CENPS-OP-DMMO

MEMORANDUM FOR RECORD 25 June 1992

SUBJECT: DETERMINATION ON THE SUITABILITY OF DREDGED MATERIAL TESTED FOR THE INNER CHANNEL OF GRAYS HARBOR OPERATION AND MAINTENANCE DREDGING FOR DISPOSAL AT EITHER THE SOUTH JETTY OR POINT CHEHALIS ESTUARINE OPEN WATER DISPOSAL SITES, OR AT THE 3.9 MILE OCEAN DISPOSAL SITE.

1. The following summary reflects the consensus determination of the Agencies' (U.S. Army Corps or Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency) with jurisdiction on dredging and disposal on the suitability of the estimated 700,000 to 1,000,000 cubic yards of material scheduled for maintenance dredging from the federally maintained inner channel, Grays Harbor, Washington for disposal at either the South Jetty or Point Chehalis estuarine disposal sites, or at the 3.9 mile ocean disposal site. The determination of suitability is based on the acceptability of the sampling plan and all relevant test data contained in May 14, 1992 SAIC Data Summary Report. The results of these testing data will be used to assess future management plans for 1993 maintenance dredging as agreed to by the Grays Harbor Dredged Material Management Study Group (DMMSG).

2. The Agencies' approved sampling and testing plan was followed, and quality assurance/quality control guidelines specified by PSEP and the PSDDA program were generally complied with. The data gathered were deemed sufficient and acceptable for decision making by the Agencies based on best professional judgement.

3. Chemistry data from eight composited samples from twenty-four sampling locations indicated that four dredged material management units (DMMU) had either minor detected exceedances of chemical of concern PSDDA screening level (SL) guideline values for mercury (C5) and Diethylphtalate (C8), whereas two DMMU (C3 and C4) slightly exceeded the detection limit SL for Hexachlorobutadiene (Table 1). PSDDA SL's are used in Puget Sound to establish a concern for biological effects, where chemicals below the SL have a low level of concern. In this context, they are only used in Grays Harbor as an interim yardstick to evaluate chemical concentration levels measured in sediments. All three chemicals were well below the Puget Sound derived "Lowest Apparent Effect Threshold" (LAET) levels, where biological effects have been observed (Table 1). Six samples collected along two transects within the Cow Point Reach portion of the federal navigation channel (DMMU C2 = S4 + S5 + S6; DMMU C3 = S7 + S8 + S9) were composited into two samples, and subsequently underwent concurrent chemical and biological testing. Concurrent biological testing was called for by the Agencies based on a higher concern for the sediment quality of this material. The biological testing results are summarized in Table 3 and paragraph 7 below. Because the slight mercury exceedance in DMMU C5 was below the LAET, the agencies consensus was that biological testing was not necessary for this DMMU. Therefore, with respect to the remaining DMMU for the Grays Harbor Operations and Maintenance Dredging Project, the Agencies' consensus was that because chemical exceedances of PSDDA SL's were generally below biological effects levels, no additional biological effects testing was required.

Table 1. Chemicals detected over PSDDA screening level.

Chemical	PSDDA SL	LAET	C-3	C-4	C-5	C-8
Mercury	0.21 ppm	2.1 ppm (Amphipod) 0.59 ppm (Oyster) 2.1 ppm (Benthic) **0.41 ppm (Microtox)**	--	--	0.235 ppm	--
Diethyl phthalate	97 ppb	>1200 ppb (Amphipod) >73 ppb (Oyster) **200 ppb (Benthic)** >48 ppb (Microtox)	--	--	--	97* ppb
Hexachloro butadiene	29 ppb	180 ppb (Amphipod) 270 ppb (Oyster) >11 ppb (Benthic) **120 ppb (Microtox)**	30u ppb	30u ppb	--	--

* replicate value exceeded SL at 240 ppb, although average for replicates was at the SL

4. Eight composited sediment samples were also analyzed for dioxins by Twin City Testing Corporation utilizing EPA method 8290. These data are summarized in Table 2. Results indicated that 2,3,7,8 TCDD (Tetrachloro-Dibenzo-p-Dioxin) was detected in all eight samples ranging from a low of 0.5 to a high of 1.7 pptr (parts per trillion). This congener is regarded by the EPA as the most toxic form of dioxin. A few other less toxic dioxin congeners were detected at low parts per trillion concentrations. In the following table, the toxicity equivalence in terms of 2,3,7,8-TCDD is shown for the nine most toxic congeners of furan and dioxin (U expresses the detection limit for congeners that could not be quantified).

5. One way to summarize potential toxicity for mammals is to calculate the toxicity equivalent concentrations (TEC) measured in tissue. Total TEC is calculated by multiplying the toxicity equivalent factor (TEF) by the congener specific concentration and summing the TEC's for all congeners. Total TEC comparisons are usually used for food ingestion, and have limited applicability to sediment because TEC **does not** consider the relative bioavailability of the congeners. Accordingly, TEC overstates toxicity to mammals when applied to sediments. TEC as a toxicity measure does not apply to fish, shellfish or birds. For comparison purposes only, the TEC's ranged from a low of 1.7 to a high of 5.2 pptr.

6. Based on the Agencies' present best professional judgment, these low concentrations are unlikely to be environmentally harmful for this project. The Agencies' consensus is that the material is suitable for either estuarine or ocean unconfined open-water disposal relative to these dioxin test results.

Table 2. Native congeners of Dioxin quantitated in Grays Harbor O&M sediments.

NATIVE CONGENERS[1] (pptr)	TEF[2]	C-1 (TEF)	C-2 (TEF)	C-3 (TEF)	C-4 (TEF)	C-5 (TEF)	C-6 (TEF)	C-7 (TEF)	C-8 (TEF)
2,3,7,8-TCDD	1	1.4 (1.4)	1.4 (1.4)	1.7 (1.7)	1.0 (1.0)	1.2 (1.2)	0.5 (0.5)	0.78 (0.78)	0.67 (0.67)
1,2,3,7,8-PeCDD	0.5	1.8 (0.9)	1.8 (0.9)	2.1 (1.05)	1.7 U (0.4)	1.8 (0.9)	0.75 (0.38)	0.88 (0.44)	0.99 (0.5)
1,2,3,7,8-HxCDD	0.1	8.0 (0.8)	8.1 (0.8)	9.6 (0.96)	6.9 (0.69)	8.78 (0.88)	3.13 (0.31)	3.41 (0.34)	4.3 (0.43)
1,2,3,4,7,8-HpCDD	0.01	39 (0.39)	34 (0.34)	48 (0.48)	27 (0.27)	31 (0.31)	14 (0.14)	18 (0.18)	17 (0.17)
OCDD	0.001	240 (0.24)	210 (0.21)	290 (0.29)	160 (0.16)	190 (0.19)	90 (0.09)	110 (0.11)	100 (0.1)
2,3,7,8-TCDF	0.1	2.7 (0.27)	1.5 (0.15)	2.9 (0.29)	1.1 (0.11)	1.9 (0.19)	1.1 U (0.06)	0.98 (0.1)	1.1 (0.11)
1,2,3,7,8-PeCDF	0.05	0.23 U (0.01)	0.22 U (0.01)	0.6 U (0.02)	0.38 U (0.01)	0.17 U (0.00)	0.17 U (0.00)	0.14 U (0.00)	0.25 U (0.01)
2,3,4,7,8-PeCDF	0.5	0.52 U (0.13)	0.37 (0.19)	0.46 U (0.12)	0.55 U (0.14)	0.23 U (0.06)	0.21 (0.11)	0.15 U (0.04)	0.24 U (0.06)
1,2,3,7,8-HxCDF	0.1	0.72 (0.07)	0.99 (0.1)	1.36 (0.14)	0.37 (0.04)	0.4 (0.04)	0.55 (0.06)	0.36 U (0.02)	0.8 (0.08)
1,2,3,7,8-HpCDF	0.01	10 (0.1)	8.8 (0.09)	13 (0.13)	6 (0.06)	7.3 (0.07)	3.6 (0.04)	4.6 (0.05)	8.5 (0.09)
OCDF	0.001	17 (0.02)	15 (0.02)	21 (0.02)	11 (0.01)	12 (0.01)	5.8 (0.01)	7.6 (0.01)	8.5 (0.01)
TOTALS:		4.33	4.21	5.2	2.9	3.86	1.72	2.07	2.23

7. Results from the two DMMU that underwent concurrent biological testing are summarized in Table 3 below. The results showed that for the two DMMU tested, biological testing results passed PSDDA disposal interpretation guidelines for dispersive sites.

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[1] TCDD = Tetrachlorodibenzodioxin TCDF = Tetrachlordibenzofuran
PeCDD = Pentachlorodibenzodioxin PeCDF = Pentachlorodibenzofuran
HxCDD = Hexachlorodibenzodioxin HxCDF = Hexachlorodibenzofuran
HpCDD = Heptachlorodibenzodioxin HpCDF = Heptachlorodibenzofuran
OCDD = Octochlorodibenzodioxin OCDF = Octochlorodibenzofuran

[2] TOXICITY EQUIVALENT FACTOR

Table 3. Biological Testing Summary.

STATION	Amphipod Mortality (%)	Echinoderm Mortality (%)	10-day Neanthes Mortality (%)	20-day Neanthes Biomass (mg) (% reference)	Microtox Test (% light change)	PSDDA pass/fail
Control	8.5	N/A	10.0	55.5 (85.6 %)	N/A	-
Carr Inlet Reference	24.0	4.3	7.5	64.8 (100 %)	-14.15	-
C-2	26.0	6.6	12.0	49.0 (75.7 %)	-16.63	pass
C-3	25.0	10.5	10.0	56.7 (87.5 %)	-12.39	pass

8. Based on the chemistry and biological testing results described above no bioassay or bioaccumulation testing was required for the remaining six DMMU that did not undergo biological testing.

9. The Agencies concluded based on the above discussion and summary of sediment chemical and biological characterization results for the inner harbor of the Grays Harbor Operations and Maintenance Project, that all the dredged material tested (700,000 to 1,000,000 cubic yards) is suitable for disposal at either the South Jetty or Point Chehalis estuarine disposal sites, or at the 3.9 mile ocean disposal site.

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Concur:

8 July 1992
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GRAYS HARBOR
MAINTENANCE DREDGING
SEDIMENT CHARACTERIZATION

FINAL REPORT

October 19, 1992

Report #R9205.013/0528/B.019
Seattle COE Delivery Order No. 5

Submitted to:

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Seattle District
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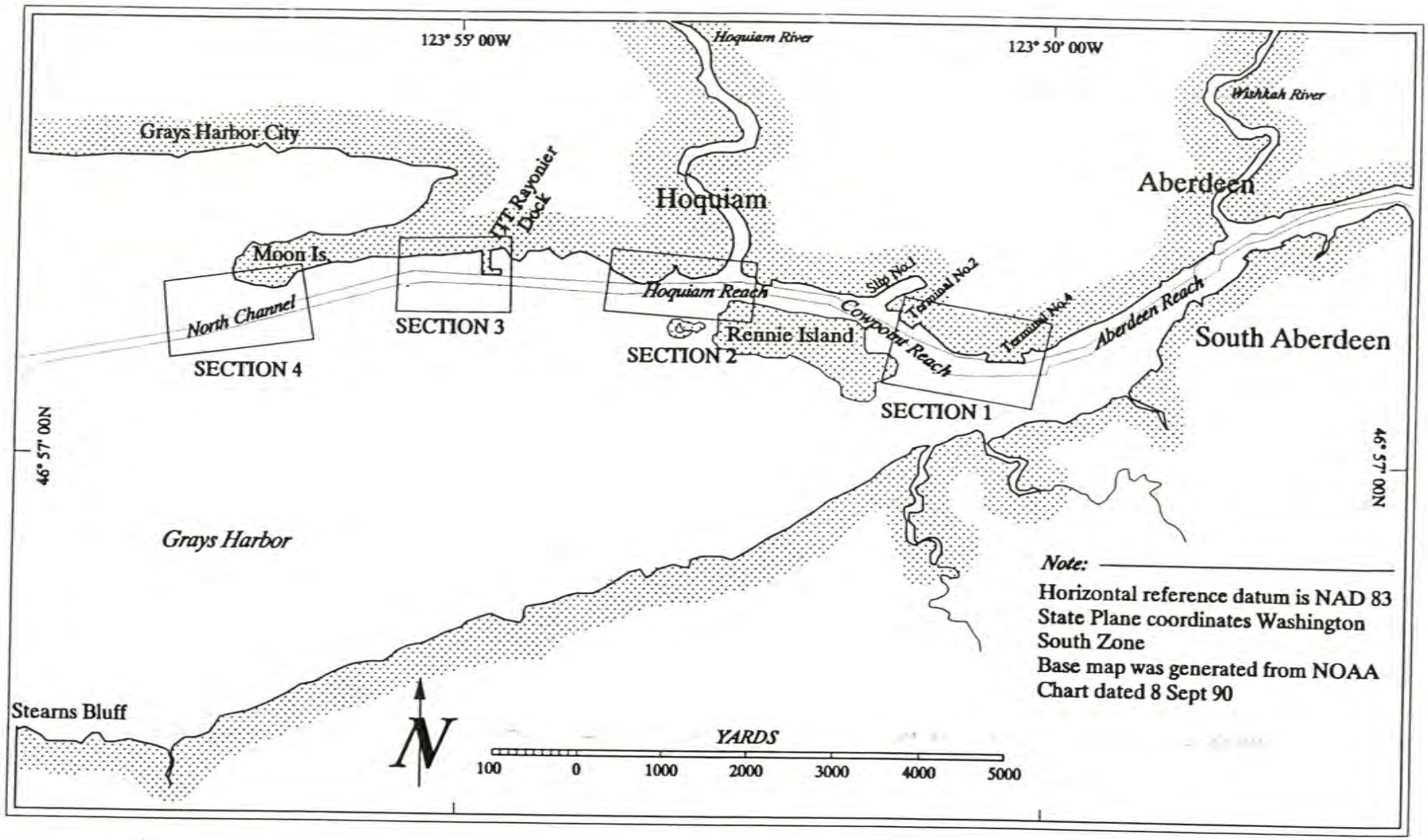

Figure 2-1. Grays Harbor Maintenance Dredging Sediment Sampling Locations. Sections 1 through 4 correspond to Figures 2-2 through 2-5, respectively.

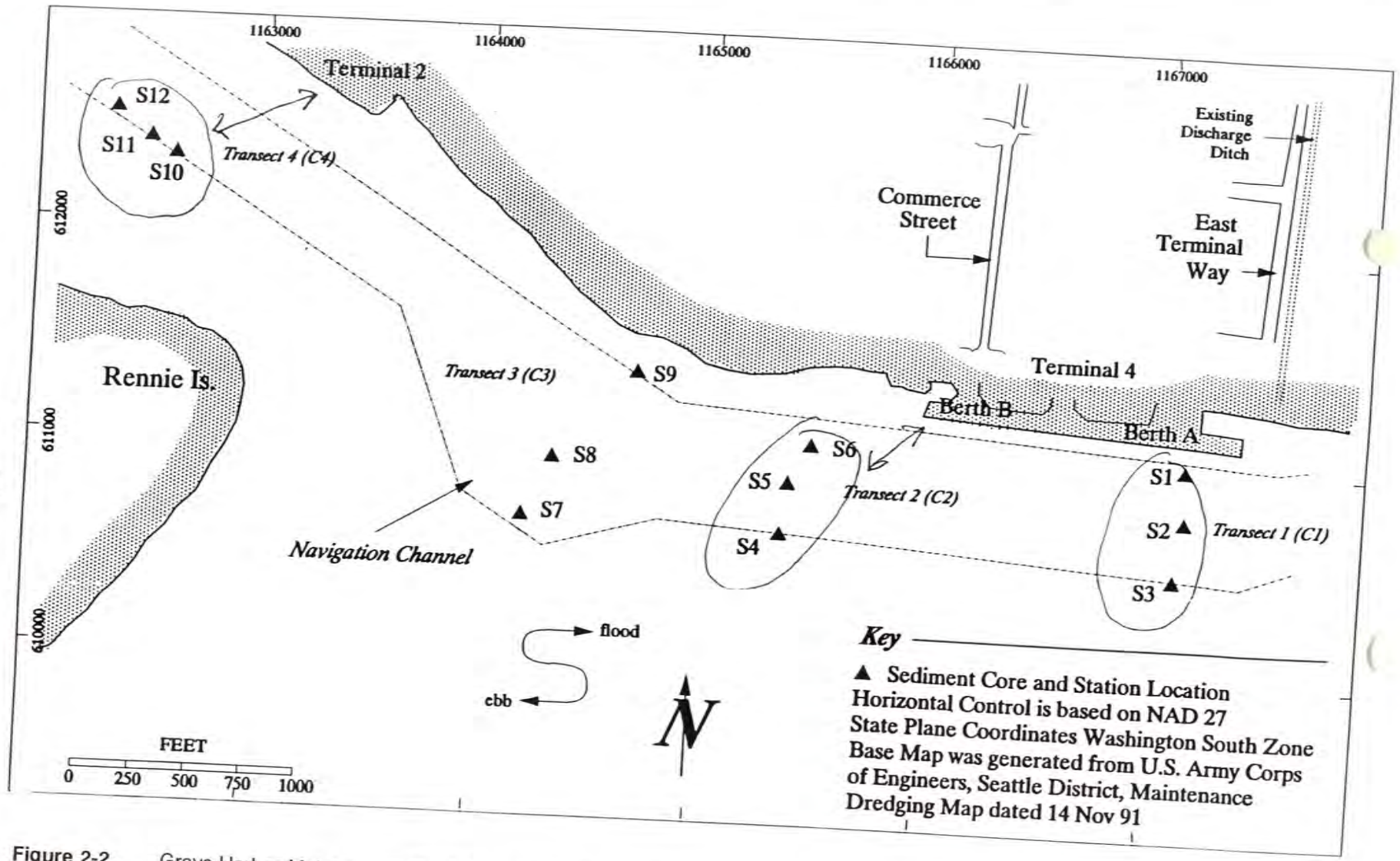

Figure 2-2. Grays Harbor Maintenance Dredging Sediment Sampling Locations (Section 1)

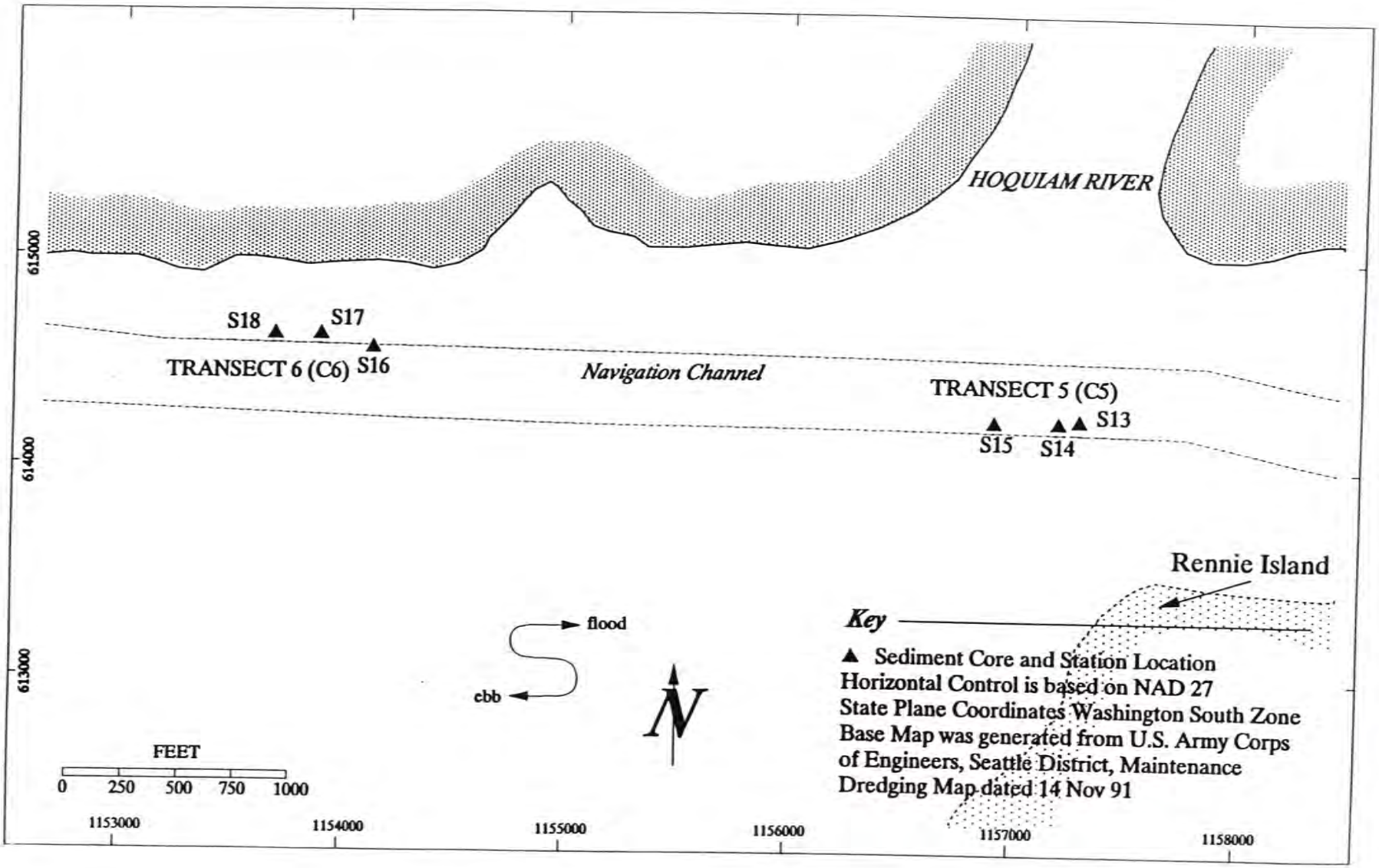

Figure 2-3. Grays Harbor Maintenance Dredging Sediment Sampling Locations (Section 2)

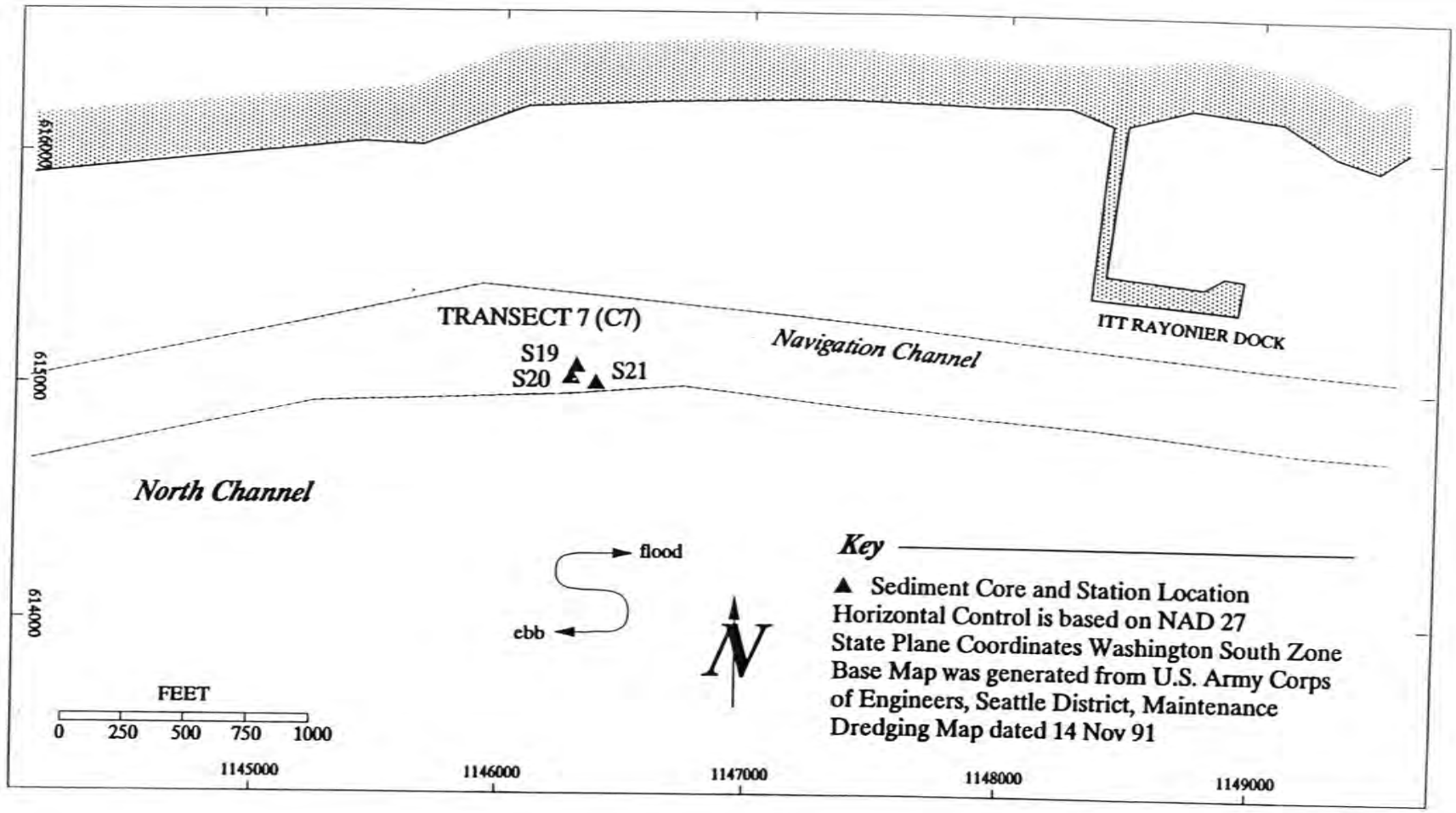

Figure 2-4. Grays Harbor Maintenance Dredging Sediment Sampling Locations (Section 3)

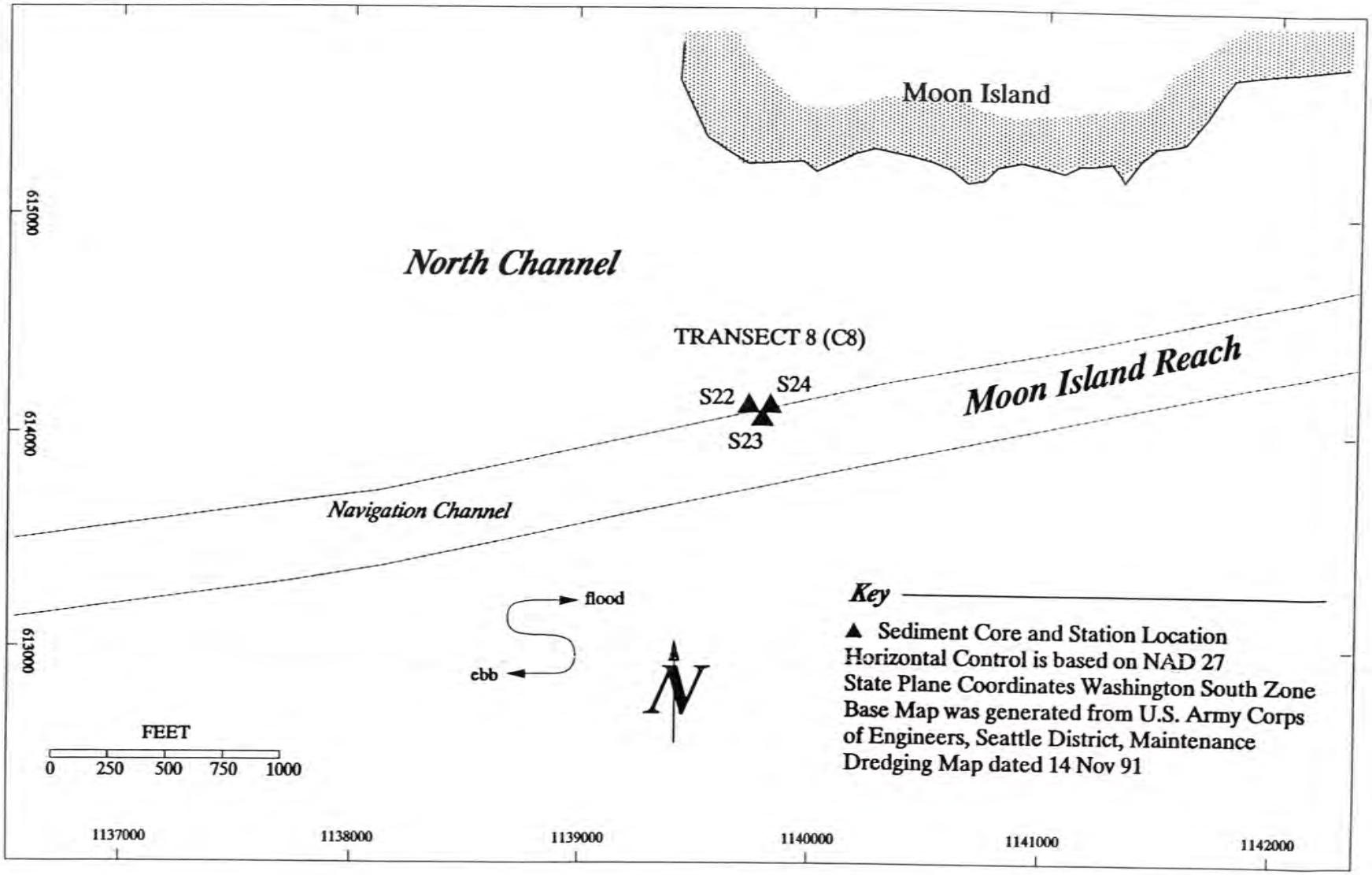

Figure 2-5. Grays Harbor Maintenance Dredging Sediment Sampling Locations (Section 4)

TABLE 2-1. Composite Sample Designations

COMPOSITE	STATIONS
S1	1, 2, 3
S2	4, 5, 6
S3	7, 8, 9
S4	10, 11, 12
S5	13, 14, 15
S6	16, 17, 18
S7	19, 20, 21
S8	22, 23, 24

2.2 Sample Collection and Field Handling

Sediment collections were conducted from a barge and tug (MARY MARGARET) equipped with a construction crane. Equipment was owned and operated by Quigg Bros.-McDonald, Inc. of Aberdeen, WA.

2.2.1 Navigation and Positioning

Positioning was provided by the USACE's shore-based survey crew, using an electronic distance measurement (EDM) unit. Local USACE benchmarks, established from the United States Coast and Geodetic Survey benchmarks, were used for horizontal control. By maintaining radio contact with the vessel's captain, the surveyors were able to direct the vessel to the desired station. Once on station, the surveyors recorded their range and azimuth measurements and directed the vessel to immediately lower the sediment coring device. The location of each core was later calculated and recorded in latitude and longitude and Washington State Plane Coordinates (South Zone) (Table 2-2).

2.2.6 Sediment Toxicity Testing

Sediment collected from each site for chemical testing also served as test material for toxicity testing. Five liters of material were retained for biological testing. Bioassays for two samples were performed in parallel with the chemical testing (composite samples C2 and C3). These two samples were selected because of their proximity to pulp mill effluents which were previously determined to contain low levels of dioxins. Sample jars were purged with nitrogen following field operations and maintained at 4°C in darkness until the biological testing was conducted in the laboratory. Bioassays were initiated within the 8 week holding time designated by PSDDA and run as one batch.

The intensively sampled locations C2 and C3 were biologically tested for the following toxicity tests: the marine amphipod using Rhepoxynius abronius; sediment larval using echinoderm larvae (Dendraster excentricus); Neanthes 10-day acute toxicity; Microtox using saline extract; and the Neanthes 20-day chronic biomass. Methods used were consistent with those approved by PSEP/PSDDA (PSEP 1986, 1991, and PSDDA 1990b).

Table 3-1. Summary of Sediment Chemistry Results

SEDIMENT COMPOSITE NO: / COLLECTION DATE:	C1 3/3/92	C2 3/3/92	C3 3/4/92	C4 3/4/92	C5 3/4/92	C6 3/4/92	C7 3/3/92	C8 3/3/92	R1 3/7/92
Total Solids (%)	54.9	54	54.9	55.8	61.5	58.9	57.1	62.9	71.7*
Total Volatile Solids (%)	3.4	4.4	4.3	4.2	4.5	4.1	4.2	3.3	2.6*
Ammonia (mg/kg)	147*	30	93	81	47	49	46	35	18 U
Total Organic Carbon (%)	1.3*	1.2	1.2	1.4	1.3	1.3	1.2	0.76	0.44
Total Sulfides (mg/kg)	14*	0.3	16*	13	8.1	13*	7.0	3.7	2.9
Acid Volatile Sulfides (mg/kg)	33*	0.76	38	22	31	27	35	32	21
Percent Gravel	4	7	1	0	0	0	0	2	0
Percent Sand	32	33	11	11	17	15	28	64	46
Percent Silt	52	50	73	77	73	71	62	30	48
Percent Clay	12	10	15	12	10	14	10	4	6
Percent Fines	64	60	88	89	83	85	72	34	54
TOTAL METALS (mg/kg dw)									
Antimony	0.42	0.45	0.36	0.40	0.39	0.43	0.42	0.31	NA
Arsenic	6.8	6.2	8.6	6.4	13	7.1	5.1	3.6	NA
Cadmium	0.12	0.14	0.12	0.13	0.12	0.12	0.12	0.08	NA
Copper	56	52	55	61	62	56	48.00	30	NA
Lead	4.7	3.7	2.7	3.8	2.2 U	3.5	5.6	7.0	NA
Mercury	0.07	0.089	0.084	0.081	0.235	0.116	0.120	0.082	NA
Nickel	34	30	34	35	36	33	32	29	NA
Silver	0.079	0.120	0.110	0.100	0.090	0.081	0.037 U	0.037 U	NA
Zinc	100	90	100	110	100	98	96	79	NA
SEMIVOLATILE ORGANICS (µg/kg dw)									
LOW MOLECULAR WEIGHT PAHs									
Phenanthrene	28	28 U	37	30 U	29	27 U	27 U	21 U	NA
HIGH MOLECULAR WEIGHT PAHs									
Fluoranthene	38	28 U	37	47	48	42	27 U	31	NA
Pyrene	32	28 U	30 U	41	49	33	27 U	25	NA
PHTHALATES									
Bis(2-ethylhexyl)phthalate	27 U	47	41	30 U	39	40	27 U	21 U	NA
Butyl benzyl phthalate	27 U	28 U	30 U	30 U	27 U	27 U	27 U	130	NA
Diethyl phthalate	27 U	28 U	30 U	30 U	27 U	27 U	27 U	97*	NA
MISCELLANEOUS COMPOUNDS									
Hexachlorobutadiene	27 U	28 U	30 U	30 U	27 U	27 U	27 U	21 U	NA
RESIN ACIDS									
Dehydroabietic acid	380	400	250	370	340	350	260	150	NA

NOTES:

U Indicates analyte was not detected above method detection limit shown.
DW Indicates value reported on the dry weight basis.
* Indicates value is the average of three values.
Indicates value reported is equal to or exceeds the PSDDA SL.
mg/kg milligrams per kilogram or parts per million (ppm).
µg/kg micrograms per kilogram or parts per billion (ppb).
NA Not analyzed.

4.0 SEDIMENT TOXICITY RESULTS

PSDDA acute and chronic bioassays were conducted on samples C2 and C3 (Cow Point area) concurrently with the chemistry analyses. The PSDDA regulatory criteria were met for each test sample. The results of the bioassay tests are summarized in Table 4-1 and the complete report is presented in Appendix F.

4.1 Amphipod Bioassay

The amphipod mortality for samples C2 (26 percent) and C3 (25 percent) was higher than both control (8.5 percent) and Carr Inlet reference samples (24 percent). Neither C2 or C3 was statistically different from or exceeded by 30 percent the response observed in the reference sediment (PSDDA "Single-Hit" rule). Although, both samples did exceed the response observed in the control sediment by more than 20 percent the samples did not exhibit a statistically significant response from the reference sediment, and therefore no PSDDA "Two-Hit" rule exceedance.

4.2 Echinoderm Larvae Bioassay

The echinoderm mortality for samples C2 (6.6 percent) and C3 (10.5 percent) was higher than the Carr Inlet reference sample (4.3 percent). However, neither C2 or C3 was statistically different from and 30 percent over the response observed in the reference sediment.

4.3 Neanthes 10-Day Bioassay

The *Neanthes* mortality for samples C2 (12 percent) and C3 (10 percent) was either equal to or higher than the control (10 percent) and Carr Inlet reference samples (7.5 percent). Neither C2 or C3 was statistically different from and 30 percent over the response observed in the reference sediment. In addition, the mortality observed in the test samples did not exceed 20 percent the response in the control sediment.

4.4 Neanthes 20-Day Bioassay

There was no statistical difference observed in biomass relative to the reference sediment (0.0648 grams) in samples C2 (0.0490 grams) and C3 (0.0567 grams).

Table 4-1. Summary of Bioassay Test Results

Station	Amphipod Mortality (%)	Echinoderm Mortality (%)	10-Day *Neanthes* Mortality (%)	20-Day *Neanthes* Change in biomass (g)	*Microtox* Test (% light change)
Control	8.5	N/A	10.0	0.0555	N/A
Carr Inlet	24.0	4.3	7.5	0.0648	-14.15
C2	26.0	6.6	12.0	0.0490	-16.63
C3	25.0	10.5	10.0	0.0567	-12.39

4.5 Microtox Saline Extract Bioassay

The negative Microtox values observed in samples C2 (-16.63) and C3 (-12.39) indicate light enhancement and is not regarded as a toxic response.