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APPENDIX F
FISH AND SHELLFISH CONCENTRATION DATA
INNER BELLINGHAM BAY

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle
Sample-ID	3	4	5	6	7	8	8-Dup	PSDDA-B
Sampling Date	8/21/90	8/20/90	9/05/90	8/21/90	9/05/90	8/22/90	8/22/90	8/21/90
Source	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	SAIC'91
Metals in mg/kg wet wt.								
Arsenic	2.74	1.86	5.11	3.3	2.85	4.19	4.27	0.9
Cadmium	0	0	0.01 U	0.01	0.01	0.01 U	0	0.07
Copper								
Lead	0.16	0.11	0.05	0.26	0.29	0.2 U	0.2 U	0.16 U
Mercury	0.1	0.11	0.08	0.1	0.12	0.15	0.16	0.03
Zinc								
Pesticide/PCBs in µg/kg wet wt.								
alpha-BHC	2 U	2 U	2 U	4 U	4 U	4 U		
gamma-BHC (Lindane)	2 U	2 U	2 U	4 U	4 U	4 U		0.3 U
Chlordane	20 U	20 U	20 U	20 U	20 U	20 U		1 U
Dieldrin	2 U	2 U	2 U	4 U	4 U	4 U		0.4 U
Total DDE+DDD+DDT								
Total PCBs								
Semivolatiles in µg/kg wet wet.								
Benzoic Acid								
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate								
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	E. Sole Muscle
Sample-ID	PTI-1991-2	Sta. 4-B	Sta. 7-B	T3-30N F-B	T4-30N M-B	T4-30N New-B	T4-30Na-B	BH-SM1
Sampling Date	Mar-91	8/21/90	8/21/90	8/21/90	8/21/90	8/21/90	8/21/90	1991
Source	PTI'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic		1.8	0.9	1.3	1.9	1.6	1.4	3.6
Cadmium		0.06	0.1	0.09	0.11	0.08	0.1	
Copper								0.17
Lead		0.19 U	0.32	0.16	0.15 U	0.14 U	0.19 U	0.03
Mercury		0.07	0.06	0.06	0.09	0.03	0.05	0.03
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC								
gamma-BHC (Lindane)		0.4 U	0.3 U	0.3 U	0.3 U	0.6 U	0.3 U	
Chlordane		4.2 U	1 U	1 U	1 U	1.9 U	1	
Dieldrin		0.5 U	0.4 U	0.4 U	0.4 U	0.8 U	0.4 U	
Total DDE+DDD+DDT								
Total PCBs								
Semivolatiles in µg/kg wet wet								
Benzoic Acid								36 U
Benzyl Alcohol								14 E
Bis[2-ethylhexyl] phthalate								3.6 U
Di-n-butyl phthalate								3.6 U
Fluoranthene								
Phenanthrene								3.6 U
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents	0.28							

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle
Sample-ID	BH-SM1	BH-SM1A	BH-SM2	BH-SM2	BH-SM2A	BH-SM3	BH-SM3	BH-SM3A
Sampling Date	1993	1992	1991	1993	1992	1991	1993	1992
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	4.3	3.9	2.9	3.5	2.9	3.4	3.3	2.9
Cadmium								
Copper	0.39	0.25	0.36	0.67	0.27	0.25	0.49	0.24
Lead	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03	0.03 U	0.03 U
Mercury	0.04 E	0.02 E	0.04	0.03 E	0.03 E	0.03	0.03 E	0.03 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC								
gamma-BHC (Lindane)								
Chlordane								
Dieldrin								
Total DDE+DDD+DDT								
Total PCBs	2			2			2.9	
Semivolatiles in µg/kg wet wet								
Benzoic Acid	36 U	36 U	114 E	36 U	36 U	51 E	36 U	36 U
Benzyl Alcohol	3.6 U	3.6 U	18 E	3.6 U	3.6 U	15 E	3.6 U	3.6 U
Bis[2-ethylhexyl] phthalate	100 U	40 E	4.2 U	100 U	3.6 U	115 E	100 U	360 E
Di-n-butyl phthalate	4 U	3.6 U	4.2 U	4 U	70 E	4.2 U	4 U	90 E
Fluoranthene								
Phenanthrene	3.6 U	3.6 U	4.2 U	3.6 U	3.6 U	4.2 U	3.6 U	3.6 U
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	BH-SOLE1	BH-SOLE2	BH-SOLE3	NR-T1	NR-T1	NR-T1	NR-T1	NR-T10
Sampling Date	1989	1989	1989	1993	1992	1994	1995	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	5.4 E	1.8 E	4.2 E	0.6 E	0.8	0.84 E		
Cadmium								
Copper	0.25	0.22	0.21	0.6	0.47	0.92		
Lead	0.04 U	0.04 U	0.04 U	0.03 U	0.02 U	0.03 U		
Mercury	R	R	R	0.1	0.08	0.09		
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC				0.5 U	0.85	0.5 U	0.52 U	0.52 U
gamma-BHC (Lindane)				0.5 U	0.5	0.5 U	0.52 U	0.52 U
Chlordane								
Dieldrin				0.5 U	1.1	0.5 U	0.67 U	0.67 U
Total DDE+DDD+DDT				17	35.2	34.1	13.5	7.88
Total PCBs				23.4	50	42.6	42.8	21
Semivolatiles in µg/kg wet wet								
Benzoic Acid	500 U	500 U	500 U	260 U	300 U	260 U		
Benzyl Alcohol	17 U	66 U	42 U					
Bis[2-ethylhexyl] phthalate	16.8 U	11 U	11 U	65 U	60 U	65 U		
Di-n-butyl phthalate	20 U	22 U	22 U					
Fluoranthene								
Phenanthrene	8.3 U	11 U	6.9 U					
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T2	NR-T2	NR-T2	NR-T2	NR-T3	NR-T3	NR-T3	NR-T3
Sampling Date	1993	1992	1994	1995	1993	1992	1994	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	1 E	1.1	0.85 E		0.7 E	1.2	0.88 E	
Cadmium								
Copper	0.5	0.43	0.99		0.44	0.41	1.08	
Lead	0.03 U	0.02 U	0.03 U		0.03 U	0.02 U	0.03 U	
Mercury	0.08	0.07	0.06		0.09	0.08	0.07	
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	1.1	0.5 U	0.52 U	0.5 U	0.98	0.5 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U	0.53	0.5 U	0.52 U
Chlordane								
Dieldrin	0.5 U	1.2	0.5 U	0.67 U	0.5 U	1.1	0.5 U	0.67 U
Total DDE+DDD+DDT	11.2	19.9	25.9	14.3	11.8	37.4	27.8	17.9
Total PCBs	26	29	44	43.1	20.5	45	36.5	56.7
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U		260 U	300 U	260 U	
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	440 E	65 U		65 U	60 U	65 U	
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T4	NR-T4	NR-T4	NR-T4	NR-T5	NR-T5	NR-T5	NR-T5
Sampling Date	1993	1992	1994	1995	1993	1992	1994	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.9 E	0.86	0.92 E		0.6 E	0.6 E	0.8 E	
Cadmium								
Copper	0.47	0.43	1.2		0.5	0.42	0.88	
Lead	0.03 U	0.02 U	0.03 U		0.03 U	0.02 U	0.03 U	
Mercury	0.1	0.1	0.06		0.07	0.11	0.09	
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	1	0.5 U	0.52 U	0.5 U	0.66	0.5 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U
Chlordane								
Dieldrin	0.5 U	1	0.5 U	0.67 U	0.5 U	0.77	0.5 U	0.67 U
Total DDE+DDD+DDT	5.76	35.1	20	11.3	12.8	19.7	31.6	19.3
Total PCBs	15.9	38	31.3	33.5	63	34	35.2	43.2
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U		260 U	300 U	260 U	
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	60 U	65 U		65 U	60 U	65 U	
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T6	NR-T6	NR-T6	NR-T6	NR-T7	NR-T8	NR-T9	NR-X1
Sampling Date	1993	1992	1994	1995	1995	1995	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	1 E	1.2	0.96 E					0.6 E
Cadmium								
Copper	0.45	0.49	1.13					0.42
Lead	0.03 U	0.02 U	0.03 U					0.03 U
Mercury	0.11	0.1	0.1					0.04 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	0.73	0.5 U	0.52 U	0.52 U	0.52 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5	0.5 U	0.52 U	0.52 U	0.52 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.5 U	0.72	0.5 U	0.67 U	0.67 U	0.67 U	0.67 U	0.5 U
Total DDE+DDD+DDT	9	24.6	46	15.8	13.4	12.2	10.1	1.9
Total PCBs	16.2	30	52.2	51.7	37.8	40.1	31.4	5
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U					260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	60 U	65 U					65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X1	NR-X1	NR-X1	NR-X2	NR-X2	NR-X2	NR-X2	NR-X3
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.6 E	0.47 E		0.5 E	0.7 E	0.55 E		0.5 E
Cadmium								
Copper	0.47	0.87		0.41	0.46	0.71		0.42
Lead	0.03 U	0.03 U		0.03 U	0.03 U	0.03 U		0.03 U
Mercury	0.03 E	0.03		0.03 E	0.05	0.05		0.03 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.85	0.5 U	0.52 U	0.5 U	0.57	0.5 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.79	0.5 U	0.67 U	0.5 U	0.5	0.5 U	0.67 U	0.5 U
Total DDE+DDD+DDT	7	9.22	7.25	1.3	7	13.5	11	3
Total PCBs	20	16.7	27.1	4	16	23	28.4	7.2
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		360 E	60 U	65 U		65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X3	NR-X3	NR-X3	NR-X4	NR-X4	NR-X4	NR-X4	NR-X5
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.7 E	0.38 E		0.5 E	0.6 E	0.53 E		0.7 E
Cadmium								
Copper	0.48	0.68		0.41	0.48	0.72		0.45
Lead	0.03 U	0.03 U		0.03 U	0.03 U	0.03 U		0.03 U
Mercury	0.03 E	0.03		0.04 E	0.06	0.03		0.05
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.91	0.5 U	0.52 U	0.5 U	0.93	0.5 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.59	0.5 U	0.67 U	0.5 U	0.82	0.5 U	0.67 U	0.5 U
Total DDE+DDD+DDT	4.71	8.5	5.91	1.7	10.6	11.2	8	3.4
Total PCBs	10	14.7	24.1	4	24	21.9	24.9	8.6
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		65 U	60 U	65 U		65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X5	NR-X5	NR-X5	NR-X6	NR-X6	NR-X6	NR-X6	NR-X7
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.6 E	0.72 E		0.5 E	0.5 E	0.43 E		
Cadmium								
Copper	0.44	0.75		0.42	0.48	0.67		
Lead	0.03 U	0.03 U		0.03 U	0.02 U	0.03 U		
Mercury	0.05	0.04		0.06	0.04	0.05		
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.89	0.5 U	0.52 U	0.5 U	0.63	0.5 U	0.52 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.52 U
Chlordane								
Dieldrin	0.59	0.5 U	0.67 U	0.5 U	0.59	0.5 U	0.67 U	0.67 U
Total DDE+DDD+DDT	9.4	8.2	9.55	2	7.36	16	10.9	12
Total PCBs	22	13	27.1	2.7	20	18.9	33.3	32.8
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		65 U	60 U	65 U		
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Table F-1 - Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Whole Clam	Whole Clam	Whole Clam	Whole Clam	Whole Clam	Whole Clam
Sample-ID	3B	EPA-1987	NOAA-87	Post Point 1	Post Point 2	Post Point 3
Sampling Date	12/14/90	1987	1986	4/01/92	4/01/92	4/01/92
Source	Cubbage'91	EPA'87	NOAA'87	Patrick'96	Patrick'96	Patrick'96
Metals in mg/kg wet wt.						
Arsenic	1.11		1.28 E	2.4	2.6	2.3
Cadmium	0.22		0.45 E	0.24	0.27	0.24
Copper			1.5 E	1.2	1.3	1.2
Lead	0.02		0.13 E	0.09	0.09	0.09
Mercury	0.01		0.04 E	0.02	0.02	0.02
Zinc			21.5 E	10	11	10
Pesticide/PCBs in µg/kg wet w						
alpha-BHC	1.9 U			0.1 U	0.1 U	0.1 U
gamma-BHC (Lindane)	1.9 U			0.1 U	0.1 U	0.1 U
Chlordane						
Dieldrin	1.9 U			0.1 U	0.1 U	0.1 U
Total DDE+DDD+DDT						
Total PCBs						
Semivolatiles in µg/kg wet wet						
Benzoic Acid				5900	4500	1400
Benzyl Alcohol				22 U	22 U	22 U
Bis[2-ethylhexyl] phthalate				88 U	51 U	4.4 U
Di-n-butyl phthalate				32 E	81 U	182 E
Fluoranthene	10 J			4.4 U	4.4 U	4.4 U
Phenanthrene	6 J			4.4 U	4.4 U	4.4 U
Pyrene	10 J			4.4 U	4.4 U	4.4 U
Dioxins in ng/kg wet wt.						
Total TCDD Equivalents		0.59				

APPENDIX G
EFFLUENT MONITORING DATA
GEORGIA-PACIFIC OUTFALL

Table G-1. Effluent Monitoring Data, 1995 to 1997, Georgia-Pacific Outfall

Monitoring Date	Mercury Conc. in ug/L	Statistical Treatment of Nondetects		
		FULL U	HALF U	NO U
1-Jan-95	0.2 U	0.2	0.1	0
8-Jan-95	0.2 U	0.2	0.1	0
15-Jan-95	0.2 U	0.2	0.1	0
22-Jan-95	0.2 U	0.2	0.1	0
29-Jan-95	0.4	0.4	0.4	0.4
5-Feb-95	0.2 U	0.2	0.1	0
12-Feb-95	0.2 U	0.2	0.1	0
13-Feb-95	1.4	1.4	1.4	1.4
19-Feb-95	0.2 U	0.2	0.1	0
26-Feb-95	0.2 U	0.2	0.1	0
5-Mar-95	0.2 U	0.2	0.1	0
12-Mar-95	0.2 U	0.2	0.1	0
19-Mar-95	0.2 U	0.2	0.1	0
26-Mar-95	0.2 U	0.2	0.1	0
2-Apr-95	0.2 U	0.2	0.1	0
9-Apr-95	0.2 U	0.2	0.1	0
16-Apr-95	0.2 U	0.2	0.1	0
23-Apr-95	0.2 U	0.2	0.1	0
30-Apr-95	0.2 U	0.2	0.1	0
1-May-95	0.2 U	0.2	0.1	0
7-May-95	0.2 U	0.2	0.1	0
14-May-95	0.2 U	0.2	0.1	0
21-May-95	0.2 U	0.2	0.1	0
28-May-95	0.2 U	0.2	0.1	0
4-Jun-95	0.2 U	0.2	0.1	0
11-Jun-95	0.2 U	0.2	0.1	0
19-Jun-95	0.2 U	0.2	0.1	0
25-Jun-95	0.2 U	0.2	0.1	0
2-Jul-95	0.2 U	0.2	0.1	0
9-Jul-95	0.2 U	0.2	0.1	0
16-Jul-95	0.2 U	0.2	0.1	0
23-Jul-95	0.2 U	0.2	0.1	0
30-Jul-95	0.2 U	0.2	0.1	0
6-Aug-95	0.2 U	0.2	0.1	0
13-Aug-95	0.2 U	0.2	0.1	0
20-Aug-95	0.2 U	0.2	0.1	0
27-Aug-95	0.2 U	0.2	0.1	0
3-Sep-95	0.2 U	0.2	0.1	0
10-Sep-95	0.2 U	0.2	0.1	0
17-Sep-95	0.2 U	0.2	0.1	0
24-Sep-95	0.2 U	0.2	0.1	0
1-Oct-95	0.2 U	0.2	0.1	0
8-Oct-95	0.2 U	0.2	0.1	0
15-Oct-95	0.2 U	0.2	0.1	0
22-Oct-95	0.2 U	0.2	0.1	0
29-Oct-95	0.2 U	0.2	0.1	0
4-Nov-95	0.2 U	0.2	0.1	0
12-Nov-95	0.3	0.3	0.3	0.3

19-Nov-95	0.3	0.3	0.3	0.3
22-Nov-95	1.7	1.7	1.7	1.7
23-Nov-95	0.3	0.3	0.3	0.3
26-Nov-95	0.2 U	0.2	0.1	0
3-Dec-95	0.3	0.3	0.3	0.3
10-Dec-95	0.2 U	0.2	0.1	0
17-Dec-95	0.2 U	0.2	0.1	0
24-Dec-95	0.2 U	0.2	0.1	0
31-Dec-95	0.2 U	0.2	0.1	0
7-Jan-96	0.2 U	0.2	0.1	0
14-Jan-96	0.2 U	0.2	0.1	0
21-Jan-96	0.2	0.2	0.2	0.2
28-Jan-96	0.2 U	0.2	0.1	0
4-Feb-96	0.2 U	0.2	0.1	0
11-Feb-96	0.2	0.2	0.2	0.2
18-Feb-96	0.2	0.2	0.2	0.2
25-Feb-96	0.3	0.3	0.3	0.3
3-Mar-96	0.2 U	0.2	0.1	0
10-Mar-96	0.4	0.4	0.4	0.4
17-Mar-96	0.2 U	0.2	0.1	0
24-Mar-96	0.2	0.2	0.2	0.2
31-Mar-96	0.2	0.2	0.2	0.2
7-Apr-96	0.2 U	0.2	0.1	0
14-Apr-96	0.2 U	0.2	0.1	0
21-Apr-96	0.2 U	0.2	0.1	0
28-Apr-96	0.2 U	0.2	0.1	0
5-May-96	0.4	0.4	0.4	0.4
12-May-96	0.3	0.3	0.3	0.3
19-May-96	0.3	0.3	0.3	0.3
26-May-96	0.2 U	0.2	0.1	0
2-Jun-96	0.4	0.4	0.4	0.4
9-Jun-96	0.4	0.4	0.4	0.4
16-Jun-96	0.3	0.3	0.3	0.3
23-Jun-96	0.2 U	0.2	0.1	0
30-Jun-96	0.2 U	0.2	0.1	0
7-Jul-96	0.2 U	0.2	0.1	0
8-Jul-96	0.7	0.7	0.7	0.7
14-Jul-96	0.2 U	0.2	0.1	0
21-Jul-96	0.2 U	0.2	0.1	0
28-Jul-96	0.2 U	0.2	0.1	0
4-Aug-96	0.4	0.4	0.4	0.4
11-Aug-96	0.2 U	0.2	0.1	0
18-Aug-96	0.6	0.6	0.6	0.6
25-Aug-96	0.2 U	0.2	0.1	0
2-Sep-96	0.2 U	0.2	0.1	0
8-Sep-96	1.3	1.3	1.3	1.3
15-Sep-96	0.7	0.7	0.7	0.7
22-Sep-96	0.4	0.4	0.4	0.4
29-Sep-96	4.1	4.1	4.1	4.1
6-Oct-96	2.6	2.6	2.6	2.6
13-Oct-96	2.3	2.3	2.3	2.3
19-Oct-96	0.3	0.3	0.3	0.3

27-Oct-96	0.3	0.3	0.3	0.3
3-Nov-96	0.2 U	0.2	0.1	0
10-Nov-96	0.4	0.4	0.4	0.4
17-Nov-96	0.2 U	0.2	0.1	0
24-Nov-96	0.2 U	0.2	0.1	0
1-Dec-96	0.4	0.4	0.4	0.4
8-Dec-96	0.3	0.3	0.3	0.3
15-Dec-96	0.3	0.3	0.3	0.3
22-Dec-96	0.2 U	0.2	0.1	0
30-Dec-96	0.4	0.4	0.4	0.4
5-Jan-97	0.2 U	0.2	0.1	0
12-Jan-97	0.2 U	0.2	0.1	0
19-Jan-97	0.2 U	0.2	0.1	0
26-Jan-97	0.2 U	0.2	0.1	0
2-Feb-97	0.2	0.2	0.2	0.2
8-Feb-97	0.2 U	0.2	0.1	0
16-Feb-97	0.2 U	0.2	0.1	0
23-Feb-97	0.2 U	0.2	0.1	0
2-Mar-97	0.2	0.2	0.2	0.2
9-Mar-97	0.2 U	0.2	0.1	0
16-Mar-97	0.2 U	0.2	0.1	0
23-Mar-97	0.2 U	0.2	0.1	0
30-Mar-97	0.3	0.3	0.3	0.3
6-Apr-97	0.2	0.2	0.2	0.2
13-Apr-97	0.2	0.2	0.2	0.2
20-Apr-97	0.2 U	0.2	0.1	0
27-Apr-97	0.2 U	0.2	0.1	0
4-May-97	0.2 U	0.2	0.1	0
11-May-97	0.2 U	0.2	0.1	0
16-May-97	0.2 U	0.2	0.1	0
17-May-97	0.2 U	0.2	0.1	0
18-May-97	0.2	0.2	0.2	0.2
25-May-97	0.2 U	0.2	0.1	0
1-Jun-97	0.2 U	0.2	0.1	0
8-Jun-97	0.2 U	0.2	0.1	0
16-Jun-97	0.2 U	0.2	0.1	0
22-Jun-97	0.2 U	0.2	0.1	0
29-Jun-97	0.2 U	0.2	0.1	0
6-Jul-97	0.2 U	0.2	0.1	0
13-Jul-97	0.2 U	0.2	0.1	0
20-Jul-97	0.2 U	0.2	0.1	0
28-Jul-97	0.2 U	0.2	0.1	0
6-Aug-97	0.2 U	0.2	0.1	0
10-Aug-97	0.2	0.2	0.2	0.2
17-Aug-97	0.2 U	0.2	0.1	0
24-Aug-97	0.2	0.2	0.2	0.2
1-Sep-97	0.2 U	0.2	0.1	0
7-Sep-97	0.2	0.2	0.2	0.2
14-Sep-97	0.2	0.2	0.2	0.2
21-Sep-97	0.3	0.3	0.3	0.3
28-Sep-97	0.2 U	0.2	0.1	0
5-Oct-97	0.2	0.2	0.2	0.2

15-Oct-97	0.2 U	0.2	0.1	0
19-Oct-97	0.2 U	0.2	0.1	0
26-Oct-97	0.2 U	0.2	0.1	0
2-Nov-97	0.2 U	0.2	0.1	0
9-Nov-97	0.2 U	0.2	0.1	0
18-Nov-97	0.2	0.2	0.2	0.2
24-Nov-97	0.3	0.3	0.3	0.3
30-Nov-97	0.2 U	0.2	0.1	0
7-Dec-97	0.2 U	0.2	0.1	0
14-Dec-97	0.2 U	0.2	0.1	0
21-Dec-97	0.2 U	0.2	0.1	0

Annual Avg.					
		N=	163		
0.258	1995	U=	113		
0.455	1996		Full U	Half U	No U
0.206	1997	Arith Mean	0.3049	0.236	0.166
		Geo Mean	0.241	0.149	n/a
		Load,kg/day	0.0422	0.0326	0.0230

APPENDIX H
WASP INPUT/OUTPUT FILES
GEORGIA-PACIFIC OUTFALL

Table H-1. WASP Steady-State Input File

```
5/6/97  G-P Outfall Simulation
 NSEG NSYS                                   A:MODEL OPTIONS
   49    2
    2                        B:EXCHANGE COEFFICIENTS
    5      0.1        1.0     Group B, Record 2 -- Surface water dispersion
   20      200.              Group B, Record 3/4, layers 1 and 1, angle 34
    4757.0      488.0     0   13
    4757.0      488.0     0    1
    4757.0      488.0     0   14
    4757.0      488.0     0   15
    4757.0      488.0     0   16
    4757.0      488.0    13    9
    4757.0      488.0     9    5
    4757.0      488.0    14   10
    4757.0      488.0    10    6
    4757.0      488.0    15   11
    4757.0      488.0    11    7
    4757.0      488.0    16   12
    4757.0      488.0    12    8
    4757.0      488.0     8    4
    4757.0      488.0     5    1
    4757.0      488.0     6    2
    4757.0      488.0     2    0
    4757.0      488.0     7    3
    4757.0      488.0     3    0
    4757.0      488.0     4    0
   20      300.                  Group B, Record 3/4, layers 1 and 1, angle 304
    2378.4      975.0     0    9
    2378.4      975.0     0    5
    2378.4      975.0    13   14
    2378.4      975.0     9   10
    2378.4      975.0    14   15
    2378.4      975.0    10   11
    2378.4      975.0    15   16
    2378.4      975.0    11   12
    2378.4      975.0    12    0
    2378.4      975.0     8    0
    2378.4      975.0     5    6
    2378.4      975.0     1    2
    2378.4      975.0     6    7
    2378.4      975.0     2    3
    2378.4      975.0     7    8
    2378.4      975.0     3    4
    2378.4      975.0     0   13
    2378.4      975.0     0    1
    2378.4      975.0    16    0
    2378.4      975.0     4    0
   20       50.                  Group B, Record 3, layers 2 and 2, angle 34
    4895.0      488.0     0   29
    3325.0      488.0     0   17
   10616.8      488.0     0   30
   14864.1      488.0     0   31
   20212.0      488.0     0   32
   15298.7      488.0    31   27
   20215.6      488.0    32   28
   20972.3      488.0    28   24
    4560.7      488.0    29   25
    3839.4      488.0    25   21
    3388.6      488.0    21   17
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 10067.6      488.0    30    26
  9152.4      488.0    26    22
  8503.1      488.0    22    18
  8220.1      488.0    18     0
 15298.7      488.0    27    23
 13787.6      488.0    23    19
 12710.1      488.0    19     0
 20081.1      488.0    24    20
 18428.0      488.0    20     0
 20       100.                    Group B, Record 3, layers 2 and 2, angle 304
  2113.7      975.0     0    25
  1725.8      975.0     0    21
  8770.7      975.0    31    32
 10108.2      975.0    28     0
  3877.6      975.0    29    30
  3436.3      975.0    25    26
  3059.5      975.0    21    22
  6370.5      975.0    30    31
  2886.4      975.0    17    18
  6312.7      975.0    26    27
  5912.9      975.0    22    23
  5232.4      975.0    18    19
  8986.9      975.0    27    28
  9148.4      975.0    23    24
  7785.8      975.0    19    20
 10865.2      975.0    24     0
  2450.0      975.0     0    29
  1664.0      975.0     0    17
 10116.0      975.0    32     0
  9223.0      975.0    20     0
  16       4E-4                    Group B, Record 3, vert. disp. w/ lower layer 2
475664.00       3.41     1    17
475664.00       4.88     2    18
475664.00       4.88     3    19
475664.00       4.88     4    20
475664.00       3.54     5    21
475664.00       4.88     6    22
475664.00       4.88     7    23
475664.00       4.88     8    24
475664.00       4.33     9    25
475664.00       4.88    10    26
475664.00       4.88    11    27
475664.00       4.88    12    28
475664.00       4.88    13    29
475664.00       4.88    14    30
475664.00       4.88    15    31
475664.00       4.88    16    32
   1        1.0         1.0       Group B, Record 2 -- Pore water dispersion
  16      5E-10                     Group B, Record 3, vert. disp. w/ lower layer 3
475664.00       0.12    17    33
475664.00       0.12    18    34
475664.00       0.12    19    35
475664.00       0.12    20    36
475664.00       0.12    21    37
475664.00       0.12    22    38
475664.00       0.12    23    39
475664.00       0.12    24    40
475664.00       0.12    25    41
475664.00       0.12    26    42
475664.00       0.12    27    43
```

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475664.00     0.12   28   44
475664.00     0.12   29   45
475664.00     0.12   30   46
475664.00     0.12   31   47
475664.00     0.12   32   48
   0   0
      1.0       1.0        C:VOLUMES(cu m)
        1        17       1 2319507.5    0.000     0.00     4.877     0.00
        2        18       1 2319582.1    0.000     0.00     4.877     0.00
        3        19       1 2319682.7    0.000     0.00     4.877     0.00
        4        20       1 2319732.1    0.000     0.00     4.877     0.00
        5        21       1 2319696.0    0.000     0.00     4.877     0.00
        6        22       1 2319732.1    0.000     0.00     4.877     0.00
        7        23       1 2319682.7    0.000     0.00     4.877     0.00
        8        24       1 2319595.8    0.000     0.00     4.877     0.00
        9        25       1 2319682.7    0.000     0.00     4.877     0.00
       10        26       1 2319582.1    0.000     0.00     4.877     0.00
       11        27       1 2319582.1    0.000     0.00     4.877     0.00
       12        28       1 2319607.6    0.000     0.00     4.877     0.00
       13        29       1 2319582.1    0.000     0.00     4.877     0.00
       14        30       1 2319682.7    0.000     0.00     4.877     0.00
       15        31       1 2319745.8    0.000     0.00     4.877     0.00
       16        32       1 2319696.0    0.000     0.00     4.877     0.00
       17        33       2 1621770.6    0.000     0.00     3.410     0.00
       18        34       2 4008527.9    0.000     0.00     8.428     0.00
       19        35       2 6198336.7    0.000     0.00    13.031     0.00
       20        36       2 8988961.8    0.000     0.00    18.898     0.00
       21        37       2 1683229.4    0.000     0.00     3.539     0.00
       22        38       2 4284835.2    0.000     0.00     9.008     0.00
       23        39       2 7249008.3    0.000     0.00    15.240     0.00
       24        40       210596783.4    0.000     0.00    22.279     0.00
       25        41       2 2061472.9    0.000     0.00     4.334     0.00
       26        42       2 4641773.8    0.000     0.00     9.759     0.00
       27        43       2 7672163.1    0.000     0.00    16.130     0.00
       28        44       2 9858332.3    0.000     0.00    20.726     0.00
       29        45       2 2386705.0    0.000     0.00     5.018     0.00
       30        46       2 5177386.5    0.000     0.00    10.885     0.00
       31        47       2 7249205.5    0.000     0.00    15.240     0.00
       32        48       2 9858707.9    0.000     0.00    20.726     0.00
       33        49       3   57074.4    0.000     0.00     0.120     0.00
       34        49       3   57076.2    0.000     0.00     0.120     0.00
       35        49       3   57078.6    0.000     0.00     0.120     0.00
       36        49       3   57079.8    0.000     0.00     0.120     0.00
       37        49       3   57079.2    0.000     0.00     0.120     0.00
       38        49       3   57079.8    0.000     0.00     0.120     0.00
       39        49       3   57078.6    0.000     0.00     0.120     0.00
       40        49       3   57076.8    0.000     0.00     0.120     0.00
       41        49       3   57078.6    0.000     0.00     0.120     0.00
       42        49       3   57076.2    0.000     0.00     0.120     0.00
       43        49       3   57076.2    0.000     0.00     0.120     0.00
       44        49       3   57076.8    0.000     0.00     0.120     0.00
       45        49       3   57076.2    0.000     0.00     0.120     0.00
       46        49       3   57078.6    0.000     0.00     0.120     0.00
       47        49       3   57080.4    0.000     0.00     0.120     0.00
       48        49       3   57079.2    0.000     0.00     0.120     0.00
       49         0       4   1.0E+08    0.000     0.00     0.120     0.00
  1    3                   D:FLOWS
  8       1.0       1.0       D.1, Record 2
  5     153.6                           Advection 0-1-2-3-4-0
     1.0    0    1      1.0    1    2      1.0    2    3      1.0    3    4
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    1.0     4    0
 5      153.6                                   Advection 0-5-6-7-8-0
    1.0     0    5        1.0    5    6     1.0    6    7         1.0    7    8
    1.0     8    0
 5      153.6                                   Advection 0-9-10-11-12-0
    1.0     0    9      1.0    9   10       1.0   10   11         1.0   11   12
    1.0    12    0
 5      153.6                                   Advection 0-13-14-15-16-0
    1.0     0   13        1.0   13   14     1.0   14   15         1.0   15   16
    1.0    16    0
 5      197.4                                   Advection 0-17-18-19-20-0
    1.0     0   17        1.0   17   18     1.0   18   19         1.0   19   20
    1.0    20    0
 5      227.9                                 Advection 0-21-22-23-24-0
    1.0     0   21        1.0   21   22     1.0   22   23         1.0   23   24
    1.0    24    0
 5      225.8                                   Advection 0-25-26-27-28-0
    1.0     0   25        1.0   25   26     1.0   26   27         1.0   27   28
    1.0    28    0
 5      228.7                                   Advection 0-29-30-31-32-0
    1.0     0   29        1.0   29   30     1.0   30   31         1.0   31   32
    1.0    32    0
 0          1.0        1.0        Pore Water
 4          1.0        1.0
32    1.30E-4                               Settling
475664.0     1   17  475664.0    2   18  475664.0    3   19  475664.0    4   20
475664.0     5   21  475664.0    6   22  475664.0    7   23  475664.0    8   24
475664.0     9   25  475664.0   10   26  475664.0   11   27  475664.0   12   28
475664.0    13   29  475664.0   14   30  475664.0   15   31  475664.0   16   32
475664.0    17   33  475664.0   18   34  475664.0   19   35  475664.0   20   36
475664.0    21   37  475664.0   22   38  475664.0   23   39  475664.0   24   40
475664.0    25   41  475664.0   26   42  475664.0   27   43  475664.0   28   44
475664.0    29   45  475664.0   30   46  475664.0   31   47  475664.0   32   48
 16   2.09E-9                               Resuspension
475664.0    33   17  475664.0   34   18  475664.0   35   19  475664.0   36   20
475664.0    37   21  475664.0   38   22  475664.0   39   23  475664.0   40   24
475664.0    41   25  475664.0 . 42   26  475664.0   43   27  475664.0   44   28
475664.0    45   29  475664.0   46   30  475664.0   47   31  475664.0   48   32
 16  5.07E-10                               Sedimentation
475664.0    33   49  475664.0   34   49  475664.0   35   49  475664.0   36   49
475664.0    37   49  475664.0   38   49  475664.0   39   49  475664.0   40   49
475664.0    41   49  475664.0   42   49  475664.0   43   49  475664.0   44   49
475664.0    45   49  475664.0   46   49  475664.0   47   49  475664.0   48   49
  1  5.07E-10                               Burial Out
7610600.0   49    0
  0     0
       25                       E:BOUNDARY CONDITIONS FOR MERCURY
    1.05          1.0
 13          3.33E-6
  9          3.33E-6
  5          3.33E-6
  1          3.33E-6
 14          3.33E-6
 15          3.33E-6
 16          3.33E-6
 12          3.33E-6
  8          3.33E-6
  2          3.33E-6
  3          3.33E-6
  4          3.33E-6
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29          3.33E-6
25          3.33E-6
21          3.33E-6
17          3.33E-6
30          3.33E-6
31          3.33E-6
32          3.33E-6
28          3.33E-6
18          3.33E-6
19          3.33E-6
24          3.33E-6
20          3.33E-6
49              0.0
     25                    E:BOUNDARY CONDITIONS FOR SOLID 1
    1.0          1.0
13              10.0
 9              10.0
 5              10.0
 1              10.0
14              10.0
15              10.0
16              10.0
12              10.0
 8              10.0
 2              10.0
 3              10.0
 4              10.0
29              10.0
25              10.0
21              10.0
17              10.0
30              10.0
31              10.0
32              10.0
28              10.0
18              10.0
19              10.0
24              10.0
20              10.0
49               0.0
      2                F.1:POINT SOURCE LOADS OF MERCURY (KG/DAY)
    1.0          1.0
 6           0.00E-3
22           4.00E-2
      2                F.1:POINT SOURCE LOADS OF SOLID 1
    1.0          1.0
 6                  0
22              13280
      0                G:PARAMETERS
                       H:CONSTANTS
GLOBALS               1
Kinetics              2
 PIXC(1,1)          111  1.00E+06      DECAY        142  0.000000
Chem1                 0
Solids1               0
      0                                                  ENVIR. FUNCTIONS
CHEM1 DEN                                    1.0
SOLIDS                                      0.50
```

Table H-2. WASP Steady-State Output File, 5/6/97
G-P Outfall, Whatcom Waterway RI/FS

Model Segment No.	TSS mg/l	Total Hg ug/l	Dissolved Hg ug/l	Particulate Hg ug/l	Sediment Hg ug/kg
1	9.22E+00	3.25E-03	3.18E-04	2.93E-03	3.18E+02
2	8.89E+00	3.15E-03	3.18E-04	2.83E-03	3.18E+02
3	8.80E+00	3.12E-03	3.18E-04	2.80E-03	3.18E+02
4	9.00E+00	3.18E-03	3.18E-04	2.86E-03	3.18E+02
5	8.91E+00	3.15E-03	3.18E-04	2.83E-03	3.18E+02
6	8.41E+00	3.00E-03	3.19E-04	2.68E-03	3.19E+02
7	8.27E+00	2.95E-03	3.19E-04	2.64E-03	3.19E+02
8	8.58E+00	3.05E-03	3.18E-04	2.73E-03	3.18E+02
9	8.90E+00	3.15E-03	3.18E-04	2.83E-03	3.18E+02
10	8.40E+00	3.00E-03	3.19E-04	2.68E-03	3.19E+02
11	8.27E+00	2.95E-03	3.18E-04	2.63E-03	3.18E+02
12	8.58E+00	3.05E-03	3.18E-04	2.73E-03	3.18E+02
13	9.21E+00	3.25E-03	3.18E-04	2.93E-03	3.18E+02
14	8.88E+00	3.14E-03	3.18E-04	2.83E-03	3.18E+02
15	8.80E+00	3.12E-03	3.18E-04	2.80E-03	3.18E+02
16	9.00E+00	3.18E-03	3.18E-04	2.86E-03	3.18E+02
17	1.12E+01	3.93E-03	3.22E-04	3.61E-03	3.22E+02
18	1.15E+01	4.15E-03	3.32E-04	3.81E-03	3.32E+02
19	1.13E+01	4.02E-03	3.27E-04	3.70E-03	3.27E+02
20	1.09E+01	3.83E-03	3.22E-04	3.51E-03	3.22E+02
21	1.14E+01	4.04E-03	3.26E-04	3.72E-03	3.26E+02
22	1.20E+01	4.66E-03	3.58E-04	4.31E-03	3.58E+02
23	1.18E+01	4.27E-03	3.35E-04	3.94E-03	3.35E+02
24	1.12E+01	3.96E-03	3.25E-04	3.64E-03	3.25E+02
25	1.13E+01	3.98E-03	3.22E-04	3.65E-03	3.22E+02
26	1.18E+01	4.27E-03	3.32E-04	3.94E-03	3.32E+02
27	1.17E+01	4.17E-03	3.29E-04	3.84E-03	3.29E+02
28	1.12E+01	3.94E-03	3.24E-04	3.62E-03	3.24E+02
29	1.10E+01	3.85E-03	3.20E-04	3.53E-03	3.20E+02
30	1.13E+01	3.97E-03	3.23E-04	3.65E-03	3.23E+02
31	1.12E+01	3.93E-03	3.23E-04	3.61E-03	3.23E+02
32	1.08E+01	3.79E-03	3.21E-04	3.47E-03	3.21E+02
33	5.62E+05	1.81E+02	3.22E-04	1.81E+02	3.22E+02
34	5.76E+05	1.91E+02	3.32E-04	1.91E+02	3.32E+02
35	5.66E+05	1.85E+02	3.27E-04	1.85E+02	3.27E+02
36	5.44E+05	1.75E+02	3.22E-04	1.75E+02	3.22E+02
37	5.71E+05	1.86E+02	3.26E-04	1.86E+02	3.26E+02
38	6.03E+05	2.16E+02	3.58E-04	2.16E+02	3.58E+02
39	5.89E+05	1.97E+02	3.35E-04	1.97E+02	3.35E+02
40	5.60E+05	1.82E+02	3.25E-04	1.82E+02	3.25E+02
41	5.68E+05	1.83E+02	3.22E-04	1.83E+02	3.22E+02
42	5.93E+05	1.97E+02	3.32E-04	1.97E+02	3.32E+02
43	5.86E+05	1.92E+02	3.29E-04	1.92E+02	3.29E+02
44	5.60E+05	1.81E+02	3.24E-04	1.81E+02	3.24E+02
45	5.52E+05	1.77E+02	3.20E-04	1.77E+02	3.20E+02
46	5.65E+05	1.83E+02	3.23E-04	1.83E+02	3.23E+02
47	5.59E+05	1.81E+02	3.23E-04	1.81E+02	3.23E+02
48	5.41E+05	1.74E+02	3.21E-04	1.74E+02	3.21E+02
49	5.68E+05	1.86E+02	3.28E-04	1.86E+02	3.28E+02

Table H-3. WASP Dynamic Input File.

```
6/25/98 "GPTRANS3" G-P Outfall Simulation, Whatcom Waterway RI/FS.
 NSEG NSYS ICRD MFLG IDMP NSLN INTY ADFC   DD HHMM       A:MODEL OPTIONS
   49    2    0    0    1    0    1  0.0    1  0 0       1.0
   37   38   39   40   41   42
    1
 4.26E-2     3650.
    2
      1.0      10.0      30.0     3650.
    0    0
    2                      B:EXCHANGE COEFFICIENTS
    5      0.33       1.0     Group B, Record 2 -- Surface water dispersion
   20                 Group B, Record 3, layers 1 and 1, angle 34
  4757.0     488.0    0   13
  4757.0     488.0    0    1
  4757.0     488.0    0   14
  4757.0     488.0    0   15
  4757.0     488.0    0   16
  4757.0     488.0   13    9
  4757.0     488.0    9    5
  4757.0     488.0   14   10
  4757.0     488.0   10    6
  4757.0     488.0   15   11
  4757.0     488.0   11    7
  4757.0     488.0   16   12
  4757.0     488.0   12    8
  4757.0     488.0    8    4
  4757.0     488.0    5    1
  4757.0     488.0    6    2
  4757.0     488.0    2    0
  4757.0     488.0    7    3
  4757.0     488.0    3    0
  4757.0     488.0    4    0
    2                    Group B, Record 5
    200.         0       200.      3650
   20                  Group B, Record 3, layers 1 and 1, angle 304
  2378.4     975.0    0    9
  2378.4     975.0    0    5
  2378.4     975.0   13   14
  2378.4     975.0    9   10
  2378.4     975.0   14   15
  2378.4     975.0   10   11
  2378.4     975.0   15   16
  2378.4     975.0   11   12
  2378.4     975.0   12    0
  2378.4     975.0    8    0
  2378.4     975.0    5    6
  2378.4     975.0    1    2
  2378.4     975.0    6    7
  2378.4     975.0    2    3
  2378.4     975.0    7    8
  2378.4     975.0    3    4
  2378.4     975.0    0   13
  2378.4     975.0    0    1
  2378.4     975.0   16    0
  2378.4     975.0    4    0
    2                    Group B, Record 5
    300.         0       300.      3650
   20                  Group B, Record 3, layers 2 and 2, angle 34
  4895.0     488.0    0   29
```

```
  3325.0     488.0     0   17
 10616.8     488.0     0   30
 14864.1     488.0     0   31
 20212.0     488.0     0   32
 15298.7     488.0    31   27
 20215.6     488.0    32   28
 20972.3     488.0    28   24
  4560.7     488.0    29   25
  3839.4     488.0    25   21
  3388.6     488.0    21   17
 10067.6     488.0    30   26
  9152.4     488.0    26   22
  8503.1     488.0    22   18
  8220.1     488.0    18    0
 15298.7     488.0    27   23
 13787.6     488.0    23   19
 12710.1     488.0    19    0
 20081.1     488.0    24   20
 18428.0     488.0    20    0
  2                  Group B, Record 5
    50.         0       50.      3650
 20                Group B, Record 3, layers 2 and 2, angle 304
  2113.7     975.0     0   25
  1725.8     975.0     0   21
  8770.7     975.0    31   32
 10108.2     975.0    28    0
  3877.6     975.0    29   30
  3436.3     975.0    25   26
  3059.5     975.0    21   22
  6370.5     975.0    30   31
  2886.4     975.0    17   18
  6312.7     975.0    26   27
  5912.9     975.0    22   23
  5232.4     975.0    18   19
  8986.9     975.0    27   28
  9148.4     975.0    23   24
  7785.8     975.0    19   20
 10865.2     975.0    24    0
  2450.0     975.0     0   29
  1664.0     975.0     0   17
 10116.0     975.0    32    0
  9223.0     975.0    20    0
  2                  Group B, Record 5
   100.         0      100.      3650
 16                Group B, Record 3, vert. disp. w/ lower layer 2
475664.00      3.41    1   17
475664.00      4.88    2   18
475664.00      4.88    3   19
475664.00      4.88    4   20
475664.00      3.54    5   21
475664.00      4.88    6   22
475664.00      4.88    7   23
475664.00      4.88    8   24
475664.00      4.33    9   25
475664.00      4.88   10   26
475664.00      4.88   11   27
475664.00      4.88   12   28
475664.00      4.88   13   29
475664.00      4.88   14   30
475664.00      4.88   15   31
```

```
475664.00        4.88   16   32
   2                     Group B, Record 5
     4E-4          0       4E-4       3650
   1        1.0       1.0       Group B, Record 2 -- Pore water dispersion
  16                  Group B, Record 3, vert. disp. w/ lower layer 3
475664.00        0.12   17   33
475664.00        0.12   18   34
475664.00        0.12   19   35
475664.00        0.12   20   36
475664.00        0.12   21   37
475664.00        0.12   22   38
475664.00        0.12   23   39
475664.00        0.12   24   40
475664.00        0.12   25   41
475664.00        0.12   26   42
475664.00        0.12   27   43
475664.00        0.12   28   44
475664.00        0.12   29   45
475664.00        0.12   30   46
475664.00        0.12   31   47
475664.00        0.12   32   48
   2                     Group B, Record 5
    5E-10          0      5E-10       3650
   0    0
   1    0    5.                          C:VOLUMES
      1.0        1.0          Volume(cu m)        a          b          c          d
        1         17          1 2319507.5     0.000      0.00      4.877       0.00
        2         18          1 2319582.1     0.000      0.00      4.877       0.00
        3         19          1 2319682.7     0.000      0.00      4.877       0.00
        4         20          1 2319732.1     0.000      0.00      4.877       0.00
        5         21          1 2319696.0     0.000      0.00      4.877       0.00
        6         22          1 2319732.1     0.000      0.00      4.877       0.00
        7         23          1 2319682.7     0.000      0.00      4.877       0.00
        8         24          1 2319595.8     0.000      0.00      4.877       0.00
        9         25          1 2319682.7     0.000      0.00      4.877       0.00
       10         26          1 2319582.1     0.000      0.00      4.877       0.00
       11         27          1 2319582.1     0.000      0.00      4.877       0.00
       12         28          1 2319607.6     0.000      0.00      4.877       0.00
       13         29          1 2319582.1     0.000      0.00      4.877       0.00
       14         30          1 2319682.7     0.000      0.00      4.877       0.00
       15         31          1 2319745.8     0.000      0.00      4.877       0.00
       16         32          1 2319696.0     0.000      0.00      4.877       0.00
       17         33          2 1621770.6     0.000      0.00      3.410       0.00
       18         34          2 4008527.9     0.000      0.00      8.428       0.00
       19         35          2 6198336.7     0.000      0.00     13.031       0.00
       20         36          2 8988961.8     0.000      0.00     18.898       0.00
       21         37          2 1683229.4     0.000      0.00      3.539       0.00
       22         38          2 4284835.2     0.000      0.00      9.008       0.00
       23         39          2 7249008.3     0.000      0.00     15.240       0.00
       24         40          210596783.4     0.000      0.00     22.279       0.00
       25         41          2 2061472.9     0.000      0.00      4.334       0.00
       26         42          2 4641773.8     0.000      0.00      9.759       0.00
       27         43          2 7672163.1     0.000      0.00     16.130       0.00
       28         44          2 9858332.3     0.000      0.00     20.726       0.00
       29         45          2 2386705.0     0.000      0.00      5.018       0.00
       30         46          2 5177386.5     0.000      0.00     10.885       0.00
       31         47          2 7249205.5     0.000      0.00     15.240       0.00
       32         48          2 9858707.9     0.000      0.00     20.726       0.00
       33         49          3    57074.4     0.000      0.00      0.120       0.00
       34         49          3    57076.2     0.000      0.00      0.120       0.00
```

```
      35      49     3   57078.6    0.000     0.00    0.120     0.00
      36      49     3   57079.8    0.000     0.00    0.120     0.00
      37      49     3   57079.2    0.000     0.00    0.120     0.00
      38      49     3   57079.8    0.000     0.00    0.120     0.00
      39      49     3   57078.6    0.000     0.00    0.120     0.00
      40      49     3   57076.8    0.000     0.00    0.120     0.00
      41      49     3   57078.6    0.000     0.00    0.120     0.00
      42      49     3   57076.2    0.000     0.00    0.120     0.00
      43      49     3   57076.2    0.000     0.00    0.120     0.00
      44      49     3   57076.8    0.000     0.00    0.120     0.00
      45      49     3   57076.2    0.000     0.00    0.120     0.00
      46      49     3   57078.6    0.000     0.00    0.120     0.00
      47      49     3   57080.4    0.000     0.00    0.120     0.00
      48      49     3   57079.2    0.000     0.00    0.120     0.00
      49       0     4   1.0E+08    0.000     0.00    0.120     0.00
1    3                         D:FLOWS
8       1.0      1.0            D.1, Record 2
5                                 Advection 0-1-2-3-4-0
   1.0    0    1       1.0   1    2        1.0    2    3       1.0    3    4
   1.0    4    0
2
 153.6      0.0      153.6    3650.0
5                                 Advection 0-5-6-7-8-0
   1.0    0    5       1.0   5    6        1.0    6    7       1.0    7    8
   1.0    8    0
2
 153.6      0.0      153.6    3650.0
5                                 Advection 0-9-10-11-12-0
   1.0    0    9     1.0   9   10        1.0   10   11       1.0   11   12
   1.0   12    0
2
 153.6      0.0      153.6    3650.0
5                                 Advection 0-13-14-15-16-0
   1.0    0   13       1.0  13   14        1.0   14   15       1.0   15   16
   1.0   16    0
2
 153.6      0.0      153.6    3650.0
5                                 Advection 0-17-18-19-20-0
   1.0    0   17       1.0  17   18        1.0   18   19       1.0   19   20
   1.0   20    0
2
 197.4      0.0      197.4    3650.0
5                              Advection 0-21-22-23-24-0
   1.0    0   21       1.0  21   22        1.0   22   23       1.0   23   24
   1.0   24    0
2
 227.9      0.0      227.9    3650.0
5                                 Advection 0-25-26-27-28-0
   1.0    0   25       1.0  25   26        1.0   26   27       1.0   27   28
   1.0   28    0
2
 225.8      0.0      225.8    3650.0
5                                 Advection 0-29-30-31-32-0
   1.0    0   29       1.0  29   30        1.0   30   31       1.0   31   32
   1.0   32    0
2
 228.7      0.0      228.7    3650.0
0       1.0      1.0            D.3, Record 2
4       1.0      1.0            D.4, Record 2
32                               D.4, Record 3, settling vel.
```

```
475664.0     1   17  475664.0     2   18  475664.0     3   19  475664.0     4   20
475664.0     5   21  475664.0     6   22  475664.0     7   23  475664.0     8   24
475664.0     9   25  475664.0    10   26  475664.0    11   27  475664.0    12   28
475664.0    13   29  475664.0    14   30  475664.0    15   31  475664.0    16   32
475664.0    17   33  475664.0    18   34  475664.0    19   35  475664.0    20   36
475664.0    21   37  475664.0    22   38  475664.0    23   39  475664.0    24   40
475664.0    25   41  475664.0    26   42  475664.0    27   43  475664.0    28   44
475664.0    29   45  475664.0    30   46  475664.0    31   47  475664.0    32   48
  2                                  D.4, Record 5, sedimentation vel.
 1.30E-4        0.0   1.30E-4    3650.0
 16  5.16E-10                              Resuspension
475664.0    33   17  475664.0    34   18  475664.0    35   19  475664.0    36   20
475664.0    37   21  475664.0    38   22  475664.0    39   23  475664.0    40   24
475664.0    41   25  475664.0    42   26  475664.0    43   27  475664.0    44   28
475664.0    45   29  475664.0    46   30  475664.0    47   31  475664.0    48   32
  2                                  D.4, Record 5, Resuspension
 2.09E-9        0.0   2.09E-9    3650.0
 16  5.16E-10                              Sedimentation
475664.0    33   49  475664.0    34   49  475664.0    35   49  475664.0    36   49
475664.0    37   49  475664.0    38   49  475664.0    39   49  475664.0    40   49
475664.0    41   49  475664.0    42   49  475664.0    43   49  475664.0    44   49
475664.0    45   49  475664.0    46   49  475664.0    47   49  475664.0    48   49
  2                                  D.4, Record 5, Sedimentation
 5.07E-10       0.0  5.07E-10    3650.0
  1  5.16E-10                              Burial Out
7610600.0    49    0
  2                                  D.4, Record 5, Burial Out
 5.07E-10       0.0  5.07E-10    3650.0
  0    0
      25                        E:BOUNDARY CONDITIONS FOR CHEMICAL 1
    1.05        1.0
 13    2
 3.33E-6        0.0   3.33E-6    3650.0
  9    2
 3.33E-6        0.0   3.33E-6    3650.0
  5    2
 3.33E-6        0.0   3.33E-6    3650.0
  1    2
 3.33E-6        0.0   3.33E-6    3650.0
 14    2
 3.33E-6        0.0   3.33E-6    3650.0
 15    2
 3.33E-6        0.0   3.33E-6    3650.0
 16    2
 3.33E-6        0.0   3.33E-6    3650.0
 12    2
 3.33E-6        0.0   3.33E-6    3650.0
  8    2
 3.33E-6        0.0   3.33E-6    3650.0
  2    2
 3.33E-6        0.0   3.33E-6    3650.0
  3    2
 3.33E-6        0.0   3.33E-6    3650.0
  4    2
 3.33E-6        0.0   3.33E-6    3650.0
 29    2
 3.33E-6        0.0   3.33E-6    3650.0
 25    2
 3.33E-6        0.0   3.33E-6    3650.0
 21    2
```

```
3.33E-6         0.0    3.33E-6     3650.0
17     2
3.33E-6         0.0    3.33E-6     3650.0
30     2
3.33E-6         0.0    3.33E-6     3650.0
31     2
3.33E-6         0.0    3.33E-6     3650.0
32     2
3.33E-6         0.0    3.33E-6     3650.0
28     2
3.33E-6         0.0    3.33E-6     3650.0
18     2
3.33E-6         0.0    3.33E-6     3650.0
19     2
3.33E-6         0.0    3.33E-6     3650.0
24     2
3.33E-6         0.0    3.33E-6     3650.0
20     2
3.33E-6         0.0    3.33E-6     3650.0
49     2
     0.0        0.0        0.0     3650.0
25                     E:BOUNDARY CONDITIONS FOR SOLID 1
     1.0        1.0
13     2
    10.0        0.0       10.0     3650.0
 9     2
    10.0        0.0       10.0     3650.0
 5     2
    10.0        0.0       10.0     3650.0
 1     2
    10.0        0.0       10.0     3650.0
14     2
    10.0        0.0       10.0     3650.0
15     2
    10.0        0.0       10.0     3650.0
16     2
    10.0        0.0       10.0     3650.0
12     2
    10.0        0.0       10.0     3650.0
 8     2
    10.0        0.0       10.0     3650.0
 2     2
    10.0        0.0       10.0     3650.0
 3     2
    10.0        0.0       10.0     3650.0
 4     2
    10.0        0.0       10.0     3650.0
29     2
    10.0        0.0       10.0     3650.0
25     2
    10.0        0.0       10.0     3650.0
21     2
    10.0        0.0       10.0     3650.0
17     2
    10.0        0.0       10.0     3650.0
30     2
    10.0        0.0       10.0     3650.0
31     2
    10.0        0.0       10.0     3650.0
32     2
```

```
      10.0        0.0      10.0     3650.0
  28     2
      10.0        0.0      10.0     3650.0
  18     2
      10.0        0.0      10.0     3650.0
  19     2
      10.0        0.0      10.0     3650.0
  24     2
      10.0        0.0      10.0     3650.0
  20     2
      10.0        0.0      10.0     3650.0
  49     2
       0.0        0.0       0.0     3650.0
         2                F.1:POINT SOURCE LOADS OF CHEMICAL 1
       1.0        1.0
   6     2
       0.0        0.0       0.0     3650.0
  22     2
  4.00E-2         0.0    4.00E-2    3650.0
         2                F.1:POINT SOURCE LOADS OF SOLID 1
       1.0        1.0
   6     2
         0        0.0         0     3650.0
  22     2
    13280         0.0     13280     3650.0
   0     0                F.2:NON-POINT SOURCES
         0                G:PARAMETERS
                         H:CONSTANTS
GLOBALS            0        H, Record 2 for globals
CHEMICAL1          1        H, Record 2 for chemical 1
GENERAL            1        H, Record 3 for chemical 1
PIXC(1,1)        111    1.0E+6
SOLIDS1            0        H, Record 2 for solid 1
0                I:TIME FUNCTIONS
Chemical 1:                                3   1.0        1E10     J:INIT. CONC.
   1:    3.50E-6     0.057   2:   3.50E-6     0.057   3:   3.50E-6     0.057
   4:    3.50E-6     0.057   5:   3.50E-6     0.057   6:   3.50E-6     0.057
   7:    3.50E-6     0.057   8:   3.50E-6     0.057   9:   3.50E-6     0.057
  10:    3.50E-6     0.057  11:   3.50E-6     0.057  12:   3.50E-6     0.057
  13:    3.50E-6     0.057  14:   3.50E-6     0.057  15:   3.50E-6     0.057
  16:    3.50E-6     0.057  17:   3.50E-6     0.057  18:   3.50E-6     0.057
  19:    3.50E-6     0.057  20:   3.50E-6     0.057  21:   3.50E-6     0.057
  22:    3.50E-6     0.057  23:   3.50E-6     0.057  24:   3.50E-6     0.057
  25:    3.50E-6     0.057  26:   3.50E-6     0.057  27:   3.50E-6     0.057
  28:    3.50E-6     0.057  29:   3.50E-6     0.057  30:   3.50E-6     0.057
  31:    3.50E-6     0.057  32:   3.50E-6     0.057  33:      0.32      1E-5
  34:      0.205      1E-5  35:     0.115      1E-5  36:     0.115      1E-5
  37:      0.125      1E-5  38:     0.295      1E-5  39:     0.115      1E-5
  40:      0.115      1E-5  41:     0.115      1E-5  42:     0.195      1E-5
  43:      0.115      1E-5  44:     0.115      1E-5  45:     0.115      1E-5
  46:      0.115      1E-5  47:     0.115      1E-5  48:     0.115      1E-5
  49:      0.115      1E-5
Solid 1:                                   3  2.50        1E10     J:INIT. CONC.
   1:       10.0       0.0   2:      10.0       0.0   3:      10.0       0.0
   4:       10.0       0.0   5:      10.0       0.0   6:      10.0       0.0
   7:       10.0       0.0   8:      10.0       0.0   9:      10.0       0.0
  10:       10.0       0.0  11:      10.0       0.0  12:      10.0       0.0
  13:       10.0       0.0  14:      10.0       0.0  15:      10.0       0.0
  16:       10.0       0.0  17:      10.0       0.0  18:      10.0       0.0
  19:       10.0       0.0  20:      10.0       0.0  21:      10.0       0.0
```

APPENDIX I
ADDENDUM NO. 3
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WHATCOM WATERWAY AREA

DATA REPORT

ADDENDUM NO. 3
Remedial Investigation/Feasibility Study
WHATCOM WATERWAY
BELLINGHAM, WASHINGTON

March 31, 1999

Prepared For:

GEORGIA-PACIFIC WEST CORPORATION

Prepared By:

ANCHOR ENVIRONMENTAL, L.L.C.
1411 4th Avenue, Suite 1210
Seattle, WA 98101
(206) 287-9130

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1 STUDY OBJECTIVES

The objective of this investigation was to further delineate cleanup boundaries within the Whatcom Waterway Site Area (WW Area). Sediment sampling stations targeted by this investigation include areas where previous investigations have documented the presence of surface and/or subsurface sediments exceeding Sediment Quality Standards (SQS) chemical criteria, particularly at locations within or below federally-authorized navigation channels. The overall objective of this investigation was to determine whether surface sediments at these locations comply with Washington State Sediment Management Standards (SMS) interpretive criteria, based on confirmatory biological testing. Chemicals of potential concern addressed by this investigation include mercury, phenol, 4-methylphenol, and associated chemicals.

As described in a letter from Lucy Pebles of the Washington State Department of Ecology (Ecology) to John Andersen of Georgia-Pacific West Corporation (G-P) dated August 31, 1998, Ecology has determined that site-specific data must be used to make determinations regarding the toxicity of chemicals of concern within the WW Area. Although toxicity levels for mercury and other chemicals of potential concern in surface sediments have generally been established via biological testing at locations outside the navigation channels, these data cannot always be directly extrapolated to locations within the channels where mercury concentrations currently exceed SQS chemical criteria. To confirm whether these chemical exceedance areas are a part of the cleanup site, Ecology requested that G-P perform additional biological testing of surface sediments within the WW Area. This investigation was conducted in response to Ecology's request.

2 REPORT ORGANIZATION

This report presents the results of the sampling and analysis program as described in the project Work Plan (Anchor Environmental, 1998). This report is organized as follows:

- Section 1 – Study Objectives;
- Section 2 – Report Organization;
- Section 3 – Field Activities;
- Section 4 – Results;
- Section 5 – Conclusions; and
- Section 6 – References.

Figures and Tables compiling and illustrating the data are presented at the end of this document.

Appendices provide supporting project documentation and are organized as follows:

- Appendix A – Chemistry Data Validation Report;
- Appendix B – Bioassay Testing Data Validation Report; and
- Appendix C – Bioassay Testing Data Report.

3 FIELD ACTIVITIES

Surface sediment sampling was conducted within the Whatcom and I & J Street Waterways (WW Area) October 27, 1998 through October 29, 1998. Twelve surface sediment samples were collected, as depicted in Figure 1. In addition, three reference sediment samples were collected on October 29, 1998 from Carr Inlet, located in south Puget Sound, as reference samples for confirmatory bioassay testing. Sampling was performed by Anchor Environmental, EVS Solutions, Inc., and Marine Sampling Systems. A brief overview of the Work Plan, descriptions of the field activities, deviations from the Work Plan, and field quality assurance (QA) samples collected during this investigation are discussed in this section.

3.1 WORK PLAN

A project Work Plan (Anchor Environmental, 1998) was submitted for review to the Washington State Department of Ecology (Ecology), and was approved and implemented in October of 1998. The Work Plan addressed the tasks and management strategies necessary to support and complete the Addendum No. 3 investigation.

3.1.1 Specific Sampling Objectives

The approved Work Plan set forth the objectives and decision points necessary to determine whether sediments from the WW Area comply with SMS interpretive criteria, based on confirmatory bioassay testing, and subsequently to further delineate cleanup boundaries within the WW Area. Figure 2 summarizes the key decision points identified in the Work Plan.

3.1.2 Contaminants of Potential Concern

Contaminants of potential concern were identified based on a review of historical data (Hart Crowser and Anchor Environmental, 1998; Anchor Environmental and Hart Crowser, 1998). Mercury, phenol, and 4-methylphenol were identified as site-specific contaminants of potential concern.

3.1.3 Brief Overview of Analytical Scheme

A tiered analytical approach was used in this investigation in which the necessity of bioassay testing was contingent on preliminary chemistry results and/or observed woody debris at the designated sampling locations. The analytical scheme for this investigation is outlined in Figure 2.

In summary, surface sediment samples were subjected to confirmatory bioassay testing if they exceeded the sediment quality standard (SQS) chemical criteria for one or more target compounds, and/or observed woody debris in the sample was greater than 20 percent (by volume).

3.2 SAMPLE COLLECTION

Surface sediment sampling, decontamination, and processing were conducted in accordance with the approved Work Plan (Anchor Environmental, 1998). Sampling locations are presented in Figure 1. Station coordinates, alpha-numeric station identifiers, collection date and time, water depth, mudline elevation, and physical descriptions of the surface sediment collected at each sampling station are presented in Table 1. Surface sediment sampling equipment was deployed from the R/V *Nancy Anne* research vessel equipped with a hydraulic A-frame, variable speed winch, seawater wash-down hose, depth sounder, and Trimble sub-meter differential Global Positioning System (DGPS) for station positioning. A 3-meter accuracy NorthStar GPS unit served as a backup system for station positioning. Surface sediment sample collection procedures are discussed below.

Twelve surface sediment samples were collected in the WW Area. The top 10-cm of surface sediments were collected at each station using a hydraulic-operated, oversized van Veen sampler. This sampler is patented and operated by Marine Sampling Systems under the direction of Bill Jaworski and has been effective in improving sediment penetration recovery. The top 10-cm of surface sediments were collected from the van Veen for chemical, physical, and biological testing following Puget Sound Estuary Program (PSEP) protocols (PSEP, 1986; with 1997 updates). All surface sediment samples were collected and processed in accordance with the Work Plan. Only one sampler deployment was required to obtain the sediment volume necessary for chemical and biological testing.

All sediment collection and processing equipment was decontaminated in accordance with the Work Plan prior to being used at each station. Surface sediment samples were processed on board the R/V *Nancy Anne* immediately upon collection. Sample processing involved the following:

- Once the sediment sample was brought on board, it was evaluated with respect to PSEP acceptability criteria (overlying water was present, overlying water had low turbidity, van Veen sampler was not overfilled, and sediment surface was undisturbed);
- Overlying water was siphoned off and a stainless steel spoon was used to collect the upper 10-cm of sediment from inside the van Veen sampler, taking care not to collect sediment in contact with the sides/surface of the van Veen sampler;
- The upper 10-cm of sediment collected from each sampler deployment at the sampling station was combined and homogenized in a high density polyethylene (HDPE) bucket using a variable speed drill fitted with a stainless steel paddle;
- Homogenized sediment was then placed immediately into appropriate sample containers; and
- The sample containers were labeled, placed in re-sealable plastic bags, wrapped in bubble wrap, and placed on ice in coolers for transport to the laboratories.

Samples were shipped via Federal Express to Analytical Resources, Inc. in Seattle, Washington for chemical parameter analyses. Samples were shipped via courier to EVS Environment Consultants Laboratory in North Vancouver, British Columbia, Canada for biological testing.

3.3 FIELD MEASUREMENTS

Field measurements made at each sampling station included water depth, station location, field grain size determinations, and visual estimates of percent woody debris by volume. In addition, dissolved oxygen and temperature were measured at five foot intervals in the water column at each station. Field measurement data are summarized in Tables 1 and 2. Water depths were corrected for mean lower low water (MLLW) using tide gage readings which were downloaded from the National Oceanic and Atmospheric Administration's tide gage located at Cherry Point in the Strait of Georgia just north of Bellingham Bay.

Preliminary determinations of percent fines were made in the field by wet sieving approximately 50-mL of homogenized sediment sample through a 62.5-µm sieve. The field grain size determination procedure separated the sediment into two fractions: 1) greater than 62.5-µm (i.e., sand and gravel); and 2) less than 62.5-µm (i.e., silt and clay). Field grain size results were used to select appropriate reference sites for the bioassay testing.

3.4 DEVIATIONS FROM WORK PLAN

No deviations from the Work Plan occurred during this investigation.

3.5 FIELD QUALITY ASSURANCE SAMPLES

Field QA samples were collected to assess potential problems as a result of sample collection and/or sample processing in the field. One field homogenization duplicate, one field equipment rinsate blank, and one distilled water blank were submitted as discrete blind samples to the laboratory for analyses. Field QA sample results are presented in Table 3. Field QA sample results and their impacts on data quality are discussed in this section. The field homogenization duplicate was analyzed for all parameters, whereas the rinsate and distilled water blanks were analyzed for metals and organic compounds only. The QA sample results corroborated the accuracy and precision of chemical determinations performed during this investigation.

3.5.1 Field Homogenization Duplicate Sample

One field homogenization duplicate sample was collected at Station AN-SC-70 (at the mouth of Whatcom Waterway) and submitted to the laboratory as a discrete blind sample. The field homogenization duplicate consists of a split from a homogenized sample. The purpose of obtaining and analyzing the field homogenization duplicate was to assess the sample handling and field homogenization techniques. In general, field replicate results are considered acceptable if they are within an order of magnitude of one another. Relative percent difference values for the field duplicate ranged from 0 to 58 percent, with the exception of gravel, indicating that the sediment handling and homogenization techniques did not impact the quality of analytical results obtained for this investigation. The relative percent difference for gravel was elevated due to the relatively small amount present in the sample.

3.5.2 Field Blank Samples

One equipment rinsate blank and one distilled water blank were submitted to the laboratory as discrete blind samples. The rinsate blank was collected immediately following equipment decontamination associated with sediment collection at Station AN-SC-82. The rinsate blank

was prepared by pouring distilled water over the decontaminated sampling and compositing equipment into a pre-preserved sample jar. The distilled water blank was collected by pouring the distilled water directly from it's container into a pre-preserved sample jar. The purpose of the equipment rinsate and distilled water blanks was to assess the degree to which a parameter of interest was added or removed during field operations such as equipment decontamination. Zinc was detected in the equipment rinsate blank at 0.101 mg/L. This amount is considered negligible with respect to the amount of sediment collected (greater than 10-L at most stations), and therefore did not affect the quality of the data collected.

4 RESULTS

4.1 CHEMISTRY RESULTS

This section discusses chemical testing results for surface sediment samples collected during this investigation. Twelve surface sediment samples were collected during the field effort, at locations depicted on Figure 1 and listed in Table 1. All samples were obtained using standard field procedures outlined in Section 3. Sediment samples were submitted to Analytical Resources Inc. of Seattle, Washington, for chemical testing. Validated chemical analytical results for these samples are presented in Table 4. A brief review of laboratory data quality, a comparison of sample results to the sediment quality criteria, and descriptions of spatial distributions of key contaminants are discussed below.

4.1.1 Methods

All sediment samples were analyzed in accordance with the methods outlined in the Work Plan.

4.1.2 Data Quality Assessment

The overall data quality objectives for collection and chemical testing of sediment samples were met, as set forth in the Work Plan, and the data for this project are considered acceptable for use as qualified. The data validation report, prepared by Quality By Design, is presented in Appendix A.

4.1.3 Sediment Quality Screening Level Exceedances

As set forth in the Work Plan, screening-level benchmarks of sediment quality used for this investigation were based on current Washington State regulations. The Sediment Management Standards (SMS) were developed by the Washington State Department of Ecology to reduce and ultimately eliminate adverse effects on biological resources. The SMS establish two sets of numerical chemical criteria against which surface sediment chemical concentrations are evaluated. The more conservative Sediment Quality Standard (SQS) provides a regulatory goal by identifying surface sediments that are predicted to have no adverse effects (chronic or acute) on biological resources and do not pose a significant risk to humans. The higher Minimum Cleanup Level (MCUL) identifies sediments which may be associated with minor adverse effects to some sensitive species.

Mercury concentrations in surface sediments exceeded SQS criteria (0.41 mg/kg) at all twelve stations, including nine in which MCUL criteria (0.59 mg/kg) were also exceeded, and two which were at the inner Bellingham Bay bioaccumulation screening level (1.2 mg/kg). Butylbenzylphthalate exceeded the SQS criteria (4.9 mg/kg-oc) in one sample (AN-SC-81). Benzyl alcohol exceeded the SQS criteria (57 µg/kg) and MCUL criteria (73 µg/kg) in one sample (AN-SS-36). Individual sample exceedances of SQS and MCUL chemical criteria are highlighted in Table 4 and are depicted on Figure 1.

Due to matrix interferences, detection limits exceeding SQS criteria were observed for hexachlorobenzene at all stations, for 1,2,4-trichlorobenzene at stations AN-SC-72 and AN-SC-80, and for 2,4-dimethylphenol at station AN-SC-80. However, since all sediment

samples were submitted for confirmatory bioassay testing (Section 4.2), this result did not affect overall data quality.

Based on the sediment quality screening level evaluation, mercury, butylbenzylphthalate, and benzyl alcohol were the only chemical parameters that exceeded SQS chemical criteria.

4.2 CONFIRMATORY BIOASSAY TESTING RESULTS

This section summarizes the investigation of biological effects in marine sediments in the WW Area. Three toxicity tests were conducted on all twelve sediment samples collected during this study:

- 10-day amphipod mortality test using *Eohaustorius estuarius*;
- 48-hour larval development test using the mussel *Mytilus galloprovincialis*; and
- 20-day juvenile polychaete growth test using *Neanthes arenaceodentata*.

All three tests were performed by the EVS Environment Consultants Toxicity Testing Laboratory, North Vancouver, BC. This section provides a brief description of the testing methods, a summary of the quality assurance/quality control (QA/QC) review, results from the three toxicity tests, and comparisons of the toxicity test results with SMS interpretive criteria.

4.2.1 Methods

Sediment samples from fifteen stations were submitted for toxicity testing (twelve test samples from the WW Area and 3 reference samples from Carr Inlet).

Sediment samples were received by the laboratory between October 28 and 30, 1998, and stored in the dark at 4°C until testing was initiated. The amphipod toxicity tests were initiated on November 6 and 9, 1998. The bivalve larval development toxicity tests were initiated on November 15, 1998. The juvenile polychaete toxicity tests were initiated on December 8, 1998.

The three reference sediment samples were included in each test series, as were the required controls. Toxicity tests were conducted in accordance with protocols outlined in the Work Plan.

Testing followed protocols recommended by PSEP (1995) and subsequent Sediment Management Annual Review Meeting (SMARM) updates (PSDDA 1996). The endpoints measured included survival and sediment avoidance of amphipods, survival and percent abnormality of bivalve larvae, and mortality and growth of polychaetes. Under the SMS, the endpoints of interest are percent mortality for amphipods, percent normal survival for bivalve larvae, and mean individual growth for polychaetes.

Prior to test initiation, the porewater ammonia measurements from one test sample (AN-SC-78 at 21.4 mg-N/L), and two reference samples (CR-22 at 23.2 mg-N/L and CR-23W at 22.8 mg-N/L), exceeded the target value of 15 mg-N/L, prompting the initiation of the ammonia purging protocol. A separate test series was initiated for these samples that included ammonia purging. Sample CR-10 and a negative control sample were also included in the ammonia purging test series. The results of this testing series are discussed in Section 4.2.3.

As set forth in the SMS, the determination of whether adverse effects are observed in a test sediment is established in part by a pairwise statistical comparison of test sediment with that collected from an appropriate reference station. Prior to statistical analysis, data expressed as percentages were transformed using the arcsine-square root transformation. Prior to hypothesis testing, assumptions of normality and homogeneity of variance of the replicate endpoint data were tested using the Wilk-Shapiro test (W test) and Cochran's test (F test for variances), respectively. For all three endpoints of interest under the SMS, the data were not normally distributed. Therefore, a nonparametric test (Mann-Whitney U test) was used for the hypothesis testing. The statistics were then compared to interpretive criteria for biological effects to yield pass/fail evaluations for each test sample.

Test statistics were interpreted according to the SMS interpretive criteria for biological effects as promulgated in the State of Washington Administrative Code (WAC) established for sediment quality standards (SQS) (WAC 173-204-320) and for minimum cleanup levels (MCUL) (WAC 173-204-520). Table 5 summarizes the biological effects interpretive criteria.

A sediment sample from a given station fails the overall MCUL biological criteria if:

Two of the biological tests exceed the SQS biological criteria presented in Table 5

OR

One of the biological tests exceeds the MCUL biological criteria presented in Table 5

4.2.2 Data Quality Assessment

All toxicity test results included in this report were deemed acceptable for use as outlined in the Work Plan (Anchor Environmental 1998) and QAPP (Hart Crowser 1996).

Appendix B describes the general procedures used to conduct the toxicity tests, discusses specific deviations from environmental test parameters for each type of toxicity test, and presents an evaluation of the effects of these deviations. Please refer to the quality assurance review for additional details on test performance and acceptability.

4.2.3 Comparison to SMS Interpretation Criteria

The results for the individual replicates of the amphipod (*E. estuarius*), bivalve larvae (*M. galloprovincialis*), and juvenile polychaete (*N. arenaceodentata*) toxicity tests are presented in Tables 6, 7, and 8, respectively. The comparative grain-size data, biological effects data, and results of comparisons with interpretive criteria for biological effects are summarized in Tables 9 and 10. The laboratory data report for all toxicity tests are provided in Appendix C.

The selection of appropriate reference stations for comparison with test sediments was based on the percent of fine-grained sediments (silt and clay) in the samples (Table 9). The WW Area sediment samples ranged from 17.1 to 91.8 percent fine-grained material. By comparison, the percent fines in the Carr Inlet reference sediment samples ranged from 13.5 to 88.9 percent. For all of the WW Area samples, the percent fines of the reference samples matched the test samples within 20 percent.

Results for the negative control and reference sediments for the amphipod test, the bivalve larval development test, and the juvenile polychaete growth test all met the performance requirements of the SMS standards. The toxicity test results for the negative control and reference sediments are summarized in Table 10.

Tables 11 through 13 summarize the results of the toxicity tests using *E. estuarius*, *M. galloprovincialis*, and *N. arenaceodentata*, respectively. These tables list the means and standard deviations of the measured endpoints, results of the statistical comparison with the reference sediments, and whether the results passed or failed the SQS and MCUL biological effects interpretive criteria.

The mean survival in all test sediments for the 10-day amphipod test using *E. estuarius* was 87 percent or greater. All test sediments passed both the SQS and MCUL criteria for amphipod mortality.

The mean normal survival for the 48-hour bivalve larval test using *M. galloprovincialis* ranged from 54.7 percent to 79.0 percent. Of the twelve samples tested using *M. galloprovincialis*, sediment from two stations, SC-80, and SC-81, failed to meet the SQS biological criteria. All test sediments passed the MCUL criteria for bivalve mean normal survivorship.

The survival in the *N. arenaceodentata* control was 60 percent, attributable to two of the replicates becoming anoxic. The survival in the three replicates that did not become anoxic was 93 percent. The mean individual growth across all of the *N. arenaceodentata* control replicates was 0.43 mg/individual/day; the growth in the three replicates that did not become anoxic was 0.53 mg/individual/day. The mean individual growth of *N. arenaceodentata* in the test sediment ranged from 0.41 to 0.59 mg/individual/day. Regardless of the control comparison, all of the sediments tested with *N. arenaceodentata* passed both SQS and MCUL biological criteria.

5 CONCLUSIONS

No biological responses were observed in the *E. estuarius*, *M. galloprovincialis*, or *N. arenaceodentata* toxicity tests that resulted in a failure of the MCUL biological criteria. However, two stations (AN-SC-80 and AN-SC-81) failed the SQS biological criteria for *M. galloprovincialis*. The contiguous areas represented by the available data that are targeted for prospective cleanup actions are depicted in Figure 1.

6 REFERENCES

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Figures and Tables

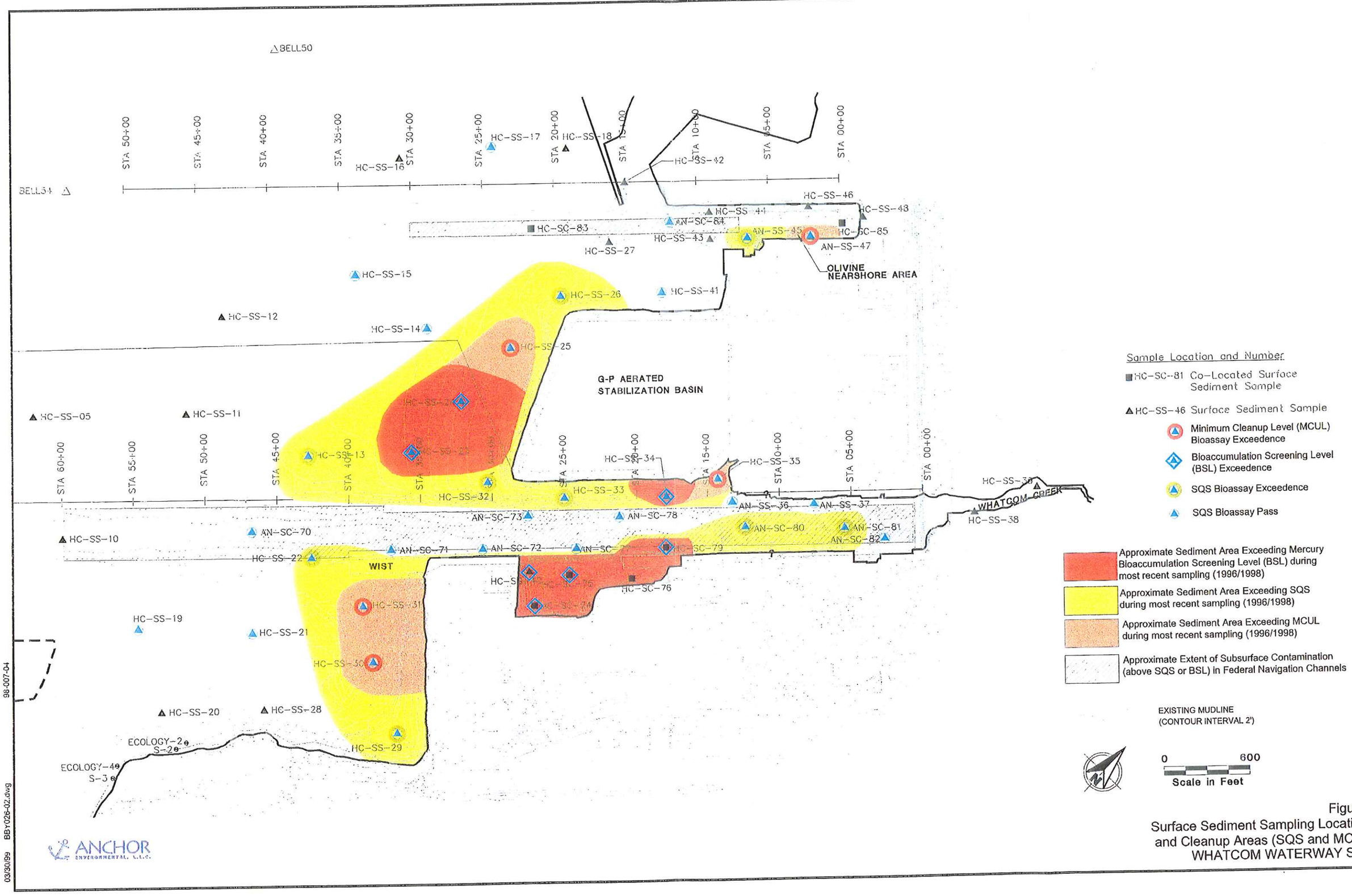
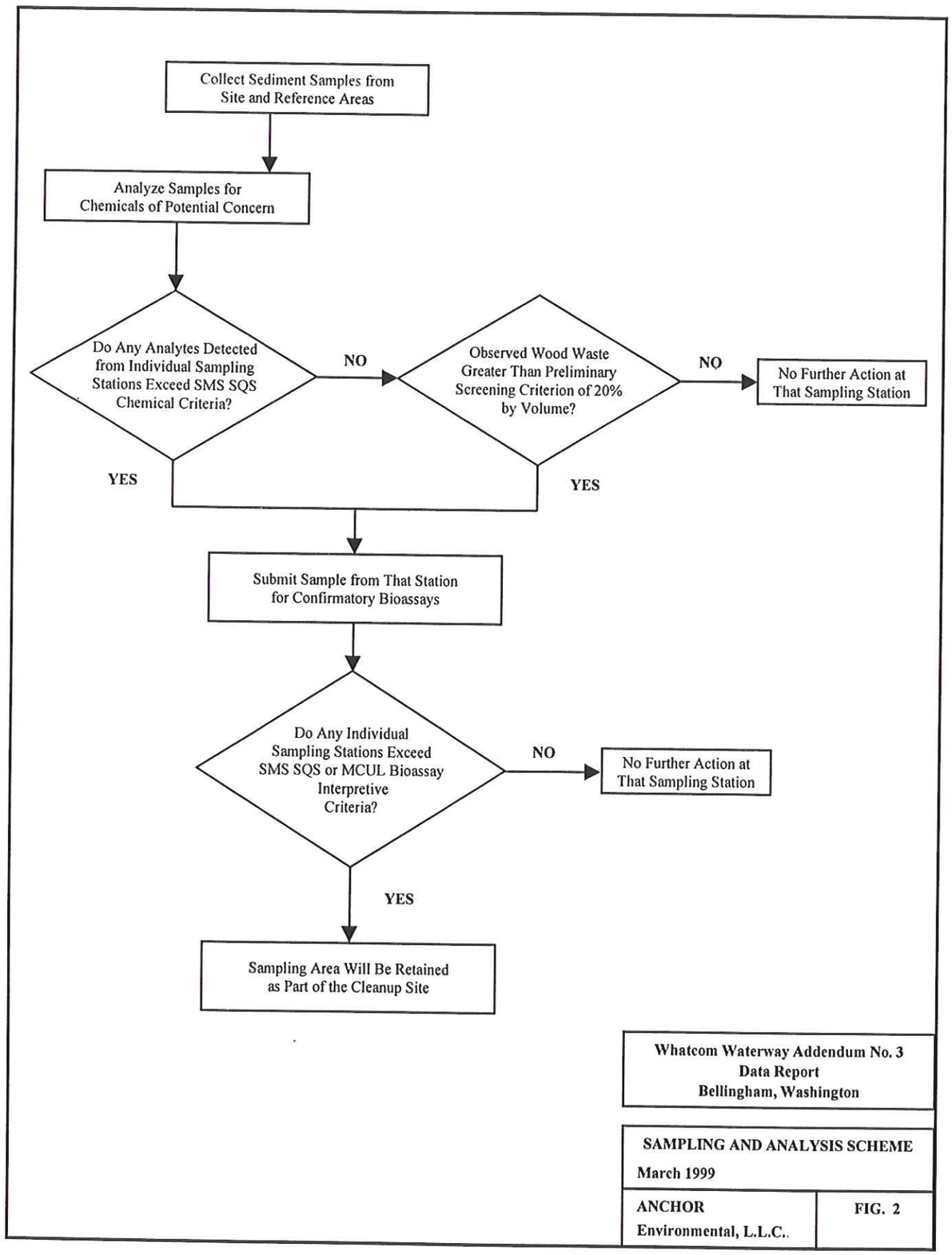


Figure 1
Surface Sediment Sampling Locations and Cleanup Areas (SQS and MCUL)
WHATCOM WATERWAY SITE



Whatcom Waterway Addendum No. 3
Data Report
Bellingham, Washington

SAMPLING AND ANALYSIS SCHEME
March 1999

ANCHOR Environmental, L.L.C.	**FIG. 2**

TABLE 1. SURFACE SEDIMENT FIELD DATA SUMMARY

Station ID	Date	Time	Station Coordinates (NAD 27) Northing	Easting	Water Depth in feet (MLLW)	Samples Collected	Sample Type	Penetration Depth (cm)	Sample Analyses	Sediment Texture	Sediment Color	Sediment Odor	Field Wet Sieving Results (<62 um)	General Sediment Observations
I&J Waterway														
AN-SC-84	10/27/98	9:20	643844.469	1239314.054	17.7	AN-SC-84	Sediment	25	Bioassay, Chemistry	silt clay	gray, top 1 cm dark olive	none	92.0%	no wood debris, consistency of pudding, a few worms
AN-SS-45	10/27/98	11:17	644138.452	1239782.903	13.8	AN-SS-45	Sediment	24	Bioassay, Chemistry	silt clay	black, top 1 cm dark olive	none	83.0%	some shell fragments
AN-SS-47	10/27/98	12:22	644441.735	1240103.136	5.4	AN-SS-47	Sediment	17	Bioassay, Chemistry	gravel, fine sand, silt clay	black, top 2 cm dark olive	none	22.0%	worms, many shell fragments and whole mussels, rock, slight oily sheen in homogenate but no petroleum odor
Whatcom Waterway														
AN-SC-70	10/27/98	14:04	640287.633	1238694.150	34.5	AN-SC-70	Sediment	23	Bioassay, Chemistry	silt clay	gray/black, top 2 cm dark olive	none	95.0%	
AN-SC-70FHR	10/27/98	14:04	640287.633	1238694.150	34.5	AN-SC-70 FHR	Sediment	23	Bioassay, Chemistry	silt clay	gray/black, top 2 cm dark olive	none	95.0%	
AN-SC-71	10/27/98	14:55	640866.719	1239478.984	34.0	AN-SC-71	Sediment	25	Bioassay, Chemistry	silt clay	black/brown, top 1-2 cm dark olive	none	92.0%	
AN-SC-72	10/28/98	8:41	641318.942	1239943.272	36.1	AN-SC-72	Sediment	22	Bioassay, Chemistry	silt clay	gray/black, top 2 cm dark olive	slight H_2S	84.0%	worms
AN-SC-73	10/28/98	9:29	641700.554	1240015.860	28.1	AN-SC-73	Sediment	21	Bioassay, Chemistry	silt clay	gray, top 2 cm dark olive	none	86.0%	
AN-SC-77	10/28/98	10:32	641758.846	1240415.316	29.7	AN-SC-77	Sediment	23	Bioassay, Chemistry	silt clay	gray, top 1 cm dark olive	none	84.0%	tube worms
AN-SC-78	10/28/98	11:50	642123.174	1240443.276	26.1	AN-SC-78	Sediment	23	Bioassay, Chemistry	silt clay	black, top 1 cm dark olive	strong H_2S	80.0%	<5% wood debris, station 27 ft west of original station
AN-SS-36	10/28/98	14:20	642744.260	1240975.496	10.0	AN-SS-36	Sediment	22	Bioassay, Chemistry	gravel, fine sand, silt clay, organic matter	black, top 0.5 cm dark olive	moderate H_2S	32.0%	20% wood debris (some chunks), shell fragments, rocks, small crab, sea anemone
AN-SC-80	10/28/98	15:42	642666.897	1241178.953	24.8	AN-SC-80	Sediment	20	Bioassay, Chemistry	silt clay	gray/black, top 0.5 cm dark olive	none	84.0%	few spots of oily sheen, "soupy"
AN-SC-82	10/29/98	9:23	643271.313	1241924.197	14.4	AN-SC-82	Sediment	21	Bioassay, Chemistry	silt clay	black, top 0.5 cm dark olive	slight H_2S	77.0%	30-40% wood debris
AN-SC-81	10/29/98	10:25	643148.956	1241671.949	17.6	AN-SC-81	Sediment	23	Bioassay, Chemistry	silt clay	gray/black, top 0.5 brown	slight H_2S	70.0%	very slight oily sheen, "soupy"
AN-SS-37	10/29/98	11:15	643124.088	1241414.014	11.8	AN-SS-37	Sediment	23	Bioassay, Chemistry	some cobble, gravel, silt clay, organic matter	black, top 0.5 cm brown	slight to moderate H_2S	64.0%	10-20% wood debris, small crab, lots of gravel, slight oily sheen, fence post rod (4'x1.5")
Carr Inlet Reference														
CR-10	10/29/98	11:02	127740.120	1185775.009	46.8	CR-10	Sediment	Not recorded	Bioassay	silt	olive brown	none	87.0%	Maldanids
CR-22S	10/29/98	12:43	126838.062	1183188.643	26.4	CR-22S	Sediment	Not recorded	Bioassay	silty sand	olive brown	none	16.0%	Ophiuroids
CR-23W	10/29/98	14:26	126936.210	1183432.433	33.8	CR-23W	Sediment	Not recorded	Bioassay	silty sand	olive brown	none	38.0%	Ophiuroids

Locations are in State Plane coordinates NAD 83 North Zone datum.

Table 2. Overlying Water Dissolved Oxygen and Temperature Measurements.

Date	Station	Measured Water Depth (feet)	Measured Probe Depth (feet)	Temperature (Celsius)	Dissolved Oxygen (mg/L)
Whatcom Waterway					
10/28/98	AN-SS-36	17.3	16	11.2	7.2
			11	11.2	7.0
10/29/98	AN-SS-37	19.7	17	11.2	7.3
			12	11.2	6.9
10/27/98	AN-SC-70	42.3	37	10.9	6.8
				11.0	6.6
10/27/98	AN-SC-71	41.2	39	11.0	6.5
			34	11.0	6.8
10/28/98	AN-SC-72	42.8	40	11.0	6.5
			35	11.1	6.9
10/28/98	AN-SC-73	27.8	25	11.2	7.2
			20	11.2	7.4
10/28/98	AN-SC-77	37.8	35	10.9	6.1
			30	11.1	6.7
10/28/98	AN-SC-78	34.5	32	11.1	5.7
			30	11.0	5.9
10/28/98	AN-SC-80	31.5	30	11.2	6.6
			25	11.2	6.7
10/29/98	AN-SC-81	27.3	24.2	11.1	6.7
			19	11.1	7.2
10/29/98	AN-SC-82	20.0	19.4	11.2	6.3
			14.4	11.2	6.4
10/27/98	AN-SC-84	25.8	25	11.3	6.8
			20	11.3	7.1
			15	11.3	7.1
			10	11.3	7.6
Middle Waterway					
10/28/98		41.0	40	11.0	5.7
			35	11.0	6.8
			30	11.0	7.2
			25	11.1	7.2
			20	11.1	8.4
			15	11.1	8.6
			10	11.1	8.9
			5	11.1	9.2

Note:
Water depths have not been converted to mean lower low water.
Dissolved oxygen and temperature measurements made using and Orion handheld meter.

TABLE 3. FIELD QUALITY ASSURANCE SAMPLE RESULTS

	Sample ID	AN-SC-201		AN-SC-202		AN-SC-70		AN-SC-200		AN-SC-70
	Sample Type	Equipment Rinsate Blank		Field Blank		AN-SC-70		AN-SC-70 homogenization duplicate		Relative Percent Difference
	Matrix	Water		Water		Sediment		Sediment		
Parameter	Units	Concentration	Qualifier	Concentration	Qualifier	Concentration	Qualifier	Concentration	Qualifier	
Conventionals										
Gravel	%	NA		NA		0.9		0.4		77
Sand	%	NA		NA		7.4		7.1		4
Silt	%	NA		NA		51.5		52.0		1
Clay	%	NA		NA		40.3		40.5		0
Fines	%	NA		NA		91.8		92.5		1
Total organic carbon	%	NA		NA		2.4		2.6		8
Total solids	%	NA		NA		37.8		35.4		7
pH	pH units	NA		NA		7.4		7.4		0
Total Metals										
Cadmium	ug/L (water) mg/kg (sediment)	4	U	4	U	0.9	J	0.6	J	40
Mercury	ug/L (water) mg/kg (sediment)	0.2	U	0.2	U	0.85		0.70		19
Zinc	ug/L (water) mg/kg (sediment)	101		10	U	100		99		1
LPAHs										
2-Methylnaphthalene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	30		30		0
Acenaphthene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	19	U	20	U	NA
Acenapthylene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	20		20	U	NA
Anthracene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	40		27		39
Fluorene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	26		21		21
Naphthalene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	160		160		0
Phenanthrene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	170		140		19
Total LPAHs	ug/L (water) ug/kg (sediment)	NA		NA		465		418		11
HPAHs										
Benzo(a)anthracene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	48		45		6
Benzo(a)pyrene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	49		46		6
Benzo(b)fluoranthene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	48		65		30
Benzo(g,h,i)perylene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	31		30		3
Benzo(k)fluoranthene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	77		49		44
Chrysene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	74		66		11
Dibenzo(a,h)anthracene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	19	U	20	U	NA
Fluoranthene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	210		200		5
Indeno(1,2,3-cd)pyrene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	32		27		17
Pyrene	ug/L (water) ug/kg (sediment)	1.0	U	1.0	U	260		230		12
Benzo(b+k)fluoranthenes	ug/L (water) ug/kg (sediment)	NA		NA		125		114		9
Total HPAHs	ug/L (water) ug/kg (sediment)	NA		NA		848		778		9

TABLE 4. SURFACE SEDIMENT CHEMISTRY DATA

Parameter	Units	Washington State Sediment Chemical Criteria SQS	MCUL	Survey	Z063 98-030-01	Z063 98-030-01	Z037 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z063 98-030-01	Z037 98-030-01
				Date	10/28/98	10/29/98	10/27/98	10/27/98	10/28/98	10/28/98	10/28/98	10/28/98	10/28/98	10/29/98	10/29/98	10/27/98
				Station and Sample ID	AN-SS-36	AN-SC-37	AN-SS-70	AN-SC-71	AN-SC-72	AN-SC-73	AN-SC-77	AN-SC-78	AN-SC-80	AN-SC-81	AN-SC-82	AN-SC-84
Metals in mg/kg dry weight																
Cadmium	(mg/kg)	5.1	6.7		0.9 J	0.9 J	0.9 J	0.9 J	0.8 J	0.9 J	1	2	1	1	1	1 U
Mercury	(mg/kg)	0.41	0.59		0.61	0.50	0.85	1.2	0.90	0.81	1.2	1.0	0.71	0.62	0.52	0.45
Zinc	(mg/kg)	410	960		92	148	100	109	102	129	116	121	145	183	166	106
Conventional Parameters																
Gravel	%				17.4	40.1	0.9	0.2	0.0	0.0	0.1	1.2	1.2	0.0	0.1	2.1
Sand	%				65.6	22.3	7.4	13.3	16.6	10.5	9.1	11.6	14.9	26.0	17.2	6.1
Silt	%				9.3	24.1	51.5	44.7	45.3	46.8	47.2	54.2	45.3	46.0	50.8	47.7
Clay	%				7.8	13.5	40.3	41.8	38.0	42.7	43.6	33.0	38.7	28.0	31.8	44.0
Fines	%				17.1	37.5	91.8	86.5	83.3	89.5	90.8	87.2	83.9	74.0	82.6	91.8
Total solids	%				72.8	58.0	37.8	35.7	37.5	35.1	36.3	37.3	33.8	51.4	32.6	43.3
Total organic carbon	%				3.3	3.4	2.4	2.7	2.2	3.4	3.6	4.3	3.0	3.0	4.8	2.6
pH	pH units				7.8	8.1	7.4	7.6	7.8	7.5	7.6	8.1	7.6	7.9	8.0	7.5
LPAHs in mg/kg TOC																
Naphthalene	(mg/kg)	99	170		1.9	5.9	6.7	6.3	5.9	2.6	2.8	2.8	3.0	3.1	1.7	2.0
Acenaphthylene	(mg/kg)	66	66		0.58 U	0.88	0.83	0.85	1.0	0.59 U	0.56 U	0.47	1.3 U	0.67	0.42	0.77 U
Acenaphthene	(mg/kg)	16	57		0.91	2.8	0.79 U	4.4	2.4	1.3	1.1	0.65	1.7	2.1	0.98	0.77 U
Flourene	(mg/kg)	23	79		1.3	3.8	1.1	5.6	5.0	2.2	2.0	1.3	2.8	3.1	3.8	0.96
Phenanthrene	(mg/kg)	100	480		5.5	14	7.1	22	18	8.8	6.4	6.0	13	17	18	3.8
Anthracene	(mg/kg)	220	1200		2.1	5.0	1.7	6.7	12	3.8	3.3	3.0	6.0	7.3	12	1.6
2-Methylnaphthalene	(mg/kg)	38	64		1.7	5.0	1.3	2.4	2.6	1.3	1.4	1.3	1.9	1.8	1.2	1.4
Total LPAHs[2]	(mg/kg)	370	780		14	37	19	48	47	21	18	16	29	35	38	11
HPAHs in mg/kg TOC																
Fluoranthene	(mg/kg)	160	1200		9.1	18	8.8	32	31	18	20	11	33	29	14	8.5
Pyrene	(mg/kg)	1000	1400		33	41	11	44	50	20	26	19	40 G	57	25	9.2
Benzo(a)anthracene	(mg/kg)	110	270		4.2	11	2.0	14	18	7.4	7.8	4.9	16	17	15	2.4
Chrysene	(mg/kg)	110	460		5.5	15	3.1	19	27	9.4	11	6.5	18	29	46	3.8
Benzo(b)fluoranthene	(mg/kg)				7.6	14	2.0	11	13	6.5	6.1	5.8	15	28	16	2.5
Benzo(k)fluoranthene	(mg/kg)				5.8	10	3.2	10	10	5.3	6.4	4.4	13	15	7.5	3.0
Total benzofluoranthenes[1]	(mg/kg)	230	450		13	24	5.2	21	23	12	13	10	27	43	24	5.5
Benzo(a)pyrene	(mg/kg)	99	210		5.5	10	2.0	8.5	9.1	5.0	5.3	3.5	9.3	19	9.2	1.9
Indeno(1,2,3-cd)pyrene	(mg/kg)	34	88		2.4	5.0	1.3	3.4	4.0	2.2	2.6	2.0	4.7	9.7 L	4.6 L	1.1
Dibenzo(a,h)anthracene	(mg/kg)	12	33		1.3	1.7	0.79 U	1.2	1.6	0.82	0.97	0.56	2.2	3.7 L	1.6 L	0.77 U
Benzo(g,h,i)perylene	(mg/kg)	31	78		2.1	3.5	1.3	2.2	2.5	1.6	1.6	1.9	3.7	7.0 L	2.9 L	1.3
Total HPAHs[2]	(mg/kg)	960	5300		77	131	35	147	166	76	88	59	154	214	142	35
Phthalates in mg/kg TOC																
Dimethylphthalate	(mg/kg)	53	53		0.58 U	1.2	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.83	0.42 U	0.77 U
Diethylphthalate	(mg/kg)	61	110		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
Di-n-Butylphthalate	(mg/kg)	220	1700		0.58 U	1.0	1.8	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	1.3
Butylbenzylphthalate	(mg/kg)	4.9	64		0.58 U	1.6	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	1.0 M	2.1 M	5.3 M	2.3 M	0.88
Bis(2-ethylhexyl)phthalate	(mg/kg)	47	78		28	25 EB	6.3	4.4 E	6.4 E	5.3 E	5.3 E	8.4	26	47 EB	27 EB	4.6
Di-n-Octyl phthalate	(mg/kg)	58	4500		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	1.2 E	0.77 U
Semivolatiles in mg/kg TOC																
1,2-Dichlorobenzene	(mg/kg)	2.3	2.3		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
1,4-Dichlorobenzene	(mg/kg)	3.1	9.0		3.0	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
1,2,4-Trichlorobenzene	(mg/kg)	0.81	1.80		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
Hexachlorobenzene	(mg/kg)	0.38	2.30		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
Dibenzofuran	(mg/kg)	15	58		1.4	4.1	2.0	5.6	4.5	2.3	2.3	1.5	3.2	3.0	1.9	1.4
Hexachlorobutadiene	(mg/kg)	3.9	6.2		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
N-Nitrosodiphenylamine	(mg/kg)	11	11		0.58 U	0.56 U	0.79 U	0.74 U	0.91 U	0.59 U	0.56 U	0.47 U	1.3 U	0.67 U	0.42 U	0.77 U
Semivolatiles in ug/kg dry weight																
Phenol	(ug/kg)	420	1200		36	19 U	19 U	20 U	20 U	20 U	20 U	20 U	39 U	20 U	20 U	34
2-Methylphenol	(ug/kg)	63	63		19 U	19 U	19 U	20 U	20 U	20 U	20 U	20 U	39 U	20 U	20 U	20 U
4-Methylphenol	(ug/kg)	670	670		300	200	240	290	240	170	140	160	140	89	84	62
2,4-Dimethylphenol	(ug/kg)	29	29		19 U	19 U	19 U	20 U	20 U	20 U	20 U	20 U	39 U	20 U	20 U	20 U
Pentachlorophenol	(ug/kg)	360	690		97 U	95 U	96 U	99 U	99 U	99 U	99 U	98 U	190 U	98 U	98 U	99 U
Benzyl Alcohol	(ug/kg)	57	73		180	19 U	19 U	20 U	20 U	20 U	20 U	20 U	39 U	20 U	20 U	20 U
Benzoic Acid	(ug/kg)	650	650		190 U	190 U	190 U	200 U	200 U	200 U	200 U	200 U	390 U	200 U	200 U	200 U

Notes:

(1) Total benzofluoranthene criterion represents the sum of the concentrations of the b and k isomers.

(2) Total LPAHs and HPAHs are sum of all contaminants within the subheading. For those with concentrations that were not detected, the detection limit was used in the calculation.

The "E" qualifier was attached to the Total LPAHs or HPAHs value if any of the contributing concentrations were denoted with that qualifier.

Yellow shading denotes exceedance of SQS criteria

Orange shading denotes exceedance of MCUL criteria

Gray shading denotes detection limit exceeds SQS or MCUL criteria

Table 5. Sediment standards biological criteria

SQS Biological Criteria	MCUL Biological Criteria
Sediments are determined to have adverse effects on biological resources when any one of the confirmatory marine sediment biological tests of WAC 173-204-315(1) demonstrates the following results:	The MCUL is exceeded when any two of the biological tests exceed the SQS biological criteria, or one of the following test determinations is made:
1) Amphipod: The test sediment has a significantly higher[a] mean mortality than the reference sediment, and the test sediment mean mortality exceeds 25 percent, on an absolute basis.	1) Amphipod: The test sediment has a significantly higher[a] mean mortality than the reference sediment, and the test sediment mean mortality is more than 30 percent higher than the reference sediment mean mortality, on an absolute basis.
2) Larval: The test sediment has a mean survivorship of normal larvae that is significantly less[a] than the mean normal survivorship in the reference sediment, and the test sediment mean normal survivorship is less than 85 percent of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is significantly greater[a] than 15 percent relative to time-final in the reference sediment).	2) Larval: The test sediment has a mean survivorship of normal larvae that is significantly less[a] than the mean normal survivorship in the reference sediment, and the test sediment mean normal survivorship is less than 70 percent of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is significantly greater[a] than 30 percent relative to time-final in the reference sediment).
3) Juvenile polychaete: The test sediment has a mean individual growth rate that is statistically different[a] from the reference sediment mean individual growth rate, and the test sediment has a mean individual growth rate of less than 70 percent of the reference sediment mean individual growth rate.	3) Juvenile polychaete: The test sediment has a mean individual growth rate that is statistically different[a] from the reference sediment mean individual growth rate, and the test sediment has a mean individual growth rate of less than 50 percent of the reference sediment mean individual growth rate.

NOTE: MCUL- Minimum Cleanup Level
SQS - Sediment Quality Standards

[a] Statistical significance is defined using a *t*-test or Mann-Whitney U-test, $\alpha = 0.05$.

Table 6. Results of individual replicates in 10-day *E. estuarius* toxicity test

	Replicate Survival (%)					
	A	B	C	D	E	Mean
Reference Samples—Non-purged						
CR-10	95	95	90	85	90	91
CR-22	100	95	100	100	90	97
CR-23W	95	95	100	95	95	96
Negative control	100	100	95	100	95	98
Reference Samples—Purged						
CR-10	90	100	100	100	90	96
CR-22	100	100	100	100	100	100
CR-23W	100	100	100	100	100	100
Negative control	100	100	100	100	90	98
Whatcom Waterway Area Samples—Non-purged						
AN-SS-36	85	95	75	95	95	89
AN-SS-37	90	90	95	95	95	93
AN-SC-70	100	90	95	95	90	94
AN-SC-71	95	90	85	90	95	91
AN-SC-72	80	90	100	95	100	93
AN-SC-73	100	80	95	95	90	92
AN-SC-77	90	100	95	95	90	94
AN-SC-78	100	100	100	100	85	97
AN-SC-80	100	100	90	100	100	98
AN-SC-81	100	85	95	70	85	87
AN-SC-82	95	100	95	100	95	97
AN-SC-84	90	100	100	95	90	95
Whatcom Waterway Area Samples—Purged						
AN-SC-78	80	100	90	95	100	93

Table 7. Results of individual replicates in 48-hour *M. galloprovincialis* larval toxicity test

	Replicate Percent Normal Survival (%)					
	A	B	C	D	E	Mean
Reference ID						
CR-10	66.7	69.5	63.5	82.8	67.7	70.0
CR-22	67.0	68.4	73.0	60.0	74.4	68.6
CR-23W	67.4	73.7	65.3	71.2	66.0	68.7
Negative Control	93.7	98.6	93.0	86.0	87.7	91.8
Sample ID						
Whatcom Waterway Area samples						
AN-SS-36	58.3	62.5	61.8	55.1	66.7	60.8
AN-SS-37	62.8	67.7	62.1	59.7	64.9	63.4
AN-SC-70	76.8	69.5	77.5	66.3	73.3	72.7
AN-SC-71	66.0	72.3	62.5	70.9	69.8	68.3
AN-SC-72	69.1	72.3	61.8	66.3	74.7	68.8
AN-SC-73	70.5	66.3	68.4	71.9	62.8	68.0
AN-SC-77	77.2	73.3	69.1	72.3	74.0	73.2
AN-SC-78	55.4	69.5	67.4	62.5	70.2	65.0
AN-SC-80	45.3	47.0	52.3	62.5	66.3	54.7
AN-SC-81	57.9	60.0	55.8	59.3	60.7	58.7
AN-SC-82	61.4	77.9	48.8	51.9	59.0	59.8
AN-SC-84	76.8	80.0	76.5	81.1	79.0	78.7

Table 8. Results of individual replicates in 20-day *N. arenaceodentata* toxicity test

	Growth Rate (mg/individual/day dry weight)					
	A	B	C	D	E	Mean
Reference ID						
CR-10	0.44	0.44	0.50	0.17	0.62	0.43
CR-22	0.54	0.60	0.64	0.56	0.51	0.57
CR-23W	0.32	0.66	0.53	0.89	0.54	0.59
Negative Control	0.48	0.59	0.12	0.53	0.00*	0.43
Sample ID						
Whatcom Waterway Area samples						
AN-SS-36	0.43	0.42	0.76	0.46	0.56	0.53
AN-SS-37	0.55	0.40	0.50	0.58	0.00*	0.51
AN-SC-70	0.41	0.32	0.39	0.79	0.49	0.48
AN-SC-71	0.58	0.41	0.42	0.52	0.46	0.48
AN-SC-72	0.63	0.44	0.67	0.38	0.21	0.47
AN-SC-73	0.41	0.28	0.82	0.28	0.51	0.46
AN-SC-77	0.55	0.62	0.50	0.68	0.50	0.57
AN-SC-78	0.54	0.42	0.99	0.42	0.60	0.59
AN-SC-80	0.55	0.45	0.43	0.37	0.64	0.48
AN-SC-81	0.29	0.47	0.60	0.54	0.24	0.43
AN-SC-82	0.45	0.59	0.42	0.43	0.57	0.49
AN-SC-84	0.45	0.39	0.59	0.39	0.25	0.41

* 100% mortality

Table 9. Percent fines in data test sediments

	FINES (Silt + Clay) (%)
Reference ID	
CR-10C	88.9
CR-22	13.5
CR-23W	33.8
Sample ID	
Whatcom Waterway Area samples	
AN-SS-36	17.1
AN-SS-37	37.5
AN-SC-70	91.8
AN-SC-71	86.5
AN-SC-72	83.3
AN-SC-73	89.5
AN-SC-77	90.8
AN-SC-78	87.2
AN-SC-80	84.1
AN-SC-81	74.0
AN-SC-82	82.6
AN-SC-84	91.8

Table 10. Summary of toxicity test results for controls and reference stations and comparison to performance criteria

Sample ID	Mean Percent Mortality of *E. estuaris* [a]	Mean Percent Normal Survival of *M. galloprovincialis* [a]	Mean Individual Growth Rate of *N. arenaceodentata* (mg/individual/day, dry weight, and percent mortality)[a]
Negative Control			
Performance criterion	< 10% mortality	> 70% normal survival	0.38 (< 10% mortality)
Test performance	2% (non-purged) 2% (purged)	91.8%	0.53 (6.7% mortality)[b]
Reference Sediment			
Performance criterion	< 25 % mortality	> 65% of control	> 80% of control
CR-10	9% (non-purged) 4% (purged)	76.3%	MIG = 0.4318 (80.8%)
CR-22	3% (non-purged) 0% (purged)	74.7%	MIG = 0.5682 (106.3%)
CR-23W	4% (non-purged) 0% (purged)	74.8%	MIG = 0.5861 (109.7%)

[a] Mean for five replicate samples.

[b] Two of the *N. arenaceodentata* control replicates became anoxic resulting in complete mortality in one and 80% mortality in the other. The data presented are calculated from the remaining three replicates.

Table 11. Summary of the results of the *E. estuarius* toxicity tests and comparison to Sediment Management Standards criteria

Station	Test Result (% survival)	Reference	Statistical Difference	SQS	MCUL
SS-36	89	CR-22	No	PASS	PASS
SS-37	93	CR-23W	No	PASS	PASS
SC-70	94	CR-10	No	PASS	PASS
SC-71	91	CR-10	No	PASS	PASS
SC-72	93	CR-10	No	PASS	PASS
SC-73	92	CR-10	No	PASS	PASS
SC-77	94	CR-10	No	PASS	PASS
SC-78	97	CR-10	No	PASS	PASS
SC-78 (purged)	93	CR-10	No	PASS	PASS
SC-80	98	CR-10	No	PASS	PASS
SC-81	87	CR-10	No	PASS	PASS
SC-82	97	CR-10	No	PASS	PASS
SC-84	95	CR-10	No	PASS	PASS

NOTE: SQS - Sediment Quality Standards
MCUL - Minimum Cleanup Level

[a] Mean and standard deviation for five replicate samples.

[b] Statistically significant relative to reference as determined by a Mann-Whitney test at the $\alpha = 0.05$ level.

Table 12. Summary of the results of the *M. galloprovincialis* toxicity tests and comparison to Sediment Management Standards criteria

Station	Test Result (% normal survivorship)	Reference	Statistical Difference	Percent of Reference	SQS	MCUL
SS-36	60.8	CR-22	Yes	88.6	PASS	PASS
SS-37	63.4	CR-23W	Yes	92.3	PASS	PASS
SC-70	72.7	CR-10	No	–	PASS	PASS
SC-71	68.3	CR-10	No	–	PASS	PASS
SC-72	68.8	CR-10	No	–	PASS	PASS
SC-73	68.0	CR-10	No	–	PASS	PASS
SC-77	73.2	CR-10	No	–	PASS	PASS
SC-78	65.0	CR-10	No	–	PASS	PASS
SC-80	54.7	CR-10	Yes	78.1	FAIL	PASS
SC-81	58.7	CR-10	Yes	83.8	FAIL	PASS
SC-82	59.8	CR-10	Yes	85.4	PASS	PASS
SC-84	79.0	CR-10	No	–	PASS	PASS

Table 13. Summary of the results of the *N. arenaceodentata* toxicity tests and comparison to Sediment Management Standards criteria

Station	Test Result (mg/ind./day)	Reference	Statistical Difference	SQS	MCUL
SS-36	0.58	CR-22	No	PASS	PASS
SS-37	0.51	CR-23W	No	PASS	PASS
SC-70	0.48	CR-10	No	PASS	PASS
SC-71	0.48	CR-10	No	PASS	PASS
SC-72	0.47	CR-10	No	PASS	PASS
SC-73	0.46	CR-10	No	PASS	PASS
SC-77	0.57	CR-10	No	PASS	PASS
SC-78	0.59	CR-10	No	PASS	PASS
SC-80	0.48	CR-10	No	PASS	PASS
SC-81	0.43	CR-10	No	PASS	PASS
SC-82	0.49	CR-10	No	PASS	PASS
SC-84	0.41	CR-10	No	PASS	PASS

Appendix A

Chemistry Data Validation Report

Quality By Design

Laboratory Quality Assurance Consulting

97 Puhili Street
Hilo, Hawaii 96720

Phone: (808) 969-9424
Fax: (808) 969-9094

DATA VALIDATION REPORT

Project Name: Whatcom Waterway
Anchor Project 98-030-01
and
Boulevard Parks/Starr Rock Area
Anchor Project 98-007-03

Type of Samples: Sediments
Date of Sampling: October 26-29, 1998

Prepared for:

Anchor Environmental, L.L.C.
1411 Fourth Avenue, Suite 1210
Seattle, WA 98101

QBD Job 173

Reviewed and Approved,

Thomas S. Davis

Quality By Design

Table of Contents

This data validation report consists of the following stand alone sections, each of which is formatted to follow Functional Guidelines but which also include subsections discussing QBD contacts with the laboratory, other comments, and a summary table of data qualifiers.

Quality By Design

A. Introduction

Laboratory Sciences, Inc., d.b.a. *Quality by Design* (QBD), has completed an EPA Level II Data Assessment, on the submitted data packages in accordance with the subcontract agreement dated January 18, 1999 with Anchor Environmental, L.L.C.

The reporting format and criteria for recommending data qualifying flags for this data set are described in USEPA *"Functional Guidelines for Evaluating Organics Analyses"*, and *"Functional Guidelines for Evaluating Inorganics Analyses"*, June, 1994, the *Statement of Work for Project Numbers 98-030-01 Whatcom Waterway, Addendum 3, 98-007-03 Boulevard Park/Starr Rock* (Anchor Environmental, October 1998) and *Work Plan for Supplementary Investigation of Surface Sediments Boulevard Park/Starr Rock Area, Bellingham, Washington* (Anchor Environmental, October 1998). and *"Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound"*, May 1997 or using criteria listed in the method referenced. Data may be qualified for any of several reasons:

1. By the laboratory prior to receipt by the reviewer;
2. Because of laboratory deviation from the designated method;
3. Because the data may not meet the criteria listed in the reference above; or
4. By the professional judgment of the reviewer.

The data set consists of a 1522 page analytical report from Analytical Resources, Inc., in Seattle, Washington. and contains data for the samples shown in Table 1. Grain size analysis was subcontracted to Rosa Environmental and Geotechnical Laboratory and their entire report was included in the data package. The inorganics analysis was subcontracted to Columbia Analytical Services and their entire report was included in the data package.

Each data set includes an analytical data package for each sample, copies of the completed chain-of-custody forms. and a Quality Control (QC) Data Package. The analytical data package includes analytical results, blank sample results, both laboratory and client sample identifications, appropriate dates but not times, reporting limits, method references, surrogate recoveries as appropriate, the laboratory's name and address, and the initials of the person authorizing release of the data.. The custody forms include the receipt of the sample but not the laboratory's internal tracking. The QC Data Package includes a tabular listing of the laboratory's sample identification, spiking concentrations. recoveries, percentage calculations, and acceptance windows.

The data reviewer and senior reviewer are shown in Table 2.

Table 1. Sample Data Received

Sample Identification	Laboratory Identification	SVOC	Grain Size	Metals	Inorganics
AN-SS-304	98-22425	X	X	X	X
AN-SS-306	98-22426	X	X	X	X
AN-SS-305	98-22427	X	X	X	X
AN-SS-303	98-22428	X	X	X	X
AN-SS-302	98-22429	X	X	X	X
AN-SS-301	98-22430	X	X	X	X
AN-SC-84	98-22431	X	X	X	X
AN-SS-45	98-22432	X	X	X	X
AN-SS-47	98-22433	X	X	X	X
AN-SS-70	98-22434	X	X	X	X
AN-SS-200	98-22435	X	X	X	X
CR-10	98-22571		X		
CR-23W	98-22572		X		
CR-22	98-22573		X		
AN-SS-36	98-22607	X	X	X	X
AN-SC-80	98-22608	X	X	X	X
AN-SC-71	98-22609	X	X	X	X
AN-SC-72	98-22610	X	X	X	X
AN-SC-73	98-22611	X	X	X	X
AN-SC-77	98-22612	X	X	X	X
AN-SC-78	98-22613	X	X	X	X
AN-SC-82	98-22614	X	X	X	X
AN-SC-201	98-22615	X	X	X	X
AN-SC-202	98-22616	X	X	X	X
AN-SC-81	98-22617	X	X	X	X
AN-SC-37	98-22618	X	X	X	X

Key:

SVOA = Semivolatile Organic Analysis
Metals = Metals by ICP and Mercury by Cold Vapor Atomic Absorption
Inorganics = Classical Wet Chemistry

Table 2. Data Package, Reviewer, and Senior Reviewer

Analysis	Reviewer	Senior Reviewer
Semivolatile Analysis	Kathy J. Gunderson	Thomas S. Davis
Metals	Carlene McCutcheon	Lorraine L. Davis
Inorganic Chemistry	Carlene McCutcheon	Lorraine L. Davis
Grain Size	Carlene McCutcheon	Lorraine L. Davis

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B. Sample Receipt and Condition

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. Except as noted below, no data are missing from the packages and no errors in accuracy were found. All tests requested on the chain-of-custody were performed.

Discussion: The temperature of two of the sample coolers was above the recommended temperature range of 2 to 6°C at the time of sample log-in. The temperature of the coolers containing samples collected October 26, 1998 and October 27, 1998 were 9.0°C. The cooler temperatures for samples collected October 28, 1998 and October 29, 1998 were not recorded. Because the one cooler showed evidence of cooling, because the sampling staff stated that ice had been added to the coolers, and because these analyses are not highly volatile, it is the judgment of the reviewer that this exceedence does not warrant a data qualifier flag.

The chain-of-custody (COC) for samples collected October 27, 1998 was missing the arrow down to indicate the date collected for all samples. Kim Magruder of Anchor Environmental was contacted and verified that all the affected samples were collected October 27, 1998.

Sample AN-SC-80 did not have a matrix listed in the COC. Ms. Magruder indicated the sample was a sediment.

Sample AN-SC-71 was not listed on the COC. It was added by the laboratory at the time of sample receipt.

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C. Review of GC/MS Semivolatile Analyses

EPA Method 8270

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. All samples were analyzed within the technical holding times. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

2. GC/MS Tuning and Mass Calibration

All Decafluorotriphenylphosphine (DFTPP) tune criteria were met for the initial calibration and all dates of sample analysis.

3. Initial and Continuing Calibration

Except as noted below, all initial and continuing calibration QC criteria were met. No Target Compound List (TCL) analytes had Percent Relative Standard Deviations (%RSD) greater than that allowed by the method and all continuing calibration criteria were met.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-45	di-n-Octylphthalate	%RSD = 40.4	26 E
AN-SC-82	di-n-Octylphthalate	%RSD = 40.4	58 E
AN-SC-82DL	di-n-Octylphthalate	%RSD = 40.4	98 E
AN-SS-304	bis(2-Ethylhexyl)phthalate	%D = 28.0	76 E
AN-SC-71	bis(2-Ethylhexyl)phthalate	%D = 28.0	120 E
AN-SC-72	bis(2-Ethylhexyl)phthalate	%D = 28.0	140 E
AN-SC-73	bis(2-Ethylhexyl)phthalate	%D = 28.0	180 E
AN-SC-77	bis(2-Ethylhexyl)phthalate	%D = 28.0	190 E
AN-SC-82	bis(2-Ethylhexyl)phthalate	%D = 28.0	1300 E
AN-SC-81	bis(2-Ethylhexyl)phthalate	%D = 28.0	1400 E
AN-SC-37	bis(2-Ethylhexyl)phthalate	%D = 28.0	860 E

Discussion: The percent relative standard deviation of di-n-Octylphthalate in the initial calibration was above the acceptance criteria of 30%. As specified in *Functional*

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Guidelines, only positive results were qualified with "E" for estimated since the relative response factor criteria were met. Non-detects were not qualified.

The percent difference (%D) values for bis(2-Ethylhexyl)phthalate, Benzoic acid, and Pentachlorophenol in several of the continuing calibrations were above the acceptance criteria of 25%. As specified in *Functional Guidelines*, only positive results in associated samples were qualified with "E" for estimated. Non-detects were not qualified.

4. Blanks and Checks for Contamination

Method blank analyses were performed at the required frequencies and no target compounds were detected. Except as noted below, field blanks were analyzed as specified in the Work Plan and were free of target compounds.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SC-81	bis(2-Ethylhexyl)phthalate	Blank Contamination	1400 B
AN-SC-82	bis(2-Ethylhexyl)phthalate	Blank Contamination	1300 B
AN-SC-37	bis(2-Ethylhexyl)phthalate	Blank Contamination	860 B

Discussion: Bis(2-ethylhexyl)phthalate was detected in the rinsate blank AN-SC-201. Per Functional Guidelines, data qualifiers are not required because the concentration in the samples is greater than 10 times the concentration in the blank. The compound bis(2-Ethylhexyl)phthalate has been flagged with "B" in the associated samples per SEDQUAL requirements.

5. Surrogate Recovery

Surrogate analytes were added to all samples and blanks as required by the referenced method. Except as noted below, all percent recovery values were within laboratory and Work Plan criteria.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-47	Phenol	Surrogate	280 UG
AN-SS-47	2-Methylphenol	Surrogate	280 UG
AN-SS-47	4-Methylphenol	Surrogate	140 UG
AN-SS-47	2,4-Dimethylphenol	Surrogate	410 UG
AN-SS-47	Benzoic Acid	Surrogate	1400 UG
AN-SS-47	Pentachlorophenol	Surrogate	690 UG

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Discussion: The work plans do not list control limits for the surrogates 2-Chlorophenol-d_4 and 1,2-Dichlorobenzene-d_4. In addition, the work plan did not list surrogate control limits for water samples. In these cases, the laboratory control limits were used to assess data quality.

The Phenol-d_5 and 2-Chlorophenol-d_4 surrogate recovery values are below acceptance criteria in Sample AN-SS-47 at 26.1% and 27.8%, respectively. Non-detect target analytes in the acid fraction were qualified with "UG" for a low bias.

The 1,2-Dichlorobenzene-d_4 surrogate recovery in the diluted analysis of Sample AN-SS-301 was below the laboratory control limits at 27.2%. Data qualifiers are not required since *Functional Guidelines* allows one surrogate to fail criteria without qualification.

6. Matrix Spike/Matrix Spike Duplicate

Except as noted below, matrix spikes (MS) and matrix spike duplicates (MSD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within the work plan criteria.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-301	Phenol	MS/MSD	80 UG
AN-SS-301	1,4-Dichlorobenzene	MS/MSD	40 UG
AN-SS-301	1,2,4-Trichlorobenzene	MS/MSD	40 UG
AN-SS-301	Pentachlorophenol	MS/MSD	200 UG
AN-SS-302	Phenol	MS/MSD	39 UG
AN-SS-302	1,4-Dichlorobenzene	MS/MSD	20 UG
AN-SS-302	1,2,4-Trichlorobenzene	MS/MSD	20 UG
AN-SS-302	Pentachlorophenol	MS/MSD	98 UG
AN-SS-303	Phenol	MS/MSD	39 UG
AN-SS-303	1,4-Dichlorobenzene	MS/MSD	20 UG
AN-SS-303	1,2,4-Trichlorobenzene	MS/MSD	20 UG
AN-SS-303	Pentachlorophenol	MS/MSD	99 UG
AN-SS-304	Phenol	MS/MSD	38 UG
AN-SS-304	1,4-Dichlorobenzene	MS/MSD	19 UG
AN-SS-304	1,2,4-Trichlorobenzene	MS/MSD	19 UG
AN-SS-304	Pentachlorophenol	MS/MSD	95 UG
AN-SS-305	Phenol	MS/MSD	52 G
AN-SS-305	1,4-Dichlorobenzene	MS/MSD	22 UG

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Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-305	1,2,4-Trichlorobenzene	MS/MSD	22 UG
AN-SS-305	Pentachlorophenol	MS/MSD	110 UG
AN-SS-306	Phenol	MS/MSD	58 G
AN-SS-306	1,4-Dichlorobenzene	MS/MSD	19 UG
AN-SS-306	1,2,4-Trichlorobenzene	MS/MSD	19 UG
AN-SS-306	Pentachlorophenol	MS/MSD	97 UG
AN-SC-80	Pyrene	MS/MSD	1200 G

Discussion: The percent recovery values of Phenol, 1,4-Dichlorobenzene, 1,2,4-Trichlorobenzene, and Pentachlorophenol in the sediment MS/MSD associated with the Starr Rock site were below the Work Plan acceptance criteria for accuracy of 60-120%. Due to the pattern of low recovery in the MS, MSD and blank spike, positive results and detection limits for these analytes have been qualified with "G" for a low bias in all Starr Rock sediment samples.

The percent recovery values of Pyrene in the MS and MSD associated with the Whatcom Waterway site are below the Work Plan criteria. Since the Pyrene blank spike recovery is acceptable, only the sample spiked as the MS/MSD (AN-SC-80) was qualified with "G" for a low bias.

It appears the RPD values reported by the laboratory are calculated on the percent recovery values and not the MS and MSD concentrations. Data qualifiers are not recommended since all recalculated RPDs are within the Work Plan criteria.

The laboratory did not analyze a MS/MSD pair for the water samples. Although the SEDQUAL frequency is MS/MSD analyses at 5%, no data qualifier flags are recommended because the laboratory analyzed a Blank Spike/Blank Spike Duplicate.

Note that the Starr Rock and Whatcom Waterway Work Plans have different acceptance criteria for QC samples.

7. Blank Spike/Laboratory Control Sample/Standard Reference Material

Except as noted below, blank spikes or laboratory control samples (LCS) and standard reference materials (SRMs) were analyzed as required by the SEDQUAL program and all percent recoveries (%Rec) were within the Work Plan criteria.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-301	Phenol	BS	80 UG

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Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-301	1,4-Dichlorobenzene	BS	40 UG
AN-SS-301	1,2,4-Trichlorobenzene	BS	40 UG
AN-SS-301	Pentachlorophenol	BS	200 UG
AN-SS-302	Phenol	BS	39 UG
AN-SS-302	1,4-Dichlorobenzene	BS	20 UG
AN-SS-302	1,2,4-Trichlorobenzene	BS	20 UG
AN-SS-302	Pentachlorophenol	BS	98 UG
AN-SS-303	Phenol	BS	39 UG
AN-SS-303	1,4-Dichlorobenzene	BS	20 UG
AN-SS-303	1,2,4-Trichlorobenzene	BS	20 UG
AN-SS-303	Pentachlorophenol	BS	99 UG
AN-SS-304	Phenol	BS	38 UG
AN-SS-304	1,4-Dichlorobenzene	BS	19 UG
AN-SS-304	1,2,4-Trichlorobenzene	BS	19 UG
AN-SS-304	Pentachlorophenol	BS	95 UG
AN-SS-305	Phenol	BS	52 G
AN-SS-305	1,4-Dichlorobenzene	BS	22 UG
AN-SS-305	1,2,4-Trichlorobenzene	BS	22 UG
AN-SS-305	Pentachlorophenol	BS	110 UG
AN-SS-306	Phenol	BS	58 G
AN-SS-306	1,4-Dichlorobenzene	BS	19 UG
AN-SS-306	1,2,4-Trichlorobenzene	BS	19 UG
AN-SS-306	Pentachlorophenol	BS	97 UG

Discussion: The percent recovery values of Phenol, 1,4-Dichlorobenzene, 1,2,4-Trichlorobenzene, and Pentachlorophenol in the sediment blank spike associated with the Starr Rock site were below the Work Plan acceptance criteria for accuracy of 60-120%. Due to the pattern of low recovery in the MS, MSD and blank spikes, positive results and detection limits for these analytes have been qualified with "G" for a low bias in all Starr Rock sediment samples.

The standard reference material, Sequim Bay Sediment, was analyzed with sediment batches from both sites. As shown below, the results for all analytes, with the exception of Benzoic acid and 4-Methylphenol, were within the 95% confidence interval as required by the SEDQUAL program.

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Summary of Certified Reference Material Results Sequim Bay Sediment

Analyte	Starr Rock Laboratory Result	Starr Rock Percent Recovery	Whatcom Waterway Laboratory Result	Whatcom Waterway Percent Recovery	Sequim Bay Expected Value	Sequim Bay 95% C. I.
Phenol	67 U	NC	79	14	560	0-420
1,4-Dichlorobenzene	33 U	NC	33 U	NC	51	0-26.8
1,2-Dichlorobenzene	33 U	NC	33 U	NC	170	5.3-34.7
4-Methylphenol	37 *	7.3	77	15	509	65-297
Benzoic Acid	670	NC	780 *	NC	NA	0-747
Naphthalene	50	29	40	24	170	23-123
Hexachlorobutadiene	67 U	NC	67 U	NC	170	0-22
2-Methylnaphthalene	72	42	66	39	170	23-155
Acenaphthylene	33 U	NC	33 U	NC	170	6-94
Acenaphthene	78	46	86	51	170	49-141
Fluorene	80	47	83	49	170	51-145
Hexachlorobenzene	33 U	NC	33 U	NC	1.7	0.84-1.16
Pentachlorophenol	390	77	170	33	509	0-985
Phenanthrene	120	71	130	76	170	2-310
Anthracene	74	44	93	55	170	35-187
Fluoranthene	130	76	160	94	170	0-302
Pyrene	110	65	170	100	170	0-281
Benzo(a)anthracene	100	59	120	71	170	33-197
Chrysene	110	65	120	71	170	23-233
Benzo(b)fluoranthene	120	71	140	82	170	0-382
Benzo(a)pyrene	120	35	140	41	340	26-214
Indeno(1,2,3-cd)pyrene	33 U	NC	33 U	NC	170	0-186
Dibenz(a,h)anthracene	86	51	100	59	170	35-167
Benzo(g,h,i)perylene	59	35	120	71	170	0-191
Average Percent Recovery		**51**		**56**		

Notes: * Indicates the value is outside the QAPP acceptance criteria of the 95% confidence interval
U: Indicates the compound was not detected at the reported concentration
All results are in µg/Kg

Quality By Design

8. Field Duplicates

Sample AN-SS-200 was identified as a field duplicate of Sample AN-SS-70. Field duplicate precision is acceptable since most RPDs are less than 40%. RPD values are presented in Table 3.

Table 3: Field Duplicate Result and RPD.

Analyte	Sample ID AN-SS-70	Field Duplicate ID AN-SS-200	RPD
4-Methylphenol	240	270	11.7
Naphthalene	160	160	0
2-Methylnaphthalene	30	30	0
Acenaphthylene	20	20 U	NC
Dibenzofuran	48	44	8.6
Fluorene	26	21	21.3
Phenanthrene	170	140	19.4
Anthracene	40	27	38.8
di-n-Butylphthalate	43	34	23.4
Fluoranthene	210	200	4.9
Pyrene	260	230	12.2
Benzo(a)anthracene	48	45	6.5
bis(2-Ethylhexyl)phthalate	150	83	57.5
Chrysene	74	66	11.4
Benzo(b)fluoranthene	48	65	30.1
Benzo(k)fluoranthene	77	49	44.4
Benzo(a)pyrene	49	46	6.3
Indeno(1,2,3-cd)pyrene	32	27	16.9
Benzo(g,h,i)perylene	31	30	3.3

Key: NC = Not Calculable
U = Not Detected

9. Internal Standards Performance

Internal standards were added to all samples and blanks as required by the method. Except as noted below, all internal standard areas and retention times were within the required limits.

Quality By Design

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SC-81	Indeno(1.2,3-cd)pyrene	Internal standard	290 L
AN-SC-81	Dibenz(a,h)anthracene	Internal standard	110 L
AN-SC-81	Benzo(g,h,i)perylene	Internal standard	210 L
AN-SC-82	Indeno(1,2,3-cd)pyrene	Internal standard	220 L
AN-SC-82	Dibenz(a,h)anthracene	Internal standard	77 L
AN-SC-82	Benzo(g,h,i)perylene	Internal standard	140 L

Discussion: In Samples AN-SC-81 and AN-SC-82, the area of internal standard Perylene-d_{12} is less than the criteria of two times the Perylene-d_{12} area in the associated calibration verification. Positive results and detection limits of the associated analytes in these samples have been qualified with "L" for low bias.

10. TCL Compound Identification

All TCL Compound identifications met the criteria of the referenced method.

Discussion: The Butylbenzylphthalate results in Samples AN-SC-78, AN-SC-80, AN-SC-81, and AN-SC-82 were flagged "M" by the laboratory. The laboratory defines the M flag as "Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match". In all cases the Butylbenzylphthalate peak coeluted with an unknown hydrocarbon. The analytical data system poorly subtracted the background hydrocarbon spectrum from the Butylbenzylphthalate spectrum. In the reviewer's opinion, the spectra is strong enough to justify reporting Butylbenzylphthalate without qualification since the peak shapes and ion ratios are acceptable.

11. Compound Quantitation and Reported Detection Limits

Quantitation was performed in accordance with the referenced method, including the correct calculations using appropriate internal standards, quantitation ion, and RRF. Except as noted below, the Work Plan required reporting limits were met.

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-301	Fluoranthene	Linear range exceeded	5500 R
AN-SS-301	Pyrene	Linear range exceeded	9500 R
AN-SS-301	Benzo(a)anthracene	Linear range exceeded	5000 R

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ORGANICS ANALYSIS DATA SHEET — Sample N[illegible]AN-SS-304
Semivolatiles by GC/MS — DILUTION
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Lab Sample ID: Z036A — QC Report No: Z036-Anchor Environmental
LIMS ID: 98-22425 — Project: Starr Rock
Matrix: Sediment — 98-007-03
Data Release Authorized: [signature] — Date Sampled: 10/26/98
Reported: 11/19/98 — Date Received: 10/28/98

Date extracted: 11/03/98 — Sample Amount: 52.8 g-dry-wt
Date analyzed: 11/11/98 — Final Extract Volume: 1.0 mL
Instrument: nt1 — Dilution Factor: 1:10
GPC Cleanup: YES — Percent Moisture: 34.2%
pH: 7.6

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	380 U	R
106-46-7	1,4-Dichlorobenzene	190 U	
100-51-6	Benzyl Alcohol	950 U	
95-50-1	1,2-Dichlorobenzene	190 U	
95-48-7	2-Methylphenol	380 U	
106-44-5	4-Methylphenol	190 U	
105-67-9	2,4-Dimethylphenol	570 U	
65-85-0	Benzoic Acid	1,900 U	
120-82-1	1,2,4-Trichlorobenzene	190 U	
91-20-3	**Naphthalene**	**670**	
87-68-3	Hexachlorobutadiene	380 U	
91-57-6	2-Methylnaphthalene	190 U	
131-11-3	Dimethylphthalate	190 U	
208-96-8	**Acenaphthylene**	**240**	
83-32-9	Acenaphthene	190 U	
132-64-9	Dibenzofuran	190 U	
84-66-2	Diethylphthalate	190 U	
86-73-7	**Fluorene**	**240**	
86-30-6	N-Nitrosodiphenylamine	190 U	
118-74-1	Hexachlorobenzene	190 U	
87-86-5	Pentachlorophenol	950 U	
85-01-8	**Phenanthrene**	**1,900**	
120-12-7	**Anthracene**	**510**	R
84-74-2	Di-n-Butylphthalate	190 U	R
206-44-0	**Fluoranthene**	**3,400**	

KJ 1.19.99

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET Sample N[illegible]AN-SS-304
Semivolatiles by GC/MS DILUTION
Page 2 of 2
Lab Sample ID: Z036A QC Report No: Z036-Anchor Environmental
LIMS ID: 98-22425 Project: Starr Rock
Matrix: Sediment 98-007-03
Data Release Authorized: Date Sampled: 10/26/98
Reported: 11/19/98 Date Received: 10/28/98

Date extracted: 11/03/98 Sample Amount: 52.8 g-dry-wt
Date analyzed: 11/11/98 Final Extract Volume: 1.0 mL
Instrument: nt1 Dilution Factor: 1:10
GPC Cleanup: YES Percent Moisture: 34.2%
pH: 7.6

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	3,000	R
85-68-7	Butylbenzylphthalate	190 U	
56-55-3	**Benzo(a)anthracene**	1,400	
117-81-7	bis(2-Ethylhexyl)phthalate	190 U	
218-01-9	**Chrysene**	1,800	
117-84-0	Di-n-Octyl phthalate	190 U	
205-99-2	**Benzo(b)fluoranthene**	1,600	
207-08-9	**Benzo(k)fluoranthene**	1,300	
50-32-8	**Benzo(a)pyrene**	1,800	
193-39-5	**Indeno(1,2,3-cd)pyrene**	1,000	R
53-70-3	**Dibenz(a,h)anthracene**	260	
191-24-2	**Benzo(g,h,i)perylene**	800	

[illegible]

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	50.4%	d5-Phenol	44.3%
2-Fluorobiphenyl	56.8%	2-Fluorophenol	70.4%
d14-p-Terphenyl	63.6%	2,4,6-Tribromophenol	76.3%
d4-1,2-Dichlorobenzene	51.6%	d4-2-Chlorophenol	55.7%

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Sample No: AN-SS-306

Lab Sample ID: Z036B
LIMS ID: 98-22426
Matrix: Sediment
Data Release Authorized: MV
Reported: 11/19/98

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 53.4%
pH: 7.5

CAS Number	Analyte	ug/kg		
108-95-2	**Phenol**	**58**		G
106-46-7	1,4-Dichlorobenzene	19	U	G
100-51-6	Benzyl Alcohol	97	U	
95-50-1	1,2-Dichlorobenzene	19	U	
95-48-7	2-Methylphenol	39	U	
106-44-5	**4-Methylphenol**	**36**		
105-67-9	2,4-Dimethylphenol	58	U	
65-85-0	Benzoic Acid	190	U	
120-82-1	1,2,4-Trichlorobenzene	19	U	G
91-20-3	**Naphthalene**	**51**		
87-68-3	Hexachlorobutadiene	39	U	
91-57-6	2-Methylnaphthalene	19	U	
131-11-3	Dimethylphthalate	19	U	
208-96-8	Acenaphthylene	19	U	
83-32-9	Acenaphthene	19	U	
132-64-9	Dibenzofuran	19	U	
84-66-2	Diethylphthalate	19	U	
86-73-7	Fluorene	19	U	
86-30-6	N-Nitrosodiphenylamine	19	U	
118-74-1	Hexachlorobenzene	19	U	
87-86-5	Pentachlorophenol	97	U	G
85-01-8	**Phenanthrene**	**110**		
120-12-7	**Anthracene**	**25**		
84-74-2	Di-n-Butylphthalate	19	U	
206-44-0	**Fluoranthene**	**200**		

KP 11/19/98

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z036B
LIMS ID: 98-22426
Matrix: Sediment
Data Release Authorized: MV
Reported: 11/19/98

Sample No: AN-SS-306

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 53.4%
pH: 7.5

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	210
85-68-7	Butylbenzylphthalate	19 U
56-55-3	**Benzo(a)anthracene**	87
117-81-7	**bis(2-Ethylhexyl)phthalate**	34
218-01-9	**Chrysene**	100
117-84-0	Di-n-Octyl phthalate	19 U
205-99-2	**Benzo(b)fluoranthene**	170
207-08-9	**Benzo(k)fluoranthene**	110
50-32-8	**Benzo(a)pyrene**	120
193-39-5	**Indeno(1,2,3-cd)pyrene**	99
53-70-3	**Dibenz(a,h)anthracene**	32
191-24-2	**Benzo(g,h,i)perylene**	65

11-19-98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	44.6%	d5-Phenol	47.8%
2-Fluorobiphenyl	51.7%	2-Fluorophenol	50.2%
d14-p-Terphenyl	71.4%	2,4,6-Tribromophenol	69.5%
d4-1,2-Dichlorobenzene	39.9%	d4-2-Chlorophenol	45.0%

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z036C
LIMS ID: 98-22427
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: AN-SS-305

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 45.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 69.6%
pH: 7.4

CAS Number	Analyte	ug/kg	
108-95-2	**Phenol**	52	G
106-46-7	1,4-Dichlorobenzene	22 U	G
100-51-6	Benzyl Alcohol	110 U	
95-50-1	1,2-Dichlorobenzene	22 U	
95-48-7	2-Methylphenol	44 U	
106-44-5	**4-Methylphenol**	190	
105-67-9	2,4-Dimethylphenol	66 U	
65-85-0	Benzoic Acid	220 U	
120-82-1	1,2,4-Trichlorobenzene	22 U	G
91-20-3	**Naphthalene**	1,000	
87-68-3	Hexachlorobutadiene	44 U	
91-57-6	**2-Methylnaphthalene**	180	
131-11-3	Dimethylphthalate	22 U	
208-96-8	**Acenaphthylene**	110	
83-32-9	**Acenaphthene**	76	
132-64-9	**Dibenzofuran**	130	
84-66-2	Diethylphthalate	22 U	
86-73-7	**Fluorene**	160	
86-30-6	N-Nitrosodiphenylamine	22 U	
118-74-1	Hexachlorobenzene	22 U	
87-86-5	Pentachlorophenol	110 U	G
85-01-8	**Phenanthrene**	800	
120-12-7	**Anthracene**	280	
84-74-2	Di-n-Butylphthalate	22 U	
206-44-0	**Fluoranthene**	1,100	

KJS 11.19.98

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z036C
LIMS ID: 98-22427
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: AN-SS-305

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 45.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 69.6%
pH: 7.4

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	1,700
85-68-7	Butylbenzylphthalate	22 U
56-55-3	**Benzo(a)anthracene**	620
117-81-7	**bis(2-Ethylhexyl)phthalate**	64
218-01-9	**Chrysene**	620
117-84-0	Di-n-Octyl phthalate	22 U
205-99-2	**Benzo(b)fluoranthene**	610
207-08-9	**Benzo(k)fluoranthene**	510
50-32-8	**Benzo(a)pyrene**	780
193-39-5	**Indeno(1,2,3-cd)pyrene**	480
53-70-3	**Dibenz(a,h)anthracene**	170
191-24-2	**Benzo(g,h,i)perylene**	360

RLD 1.19.99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	49.4%	d5-Phenol	50.0%
2-Fluorobiphenyl	50.5%	2-Fluorophenol	51.1%
d14-p-Terphenyl	77.6%	2,4,6-Tribromophenol	62.9%
d4-1,2-Dichlorobenzene	40.5%	d4-2-Chlorophenol	46.5%

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Semivolatiles by GC/MS

Sample No: AN-SS-303

Page 1 of 2
Lab Sample ID: Z036D
LIMS ID: 98-22428
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.1%
pH: 7.4

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	39 U	G
106-46-7	1,4-Dichlorobenzene	20 U	G
100-51-6	Benzyl Alcohol	99 U	
95-50-1	1,2-Dichlorobenzene	20 U	
95-48-7	2-Methylphenol	39 U	
106-44-5	**4-Methylphenol**	**70**	
105-67-9	2,4-Dimethylphenol	59 U	
65-85-0	Benzoic Acid	200 U	
120-82-1	1,2,4-Trichlorobenzene	20 U	G
91-20-3	**Naphthalene**	**80**	
87-68-3	Hexachlorobutadiene	39 U	
91-57-6	**2-Methylnaphthalene**	**25**	
131-11-3	Dimethylphthalate	20 U	
208-96-8	Acenaphthylene	20 U	
83-32-9	Acenaphthene	20 U	
132-64-9	**Dibenzofuran**	**22**	
84-66-2	Diethylphthalate	20 U	
86-73-7	Fluorene	20 U	
86-30-6	N-Nitrosodiphenylamine	20 U	
118-74-1	Hexachlorobenzene	20 U	
87-86-5	Pentachlorophenol	99 U	G
85-01-8	**Phenanthrene**	**91**	
120-12-7	**Anthracene**	**25**	
84-74-2	Di-n-Butylphthalate	20 U	
206-44-0	**Fluoranthene**	**120**	

KJD 1.19.99

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Lab Sample ID: Z036D
LIMS ID: 98-22428
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: AN-SS-303

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.1%
pH: 7.4

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	200
85-68-7	Butylbenzylphthalate	20 U
56-55-3	**Benzo(a)anthracene**	42
117-81-7	**bis(2-Ethylhexyl)phthalate**	67
218-01-9	**Chrysene**	60
117-84-0	Di-n-Octyl phthalate	20 U
205-99-2	**Benzo(b)fluoranthene**	75
207-08-9	**Benzo(k)fluoranthene**	40
50-32-8	**Benzo(a)pyrene**	53
193-39-5	**Indeno(1,2,3-cd)pyrene**	34
53-70-3	Dibenz(a,h)anthracene	20 U
191-24-2	**Benzo(g,h,i)perylene**	30

RJO 11.19.98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	46.6%	d5-Phenol	47.4%
2-Fluorobiphenyl	51.4%	2-Fluorophenol	51.5%
d14-p-Terphenyl	67.0%	2,4,6-Tribromophenol	71.1%
d4-1,2-Dichlorobenzene	41.8%	d4-2-Chlorophenol	46.5%

FORM-1

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Semivolatiles by GC/MS
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Sample No: AN-SS-302

Lab Sample ID: Z036E
LIMS ID: 98-22429
Matrix: Sediment
Data Release Authorized: MN
Reported: 11/19/98

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.0%
pH: 7.4

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	39 U	G
106-46-7	1,4-Dichlorobenzene	20 U	G
100-51-6	Benzyl Alcohol	98 U	
95-50-1	1,2-Dichlorobenzene	20 U	
95-48-7	2-Methylphenol	39 U	
106-44-5	**4-Methylphenol**	**190**	
105-67-9	2,4-Dimethylphenol	59 U	
65-85-0	Benzoic Acid	200 U	
120-82-1	1,2,4-Trichlorobenzene	20 U	G
91-20-3	**Naphthalene**	**240**	
87-68-3	Hexachlorobutadiene	39 U	
91-57-6	**2-Methylnaphthalene**	**68**	
131-11-3	Dimethylphthalate	20 U	
208-96-8	**Acenaphthylene**	**100**	
83-32-9	**Acenaphthene**	**34**	
132-64-9	**Dibenzofuran**	**65**	
84-66-2	Diethylphthalate	20 U	
86-73-7	**Fluorene**	**65**	
86-30-6	N-Nitrosodiphenylamine	20 U	
118-74-1	Hexachlorobenzene	20 U	
87-86-5	Pentachlorophenol	98 U	G
85-01-8	**Phenanthrene**	**320**	
120-12-7	**Anthracene**	**180**	
84-74-2	Di-n-Butylphthalate	20 U	
206-44-0	**Fluoranthene**	**870**	

KJS 1.19.99

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z036E
LIMS ID: 98-22429
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: AN-SS-302

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.0%
pH: 7.4

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	1,200	
85-68-7	Butylbenzylphthalate	20	U
56-55-3	**Benzo(a)anthracene**	550	
117-81-7	**bis(2-Ethylhexyl)phthalate**	58	
218-01-9	**Chrysene**	610	
117-84-0	Di-n-Octyl phthalate	20	U
205-99-2	**Benzo(b)fluoranthene**	490	
207-08-9	**Benzo(k)fluoranthene**	520	
50-32-8	**Benzo(a)pyrene**	730	
193-39-5	**Indeno(1,2,3-cd)pyrene**	400	
53-70-3	**Dibenz(a,h)anthracene**	98	
191-24-2	**Benzo(g,h,i)perylene**	220	

KP 1.2-11.98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	54.8%	d5-Phenol	58.6%
2-Fluorobiphenyl	61.8%	2-Fluorophenol	61.6%
d14-p-Terphenyl	76.4%	2,4,6-Tribromophenol	82.2%
d4-1,2-Dichlorobenzene	46.6%	d4-2-Chlorophenol	52.9%

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Semivolatiles by GC/MS
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Sample No: AN-SS-301

Lab Sample ID: Z036F
LIMS ID: 98-22430
Matrix: Sediment
Data Release Authorized: IW
Reported: 11/19/98

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/18/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.2 g-dry-wt
Final Extract Volume: 2.0 mL
Dilution Factor: 1:1
Percent Moisture: 64.2%
pH: 7.4

CAS Number	Analyte	ug/kg		
108-95-2	Phenol	80	U	G
106-46-7	1,4-Dichlorobenzene	40	U	G
100-51-6	Benzyl Alcohol	200	U	
95-50-1	1,2-Dichlorobenzene	40	U	
95-48-7	2-Methylphenol	80	U	
106-44-5	**4-Methylphenol**	**86**		
105-67-9	2,4-Dimethylphenol	120	U	
65-85-0	Benzoic Acid	400	U	
120-82-1	1,2,4-Trichlorobenzene	40	U	G
91-20-3	**Naphthalene**	**1,400**		
87-68-3	Hexachlorobutadiene	80	U	
91-57-6	**2-Methylnaphthalene**	**570**		
131-11-3	Dimethylphthalate	40	U	
208-96-8	**Acenaphthylene**	**700**		
83-32-9	**Acenaphthene**	**230**		
132-64-9	**Dibenzofuran**	**240**		
84-66-2	Diethylphthalate	40	U	
86-73-7	**Fluorene**	**430**		
86-30-6	N-Nitrosodiphenylamine	40	U	
118-74-1	Hexachlorobenzene	40	U	
87-86-5	Pentachlorophenol	200	U	G
85-01-8	**Phenanthrene**	**2,400**		
120-12-7	**Anthracene**	**1,400**		
84-74-2	Di-n-Butylphthalate	40	U	
206-44-0	**Fluoranthene**	**5,500**	**E**	R

RPD 1-19-99

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Lab Sample ID: Z036F
LIMS ID: 98-22430
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: AN-SS-301

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/18/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.2 g-dry-wt
Final Extract Volume: 2.0 mL
Dilution Factor: 1:1
Percent Moisture: 64.2%
pH: 7.4

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	9,500 E	R
85-68-7	Butylbenzylphthalate	40 U	
56-55-3	Benzo(a)anthracene	5,000 E	R
117-81-7	bis(2-Ethylhexyl)phthalate	57	
218-01-9	Chrysene	4,900 E	R
117-84-0	Di-n-Octyl phthalate	40 U	
205-99-2	Benzo(b)fluoranthene	5,300 E	R
207-08-9	Benzo(k)fluoranthene	2,600	
50-32-8	Benzo(a)pyrene	6,000 E	R
193-39-5	Indeno(1,2,3-cd)pyrene	3,700 E	R
53-70-3	Dibenz(a,h)anthracene	1,300	
191-24-2	Benzo(g,h,i)perylene	3,100	

KSD 1.19.99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	45.2%	d5-Phenol	46.8%
2-Fluorobiphenyl	48.7%	2-Fluorophenol	51.1%
d14-p-Terphenyl	72.9%	2,4,6-Tribromophenol	64.3%
d4-1,2-Dichlorobenzene	39.4%	d4-2-Chlorophenol	46.4%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z036F
LIMS ID: 98-22430
Matrix: Sediment
Data Release Authorized: MA
Reported: 11/19/98

Sample No: RN-SS-301
DILUTION

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/18/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.2 g-dry-wt
Final Extract Volume: 2.0 mL
Dilution Factor: 1:10
Percent Moisture: 64.2%
pH: 7.4

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	800 U	R
106-46-7	1,4-Dichlorobenzene	400 U	
100-51-6	Benzyl Alcohol	2,000 U	
95-50-1	1,2-Dichlorobenzene	400 U	
95-48-7	2-Methylphenol	800 U	
106-44-5	4-Methylphenol	400 U	
105-67-9	2,4-Dimethylphenol	1,200 U	
65-85-0	Benzoic Acid	4,000 U	
120-82-1	1,2,4-Trichlorobenzene	400 U	
91-20-3	**Naphthalene**	**1,300**	
87-68-3	Hexachlorobutadiene	800 U	
91-57-6	**2-Methylnaphthalene**	**480**	
131-11-3	Dimethylphthalate	400 U	
208-96-8	**Acenaphthylene**	**640**	
83-32-9	Acenaphthene	400 U	
132-64-9	Dibenzofuran	400 U	
84-66-2	Diethylphthalate	400 U	
86-73-7	Fluorene	400 U	
86-30-6	N-Nitrosodiphenylamine	400 U	
118-74-1	Hexachlorobenzene	400 U	
87-86-5	Pentachlorophenol	2,000 U	
85-01-8	**Phenanthrene**	**2,100**	
120-12-7	**Anthracene**	**1,300**	
84-74-2	Di-n-Butylphthalate	400 U	
206-44-0	**Fluoranthene**	**6,400**	

KD 1.19.98

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z036F
LIMS ID: 98-22430
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: [illegible]N-SS-301
DILUTION

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/18/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.2 g-dry-wt
Final Extract Volume: 2.0 mL
Dilution Factor: 1:10
Percent Moisture: 64.2%
pH: 7.4

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	7,700	
85-68-7	Butylbenzylphthalate	400 U	R
56-55-3	**Benzo(a)anthracene**	4,400	
117-81-7	bis(2-Ethylhexyl)phthalate	400 U	R
218-01-9	**Chrysene**	5,100	
117-84-0	Di-n-Octyl phthalate	400 U	R
205-99-2	**Benzo(b)fluoranthene**	3,000	
207-08-9	**Benzo(k)fluoranthene**	3,600	R
50-32-8	**Benzo(a)pyrene**	5,100	
193-39-5	**Indeno(1,2,3-cd)pyrene**	3,400	
53-70-3	**Dibenz(a,h)anthracene**	680	R
191-24-2	**Benzo(g,h,i)perylene**	2,800	R

KD 11/19/98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	42.4%	d5-Phenol	41.1%
2-Fluorobiphenyl	47.2%	2-Fluorophenol	52.3%
d14-p-Terphenyl	52.8%	2,4,6-Tribromophenol	52.8%
d4-1,2-Dichlorobenzene	27.2%	d4-2-Chlorophenol	42.7%

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET Sample No: Std Reference
Semivolatiles by GC/MS SQ-1
Page 1 of 2
Lab Sample ID: Z036-SRM QC Report No: Z036-Anchor Environmental
LIMS ID: 98-22425 Project: Starr Rock
Matrix: Sediment 98-007-03
Data Release Authorized: MW Date Sampled: 10/26/98
Reported: 11/19/98 Date Received: 10/28/98

Date extracted: 11/03/98 Sample Amount: 29.9 g-dry-wt
Date analyzed: 11/11/98 Final Extract Volume: 1.0 mL
Instrument: nt1 Dilution Factor: 1:1
GPC Cleanup: YES Percent Moisture: 40.2%
pH: 6.0

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	67 U	G
106-46-7	1,4-Dichlorobenzene	33 U	G
100-51-6	Benzyl Alcohol	170 U	
95-50-1	1,2-Dichlorobenzene	33 U	
95-48-7	2-Methylphenol	67 U	
106-44-5	**4-Methylphenol**	**37**	
105-67-9	2,4-Dimethylphenol	100 U	
65-85-0	**Benzoic Acid**	**670**	
120-82-1	1,2,4-Trichlorobenzene	33 U	G
91-20-3	**Naphthalene**	50	
87-68-3	Hexachlorobutadiene	67 U	
91-57-6	**2-Methylnaphthalene**	**72**	
131-11-3	Dimethylphthalate	33 U	
208-96-8	Acenaphthylene	33 U	
83-32-9	**Acenaphthene**	**78**	
132-64-9	Dibenzofuran	33 U	
84-66-2	Diethylphthalate	33 U	
86-73-7	**Fluorene**	**80**	
86-30-6	N-Nitrosodiphenylamine	33 U	
118-74-1	Hexachlorobenzene	33 U	
87-86-5	**Pentachlorophenol**	390	G
85-01-8	**Phenanthrene**	**120**	
120-12-7	**Anthracene**	**74**	
84-74-2	Di-n-Butylphthalate	33 U	
206-44-0	**Fluoranthene**	**130**	

KJW 11/19/98

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Lab Sample ID: Z036-SRM
LIMS ID: 98-22425
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

Sample No: Std Reference
SQ-1

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 29.9 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 40.2%
pH: 6.0

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	110
85-68-7	Butylbenzylphthalate	33 U
56-55-3	**Benzo(a)anthracene**	100
117-81-7	**bis(2-Ethylhexyl)phthalate**	82
218-01-9	**Chrysene**	110
117-84-0	Di-n-Octyl phthalate	33 U
205-99-2	**Benzo(b)fluoranthene**	120
207-08-9	Benzo(k)fluoranthene	33 U
50-32-8	**Benzo(a)pyrene**	120
193-39-5	Indeno(1,2,3-cd)pyrene	33 U
53-70-3	**Dibenz(a,h)anthracene**	86
191-24-2	**Benzo(g,h,i)perylene**	59

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	61.4%	d5-Phenol	63.8%
2-Fluorobiphenyl	66.1%	2-Fluorophenol	69.8%
d14-p-Terphenyl	75.1%	2,4,6-Tribromophenol	95.1%
d4-1,2-Dichlorobenzene	55.6%	d4-2-Chlorophenol	57.8%

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Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-301	Chrysene	Linear range exceeded	4900 R
AN-SS-301	Benzo(b)fluoranthene	Linear range exceeded	5300 R
AN-SS-301	Benzo(a)pyrene	Linear range exceeded	6000 R
AN-SS-301	Indeno(1,2,3-cd)pyrene	Linear range exceeded	3700 R
AN-SS-304	Phenanthrene	Linear range exceeded	2000 R
AN-SS-304	Fluoranthene	Linear range exceeded	3100 R
AN-SS-304	Benzo(a)pyrene	Linear range exceeded	1700 R
AN-SS-47	bis(2-Ethylhexyl)phthalate	Linear range exceeded	22000 R
AN-SC-81	Pyrene	Linear range exceeded	1900 R
AN-SC-82	Pyrene	Linear range exceeded	1700 R
AN-SC-82	Chrysene	Linear range exceeded	1900 R
AN-SS-301DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SS-304DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SS-47DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SC-81DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SC-82DL	All analytes for which the dilution was not performed.	Excessive dilution	R

Discussion: The laboratory reporting limits did not meet the work plan requirements for 2,4-Dimethylphenol and Benzyl alcohol. The laboratory reported 30 and 50 µg/Kg, and the Work Plan requirement is 20 and 25 µg/Kg, for 2,4-Dimethylphenol and Benzyl alcohol, respectively.

The work plan did not establish reporting limits for water samples.

Several samples were diluted due to suspected levels of target compounds. In these instances, the laboratory reported one result for the original analysis and one for each dilution, resulting in two sets of results for one sample. To condense the results to

Quality By Design

one set of results per sample, the results that are above the calibration range, or which should not be used because of excessive dilution, have been flagged "R" for unusable.

The Butylbenzylphthalate reporting limits in Samples AN-SC-81 and AN-SC-82 have been flagged "Y" by the laboratory. The laboratory defines the Y flag as "Indicates raised reporting limit due to background interference or to activity on the instrument." In the reviewer's opinion, the raised reporting limit is justified due to the hydrocarbon background present in these samples.

The work plan listed Total Organic Carbon (TOC) corrected reporting limits for the Polynuclear Aromatic Hydrocarbons, Phthalates, and Chlorinated Aromatics. Generally, the TOC corrected reporting limits were much greater than the TOC uncorrected limits reported by the laboratory. However, for Sample AN-SS-47, only 10.46 grams was extracted (compared to the usual 100 grams) giving high reporting limits that might exceed the work plan limits when TOC corrected.

12. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not required for this project.

13. System Performance

System performance was acceptable and had no significant problems such as loss of resolution or peak tailing.

14. Laboratory Contact

Mark Harris of Analytical Resources, Inc. was contacted by electronic mail on December 29, 1998 to request the true values for the standard reference material Sequim Bay Sediment. A faxed reply was received via the Anchor Environmental office on December 30, 1998.

15. Other Comments

Precision information is not available for the water samples from the Whatcom Waterway site since neither a matrix spike duplicate, sample duplicate or blank spike duplicate was analyzed.

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16. Data Use and Overall Assessment

The analytes qualified with an "R" are unusable. All other data, as qualified, are acceptable for use. The analyses were generally within the requirements of the referenced method. No discrepancies were observed between raw data and reported data results. All data flags are summarized at the end of this report.

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D. Review of Metals Analyses

EPA Method 6010/7000/7471

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. All samples were analyzed within the technical holding times. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

2. Initial and Continuing Calibration, including all calibrations and continuing calibration checks.

All initial and continuing calibration Quality Control criteria were met, including the number of standards used and correlation coefficients. All continuing calibration criteria, including frequency of analysis and percent recovery were met.

3. Blanks and Checks for Contamination

Instrument and method blank analyses were performed at the required frequencies and either no analytes were detected or levels were below the reporting limit.

4. ICP Interference Check Standard

The Interference Check Sample was analyzed at a frequency required by the referenced method and was within established criteria.

5. Laboratory Control Sample (LCS) Analysis

A Laboratory Control Standard was analyzed at a frequency required by the referenced method and all percent recoveries were within laboratory or method criteria.

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6. Matrix Spike/Matrix Duplicates

Matrix spikes (MS) and matrix duplicates (MD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within laboratory or method criteria.

7. Graphite Furnace Atomic Absorption Analysis

All special criteria for Graphite Furnace Atomic Absorption analysis were performed at a frequency required by the referenced method and was within established criteria.

8. ICP Serial Dilution

Samples that were a factor of 50 above the Instrument Detection Limit for the analyte were diluted 5-fold and were within criteria required by the referenced method.

9. Field Duplicates

Samples AN-SS-200 and AN-SS-70 were identified as field duplicates. Field duplicate precision is acceptable since most RPDs are less than 40%. RPD values are presented in Table 4.

Table 4: Field Duplicate Result and RPD.

Analyte	Sample ID AN-SS-70	Field Duplicate ID AN-SS-200	RPD
Cadmium	0.9	0.6	40.0
Mercury	0.8	0.7	13.3
Zinc	100	99	1.0

10. Sample Result Verification

The final reports were reviewed and compared against raw instrumental data and logs to check anomalies, data reduction/calculations, transcription, linear ranges, and dilutions. Except as noted below, no errors in accuracy were found

Discussion: The laboratory did not meet the QAPP Method Reporting Limit for Lead. The QAPP MRL for Lead is 3.0 mg/kg and the laboratory reported a MRL of 20 mg/kg. In

Quality By Design

consultation with Ms. Magruder, the laboratory reporting limit was determined to be acceptable.

11. Laboratory Contact

There was no verbal or written communication with the laboratory.

12. Other Comments

None.

13. Data Use and Overall Assessment

The data are acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results.

Quality By Design

E. Review of Inorganic Analyses

EPA Method 9060 (TOC), 150.1 (pH) and CLP ILM03.0 (Total Solids) and Grain Size

1. Timeliness and a Check for Errors.

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. Except as noted below, no data are missing from the packages and no errors in accuracy were found. All tests requested on the chain-of-custody were performed. All samples were analyzed within the technical holding times. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

Discussion: The analysis for Grain Size was performed by Rosa Environmental and Geotechnical Laboratory. The chain-of-custody issued for the transport of samples from Analytical Resources, Inc. to Rosa Environmental does not show a time of relinquishment from Analytical Resources, Inc.

2. Initial and Continuing Calibration.

All initial and continuing calibration Quality Control criteria were met, including the number of standards used and correlation coefficients. All continuing calibration criteria, including frequency of analysis and percent recovery were met.

3. Blanks and Checks for Contamination.

Except as noted below, instrument and method blank analyses were performed at the required frequencies and either no analytes were detected or levels were below the reporting limit.

Discussion: Total Organic Carbon was detected in the method blank analyzed on November 11, 1998 and associated with Samples AN-SS-36, AN-SC-80, AN-SC-71, AN-SC-72, AN-SC-73, AN-SC-77, AN-SC-78, AN-SC-82, AN-SC-81, and AN-SC-37. The concentrations of the sample results were greater than five times (5X) the blank level and no data flags are recommended.

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4. Laboratory Control Standards and Blank Spikes.

A Laboratory Control Standard was analyzed at a frequency required by the referenced method and all percent recoveries were within laboratory or method criteria.

5. Precision and Accuracy.

Matrix spikes (MS) and matrix spike duplicates (MSD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within laboratory or method criteria.

6. Field Duplicates.

Samples AN-SS-70 and AN-SS-200 were identified as field duplicates. Field duplicate precision is acceptable since most RPDs are less than 40%. RPD values are presented in Table 5.

Table 5: Field Duplicate Result and RPD.

Analyte	Sample ID AN-SS-70	Field Duplicate ID AN-SS-200	RPD
Total Organic Carbon	2.4	2.6	8.0
pH	7.4	7.4	0
Total Solids	37.9	35.4	6.8

7. Sample Result Verification.

The final reports were reviewed and compared against raw instrumental data and logs to check anomalies, data reduction/calculations, transcription, linear ranges, and dilutions. Except as noted below, no errors in accuracy were found.

Associated Samples	Analyte Affected	Type of Deviation	Flag
AN-SC-80 MS	Total Organic Carbon	Calculation Error	79.0

Discussion: A calculation error was found in determining the percent recovery for the Total Organic Carbon matrix spike. The corrected value is listed in the summary table and on the laboratory final report form.

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On the raw data associated with AN-SC-80 (Run C), the graph and summary table are not in agreement. The laboratory has been contacted to correct the report and reissue it directly to Anchor.

8. Laboratory Contact.

The QBD project manager contacted Mark Harris at ARI Laboratory to verify the TOC calculations used. This was followed up by fax notes, copies of which are appended to this validation report.

9. Other Comments.

None.

10. Data Use and Overall Assessment.

The data, as qualified, are acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results. All data flags are summarized at the end of this report.

Quality By Design

F. Puget Sound Estuary Program Data Qualifier Definitions

Used for both organics and inorganic analyses

B = Analyte detected in samples and in method blank

C = Combined with unresolved substances

E = Estimated

G = Value greater than minimum shown

K = Detected at less than the maximum shown

L = Value less than the maximum shown

M = Value is a mean

Q = Questionable value

R = Rejected or unusable value

T = Detected below the quantification limit shown

U = Undetected at the detection limit shown

X = Recovery less than 10 percent

Z = Blank corrected

Quality By Design

G. Summary Table of Data Qualifier Flags

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-45	di-n-Octylphthalate	%RSD = 40.4	26 E
AN-SC-82	di-n-Octylphthalate	%RSD = 40.4	58 E
AN-SC-82DL	di-n-Octylphthalate	%RSD = 40.4	98 E
AN-SS-304	bis(2-Ethylhexyl)phthalate	%D = 28.0	76 E
AN-SC-71	bis(2-Ethylhexyl)phthalate	%D = 28.0	120 E
AN-SC-72	bis(2-Ethylhexyl)phthalate	%D = 28.0	140 E
AN-SC-73	bis(2-Ethylhexyl)phthalate	%D = 28.0	180 E
AN-SC-77	bis(2-Ethylhexyl)phthalate	%D = 28.0	190 E
AN-SC-82	bis(2-Ethylhexyl)phthalate	%D = 28.0	1300 E
AN-SC-81	bis(2-Ethylhexyl)phthalate	%D = 28.0	1400 E
AN-SC-37	bis(2-Ethylhexyl)phthalate	%D = 28.0	860 E
AN-SC-81	Bis(2-ethylhexyl)phthalate	Blank Contamination	1400 B
AN-SC-82	Bis(2-ethylhexyl)phthalate	Blank Contamination	1300 B
AN-SC-37	Bis(2-ethylhexyl)phthalate	Blank Contamination	860 B
AN-SS-47	Phenol	Surrogate	280 UG
AN-SS-47	2-Methylphenol	Surrogate	280 UG
AN-SS-47	4-Methylphenol	Surrogate	140 UG
AN-SS-47	2,4-Dimethylphenol	Surrogate	410 UG
AN-SS-47	Benzoic Acid	Surrogate	1400 UG
AN-SS-47	Pentachlorophenol	Surrogate	690 UG
AN-SS-301	Phenol	MS/MSD	80 UG
AN-SS-301	1,4-Dichlorobenzene	MS/MSD and BS	40 UG
AN-SS-301	1,2,4-Trichlorobenzene	MS/MSD and BS	40 UG
AN-SS-301	Pentachlorophenol	MS/MSD and BS	200 UG
AN-SS-302	Phenol	MS/MSD and BS	39 UG
AN-SS-302	1,4-Dichlorobenzene	MS/MSD and BS	20 UG
AN-SS-302	1,2,4-Trichlorobenzene	MS/MSD and BS	20 UG
AN-SS-302	Pentachlorophenol	MS/MSD and BS	98 UG
AN-SS-303	Phenol	MS/MSD and BS	39 UG
AN-SS-303	1,4-Dichlorobenzene	MS/MSD and BS	20 UG
AN-SS-303	1,2,4-Trichlorobenzene	MS/MSD and BS	20 UG

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Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-303	Pentachlorophenol	MS/MSD and BS	99 UG
AN-SS-304	Phenol	MS/MSD and BS	38 UG
AN-SS-304	1,4-Dichlorobenzene	MS/MSD and BS	19 UG
AN-SS-304	1,2,4-Trichlorobenzene	MS/MSD and BS	19 UG
AN-SS-304	Pentachlorophenol	MS/MSD and BS	95 UG
AN-SS-305	Phenol	MS/MSD and BS	52 G
AN-SS-305	1,4-Dichlorobenzene	MS/MSD and BS	22 UG
AN-SS-305	1,2,4-Trichlorobenzene	MS/MSD and BS	22 UG
AN-SS-305	Pentachlorophenol	MS/MSD and BS	110 UG
AN-SS-306	Phenol	MS/MSD and BS	58 G
AN-SS-306	1,4-Dichlorobenzene	MS/MSD and BS	19 UG
AN-SS-306	1,2,4-Trichlorobenzene	MS/MSD and BS	19 UG
AN-SS-306	Pentachlorophenol	MS/MSD and BS	97 UG
AN-SC-80	Pyrene	MS/MSD	1200 G
AN-SC-81	Indeno(1,2,3-cd)pyrene	Internal standard	290 L
AN-SC-81	Dibenz(a,h)anthracene	Internal standard	110 L
AN-SC-81	Benzo(g,h,i)perylene	Internal standard	210 L
AN-SC-82	Indeno(1,2,3-cd)pyrene	Internal standard	220 L
AN-SC-82	Dibenz(a,h)anthracene	Internal standard	77 L
AN-SC-82	Benzo(g,h,i)perylene	Internal standard	140 L
AN-SS-301	Fluoranthene	Linear range exceeded	5500 R
AN-SS-301	Pyrene	Linear range exceeded	9500 R
AN-SS-301	Benzo(a)anthracene	Linear range exceeded	5000 R
AN-SS-301	Chrysene	Linear range exceeded	4900 R
AN-SS-301	Benzo(b)fluoranthene	Linear range exceeded	5300 R
AN-SS-301	Benzo(a)pyrene	Linear range exceeded	6000 R
AN-SS-301	Indeno(1,2,3-cd)pyrene	Linear range exceeded	3700 R
AN-SS-304	Phenanthrene	Linear range exceeded	2000 R
AN-SS-304	Fluoranthene	Linear range exceeded	3100 R
AN-SS-304	Benzo(a)pyrene	Linear range exceeded	1700 R
AN-SS-47	bis(2-Ethylhexyl)phthalate	Linear range exceeded	22000 R
AN-SC-81	Pyrene	Linear range exceeded	1900 R
AN-SC-82	Pyrene	Linear range exceeded	1700 R
AN-SC-82	Chrysene	Linear range exceeded	1900 R
AN-SS-301DL	All analytes for which the dilution was not performed.	Excessive dilution	R

Quality By Design

Associated Samples	Analyte Affected	Type of Deviation	Qualifier
AN-SS-304DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SS-47DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SC-81DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SC-82DL	All analytes for which the dilution was not performed.	Excessive dilution	R
AN-SC-80 MS	Total Organic Carbon	Calculation Error	79.0

H. Revised Laboratory Reports

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Sample No: AN-SS-304

Lab Sample ID: Z036A
LIMS ID: 98-22425
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/19/98

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 52.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 34.2%
pH: 7.6

CAS Number	Analyte	ug/kg		
108-95-2	Phenol	38	U	G
106-46-7	1,4-Dichlorobenzene	19	U	G
100-51-6	Benzyl Alcohol	95	U	
95-50-1	1,2-Dichlorobenzene	19	U	
95-48-7	2-Methylphenol	38	U	
106-44-5	**4-Methylphenol**	**120**		
105-67-9	2,4-Dimethylphenol	57	U	
65-85-0	Benzoic Acid	190	U	
120-82-1	1,2,4-Trichlorobenzene	19	U	G
91-20-3	**Naphthalene**	**710**		
87-68-3	Hexachlorobutadiene	38	U	
91-57-6	**2-Methylnaphthalene**	**160**		
131-11-3	Dimethylphthalate	19	U	
208-96-8	**Acenaphthylene**	**220**		
83-32-9	**Acenaphthene**	**100**		
132-64-9	**Dibenzofuran**	**120**		
84-66-2	Diethylphthalate	19	U	
86-73-7	**Fluorene**	**220**		
86-30-6	N-Nitrosodiphenylamine	19	U	
118-74-1	Hexachlorobenzene	19	U	
87-86-5	Pentachlorophenol	95	U	G
85-01-8	**Phenanthrene**	**2,000**	**E**	R
120-12-7	**Anthracene**	**480**		
84-74-2	Di-n-Butylphthalate	19	U	
206-44-0	**Fluoranthene**	**3,100**	**E**	R

FMP 1-19-99

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z036A
LIMS ID: 98-22425
Matrix: Sediment
Data Release Authorized: MM
Reported: 11/19/98

Sample No: AN-SS-304

QC Report No: Z036-Anchor Environmental
Project: Starr Rock
98-007-03
Date Sampled: 10/26/98
Date Received: 10/28/98

Date extracted: 11/03/98
Date analyzed: 11/10/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 52.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 34.2%
pH: 7.6

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	3,300 E
85-68-7	Butylbenzylphthalate	19 U
56-55-3	**Benzo(a)anthracene**	1,400
117-81-7	**bis(2-Ethylhexyl)phthalate**	~~76~~ E
218-01-9	**Chrysene**	1,400
117-84-0	Di-n-Octyl phthalate	19 U
205-99-2	**Benzo(b)fluoranthene**	1,500
207-08-9	**Benzo(k)fluoranthene**	1,200
50-32-8	**Benzo(a)pyrene**	1,700 E R
193-39-5	**Indeno(1,2,3-cd)pyrene**	1,200
53-70-3	**Dibenz(a,h)anthracene**	300
191-24-2	**Benzo(g,h,i)perylene**	980

RP 1.19.99
TD 2/15/99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	62.4%	d5-Phenol	66.8%
2-Fluorobiphenyl	58.0%	2-Fluorophenol	67.9%
d14-p-Terphenyl	77.7%	2,4,6-Tribromophenol	81.5%
d4-1,2-Dichlorobenzene	54.5%	d4-2-Chlorophenol	64.2%

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Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z037B
LIMS ID: 98-22432
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SS-45

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 59.8%
pH: 7.6

CAS Number	Analyte	ug/kg
108-95-2	Phenol	40 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	99 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	40 U
106-44-5	**4-Methylphenol**	**220**
105-67-9	2,4-Dimethylphenol	60 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**100**
87-68-3	Hexachlorobutadiene	40 U
91-57-6	**2-Methylnaphthalene**	**83**
131-11-3	**Dimethylphthalate**	**23**
208-96-8	**Acenaphthylene**	**21**
83-32-9	**Acenaphthene**	**31**
132-64-9	**Dibenzofuran**	**100**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**70**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	99 U
85-01-8	**Phenanthrene**	**270**
120-12-7	**Anthracene**	**170**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**660**

KJ 1.2099

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Sample No: AN-SS-45

Lab Sample ID: Z037B
LIMS ID: 98-22432
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 59.8%
pH: 7.6

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,500	
85-68-7	Butylbenzylphthalate	35	
56-55-3	Benzo(a)anthracene	370	
117-81-7	bis(2-Ethylhexyl)phthalate	1,400	
218-01-9	Chrysene	520	
117-84-0	Di-n-Octyl phthalate	26	E
205-99-2	Benzo(b)fluoranthene	390	
207-08-9	Benzo(k)fluoranthene	340	
50-32-8	Benzo(a)pyrene	230	
193-39-5	Indeno(1,2,3-cd)pyrene	110	
53-70-3	Dibenz(a,h)anthracene	51	
191-24-2	Benzo(g,h,i)perylene	88	

KJD 1-18-99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	50.0%	d5-Phenol	44.0%
2-Fluorobiphenyl	53.0%	2-Fluorophenol	53.2%
d14-p-Terphenyl	84.8%	2,4,6-Tribromophenol	69.1%
d4-1,2-Dichlorobenzene	45.6%	d4-2-Chlorophenol	45.3%

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Sample No: AN-SS-47

Lab Sample ID: Z037C
LIMS ID: 98-22433
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 7.24 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 30.8%
pH: 7.7

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	280 U	G
106-46-7	1,4-Dichlorobenzene	140 U	
100-51-6	Benzyl Alcohol	690 U	
95-50-1	1,2-Dichlorobenzene	140 U	
95-48-7	2-Methylphenol	280 U	G
106-44-5	4-Methylphenol	140 U	G
105-67-9	2,4-Dimethylphenol	410 U	G
65-85-0	Benzoic Acid	1,400 U	G
120-82-1	1,2,4-Trichlorobenzene	140 U	
91-20-3	Naphthalene	140 U	
87-68-3	Hexachlorobutadiene	280 U	
91-57-6	2-Methylnaphthalene	140 U	
131-11-3	Dimethylphthalate	140 U	
208-96-8	Acenaphthylene	140 U	
83-32-9	Acenaphthene	140 U	
132-64-9	Dibenzofuran	140 U	
84-66-2	Diethylphthalate	140 U	
86-73-7	Fluorene	140 U	
86-30-6	N-Nitrosodiphenylamine	140 U	
118-74-1	Hexachlorobenzene	140 U	
87-86-5	Pentachlorophenol	690 U	G
85-01-8	**Phenanthrene**	**480**	
120-12-7	**Anthracene**	**180**	
84-74-2	**Di-n-Butylphthalate**	**750**	
206-44-0	**Fluoranthene**	**3,100**	

KJD 1.20.99

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Lab Sample ID: Z037C
LIMS ID: 98-22433
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SS-47

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 7.24 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 30.8%
pH: 7.7

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	4,200	
85-68-7	Butylbenzylphthalate	140	U
56-55-3	**Benzo(a)anthracene**	490	
117-81-7	**bis(2-Ethylhexyl)phthalate**	22,000	E R
218-01-9	**Chrysene**	1,300	
117-84-0	Di-n-Octyl phthalate	140	U
205-99-2	**Benzo(b)fluoranthene**	700	
207-08-9	**Benzo(k)fluoranthene**	1,000	
50-32-8	**Benzo(a)pyrene**	440	
193-39-5	**Indeno(1,2,3-cd)pyrene**	230	
53-70-3	Dibenz(a,h)anthracene	140	U
191-24-2	**Benzo(g,h,i)perylene**	170	

kfj 1-2-99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	32.8%	d5-Phenol	26.1%
2-Fluorobiphenyl	46.3%	2-Fluorophenol	37.4%
d14-p-Terphenyl	84.6%	2,4,6-Tribromophenol	70.6%
d4-1,2-Dichlorobenzene	33.2%	d4-2-Chlorophenol	27.8%

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ORGANICS ANALYSIS DATA SHEET Sample No: AN-SS-47
Semivolatiles by GC/MS DILUTION
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Lab Sample ID: Z037C QC Report No: Z037-Anchor Environmental
LIMS ID: 98-22433 Project: WW ADDENDUM #3
Matrix: Sediment 98-030-01
Data Release Authorized: MW Date Sampled: 10/27/98
Reported: 11/17/98 Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/13/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 7.24 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:10
Percent Moisture: 30.8%
pH: 7.7

CAS Number	Analyte	ug/kg	
108-95-2	Phenol	2,800 U	R
106-46-7	1,4-Dichlorobenzene	1,400 U	
100-51-6	Benzyl Alcohol	6,900 U	
95-50-1	1,2-Dichlorobenzene	1,400 U	
95-48-7	2-Methylphenol	2,800 U	
106-44-5	4-Methylphenol	1,400 U	
105-67-9	2,4-Dimethylphenol	4,100 U	
65-85-0	Benzoic Acid	14,000 U	
120-82-1	1,2,4-Trichlorobenzene	1,400 U	
91-20-3	Naphthalene	1,400 U	
87-68-3	Hexachlorobutadiene	2,800 U	
91-57-6	2-Methylnaphthalene	1,400 U	
131-11-3	Dimethylphthalate	1,400 U	
208-96-8	Acenaphthylene	1,400 U	
83-32-9	Acenaphthene	1,400 U	
132-64-9	Dibenzofuran	1,400 U	
84-66-2	Diethylphthalate	1,400 U	
86-73-7	Fluorene	1,400 U	
86-30-6	N-Nitrosodiphenylamine	1,400 U	
118-74-1	Hexachlorobenzene	1,400 U	
87-86-5	Pentachlorophenol	6,900 U	
85-01-8	Phenanthrene	1,400 U	
120-12-7	Anthracene	1,400 U	
84-74-2	Di-n-Butylphthalate	1,400 U	
206-44-0	**Fluoranthene**	**3,500**	

KJD 1-20-99

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ORGANICS ANALYSIS DATA SHEET — **Sample No:** AN-SS-47
Semivolatiles by GC/MS — DILUTION
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Lab Sample ID: Z037C — QC Report No: Z037-Anchor Environmental
LIMS ID: 98-22433 — Project: WW ADDENDUM #3
Matrix: Sediment — 98-030-01
Data Release Authorized: MW — Date Sampled: 10/27/98
Reported: 11/17/98 — Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/13/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 7.24 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:10
Percent Moisture: 30.8%
pH: 7.7

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	**3,700**	R
85-68-7	Butylbenzylphthalate	1,400 U	↓
56-55-3	Benzo(a)anthracene	1,400 U	↓
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20,000**	
218-01-9	**Chrysene**	**1,500**	R
117-84-0	Di-n-Octyl phthalate	1,400 U	↓
205-99-2	Benzo(b)fluoranthene	1,400 U	↓
207-08-9	Benzo(k)fluoranthene	1,400 U	↓
50-32-8	Benzo(a)pyrene	1,400 U	↓
193-39-5	Indeno(1,2,3-cd)pyrene	1,400 U	↓
53-70-3	Dibenz(a,h)anthracene	1,400 U	↓
191-24-2	Benzo(g,h,i)perylene	1,400 U	↓

KD 1.20 99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	30.8%	d5-Phenol	32.0%
2-Fluorobiphenyl	50.4%	2-Fluorophenol	42.4%
d14-p-Terphenyl	67.2%	2,4,6-Tribromophenol	56.5%
d4-1,2-Dichlorobenzene	38.4%	d4-2-Chlorophenol	38.1%

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Lab Sample ID: Z037D
LIMS ID: 98-22434
Matrix: Sediment
Data Release Authorized:
Reported: 11/17/98

Sample No: AN-SS-70

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 60.2%
pH: 7.6

CAS Number	Analyte	ug/kg
108-95-2	Phenol	39 U
106-46-7	1,4-Dichlorobenzene	19 U
100-51-6	Benzyl Alcohol	96 U
95-50-1	1,2-Dichlorobenzene	19 U
95-48-7	2-Methylphenol	39 U
106-44-5	**4-Methylphenol**	**240**
105-67-9	2,4-Dimethylphenol	58 U
65-85-0	Benzoic Acid	190 U
120-82-1	1,2,4-Trichlorobenzene	19 U
91-20-3	**Naphthalene**	**160**
87-68-3	Hexachlorobutadiene	39 U
91-57-6	**2-Methylnaphthalene**	**30**
131-11-3	Dimethylphthalate	19 U
208-96-8	**Acenaphthylene**	**20**
83-32-9	Acenaphthene	19 U
132-64-9	**Dibenzofuran**	**48**
84-66-2	Diethylphthalate	19 U
86-73-7	**Fluorene**	**26**
86-30-6	N-Nitrosodiphenylamine	19 U
118-74-1	Hexachlorobenzene	19 U
87-86-5	Pentachlorophenol	96 U
85-01-8	**Phenanthrene**	**170**
120-12-7	**Anthracene**	**40**
84-74-2	**Di-n-Butylphthalate**	**43**
206-44-0	**Fluoranthene**	**210**

KP 1.20.99

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
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Lab Sample ID: Z037D
LIMS ID: 98-22434
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SS-70

QC Report No: Z037-Anchor Environmental
Project: WW ADDENDUM #3
98-030-01
Date Sampled: 10/27/98
Date Received: 10/28/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 60.2%
pH: 7.6

CAS Number	Analyte	ug/kg
129-00-0	**Pyrene**	260
85-68-7	Butylbenzylphthalate	19 U
56-55-3	**Benzo(a)anthracene**	48
117-81-7	**bis(2-Ethylhexyl)phthalate**	150
218-01-9	**Chrysene**	74
117-84-0	Di-n-Octyl phthalate	19 U
205-99-2	**Benzo(b)fluoranthene**	48
207-08-9	**Benzo(k)fluoranthene**	77
50-32-8	**Benzo(a)pyrene**	49
193-39-5	**Indeno(1,2,3-cd)pyrene**	32
53-70-3	Dibenz(a,h)anthracene	19 U
191-24-2	**Benzo(g,h,i)perylene**	31

KJO 1.22.99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	46.9%	d5-Phenol	38.1%
2-Fluorobiphenyl	53.1%	2-Fluorophenol	44.1%
d14-p-Terphenyl	89.6%	2,4,6-Tribromophenol	58.6%
d4-1,2-Dichlorobenzene	36.9%	d4-2-Chlorophenol	36.5%

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063B
LIMS ID: 98-22608
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-80
QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.8 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:2
Percent Moisture: 63.0%
pH: 7.5

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,200	G
85-68-7	Butylbenzylphthalate	62	M
56-55-3	Benzo(a)anthracene	480	
117-81-7	bis(2-Ethylhexyl)phthalate	770	
218-01-9	Chrysene	530	
117-84-0	Di-n-Octyl phthalate	39	U
205-99-2	Benzo(b)fluoranthene	440	
207-08-9	Benzo(k)fluoranthene	380	
50-32-8	Benzo(a)pyrene	280	
193-39-5	Indeno(1,2,3-cd)pyrene	140	
53-70-3	Dibenz(a,h)anthracene	66	
191-24-2	Benzo(g,h,i)perylene	110	

RD 1.20 GF

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	48.3%	d5-Phenol	49.3%
2-Fluorobiphenyl	59.0%	2-Fluorophenol	52.6%
d14-p-Terphenyl	98.6%	2,4,6-Tribromophenol	86.0%
d4-1,2-Dichlorobenzene	33.0%	d4-2-Chlorophenol	50.0%

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Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063C
LIMS ID: 98-22609
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-71

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.4%
pH: 7.3

CAS Number	Analyte	ug/kg
108-95-2	Phenol	40 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	99 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	40 U
106-44-5	**4-Methylphenol**	**290**
105-67-9	2,4-Dimethylphenol	60 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**170**
87-68-3	Hexachlorobutadiene	40 U
91-57-6	**2-Methylnaphthalene**	**66**
131-11-3	Dimethylphthalate	20 U
208-96-8	**Acenaphthylene**	**23**
83-32-9	**Acenaphthene**	**120**
132-64-9	**Dibenzofuran**	**150**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**150**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	99 U
85-01-8	**Phenanthrene**	**590**
120-12-7	**Anthracene**	**180**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**870**

KJS 1.20.99

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: AN-SC-71

Page 2 of 2
Lab Sample ID: Z063C
LIMS ID: 98-22609
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.4%
pH: 7.3

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,200	
85-68-7	Butylbenzylphthalate	20	U
56-55-3	Benzo(a)anthracene	380	
117-81-7	bis(2-Ethylhexyl)phthalate	120	E
218-01-9	Chrysene	520	
117-84-0	Di-n-Octyl phthalate	20	U
205-99-2	Benzo(b)fluoranthene	300	
207-08-9	Benzo(k)fluoranthene	280	
50-32-8	Benzo(a)pyrene	230	
193-39-5	Indeno(1,2,3-cd)pyrene	93	
53-70-3	Dibenz(a,h)anthracene	33	
191-24-2	Benzo(g,h,i)perylene	60	

KCP 1-12-99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	47.9%	d5-Phenol	52.9%
2-Fluorobiphenyl	57.0%	2-Fluorophenol	50.7%
d14-p-Terphenyl	85.5%	2,4,6-Tribromophenol	76.4%
d4-1,2-Dichlorobenzene	33.1%	d4-2-Chlorophenol	43.9%

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063D
LIMS ID: 98-22610
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-72

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.1%
pH: 7.1

CAS Number	Analyte	ug/kg
108-95-2	Phenol	39 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	99 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	39 U
106-44-5	**4-Methylphenol**	**240**
105-67-9	2,4-Dimethylphenol	59 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**130**
87-68-3	Hexachlorobutadiene	39 U
91-57-6	**2-Methylnaphthalene**	**57**
131-11-3	Dimethylphthalate	20 U
208-96-8	**Acenaphthylene**	**22**
83-32-9	**Acenaphthene**	**52**
132-64-9	**Dibenzofuran**	**100**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**110**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	99 U
85-01-8	**Phenanthrene**	**390**
120-12-7	**Anthracene**	**270**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**680**

KD 1.25.99

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063D
LIMS ID: 98-22610
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-72

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 61.1%
pH: 7.1

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	1,100	
85-68-7	Butylbenzylphthalate	20	U
56-55-3	**Benzo(a)anthracene**	390	
117-81-7	**bis(2-Ethylhexyl)phthalate**	140	E
218-01-9	**Chrysene**	590	
117-84-0	Di-n-Octyl phthalate	20	U
205-99-2	**Benzo(b)fluoranthene**	290	
207-08-9	**Benzo(k)fluoranthene**	220	
50-32-8	**Benzo(a)pyrene**	200	
193-39-5	**Indeno(1,2,3-cd)pyrene**	89	
53-70-3	**Dibenz(a,h)anthracene**	36	
191-24-2	**Benzo(g,h,i)perylene**	56	

RPD 1.20 9C

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	43.4%	d5-Phenol	45.4%
2-Fluorobiphenyl	53.9%	2-Fluorophenol	46.2%
d14-p-Terphenyl	72.0%	2,4,6-Tribromophenol	72.6%
d4-1,2-Dichlorobenzene	33.5%	d4-2-Chlorophenol	39.3%

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063E
LIMS ID: 98-22611
Matrix: Sediment
Data Release Authorized:
Reported: 11/17/98

Sample No: AN-SC-73
QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.5%
pH: 7.2

CAS Number	Analyte	ug/kg
108-95-2	Phenol	39 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	99 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	39 U
106-44-5	**4-Methylphenol**	**170**
105-67-9	2,4-Dimethylphenol	59 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**90**
87-68-3	Hexachlorobutadiene	39 U
91-57-6	**2-Methylnaphthalene**	**43**
131-11-3	Dimethylphthalate	20 U
208-96-8	Acenaphthylene	20 U
83-32-9	**Acenaphthene**	**45**
132-64-9	**Dibenzofuran**	**79**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**76**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	99 U
85-01-8	**Phenanthrene**	**300**
120-12-7	**Anthracene**	**130**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**600**

KJD 12/9/98

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RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063E
LIMS ID: 98-22611
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-73

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.7 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.5%
pH: 7.2

CAS Number	Analyte	ug/kg	
129-00-0	**Pyrene**	690	
85-68-7	Butylbenzylphthalate	20	U
56-55-3	**Benzo(a)anthracene**	250	
117-81-7	**bis(2-Ethylhexyl)phthalate**	180	E
218-01-9	**Chrysene**	320	
117-84-0	Di-n-Octyl phthalate	20	U
205-99-2	**Benzo(b)fluoranthene**	220	
207-08-9	**Benzo(k)fluoranthene**	180	
50-32-8	**Benzo(a)pyrene**	170	
193-39-5	**Indeno(1,2,3-cd)pyrene**	76	
53-70-3	**Dibenz(a,h)anthracene**	28	
191-24-2	**Benzo(g,h,i)perylene**	54	

AP 11/25

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	44.6%	d5-Phenol	40.7%
2-Fluorobiphenyl	55.0%	2-Fluorophenol	46.3%
d14-p-Terphenyl	83.5%	2,4,6-Tribromophenol	76.3%
d4-1,2-Dichlorobenzene	34.5%	d4-2-Chlorophenol	36.9%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063F
LIMS ID: 98-22612
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-77

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.6 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.6%
pH: 7.5

CAS Number	Analyte	ug/kg
108-95-2	Phenol	40 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	99 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	40 U
106-44-5	**4-Methylphenol**	**140**
105-67-9	2,4-Dimethylphenol	59 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**100**
87-68-3	Hexachlorobutadiene	40 U
91-57-6	**2-Methylnaphthalene**	**51**
131-11-3	Dimethylphthalate	20 U
208-96-8	Acenaphthylene	20 U
83-32-9	**Acenaphthene**	**41**
132-64-9	**Dibenzofuran**	**83**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**72**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	99 U
85-01-8	**Phenanthrene**	**230**
120-12-7	**Anthracene**	**120**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**730**

KJ 1.20 99

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: AN-SC-77

Lab Sample ID: Z063F
LIMS ID: 98-22612
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.6 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.6%
pH: 7.5

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	940	
85-68-7	Butylbenzylphthalate	20 U	
56-55-3	Benzo(a)anthracene	280	
117-81-7	bis(2-Ethylhexyl)phthalate	190	E
218-01-9	Chrysene	390	
117-84-0	Di-n-Octyl phthalate	20 U	
205-99-2	Benzo(b)fluoranthene	220	
207-08-9	Benzo(k)fluoranthene	230	
50-32-8	Benzo(a)pyrene	190	
193-39-5	Indeno(1,2,3-cd)pyrene	93	
53-70-3	Dibenz(a,h)anthracene	35	
191-24-2	Benzo(g,h,i)perylene	58	

FAD 11.18.98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	47.1%	d5-Phenol	44.6%
2-Fluorobiphenyl	58.4%	2-Fluorophenol	50.0%
d14-p-Terphenyl	84.4%	2,4,6-Tribromophenol	79.6%
d4-1,2-Dichlorobenzene	37.1%	d4-2-Chlorophenol	38.5%

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: AN-SC-82

Page 1 of 2
Lab Sample ID: Z063H
LIMS ID: 98-22614
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 64.7%
pH: 9.5

CAS Number	Analyte	ug/kg
108-95-2	Phenol	39 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	98 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	39 U
106-44-5	**4-Methylphenol**	**84**
105-67-9	2,4-Dimethylphenol	59 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**80**
87-68-3	Hexachlorobutadiene	39 U
91-57-6	**2-Methylnaphthalene**	**58**
131-11-3	Dimethylphthalate	20 U
208-96-8	Acenaphthylene	20 U
83-32-9	**Acenaphthene**	**47**
132-64-9	**Dibenzofuran**	**90**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**180**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	98 U
85-01-8	**Phenanthrene**	**870**
120-12-7	**Anthracene**	**560**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**660**

KJD 1.20.99

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: AN-SC-82

Lab Sample ID: Z063H
LIMS ID: 98-22614
Matrix: Sediment
Data Release Authorized:
Reported: 11/17/98

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 64.7%
pH: 9.5

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,700 E	R
85-68-7	Butylbenzylphthalate	110 M	
56-55-3	Benzo(a)anthracene	730	
117-81-7	bis(2-Ethylhexyl)phthalate	1,300	E B
218-01-9	Chrysene	1,900 E	R
117-84-0	Di-n-Octyl phthalate	58	E
205-99-2	Benzo(b)fluoranthene	790	
207-08-9	Benzo(k)fluoranthene	360	
50-32-8	Benzo(a)pyrene	440	
193-39-5	Indeno(1,2,3-cd)pyrene	220	L
53-70-3	Dibenz(a,h)anthracene	77	L
191-24-2	Benzo(g,h,i)perylene	140	L

AJD 1.17.99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	54.3%	d5-Phenol	53.6%
2-Fluorobiphenyl	64.1%	2-Fluorophenol	50.5%
d14-p-Terphenyl	109%	2,4,6-Tribromophenol	70.6%
d4-1,2-Dichlorobenzene	40.7%	d4-2-Chlorophenol	45.5%

FORM-1

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063H
LIMS ID: 98-22614
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-82
DILUTION

QC Report No: Z063-
Project:

Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:5
Percent Moisture: 64.7%
pH: 9.5

CAS Number	Analyte	ug/kg
108-95-2	Phenol	200 U
106-46-7	1,4-Dichlorobenzene	98 U
100-51-6	Benzyl Alcohol	490 U
95-50-1	1,2-Dichlorobenzene	98 U
95-48-7	2-Methylphenol	200 U
106-44-5	4-Methylphenol	98 U
105-67-9	2,4-Dimethylphenol	290 U
65-85-0	Benzoic Acid	980 U
120-82-1	1,2,4-Trichlorobenzene	98 U
91-20-3	Naphthalene	98 U
87-68-3	Hexachlorobutadiene	200 U
91-57-6	2-Methylnaphthalene	98 U
131-11-3	Dimethylphthalate	98 U
208-96-8	Acenaphthylene	98 U
83-32-9	Acenaphthene	98 U
132-64-9	Dibenzofuran	98 U
84-66-2	Diethylphthalate	98 U
86-73-7	**Fluorene**	**190**
86-30-6	N-Nitrosodiphenylamine	98 U
118-74-1	Hexachlorobenzene	98 U
87-86-5	Pentachlorophenol	490 U
85-01-8	**Phenanthrene**	**810**
120-12-7	**Anthracene**	**600**
84-74-2	Di-n-Butylphthalate	98 U
206-44-0	**Fluoranthene**	**1,100**

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KJO 1.20.99

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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063H
LIMS ID: 98-22614
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-82
DILUTION

QC Report No: Z063-
Project:

Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 51.3 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:5
Percent Moisture: 64.7%
pH: 9.5

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,200	
85-68-7	Butylbenzylphthalate	200 Y	R
56-55-3	Benzo(a)anthracene	950	R
117-81-7	bis(2-Ethylhexyl)phthalate	1,700	
218-01-9	Chrysene	2,200	R
117-84-0	Di-n-Octyl phthalate	98	R
205-99-2	Benzo(b)fluoranthene	600	R
207-08-9	Benzo(k)fluoranthene	700	
50-32-8	Benzo(a)pyrene	480	
193-39-5	Indeno(1,2,3-cd)pyrene	240	
53-70-3	Dibenz(a,h)anthracene	100	
191-24-2	Benzo(g,h,i)perylene	210	

MD 11.20.98

MD 11.18.98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	51.8%	d5-Phenol	37.9%
2-Fluorobiphenyl	58.2%	2-Fluorophenol	57.1%
d14-p-Terphenyl	75.2%	2,4,6-Tribromophenol	84.5%
d4-1,2-Dichlorobenzene	42.6%	d4-2-Chlorophenol	45.9%

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Sample No: AN-SC-81

Lab Sample ID: Z063I
LIMS ID: 98-22615
Matrix: Sediment
Data Release Authorized: MA
Reported: 11/17/98

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.9 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.4%
pH: 7.6

CAS Number	Analyte	ug/kg
108-95-2	Phenol	39 U
106-46-7	1,4-Dichlorobenzene	20 U
100-51-6	Benzyl Alcohol	98 U
95-50-1	1,2-Dichlorobenzene	20 U
95-48-7	2-Methylphenol	39 U
106-44-5	**4-Methylphenol**	**89**
105-67-9	2,4-Dimethylphenol	59 U
65-85-0	Benzoic Acid	200 U
120-82-1	1,2,4-Trichlorobenzene	20 U
91-20-3	**Naphthalene**	**93**
87-68-3	Hexachlorobutadiene	39 U
91-57-6	**2-Methylnaphthalene**	**55**
131-11-3	**Dimethylphthalate**	**25**
208-96-8	**Acenaphthylene**	**20**
83-32-9	**Acenaphthene**	**64**
132-64-9	**Dibenzofuran**	**91**
84-66-2	Diethylphthalate	20 U
86-73-7	**Fluorene**	**94**
86-30-6	N-Nitrosodiphenylamine	20 U
118-74-1	Hexachlorobenzene	20 U
87-86-5	Pentachlorophenol	98 U
85-01-8	**Phenanthrene**	**510**
120-12-7	**Anthracene**	**220**
84-74-2	Di-n-Butylphthalate	20 U
206-44-0	**Fluoranthene**	**870**

KJ 1.20.99

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063I
LIMS ID: 98-22615
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-81
QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.9 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 62.4%
pH: 7.6

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,900 E	R
85-68-7	Butylbenzylphthalate	160 M	
56-55-3	Benzo(a)anthracene	510	
117-81-7	bis(2-Ethylhexyl)phthalate	1,400	EB
218-01-9	Chrysene	870	
117-84-0	Di-n-Octyl phthalate	20 U	
205-99-2	Benzo(b)fluoranthene	830	
207-08-9	Benzo(k)fluoranthene	460	
50-32-8	Benzo(a)pyrene	560	
193-39-5	Indeno(1,2,3-cd)pyrene	290	L
53-70-3	Dibenz(a,h)anthracene	110	L
191-24-2	Benzo(g,h,i)perylene	210	L

KW 1-20-99

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	53.1%	d5-Phenol	50.9%
2-Fluorobiphenyl	65.4%	2-Fluorophenol	49.6%
d14-p-Terphenyl	110%	2,4,6-Tribromophenol	72.4%
d4-1,2-Dichlorobenzene	40.6%	d4-2-Chlorophenol	42.1%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET — Sample [illegible]AN-SC-81
Semivolatiles by GC/MS — DILUTION
Page 1 of 2
Lab Sample ID: Z063I — QC Report No: Z063-
LIMS ID: 98-22615 — Project:
Matrix: Sediment
Data Release Authorized: hmw — Date Sampled:
Reported: 11/17/98 — Date Received: 11/03/98

Date extracted: 11/04/98 — Sample Amount: 50.9 g-dry-wt
Date analyzed: 11/12/98 — Final Extract Volume: 1.0 mL
Instrument: nt1 — Dilution Factor: 1:5
GPC Cleanup: YES — Percent Moisture: 62.4%
pH: 7.6

CAS Number	Analyte	ug/kg
108-95-2	Phenol	200 U
106-46-7	1,4-Dichlorobenzene	98 U
100-51-6	Benzyl Alcohol	490 U
95-50-1	1,2-Dichlorobenzene	98 U
95-48-7	2-Methylphenol	200 U
106-44-5	4-Methylphenol	98 U
105-67-9	2,4-Dimethylphenol	290 U
65-85-0	Benzoic Acid	980 U
120-82-1	1,2,4-Trichlorobenzene	98 U
91-20-3	Naphthalene	98 U
87-68-3	Hexachlorobutadiene	200 U
91-57-6	2-Methylnaphthalene	98 U
131-11-3	Dimethylphthalate	98 U
208-96-8	Acenaphthylene	98 U
83-32-9	Acenaphthene	98 U
132-64-9	**Dibenzofuran**	100
84-66-2	Diethylphthalate	98 U
86-73-7	**Fluorene**	110
86-30-6	N-Nitrosodiphenylamine	98 U
118-74-1	Hexachlorobenzene	98 U
87-86-5	Pentachlorophenol	490 U
85-01-8	**Phenanthrene**	500
120-12-7	**Anthracene**	230
84-74-2	Di-n-Butylphthalate	98 U
206-44-0	**Fluoranthene**	1,500

RD 1.20 99

FORM-1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS

Lab Sample ID: Z063I
LIMS ID: 98-22615
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-81
DILUTION

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/12/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 50.9 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:5
Percent Moisture: 62.4%
pH: 7.6

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,700	
85-68-7	Butylbenzylphthalate	200	Y R
56-55-3	Benzo(a)anthracene	690	
117-81-7	bis(2-Ethylhexyl)phthalate	1,900	
218-01-9	Chrysene	890	
117-84-0	Di-n-Octyl phthalate	98	U
205-99-2	Benzo(b)fluoranthene	550	
207-08-9	Benzo(k)fluoranthene	740	
50-32-8	Benzo(a)pyrene	500	
193-39-5	Indeno(1,2,3-cd)pyrene	300	
53-70-3	Dibenz(a,h)anthracene	130	
191-24-2	Benzo(g,h,i)perylene	220	

RJO 1·20·98

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	48.4%	d5-Phenol	36.9%
2-Fluorobiphenyl	61.2%	2-Fluorophenol	58.3%
d14-p-Terphenyl	78.0%	2,4,6-Tribromophenol	89.2%
d4-1,2-Dichlorobenzene	48.4%	d4-2-Chlorophenol	46.3%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 1 of 2
Lab Sample ID: Z063J
LIMS ID: 98-22616
Matrix: Sediment
Data Release Authorized:
Reported: 11/17/98

Sample No: AN-SC-37
QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 52.6 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 50.1%
pH: 7.4

CAS Number	Analyte	ug/kg
108-95-2	Phenol	38 U
106-46-7	1,4-Dichlorobenzene	19 U
100-51-6	Benzyl Alcohol	95 U
95-50-1	1,2-Dichlorobenzene	19 U
95-48-7	2-Methylphenol	38 U
106-44-5	**4-Methylphenol**	**200**
105-67-9	2,4-Dimethylphenol	57 U
65-85-0	Benzoic Acid	190 U
120-82-1	1,2,4-Trichlorobenzene	19 U
91-20-3	**Naphthalene**	**200**
87-68-3	Hexachlorobutadiene	38 U
91-57-6	**2-Methylnaphthalene**	**170**
131-11-3	**Dimethylphthalate**	**41**
208-96-8	**Acenaphthylene**	**30**
83-32-9	**Acenaphthene**	**94**
132-64-9	**Dibenzofuran**	**140**
84-66-2	Diethylphthalate	19 U
86-73-7	**Fluorene**	**130**
86-30-6	N-Nitrosodiphenylamine	19 U
118-74-1	Hexachlorobenzene	19 U
87-86-5	Pentachlorophenol	95 U
85-01-8	**Phenanthrene**	**470**
120-12-7	**Anthracene**	**170**
84-74-2	**Di-n-Butylphthalate**	**34**
206-44-0	**Fluoranthene**	**620**

FORM-1

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by GC/MS
Page 2 of 2
Lab Sample ID: Z063J
LIMS ID: 98-22616
Matrix: Sediment
Data Release Authorized: MW
Reported: 11/17/98

Sample No: AN-SC-37

QC Report No: Z063-
Project:
Date Sampled:
Date Received: 11/03/98

Date extracted: 11/04/98
Date analyzed: 11/11/98
Instrument: nt1
GPC Cleanup: YES

Sample Amount: 52.6 g-dry-wt
Final Extract Volume: 1.0 mL
Dilution Factor: 1:1
Percent Moisture: 50.1%
pH: 7.4

CAS Number	Analyte	ug/kg	
129-00-0	Pyrene	1,400	
85-68-7	Butylbenzylphthalate	56	
56-55-3	Benzo(a)anthracene	390	
117-81-7	bis(2-Ethylhexyl)phthalate	860	EB
218-01-9	Chrysene	520	
117-84-0	Di-n-Octyl phthalate	19	U
205-99-2	Benzo(b)fluoranthene	480	
207-08-9	Benzo(k)fluoranthene	350	
50-32-8	Benzo(a)pyrene	340	
193-39-5	Indeno(1,2,3-cd)pyrene	170	
53-70-3	Dibenz(a,h)anthracene	59	
191-24-2	Benzo(g,h,i)perylene	120	

180 i.conf

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	51.0%	d5-Phenol	49.1%
2-Fluorobiphenyl	61.6%	2-Fluorophenol	47.9%
d14-p-Terphenyl	79.9%	2,4,6-Tribromophenol	71.9%
d4-1,2-Dichlorobenzene	40.5%	d4-2-Chlorophenol	39.9%

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

Matrix: Sediment

QC Report No: Z063-
Project:
Date Received: 11/03/98

Data Release Authorized:
Reported: 11/16/98 Dr. M.A. Perkins

MATRIX SPIKE/MATRIX SPIKE DUP. QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 98-22608, Z063 B	Client Sample ID: AN-SC-80				
Total Organic Carbon MS	Percent	3.01	4.55	1.95	~~78.8%~~ 79.0
Total Organic Carbon MSD	Percent	3.01	4.47	2.15	67.9%

MS/MSD Recovery Limits: 75 - 125 %

Soil MS/MSD QA Report Page 1 for Z063 received 11/03/98

2/19/99 ld

Quality By Design

Attachment 1: Communication with the Laboratory

kathyg

From: Kim Magruder <kmagruder@anchorenv.com>
To: 'kathyg@willapabay.org'
Subject: Whatcom Waterway/Starr Rock Field QA Sample IDs
Date: Tuesday, January 05, 1999 2:20 PM

Kathy,
I can't remember if I sent the field QA sample IDs to you or not. I suspect not. The field QA sample IDs are as follows:

Field homogenization split sample: AN-SS-200 (collected at Station AN-SS-70)
Rinsate blank: AN-SC-201
Distilled water blank: AN-SC-202

Again, sorry for the delay! Kim.

Post-it® Fax Note 7671	Date 1-6-99	# of pages ▶ 2 1
To Lorraine	From Kathy	
Co./Dept. RBD	Co.	
Phone #	Phone #	
Fax # Left Voice Mail for Kim	Fax #	

1-1099

Analytical Resources, Incorporated
Analytical Chemists and Consultants

FAX

Date: January 28, 1999 1405
From: Mark D. Harris, ARI, 206/621-6490
RE: Z036, Anchor Environmental, Starr Rock

Pages (incl. cover): 1

To: Lorraine Davis, Quality By Design
808/969-9094

Comments:

Actually this is easier than I thought.

The burn weight number is entered into the instrument and that factor is taken into account when the Observed C number is recorded. This number is, in turn, blank corrected and converted to the correct units to reach the final result.

For example, on page 1250 for sample Z036A, the Observed C is 91,300. Subtract the mean blank concentration (listed in the upper third of the page) of 40 and you have the Corrected C value - 91,760 This is converted to percent which is reported as 9.2 on page 1204.

Let me know if you have any further questions.

Quality By Design
97 Puhili Street
Hilo, Hawaii 96720
Phone: (808) 969-9424
Fax: (808) 969-9094
e-mail: qbdhilo@gte.net

FACSIMILE TRANSMISSION SHEET

Date: February 20, 1999

Fax #: 206/621-7523

To: Analytical Resources, Incorporated

From: Lorraine Davis

Attn: Mark Harris

Total Pages,
including this one: 1

In our review of Rosa Environmental and Geotechnical Laboratory Grain Size data for your project/sample 98-22608 (Anchor Environmental Whatcom Waterway/Starr Rock) it appears that the grain size graph which corresponds to Sample AN-SC-80C does not accurately reflect the values found on the table for the same sample.

Will you request a review of this particular sample by Rosa Environmental and Geotechnical and if there is a discrepancy, that they reissue a corrected report and graph? The corrected report is to go to Anchor Environmental directly, and not to us.

If you have any questions, please don't hesitate to call me.

Thank you for you assistance.

********** XMT REPORT **********

Feb. 20 1999 12:14PM

NO.	OTHER FACSIMILE	START TIME	USAGE TIME	MODE	PAGES	RESULT	CODE
01	621 7523	Feb. 20 12:13PM	00'40	TX	01	OK	(00)

****

kathyg

From: kathyg <kathyg@willapabay.org>
To: Mark Harris <mark@arilabs.com>
Cc: Tom Davis <qbdhilo@gte.net>
Subject: Anchor Environmental - Whatcom Waterway
Date: Tuesday, December 29, 1998 11:03 AM

Hi Mark,

I am working for Quality By Design and they are doing the validation of the Whatcom Waterway project for Anchor Environmental. For your project numbers Z036 and Z037, I need the "true values" for the semivolatile analyses of the SRM. In SDG Z036 it is labeled Z036 SRM, in SDG Z037 it is labeled as sample SQ-1 (Z037-063).

Thanks, Kathy

Fax

Analytical Resources, Inc.
333 Ninth Ave North
Seattle, WA 98109-5187
Phone # (206) 621-6490
Fax # (206) 621-7523

From: Kit Gardner For Mark Harris

Send To:

Addressee Kathy G
Company Anchor Environmental

Fax #
Phone

Post-it® Fax Note 7673 | Date 12/31/98 | # of pages 4
To Kathy Gunderson
Fax # (360) 942-6060
From Kim Magruder
Phone # (206) 287-9130

Number of pages including this cover page 4

Date 12·30·98

Time 10:30 a.m.

Comments

ARI

Rev.4
07/08/94

0022F

Mark Harris

From: kathyg [kathyg@willapabay.org]
Sent: Tuesday, December 29, 1998 11:03 AM
To: Mark Harris
Cc: Tom Davis
Subject: Anchor Environmental - Whatcom Waterway

Hi Mark.

I am working for Quality By Design and they are doing the validation of the Whatcom Waterway project for Anchor Environmental. For your project numbers Z036 and Z037, I need the "true values" for the semivolatile analyses of the SRM. In SDG Z036 it is labeled Z036 SRM, in SDG Z037 it is labeled as sample SQ-1 (Z037-063).

Thanks, Kathy

287-9131

Sequim Bay Sediment Data w/o HPLC & Isotopic Data (From 6/96 to 7/96)

Compound	Expected ug/Kg	n	Average	Std Dev
Naphthalene	170	77	73	25.04
2-Methylnapthalene	170	75	89	33.05
1-Methylnapthalene	170	30	146	58.58
Biphenyl	849	25	753	469.07
2,6-Dimethylnapthalene	170	22	236	196.59
Acenaphthylene	170	58	50	22.01
Acenaphthene	170	79	95	23.09
Fluorene	170	80	98	23.65
Phenanthrene	170	81	156	78.99
Anthracene	170	81	111	37.69
1-Methylphenanthrene	170	23	227	313.19
Fluoranthene	170	80	143	79.34
Pyrene	170	81	132	74.29
Benzo(a)anthracene	170	81	115	41.03
Chrysene	170	80	128	52.57
Benzo(b)fluoranthene	170	66	132	124.91
Benzo(e)pyrene	340	24	326	129.33
Benzo(a)pyrene	170	81	120	47.15
Perylene	170	33	169	92.14
Indeno(123-cd)pyrene	170	10	64	60.85
Dibenz(ah)anthracene	170	79	101	32.87
Benzo(ghi)perylene	170	85	91	49.77
Hexachorobenzene	1.7	12	1.0	0.08
Lindane	1.7	25	1.3	0.86
Heptachlor	1.7	4	2.3	1.69
Aldrin	1.7	17	1.7	0.80
Heptachlorepoxide	1.7	21	1.6	1.02
alpha-Chlordane	8.5	16	4.0	1.10
trans-Nonachlor	1.7	12	0.9	0.10
Dieldrin	1.7	21	1.3	0.64
Mirex	3.4	12	1.1	0.29
o,p-DDE	3.4	16	1.3	1.06
p,p-DDE	3.4	17	1.6	1.37
o,p-DDD	3.4	13	1.2	0.82
p,p-DDD	3.4	16	1.5	0.99
o,p-DDT	3.4	16	0.9	0.60
p,p-DDT	3.4	4	2.5	1.78
Aroclor 1254	170	38	112	39.47
Chlorinated terphenyl	85	0		
Phenol	560	55	171	124.85
4-Methylphenol	509	55	161	114.22
Pentachlorophenol	509	54	351	317.10
alpha-BHC	1.7	12	3.1	2.53

Sequim Bay Sediment Data w/o HPLC & Isotopic Data (From 6/88 to 7/98)

Compound	Expected ug/Kg	n	Average	Std Dev
1,2-Dichlorobenzene	170	41	20	7.35
1,3-Dichlorobenzene	102	48	26	9.98
1,4-Dichlorobenzene	51	37	12	7.40
Nitrobenzene	170	2	38	53.03
2,6-Dinitrotoluene	170	0		
2,4-Dinitrotoluene	170	0		
4-Chlorophenylphenyl ether	170	40	102	22.87
4-Bromophenylphenyl ether	170	42	234	56.12
Isophorone	170	44	75	26.42
Hexachlorobutadiene	170	7	6	8.16
alpha-Endosulfan	3.4	6	26.5	3.89
beta-Endosulfan	3.4	8	20.0	4.17
Endrin	3.4	5	8.2	1.02
Tributyl tin chloride	170	21	116	140.17
Coprostanol	272	22	302	123.67
2-Methoxyphenol	509	8	103	119.56
Tetrachloroguiacol	509	13	456	274.71
Diethylhexyl phthalate	170	47	180	217.79
Diphenyl isophthalate	170	0		
Benzoic acid		36	291	227.98
Butylbenzyl phthalate		7	16	17.03
9H-Carbazole		4	24	28.59
Dibenzofuran		6	11	14.52
Benzyl alcohol		3	12	4.90
Nitrobenzene-d5		39	56	16.69
2-Fluorobiphenyl		39	70	16.69
Terphenyl-d14		47	114	120.34
Pyrene-d10		12	94	35.23
Phenol-d5		39	64	16.02
2-Fluorophenol		39	60	14.04
1,2-Dichlorobenzene-d4		19	63	14.17
2,4,6-Tribromophenol		20	73	17.83
Anthracene-d10		2	87	2.26
2,3,5,6-p-Cresol-d4		2	79	19.73
Fluoranthene-d10		2	105	24.32
Dibenz(ah)anthracene-d14		9	246	350.65
Acridine-d9		2	73	70.57
2-Chlorophenol-d4		17	56	14.63
Diphenyl-d10		6	77	29.56
Fluoranthene-d10		6	96	24.33

Anchor Env. Whatcom Waterway Phone log

⇒ Questions for Kim → Field dups?
↘ Target compound list (not whole 8270 list reported)
↘ RLs.
↘ QAPP criteria?
– True values for SRM
Combine E/C Results?
J(4) >50% Moisture – No Navy only

2-21 > Kim, Anchor 206-287-9130
VM

2 28 Kim, Anchor
VM

2-29-98 Kim, Anchor
she'll ⇒ e-mail Field dups. We will have to get SRM true values from ARI.
I will e-mail my questions to her.

3-4-98 Kim
VM: Field dup IDs?

1 19-99 Kim
RE: RLs Table 2 Attachment A, Last Section for dry wt – not TX corrected
Check on Metals?

·20 99 Kim

Use of R flag on dilution results ok

22-99 Kim 206·287-9130

RE: Different P & A criteria per site.

Starr Rock precision?

Starr Rock RPD ± 45

± 90 to field dup from whatcom water

Table 3 for WW - would be ok

→ ~~Sate~~ State what ST. D Qual allows

but already done using limits in workplan

Quality By Design
97 Puhili Street
Hilo, Hawaii 96720
Phone: (808) 969-9424
Fax: (808) 969-9094
e-mail: qbdhilo@gte.net

FACSIMILE TRANSMISSION SHEET

Date: February 20, 1999

Fax #: 206/621-7523

To: Analytical Resources, Incorporated

From: Lorraine Davis

Attn: Mark Harris

Total Pages,
including this one: 1

In our review of Rosa Environmental and Geotechnical Laboratory Grain Size data for your project/sample 98-22608 (Anchor Environmental Whatcom Waterway/Starr Rock) it appears that the grain size graph which corresponds to Sample AN-SC-80C does not accurately reflect the values found on the table for the same sample.

Will you request a review of this particular sample by Rosa Environmental and Geotechnical and if there is a discrepancy, that they reissue a corrected report and graph? The corrected report is to go to Anchor Environmental directly, and not to us.

If you have any questions, please don't hesitate to call me.

Thank you for you assistance.

Appendix B

Bioassay Data Validation Report

QUALITY ASSURANCE REVIEW

The following review is based on the guidelines set forth in Section 9, "Quality Assurance for Bioassays," in *Data Validation Guidance Manual for Selected Sediment Variables* (PTI 1989), on the Puget Sound Estuary Protocols (PSEP 1995), on methods described in the EVS Environment Consultants (EVS) Standard Operating Procedures (SOP; EVS 1995), and on the data quality objectives outlined in the Workplans (Anchor 1998a,b). The three data packages reviewed were for toxicity tests using the amphipod *Eohaustorius estuarius,* the bivalve larvae *Mytilus galloprovincialis*, and the juvenile polychaete *Neanthes arenaceodentata*. These toxicity tests were conducted on 23 sediment samples collected from Bellingham Bay and Carr Inlet, Washington. The three toxicity tests were conducted by EVS Bioassay Laboratory, North Vancouver, BC.

BIOASSAYS

The toxicity tests were each conducted on twenty test sediments, three reference sediments, and one negative control. The amphipod toxicity tests were performed in two test batches (one non-purge and one purge) initiated November 6 and 9, 1998, respectively. The bivalve larval development toxicity test was initiated on November 15, 1998, and the juvenile polychaete toxicity test was initiated on December 8, 1998. The measurement endpoints included mean percent survival and sediment avoidance for the amphipods, survival and percent abnormality for the bivalve larvae, and mortality and growth for the polychaetes.

SAMPLE COLLECTION, TRANSPORT, AND STORAGE

Samples were collected, transported, and stored in accordance with the procedures outlined in the work plans. The only deviation from the guidelines was that the temperatures of several coolers, when received by the EVS laboratory, were above the holding temperature range of 4° ± 2°C specified in the work plan. The temperatures recorded by the bioassay laboratory for the sample shipments ranged from 4°C to 10°C. Samples were stored in the dark at 4°C at the laboratory.

DATA COMPLETENESS AND FORMAT

Information regarding the responses, experimental conditions, control results, and conditions influencing data quality were included in the Whatcom Waterway Area and Boulevard Park/Starr Rock Area data packages.

DATA VALIDATION AND ASSESSMENT

Analytical Methods

Organism holding and acclimatization periods were carefully controlled. All tests were conducted using randomly distributed identical test chambers filled with the appropriate amount of test sediment and overlying water. During the testing, water quality measurements of salinity, temperature, pH, and ammonia were within the criteria outlined in the SOPs and in PSEP guidelines, with the exceptions discussed below.

Amphipod Test

The measured salinity of 30 ppt slightly exceeded the recommended range of 27-29 ppt for both the purge and non-purge amphipod tests. Purging requirements caused the amphipod holding time of 10 days to be exceeded by 1 day. Since the mean survival in the purge and non-purge test controls were both 98 percent, these deviations did not seem to affect the results of the test.

Juvenile Polychaete Test

The dissolved oxygen (DO) measurements fell below the recommended range of greater than 60 percent saturation (ASTM 1997). The low DO concentrations measured in some replicates are unlikely to have substantially affected the outcome of the test because aeration was checked daily and low DO could not have persisted for longer than 24 hours in any one jar. The pH measurements slightly exceeded the recommended range of 7.5 to 8.5 (EVS 1995). The low pH measurements may be the result of low DO concentrations.

Although two of the control replicates became anoxic, the dissolved concentrations were not correlated with survival or growth. Overall, the sound growth and survival across the reference and test sediments indicate that the performance of the test was acceptable.

Bivalve Larval Test

The mean percent/normal larvae in the seawater control met the criterion for test acceptability (PSEP 1995). All water quality parameters during the test were within acceptable ranges.

Test Precision

Replicate analyses, sample homogenization, and larval counts were adequately performed to assure test precision.

Positive Controls

Reference toxicant tests were conducted concurrently with each sediment toxicity test. The results of the reference toxicant tests for *E. estuarius* and *M. galloprovincialis* were within the confidence ranges established by the laboratory. The reference toxicant test for the *N. arenaceodentata* series was slightly lower than the laboratory range but was within the laboratory control limits (mean ± 3SD) of 9.6 ± 6.9 mg/L Cd.

Toxicity Test	Reference Toxicant Test	LC50/EC50 Measurement	Acceptable Range (mean ∀ 2SD)
E. estuarius (non-purge)	96-hour LC50 with cadmium	10.8 mg/L cadmium	8.0 ± 6.9 mg/L cadmium
E. estuarius (purge)	96-hour LC50 with cadmium	8.1 mg/L cadmium	8.3 ± 7.1 mg/L cadmium
M. galloprovincialis	48-hour EC50 with sodium dodecyl sulphate (SDS)	3.3 mg/L SDS	3.7 ± 1.6 mg/L SDS
N. arenaceodentata	96-hour LC50 with cadmium	4.2 mg/L cadmium	9.6 ± 4.7 mg/L cadmium

The results of reference toxicant test with *N. arenaceodentata* indicate that the batch of test organisms may be more sensitive than average. Therefore, given the sound growth and low mortality across the test and reference sediment there is strong confidence in the decision that none of the test sediments were toxic to *N. arenaceodentata.*

Negative Controls

A negative control test was conducted concurrently with each sediment toxicity test. The mean performance of the negative control samples for the *E. estuarius* and *M. galloprovincialis* toxicity tests met the Sediment Management Standards performance criteria, therefore indicating that the tests were valid.

For the *N. arenaceodentata* test, the mean survival in the negative control failed to meet the criteria of greater than 90 percent for the test acceptability outlined in PSEP (1995). The low control survival results may be attributed to anoxic conditions observed within the control sediments in the two replicates with the lowest survival. The color of these two replicates was dark grey as opposed to the pale cream color of the other three replicates. The mean survival of the three replicates that were not anoxic was 93 percent. Mean survival in the reference sediment samples ranged from 80 to 92 percent.

Growth responses in the negative control met the criterion of 0.38 mg/individual/day. The growth response in the references met the criterion that mean individual growth be at least 80 percent that of the control. Overall, given the low mortality and sound growth across the oxic control replicates and all of the reference sediment and test sediment samples, the test performance is acceptable.

Conclusion

The data from the Whatcom Waterway and Boulevard Park/Starr Rock Area sediment toxicity tests are complete with respect to the requirements outlined for this data quality review. The conclusion of this review is that the test results for *E. estuarius, M. galloprovincialis*, and *N. arenaceodentata* are usable as reported.

References

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Appendix C

Bioassay Data Report

February 1999

LABORATORY REPORT

ADDENDUM 3
Whatcom Waterway Area Project for Anchor Environmental (Project No. 98-030-01) Marine Sediment Toxicity Testing

PREPARED FOR:

EVS Solutions Inc.
Seattle, WA

PREPARED BY:

EVS ENVIRONMENT CONSULTANTS
North Vancouver, BC

EVS ENVIRONMENT CONSULTANTS

Our File: 9/852-01.1
Work Order: 9800686, 9800687, 9800688, 9800689

February 16, 1999

Mr. Dan Hennessy
EVS Solutions Inc.
200 West Mercer Street
Suite 401
Seattle, WA 98119
USA

Dear Mr. Hennessy:

Re: Addendum No. 3, Whatcom Waterway Project for Anchor Environmental (Project No. 98-030-01)

We are pleased to provide the results of the toxicity testing on marine sediment samples received by EVS Environment Consultants between October 28 and 30, 1998.

We have completed marine toxicity testing on fourteen (14) sediment samples and three (3) reference sediments collected between October 27 and 29, 1998.

This report includes data and results for testing using the estuarine amphipod, *Eohaustorius estuarius* (non-purge and purge testing), the juvenile polychaete, *Neanthes arenaceodentata*, and larvae of the mussel, *Mytilus galloprovincialis*. The test methods, results and raw data including statistical printouts are provided in the following report. If you have any questions or comments, please do not hesitate to contact the undersigned at (604) 986-4331.

Yours truly,

EVS ENVIRONMENT CONSULTANTS

Jennifer V. Stewart, B.Sc.
Manager, Laboratory Services

PAH/eca

195 Pemberton Avenue
North Vancouver, B.C.
Canada V7P 2R4
Tel: (604) 986-4331
Fax: (604) 662-8548
evs_consultants@mindlink.bc.ca

200 West Mercer Street
Suite 403
Seattle, WA 98119
Tel: (206) 217-9337
Fax: (206) 217-9343
evswa@halcyon.com