



STAGE II ENVIRONMENTAL RISK CHARACTERIZATION

Former Gloucester Manufactured Gas Plant Facility
Gloucester, Massachusetts

Prepared for:

National Grid
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Tables

Table 4-1
Benthic Macroinvertebrate Community Data
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Replicate	Number of Organisms	Shannon Diversity Index	Number of Taxa (Richness)	Evenness	Percent Dominant Taxon	Percent Polychaetes	Number of Amphipods
LC-HC1	1	210	0.74	6	0.41	73.3	76.2	2
	2	214	0.71	9	0.32	79.9	83.2	2
	3	215	0.73	9	0.33	75.3	78.1	1
LC-NE1	1	25	1.01	3	0.92	48.0	64.0	9
	2	75	1.84	12	0.74	34.7	54.7	30
	3	72	1.19	8	0.57	65.3	29.2	47
LC-NE2	1	65	1.37	9	0.63	53.8	93.8	4
	2	46	1.80	9	0.82	30.4	76.1	10
	3	23	1.88	8	0.90	30.4	91.3	2
LC-SW1	1	213	0.84	7	0.43	68.1	68.5	60
	2	202	1.21	8	0.58	49.5	51.0	87
	3	207	1.04	8	0.50	52.2	53.1	87
LC-SW2	1	224	1.12	9	0.51	66.5	69.2	65
	2	216	0.89	9	0.41	75.0	77.8	48
	3	218	0.95	7	0.49	66.5	66.5	73
N0E5	1	203	1.48	10	0.64	41.9	94.1	2
	2	83	1.72	9	0.78	30.1	83.1	1
	3	188	0.85	8	0.41	78.7	98.4	3
N10E11	1	228	1.13	8	0.54	64.9	80.3	37
	2	206	0.75	6	0.42	81.1	96.1	0
	3	226	0.75	8	0.36	80.5	96.5	3
N11E33	1	258	1.52	10	0.66	50.8	69.4	77
	2	222	2.00	13	0.78	31.5	53.2	96
	3	236	1.71	10	0.74	35.2	47.9	120
N12E19	1	208	1.45	9	0.66	39.4	46.6	111
	2	204	1.68	7	0.86	33.8	56.9	88
	3	208	1.71	8	0.82	31.7	46.2	112
N14E11	1	215	0.73	8	0.35	82.3	93.0	10
	2	210	1.10	8	0.53	55.7	58.6	77
	3	207	0.93	8	0.45	72.9	76.8	36
N17E6	1	249	1.23	10	0.54	57.0	98.4	0
	2	215	1.15	7	0.59	43.7	99.5	0
	3	152	1.12	6	0.63	43.4	99.3	0
N-1E15	1	252	1.61	11	0.67	33.7	56.3	104
	2	228	1.49	9	0.68	33.8	54.4	100
	3	220	1.49	11	0.62	55.0	70.5	58
N-2E11	1	273	1.73	11	0.72	46.5	68.9	75
	2	256	1.51	12	0.61	53.5	71.9	71
	3	277	1.59	9	0.72	52.0	70.4	79
N-2E21	1	245	1.69	12	0.68	33.5	49.8	120
	2	239	1.22	12	0.49	59.4	63.6	87
	3	208	1.68	12	0.68	34.6	50.0	101
N-3E28	1	292	1.28	11	0.54	53.8	78.4	53
	2	239	1.73	11	0.72	38.5	60.3	88
	3	250	1.31	9	0.60	55.2	78.0	53
N3E31	1	214	1.87	13	0.73	35.5	72.9	54
	2	234	1.18	10	0.51	56.4	87.6	28
	3	224	1.08	9	0.49	57.6	89.3	24
N5E11	1	253	1.65	11	0.69	47.0	37.2	151
	2	246	1.70	12	0.68	37.8	36.2	155
	3	215	1.71	11	0.71	36.3	47.0	112
N5E21	1	307	1.86	12	0.75	33.6	45.3	157
	2	234	1.85	12	0.74	41.5	59.8	87
	3	234	1.86	12	0.75	37.6	50.0	112
N5E2	1	264	0.86	7	0.44	74.2	76.5	20
	2	214	0.13	4	0.10	97.7	98.1	4
	3	255	0.65	6	0.36	84.3	86.7	16
N6E15	1	211	1.76	12	0.71	43.1	66.8	67
	2	221	1.74	12	0.70	39.4	55.7	97
	3	275	1.84	16	0.67	38.2	58.2	108
N-6E15	1	215	1.01	9	0.46	58.1	62.8	76
	2	206	1.16	7	0.60	46.1	44.7	110
	3	200	0.87	6	0.49	55.0	42.5	113
N-7E0	1	43	1.65	8	0.79	44.2	69.8	9
	2	128	0.38	6	0.21	92.2	99.2	1
	3	107	1.43	11	0.60	43.9	93.5	1
N7E7	1	222	0.73	7	0.37	69.8	71.2	1
	2	243	0.66	3	0.60	65.8	66.3	0
	3	233	0.73	5	0.45	65.2	65.7	3
N8E24	1	212	1.65	10	0.72	36.3	46.7	113
	2	213	1.68	11	0.70	29.6	40.8	125
	3	206	1.62	14	0.61	34.0	39.8	122
N9E15	1	201	0.87	6	0.48	67.2	68.7	58
	2	219	1.37	10	0.59	47.0	59.4	83
	3	208	0.80	7	0.41	73.1	76.0	45

Table 4-2
 Toxicity Test Data
 Stage II Environmental Risk Characterization
 National Grid - Former Gloucester Manufactured Gas Plant
 Gloucester, Massachusetts

Location ID	<i>Neanthes arenaceodentata</i>			<i>Leptocheirus plumulosus</i>			
	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Number of Young per Organism
LC-HC1	1	100	5.47	1	100	1.44	3.30
	2	100	4.26	2	90	1.43	2.56
	3	80	5.78	3	100	1.51	1.60
	4	80	5.56	4	85	1.20	1.88
	5	100	6.09	5	100	1.31	3.75
	6	80	5.91				
	7	100	6.50				
	8	60	10.04				
LC-NE1	1	100	5.12	1	85	1.36	1.94
	2	80	6.40	2	95	1.60	2.63
	3	100	4.94	3	95	1.44	3.16
	4	100	5.77	4	85	1.28	1.47
	5	100	4.60	5	85	1.28	2.88
	6	80	5.91				
	7	100	5.87				
	8	80	6.02				
LC-NE2	1	100	5.37	1	95	0.54	1.32
	2	100	4.89	2	100	1.69	3.05
	3	80	5.58	3	90	1.00	3.44
	4	100	5.53	4	90	1.17	2.39
	5	100	4.76	5	85	0.66	3.71
	6	80	4.17				
	7	100	3.48				
	8	80	4.92				
LC-SW2	1	100	4.80	1	90	1.03	1.39
	2	100	4.79	2	100	1.20	3.50
	3	100	3.29	3	85	0.81	2.71
	4	100	4.67	4	90	0.97	2.67
	5	100	5.66	5	80	0.76	2.06
	6	100	3.35				
	7	100	6.09				
	8	100	4.40				
LC-SW1	1	100	4.22	1	70	0.34	0
	2	100	4.96	2	90	0.60	0.39
	3	100	4.37	3	75	0.42	0.33
	4	100	5.12	4	90	0.58	0.56
	5	100	4.72	5	75	0.58	0.47
	6	100	5.26				
	7	100	6.04				
	8	100	5.86				
NOE5	1	100	4.99	1	80	1.11	3.00
	2	40	10.41	2	85	0.70	2.59
	3	100	5.23	3	55	1.70	0.82
	4	100	5.45	4	60	0.37	1.00
	5	100	4.83	5	100	0.98	2.00
	6	100	4.52				
	7	100	4.94				
	8	60	6.40				
N10E11	1	100	4.92	1	45	0.33	0.33
	2	100	3.02	2	15	0.29	0
	3	80	5.78	3	0	NA	NA
	4	60	8.28	4	25	0.26	0
	5	100	5.21	5	50	0.56	0.20
	6	100	3.66				
	7	80	7.09				
	8	80	3.30				

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	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Number of Young per Organism
N11E33	1	100	4.24	1	95	0.81	1.05
	2	100	3.90	2	60	0.94	1.42
	3	100	3.98	3	75	0.82	1.67
	4	80	4.44	4	75	0.93	1.13
	5	100	4.97	5	100	1.01	1.25
	6	80	5.19				
	7	80	5.59				
	8	100	4.40				
N12E19	1	100	5.92	1	90	0.78	0.61
	2	80	7.73	2	45	0.47	0.89
	3	80	4.37	3	70	0.57	0.43
	4	80	4.89	4	85	0.84	1.12
	5	60	4.50	5	40	0.40	0.63
	6	80	7.27				
	7	60	4.69				
	8	80	4.44				
N14E11	1	100	3.00	1	90	0.90	2.78
	2	100	4.19	2	85	0.55	1.59
	3	100	3.69	3	90	0.92	3.67
	4	80	2.69	4	95	0.78	1.11
	5	100	5.34	5	80	0.75	2.13
	6	100	1.92				
	7	60	4.46				
	8	100	2.71				
N17E6	1	80	4.16	1	95	1.07	0.68
	2	100	4.66	2	95	1.05	0.74
	3	100	6.75	3	90	1.04	1.61
	4	100	3.22	4	50	0.60	2.20
	5	100	3.61	5	60	0.66	1.92
	6	20	2.21				
	7	100	4.31				
	8	80	4.61				
N-1E15	1	100	5.98	1	45	0.34	0
	2	80	2.18	2	70	0.41	0
	3	100	2.99	3	65	0.65	0.46
	4	100	5.17	4	55	0.22	0.09
	5	100	5.31	5	65	0.81	0.23
	6	0	NA				
	7	100	2.77				
	8	80	2.71				
N-2E11	1	100	4.38	1	90	0.81	2.61
	2	100	5.02	2	95	0.73	3.05
	3	60	5.05	3	85	1.29	2.53
	4	100	4.93	4	90	0.73	1.44
	5	100	6.64	5	100	1.18	3.25
	6	100	4.93				
	7	100	5.19				
	8	80	4.12				
N-2E21	1	80	4.04	1	75	0.60	1.07
	2	100	4.78	2	95	1.14	1.11
	3	80	4.41	3	90	0.78	1.22
	4	0	NA	4	85	0.76	1.12
	5	100	4.67	5	95	0.72	1.26
	6	20	5.25				
	7	100	4.17				
	8	100	4.81				

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	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Number of Young per Organism
N-3E28	1	100	4.37	1	50	0.31	0.50
	2	100	5.22	2	70	0.72	3.29
	3	100	6.61	3	70	0.53	1.57
	4	100	4.62	4	100	1.01	5.30
	5	100	6.44	5	65	1.39	2.23
	6	80	6.78				
	7	100	6.43				
	8	80	4.32				
N3E31	1	100	4.54	1	55	0.42	0.73
	2	100	5.07	2	10	0.20	0
	3	100	4.32	3	20	0.31	1.25
	4	80	4.41	4	75	0.29	0
	5	100	5.01	5	55	0.55	1.82
	6	80	5.77				
	7	100	5.19				
	8	100	4.87				
N5E11	1	100	4.22	1	0	NA	NA
	2	100	7.24	2	5	0.23	0
	3	100	5.60	3	0	NA	NA
	4	100	4.05	4	10	0.38	0
	5	100	5.55	5	0	NA	NA
	6	100	3.38				
	7	100	3.53				
	8	120	3.26				
N5E2	1	100	5.30	1	55	0.40	0
	2	80	5.43	2	70	0.84	0.29
	3	100	3.46	3	60	0.51	0
	4	100	2.50	4	75	0.45	0
	5	80	5.61	5	95	1.28	1.21
	6	100	2.38				
	7	60	3.14				
	8	100	4.27				
N5E21	1	100	3.29	1	0	NA	NA
	2	0	NA	2	0	NA	NA
	3	100	3.29	3	0	NA	NA
	4	60	3.94	4	0	NA	NA
	5	80	3.28	5	0	NA	NA
	6	100	2.76				
	7	60	5.00				
	8	0	NA				
N6E15	1	100	4.43	1	90	0.51	0
	2	100	4.18	2	90	0.97	2.56
	3	100	4.86	3	45	0.33	1.00
	4	100	3.34	4	85	0.65	2.65
	5	100	5.70	5	95	0.67	0.53
	6	100	4.96				
	7	100	4.48				
	8	80	4.53				
N-6E15	1	100	3.95	1	10	0.11	0
	2	80	5.55	2	30	0.05	0.50
	3	100	4.18	3	15	0.25	0
	4	100	5.67	4	30	0.34	0
	5	80	6.10	5	20	0.23	0.25
	6	60	6.64				
	7	100	5.14				
	8	100	4.98				

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	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Replicate	Percent Survival	Weight per Organism (mg dry weight)	Number of Young per Organism
N-7E0	1	80	4.68	1	75	1.44	0.47
	2	60	7.62	2	85	1.10	4.65
	3	100	4.80	3	90	1.32	5.00
	4	80	5.73	4	95	1.32	3.11
	5	100	4.37	5	90	1.22	1.44
	6	100	4.40				
	7	100	6.40				
	8	100	5.06				
N7E7	1	100	5.86	1	85	1.16	1.47
	2	80	4.66	2	55	0.63	0.91
	3	100	6.19	3	15	0.16	0
	4	100	4.32	4	25	0.33	0
	5	80	4.66				
	6	80	4.58				
	7	100	4.62				
	8	80	5.96				
N8E24	1	80	3.93	1	90	0.51	0.44
	2	100	6.18	2	20	0.30	1.25
	3	80	5.95	3	45	0.51	0.11
	4	100	5.12	4	95	0.80	0.68
	5	80	3.06	5	100	0.82	0.50
	6	80	7.82				
	7	100	4.09				
	8	80	5.11				
N9E15	1	100	4.34	1	90	1.23	0.56
	2	100	4.46	2	100	1.39	2.60
	3	100	2.14	3	85	1.62	3.88
	4	100	3.33	4	90	1.46	2.50
	5	100	4.44	5	100	1.08	3.60
	6	100	3.88				
	7	100	4.03				
	8	100	4.04				

Notes:
 NA - Not Applicable because no organisms survived.

**Table 5-1
 Constituents Detected in Sediment, Porewater and Surface Water
 Stage II Environmental Risk Characterization
 National Grid - Former Gloucester Manufactured Gas Plant
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Sediment		Porewater	Surface Water
1-Methylnaphthalene	Arsenic (a)	1-Methylnaphthalene	2-Methylnaphthalene
2-Methylnaphthalene	Barium	2-Methylnaphthalene	Naphthalene
Acenaphthene	Cadmium (a)	Acenaphthene	Arsenic
Acenaphthylene	Chromium (a)	Acenaphthylene	Barium
Anthracene	Copper (a)	Anthracene	Beryllium
Benzo(a)anthracene	Lead	Benzo(a)anthracene	Chromium
Benzo(a)pyrene	Mercury	Benzo(a)pyrene	Nickel
Benzo(g,h,i)perylene	Nickel (a)	Benzo(g,h,i)perylene	Lead
Benzo[b+k]fluoranthene	Selenium (a)	Benzo[b+k]fluoranthene	Silver
Benzo[e]pyrene	Silver (a)	Benzo[e]pyrene	Antimony
C1-Chrysenes	Zinc (a)	C1-Chrysenes	Selenium
C1-Fluoranthenes/Pyrenes	Acid Volatile Sulfides	C1-Fluoranthenes/Pyrenes	Thallium
C1-Fluorenes	Simultaneously Extracted Metals (b)	C1-Fluorenes	Zinc
C1-Phenanthrenes/Anthracenes	Benzene	C1-Phenanthrenes/Anthracenes	
C2-Fluorenes	C11-C22 Aromatics, Adjusted	C2-Chrysenes	
C2-Naphthalenes	C19-C36 Aliphatics	C2-Fluorenes	
C2-Phenanthrenes/Anthracenes	C9-C10 Aromatics	C2-Naphthalenes	
C3-Naphthalenes	C9-C12 Aliphatics, Adjusted	C2-Phenanthrenes/Anthracenes	
C3-Phenanthrenes/Anthracenes	C9-C18 Aliphatics	C3-Chrysenes	
C4-Naphthalenes	Ethylbenzene	C3-Fluorenes	
C4-Phenanthrenes/Anthracenes	Methyl tert-butyl ether	C3-Naphthalenes	
Chrysene	o-Xylene	C3-Phenanthrenes/Anthracenes	
Dibenz(a,h)anthracene	p/m-Xylenes	C4-Chrysenes	
Fluoranthene	Cyanide	C4-Naphthalenes	
Fluorene	Aroclor 1254 (c)	C4-Phenanthrenes/Anthracenes	
Indeno(1,2,3-cd)pyrene	Aroclor 1260 c)	Chrysene	
Naphthalene		Dibenzo(a,h)anthracene	
Perylene		Fluoranthene	
Phenanthrene		Fluorene	
Pyrene		Indeno(1,2,3-cd)pyrene	
		Naphthalene	
		Perylene	
		Phenanthrene	
		Pyrene	

Notes:

- (a) Not selected as constituent of potential ecological concern in sediment because concentrations in the study area were not statistically significantly different from concentrations in Local Conditions.
- (b) Analysis includes cadmium, copper, lead, nickel, silver, and zinc.
- (c) Not selected as constituent of potential ecological concern in sediment because no evidence suggests that its presence is associated with the former MGP.

Table 5-2
Comparison of Constituent Concentrations in Study Area Surface Water to Screening Values and Concentrations in Local Conditions Surface Water
Stage II Environmental Risk Characterization
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Gloucester, Massachusetts

Constituent	Screening Value	Study Area														Local Conditions					
		SW-101-HT	SW-101-LT	SW1-HT-N5E4	SW1-LT-N5E4	SW-201-HT-N5E4	SW-201-LT-N5E4	SW-202-HT-N7E7	SW-202-LT-N7E7	SW-203-HT-N10E2	SW-203-LT-N10E2	SW-204-HT-N1E1 (duplicate of SW-203-LT-N10E2)	SW2-HT-N7E7	SW2-LT-N7E7	SW3-HT-N10E2	SW3-LT-N10E2&DUP	SW-401	SW-403	SW-404	SW-405	SW-402 & DUP
2-Chloronaphthalene						0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U									
2-Methylnaphthalene	0.07 (a)	0.00109	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Acenaphthene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Acenaphthylene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Anthracene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Antimony		0.00125 U	0.00125 U														0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Aroclor-1016		0.000125 U	0.000126 U																		
Aroclor-1221		0.000125 U	0.000126 U																		
Aroclor-1232		0.000125 U	0.000126 U																		
Aroclor-1242		0.000125 U	0.000126 U																		
Aroclor-1248		0.000125 U	0.000126 U																		
Aroclor-1254		0.000125 U	0.000126 U																		
Aroclor-1260		0.000125 U	0.000126 U																		
Aroclor-1262		0.000125 U	0.000126 U																		
Aroclor-1268		0.000125 U	0.000126 U																		
Arsenic	0.036 (b)	0.0005 U	0.0015														0.009	0.0095	0.0098	0.0095	0.009
Available Cyanide				0.001 U	0.001 U								0.001 U	0.001 U	0.001 U	0.001 U/U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Barium	41	0.0078	0.0075														0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzene		0.001 U	0.001 U														0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Benzo(a)anthracene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene		0.0001 U	0.0001 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(b)fluoranthene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(g,h,i)perylene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(k)fluoranthene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Beryllium		0.0005 U	0.0005 U														0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
C11-C22 Aromatics, Adjusted		0.05 U	0.05 U														0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
C11-C22 Aromatics, Unadjusted																	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
C19-C36 Aliphatics		0.05 U	0.05 U														0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
C5-C8 Aliphatics, Adjusted		0.025 U	0.025 U														0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
C5-C8 Aliphatics, Unadjusted																	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
C9-C10 Aromatics		0.025 U	0.025 U														0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
C9-C12 Aliphatics, Adjusted		0.025 U	0.025 U														0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
C9-C12 Aliphatics, Unadjusted																	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
C9-C18 Aliphatics		0.05 U	0.05 U														0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Cadmium		0.00005 U	0.00005 U														0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chromium		0.005 U	0.005 U														0.0038	0.005	0.0038	0.0048	0.00505
Chrysene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Dibenzo(a,h)anthracene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Ethylbenzene		0.001 U	0.001 U														0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Fluoranthene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Fluorene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Lead	0.0081 (b)	0.00041	0.00038														0.0012	0.001 U	0.001 U	0.0014	0.0014
Mercury		0.0001 U	0.0001 U														0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Methyl tert-butyl ether		0.0015 U	0.0015 U														0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Naphthalene	0.072 (a)	0.00321	0.000683			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Nickel	0.0082 (b)	0.00042	0.00042														0.0148 B, J	0.0138 J	0.0154 J	0.0138 J	0.01365 J/J
o-Xylene		0.001 U	0.001 U														0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
p/m-Xylene		0.001 U	0.001 U														0.008 U	0.008 U	0.008 U	0.008 U	0.008 U
Phenanthrene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Physiologically Available Cyanide		0.0025 U	0.0025 U																		
Pyrene		0.0002 U	0.0002 U			0.0001 U	0.000095 U	0.000095 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U					0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Selenium		0.00028 U	0.00028 U														0.0299 J	0.0333 J	0.0411 J	0.0368 J	0.03325 J/J
Silver		0.000025 U	0.000025 U														0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Styrene		0.0005 U	0.0005 U																		
Thallium		0.0025 U	0.0025 U														0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Toluene		0.001 U	0.001 U														0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Total EPH																	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U
Total PCBs		0.000125 U	0.000126 U																		
Total VPH																	0.200 U	0.200 U	0.200 U	0.200 U	0.200 U
Vanadium		0.125 U	0.125 U														0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Zinc	0.081 (b)	0.012	0.012														0.0151	0.0174	0.0151	0.0182	0.01445

Notes:
Blank indicates not analyzed.
All concentrations reported in mg/L.
U - Analyte not detected. Value is one half the sample reporting limit.
B - Estimated Result. Result is less than RL.
J - Method blank contamination. The associated method blank contains the target analyte at a reportable level.
(a) - MADEP (2008). Target surface water concentrations used to derive GW-3 standards.
(b) - EPA (2006). National Recommended Water Quality Criteria. Continuous Chronic Concentrations for Saltwater.

**Table 5-3
Sediment and Porewater Samples
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts**

	Sediment			Porewater
A-2	N10E38-S1	N1E15-S2	N5E4-S1	LCHC1-GL02 (a)
B-1 S1	N10E38-S2	N-1E6-S1	N5E4-S2	LCNE1-GL03 (a)
LC1-S1 (a)	N10E4-S1	N20E11-S1	N5E7-S1	LCNE2-GL04 (a)
LC2-S1 (a)	N11E13-S1	N20E15-S1	N5E7-S2	LCSW1-GL05 (b)
LCHC1-G1 (a)	N11E13-S2	N20E35-S1	N6E15-G1	LCSW2-GL06 (a)
LCHC1-GL02 (a)	N11E27-S1	N-24E25-S1	N-6E15-G1	N0E5-GL07
LCHC2-S1 (a)	N11E29-S1	N-24E8-S1	N-6E15-GL16	N10E11-GL22
LCHC3-S1 (a)	N11E30-S1	N26E32-S1	N6E15-GL17	N11E33-GL23
LCNE1-G1 (a)	N11E33-G1	N-2E11-G1	N6E18-S2	N12E19-GL24
LCNE1-GL03 (a)	N11E33-GL23	N-2E11-GL09	N6E27-S1	N14E11-GL25
LCNE2-G1 (a)	N11E35-S1	N-2E21-G1	N6E31-S1	N17E6-GL26
LCNE2-GL04 (a)	N11E4A-S1	N-2E21-GL10	N6E3-S1	N-1E15-GL08
LCNE3-S1 (a)	N12E11-S1&S3	N2E2-S1	N6E3-S2	N-2E11-GL09
LCSW1-G1 (b)	N12E15-S1	N-2E33-S1	N-7E0-G1	N-2E21-GL10
LCSW1-GL05 (b)	N12E15-S2	N30E27-S1&S2	N-7E0-GL18	N-3E28-GL11
LCSW2-G1 (a)	N12E19-G1	N3E11-S1	N7E11-S1	N3E31-GL12
LCSW2-GL06 (a)	N12E19-GL24	N3E24-S1&DUP2	N-7E15-S1	N5E11-GL14&DUP1
LCSW3-S1 (a)	N12E22-S1	N-3E28-G1	N7E2-S1	N5E21-GL15
MR-1-S1	N12E25-S1	N-3E28-GL11	N7E7-G1	N5E2-GL13
MR-2-S1	N12E27-S1	N3E31-G1	N7E7-GL19	N-6E15-GL16
MR-3-S1	N13E12-S1	N3E31-GL12	N7E7-S1&S3	N6E15-GL17
MR-4-S1	N13E30-S1	N3E33-S1	N8E19-S1	N-7E0-GL18
MR-5-S1	N13E33-S1	N3E3-S1	N8E24-G1	N7E7-GL19
MR-6-S1	N14E11-G1	N-4E2-S1	N8E24-GL20	N8E24-GL20
MR-7-S1	N14E11-GL25	N-4E2-S2	N8E30-S1	N9E15-GL21
N(-)2E13-S1	N14E31-S1	N4E38-S1	N8E6A-S1	
N(-)2E24-S1 & DUP	N14E9-S1	N4E3-S1	N9E11-S1	
N(-)3E19-S1	N15E19-S1	N4E3-S2	N9E11-S2	
N(-)4E13-S1	N15E19-S2	N5E11-G1	N9E15-G1	
N(-)6E13-S1	N15E38-S1	N5E11-GL14&DUP1	N9E15-GL21	
N(-)6E17-S1	N15E4-S1	N5E11-S1	N9E33-S1	
N(-)8E15-S1	N15E8-S1	N5E11-S2	NS-6-S1	
N0E25-S1	N17E11-S1	N5E15-S1	NS-7-S1 & DUP	
N0E31-S1	N-17E13-S1	N5E21-G1	WB-1 S1	
N0E5-G1	N-17E13-S2	N5E21-GL15		
N0E5-GL07	N17E6-G1	N-5E27-S1		
N10E11-G1	N17E6-GL26	N5E2-G1		
N10E11-GL22	N18E31-S1	N5E2-GL13		
N10E1A-S1	N1E11-S1	N5E2-S1		
N10E1-S1	N-1E15-G1	N5E2-S2		
N10E27-S1	N-1E15-GL08	N5E32-S1		
N-10E28-S1	N1E15-S1	N5E3-S2		

Notes:

- (a) Sample collected outside study area for the purpose of characterizing Local Conditions.
- (b) Sample collected outside study area but considered inconsistent with remaining Local Conditions samples.
- G1 - Designates grab sample
- S1, S2, S3 - Designates sample collected from sediment core

Table 5-4
Individual PAH's included in TPAH16 and TPAH34
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

PAH	TPAH16	TPAH34
1-Methylnaphthalene		√
2-Methylnaphthalene		√
Acenaphthene	√	√
Acenaphthylene	√	√
Anthracene	√	√
Benzo(a)anthracene	√	√
Benzo(a)pyrene	√	√
Benzo(e)Pyrene		√
Benzo(ghi)perylene	√	√
Benzo[b]fluoranthene (a)	√	√
Benzo[k]fluoranthene (a)	√	√
C1 - Chrysenes		√
C1 - Fluoranthenes/Pyrenes		√
C1 - Fluorenes		√
C1 - Phenanthrenes/Anthracenes		√
C2 - Chrysenes		√
C2 - Fluorenes		√
C2 - Naphthalenes		√
C2 - Phenanthrenes/Anthracenes		√
C3 - Chrysenes		√
C3 - Fluorenes		√
C3 - Naphthalenes		√
C3 - Phenanthrenes/Anthracenes		√
C4 - Chrysenes		√
C4 - Naphthalenes		√
C4 - Phenanthrenes/Anthracenes		√
Chrysene	√	√
Dibenzo(a,h)anthracene	√	√
Fluoranthene	√	√
Fluorene	√	√
Indeno(1,2,3-cd)Pyrene	√	√
Naphthalene	√	√
Perylene		√
Phenanthrene	√	√
Pyrene	√	√

Notes:

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

(a) Benzo(b)fluoranthene and benzo(k)fluoranthene were reported as benzo[b+k]fluoranthene in some samples and individually in other samples.

Table 5-5a
COPEC Concentrations in Sediment
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH34 (mg/kg OC)	TPAH34/TPAH16 Ratio	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg)	(mg/kg OC)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert-butyl ether (mg/kg)	SEM/AVS (unitless)
Reference Area Locations																								
LC-1	LC1-S1	34	1359		57.0		2281								0.82 U	0.82 U	0.82 U		21 U	21 U			0.41 U	
LC-2	LC2-S1	24	869		40.1		1458								0.72 U	0.72 U	0.72 U		18 U	18 U			0.36 U	
LC-HC1	LCHC1-G1 & LCHC1-GL02	19	430	28.1		624		1.45	58	122	0.57			1.45 U										0.038
LC-HC2	LCHC2-S1	21	628		34.8		1054		57	163	0.57													
LC-HC3	LCHC3-S1	10	564		17.5		946		125	79	0.30													
LC-NE1	LCNE1-G1 & LCNE1-GL03	27	522	46.0		888		1.70	80	199	0.82			1.4 U										0.024
LC-NE2	LCNE2-G1 & LCNE2-GL04	25	512	44.2		901		1.76	74	163	0.78			1.3 U										0.053
LC-NE3	LCNE3-S1	115	5093	196.3		8724		1.7	56	58	0.18	0.001 U		0.85 U										
LC-SW2	LCSW2-G1 & LCSW2-GL06	22	518	40.1		929		1.79	73	154	0.74			0.25 U										0.109
LC-SW3	LCSW3-S1	26	779		43.1		1307		83	200	0.77													
90th %ile Concentration		42	1732	136		5606			96	199	1	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.092
Study Area Locations																								
LC-SW1	LCSW1-GL05	52	1081	109		2245		2.08																0.023
	LCSW1-G1	38	772	72		1474		1.91	99	215	1.2			1.3 U										
	Location Average	45	927	90		1860			99	215	1.2			1.3 U										
A-2	A-2	205	5498		390		10446																	
B-1	B-1 S1	175	5456		333		10319								2.3	1.2	9.2	53.2	17	7 U	8.1	3.9 U	0.34 U	
MR-1	MR-1-S1	264	5067		502		9626																	
MR-2	MR-2-S1	59	2005		113		3810																	
MR-3	MR-3-S1	36	1679		68		3190																	
MR-4	MR-4-S1	78	2346		148		4458																	
MR-5	MR-5-S1	1651	35614		3136		67666																	
MR-6	MR-6-S1	1385	31948		2631		60701																	
MR-7	MR-7-S1																							
NOE25	NOE25-S1	156	5109		297		9739								0.453 U	0.453 U	0.906 U		11.3 U	11.3 U			0.2265 U	
NOE5	NOE5-G1	20	588	32		941		1.60	86	164	0.30			0.9 U										
	NOE5-GL07	32	945	50		1493		1.58																
	Location Average	26	767	41		1217			86	164	0.3			0.9 U										0.043
NOE31	NOE31-S1	61	2000		116		3800																	0.043
N10E1	N10E1-S1	155	4356		295		8304								0.26 U	0.26 U	0.52 U		6.5 U	6.5 U			0.13 U	
N10E1A	N10E1A-S1									396	1.0													
N10E11	N10E11-G1 & N10E11-GL22	198	3578	396		7158		2.00	87	261	1.4	0.001 U		1.2 U										0.676
N10E27	N10E27-S1	147	4210		281		8024								0.3535 U	0.354 U	0.707		8.85 U	8.85 U			0.1765 U	
N-10E28	N-10E28-S1	29	1160		55		2212								0.427 U	0.427 U	0.854 U		10.7 U	10.7 U			0.2135 U	
N10E38	N10E38-S1	58	2286		111		4358								0.372 U	0.372 U	0.744 U		9.3 U	9.3 U			0.186 U	
	N10E38-S2	33	1473		63		2808								0.323 U	0.323 U	0.646 U		8.1 U	8.1 U			0.162 U	
	Location Average	46	1880		87		3583								0.323 U	0.323 U	0.646 U		8.1 U	8.1 U			0.162 U	
N10E4	N10E4-S1	130	13198		248		25156								0.459 U	0.459 U	0.918 U		11.5 U	11.5 U			0.2295 U	
N11E4A	N11E4A-S1									482	4.3													
N11E13	N11E13-S1	167	4034		317		7666																	
	N11E13-S2	5	187		10		356																	
	Location Average	86	2111		163		4011																	
N11E27	N11E27-S1	363	9677		692		18446		117	298	1.3													
N11E29	N11E29-S1	518	15383		983		29227																	
N11E30	N11E30-S1	78	2286		148		4357		115	278	1.4	0.001 U		1.15 U										
N11E33	N11E33-GL23	141	2332	296		4903		2.10																0.025
	N11E33-G1	118	1956	229		3787		1.94	97	240	1.1			1.35 U										
	Location Average	129	2144	262		4345			97	240	1.1			1.35 U										0.025
N11E35	N11E35-S1	67	1920		128		3647																	
N12E11	N12E11-S1/S3	142	4428		270		8439								0.4475 U	0.448 U	0.895 U		11.2 U	11.2 U			0.2235 U	
	N12E15-S2	4.9	272		9		518								0.342 U	0.342 U	0.684 U		8.55 U	8.55 U			0.171 U	
	N12E15-S1	40	1983		76		3780								0.31 U	0.31 U	0.62 U		7.75 U	7.75 U			0.155 U	
Location Average	22	1128		42		2149								0.31 U	0.31 U	0.62 U		7.75 U	7.75 U			0.155 U		
N12E19	N12E19-G1 & N12E19-GL24	77	1559	160		3234		2.07	102	255	2.2			1.3 U										0.027
N12E22	N12E22-S1	64	1891		123		3604								0.387 U	0.387 U	0.774 U		9.65 U	9.65 U			0.1935 U	
N12E25	N12E25-S1	85	2784		162		5290																	
N12E27	N12E27-S1	203	6435		386		12226																	
N13E12	N13E12-S1	103	3035		195		5766																	
N13E30	N13E30-S1	47	1264		90		2402																	
N13E33	N13E33-S1	113	2977		215		5655																	
N14E11	N14E11-G1	52	1107	97		2070		1.87	79	182	1.5	0.001 U		1.4 U										
	N14E11-GL25	70	1509	139		2987		1.98																
	Location Average	61	1308	118		2529			79	182	1.5	0.001 U		1.4 U										0.108
N14E31	N14E31-S1	63	2208		120		4209		115	265	1.1													
N14E9	N14E9-S1	97	3418		186		6515								0.585 U	0.585 U	1.17 U		14.6 U	14.6 U			0.2915 U	
N15E8	N15E8-S1	46	1131		88		2149																	
N15E19	N15E19-S1	1.2	51		2		97								0.4325 U	0.433 U	0.865 U		10.8 U	10.8 U			0.216 U	
	N15E19-S2	100	5582		192		10640																	

Table 5-5a
COPEC Concentrations in Sediment
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH34 (mg/kg OC)	TPAH34/TPAH16 Ratio	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg)	(mg/kg OC)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert-butyl ether (mg/kg)	SEM/AVS (unitless)	
N17E11	N17E11-S1	71	1808		136		3446		120	272	0.74	0.001	U												
N-17E13	N-17E13-S2	86	4887		163		9315								0.3115	U	0.312	U	0.632	U				0.35	
	N-17E13-S1	36	1831		68		3489								0.331	U	0.331	U	0.662	U				0.1655	U
	Location Average	61	3359		116		6402								0.312	U	0.312	U	0.632	U				0.26	
N17E6	N17E6-GL26	12	241	22		457		1.89																0.022	
	N17E6-G1	6.0	124	11		221		1.78	91	536	0.22	0.001	U											0.022	
Location Average		9	183	16		339			91	536	0.2	0.001	U												
N18E31	N18E31-S1	59	2219		112		4229								0.3335	U	0.334	U	0.667	U				0.167	U
N1E11	N1E11-S1	151	4374		288		8338		81	186	0.38														
N1E15	N1E15-S1	111	6366		212		12134								0.296	U	0.296	U	0.592	U				0.148	U
	N1E15-S2	1.5	112		3		213								0.2645	U	0.265	U	0.529	U				0.1325	U
	Location Average	56	3239		108		6173								0.265	U	0.265	U	0.529	U				0.133	U
N-1E15	N-1E15-G1 & N-1E15-GL08	205	4720	411		9482		2.01	90	206	1.0													0.076	
N-1E6	N-1E6-S1	117	3949		222		7528								0.3665	U	0.367	U	0.733	U				0.1835	U
N20E11	N20E11-S1	62	1909	110		3398		1.8	67	308	0.82	0.001	U												
N20E15	N20E15-S1	23	1054		44		2009								0.418	U	0.418	U	0.836	U				0.209	U
N20E35	N20E35-S1	62	2577		118		4912								0.36	U	0.36	U	0.72	U				0.18	U
N-24E25	N-24E25-S1	17	1333		33		2540								0.373	U	0.373	U	0.746	U				0.1865	U
N-24E8	N-24E8-S1	80	3496		153		6663								0.3425	U	0.343	U	0.685	U				0.1715	U
N26E32	N26E32-S1	43	2366		81		4510																		
N-2E11	N-2E11-G1 & N-2E11-GL09	86	2290	160		4262		1.86	80	169	0.71	0.024	0.6	1.2	U									0.047	
N(-)2E13	N(-)2E13-S1	78	1888		149		3588																		
N2E2	N2E2-S1	144	5451	218		8225		1.5	130	322	2.4			0.42											
N-2E21	N-2E21-G1 & N-2E21-GL10	110	2199	196		3900		1.77	102	217	0.86			1.4	U									0.027	
N(-)2E24	N(-)2E24-S1 & DUP-5	137	3004		260		5708																		
N-2E33	N-2E33-S1	62	2496		119		4757								0.372	U	0.372	U	0.744	U				0.186	U
N30E27	N30E27-S1&S2DUP	39	2442		74		4655								0.287	U	0.287	U	0.574	U				0.1435	U
N3E11	N3E11-S1	283	6818		539		12997								0.4155	U	0.416	U	0.831	U				0.208	U
N3E24	N3E24-S1&S1DUP2	203	5069		388		9662		98	400	0.50														
N(-)3E19	N(-)3E19-S1	207	4435		393		8427																		
N-3E28	N-3E28-G1 & N-3E28-GL11	98	1951	209		4164		2.13	84	184	0.86			1.5	U									0.017	
N3E3	N3E3-S1	96	3687		183		7028								0.235	U	0.235	U	0.47	U				0.1175	U
N3E31	N3E31-G1 & N3E31-GL12	181	3334	423		7802		2.34	85	215	1.8	0.001	U	1.25	U									0.021	
N3E33	N3E33-S1	53	1615		101		3068																		
N-4E2	N-4E2-S1	31	1271		58		2423								0.299	U	0.299	U	0.598	U				0.1495	U
	N-4E2-S2	5.9	511		11		975								0.165	U	0.165	U	0.33	U				0.0825	U
	Location Average	18	891		35		1699								0.165	U	0.165	U	0.330	U				0.083	U
N4E3	N4E3-S1	93	4533		177		8641								0.4535	U	0.454	U	0.907	U				0.227	U
	N4E3-S2	81	3012		155		5741								0.26	U	0.26	U	0.52	U				0.13	U
Location Average		87	3773		166		7191								0.26	U	0.26	U	0.52	U				0.13	U
N(-)4E13	N(-)4E13-S1	74	2249		140		4274																		
N4E38	N4E38-S1	40	1555		77		2965								0.413	U	0.413	U	0.826	U				0.2065	U
N5E11	N5E11-S1	230	7938		439		15131								0.404	U	0.404	U	0.808	U				0.202	U
	N5E11-S2	567	26363		1080		50251								3.59	U	3.59	U	7.18	U				1.795	U
	N5E11-G1&dup & N5E11-Location Average	470	9454	981		19695		2.09	88	207.5	2.0	0.001	U	1.275	U									0.030	
N5E15	N5E15-S1	326	12775		621		24351		88	207.5	2.0	0.001	U	1.275	U									0.030	
N5E2	N5E2-S2	232	2869		443		5469								0.2405	U	0.241	U	0.481	U				0.1205	U
	N5E2-S1	589	7655		1123		14591								2.68	J	14.8	J	2.684	J				0.181	UJ
	N5E2-G1 & N5E2-GL13	224	3944	390		6865			125	3270	1.2			0.8	U	1.02	0.442	U	0.883	U				0.221	U
Location Average	349	4823	390	783	6865	10030			125	3270	1.2			0.8	U	1.9	7.6	1.8						0.041	
N5E21	N5E21-G1 & N5E21-GL15	4570	45098	9693		95662		2.12	119	290	2.2			1.3	U									0.059	
N-5E27	N-5E27-S1	41	1343		78		2559								0.535	U	0.535	U	1.07	U				0.2685	U
N5E3	N5E3-S2	4.0	335		8		639								1.64	1.08	0.9745							0.0925	U
N5E4	N5E4-S2	4.9	327		9		622								0.208	UJ	0.208	UJ	0.416	UJ				0.104	UJ
	N5E4-S1	55	2427		104		4626								0.2695	U	0.27	UJ	0.539	UJ				0.135	UJ
	Location Average	30	1377		57		2624								0.208	UJ	0.208	UJ	0.416	UJ				0.104	UJ
N5E7	N5E7-S1	192	8191		367		15613								0.3755	UJ	0.376	UJ	0.751	UJ				0.1875	UJ
	N5E7-S2	215	7668		409		14617								0.326	UJ	0.326	UJ	0.352	UJ				0.163	UJ
Location Average		204	7930		388		15115								0.326	UJ	0.326	UJ	0.352	UJ				0.163	UJ
N5E32	N5E32-S1	43	1276		82		2425																		
N6E15	N6E15-G1 & N6E15-GL17	209	3549	404		6871		1.94	83	234	0.82			1.15	U									0.069	
N(-)6E13-	N(-)6E13-S1	52	1546		99		2938																		
N-6E15	N-6E15-G1 & N-6E15-GL16	264	4430	51																					

Table 5-5a
COPEC Concentrations in Sediment
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	TPAH16 (mg/kg)	OC- Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC- Normalized TPAH34 (mg/kg OC)	Estimated OC- Normalized TPAH34 (mg/kg OC)	TPAH34 TPAH16 Ratio	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg)	(mg/kg OC)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethyl- benzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert- butyl ether (mg/kg)	SEM/AVS (unitless)	
N7E11	N7E11-S1	117	3038		223		5792								0.3925 U	0.393 U	0.785 U		9.8 U	9.8 U			0.196 U		
N-7E15	N-7E15-S1	77	3745		146		7138								0.3485 U	0.349 U	0.697 U		8.7 U	8.7 U			0.1745 U		
N7E2	N7E2-S1	345	16433		658		31324								1.525 U	7.35	9.09		199	38.1 U			0.76 U		
N7E7	N7E7-S1/S3	309	19304		589		36795								0.3035 U	0.304 U	0.607 U		7.6 U	7.6 U			0.152 U	0.025	
	N7E7-G1 & N7E7-GL19	164	1891	348	589	4018	36795		124	1380	2.7	0.01	0.1	1.05 U										0.025	
	Location Average	236	10598	348	589	4018	36795		124	1380	2.7	0.01	0.1	1.05 U	0.304 U	0.304 U	0.607 U		7.6 U	7.6 U			0.152 U	0.025	
N8E6A	N8E6A-S1									108	0.3														
N(-)8E15	N(-)8E15-S1	90	2290		171		4350																		
N8E19	N8E19-S1	98	7817		186		14901								0.2795 U	0.28 U	0.559 U		7 U	7 U			0.1395 U		
N8E24	N8E24-G1 & N8E24-GL20	113	2096	246		4550		2.17	94	217	1.2													0.050	
N8E30	N8E30-S1	150	3157		286		6019		126	278	1.7														
N9E11	N9E11-S1	121	4744		231		9042								0.4265 U	0.427 U	0.853 U		10.65 U	31.4			0.2135 U		
	N9E11-S2	5.7	219		11		417								0.3715 U	0.372 U	0.743 U		9.3 U	9.3 U			0.1855 U		
	Location Average	63	2482		121		4730								0.372 U	0.372 U	0.743 U		9.3 U	20.4			0.186 U		
N9E15	N9E15-G1 & N9E15-GL21	79	2076	135		3545		1.71	66	127	1.6													0.091	
N9E33	N9E33-S1	115	2939		219		5584																		
NS-6	NS-6-S1									203	1.2														
NS-7	NS-7-S1 & DUP-1									176	1.1														
WB-1	WB-1 S1	3090	96563		5890		182618								13.5 U	57	104	25.4	1600	270 U	240	70	13.5 U		
Arithmetic mean in Study Area =		236	5747	836	363	10597	11472	1.9	101.5	362	1.24	0.3		0.80	2.01	3.48	39	53.03	16.44	124	37	0.50			
Geometric mean in Study Area =								1.9																	

Notes:
COPEC - Constituent of potential ecological concern
TPAH16 - 16 parent polycyclic aromatic hydrocarbons
TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons
OC - Organic carbon
SEM - Simultaneously extracted metals
AVS - Acid volatile sulfide
SEM/AVS - Ratio of SEM to AVS
ND - Not detected
U - Undetected; value provided is one half the sample reporting limit
J - Estimated value
UJ - Undetected; value provided is one half the estimated sample reporting limit
G1 - Designates grab sample
S1, S2, S3 - Designates sample collected from sediment core

Table 5-5b
Summary Statistics for COPECs in Study Area Sediment
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

COPEC	Units	# Detects	# Samples	Range of Detects		Mean	Standard Deviation
				Minimum	Maximum		
TPAH16	(mg/kg)	102	102	4	4570	236	593
OC-Normalized TPAH16	(mg/kg OC)	102	102	183	96563	5747	11361
TPAH34	(mg/kg)	24	24	16	9693	836	2078
Estimated TPAH34	(mg/kg)	81	81	8	5890	363	773
OC-Normalized TPAH34	(mg/kg OC)	24	24	339	95662	10917	20229
Estimated OC-Normalized TPAH34	(mg/kg OC)	81	81	639	182618	11472	22499
Barium	(mg/kg)	32	32	34	263	101	37
Lead	(mg/kg)	36	36	14	3270	362	542
Mercury	(mg/kg)	36	36	0.02	4	1.2	0.8
Tributyltin	(mg/kg)	3	3	0.02	0.64	0.3	0.32
Cyanide	(mg/kg)	1	24	0.42	0.42	1.2	0.23
Benzene	(mg/kg)	3	44	1.64	2.3	0.8	2
Ethylbenzene	(mg/kg)	5	44	1.1	57	2	9
Total Xylenes	(mg/kg)	6	44	0.71	104	3	16
C11-C22 Aromatics, Adjusted	(mg/kg)	2	2	25	53	39	20
C9-C10 Aromatics	(mg/kg)	6	44	17	1600	53	241
C9-C12 Aliphatics, Adjusted	(mg/kg)	3	44	20	23	16	40
C9-C18 Aliphatics	(mg/kg)	2	2	8	240	124	164
C19-C36 Aliphatics	(mg/kg)	1	2	70	70	37	47
Methyl tert-butyl ether	(mg/kg)	1	44	0.26	0.26	0.50	2
SEM/AVS	(unitless)	30	30	0.02	0.68	0.065	0.12

Notes:

All computations were performed using data from only the 0-1 foot depth from those samples listed in Table 5-3.

Non-detect sample results were set equal to one-half the sample reporting limit for mean and standard deviation calculations.

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

COPEC - Constituent of potential ecological concern

OC - Organic carbon

SEM - Simultaneously extracted metals

AVS - Acid volatile sulfide

SEM/AVS - Ratio of SEM to AVS

Table 5-6
Exposure Point Concentrations Used to Evaluate Benthivorous Fish
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

	EPC in Sediment (mg/kg)	Benthivorous Fish Biota-to-Sediment Accumulation Factor (mg/kg tissue wet weight)/(mg/kg sediment)	Benthivorous Fish Tissue (mg/kg wet weight)	Forage Fish Biota-to- Sediment Accumulation Factor (mg/kg tissue wet weight)/(mg/kg sediment)	Forage Fish Tissue (mg/kg wet weight)
COPEC					
TPAH16	236	NA	NA	NA	NA
OC-Normalized TPAH16	5747	NA	NA	NA	NA
TPAH34	836	NA	NA	NA	NA
OC-Normalized TPAH34	10597	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Barium	101	NA	NA	NA	NA
Lead	362	NA	NA	NA	NA
Mercury	1.2	0.15 (b)	0.19 (c)	0.75 (d)	0.93 (c)
Nickel	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA
OC-Normalized Tributyltin	0.3	NA	NA	NA	NA
Cyanide	See text	NA	NA	NA	NA
Benzene	0.8	NA	NA	NA	NA
Ethylbenzene	2	NA	NA	NA	NA
Total Xylenes	3	NA	NA	NA	NA
C5-C8 Aliphatics, Adjusted	NA	NA	NA	NA	NA
C11-C22 Aromatics, Adjusted	39	NA	NA	NA	NA
C9-C10 Aromatics	53	NA	NA	NA	NA
C9-C18 Aliphatics	124	NA	NA	NA	NA
C9-C12 Aliphatics, Adjusted	16	NA	NA	NA	NA
C19-C36 Aliphatics	37	NA	NA	NA	NA
Methyl tert-butyl ether	0.5	NA	NA	NA	NA
2-Methylnaphthalene	(a)	NA	NA	NA	NA
Naphthalene	(a)	NA	NA	NA	NA

Notes:

EPC - Exposure point concentration

NA - Not applicable

ND - Not detected

COPEC - Constituent of potential ecological concern

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

OC - Organic carbon

(a) Evaluated as TPAH in sediment

(b) Value for Winter Flounder from Hammerschmidt and Fitzgerald (2006)

(c) Concentration of methylmercury

(d) Value for bluefish from Hammerschmidt and Fitzgerald (2006)

Table 5-7a
COPEC Concentrations in Porewater
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Measured TPAH16	Estimated TPAH16	Measured TPAH34	Estimated TPAH34
Reference Area Locations					
LC-1	LC1-S1		0.70		
LC-2	LC2-S1		0.45		
LC-HC1	LCHC1-GL02	0.35		0.90	
LC-HC2	LCHC2-S1		0.25		
LC-HC3	LCHC3-S1		0.24		
LC-NE1	LCNE1-GL03	0.52		1.3	
LC-NE2	LCNE2-GL04	0.52		1.2	
LC-NE3	LCNE3-S1		2.3		6.4
LC-SW2	LCSW2-GL06	0.53		1.2	
LC-SW3	LCSW3-S1		0.31		
Study Area Locations					
LC-SW1	LCSW1-GL05	0.92		3.1	
A-2	A-2		2.6		
B-1 S1	B-1 S1		6.2		
MR-1	MR-1-S1		0.065		
MR-2	MR-2-S1		0.054		
MR-3	MR-3-S1		0.047		
MR-4	MR-4-S1		0.053		
MR-5	MR-5-S1		13		
MR-6	MR-6-S1		0.66		
N0E25	N0E25-S1		2.3		
N0E5	N0E5-GL07	1.1		6.0	
N0E31	N0E31-S1		0.042		
N10E1	N10E1-S1		1.9		
N10E11	N10E11-GL22	2.0		6.6	
N10E27	N10E27-S1		2.3		
N-10E28	N-10E28-S1		0.58		
N10E38	N10E38-S1		1.0		
N10E38	N10E38-S2		0.71		
	<i>Location Average</i>		<i>0.86</i>		
N10E4	N10E4-S1		5.6		
N11E13	N11E13-S1		0.2		
N11E13	N11E13-S2		0.35		
	<i>Location Average</i>		<i>0.27</i>		
N11E27	N11E27-S1		5.5		
N11E29	N11E29-S1		1.3		
N11E30	N11E30-S1		0.98		
N11E33	N11E33-GL23	1.1		2.9	
N11E35	N11E35-S1		0.062		
N12E11	N12E11-S1&S3		1.9		
N12E15	N12E15-S2		0.6		
N12E15	N12E15-S1		0.88		
	<i>Location Average</i>		<i>0.74</i>		
N12E19	N12E19-GL24	0.86		2.0	
N12E22	N12E22-S1		0.85		
N12E25	N12E25-S1		0.077		
N12E27	N12E27-S1		0.087		
N13E12	N13E12-S1		0.042		
N13E30	N13E30-S1		0.49		
N13E33	N13E33-S1		0.043		
N14E11	N14E11-GL25	0.71		1.6	
N14E31	N14E31-S1		1.1		

Table 5-7a
COPEC Concentrations in Porewater
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Measured TPAH16	Estimated TPAH16	Measured TPAH34	Estimated TPAH34
N14E9	N14E9-S1		1.4		
N15E19	N15E19-S1		0.2		
N15E19	N15E19-S2		2.7		
	<i>Location Average</i>		1.4		
N15E38	N15E38-S1		1.1		
N15E4	N15E4-S1		8.4		52
N15E8	N15E8-S1		0.026		
N17E11	N17E11-S1		0.71		
N-17E13	N-17E13-S2		2.0		
N-17E13	N-17E13-S1		0.8		
	<i>Location Average</i>		1.4		
N17E6	N17E6-GL26	0.51		1.3	
N18E31	N18E31-S1		0.98		
N1E11	N1E11-S1		1.7		
N1E15	N1E15-S1		2.7		
N1E15	N1E15-S2		0.3		
	<i>Location Average</i>		1.5		
N-1E15	N-1E15-GL08	2.2		7.6	
N-1E6	N-1E6-S1		1.9		
N20E11	N20E11-S1		0.72		2.6
N20E15	N20E15-S1		0.55		
N20E35	N20E35-S1		1.1		
N-24E25	N-24E25-S1		0.80		
N-24E8	N-24E8-S1		1.4		
N26E32	N26E32-S1		0.88		
N-2E11	N-2E11-GL09	0.47		1.4	
N2E2	N2E2-S1		2.4		6.2
N(-)2E13	N(-)2E13-S1		0.020		
N-2E21	N-2E21-GL10	0.78		1.8	
N(-)2E24	N(-)2E24-S1 & DUP		0.051		
N-2E33	N-2E33-S1		1.1		
N30E27	N30E27-S1&S2		1.1		
N3E11	N3E11-S1		2.5		
N(-)3E19	N(-)3E19-S1		0.050		
N3E24	N3E24-S1&DUP2		3.1		
N-3E28	N-3E28-GL11	0.65		2.4	
N3E33	N3E33-S1		0.039		
N3E3	N3E3-S1		1.4		
N3E31	N3E31-GL12	4.7		20	
N-4E2	N-4E2-S1		0.61		
N-4E2	N-4E2-S2		0.35		
	<i>Location Average</i>		0.48		
N4E3	N4E3-S1		1.9		
N4E3	N4E3-S2		1.1		
	<i>Location Average</i>		1.5		
N(-)4E13	N(-)4E13-S1		0.049		
N4E38	N4E38-S1		0.74		
N5E11	N5E11-GL14&DUP1	140		424	
N5E15	N5E15-S1		11		
N5E2	N5E2-GL13	2.8		7.14	
N5E21	N5E21-GL15	440		1524	
N-5E27	N-5E27-S1		0.60		
N5E3	N5E3-S2		1.2		

Table 5-7a
COPEC Concentrations in Porewater
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Measured TPAH16	Estimated TPAH16	Measured TPAH34	Estimated TPAH34
N5E32	N5E32-S1		0.035		
N5E4	N5E4-S2		0.26		
N5E4	N5E4-S1		1.2		
	<i>Location Average</i>		<i>0.73</i>		
N5E7	N5E7-S1		3.5		
N5E7	N5E7-S2		3.0		
	<i>Location Average</i>		<i>3.2</i>		
N(-)6E13	N(-)6E13-S1		0.017		
N6E15	N6E15-GL17	1.1		3.3	
N-6E15	N-6E15-GL16	6.6		22	
N(-)6E17	N(-)6E17-S1		0.025		
N6E18	N6E18-S2		9.8		
N6E27	N6E27-S1		0.99		
N6E3	N6E3-S1		0.79		
N6E3	N6E3-S2		0.97		
	<i>Location Average</i>		<i>0.88</i>		
N6E31	N6E31-S1		0.029		
N-7E0	N-7E0-GL18	0.36		1.1	
N7E11	N7E11-S1		1.4		
N-7E15	N-7E15-S1		1.5		
N7E2	N7E2-S1		32		
N7E7	N7E7-GL19	1.1		2.9	
N(-)8E15	N(-)8E15-S1		0.011		
N8E19	N8E19-S1		3.3		
N8E24	N8E24-GL20	1.3		3.9	
N8E30	N8E30-S1		1.3		
N9E11	N9E11-S1		2.5		
N9E11	N9E11-S2		0.51		
	<i>Location Average</i>		<i>1.5</i>		
N9E15	N9E15-GL21	0.66		1.5	
N9E33	N9E33-S1		0.060		
WB-1 S1	WB-1 S1		200		

Notes:

All concentrations in ug/L.

COPEC - Constituent of potential ecological concern

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

Table 5-7b
Summary Statistics for COPECs in Study Area Porewater
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

COPEC	# Detects	# Samples	Range of Detects		Mean	Standard Deviation
			Minimum	Maximum		
Measured TPAH16	21	21	0.36	440	29	99
Estimated TPAH16	82	82	0.01	200	4	22
Measured TPAH34	21	21	1.1	1524	97	339
Estimated TPAH34	3	3	2.63	52	20	28

Notes:

All concentrations in ug/L.

COPEC - Constituent of potential ecological concern

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

Table 5-8
Default and Site-Specific Organic Carbon-Water Partitioning Coefficients and Final Chronic Values for PAH
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

PAH	FCV (µg/L)	Default K _{oc} (L/kg)	Default FCV-OC (mg/kg OC)	Site-Specific K _{oc} (L/kg)	Site-Specific FCV-OC (mg/kg OC)
1-Methylnaphthalene	75.37	5916	444	70020	5277
2-Methylnaphthalene	72.16	6194	444	677004	48853
Acenaphthene	55.85	8790	491	232487	12984
Acenaphthylene	306.9	1472	452	5938829	1822627
Anthracene	20.73	28642	594	4995558	103558
Benzo(a)anthracene	2.227	377572	841	11418595	25429
Benzo(a)pyrene	0.9573	1006932	965	10737820	10279
benzo[e]pyrene	0.9008	1073989	967	5198266	4683
Benzo(g,h,i)perylene	0.4391	2494595	1094	15054313	6610
Benzo[b+k]fluoranthene	0.65945	1486503	980	13105466	8642 (a)
C1-Chrysenes	0.8557	1086426	929	39619418	33902
C1-Fluoranthenes/Pyrenes	4.887	157398	770	1869000	9134
C1-Fluorenes	13.99	43652	611	667072	9332
C1-Phenanthrenes/Anthracenes	7.436	90157	670	519498	3863
C2-Chrysenes	0.4827	2089296	1008	NA	NA
C2-Fluorenes	5.305	129420	686	999030	5300
C2-Naphthalenes	30.24	16866	510	123442	3733
C2-Phenanthrenes/Anthracenes	3.199	232809	746	698550	2235
C3-Chrysenes	0.1675	6637431	1112	NA	NA
C3-Fluorenes	1.916	400867	769	NA	NA
C3-Naphthalenes	11.1	52360	581	122613	1361
C3-Phenanthrenes/Anthracenes	1.256	660693	829	533440	670
C4-Chrysenes	0.07062	17179084	1214	NA	NA
C4-Naphthalenes	4.048	162181	657	57644	233
C4-Phenanthrenes/Anthracenes	0.5594	1633052	913	229464	128
Chrysene	2.042	413048	844	10427211	21292
Dibenzo(a,h)anthracene	0.2825	3971915	1123	NA	NA
Fluoranthene	7.109	99541	707	5871993	41744
Fluorene	39.3	13709	538	471302	18522
Indeno(1,2,3-cd)pyrene	0.275	4055085	1115	39258792	10796
Naphthalene	193.5	1991	385	240833	46601
Perylene	0.9008	1073989	967	5928252	5340
Phenanthrene	19.13	31189	596	868272	16610
Pyrene	10.11	69024	697	918838	9289

Notes:

NA - Not applicable; Site-specific K_{oc} was not developed because this PAH was not detected in both sediment and porewater

FCV - Final Chronic Values (EPA, 2003)

Default K_{oc} obtained from EPA (2003)

K_{oc} - Organic carbon water partition coefficient. Values are the geometric mean of K_{oc} values calculated at each sample location where a constituent was detected in sediment and porewater. Individual K_{oc} values calculated as concentration in sediment divided by concentration in porewater, divided by fraction organic carbon at the sample location

PAH - polycyclic aromatic hydrocarbons

OC - Organic carbon

(a) This value is the average of values for benzo(b)fluoranthene and benzo(k)fluoranthene, and was applied to analytical results reported as benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo[b+k]fluoranthene

FCV-OC - Organic carbon-normalized Final Chronic Value in sediment

Table 5-9
Regression Analysis of Toxicity Test Endpoints and COPEC Concentrations
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Medium	COPEC	Concentration Range Evaluated	<i>Neanthes</i> (a)	<i>Leptocheirus</i>		
			Growth	Survival	Growth	Reproduction
Sediment	TPAH16	Concentration Range	12 - 456 mg/kg	12 - 456 mg/kg	12 - 456 mg/kg	12 - 456 mg/kg
		p	0.6	0.00003	0.002	0.006
	R ²	0.02	0.63	0.41	0.34	
	TPAH34	Concentration Range	22 - 932 mg/kg	22 - 932 mg/kg	22 - 932 mg/kg	22 - 932 mg/kg
		p	0.68	0.000008	0.001	0.005
	R ²	0.009	0.68	0.46	0.37	
	Barium	Concentration Range	66 - 132 mg/kg	66 - 132 mg/kg	66 - 132 mg/kg	66 - 132 mg/kg
p		0.33	0.80	0.20	0.24	
R ²	0.005	0.04	0.09	0.08		
Lead	Concentration Range	127 - 3270 mg/kg	127 - 3270 mg/kg	127 - 3270 mg/kg	127 - 3270 mg/kg	
	p	0.38	0.92	0.76	0.20	
R ²	0.04	0.0005	0.005	0.09		
Mercury	Concentration Range	0.22 - 2.8 mg/kg	0.22 - 2.8 mg/kg	0.22 - 2.8 mg/kg	0.22 - 2.8 mg/kg	
	p	0.46	0.002	0.06	0.052	
R ²	0.03	0.39	0.19	0.19		
Mercury and TPAH34	Concentration Range		TPAH34 = 22 - 932 mg/kg Mercury = 0.22 - 2.8 mg/kg			
	Regression p	(b)	0.00004	(b)	(b)	
	Regressions R ²	(b)	0.66	(b)	(b)	
	Mercury p	(b)	0.4	(b)	(b)	
TPAH p	(b)	0.0004	(b)	(b)		
Organic Carbon Normalized	TPAH16	Concentration Range	241 - 10,422 mg/kg OC	241 - 10,422 mg/kg OC	241 - 10,422 mg/kg OC	241 - 10,422 mg/kg OC
		p	0.48	0.0003	0.01	0.03
	R ²	0.03	0.53	0.29	0.25	
	TPAH34	Concentration Range	457 - 21,304 mg/kg OC	457 - 21,304 mg/kg OC	457 - 21,304 mg/kg OC	457 - 21,304 mg/kg OC
p		0.55	0.0001	0.007	0.02	
R ²	0.02	0.58	0.34	0.27		
Porewater	TPAH16	Concentration Range	0.36 - 140 ug/L	0.36 - 140 ug/L	0.36 - 140 ug/L	0.36 - 140 ug/L
		p	0.79	0.004	0.14	0.17
	R ²	0.004	0.38	0.11	0.10	
	TPAH34	Concentration Range	1.1 - 424 ug/L	1.1 - 424 ug/L	1.1 - 424 ug/L	1.1 - 424 ug/L
p		0.8	0.004	0.14	0.17	
R ²	0.004	0.38	0.12	0.10		

Notes:

(a) *Neanthes* survival did not differ from reference area survival, so correlations between *Neanthes* survival and COPEC concentrations were not evaluated.

(b) Not evaluated.

Correlation between endpoint and COPEC concentrations is statistically significant.

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

COPEC - Constituent of Potential Environmental Concern

OC - Organic Carbon

Table 5-10
Derivation of TRVs for TPAH Using Leptocheirus Toxicity Test Results
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Leptocheirus Survival		Effect Concentration (EC)					
		Porewater		Sediment		OC-Normalized Sediment	
		TPAH16	TPAH34	TPAH16	TPAH34	TPAH16	TPAH34
		Slope	1.545	1.425	4.517	5.232	3.917
Intercept	4.144	3.459	-5.653	-8.873	-9.307	-10.464	
Highest Non-Significant Reduction from Reference	28%	1.5	4.7	170	347	3195	6127
Lowest Significant Reduction from Reference	34%	1.9	6.2	185	374	3531	6769
TRV = EC31	31%	1.7	5.4	177	360	3349	6421
Leptocheirus Growth		Effect Concentration (EC)					
		Porewater		Sediment		OC-Normalized Sediment	
		TPAH16	TPAH34	TPAH16	TPAH34	TPAH16	TPAH34
		Slope	1.616	1.317	2.005	2.078	1.897
Intercept	4.641	4.022	0.58	-0.179	-1.64	-3.148	
Highest Non-Significant Reduction from Reference	41%	1.2	3.7	123	241	2393	4686
Lowest Significant Reduction from Reference	47%	1.5	4.8	146	284	2871	5500
TRV = EC44	44%	1.3	4.3	135	263	2637	5104

Table 5-11
Toxicity Reference Values
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

COPEC		Sediment TRV (mg/kg)	OC-Normalized Sediment TRV (mg/kg OC)	Porewater TRV (ug/L)	Fish Tissue TRV (mg/kg wet weight)	Piscivorous Bird TRV (mg/kg-day)
TPAH16	<i>Survival</i>	177	3349	1.7	NA	NA
	<i>Growth</i>	135	2637	1.3	NA	NA
TPAH34	<i>Survival</i>	360	6421	5.4	NA	NA
	<i>Growth</i>	263	5104	4.3	NA	NA
Barium		130	NA	NA	NA	NA
Lead		218	NA	NA	NA	NA
Mercury		4.1	NA	NA	0.21	0.0064
Tributyltin		NA	0.6	NA	NA	NA
Cyanide		0.1	NA	NA	NA	NA
SEM/AVS		1	NA	NA	NA	NA
Benzene	B-1 S1	0.91				
	N5E2	2.24				
	N5E3-S2	0.34				
	WB-1 S1	0.91				
	Study Area Average	0.91	NA	NA	NA	NA
C11-C22 Aromatics, Adjusted	B-1 S1	0.8				
	WB-1 S1	0.8				
	Study Area Average	0.8	NA	NA	NA	NA
C19-C36 Aliphatics	WB-1 S1	45636				
	Study Area Average	45696	NA	NA	NA	NA
C9-C10 Aromatics	B-1 S1	30.72				
	N5E11 S2	20.64				
	N5E15 S1	24.48				
	N5E2 S2	77.77				
	N7E2 S1	20.16				
	WB-1 S1	30.72				
Study Area Average	30.72	NA	NA	NA	NA	
C9-C12 Aliphatics, Adjusted	N5E15 S1	6885				
	N5E2 S2	21870				
	N9E11 S1	6885				
	WB-1 S1	8640				
	Study Area Average	8640	NA	NA	NA	NA
C9-C18 Aliphatics	B-1 S1	39168				
	WB-1 S1	39168				
	Study Area Average	39168	NA	NA	NA	NA
Ethylbenzene	B-1 S1	1.18				
	N5E2 S2	2.99				
	N5E3 S2	0.44				
	N7E2 S1	0.78				
	WB-1 S1	1.18				
	Study Area Average	1.18	NA	NA	NA	NA
Methyl tert-butyl ether	N(-)17E13 S1	9.4				
	WB-1 S1	17.19				
	Study Area Average	17.19	NA	NA	NA	NA
Total Xylene	B-1 S1	1.6				
	N5E2 S2	4.04				
	N5E3 S2	0.6				
	N7E2 S1	1.05				
	WB-1 S1	1.6				
	Study Area Average	1.6	NA	NA	NA	NA

Notes:

TRV - Toxicity reference value

NA - Not applicable

(a) Evaluated as TPAH in sediment.

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

SEM - Simultaneously extracted metals

AVS - Acid volatile sulfide

SEM/AVS - Ratio of SEM to AVS

OC - Organic carbon

Table 5-12
Description of Benthic Community Metrics
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Category	Metric	Definition	Predicted Response to Increasing Stress
Richness	Taxa Richness	Number of different taxa in sample; measures overall variety of macroinvertebrate assemblage	Decrease
	Abundance	Total number of organisms in sample	Decrease
Composition	Shannon Diversity Index	Measures the diversity of a sample including number of species and species evenness	Decrease
	Evenness	Measures the diversity of a sample in terms of the number of individuals of each species	Decrease
	Percent Dominant Taxon	Measures the dominance of the single most abundant taxon in sample	Increase
Tolerance	Percent Polychaete	Measures the dominance of polychaete worms in sample	Increase
	Number of Amphipods	Measures the presence of amphipods in sample	Decrease

Notes:
Source: EPA (2000)

Table 5-13
Evaluation of Benthic Community Metrics
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Metric													
	Abundance		Shannon Diversity Index		Number of Taxa		Evenness		Percent Dominant Taxon		Percent Polychaetes		Number of Amphipods	
	Value	p	Value	p	Value	p	Value	p	Value	p	Value	p	Value	p
LC-HC1	213		0.73		8.0		0.36		76		79		1.7	
LC-NE1	57		1.35		7.7		0.75		49		49		28.7	
LC-NE2	45		1.69		8.7		0.78		38		87		5.3	
LC-SW2	219		0.99		8.3		0.47		69		71		62.0	
Average of Reference Locations	134		1.19		8.2		0.59		58		72		24.4	
LC-SW1	207	0.89	1.03	0.89	7.7	0.26	0.51	0.77	56.58	0.77	57.56	0.08	78.0	0.02 (a)
N0E5	158	1.00	1.35	0.67	9.0	0.45	0.61	0.77	50.24	0.56	91.88	0.03	2.0	0.11
N10E11	220	0.08	0.88	0.47	7.3	0.20	0.44	0.39	75.50	0.11	90.95	0.03	13.3	0.38
N11E33	239	0.014 (a)	1.74	0.08	11.0	0.02 (a)	0.73	0.25	39.16	0.19	56.80	0.11	97.7	0.0091 (a)
N12E19	207	1.00	1.61	0.19	8.0	0.59	0.78	0.15	34.99	0.11	49.88	0.04 (b)	103.7	0.0091 (a)
N14E11	211	0.66	0.92	0.31	8.0	0.36	0.44	0.39	70.33	0.31	76.14	0.77	41.0	0.22
N17E6	205	0.22	1.17	0.56	7.7	0.65	0.58	0.67	48.06	0.31	99.09	0.009	0	0.009
N-1E15	233	0.014 (a)	1.53	0.19	10.3	0.07	0.66	0.47	40.83	0.19	60.40	0.15	87.3	0.02 (a)
N-2E11	269	0.0094 (a)	1.61	0.19	10.7	0.06	0.68	0.47	50.67	0.31	70.38	0.56	75.0	0.013 (a)
N-2E21	231	0.08	1.53	0.25	12.0	0.013 (a)	0.62	0.67	42.50	0.19	54.46	0.04 (b)	102.7	0.0091 (a)
N-3E28	260	0.0094 (a)	1.44	0.31	10.3	0.07	0.62	0.67	49.15	0.39	72.23	0.89	64.7	0.04 (a)
N3E31	224	0.06	1.38	0.39	10.7	0.05	0.58	0.89	49.84	0.47	83.26	0.31	35.3	0.38
N5E11	238	0.04 (a)	1.69	0.19	11.3	0.02 (a)	0.70	0.39	40.37	0.19	40.10	0.03 (b)	139.3	0.0091 (a)
N5E2	244	0.05	0.55	0.03	12.0	0.05	0.30	0.08	85.41	0.03	87.10	0.11	13.3	0.94
N5E21	258	0.0093 (a)	1.86	0.03 (a)	5.7	0.013	0.75	0.19	37.54	0.15	51.70	0.04 (b)	118.7	0.0091 (a)
N6E15	236	0.08	1.78	0.11	13.3	0.011 (a)	0.69	0.39	40.23	0.19	60.22	0.15	90.7	0.014 (a)
N-6E15	207	0.72	1.02	0.67	7.3	0.36	0.52	0.67	53.09	0.47	49.98	0.04 (b)	99.7	0.0091 (a)
N-7E0	93	0.56	1.15	1.00	8.3	0.82	0.53	0.77	60.10	1.00	87.48	0.15	3.7	0.09
N7E7	233	0.014 (a)	0.71	0.02	5.0	0.04	0.48	0.47	66.97	0.89	67.70	0.31	1.3	0.05
N8E24	210	0.77	1.65	0.19	11.7	0.02 (a)	0.68	0.47	33.29	0.06	42.45	0.03 (b)	120.0	0.0091 (a)
N9E15	209	0.47	1.01	0.56	7.7	0.65	0.50	0.56	62.42	0.89	67.99	0.31	62.0	0.08

Notes:

Metric value is statistically significantly different from reference area metric (alpha = 0.05), indicating potential adverse effect for this metric.

(a) Although p value is less than 0.05, metric at study area location is statistically significantly higher than reference area metrics, indicating no adverse effect.

(b) Although p value is less than 0.05, metric at study area location is statistically significantly lower than reference area metrics, indicating no adverse effect.

Table 5-14
Sediment Grain Size Distribution
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	% Gravel	% Sand	% Silt/Clay
LC-1	0	7	93
LC-2	0	35	65
LC-HC1	1	30	68
LC-HC2	0	26	74
LC-HC3	9	25	66
LC-NE1	0	4	96
LC-NE2	0	14	86
LC-NE3	22	10	68
LC-SW1	0	6	94
LC-SW2	0	9	91
LC-SW3	0	13	87
NOE5	14	54	32
N10E11	7	22	71
N10E23	0	5	95
N-10E28	0	8	92
N10E38	0	19	81
N10E7A	0	19	81
N11E27	0	10	90
N11E33	0	30	70
N12E19	0	9	91
N13E15	0	4	96
N14E11	1	17	82
N15E38	0	12	88
N15E4	1	28	72
N17E11	0	5	95
N-17E13	0	6	95
N17E6	67	14	20
N18E31	0	24	76
N1E11	0	10	90
N-1E15	0	12	88
N20E11	0	15	85
N20E35	0	7	93
N-24E25	20	20	60
N-24E8	0	12	88
N-2E11	0	35	65
N2E2	1	49	50
N-2E21	0	32	68
N-2E33	0	3	97
N30E27	0	13	87
N3E24	0	9	91
N-3E28	0	9	91
N3E31	0	27	73
N-3E31	0	4	96
N-3E36	7	60	33
N4E38	0	5	95
N5E11	0	13	87
N5E2	0	95	5
N5E21	2	12	85
N6E15	0	28	73
N6E18	0	9	91
N-7E0	0	36	64
N-7E15	0	17	83
N7E7	33	37	30
N8E24	0	25	75
N8E30	36	27	37
N9E15	11	15	74

Table 5-15
Evaluation of Toxicity Test Results
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	<i>Neanthes arenaceodentata</i> ¹		<i>Leptocheirus plumulosus</i> ²		
	Percent Survival	Weight per Organism (mg dry weight)	Percent Survival	Weight per Organism (mg dry weight)	Reproduction (Number of Young per Organism)
CONTROL ³	100	4.07	98	1.07	1.30
LC-HC1	88	6.20	95	1.38	2.62
LC-NE1	93	5.58	89	1.39	2.42
LC-NE2	93	4.84	92	1.01	2.78
LC-SW2	100	4.63	89	0.96	2.46
Average of Reference Locations	95	5.06	93	1.16	2.32
LC-SW1	100	5.07	80	0.50	0.35
N0E5	88	5.84	76	0.97	1.88
N10E11	88	5.16	27	0.36	0.13
N11E33	93	4.59	81	0.90	1.30
N12E19	78	5.47	66	0.61	0.73
N14E11	93	3.50	88	0.78	2.25
N17E6	85	4.19	78	0.88	1.43
N-1E15	83	3.87	60	0.48	0.16
N-2E11	93	5.03	92	0.95	2.58
N-2E21	73	4.59	88	0.80	1.15
N-3E28	95	5.60	71	0.79	2.58
N3E31	95	4.90	43	0.35	0.76
N5E11	103	4.60	3	0.30	0
N5E2	90	4.01	71	0.70	0.30
N5E21	63	3.59	0	(a)	(a)
N6E15	98	4.56	81	0.63	1.69
N-6E15	90	5.28	21	0.20	0.15
N-7E0	90	5.38	87	1.28	2.93
N7E7	90	5.11	45	0.57	0.59
N8E24	88	5.16	70	0.59	0.60
N9E15	100	3.83	93	1.35	2.63

Notes:

¹ Survival and weight of *Neanthes arenaceodentata* at each sample point represents the mean of eight replicates

² Survival, weight and reproduction of *Leptocheirus plumulosus* at each sample point represents the mean of five replicates

³ Sample ID "CONTROL" was an average of the laboratory control samples for Survival, Weight and

Reproduction Tests. "CONTROL" results were not used in the statistical evaluation of study area endpoints

Endpoint value is statistically significantly different from reference endpoint values

(a) Endpoint not measured because no organisms survived

Table 5-16
Comparison of TPAH Concentrations in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location Sample ID		Survival TRV					Growth TRV						
		TPAH16 (mg/kg) TRV	OC- Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg) 360	Estimated TPAH34 (mg/kg) 360	OC- Normalized TPAH34 (mg/kg OC) 6421	Estimated OC- Normalized TPAH34 (mg/kg OC) 6421	TPAH16 (mg/kg) 135	OC- Normalized TPAH16 (mg/kg OC) 2637	TPAH34 (mg/kg) 263	Estimated TPAH34 (mg/kg) 263	OC- Normalized TPAH34 (mg/kg OC) 5104	Estimated OC- Normalized TPAH34 (mg/kg OC) 5104
Reference Area Locations													
LC-1	LC1-S1	34	1359		57.0		2281	34	1359		57.0		2281
LC-2	LC2-S1	24	869		40.1		1458	24	869		40.1		1458
LC-HC1	LCHC1-G1 & LCHC1-GL02	19	430	28.1		624		19	430	28.1		624	
LC-HC2	LCHC2-S1	21	628		34.8		1054	21	628		34.8		1054
LC-HC3	LCHC3-S1	10	564		17.5		946	10	564		17.5		946
LC-NE1	LCNE1-G1 & LCNE1-GL03	27	522	46.0		888		27	522	46.0		888	
LC-NE2	LCNE2-G1 & LCNE2-GL04	25	512	44.2		901		25	512	44.2		901	
LC-NE3	LCNE3-S1	115	5093	196.3		8724		115	5093	196.3		8724	
LC-SW2	LCSW2-G1 & LCSW2-GL06	22	518	40.1		929		22	518	40.1		929	
LC-SW3	LCSW3-S1	26	779		43.1		1307	26	779		43.1		1307
Study Area Locations													
LC-SW1	LCSW1-GL05	52	1081	109		2245		52	1081	109		2245	
	LCSW1-G1	38	772	72		1474		38	772	72		1474	
	<i>Location Average</i>	<i>45</i>	<i>927</i>	<i>90</i>		<i>1860</i>		<i>45</i>	<i>927</i>	<i>90</i>		<i>1860</i>	
A-2	A-2	205	5498		390		10446	205	6409		390		12176
B-1	B-1 S1	175	5456		333		10319	175	5456		333		10319
MR-1	MR-1-S1	264	5067		502		9626	264	5067		502		9626
MR-2	MR-2-S1	59	2005		113		3810	59	2005		113		3810
MR-3	MR-3-S1	36	1679		68		3190	36	1679		68		3190
MR-4	MR-4-S1	78	2346		148		4458	78	2346		148		4458
MR-5	MR-5-S1	1651	35614		3136		67666	1651	35614		3136		67666
MR-6	MR-6-S1	1385	31948		2631		60701	1385	31948		2631		60701
MR-7	MR-7-S1												
N0E25	N0E25-S1	156	5109		297		9739	156	5109		297		9739
N0E5	N0E5-G1	20	588	32		941		20	588	32		941	
	N0E5-GL07	32	945	50		1493		32	945	50		1493	
	<i>Location Average</i>	<i>26</i>	<i>767</i>	<i>41</i>		<i>1217</i>		<i>26</i>	<i>767</i>	<i>41</i>		<i>1217</i>	
N0E31	N0E31-S1	61	2000		116		3800	61	2000		116		3800
N10E1	N10E1-S1	155	4356		295		8304	155	4356		295		8304
N10E1A	N10E1A-S1												
N10E11	N10E11-G1 & N10E11-GL22	198	3578	396		7158		198	3578	396		7158	
N10E27	N10E27-S1	147	4210		281		8024	147	4210		281		8024
N-10E28	N-10E28-S1	29	1160		55		2212	29	1160		55		2212
N10E38	N10E38-S1	58	2286		111		4358	58	2286		111		4358
	N10E38-S2	33	1473		63		2808	33	1473		63		2808
	<i>Location Average</i>	<i>46</i>	<i>1880</i>		<i>87</i>		<i>3583</i>	<i>46</i>	<i>1880</i>		<i>87</i>		<i>3583</i>
N10E4	N10E4-S1	130	13198		248		25156	130	13198		248		25156
N11E4A	N11E4A-S1												
N11E13	N11E13-S1	167	4034		317		7666	167	4034		317		7666
	N11E13-S2	5	187		10		356	5	187		10		356
	<i>Location Average</i>	<i>86</i>	<i>2111</i>		<i>163</i>		<i>4011</i>	<i>86</i>	<i>2111</i>		<i>163</i>		<i>4011</i>
N11E27	N11E27-S1	363	9677		692		18446	363	9677		692		18446
N11E29	N11E29-S1	518	15383		983		29227	518	15383		983		29227
N11E30	N11E30-S1	78	2286		148		4357	78	2286		148		4357

Table 5-16
Comparison of TPAH Concentrations in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV					Growth TRV						
		TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH34 (mg/kg OC)	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH34 (mg/kg OC)
	(units) TRV	177	3349	360	360	6421	6421	135	2637	263	263	5104	5104
N11E33	N11E33-GL23	141	2332	296		4903		141	2332	296		4903	
	N11E33-G1	118	1956	229		3787		118	1956	229		3787	
	<i>Location Average</i>	129	2144	262		4345		129	2144	262		4345	
N11E35	N11E35-S1	67	1920		128		3647	67	1920		128		3647
N12E11	N12E11-S1/S3	142	4428		270		8439	142	4428		270		8439
N12E15	N12E15-S2	4.9	272		9		518	4.9	272		9		518
	N12E15-S1	40	1983		76		3780	40	1983		76		3780
	<i>Location Average</i>	22	1128		42		2149	22	1128		42		2149
N12E19	N12E19-G1 & N12E19-GL24	77	1559	160		3234		77	1559	160		3234	
N12E22	N12E22-S1	64	1891		123		3604	64	1891		123		3604
N12E25	N12E25-S1	85	2784		162		5290	85	2784		162		5290
N12E27	N12E27-S1	203	6435		386		12226	203	6435		386		12226
N13E12	N13E12-S1	103	3035		195		5766	103	3035		195		5766
N13E30	N13E30-S1	47	1264		90		2402	47	NA		90		NA
N13E33	N13E33-S1	113	2977		215		5655	113	2977		215		5655
N14E11	N14E11-G1	52	1107	97		2070		52	1107	97		2070	
	N14E11-GL25	70	1509	139		2987		70	1509	139		2987	
	<i>Location Average</i>	61	1308	118		2529		61	1308	118		2529	
N14E31	N14E31-S1	63	2208		120		4209	63	2208		120		4209
N14E9	N14E9-S1	97	3418		186		6515	97	3418		186		6515
N15E8	N15E8-S1	46	1131		88		2149	46	1131		88		2149
N15E19	N15E19-S1	1.2	51		2		97	1.2	51		2		97
	N15E19-S2	100	5582		192		10640	100	5582		192		10640
	<i>Location Average</i>	51	2817		97		5369	51	2817		97		5369
N15E38	N15E38-S1	49	2069		93		3944	49	2069		93		3944
N15E4	N15E4-S1	1989	18080	4425		40227		1989	18080	4425		40227	
N17E11	N17E11-S1	71	1808		136		3446	71	1808		136		3446
N-17E13	N-17E13-S2	86	4887		163		9315	86	4887		163		9315
	N-17E13-S1	36	1831		68		3489	36	1831		68		3489
	<i>Location Average</i>	61	3359		116		6402	61	3359		116		6402
N17E6	N17E6-GL26	12	241	22		457		12	241	22		457	
	N17E6-G1	6.0	124	11		221		6.0	124	11		221	
	<i>Location Average</i>	9	183	16		339		9	183	16		339	
N18E31	N18E31-S1	59	2219		112		4229	59	2219		112		4229
N1E11	N1E11-S1	151	4374		288		8338	151	4374		288		8338
N1E15	N1E15-S1	111	6366		212		12134	111	6366		212		12134
	N1E15-S2	1.5	112		3		213	1.5	112		3		213
	<i>Location Average</i>	56	3239		108		6173	56	3239		108		6173
N-1E15	N-1E15-G1 & N-1E15-GL08	205	4720	411		9482		205	4720	411		9482	
N-1E6	N-1E6-S1	117	3949		222		7528	117	3949		222		7528
N20E11	N20E11-S1	62	1909	110		3398		62	1909	110		3398	
N20E15	N20E15-S1	23	1054		44		2009	23	1054		44		2009
N20E35	N20E35-S1	62	2577		118		4912	62	2577		118		4912
N-24E25	N-24E25-S1	17	1333		33		2540	17	1333		33		2540

Table 5-16
Comparison of TPAH Concentrations in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV					Growth TRV						
		TPAH16 (mg/kg) (units) TRV	OC- Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg) TRV	Estimated TPAH34 (mg/kg)	OC- Normalized TPAH34 (mg/kg OC)	Estimated OC- Normalized TPAH34 (mg/kg OC)	TPAH16 (mg/kg)	OC- Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg) TRV	Estimated TPAH34 (mg/kg)	OC- Normalized TPAH34 (mg/kg OC)	Estimated OC- Normalized TPAH34 (mg/kg OC)
		177	3349	360	360	6421	6421	135	2637	263	263	5104	5104
N-24E8	N-24E8-S1	80	3496		153		6663	80	3496		153		6663
N26E32	N26E32-S1	43	2366		81		4510	43	2366		81		4510
N-2E11	N-2E11-G1 & N-2E11-GL09	86	2290	160		4262		86	2290	160		4262	
N(-)2E13	N(-)2E13-S1	78	1888		149		3588	78	1888		149		3588
N2E2	N2E2-S1	144	5451	218		8225		144	5451	218		8225	
N-2E21	N-2E21-G1 & N-2E21-GL10	110	2199	196		3900		110	2199	196		3900	
N(-)2E24	N(-)2E24-S1 & DUP-5	137	3004		260		5708	137	3004		260		5708
N-2E33	N-2E33-S1	62	2496		119		4757	62	2496		119		4757
N30E27	N30E27-S1&S2DUP	39	2442		74		4655	39	2442		74		4655
N3E11	N3E11-S1	283	6818		539		12997	283	6818		539		12997
N3E24	N3E24-S1&S1DUP2	203	5069		388		9662	203	5069		388		9662
N(-)3E19	N(-)3E19-S1	207	4435		393		8427	207	4435		393		8427
N-3E28	N-3E28-G1 & N-3E28-GL11	98	1951	209		4164		98	1951	209		4164	
N3E3	N3E3-S1	96	3687		183		7028	96	3687		183		7028
N3E31	N3E31-G1 & N3E31-GL12	181	3334	423		7802		181	3334	423		7802	
N3E33	N3E33-S1	53	1615		101		3068	53	1615		101		3068
N-4E2	N-4E2-S1	31	1271		58		2423	31	1271		58		2423
	N-4E2-S2	5.9	511		11		975	5.9	511		11		975
	Location Average	18	891		35		1699	18	891		35		1699
N4E3	N4E3-S1	93	4533		177		8641	93	4533		177		8641
	N4E3-S2	81	3012		155		5741	81	3012		155		5741
	Location Average	87	3773		166		7191	87	3773		166		7191
N(-)4E13	N(-)4E13-S1	74	2249		140		4274	74	2249		140		4274
N4E38	N4E38-S1	40	1555		77		2965	40	1555		77		2965
N5E11	N5E11-S1	230	7938					230	7938		439		15131
	N5E11-S2	567	26363					567	26363		1080		50251
	N5E11-G1&dup & N5E11-GL14	470	9454	981		19695		470	9454	981	19695		
	Location Average	422	14585	981		19695		422	14585	981	760	19695	32691
N5E15	N5E15-S1	326	12775		621		24351	326	12775		621		24351
N5E2	N5E2-S2	232	2869					232	2869		443		5469
	N5E2-S1	589	7655					589	7655		1123		14591
	N5E2-G1 & N5E2-GL13	224	3944	390		6865		224	3944	390	6865		
	Location Average	349	4823	390		6865		349	4823	390	783	6865	10030
N5E21	N5E21-G1 & N5E21-GL15	4570	45098	9693		95662		4570	45098	9693		95662	
N-5E27	N-5E27-S1	41	1343		78		2559	41	1343		78		2559
N5E3	N5E3-S2	4.0	335		8		639	4.0	335		8		639
N5E4	N5E4-S2	4.9	327		9		622	4.9	327		9		622
	N5E4-S1	55	2427		104		4626	55	2427		104		4626
	Location Average	30	1377		57		2624	30	1377		57		2624
N5E7	N5E7-S1	192	8191		367		15613	192	8191		367		15613
	N5E7-S2	215	7668		409		14617	215	7668		409		14617
	Location Average	204	7930		388		15115	204	7930		388		15115
N5E32	N5E32-S1	43	1276		82		2425	43	1276		82		2425
N6E15	N6E15-G1 & N6E15-GL17	209	3549	404		6871		209	3549	404		6871	
N(-)6E13-	N(-)6E13-S1	52	1546		99		2938	52	1546		99		2938

Table 5-16
Comparison of TPAH Concentrations in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV					Growth TRV					
		TPAH16 (mg/kg) (units) TRV	OC- Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg) 360	Estimated TPAH34 (mg/kg) 360	OC- Normalized TPAH34 (mg/kg OC) 6421	Estimated OC- Normalized TPAH34 (mg/kg OC) 6421	TPAH16 (mg/kg) 135	OC- Normalized TPAH16 (mg/kg OC) 2637	TPAH34 (mg/kg) 263	Estimated TPAH34 (mg/kg) 263	OC- Normalized TPAH34 (mg/kg OC) 5104
N-6E15	N-6E15-G1 & N-6E15-GL16	264	4430	517		8673	264	4430	517		8673	
N(-)6E17	N(-)6E17-S1	136	3113		259	5914	136	3113		259		5914
N6E18	N6E18-S2	194	15488		369	29522	194	15488		369		29522
N6E27	N6E27-S1	83	2243		158	4276	83	2243		158		4276
N6E3	N6E3-S1	167	1668		318	3179	167	1668		318		3179
	N6E3-S2	117	2021		223	3852	117	2021		223		3852
	Location Average	142	1845		271	3516	142	1845		271		3516
N6E31	N6E31-S1	45	1137		86	2160	45	1137		86		2160
N-7E0	N-7E0-G1 & N-7E0-GL18	70	1525	106		2308	70	1525	106		2308	
N7E11	N7E11-S1	117	3038		223	5792	117	3038		223		5792
N-7E15	N-7E15-S1	77	3745		146	7138	77	3745		146		7138
N7E2	N7E2-S1	345	16433		658	31324	345	16433		658		31324
N7E7	N7E7-S1/S3	309	19304				309	19304		589		36795
	N7E7-G1 & N7E7-GL19	164	1891	348		4018	164	1891	348		4018	
	Location Average	236	10598	348		4018	236	10598	348		4018	36795
N8E6A	N8E6A-S1											
N(-)8E15	N(-)8E15-S1	90	2290		171	4350	90	2290		171		4350
N8E19	N8E19-S1	98	7817		186	14901	98	7817		186		14901
N8E24	N8E24-G1 & N8E24-GL20	113	2096	246		4550	113	2096	246		4550	
N8E30	N8E30-S1	150	3157		286	6019	150	3157		286		6019
N9E11	N9E11-S1	121	4744		231	9042	121	4744		231		9042
	N9E11-S2	5.7	219		11	417	5.7	219		11		417
	Location Average	63	2482		121	4730	63	2482		121		4730
N9E15	N9E15-G1 & N9E15-GL21	79	2076	135		3545	79	2076	135		3545	
N9E33	N9E33-S1	115	2939		219	5584	115	2939		219		5584
NS-6	NS-6-S1											
NS-7	NS-7-S1 & DUP											
WB-1	WB-1 S1	3090	96563		5890	182618	3090	96563		5890		182618

Notes:

COPEC - Constituent of potential ecological concern
TPAH16 - 16 parent polycyclic aromatic hydrocarbons
TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons
OC - Organic carbon
SEM - Simultaneously extracted metals
AVS - Acid volatile sulfide
SEM/AVS - Ratio of SEM to AVS
TRV - Toxicity reference value

ND - Not detected
U - Undetected; value provided is one half the sample reporting limit
J - Estimated value
UJ - Undetected; value provided is one half the estimated sample reporting limit
COPEC concentration exceeds TRV
(a) See Table 5-9 for TRVs
G1 - Designates grab sample
S1, S2, S3 - Designates sample collected from sediment core

Table 5-17
Comparison of Concentrations of Metals, VOCs, EPH and VPH in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Barium (units) (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg) (mg/kg OC)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethyl- benzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert- butyl ether (mg/kg)	SEM / AVS (unitless)
Reference Area Locations		TRV	130	218	4.1	0.6	0.1	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1
LC-1	LC1-S1						0.82 UJ	0.82 U	0.82 U		21 U	21 U			0.41 U	
LC-2	LC2-S1						0.72 U	0.72 U	0.72 U		18 U	18 U			0.36 U	
LC-HC1	LCHC1-G1 & LCHC1-GL02	58	122	0.57		1.45 U										0.038
LC-HC2	LCHC2-S1	57	163	0.57												
LC-HC3	LCHC3-S1	125	79	0.30												
LC-NE1	LCNE1-G1 & LCNE1-GL03	80	199	0.82		1.4 U										0.024
LC-NE2	LCNE2-G1 & LCNE2-GL04	74	163	0.78		1.3 U										0.053
LC-NE3	LCNE3-S1	56	58	0.18	0.001 U	0.85 U										
LC-SW2	LCSW2-G1 & LCSW2-GL06	73	154	0.74		0.25 U										0.109
LC-SW3	LCSW3-S1	83	200	0.77												
Study Area Locations																
LC-SW1	LCSW1-GL05 LCSW1-G1 <i>Location Average</i>	99 99	215 215	1.2 1.2		1.3 U 1.3 U										0.023 0.023
A-2	A-2															
B-1	B-1 S1						2.3	1.2	9.2	53.2	17	7 U	8.1	3.9 U	0.34 U	
MR-1	MR-1-S1															
MR-2	MR-2-S1															
MR-3	MR-3-S1															
MR-4	MR-4-S1															
MR-5	MR-5-S1															
MR-6	MR-6-S1															
MR-7	MR-7-S1															
N0E25	N0E25-S1						0.453 U	0.453 U	0.906 U		11.3 U	11.3 U			0.2265 U	
N0E5	N0E5-G1 N0E5-GL07 <i>Location Average</i>	86 86	164 164	0.30 0.30		0.9 U 0.9 U										0.043 0.043
N0E31	N0E31-S1															
N10E1	N10E1-S1						0.26 U	0.26 U	0.52 U		6.5 U	6.5 U			0.13 U	
N10E1A	N10E1A-S1		396	1.0												
N10E11	N10E11-G1 & N10E11-GL22	87	261	1.4	0.001 U	1.2 U										0.676
N10E27	N10E27-S1						0.354 U	0.354 U	0.707		8.85 U	8.85 U			0.1765 U	
N-10E28	N-10E28-S1						0.427 U	0.427 U	0.854 U		10.7 U	10.7 U			0.2135 U	
N10E38	N10E38-S1 N10E38-S2 <i>Location Average</i>						0.372 U 0.323 U 0.32 U	0.372 U 0.323 U 0.32 U	0.744 U 0.646 U 0.65 U		9.3 U 8.1 U 8.1 U	9.3 U 8.1 U 8.1 U			0.186 U 0.162 U 0.162 U	
N10E4	N10E4-S1						0.459 U	0.459 U	0.918 U		11.5 U	11.5 U			0.2295 U	
N11E4A	N11E4A-S1		482	4.3												
N11E13	N11E13-S1 N11E13-S2 <i>Location Average</i>															
N11E27	N11E27-S1	117	298	1.3												
N11E29	N11E29-S1															
N11E30	N11E30-S1	115	278	1.4	0.001 U	1.15 U										
N11E33	N11E33-GL23 N11E33-G1 <i>Location Average</i>	97 97	240 240	1.1 1.1		1.35 U 1.35 U										0.025 0.025
N11E35	N11E35-S1															
N12E11	N12E11-S1/S3						0.448 U	0.448 U	0.895 U		11.2 U	11.2 U			0.2235 U	
N12E15	N12E15-S2 N12E15-S1 <i>Location Average</i>						0.342 U 0.31 U 0.31 U	0.342 U 0.31 U 0.31 U	0.684 U 0.62 U 0.62 U		8.55 U 7.75 U 7.75 U	8.55 U 7.75 U 7.75 U			0.171 U 0.155 U 0.155 U	

Table 5-17
Comparison of Concentrations of Metals, VOCs, EPH and VPH in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg) (mg/kg OC)		Cyanide (mg/kg)	Benzene (mg/kg)	Ethyl- benzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert- butyl ether (mg/kg)	SEM / AVS (unitless)
		(units) TRV	130	218	4.1	0.6	0.1	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1
N12E19	N12E19-G1 & N12E19-GL24	102	255	2.2			1.3 U										0.027
N12E22	N12E22-S1							0.387 U	0.387 U	0.774 U		9.65 U	9.65 U				0.1935 U
N12E25	N12E25-S1																
N12E27	N12E27-S1																
N13E12	N13E12-S1																
N13E30	N13E30-S1																
N13E33	N13E33-S1																
N14E11	N14E11-G1 N14E11-GL25	79	182	1.5	0.001 U		1.4 U										0.108
	Location Average	79	182	1.5	0.001 U		1.4 U										0.108
N14E31	N14E31-S1	115	265	1.1													
N14E9	N14E9-S1							0.585 U	0.585 U	1.17 U		14.6 U	14.6 U				0.2915 U
N15E8	N15E8-S1																
N15E19	N15E19-S1 N15E19-S2							0.433 U 0.36 U	0.433 U 0.36 U	0.865 U 0.72 U		10.8 U 9 U	10.8 U 9 U				0.216 U 0.13 U
	Location Average							0.36 U 0.36 U	0.36 U 0.36 U	0.72 U 0.72 U		9 U 9 U	9 U 9 U				0.13 U 0.13 U
N15E38	N15E38-S1							0.75 U	0.75 U	1.5 U		18.8 U	18.8 U				0.376 U
N15E4	N15E4-S1	263			0.007 J 0.06		1.4 U										0.045
N17E11	N17E11-S1	120	272	0.74	0.001 U												
N-17E13	N-17E13-S2 N-17E13-S1							0.312 U 0.331 U	0.312 U 0.331 U	0.632 U 0.662 U		7.8 U 8.3 U	7.8 U 8.3 U				0.35 0.1655 U
	Location Average							0.31 U 0.31 U	0.31 U 0.31 U	0.63 U 0.63 U		7.8 U 7.8 U	7.8 U 7.8 U				0.26
N17E6	N17E6-GL26 N17E6-G1	91	536	0.22	0.001 U		1.3 U										0.022
	Location Average	91	536	0.22	0.001 U		1.3 U										0.022
N18E31	N18E31-S1							0.334 U	0.334 U	0.667 U		8.35 U	8.35 U				0.167 U
N1E11	N1E11-S1	81	186	0.38													
N1E15	N1E15-S1 N1E15-S2							0.296 U 0.265 U	0.296 U 0.265 U	0.592 U 0.529 U		7.4 U 6.6 U	7.4 U 6.6 U				0.148 U 0.1325 U
	Location Average							0.26 U 0.26 U	0.26 U 0.26 U	0.53 U 0.53 U		6.6 U 6.6 U	6.6 U 6.6 U				0.1325 U
N-1E15	N-1E15-G1 & N-1E15-GL08	90	206	1.0			1.25 U										0.076
N-1E6	N-1E6-S1							0.367 U	0.367 U	0.733 U		9.15 U	9.15 U				0.1835 U
N20E11	N20E11-S1	67	308	0.82	0.001 U												
N20E15	N20E15-S1							0.418 U	0.418 U	0.836 U		10.45 U	10.45 U				0.209 U
N20E35	N20E35-S1							0.36 U	0.36 U	0.72 U		9 U	9 U				0.18 U
N-24E25	N-24E25-S1							0.373 U	0.373 U	0.746 U		9.3 U	9.3 U				0.1865 U
N-24E8	N-24E8-S1							0.343 U	0.343 U	0.685 U		8.55 U	8.55 U				0.1715 U
N26E32	N26E32-S1																
N-2E11	N-2E11-G1 & N-2E11-GL09	80	169	0.71	0.024 0.6		1.2 U										0.047
N(-)2E13	N(-)2E13-S1																
N2E2	N2E2-S1	130	322	2.4			0.42										
N-2E21	N-2E21-G1 & N-2E21-GL10	102	217	0.86			1.4 U										0.027
N(-)2E24	N(-)2E24-S1 & DUP-5																
N-2E33	N-2E33-S1							0.372 U	0.372 U	0.744 U		9.3 U	9.3 U				0.186 U
N30E27	N30E27-S1&S2DUP							0.287 U	0.287 U	0.574 U		7.2 U	7.2 U				0.1435 U
N3E11	N3E11-S1							0.416 U	0.416 U	0.831 U		10.4 U	10.4 U				0.208 U
N3E24	N3E24-S1&S1DUP2	98	400	0.50													
N(-)3E19	N(-)3E19-S1																
N-3E28	N-3E28-G1 & N-3E28-GL11	84	184	0.86			1.5 U										0.017
N3E3	N3E3-S1							0.235 U	0.235 U	0.47 U		5.85 U	5.85 U				0.1175 U
N3E31	N3E31-G1 & N3E31-GL12	85	215	1.8	0.001 U		1.25 U										0.021
N3E33	N3E33-S1																

Table 5-17
Comparison of Concentrations of Metals, VOCs, EPH and VPH in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg) (mg/kg OC)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethyl- benzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert- butyl ether (mg/kg)	SEM / AVS (unitless)
		TRV					(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1
N-4E2	N-4E2-S1						0.299 U	0.299 U	0.598 U		7.5 U	7.5 U			0.1495 U	
	N-4E2-S2						0.165 U	0.165 U	0.33 U		4.12 U	4.12 U			0.0825 U	
	<i>Location Average</i>						0.17 U	0.165 U	0.33 U		4.12 U	4.12 U			0.0825 U	
N4E3	N4E3-S1						0.454 U	0.454 U	0.907 U		11.35 U	11.35 U			0.227 U	
	N4E3-S2						0.26 U	0.26 U	0.52 U		6.5 U	6.5 U			0.13 U	
	<i>Location Average</i>						0.26 U	0.26 U	0.52 U		6.5 U	6.5 U			0.13 U	
N(-)4E13	N(-)4E13-S1															
N4E38	N4E38-S1						0.413 U	0.413 U	0.826 U		10.3 U	10.3 U			0.2065 U	
N5E11	N5E11-S1						0.404 U	0.404 U	0.808 U		10.1 U	10.1 U			0.202 U	
	N5E11-S2						3.59 U	3.59 U	7.18 U		193 J	89.5 UJ			1.795 U	
	N5E11-G1&dup & N5E11-GL14	88	207.5	2.0	0.001 U	1.275 U										0.030
	<i>Location Average</i>	88	207.5	2.0	0.001 U	1.275 U	0.40 U	0.40 U	0.81 U		102	10.1 U			0.202 U	
N5E15	N5E15-S1						0.241 U	0.241 U	0.481 U		26.6	19.6			0.1205 U	
N5E2	N5E2-S2						2.7 J	14.8 J	2.684 J		77.6 J	35.2 J			0.181 UJ	
	N5E2-S1						1.02	0.442 U	0.883 U		11 U	11 U			0.221 U	
	N5E2-G1 & N5E2-GL13	125	3270	1.2		0.8 U										0.041
	<i>Location Average</i>	125	3270	1.2		0.8 U	1.9	7.6	1.8		44	23			0.181 UJ	
N5E21	N5E21-G1 & N5E21-GL15	119	290	2.2		1.3 U										0.059
N-5E27	N-5E27-S1						0.535 U	0.535 U	1.07 U		13.45 U	13.45 U			0.2685 U	
N5E3	N5E3-S2						1.64	1.08	0.975		4.62 U	4.62 U			0.0925 U	
N5E4	N5E4-S2						0.208 UJ	0.208 UJ	0.416 UJ		5.2 UJ	5.2 UJ			0.104 UJ	
	N5E4-S1						0.27 UJ	0.27 UJ	0.539 UJ		6.75 UJ	6.75 UJ			0.135 UJ	
	<i>Location Average</i>						0.21 UJ	0.208 UJ	0.42 UJ		5.2 UJ	5.2 UJ			0.104 UJ	
N5E7	N5E7-S1						0.376 UJ	0.376 UJ	0.751 UJ		9.4 UJ	9.4 UJ			0.1875 UJ	
	N5E7-S2						0.326 UJ	0.326 UJ	0.352 UJ		8.15 UJ	8.15 UJ			0.163 UJ	
	<i>Location Average</i>						0.33 UJ	0.33 UJ	0.35 UJ		8.15 UJ	8.15 UJ			0.163 UJ	
N5E32	N5E32-S1															
N6E15	N6E15-G1 & N6E15-GL17	83	234	0.82		1.15 U										0.069
N(-)6E13-	N(-)6E13-S1															
N-6E15	N-6E15-G1 & N-6E15-GL16	132	322	1.1		1.25 U										0.098
N(-)6E17	N(-)6E17-S1															
N6E18	N6E18-S2	34	14.4	0.02												
N6E27	N6E27-S1						0.468 U	0.468 U	0.935 U		11.7 U	11.7 U			0.234 U	
N6E3	N6E3-S1						0.378 UJ	0.378 UJ	0.756 UJ		9.45 UJ	9.45 UJ			0.189 UJ	
	N6E3-S2						0.296 UJ	0.296 UJ	0.592 UJ		7.4 UJ	7.4 UJ			0.148 UJ	
	<i>Location Average</i>						0.296 UJ	0.296 UJ	0.59 UJ		7.4 UJ	7.4 UJ			0.148 UJ	
N6E31	N6E31-S1															
N-7E0	N-7E0-G1 & N-7E0-GL18	69	151	0.63		1.25 U										0.016
N7E11	N7E11-S1						0.393 U	0.393 U	0.785 U		9.8 U	9.8 U			0.196 U	
N-7E15	N-7E15-S1						0.349 U	0.349 U	0.697 U		8.7 U	8.7 U			0.1745 U	
N7E2	N7E2-S1						1.525 U	7.35	9.09		199	38.1 U			0.76 U	
N7E7	N7E7-S1/S3						0.304 U	0.304 U	0.607 U		7.6 U	7.6 U			0.152 U	
	N7E7-G1 & N7E7-GL19	124	1380	2.7	0.01	0.1	1.05 U									0.025
	<i>Location Average</i>	124	1380	2.7	0.01	0.1	1.05 U	0.304 U	0.304 U	0.61 U	7.6 U	7.6 U			0.152 U	
N8E6A	N8E6A-S1		108	0.3												
N(-)8E15	N(-)8E15-S1															
N8E19	N8E19-S1						0.28 U	0.28 U	0.559 U		7 U	7 U			0.1395 U	
N8E24	N8E24-G1 & N8E24-GL20	94	217	1.2		1.3 U										0.050
N8E30	N8E30-S1	126	278	1.7												

Table 5-17
Comparison of Concentrations of Metals, VOCs, EPH and VPH in Sediment to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Barium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Tributyltin (mg/kg)	Cyanide (mg/kg)	Benzene (mg/kg)	Ethyl- benzene (mg/kg)	Xylenes (mg/kg)	C11-C22 Aromatics (mg/kg)	C9-C10 Aromatics (mg/kg)	C9-C12 Aliphatics (mg/kg)	C9-C18 Aliphatics (mg/kg)	C19-C36 Aliphatics (mg/kg)	Methyl tert- butyl ether (mg/kg)	SEM / AVS (unitless)
		TRV	130	218	4.1	0.6	0.1	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	1
N9E11	N9E11-S1						0.427 U	0.427 U	0.853 U		10.65 U	31.4			0.2135 U	
	N9E11-S2						0.372 U	0.372 U	0.743 U		9.3 U	9.3 U			0.1855 U	
	<i>Location Average</i>						<i>0.37 U</i>	<i>0.372 U</i>	<i>0.74 U</i>		<i>9.3 U</i>	<i>20.4</i>			<i>0.1855 U</i>	
N9E15	N9E15-G1 & N9E15-GL21	66	127	1.6		1.2 U										0.091
N9E33	N9E33-S1															
NS-6	NS-6-S1		203	1.2												
NS-7	NS-7-S1 & DUP		176	1.1												
WB-1	WB-1 S1						13.5 U	57	104	25.4	1600	270 U	240	70	13.5 U	

Notes:
COPEC - Constituent of potential ecological concern
TPAH16 - 16 parent polycyclic aromatic hydrocarbons
TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons
OC - Organic carbon
SEM - Simultaneously extracted metals
AVS - Acid volatile sulfide
SEM/AVS - Ratio of SEM to AVS
TRV - Toxicity reference value
ND - Not detected
U - Undetected; value provided is one half the sample reporting limit
J - Estimated value
UJ - Undetected; value provided is one half the estimated sample reporting limit
COPEC concentration exceeds TRV
(a) See Table 5-9 for TRVs
G1 - Designates grab sample
S1, S2, S3 - Designates sample collected from sediment core

Table 5-18
Comparison of COPEC Concentrations in Porewater to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV				Growth TRV			
		TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34	TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34
	TRV	1.7	1.7	5.4	5.4	1.3	1.3	4.3	4.3
Reference Area Locations									
LC-1	LC1-S1		0.70				0.70		
LC-2	LC2-S1		0.45				0.45		
LC-HC1	LHC1-GL02	0.35		0.90		0.35		0.90	
LC-HC2	LHC2-S1		0.25				0.25		
LC-HC3	LHC3-S1		0.24				0.24		
LC-NE1	LCNE1-GL03	0.52		1.3		0.52		1.3	
LC-NE2	LCNE2-GL04	0.52		1.2		0.52		1.2	
LC-NE3	LCNE3-S1		2.3		6.4		2.3		6.4
LC-SW2	LCSW2-GL06	0.53		1.2		0.53		1.2	
LC-SW3	LCSW3-S1		0.31				0.31		
Study Area Locations									
LC-SW1	LCSW1-GL05	0.92		3.1		0.92		3.1	
A-2	A-2		2.6				2.6		
B-1 S1	B-1 S1		6.2		(a)		6.2		(a)
MR-1	MR-1-S1		2.1				2.1		
MR-2	MR-2-S1		0.82				0.82		
MR-3	MR-3-S1		0.74				0.74		
MR-4	MR-4-S1		1				1		
MR-5	MR-5-S1		51		(a)		51		
MR-6	MR-6-S1		15		(a)		15		
N0E25	N0E25-S1		2.3				2.3		
N0E5	N0E5-GL07	1.1		6.0		1.1		6.0	
N0E31	N0E31-S1		0.83				0.83		
N10E1	N10E1-S1		1.9				1.9		
N10E11	N10E11-GL22	2.0		6.6		2.0		6.6	
N10E27	N10E27-S1		2.3				2.3		
N-10E28	N-10E28-S1		0.58				0.58		
N10E38	N10E38-S1		1.0				1.0		
	N10E38-S2		0.7				0.7		
	Location Average		0.86				0.86		
N10E4	N10E4-S1		5.6		(a)		5.6		(a)
N11E13	N11E13-S1		2				2		
	N11E13-S2		0.48				0.48		
	Location Average		1.2				1.2		
N11E27	N11E27-S1		5.5		(a)		5.5		(a)
N11E29	N11E29-S1		9.6		(a)		9.6		
N11E30	N11E30-S1		0.98				0.98		
N11E33	N11E33-GL23	1.1		2.9		1.1		2.9	
N11E35	N11E35-S1		0.83				0.83		
N12E11	N12E11-S1&S3		1.9				1.9		
N12E15	N12E15-S2		0.60				0.60		
	N12E15-S1		0.88				0.88		
	Location Average		0.74				0.74		
N12E19	N12E19-GL24	0.86		2.0		0.86		2.0	
N12E22	N12E22-S1		0.85				0.85		
N12E25	N12E25-S1		1.4				1.4		
N12E27	N12E27-S1		3.4				3.4		
N13E12	N13E12-S1		1.2				1.2		
N13E30	N13E30-S1		0.5				0.5		
N13E33	N13E33-S1		1.4				1.4		
N14E11	N14E11-GL25	0.71		1.6		0.71		1.6	
N14E31	N14E31-S1		1.1				1.1		
N14E9	N14E9-S1		1.4				1.4		
N15E19	N15E19-S1		0.20				0.20		
	N15E19-S2		2.7				2.7		
	Location Average		1.4				1.4		
N15E38	N15E38-S1		1.1				1.1		
N15E4	N15E4-S1		8.4		52		8.4		52
N15E8	N15E8-S1		0.44				0.44		
N17E11	N17E11-S1		0.71				0.71		
N-17E13	N-17E13-S2		2.0				2.0		
	N-17E13-S1		0.8				0.8		
	Location Average		1.4				1.4		
N17E6	N17E6-GL26	0.51		1.3		0.51		1.3	
N18E31	N18E31-S1		0.98				0.98		
N1E11	N1E11-S1		1.7				1.7		

Table 5-18
Comparison of COPEC Concentrations in Porewater to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV				Growth TRV			
		TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34	TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34
	TRV	1.7	1.7	5.4	5.4	1.3	1.3	4.3	4.3
N1E15	N1E15-S1		2.7				2.7		
	N1E15-S2		0.26				0.26		
	<i>Location Average</i>		1.5				1.5		
N-1E15	N-1E15-GL08	2.2		7.6		2.2		7.6	
N-1E6	N-1E6-S1		1.9				1.9		
N20E11	N20E11-S1		0.72		2.6		0.72		2.6
N20E15	N20E15-S1		0.55				0.55		
N20E35	N20E35-S1		1.1				1.1		
N-24E25	N-24E25-S1		0.80				0.80		
N-24E8	N-24E8-S1		1.4				1.4		
N26E32	N26E32-S1		0.88				0.88		
N-2E11	N-2E11-GL09	0.47		1.4		0.47		1.4	
N2E2	N2E2-S1		2.4		6.2		2.4		6.2
N(-)2E13	N(-)2E13-S1		0.75				0.75		
N-2E21	N-2E21-GL10	0.78		1.8		0.78		1.8	
N(-)2E24	N(-)2E24-S1 & DUP-5		1.4				1.4		
N-2E33	N-2E33-S1		1.1				1.1		
N30E27	N30E27-S1&S2		1.1				1.1		
N3E11	N3E11-S1		2.5				2.5		
N(-)3E19	N(-)3E19-S1		2				2		
N3E24	N3E24-S1&DUP2		3.1				3.1		
N-3E28	N-3E28-GL11	0.65		2.4		0.65		2.4	
N3E33	N3E33-S1		0.73				0.73		
N3E3	N3E3-S1		1.4				1.4		
N3E31	N3E31-GL12	4.7		20		4.7		20	
N-4E2	N-4E2-S1		0.61				0.61		
	N-4E2-S2		0.35				0.35		
	<i>Location Average</i>		0.48				0.48		
N4E3	N4E3-S1		1.9				1.9		
	N4E3-S2		1.1				1.1		
	<i>Location Average</i>		1.5				1.5		
N(-)4E13	N(-)4E13-S1		0.94				0.94		
N4E38	N4E38-S1		0.74				0.74		
N5E11	N5E11-GL14	140		424		140		424	
N5E15	N5E15-S1		11		(a)		11		(a)
N5E2	N5E2-GL13	2.8		7.1		2.8		7.1	
N5E21	N5E21-GL15	440		1524		440		1524	
N-5E27	N-5E27-S1		0.60				0.60		
N5E3	N5E3-S2		1.2				1.2		
N5E32	N5E32-S1		0.54				0.54		
N5E4	N5E4-S2		0.26				0.26		
	N5E4-S1		1.2				1.2		
	<i>Location Average</i>		0.73				0.73		
N5E7	N5E7-S1		3.5				3.5		
	N5E7-S2		3.0				3.0		
	<i>Location Average</i>		3.2				3.2		
N(-)6E13	N(-)6E13-S1		0.56				0.56		
N6E15	N6E15-GL17	1.1		3.3		1.1		3.3	
N-6E15	N-6E15-GL16	6.6		22		6.6		22	
N(-)6E17	N(-)6E17-S1		1.2				1.2		
N6E18	N6E18-S2		9.8		(a)		9.8		(a)
N6E27	N6E27-S1		0.99				0.99		
N6E3	N6E3-S1		0.79				0.79		
	N6E3-S2		0.97				0.97		
	<i>Location Average</i>		0.88				0.88		
N6E31	N6E31-S1		0.54				0.54		
N-7E0	N-7E0-GL18	0.36		1.1		0.36		1.1	
N7E11	N7E11-S1		1.4				1.4		
N-7E15	N-7E15-S1		1.5				1.5		
N7E2	N7E2-S1		32		(a)		32		(a)
N7E7	N7E7-S1&S3		8.0		(a)		8.0		(a)
N(-)8E15	N(-)8E15-S1		0.91				0.91		
N8E19	N8E19-S1		3.3				3.3		
N8E24	N8E24-GL20	1.3		3.9		1.3		3.9	
N8E30	N8E30-S1		1.3				1.3		
N9E11	N9E11-S1		2.5				2.5		
	N9E11-S2		0.51				0.51		
	<i>Location Average</i>		1.5				1.5		

Table 5-18
Comparison of COPEC Concentrations in Porewater to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sample ID	Survival TRV				Growth TRV			
		TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34	TPAH16	Estimated TPAH16	TPAH34	Estimated TPAH34
	TRV	1.7	1.7	5.4	5.4	1.3	1.3	4.3	4.3
N9E15	N9E15-GL21	0.66		1.5		0.66		1.5	
N9E33	N9E33-S1		1.4				1.4		
WB-1 S1	WB-1 S1		200		(a)		200		(a)

Notes:
 All concentrations in ug/L
 COPEC - Constituent of potential ecological concern
 TPAH16 - 16 parent polycyclic aromatic hydrocarbons
 TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons
 TRV - Toxicity reference value
COPEC concentration exceeds TRV
(a) Estimated TPAH16 concentration also exceeds TRV for TPAH34
 G1 - Designates grab sample
 S1, S2, S3 - Designates sample collected from sediment core

Table 5-19
Sediment and Porewater SUM TUs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sediment		Porewater	
	TPAH16	TPAH34	TPAH16	TPAH34
Reference Area Locations				
LC1	0.1			
LC2	0.08			
LCHC1-GL02	0.04	0.1	0.03	0.2
LCHC2	0.06			
LCHC3	0.05			
LCNE1-GL03	0.04	0.2	0.03	0.2
LCNE2-GL04	0.04	0.2	0.03	0.2
LCNE3	0.4	2		
LCSW2-GL06	0.04	0.3	0.04	0.2
LCSW3	0.07			
Study Area Locations				
LCSW1-GL05	0.09	0.7	0.1	0.9
A-2	0.4		0.4	
B-1	0.5			
MR-1	0.4		0.4	
MR-2	0.2		0.2	
MR-3	0.1		0.1	
MR-4	0.2		0.2	
MR-5	2	(a)	2	(a)
MR-6	2	(a)	2	(a)
N0E25	0.4			
N0E31	0.2		0.2	
N0E5-GL07	0.08	0.3	0.07	0.6
N10E11-GL22	0.3	2	0.3	2
N10E1	0.4	0.4		
N10E27	0.3			
N-10E28	0.1			
N10E38	0.2			
N10E4	1			
N11E13	0.2		0.2	
N11E27	0.7			
N11E29	1		1	
N11E30	0.2			
N11E33-GL23	0.2	1	0.1	0.9
N11E35	0.2		0.2	
N12E11	0.4			
N12E15	0.08			
N12E19-GL24	0.1	0.9	0.08	0.5
N12E22	0.2			
N12E25	0.2		0.2	
N12E27	0.5		0.5	
N13E12	0.3		0.3	
N13E30	0.1		0.1	
N13E33	0.3		0.3	
N14E11-GL25	0.1	0.8	0.06	0.3
N14E31	0.2			
N14E9	0.3			
N15E19	0.2			
N15E38	0.2			
N15E8	0.1		0.1	
N15E4	1	15		
N17E11	0.2			
N-17E13	0.3			
N17E6-GL26	0.02	0.1	0.03	0.3
N18E31	0.2			
N1E11	0.4			
N-1E15-GL08	0.4	3	0.4	2
N1E15	0.2			
N-1E6	0.3			
N20E11	0.2	1		
N20E15	0.08			

Table 5-19
Sediment and Porewater SUM TUs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	Sediment		Porewater	
	TPAH16	TPAH34	TPAH16	TPAH34
N20E35	0.2			
N-24E25	0.1			
N-24E8	0.3			
N26E32	0.2			
N-2E11-GL09	0.2	1	0.05	0.3
N-2E21-GL10	0.2	1	0.07	0.3
N(-)2E24 & DUP	0.2		0.2	
N2E2	0.5	2		
N(-)2E13	0.2		0.2	
N-2E33	0.2			
N30E27	0.2			
N3E11	0.5			
N3E24	0.4			
N(-)3E19	0.4		0.4	
N-3E28-GL11	0.2	1	0.08	0.5
N3E31-GL12	0.2	3	0.4	3
N3E3	0.3			
N3E33	0.1		0.1	
N-4E2	0.08			
N(-)4E13	0.2		0.2	
N4E38	0.1			
N4E3	0.3			
N5E11-GL14	0.6	5	4	24
N5E15	0.8			
N5E21-GL15	2	26	10	92
N-5E27	0.1			
N5E2-GL13	0.3	2	0.2	1
N5E3	0.01			
N5E4	0.1			
N5E7	0.6			
N5E32	0.1		0.1	
N(-)6E13	0.1		0.1	
N-6E15-GL16	0.3	2	1	5
N6E15-GL17	0.3	2	0.1	0.7
N(-)6E17	0.3		0.3	
N6E18	1			
N6E27	0.2			
N6E3	0.2			
N6E31	0.1		0.1	
N-7E0-GL18	0.1	0.4	0.04	0.3
N7E11	0.2			
N-7E15	0.3			
N7E2	0.9			
N7E7-GL19	0.8	1	0.2	0.8
N(-)8E15	0.2		0.2	
N8E19	0.7			
N8E24-GL20	0.2	1	0.2	1
N8E30	0.3			
N9E11	0.2			
N9E15-GL21	0.1	0.8	0.05	0.3
N9E33	0.2		0.2	
WB-1	6	(a)		

Notes:

SUM TU - Sum of toxic units for individual PAH

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

Blank indicates SUM TU not calculated because parameter not measured

SUM TU exceeds 1

(a) Although TPAH34 was not measured at this location, the SUM TU for TPAH34 can be assumed to exceed 1 because the SUM TU for TPAH16 at this location exceeded 1.

Table 5-20
Comparison of Estimated Concentrations in Fish Tissue to TRVs
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Area	Mercury EPC in Sediment (mg/kg)	BSAF (mg/kg ww tissue / mg/kg sediment)	Estimated Concentration in Fish Tissue (mg/kg ww)	TRV (mg/kg ww tissue)
Study Area (excluding Marine Railway)	1.2	0.15 (a)	0.19	0.21

Notes:
 mg/kg ww - milligram per kilogram wet weight
 EPC - Exposure point concentration
 BSAF - Biota-to-sediment accumulation factor
 TRV - Toxicity reference value

Table 5-21
Sediment SUM TUs for Benthivorous Fish
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

Location	TPAH16 in Sediment	TPAH34 in Sediment
Study Area	0.4	3

Notes:

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

SUM TU - Sum of toxic units for individual PAH

SUM TU exceeds 1

Table 5-22
Comparison of EPCs for COPECs in Sediment to TRVs for Benthivorous Fish
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

COPEC	EPC in Sediment (mg/kg)	Sediment TRV (mg/kg)
TPAH16	236	177 (survival), 135 (growth)
OC-Normalized TPAH16	5758	3349 (survival), 2637 (growth)
TPAH34	836	360 (survival), 263 (growth)
OC-Normalized TPAH34	10597	6421 (survival), 5104 (growth)
Barium	101	130
Lead	362	218
Mercury	1.2	NA
OC-Normalized Tributyltin	0.3	0.6
Cyanide	See text	0.1
Benzene	0.8	0.91
Ethylbenzene	2	1.18
Total Xylenes	3.5	1.6
C11-C22 Aromatics, Adjusted	39	0.8
C9-C10 Aromatics	53	31
C9-C18 Aliphatics	124	39168
C9-C12 Aliphatics, Adjusted	16	8640
C19-C36 Aliphatics	37	45696
Methyl tert-butyl ether	0.5	17

Notes:

EPC - Exposure point concentration

NA - Not applicable

COPEC - Constituent of potential ecological concern

TPAH16 - 16 parent polycyclic aromatic hydrocarbons

TPAH34 - 34 parent and alkylated polycyclic aromatic hydrocarbons

OC - Organic carbon

TRV - Toxicity Reference Value

Table 5-23
Evaluation of Potential Risk to Piscivorous Birds
Stage II Environmental Risk Characterization
National Grid - Former Gloucester Manufactured Gas Plant
Gloucester, Massachusetts

COPEC	Study Area EPC in Sediment (mg/kg)	BSAF (mg/kg ww tissue / mg/kg sediment)	Estimated Concentration in Fish Tissue (mg/kg ww)	Average Daily Intake from Fish (mg/kg-day)	TRV (mg/kg-d)
Mercury	1.2	0.75 (a)	0.93	0.0031	0.0064

Parameter	Value
Osprey Body Weight (kg)	1.5 (b)
Osprey Dietary Intake (kg ww/day)	0.31 (c)
Area Use Factor	0.04 (d)
Seasonal Use Factor	0.4 (e)

Notes:

EPC - Exposure point concentration

BSAF - Biota-to-sediment accumulation factor

TRV - Toxicity reference value

COPEC - Constituent of potential environmental concern

ww - wet weight

(a) Value for bluefish from Hammerschmidt and Fitzgerald (2006)

(b) Average of male and female adults (EPA, 1993)

(c) Calculated as the dietary intake in kg/kg-day x body weight in kg (EPA, 1993)

(d) Ratio of the radius of the study area to the radius of the osprey foraging range (EPA, 1993)

(e) April through August (EPA, 1993)

Table 5-24
 Environmental Risk Characterization Conclusions
 Stage II Environmental Risk Characterization
 National Grid - Former Gloucester Manufactured Gas Plant
 Gloucester, Massachusetts

Location	Weight of Evidence Evaluation											Weight of Evidence Evaluation											Weight of Evidence Evaluation				Evaluation of Observations of VOT				RAH?	Sig Risk				
	Benthic Community Evaluation							Toxicity Tests				Comparison to Site-Specific Survival TRVs						Comparison to Site-Specific Growth TRVs					Sediment SUM TU		Porewater SUM TU		Observation Made in 2007	Observation Made in 2008	Observation Made in 2009/2010							
	Abundance	Shannon Diversity Index	Number of Taxa	Evenness	Percent Dominant Taxon	Percent Polychaetes	Number of Amphipods	Neanthes		Leptocheirus		Sediment			Porewater			Sediment			Porewater		TPAH16 (ug/L)	TPAH34 (ug/L)	TPAH16 (ug/L)	TPAH34 (ug/L)										
								Percent Survival	Weight per Organism (mg dry wt)	Percent Survival	Weight per Organism (mg dry weight)	Reproduction (Number of Young per Organism)	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH16 (mg/kg OC)	TPAH16 (ug/L)	Estimated TPAH16 (ug/L)	TPAH34 (ug/L)	Estimated TPAH34 (ug/L)								TPAH16 (mg/kg)			OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)
TPAH16 (ug/L)	Estimated TPAH16 (ug/L)	TPAH34 (ug/L)	Estimated TPAH34 (ug/L)	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH16 (mg/kg OC)	TPAH16 (ug/L)	Estimated TPAH16 (ug/L)	TPAH34 (ug/L)	Estimated TPAH34 (ug/L)	TPAH16 (mg/kg)	OC-Normalized TPAH16 (mg/kg OC)	TPAH34 (mg/kg)	Estimated TPAH34 (mg/kg)	OC-Normalized TPAH34 (mg/kg OC)	Estimated OC-Normalized TPAH16 (mg/kg OC)	TPAH16 (ug/L)	Estimated TPAH16 (ug/L)	TPAH34 (ug/L)	Estimated TPAH34 (ug/L)	TPAH16	TPAH34	TPAH16	TPAH34									
LCSW1-GL05	207	1.03	7.7	0.51	56.58	57.56	78.0	100	5.07	80	0.50	0.35	52	1081	109	72	2245	0.92	3.1	52	1081	109	72	2245	0.92	3.1	0.09	0.7	0.1	0.9		No VOT or sheen				
Location Average A-2													205	5498	390	10446	2.6	2.6	205	5498	390	10446	2.6	2.6	0.4	0.4	Yes			No VOT or sheen			Yes			
B-1													175	5456	333	10319	6.2	>6.0	175	5456	333	10319	6.2	>6.0	0.5		Yes	Faint to moderate rainbow sheen observed in 2005	Faint to moderate rainbow sheen observed in 2005			Yes	Yes			
MR-1													264	5067	502	9626	0.065		264	5067	502	9626	0.065		0.4	0.4	Yes			No VOT or sheen			Yes			
MR-2													59	2005	113	3810	0.054		59	2005	113	3810	0.054		0.2	0.2				No VOT or sheen						
MR-3													36	1679	68	3190	0.047		36	1679	68	3190	0.047		0.1	0.1				Small sheen at 0.3 ft.						
MR-4													78	2346	148	4458	0.053		78	2346	148	4458	0.053		0.2	0.2				No VOT or sheen						
MR-5													1651	35614	3136	67666	13		1651	35614	3136	67666	13		2	2	Yes			Layer of VOT at 0.3 ft.; heavy, spotty rainbow sheen			Yes	Yes		
MR-6													1385	31948	2631	60701	0.66		1385	31948	2631	60701	0.66		2	2	Yes			Spotty sheen from 0.0-1.5 ft.			Yes			
MR-7																																				
NOE25													156	5109	297	9739	2.3		156	5109	297	9739	2.3		0.4		Yes	Saturated layer at 0.79ft (1/8" thick); drops of product on gloves					Yes	Yes		
NOE5-GL07	158	1.35	9.0	0.61	50.24	91.88	2.0	88	5.84	76	0.97	1.88	20	588	32	941	1.1	6.0	20	588	32	941	1.1	6.0	0.08	0.3	0.07	0.6		No VOT or sheen						
Location Average NOE31													61	2000	116	3800	0.042		61	2000	116	3800	0.042		0.2	0.2				No VOT or sheen						
N10E1													155	4356	295	8304	1.9		155	4356	295	8304	1.9		0.4	0.4	Yes	Saturated sediment/VOT from 0.67-3.55ft			VOT observed at 0.5-2.5ft			Yes	Yes	
N10E1A													198	3578	396	7158	2.0	6.6	198	3578	396	7158	2.0	6.6	0.3	2	0.3	2	Yes		Sheen from 0.0-2.4ft.			Yes	Yes	
N10E11-GL22	220	0.88	7.3	0.44	75.50	90.95	13.3	88	5.16	27	0.36	0.13	147	4210	281	8024	2.3		147	4210	281	8024	2.3		0.3		Yes	Few spots of sheen from 0.33-0.42ft.					Yes			
N10E27													29	1160	55	2212	0.58		29	1160	55	2212	0.58		0.1					No VOT or sheen						
N-10E28													58	2286	111	4358	1.0		58	2286	111	4358	1.0		0.2					No VOT or sheen						
N10E38													33	1473	63	2808	0.7		33	1473	63	2808	0.7		0.2					No VOT or sheen						
Location Average N10E4													46	1880	87	3583	0.86		46	1880	87	3583	0.86		1					No VOT or sheen						
N11E4A													130	13198	248	25156	5.6		130	13198	248	25156	5.6							No VOT or sheen						
N11E4A																																				
N11E13													167	4034	317	7666	0.19		167	4034	317	7666	0.19		0.2	0.2				Saturated sediment and heavy sheen from 0.0-1.8ft.			Yes	Yes		
Location Average N11E27													5	187	10	356	0.35		5	187	10	356	0.35		0.2					Spotty sheen from 0.0-1.0ft (six to ten tiny spots).						
N11E27													86	2111	163	4011	0.3		86	2111	163	4011	0.3		0.7		Yes						Yes			
N11E29													363	9677	692	18446	5.5		363	9677	692	18446	5.5		1	1	Yes			Spotty silver sheen from 0.0-0.8ft.						
N11E30													518	15383	983	29227	1.3		518	15383	983	29227	1.3		0.2					Very small sheens at 0.2ft.						
N11E33-GL23	239	1.74	11.0	0.73	39.16	56.80	97.7	93	4.59	81	0.90	1.30	78	2286	148	4357	0.98		78	2286	148	4357	0.98		0.2	1	0.1	0.9		Bluish iridescent sheen from 0.5-1.1ft.						
Location Average N11E35													141	2332	296	4903	1.1	2.9	141	2332	296	4903	1.1	2.9	0.2	1	0.1	0.9								
N11E35													118	1956	229	3787	0.62		118	1956	229	3787	0.62		0.2	0.2				Spotty small silver sheen from 0.0-2.2ft.						
N12E11													142	4428	270	8439	1.9		142	4428	270	8439	1.9		0.4		Yes	No VOT or sheen					Yes			
N12E15													4.9	272	9	518	0.60		4.9	272	9	518	0.60		0.08					No VOT or sheen						
Location Average N12E19-GL24													40	1983	76	3780	0.88		40	1983	76	3780	0.88		0.2											
N12E19-GL24	207	1.61	8.0	0.78	34.99	49.88	103.7	78	5.47	66	0.61	0.73	22	1128	42	2149	0.74		22	1128	42	2149	0.74		0.1	0.9	0.08	0.5		Oil/tar saturated sediment from 0.0-1.0ft.	No VOT or sheen			Yes	Yes	
N12E22													77	1559	160	3234	0.86	2.0	77	1559	160	3234	0.86	2.0	0.1	0.9	0.08	0.5			No VOT or sheen					
N12E25													64	1891	123	3604	0.85		64	1891	123	3604	0.85		0.2											
N12E27													85	2784	162	5290	0.077		85	2784	162	5290	0.077		0.2	0.2				No VOT or sheen						
N13E12													203	6435	386	12226	0.087		203	6435	386	12226	0.087		0.5	0.5	Yes			No VOT or sheen				Yes		
N13E30													103	3035	195	5766	0.042		103	3035	195	5766	0.042		0.3	0.3				No VOT or sheen						
N13E33													47	1264	90	2402	0.49		47	1264	90	2402	0.49		0.1	0.1				No VOT or sheen						
N14E11-GL25	211	0.92	8.0	0.44	70.33	76.14	41.0	93	3.50	88	0.78	2.25	113	2977	215	5655	0.043		113	2977	215	5655	0.043		0.3	0.3				No VOT or sheen						
Location Average N14E31													52	1107	97	2070	0.71	1.6	52	1107	97	2070	0.71	1.6	0.1	0.8	0.06	0.3				No VOT or sheen				
N14E31													70	1509	139	2987	0.85		70	1509	139	2987	0.85													

