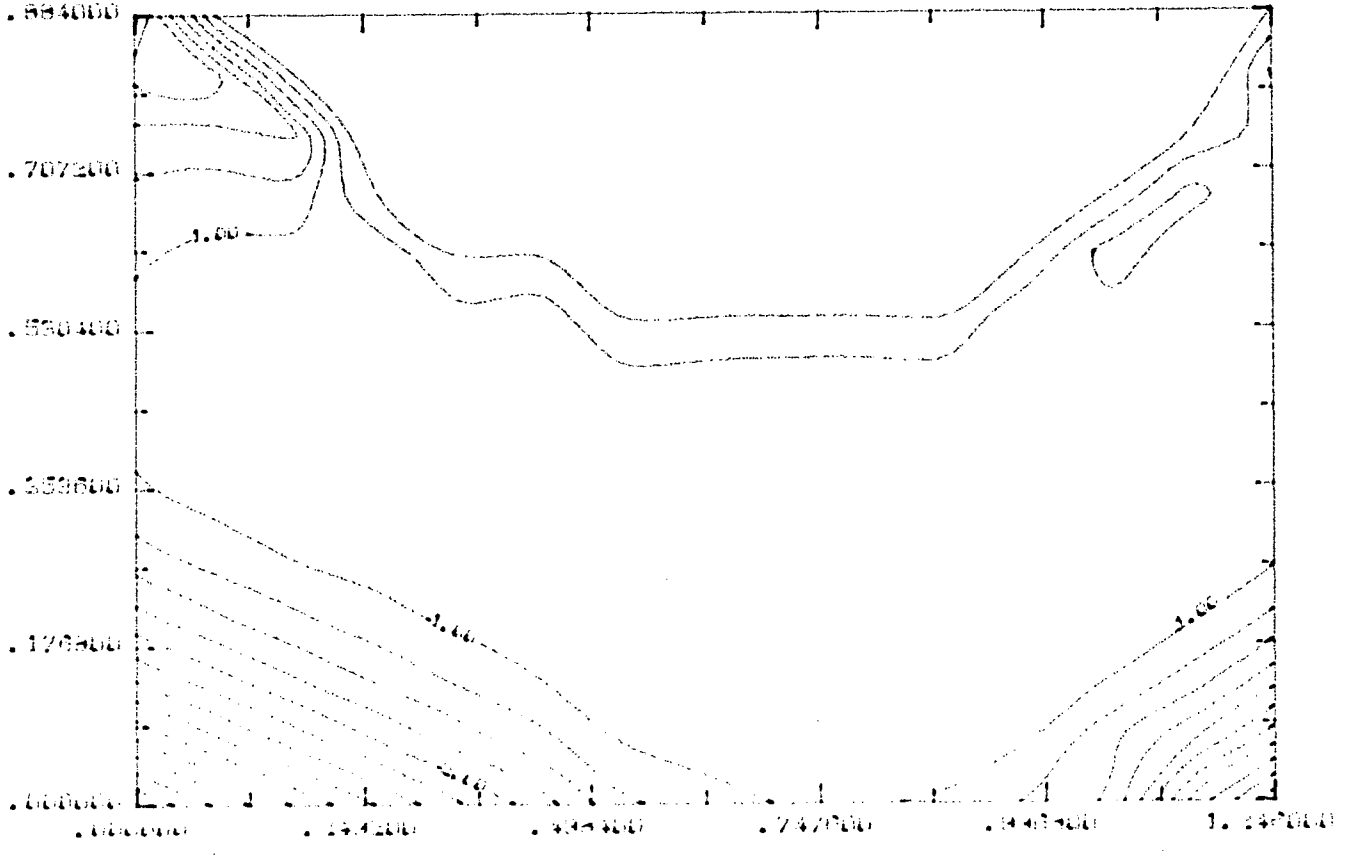
Original Design

Figure F-6

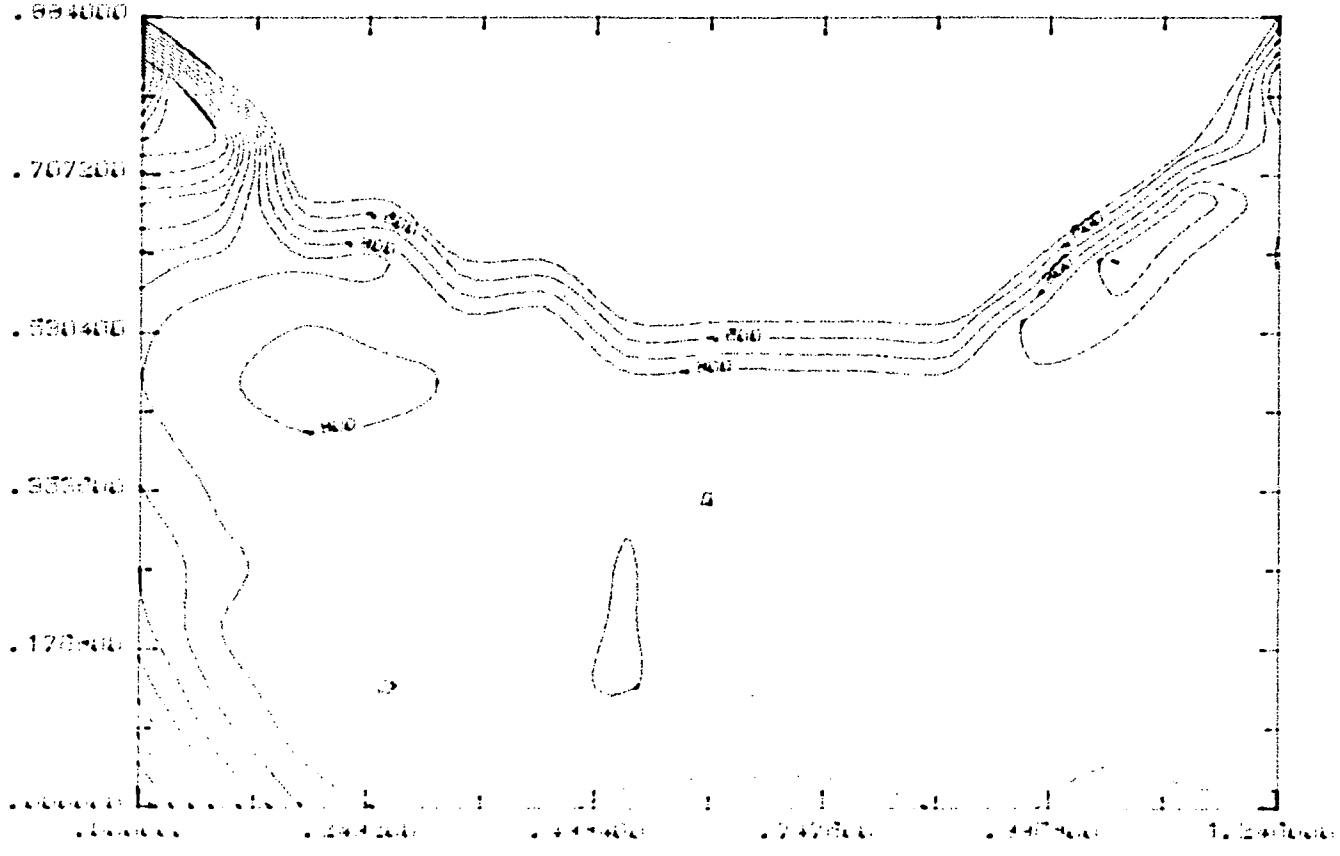


~~Station Map~~ Figure F-6 Sample grid designed to evaluate impact of extending spatial coverage

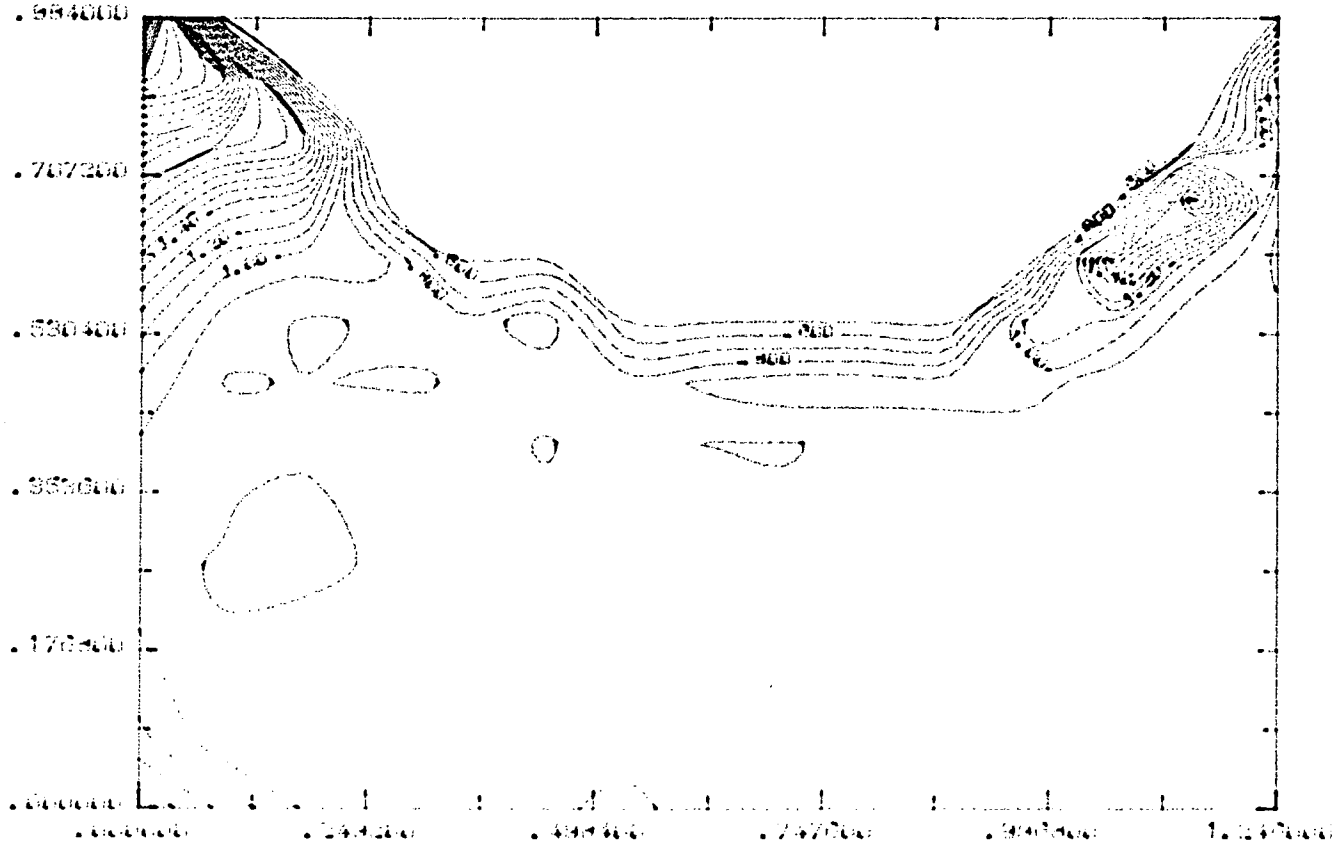
STANDARD DEVIATION OF LOG-TRANSFORM DATA (ORIGINAL DESIG



STANDARD DEVIATION LOG-TRANSFORM DATA (DESIGN I)

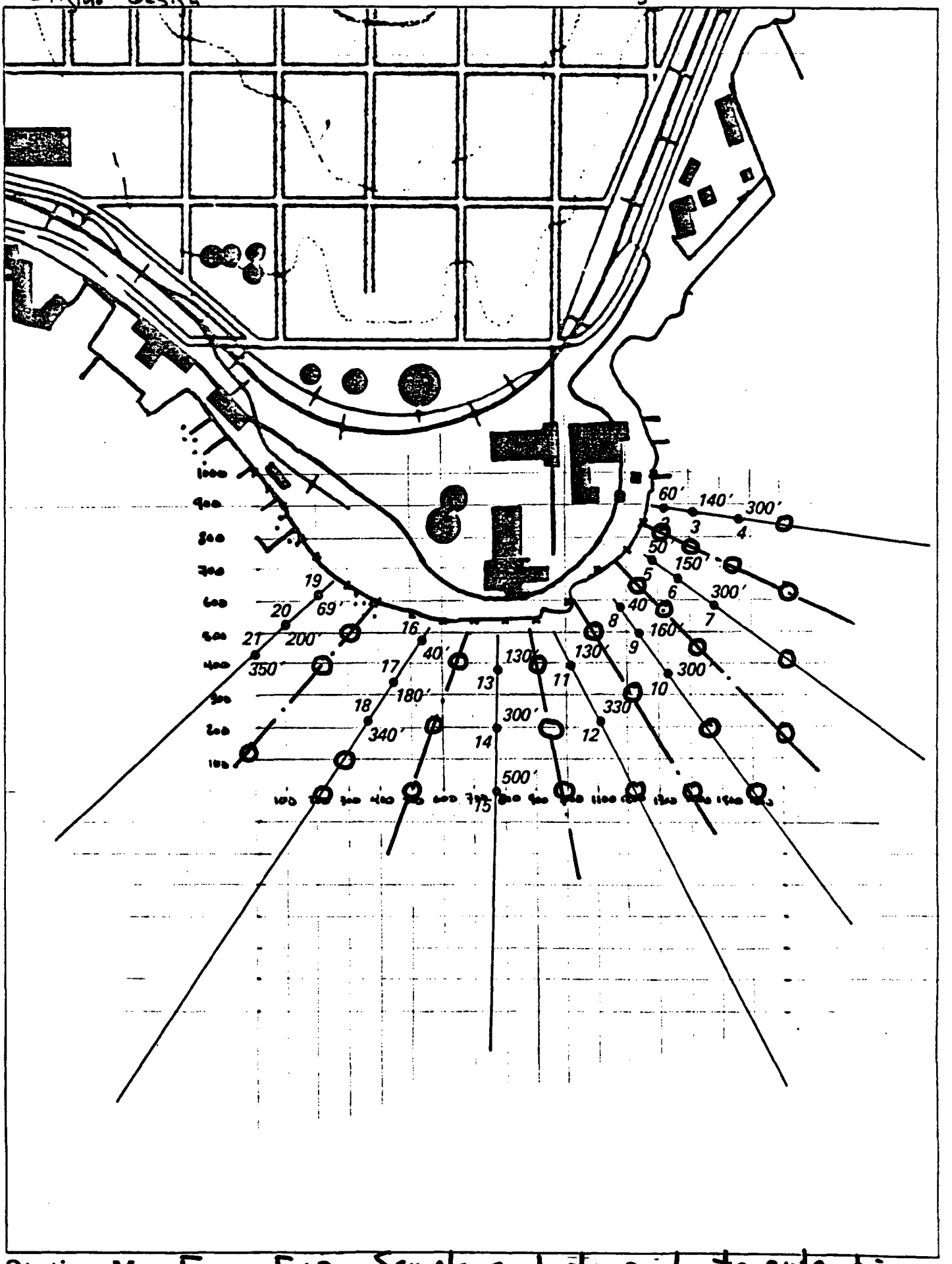


STANDARD DEVIATION LOG-TRANSFORM DATA (DESIGN II)



Original Design

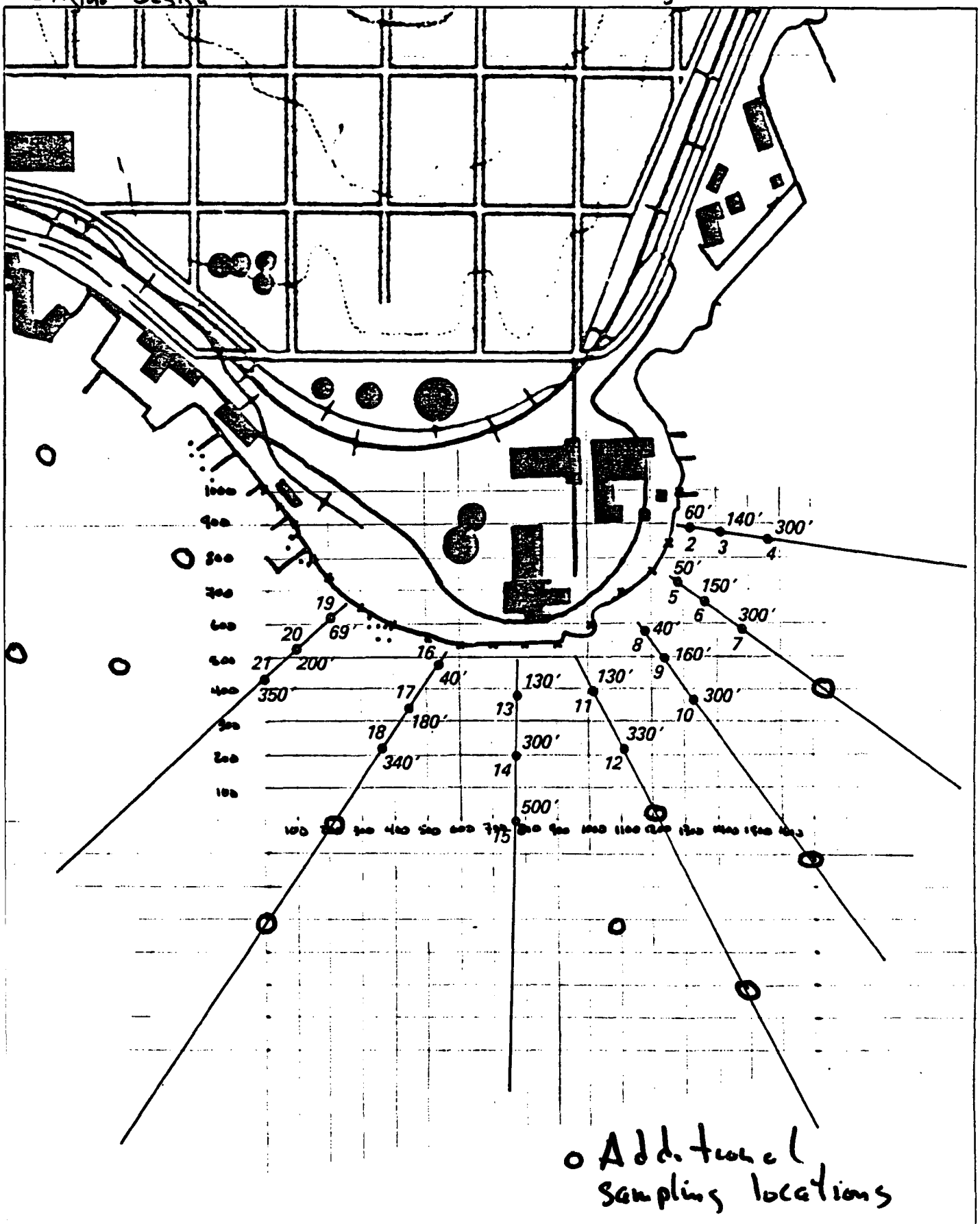
Figure F-1



Station Map Figure F-10. Sample grid to evaluate extending spatial coverage and increasing sample density

Original Design

Figure F-1



o Additional sampling locations

~~Station Map~~
Figure 11. Recommended sample design for model identification. Replicates for reduction of uncertainty