POST REMEDIATION INVESTIGATION OF SEDIMENT TOXICITY IN THE TANNERY BAY AREA OF WHITE LAKE, MICHIGAN

BY

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Executive Summary

An investigation of solid phase toxicity was conducted in the Tannery Bay area of White Lake, Michigan approximately 18 months after a remediation program removed 80,000 cu yds of contaminated sediment in 2002/2003. Previous investigations found the sediments to be highly contaminated with arsenic, chromium, mercury, and visible tannery waste (hide fragments, hair, and purple discoloration), in addition to exhibiting significant acute toxicity in laboratory bioassays. Post remediation sampling in 2003 found that only isolated traces of visible tannery waste remained. Levels of arsenic, mercury, and chromium, however, were similar to pre-remediation levels. In order to determine if dredging reduced or eliminated adverse environmental impacts in Tannery Bay, a post remediation investigation of sediment chemistry and toxicity was conducted by the Annis Water Resources Institute, Muskegon MI on 6/29/2004. Acute toxicity tests (10–day chronic) were performed on the sediments using *Hyalella azteca* and *Chironomus tentans* in addition to chemical analyses for heavy metals and physical parameters.

The 2004 sediment chemistry results for arsenic and chromium were significantly less than the data collected immediately after remediation in 2003 by DLZ. The 2004 results were similar to data collected in 1996 except for a significant reduction in organic chromium. Sediment chemistry results are summarized below:

	1996*	DLZ (2003)	AWRI 2004
Total Chromium	2,108 mg/kg	4,463 mg/kg	2,716 mg/kg
Organic Chromium	161 mg/kg	Not Analyzed	58 mg/kg
Arsenic	36 mg/kg	117 mg/kg	30 mg/kg
Mercury	1.6 mg/kg	Not Analyzed	2.0 mg/kg

* Rediske et al. (1998)

These results suggest that sediment arsenic and chromium concentrations have declined after remediation. Possible explanations include the deposition of clean sediment and mixing. The significant reduction in organic chromium is consistent with the removal of visible tannery waste from the sediment.

The following statistically significant toxicity relationships were observed:

Organism	Test Response	Treatment vs. Control	Sites
Hyalella azteca	Survival	78% vs. 83%	TB-5
Hyalella azteca	Growth	0.09 mg- 0.12 mg vs.0.18 mg	TB-8, TB-9, TB-12, TB-13, TB-16, TB-17, TB-18, and TB-20
Chironomus tentans	Survival	38% vs. 83%	TB-5
Chironomus tentans	Growth	0.49 mg and 0.54 mg vs.0.74 mg	TB-5 and TB-14

Amphipod survival was close to the EPA's acceptability guideline for controls (78% for TB-5 vs. 80% guideline for amphipods). Chironomid survival was significantly lower than the acceptability guideline (38% vs. 70% guideline for chironomids). Amphipod survival was negatively correlated with sediment arsenic concentrations ($p < 0.01$). For chironomids, no significant correlations were present in the data for survival while growth was negatively correlated with organic chromium at the 5% level. These correlations must be viewed with caution because only one survival or growth data point was statistically different from the control in each case. Amphipod growth was significantly lower than the White Lake control (TB-1) at all Tannery Bay locations and no significant correlations were present with respect to contaminant concentration. The amphipod growth data also was analyzed using a reference sediment from an uncontaminated site in Muskegon County (Cress Creek, CC-1). Statistically significant amphipod growth reductions were present in 8 of the 19 locations. Stations with the highest arsenic and organic chromium concentrations (TB-5 and TB-14, respectively) did not exhibit reduced growth with respect to the reference sediment. Growth measurements per individual were considerably higher (0.33 mg/amphipod vs. 0.15 mg/amphipod) at TB-1 compared to a control sample from Lake Macatawa used in a previous investigation. The results of amphipod growth measurements suggest that a low level of sediment toxicity remains in Tannery Bay. Since the site control appears to have a positive bias with respect to increased amphipod weights, the amount of growth inhibition specifically related to contaminants cannot be determined from these experiments. Based on this information, future investigations of sediment toxicity in Tannery Bay should involve the evaluation of additional control locations that reflect recent dredging and the absence of macrophytes.

The results of this investigation show that contaminant concentrations have decreased from 2003 levels and that the high level of toxicity previously associated with Tannery Bay sediments was not present after remediation. Only one location (TB-5) showed statistically significant mortality for amphipods and chironomids. Based on these results, the removal of contaminated sediments from Tannery Bay eliminated the toxicity related to decreased survival from all but one location. While some toxicity with respect to reduction in organism growth appears to remain in Tannery Bay, the amount of inhibition related to contaminants could not be determined due to a positive bias in the site control. Since contaminant concentrations appear to be decreasing and there is a rationale to support the selection of different control locations, a second toxicity investigation should be performed in 2005. These results plus data on the composition of the benthic macroinvertebrate community will provide an indication of the degree to which ecosystem recovery has taken place and determine if any residual areas of toxicity are present.

1.0 INTRODUCTION

White Lake is a 2,571 acre, drowned-rivermouth lake located on the eastern shore of Lake Michigan in Muskegon County. Wastes discharged by Whitehall Leather from 1890-1973 have impacted eastern White Lake. Wastewater and sludge from tanning operations were discharged from 1890 to 1973. The process was changed from tree bark to a chromium-based system in 1945 and wastewater containing heavy metals, hide fragments, and animal hair was discharged directly into an area of White Lake called Tannery Bay (Figure 1.1). Arsenic and mercury were added to the process as biocides. In addition to heavy metals, the wastewater contained high levels of organic nitrogen, biological oxygen demand (BOD), and sulfide. Previous investigations have indicated extensive contamination of sediments in this region of White Lake. High levels of chromium (4,000 - 60,000 mg/kg), mercury (1 -15 mg/kg), and arsenic (10 - 200 mg/kg) were reported (Bolattino and Fox 1995; Rediske et al. 1998). Sediments from Tannery Bay also were found to be toxic to amphipods; and toxicity was correlated with organically bound chromium (Rediske et al. 1998; 2003). In 2003, approximately 80,000 cubic yards of contaminated sediment were removed from Tannery Bay by the Michigan Department of Natural Resources. The goal of the sediment remediation program was to remove sediments that were contaminated with tannery wastes. Verification samples collected by DLZ (2003) determined that a majority of the tannery waste was removed and only isolated locations contained visible residue (hair and purple coloration). In addition, chromium and arsenic levels were found to be similar to historic concentrations in a majority of the locations sampled. Organic chromium concentrations were not evaluated.

In order to determine if the dredging reduced or eliminated adverse environmental impacts in Tannery Bay, the Annis Water Resources Institute (AWRI) conducted a post-remediation investigation of sediment chemistry and toxicity on June 29, 2004. Samples were collected using a PONAR dredge and analyzed for total and organic chromium, selected heavy metals, and physical parameters. Solid phase toxicity also was measured using EPA (2000) methods with amphipods and chironomids. A total of 19 samples were collected from Tannery Bay. The locations were selected based on the DLZ (2003) results to encompass a range of metal concentrations and the occurrence of visible tannery waste. A control sample located near the mouth of the White River also was included. The results of this investigation were designed to determine if the remediation program was successful or if additional sediment must be removed from Tannery Bay to eliminate toxicity.

2.0 Sampling Locations

The sampling locations for this investigation are shown in Figure 2.1. Sediment samples were collected with a petite PONAR on the *RV W.G. Jackson*. GPS coordinates, sample depths, and visual descriptions are shown in Table 2.1.

FIGURE 1.1 WHITE LAKE AND TANNERY BAY.

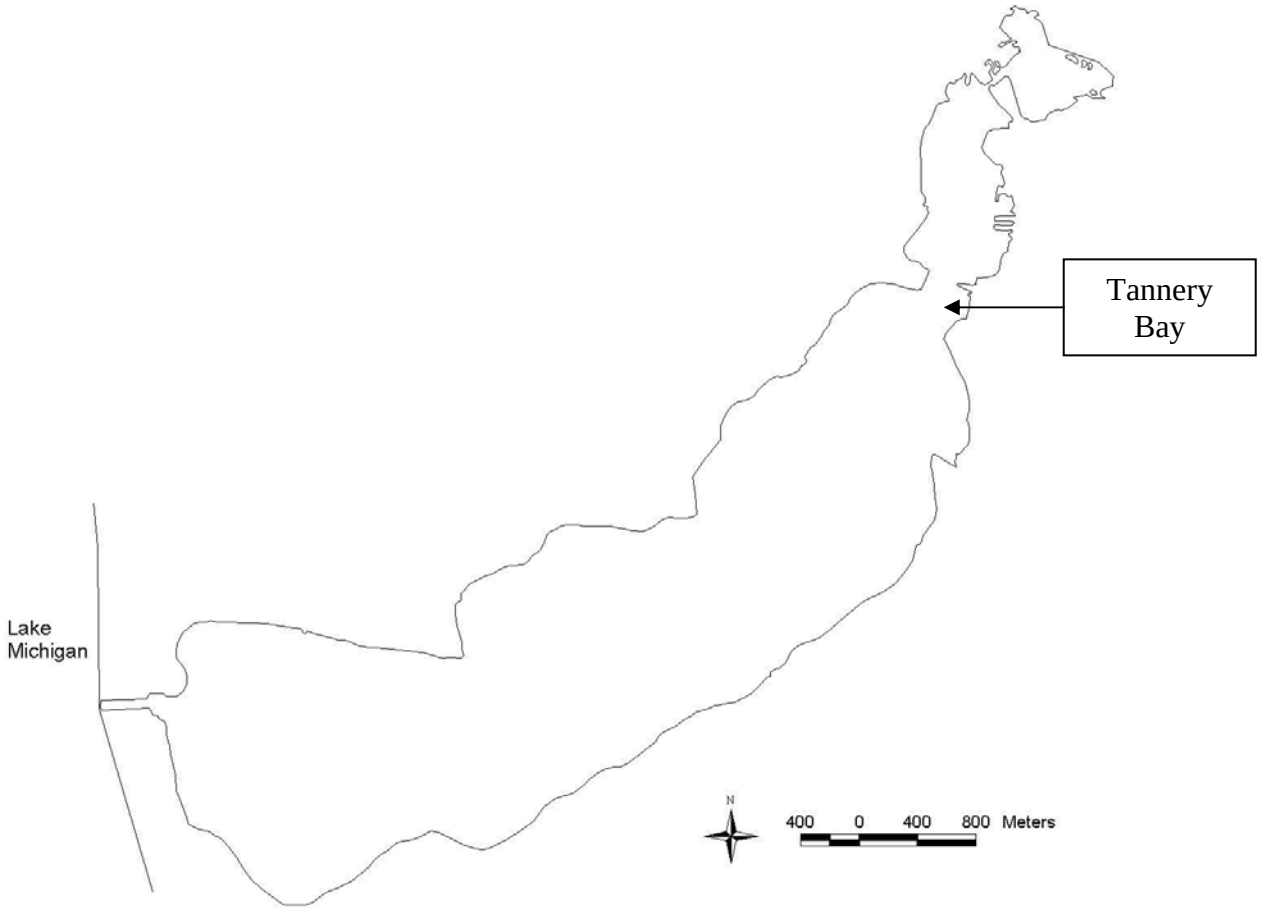

FIGURE 2.1. TANNERY BAY SAMPLING STATIONS (2004).

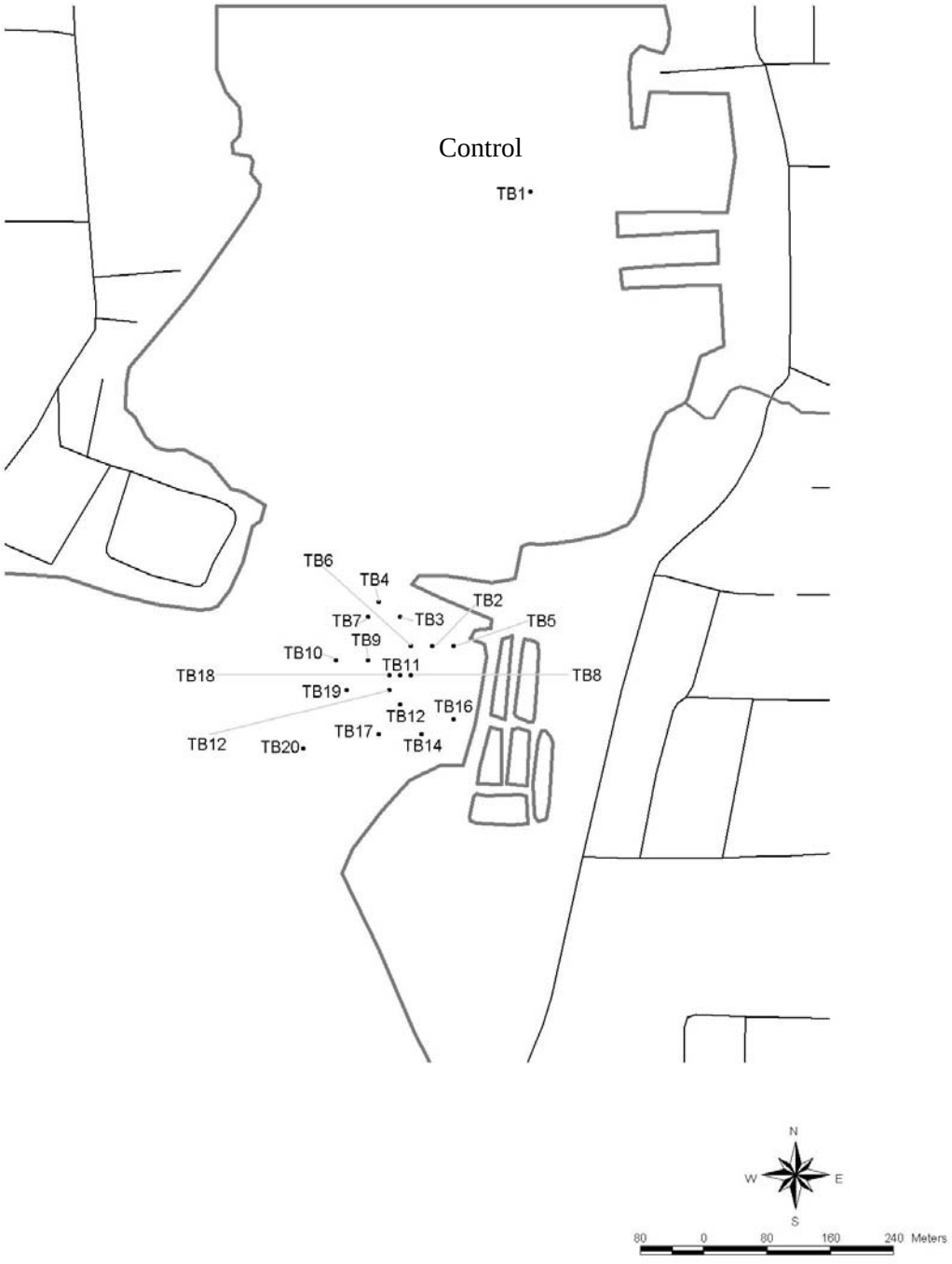

TABLE 2.1. TANNERY BAY SAMPLE COORDINATES, DEPTHS, AND VISUAL DESCRIPTIONS (2004).

Station	Sample Number	Sediment Depth	Latitude	Longitude	Visual Description
		Ft	N	W	
TB-1 (control)	12836	12.0	43° 24.35'	86° 21.18'	Black Organic Silt
TB-2	12837	16.3	43° 24.04'	86° 21.27'	Black organic silt; occasional hair and hide fragments
TB-3	12838	13.2	43° 24.06'	86° 21.30'	Black, mottled brown silts, occasional hair and wood chips
TB-4	12839	15.4	43° 24.07'	86° 21.32'	Black to brown organic silt; occasional hair and hide
TB-5	12840	15.0	43° 24.04'	86° 21.25'	Black organic silt, wood chips, sulfide odor; hair and hid fragments, some purple coloration.
TB-6	12841	16.1	43° 24.04'	86° 21.29'	Brown black organic silt, with a tinge of purple, oil droplets, occasional hair
TB-7	12842	12.5	43° 24.06'	86° 21.33'	Black brown organic silt, occasional hair; coon tail, 1 damsel fly, several zebra mussels
TB-8	12843	18.7	43° 24.02'	86° 21.29'	Black brown organic silt, hint of purple
TB-9	12844	11.1	43° 24.03'	86° 21.33'	Black brown organic silt, hint of purple, wood chips, plant detritus
TB-10	12845	12.8	43° 24.03'	86° 21.36'	Black brown organic silt
TB-11	12846	16.8	43° 24.02'	86° 21.30'	Black brown organic silt, some hairs
TB-12	12847	15.1	43° 24.01'	86° 21.31'	Black brown organic silt, trace purple color
TB-13	12848	17.4	43° 24.00'	86° 21.30'	Black brown organic silt, trace purple color, oil droplets
TB-14	12849	14.1	43° 23.98'	86° 21.28'	Black brown organic silt, trace purple, trace hair
TB-15	12850	16.6	43° 24.00'	86° 21.30'	Black organic silt, trace purple, trace hair
TB-16	12851	11.5	43° 23.99'	86° 21.25'	Black brown silt, trace hair and purple color, wood chips
TB-17	12852	11.2	43° 23.98'	86° 21.32'	Black brown silt, wood chips, macrophyles
TB-18	12853	14.2	43° 24.02'	86° 21.31'	Brown silt with traces of purple
TB-19	12854	12.7	43° 24.01'	86° 21.35'	Brown black silt, wood chips
TB-20	12855	13.1	43° 23.97'	86° 21.39'	Brown black silt
TB-20 dup	12855 dup	13.1	43° 23.97'	86° 21.39'	Brown black silt

3.0 METHODS

The evaluation of the toxicity of Tannery Bay sediments was conducted using the 10-day survival test for the amphipod *Hyalella azteca* and the dipteran *Chironomus tentans* (EPA 2000). Sediment samples were collected with a petite PONAR and transferred to 4-liter glass jars with Teflon lined caps. All sediments were stored at 4°C prior to analysis. A moderately hard well water for *H. azteca* and *C. tentans* cultures and maintenance was employed.

3.1 Test Organisms

Stocks of *H. azteca* and *C. tentans* were obtained from Aquatic Biosystems, Boulder, Colorado. Organism stocks were acclimated in the moderately hard well water for 48 hrs prior to initiation of the solid phase toxicity tests. The *H. azteca* were 7-14 days old and the *C. tentans* were third-instar (12-14 days old).

3.2 Experimental Design

For the solid phase testing, eight replicates per sediment sample were set up for both *H. azteca* and *C. tentans* exposures, with a sample collected from an uncontaminated area of White Lake (TB-1) used as a control. A negative control sample of sediment from Cress Creek (CC-1) (Muskegon, MI) also was analyzed for reference purposes. Sediments from this site are not impacted by significant anthropogenic contaminants and the data are used to evaluate the toxicity and growth of the test organisms under reference conditions. The experimental conditions outlined in Tables 3.1 and 3.2 were used for the toxicity evaluations. One day prior to the start of the test (day -1), the sediment from each site was mixed thoroughly and 100 mL aliquots were transferred to each of the eight test chambers. Additionally, visual observations of the sediments were made. Moderately hard well water was also added at this time. On day 0, the overlying water was renewed once before the test organisms were introduced into each of the glass beakers. Measurement of water quality parameters was also initiated on this day. Ten 7-14 day old *H. azteca* and 10 third instar *C. tentans* larvae were randomly added to their respective test chambers. At this time the organisms were fed 1.5 mL of Tetrafin® suspension. The glass beakers were placed in a rack and transferred to a temperature controlled chamber ($23 \pm 1^{o}C$). The light cycle was 16 hours on and 8 hours off. Temperature and dissolved oxygen measurements were taken from one randomly selected beaker for each sediment sample every 12 hours, after which the overlying water was renewed in all the beakers. Feeding occurred after the morning renewal. This procedure was repeated daily through day 10, at which point the test was terminated. On day 0, the overlying water from the beakers was composited from each sediment sample and 250 mls were retained for alkalinity, pH, conductance, hardness, and ammonia analysis. On the last day, the same procedure was carried out. On day 10, the sediments were sieved, and the surviving test organisms were removed and counted. The biological endpoint for these sediment tests was mortality. The validity of the test was based on greater than 80% survival for amphipods and greater than 70% survival for midges in the controls. In addition, growth measurements (weight gain) were made for each organism. Amphipods were placed in tared aluminum pans, dried for 48 hrs at $105^{0}C$, and cooled in a desiccator for one hour prior to

TABLE 3.1. RECOMMENDED TEST CONDITIONS FOR CONDUCTING A 10-DAY SEDIMENT TOXICITY TEST WITH *HYALELLA AZTECA*

1.	Test Type:	Whole-sediment toxicity test with renewal of overlying water
2.	Temperature (°C):	23 ± 1°C
3.	Light quality:	Wide-spectrum fluorescent lights
4.	Illuminance:	About 500 to 1000 lux
5.	Photoperiod:	16 h light, 8 h darkness
6.	Test chamber size:	300 mL high-form lipless beaker
7.	Sediment volume:	100 mL
8.	Overlying water volume:	175 mL
9.	Renewal of overlying water:	2 volume additions per day (i.e., one volume addition every 12 hours)
10.	Age of test organisms:	7 to 14 days old at the start of the test
11.	Number of organisms per chamber:	10
12.	Number of replicate chambers per treatment:	8
13.	Feeding:	Tetrafin® fish food, fed 1.5 mL daily to each test chamber
14.	Aeration:	None, unless dissolved oxygen in overlying water drops below 2.5 ppm
15.	Overlying water:	Well water
16.	Overlying water quality:	Hardness, alkalinity, conductivity, pH, and ammonia measured at the beginning and end of a test. Temperature and dissolved oxygen measured daily.
17.	Test duration:	10 days
18.	End point (toxicity):	Survival, with greater than 80% in the control
	End Point (growth):	Weight increase from initial measurement

Test Method 100.1. EPA Publication EPA/600/R-99/064 (2000).

TABLE 3.2. RECOMMENDED TEST CONDITIONS FOR CONDUCTING A 10-DAY SEDIMENT TOXICITY TEST WITH *CHIRONOMUS TENTANS*

1.	Test Type:	Whole-sediment toxicity test with renewal of overlying water
2.	Temperature (°C):	23 ± 1°C
3.	Light quality:	Wide-spectrum fluorescent lights
4.	Illuminance:	About 500 to 1000 lux
5.	Photoperiod:	16 h light, 8 h darkness
6.	Test chamber size:	300 mL high-form lipless beaker
7.	Sediment volume:	100 mL
8.	Overlying water volume:	175 mL
9.	Renewal of overlying water:	2 volume additions per day (i.e., one volume addition every 12 hours)
10.	Age of test organisms:	Third-instar larvae (All organisms must be third- instar or younger with at least 50% of the organisms at third-instar)
11.	Number of organisms per chamber:	10
12.	Number of replicate chambers per treatment:	8
13.	Feeding:	Tetrafin® fish food, fed 1.5 mL daily to each test chamber (1.5 mL contains 4.0 mg of dry solids)
14.	Aeration:	None, unless dissolved oxygen in overlying water drops below 2.5 ppm
15.	Overlying water:	Well water
16.	Overlying water quality:	Hardness, alkalinity, conductivity, pH, and ammonia measured at the beginning and end of a test. Temperature and dissolved oxygen measured daily
17.	Test duration:	10 days
18.	End point (toxicity):	Survival, with greater than 80% in the control
	End Point (growth):	Weight > 0.48 mg/organism in the control

Test Method 100.2. EPA Publication EPA/600/R-99/064 (2000).

weighing. The midges were placed in ceramic dishes and set in a muffle furnace for 8 hrs at 505^0C. After combustion, the residue was washed into a tared aluminum pan with DI water. The pans were dried for 24 hrs at 105^0C and cooled in a desicator for one hour prior to weighing.

4.0 RESULTS

4.1 Chemical Measurements

Sediments from Tannery Bay consisted of black organic silts with small amounts of hair, hide fragments, wood chips, and plant detritus. The results of grain size and TOC analyses are shown in Table 4.1. The coarse sediment fraction at TB-5 was hair and hide fragments. The remaining stations samples with grain size fractions > 1000 *u*m exceeding 1% of the total mass, contained primarily wood chips and/or plant detritus.

TABLE 4.1.1. RESULTS OF GRAIN SIZE AND TOC ANALYSES OF TANNERY BAY SEDIMENTS (2004).

Station	Grain Size Fractions % weight							TOC %	% Solids
	> 2000 *u*m	2000-1000 *u*m	1000-850 *u*m	850-500 *u*m	500-125 *u*m	125-63 *u*m	< 63 *u*m		
TB-1	0.0	0.1	0.0	0.1	1.6	13.7	84.6	13	16
TB-2	0.5	1.3	0.6	2.3	5.8	23.6	66.0	7	18
TB-3	0.6	0.8	0.4	0.7	1.2	9.9	86.5	7	15
TB-4	0.1	0.1	0.1	0.4	2.3	18.1	79.0	12	16
TB-5	8.7	3.9	1.3	7.1	18.1	22.5	38.4	6	17
TB-6	0.6	0.9	1.3	2.3	5.0	22.2	67.8	11	12
TB-7	0.9	0.9	0.5	0.9	3.0	6.3	87.5	6	15
TB-8	0.3	0.2	0.4	0.1	0.8	14.9	83.4	9	13
TB-9	2.6	0.9	0.3	0.7	2.1	13.4	80.0	3	15
TB-10	0.9	1.3	0.3	0.7	1.9	8.1	86.9	5	14
TB-11	0.3	0.1	0.0	0.3	1.1	6.9	91.4	8	14
TB-12	0.1	0.2	0.1	0.2	0.6	5.6	93.2	7	12
TB-13	0.4	1.0	0.3	0.7	1.8	8.1	87.7	5	14
TB-14	0.0	0.0	0.0	0.1	0.6	2.8	96.5	4	12
TB-15	0.1	0.0	0.0	0.1	0.4	3.9	95.5	4	13
TB-16	2.1	2.4	2.9	4.0	7.6	14.7	66.3	3	15
TB-17	7.0	1.3	0.4	0.9	2.4	8.4	79.7	1	15
TB-18	0.9	1.1	0.2	0.7	1.3	3.7	92.2	4	14
TB-19	0.5	0.5	0.1	0.4	1.4	5.9	91.4	2	13
TB-20	1.8	1.4	0.4	0.8	2.7	10.4	82.5	2	14
CC-1	0.2	0.2	0.2	1.0	4.0	21.1	73.3	5	15

The results of selected metals analyses conducted on the Tannery Bay samples by the MDEQ Laboratory are summarized in Table 4.1.2. The complete set of analytical results is

TABLE 4.1.2. RESULTS OF CHROMIUM, MERCURY, AND ARSENIC ANALYSES CONDUCTED ON TANNERY BAY SEDIMENTS (2004).

Station	Total As mg/kg	Total Hg mg/kg	Total Cr mg/kg	Organic Cr mg/kg
TB-1 (Control)	4.6	0.11	26	1
TB-2	19	1.00	1900	29
TB-3	29	2.30	4000	72
TB-4	7.5	0.79	5200	52
TB-5	83	3.00	1700	92
TB-6	41	4.30	2600	16
TB-7	10	0.61	1800	58
TB-8	59	5.30	4400	69
TB-9	11	0.43	1500	80
TB-10	7.9	0.38	970	32
TB-11	51	3.50	5900	40
TB-12	24	1.80	3200	46
TB-13	13	0.86	1500	52
TB-14	31	2.60	3400	117
TB-15	62	6.10	3000	57
TB-16	67	2.00	4000	84
TB-17	12	0.75	1300	62
TB-18	29	1.80	4500	79
TB-19	4.7	0.23	350	48
TB-20	4.9	0.21	390	19
Average	**30**	**2.0**	**2716**	**58**

provided in Appendix B. Mean concentrations of metals before and after the 2000/2003 remediation are summarized below:

	Pre-Remediation 1996* (n=8, ± 1 SE)	Post Remediation DLZ 2003 (n=19, ± 1 SE)	Post Remediation (n=19, ± 1 SE)
Total Cr	2,108 ± 530 mg/kg	4,463 ± 395 mg/kg	2,716 ± 374 mg/kg
Organic Cr	161 ± 47 mg/kg	Not Analyzed	58 ± 34 mg/kg
As	36 ± 27 mg/kg	117 ± 22 mg/kg	30 ± 5 mg/kg
Hg	1.6 ± 0.5 mg/kg	Not Analyzed	2.0 ± 0.4 mg/kg

* Rediske et al. (1998)

With the exception of organic chromium, pre- and post-remediation concentrations (1996 and 2004) were similar. Organic chromium concentrations decreased by a factor of 3. This reduction was consistent with the removal of tannery wastes as elevated organic chromium concentrations were previously linked to sediments with purple coloration and/or the presence of hide fragments (Rediske et al. 2004). A two sample independent t-test for equality of means as conducted on the 1996 and 2004 data and there was no significant difference between the two data sets ($p > 0.05$). The 2004 results for Cr and As were significantly lower than the DLZ (2003) data ($p < 0.01$). While differences in sampling locations may account for some of the dissimilarity, it is possible that sediments with lower contaminant concentrations are currently being deposited.

Conductivity, hardness, alkalinity, ammonia, and pH were determined on the culture water at the beginning and on the tenth day of each test (Appendix C: Tables C-1, C-3). With the exception of ammonia in most of the sediments, all water quality parameters remained relatively constant (< 50% variation from start to end of test). Variations of greater than 50%, from initial to final measurements for both test species were observed for ammonia. Based on the initial pH values (all < 8.00) and the fact that the overlying water was exchanged prior to adding the organisms, toxicity related to unionized ammonia was not anticipated to be a factor in these experiments. Temperature and dissolved oxygen measurements were recorded daily throughout the duration of the tests (Appendix C: Tables C-2, C-4). Very little variation was noted with respect to temperature.

4.2 Solid Phase Toxicity Tests

Sediment samples were passed through a 2.8 mm sieve to remove coarse detritus prior to their use in the solid phase toxicity assays. Mortality and growth endpoints were used to assess the toxicity of the sediments. Shapiro Wilk's Test for normality was performed on the variables of average amphipod weight, average chironomid weight, amphipod survival, and chironomid survival. The results from this test suggest that all the variables are non-normal in distribution ($\alpha = 0.05$). This problem with normality was not resolvable with a transformation. Due to the condition of non-normality and since there was equal replication between treatments ($n = 8$), Steel's Many-One Rank Test was chosen as the multiple comparison technique (EPA 2000). Sediment from TB-1 was used as the site control for statistical analyses. A restriction in the allowable number of replicates prevented the use of ToxStat to perform the statistical analysis on mortality and growth endpoints. The rank sums for Steel's Many-One Rank Test were computed manually using both Microsoft Excel and SPSS version 12.0. A published table of critical values for Steel's test could not be found with $k > 9$. There were 19 sites in addition to the control (k=19). The test statistic used to determine significance ($t = 42$) was calculated manually using the formulae (Steel 1959) and the appropriate Dunnett's critical value (Kuehl 1999). Data from the reference control (CC-1) was included in the statistical analyses only if was significantly different from the experimental control (TB-1).

Hyalella azteca

Test criteria for temperature (23 $\pm$ 1°C), dissolved oxygen (> 2.5 ppm), and survival in the control (>80%) were met. Survival data for *Hyalella azteca* are presented in Table 4.2.1. Un-transformed survival data were evaluated for normality with Shapiro Wilk's Test at $\alpha = 0.05$.

TABLE 4.2.1. SUMMARY OF *HYALELLA AZTECA* SURVIVAL DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Number of Organisms	Replicate								Survival	
		A	B	C	D	E	F	G	H	Mean	Std Dev
CC-1 Negative Control	Initial	10	10	10	10	10	10	10	10		
	Final	9	8	9	9	9	9	10	10	9.125	0.6409
12836	Initial	10	10	10	10	10	10	10	10		
TB-1 Control	Final	9	8	9	9	9	10	10	10	9.250	0.7071
12837	Initial	10	10	10	10	10	10	10	10		
TB-2	Final	9	9	10	8	10	8	7	6	8.375	1.4079
12838	Initial	10	10	10	10	10	10	10	10		
TB-3	Final	8	10	7	10	10	10	8	9	9.000	1.1952
12839	Initial	10	10	10	10	10	10	10	10		
TB-4	Final	10	9	9	10	9	10	9	9	9.375	0.5175
12840	Initial	10	10	10	10	10	10	10	10		
TB-5	Final	8	9	7	8	7	8	8	7	7.750	0.7071
12841	Initial	10	10	10	10	10	10	10	10		
TB-6	Final	10	10	10	8	10	9	9	7	9.125	1.1260
12842	Initial	10	10	10	10	10	10	10	10		
TB-7	Final	10	8	10	10	10	10	10	9	9.625	0.7440
12843	Initial	10	10	10	10	10	10	10	10		
TB-8	Final	7	8	9	10	9	9	9	9	8.750	0.8864
12844	Initial	10	10	10	10	10	10	10	10		
TB-9	Final	9	8	9	9	9	8	8	9	8.625	0.5175
12845	Initial	10	10	10	10	10	10	10	10		
TB-10	Final	9	8	9	10	9	10	10	9	9.250	0.7071
12846	Initial	10	10	10	10	10	10	10	10		
TB-11	Final	8	8	10	9	9	8	7	10	8.625	1.0607
12847	Initial	10	10	10	10	10	10	10	10		
TB-12	Final	9	9	10	9	4	10	9	7	8.375	1.9955
12848	Initial	10	10	10	10	10	10	10	10		
TB-13	Final	10	7	10	9	11	9	5	10	8.875	1.9594
12849	Initial	10	10	10	10	10	10	10	10		
TB-14	Final	8	9	10	8	6	9	9	9	8.500	1.1952
12850	Initial	10	10	10	10	10	10	10	10		
TB-15	Final	9	8	10	9	9	8	9	7	8.625	0.9161

TABLE 4.2.1 (CONT.). SUMMARY OF *HYALELLA AZTECA* SURVIVAL DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Number of Organisms	Replicate								Survival	
		A	B	C	D	E	F	G	H	Mean	Std Dev
12851	Initial	10	10	10	10	10	10	10	10		
TB-16	Final	9	10	9	10	8	9	8	8	8.875	0.8345
12852	Initial	10	10	10	10	10	10	10	10		
TB-17	Final	10	9	8	8	10	10	8	10	9.125	0.9910
12853	Initial	10	10	10	10	10	10	10	10		
TB-18	Final	7	10	10	9	10	9	9	10	9.250	1.0351
12854	Initial	10	10	10	10	10	10	10	10		
TB-19	Final	9	9	9	9	9	10	10	9	9.250	0.4629
12855	Initial	10	10	10	10	10	10	10	10		
TB-20	Final	8	10	10	9	9	9	10	8	9.125	0.8345
12855 d	Initial	10	10	10	10	10	10	10	10		
TB-20	Final	9	10	8	8	8	8	8	10	8.625	0.9161

The data were found to be inconsistent with a normal distribution. Steel's Many-One Rank Test (Table 4.2.2) showed statistically significant toxicity for site TB-5 (α=0.05). Amphipod survival for this location was 78%. Although this result is statistically significant, amphipod survival at TB-2 is only 2% less that the level considered acceptable for the control (78% at TB-2 vs. 80% requirement for the control) as defined in the method (EPA 2000). Mean survival in the site control (TB-1) and reference (negative) control (CC-1) were 91% and 93%, respectively.

Growth data for *Hyalella azteca* are presented in Table 4.2.3. Initial mean dry weight for 50 organisms was 0.030 mg prior to test initiation. Amphipods in all treatments exhibited measurable growth indicating a successful test (EPA 2000). Un-transformed growth data were evaluated for normality with Shapiro Wilk's Test at $\alpha = 0.05$. The data were found to be inconsistent with a normal distribution. Steel's Many-One Rank Test (Table 4.2.4) showed statistically significantly lower amphipod growth for all the Tannery Bay sites (α=0.05) compared to the control location (TB-1). The average amphipod weights at all Tannery Bay sites were 0.24 mg or less, whereas the average amphipod weight at the control site was 0.33 mg. Mean amphipod growth in the reference location was approximately 50% lower (0.18 mg) than TB-1, indicating a significant difference between the two sediments. The physical/chemical composition of sediment at TB-1 may be more conducive to amphipod growth than the reference material. Because of this potential bias, Steel's Many-One Rank Test was performed on the amphipod growth data with the reference sediment (CC-1) used as the control. The results of this analysis are presented in Table 4.3.5. Statistically significant reduction in amphipod growth was noted for 8 of the 19 Tannery Bay locations using the reference sediment as the control. Locations with statistically significant reductions in growth were TB-8, TB-9, TB-12, TB-13, TB-16, TB-17, TB-18, and TB-20.

TABLE 4.2.2. SUMMARY OF STEEL'S MANY-ONE RANK TEST ANALYSIS OF *HYALELLA AZTECA* SURVIVAL DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

***Hyalella azteca* Survival– Results from Steel's Many-One Rank Test**			
Site	**Rank Sum - Control**	**Rank Sum – Treatment**	**Sig. at 0.05 alpha**
TB-2	80	56	
TB-3	70	66	
TB-4	65.5	70.5	
TB-5	95	41	*
TB-6	67.5	68.5	
TB-7	57.5	78.5	
TB-8	78	58	
TB-9	83.5	52.5	
TB-10	68	68	
TB-11	79.5	56.5	
TB-12	75	61	
TB-13	68	68	
TB-14	80.5	55.5	
TB-15	80.5	55.5	
TB-16	76.5	59.5	
TB-17	69.5	66.5	
TB-18	65	71	
TB-19	69	67	
TB-20	70.5	65.5	

TABLE 4.2.3. SUMMARY OF *HYALELLA AZTECA* GROWTH DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Rep	# Survivors	Mean wt (mg) per survivor	Sample Mean	Sample Std Dev
12836	a	9	0.3333		
TB-1	b	8	0.2750		
	c	9	0.3889		
	d	9	0.3667	0.332	0.0373
	e	9	0.3556		
	f	10	0.3100		
	g	10	0.3000		
	h	10	0.3300		
12837	a	9	0.2222		
TB-2	b	9	0.2222		
	c	10	0.2100		
	d	8	0.2250	0.221	0.0317
	e	10	0.1700		
	f	8	0.2125		
	g	7	0.2857		
	h	6	0.2167		
12838	a	8	0.1500		
TB-3	b	10	0.1500		
	c	7	0.2571		
	d	10	0.1300	0.150	0.0500
	e	10	0.1400		
	f	10	0.1700		
	g	8	0.1125		
	h	9	0.0889		
12839	a	10	0.1800		
TB-4	b	9	0.2000		
	c	9	0.1778		
	d	10	0.1600	0.141	0.0646
	e	9	0.1778		
	f	10	0.0100		
	g	9	0.0778		
	h	9	0.1444		
12840	a	8	0.1625		
TB-5	b	9	0.2556		
	c	7	0.2714		
	d	8	0.2375	0.236	0.0523
	e	7	0.3000		
	f	8	0.2500		
	g	8	0.1500		
	h	7	0.2571		
12841	a	10	0.2500		
TB-6	b	10	0.3300		
	c	10	0.2500		
	d	8	0.1375	0.235	0.0567
	e	10	0.2000		
	f	9	0.2667		
	g	9	0.2000		
	h	7	0.2429		
12842	a	10	0.2000		
TB-7	b	8	0.1250		
	c	10	0.2100		
	d	10	0.2500	0.218	0.0418
	e	10	0.2400		
	f	10	0.2300		
	g	10	0.2300		
	h	9	0.2556		
12843	a	7	0.0857		
TB-8	b	8	0.1500		
	c	9	0.1333		
	d	10	0.1200	0.104	0.0346
	e	9	0.0889		
	f	9	0.1333		
	g	9	0.0667		
	h	9	0.0556		

Sample ID	Rep	# Survivors	lean wt (mg per survivor	Sample Mean	Sample Std Dev
12844	a	9	0.1444		
TB-9	b	8	0.1250		
	c	9	0.1111		
	d	9	0.0889	0.111	0.0277
	e	9	0.0889		
	f	8	0.0875		
	g	8	0.0875		
	h	9	0.1556		
12845	a	9	0.1222		
TB-10	b	8	0.1250		
	c	9	0.1667		
	d	10	0.1800	0.144	0.0237
	e	9	0.1667		
	f	10	0.1300		
	g	10	0.1200		
	h	9	0.1444		
12846	a	8	0.2500		
TB-11	b	8	0.1125		
	c	10	0.1100		
	d	9	0.1556	0.147	0.0528
	e	9	0.1333		
	f	8	0.1000		
	g	7	0.1143		
	h	10	0.2000		
12847	a	9	0.1667		
TB-12	b	9	0.0333		
	c	10	0.1100		
	d	9	0.0667	0.087	0.0496
	e	4	0.0250		
	f	10	0.1400		
	g	9	0.0667		
	h	7	0.0857		
12848	a	10	0.0900		
TB-13	b	7	0.1714		
	c	10	0.0900		
	d	9	0.2222	0.125	0.0518
	e	11	0.0909		
	f	9	0.1556		
	g	5	0.0800		
	h	10	0.1000		
12849	a	8	0.0875		
TB-14	b	9	0.0778		
	c	10	0.1200		
	d	8	0.1250	0.109	0.0236
	e	6	0.1500		
	f	9	0.1111		
	g	9	0.0889		
	h	9	0.1111		
12850	a	9	0.2667		
TB-15	b	8	0.1125		
	c	10	0.0800		
	d	9	0.1444	0.121	0.0627
	e	9	0.0778		
	f	8	0.1000		
	g	9	0.1000		
	h	7	0.0857		
12851	a	9	0.1333		
TB-16	b	10	0.0800		
	c	9	0.0889		
	d	10	0.0700	0.109	0.0384
	e	8	0.0875		
	f	9	0.1000		
	g	8	0.1875		
	h	8	0.1250		

TABLE 4.2.3 (CONT.). SUMMARY OF *HYALELLA AZTECA* GROWTH DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

12852	a	10	0.1900		
TB-17	b	9	0.1111		
	c	8	0.1125		
	d	8	0.0875	0.118	0.0421
	e	10	0.1500		
	f	10	0.0700		
	g	8	0.0750		
	h	10	0.1500		
12853	a	7	0.0429		
TB-18	b	10	0.1000		
	c	10	0.1000		
	d	9	0.0778	0.086	0.0252
	e	10	0.1300		
	f	9	0.0778		
	g	9	0.0778		
	h	10	0.0800		
12854	a	9	0.2000		
TB-19	b	9	0.1333		
	c	9	0.1222		
	d	9	0.0667	0.127	0.0397
	e	9	0.0889		
	f	10	0.1300		
	g	10	0.1500		
	h	9	0.1222		

12855	a	8	0.2000		
TB-20	b	10	0.0700		
	c	10	0.0900		
	d	9	0.0778	0.090	0.0495
	e	9	0.1111		
	f	9	0.0556		
	g	10	0.0800		
	h	8	0.0375		
12855 d	a	9	0.0333		
TB-20	b	10	0.1100		
	c	8	0.1625		
	d	8	0.0625	0.097	0.0418
	e	8	0.1250		
	f	8	0.0625		
	g	8	0.1000		
	h	10	0.1200		
CC-1	a	9	0.2000		
Negative	b	8	0.1250		
Control	c	9	0.2100		
	d	9	0.1655	0.183	0.0284
	e	9	0.1877		
	f	10	0.1733		
	g	10	0.2100		
	h	10	0.1944		

TABLE 4.2.4. SUMMARY OF STEEL'S MANY-ONE RANK TEST ANALYSIS OF *HYALELLA AZTECA* GROWTH DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

***Hyalella azteca* Average Weight – Results from Steel's Many-One Rank Test**			
Site	**Rank Sum - Control**	**Rank Sum – Treatment**	**Sig. at 0.05 alpha**
TB-2	99	37	*
TB-3	100	36	*
TB-4	100	36	*
TB-5	99	37	*
TB-6	97	39	*
TB-7	100	36	*
TB-8	100	36	*
TB-9	100	36	*
TB-10	100	36	*
TB-11	100	36	*
TB-12	100	36	*
TB-13	100	36	*
TB-14	100	36	*
TB-15	100	36	*
TB-16	100	36	*
TB-17	100	36	*
TB-18	100	36	*
TB-19	100	36	*
TB-20	100	36	*

TABLE 4.2.5. SUMMARY OF STEEL'S MANY-ONE RANK TEST ANALYSIS OF *HYALELLA AZTECA* GROWTH DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS USING THE REFERENCE SEDIMENT SITE (CC-1) AS THE CONTROL (2004).

***Hyalella azteca* Average Weight – Results from Steel's Many-One Rank Test**			
Site	**Rank Sum – TB-19**	**Rank Sum – Treatment**	**Sig. at 0.05 alpha**
TB-2	50	86	
TB-3	86	50	
TB-4	83	53	
TB-5	43.5	92.5	
TB-6	48.5	87.5	
TB-7	47.5	88.5	
TB-8	97	39	*
TB-9	97.5	38.5	*
TB-10	90.5	45.5	
TB-11	84.5	51.5	
TB-12	97	39	*
TB-13	89	47	
TB-14	98.5	37.5	*
TB-15	91	45	
TB-16	95.5	40.5	*
TB-17	94	42	*
TB-18	99	37	*
TB-19	91	45	

Chironomus tentans

Test criteria for temperature (23 $\pm$ 1°C), dissolved oxygen (> 2.5 ppm), growth (0.48 mg/individual), and survival in the control (>70%) were met. Survival data for *Chironomus tentans* are presented in Table 4.2.5. Un-transformed survival data were evaluated for normality with Shapiro Wilk's Test at $\alpha = 0.05$. The data were found to be inconsistent with a normal distribution. Steel's Many-One Rank Test (Table 4.2.6) showed statistically significant toxicity for site TB-5 (α=0.05). Chironomid survival for this location was 38%. Mean survival in the site control (TB-1) and reference (negative) control (CC-1) were 83% and 81%, respectively.

Growth data for *Chironomus tentans* are presented in Table 3.2.7 as ash free dry weights. Un-transformed growth data were evaluated for normality with Shapiro Wilk's Test at $\alpha = 0.05$. The data were found to be inconsistent with a normal distribution. Steel's Many-One Rank Test (Table 3.2.8) showed statistically significantly lower chironomid weight for site TB-14 (α=0.05). The average chironomid ash free dry weight at this site was 0.54 mg, whereas the average chironomid ash free dry weight at the control site was 0.74 mg. Mean ash free dry weight in the reference sediment (CC-1) was 0.79 mg, indicating similar response.

TABLE 4.2.6. SUMMARY OF *CHIRONOMUS TENTANS* SURVIVAL DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Number of Organisms	Replicate								Survival	
		A	B	C	D	E	F	G	H	Mean	Std Dev
12836	Initial	10	10	10	10	10	10	10	10		
TB-1 Control	Final	7	8	8	9	9	8	9	8	8.250	0.7071
CC-1 Negative Control	Initial	10	10	10	10	10	10	10	10		
	Final	7	8	9	7	9	9	8	8	8.125	0.8345
12837	Initial	10	10	10	10	10	10	10	10		
TB-2	Final	6	6	7	10	8	10	10	7	8.000	1.7728
12838	Initial	10	10	10	10	10	10	10	10		
TB-3	Final	7	7	8	9	10	8	10	9	8.500	1.1952
12839	Initial	10	10	10	10	10	10	10	10		
TB-4	Final	6	9	8	7	10	9	7	10	8.250	1.4880
12840	Initial	10	10	10	10	10	10	10	10		
TB-5	Final	3	3	5	3	4	5	3	4	3.750	0.8864
12841	Initial	10	10	10	10	10	10	10	10		
TB-6	Final	8	5	3	9	6	5	5	5	5.750	1.9086
12842	Initial	10	10	10	10	10	10	10	10		
TB-7	Final	4	4	3	6	8	4	5	9	5.375	2.1339
12843	Initial	10	10	10	10	10	10	10	10		
TB-8	Final	5	3	7	4	3	8	8	5	5.375	2.0659
12844	Initial	10	10	10	10	10	10	10	10		
TB-9	Final	7	10	6	10	6	10	10	8	8.375	1.8468
12845	Initial	10	10	10	10	10	10	10	10		
TB-10	Final	2	8	9	8	9	8	9	9	7.750	2.3755
12846	Initial	10	10	10	10	10	10	10	10		
TB-11	Final	7	9	9	8	6	8	7	8	7.750	1.0351
12847	Initial	10	10	10	10	10	10	10	10		
TB-12	Final	8	11	8	8	6	9	6	5	7.625	1.9226
12848	Initial	10	10	10	10	10	10	10	10		
TB-13	Final	3	9	8	9	8	8	10	9	8.000	2.1381
12849	Initial	10	10	10	10	10	10	10	10		
TB-14	Final	11	10	10	8	9	6	8	7	8.625	1.6850
12850	Initial	10	10	10	10	10	10	10	10		
TB-15	Final	9	8	12	7	5	9	8	4	7.750	2.4928
12851	Initial	10	10	10	10	10	10	10	10		
TB-16	Final	9	2	6	4	7	10	5	9	6.500	2.7775
12852	Initial	10	10	10	10	10	10	10	10		
TB-17	Final	7	5	8	6	7	8	7	3	6.375	1.6850
12853	Initial	10	10	10	10	10	10	10	10		
TB-18	Final	5	5	7	8	8	3	8	9	6.625	2.0659
12854	Initial	10	10	10	10	10	10	10	10		
TB-19	Final	7	8	7	9	8	5	5	7	7.000	1.4142
12855	Initial	10	10	10	10	10	10	10	10		
TB-20	Final	10	7	6	5	9	5	9	6	7.125	1.9594
12855 d	Initial	10	10	10	10	10	10	10	10		
TB-20	Final	6	8	8	9	7	7	1	6	6.500	2.4495

TABLE 4.2.7. SUMMARY OF STEEL'S MANY-ONE RANK TEST ANALYSIS OF *CHIRONOMUS TENTANS* SURVIVAL DATA OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

***Chironomus tentans* Survival – Results from Steel's Many-One Rank Test**			
Site	**Rank Sum - Control**	**Rank Sum – Treatment**	**Sig. at 0.05 alpha**
TB-2	72	64	
TB-3	64	72	
TB-4	67	69	
TB-5	100	36	*
TB-6	90.5	45.5	
TB-7	90.5	45.5	
TB-8	93.5	42.5	
TB-9	64.5	71.5	
TB-10	65	71	
TB-11	77	59	
TB-12	76.5	59.5	
TB-13	63.5	72.5	
TB-14	63	73	
TB-15	72.5	63.5	
TB-16	78.5	57.5	
TB-17	92.5	43.5	
TB-18	84	52	
TB-19	86	50	
TB-20	78.5	57.5	

TABLE 4.2.8. SUMMARY OF *CHIRONOMUS TENTANS* GROWTH DATA (ASH FREE DRY WT) OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Rep	# Survivors	Mean wt (mg) per survivor	Sample Mean	Sample Std Dev
12836	a	7	1.0286	0.738	0.1228
TB-1	b	8	0.6750		
	c	8	0.7375		
	d	9	0.6556		
	e	9	0.7000		
	f	8	0.7250		
	g	9	0.6444		
	h	8	0.7375		
12837	a	6	0.6167	0.569	0.1445
TB-2	b	6	0.8167		
	c	7	0.5429		
	d	10	0.5000		
	e	8	0.4250		
	f	10	0.4000		
	g	10	0.5200		
	h	7	0.7286		
12838	a	7	0.5286	0.538	0.1178
TB-3	b	7	0.4857		
	c	8	0.3875		
	d	9	0.6000		
	e	10	0.4700		
	f	8	0.4750		
	g	10	0.5800		
	h	9	0.7778		

Sample ID	Rep	# Survivors	Mean wt (mg) per survivor	Sample Mean	Sample Std Dev
12839	a	6	0.6167	0.639	0.1493
TB-4	b	9	0.9000		
	c	8	0.7000		
	d	7	0.7714		
	e	10	0.6000		
	f	9	0.4444		
	g	7	0.6000		
	h	10	0.4800		
12840	a	3	0.4000	0.495	0.1026
TB-5	b	3	0.4333		
	c	5	0.4800		
	d	3	0.5667		
	e	4	0.3250		
	f	5	0.5400		
	g	3	0.6000		
	h	4	0.6113		
12841	a	8	0.6875	0.853	0.2316
TB-6	b	5	0.6800		
	c	3	1.0333		
	d	9	0.4889		
	e	6	0.7333		
	f	5	1.0600		
	g	5	1.0400		
	h	5	1.1000		

TABLE 4.2.8 (CONT.). SUMMARY OF *CHIRONOMUS TENTANS* GROWTH DATA (ASH FREE DRY WT) OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

Sample ID	Rep	# Survivors	Mean wt (mg) per survivor	Sample Mean	Sample Std Dev
12842	a	4	0.9000	0.988	0.3419
TB-7	b	4	1.1000		
	c	3	0.6000		
	d	6	0.9667		
	e	8	0.5125		
	f	4	1.2000		
	g	5	1.6000		
	h	9	1.0222		
12843	a	5	1.2600	0.997	0.3727
TB-8	b	3	1.5000		
	c	7	0.6000		
	d	4	1.1500		
	e	3	1.4000		
	f	8	0.5875		
	g	8	0.8000		
	h	5	0.6800		
12844	a	7	0.9571	0.861	0.1369
TB-9	b	10	0.7400		
	c	6	1.0833		
	d	10	0.8600		
	e	6	0.9500		
	f	10	0.6500		
	g	10	0.8600		
	h	8	0.7875		
12845	a	2	1.6500	0.976	0.3151
TB-10	b	8	0.6625		
	c	9	0.8889		
	d	8	0.7500		
	e	9	0.8222		
	f	8	0.9875		
	g	9	0.8556		
	h	9	1.1889		
12846	a	7	0.8143	0.728	0.0854
TB-11	b	9	0.7333		
	c	9	0.6556		
	d	8	0.6875		
	e	6	0.7500		
	f	8	0.5750		
	g	7	0.7857		
	h	8	0.8250		
12847	a	8	0.5375	0.768	0.3084
TB-12	b	11	0.4727		
	c	8	0.7375		
	d	8	0.7500		
	e	6	0.9500		
	f	9	0.6222		
	g	6	0.6333		
	h	5	1.4400		
12848	a	3	1.9667	1.087	0.3826
TB-13	b	9	0.8000		
	c	8	0.9250		
	d	9	0.7333		
	e	8	0.9625		
	f	8	1.0750		
	g	10	1.1100		
	h	9	1.1222		
12849	a	11	0.5455	0.538	0.1357
TB-14	b	10	0.5800		
	c	10	0.4300		
	d	8	0.6000		
	e	9	0.2889		
	f	6	0.4833		
	g	8	0.6625		
	h	7	0.7143		

Sample ID	Rep	# Survivors	Mean wt (mg) per survivor	Sample Mean	Sample Std Dev
12850	a	9	0.7222	0.728	0.1926
TB-15	b	8	0.7500		
	c	12	0.4250		
	d	7	0.6000		
	e	5	0.8000		
	f	9	0.5778		
	g	8	1.0000		
	h	4	0.9500		
12851	a	9	0.5667	0.810	0.2362
TB-16	b	2	1.2500		
	c	6	0.7167		
	d	4	1.0500		
	e	7	0.6143		
	f	10	0.6300		
	g	5	0.8200		
	h	9	0.8333		
12852	a	7	1.4571	1.220	0.3215
TB-17	b	5	1.2800		
	c	8	1.3000		
	d	6	0.7833		
	e	7	1.4714		
	f	8	0.8750		
	g	7	0.9286		
	h	3	1.6667		
12853	a	5	0.8800	0.816	0.1471
TB-18	b	5	0.7800		
	c	7	0.6857		
	d	8	0.7000		
	e	8	0.9250		
	f	3	1.1000		
	g	8	0.7875		
	h	9	0.6667		
12854	a	7	1.1571	0.960	0.1789
TB-19	b	8	1.1750		
	c	7	0.8714		
	d	9	0.9333		
	e	8	0.7750		
	f	5	0.7400		
	g	5	1.1600		
	h	7	0.8714		
12855	a	10	1.0600	1.064	0.1376
TB-20	b	7	1.2857		
	c	6	0.9000		
	d	5	1.0000		
	e	9	1.0556		
	f	5	1.1200		
	g	9	0.8889		
	h	6	1.2000		
12855 d	a	6	1.4833	1.203	0.1503
TB-20	b	8	1.2125		
	c	8	1.3000		
	d	9	1.1000		
	e	7	1.0857		
	f	7	1.0429		
	g	1	1.3000		
	h	6	1.1000		
	a	7	0.9936	0.792	0.1328
CC-1	b	8	0.7250		
Negative	c	9	0.8475		
Control	d	7	0.6856		
	e	9	0.7300		
	f	9	0.8240		
	g	8	0.9344		
	h	8	0.5950		

TABLE 4.2.9. SUMMARY OF STEEL'S MANY-ONE RANK TEST ANALYSIS OF *CHIRONOMUS TENTANS* GROWTH DATA (ASH FREE DRY WT) OBTAINED DURING THE 10-DAY TOXICITY TEST WITH TANNERY BAY SEDIMENTS (2004).

***Chironomus tentans* Average Weight – Results from Steel's Many-One Rank Test**			
Site	**Rank Sum - Control**	**Rank Sum – Treatment**	**Sig. at 0.05 alpha**
TB-2	88	48	
TB-3	93	43	
TB-4	82.5	53.5	
TB-5	100	36	*
TB-6	57	79	
TB-7	55	81	
TB-8	58	78	
TB-9	49	87	
TB-10	47	89	
TB-11	62.5	73.5	
TB-12	72	64	
TB-13	42	94	
TB-14	94	42	*
TB-15	68	68	
TB-16	66	70	
TB-17	39	97	
TB-18	55.5	80.5	
TB-19	41	95	
TB-20	39	97	

5.0 Discussion

Nineteen sediment samples were collected from Tannery Bay in Muskegon County. Solid phase toxicity tests (10–day chronic) were performed on the sediments using *Hyalella azteca* and *Chironomus tentans*. The following statistically significant toxicity relationships were observed:

Organism	Test Response	Treatment vs. Control	Sites
Hyalella azteca	Survival	78% vs. 83%	TB-5
Hyalella azteca	Growth	0.09 mg- 0.12 mg vs.0.18 mg	TB-8, TB-9, TB-12, TB-13, TB-16, TB-17, TB-18, and TB-20
Chironomus tentans	Survival	38% vs. 83%	TB-5
Chironomus tentans	Growth	0.49 mg and 0.54 mg vs.0.74 mg	TB-5 and TB-14

Prior to the analysis of the toxicity data, it is important to determine if the natural physical/chemical characteristics of Tannery Bay sediments may have influenced the results. Since the sediments were passed through a coarse sieve prior to analysis, the amount of fine organic sediment would be similar for each sample (Table 3.1.). Based on the initial pH values (all < 7.9) and mean temperature (23 ^{0}C), the highest total ammonia observed (8.95 mg/l) in TB-17 would have an unionized ammonia concentration of 0.34 mg/l (3.77%). In consideration of the fact that the overlying water was exchanged prior to adding the organisms, toxicity related to unionized ammonia was not anticipated to be a factor in these experiments. In addition, toxicity from hydrogen sulfide was unlikely due to the maintenance of dissolved oxygen levels in excess of 4 mg/l. Because of matrix similarity in the experiments and the absence of conditions that would indicate toxicity related to ammonia or hydrogen sulfide, the mortality and growth inhibition observed in the Tannery Bay sediments were not the result of these physical and/or chemical factors.

Statistical analyses using Spearman's Rank were performed on the toxicity and sediment chemistry data to determine if significant correlations were present between organism response and contaminant concentration. A summary of the results is presented in Table 5.1. Amphipod

TABLE 5.1. THE RESULTS OF SPEARMAN'S RANK ANALYSES CONDUCTED ON THE TANNERY BAY SEDIMENT SAMPLES (2004).

Spearman's Rank Sig. (2-tailed *p*)	Average *H. azteca* survival	Average *C. tentans* survival	Average *H. azteca* weight grams	Average *C. tentans* weight grams	As mg/kg	Hg mg/kg	Total Cr mg/kg
Average *C. tentans* survival	-0.155 (0.513)						
Average *H. azteca* weight grams	0.111 (0.642)	0.066 (0.784)					
Average *C. tentans* weight grams	0.471* (.036)	-0.476* (0.034)	-0.239 (0.310)				
Arsenic mg/kg	-0.598** (0.005)	-0.307 (0.188)	-0.123 (0.604)	-0.390 (0.089)			
Mercury mg/kg	-0.527* (0.017)	-0.199 (0.400)	-0.065 (0.784)	-0.420 (0.065)	0.926** (0.000)		
Total Chromium mg/kg	-0.197 (0.406)	0.033 (0.891)	-0.241 (0.306)	-0.433 (0.057)	0.610** (0.004)	0.708** (0.000)	
Organic Chromium mg/kg	-0.321 (0.167)	0.080 (0.738)	-0.209 (0.376)	-0.521* (0.018)	0.566** (0.009	0.633** (0.003)	0.798** (0.000)

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

survival was negatively correlated to arsenic ($p < 0.01$) and mercury ($p < 0.05$). Chironomid growth (ash free dry wt) was negatively correlated with organic chromium concentrations ($p < 0.05$). These correlations must be viewed with caution because amphipod survival and chironomid growth rates were significantly different from the control location at only one station. No correlations between contaminant concentrations and amphipod growth were present in the data set. In fact, the stations with the highest levels of arsenic and organic chromium (TB-5 and TB-14, respectively) did not exhibit reduced amphipod growth. The absence of a significant correlation between amphipod growth and metal concentration suggests one or more of the following conditions may be present:

- amphipod growth inhibition was related to a contaminant that was not measured
- the measured contaminants were synergistic with respect to amphipod growth
- growth inhibition of amphipods was related to factors that may influence bioavailability such as pore water concentration and metal speciation
- growth rates in the controls may be higher than sediments from other areas in White Lake similar to Tannery Bay

Although amphipods are opportunistic and feed on a variety of organic material, their preferred food source is coarse particulate organic matter (Cummins et al. 1973; Thorp et al. 1991). Since dredging removed 5 ft - 20 ft of sediment from Tannery Bay, the new lake bottom would contain material that has undergone many years of diagenesis and contain limited new plant detritus. This type of sediment may be less suitable to support amphipod growth than the control location. In a previous investigation involving sediment from Lake Macatawa, a growth value 0.15 mg/amphipod was obtained for the negative control (Rediske 2004). Mean growth for the Tannery Bay stations was 0.14 mg/amphipod. The result for amphipod growth with the TB-1 control location was 0.33 mg/individual while growth with the reference location sediment (CC-1) was 0.18 mg/individual. Aquatic macrophytes along with visible plant detritus were present in the sediments from TB-1 and CC-1. In the toxicity experiments, a suspension of TetraFin was added daily to provide a supplemental food source during the toxicity assays. The difference in growth between the two controls used in this investigation suggests that physical/chemical characteristics can promote growth to a greater extent than TetraFin feeding. A second sediment toxicity evaluation would be required to examine both the quality of the food source and the presence of bioavailable forms of metals in Tannery Bay. Additional control samples from areas that contain limited macrophyte growth also should be included in the experimental design.

6.0 Conclusions

An investigation of solid phase toxicity was conducted in the Tannery Bay area of White Lake, Michigan after a remediation program removed 80,000 cu yds of contaminated sediment in 2002/2003. Acute toxicity tests (10–day chronic) were performed on the sediments using *Hyalella azteca* and *Chironomus tentans* in addition to chemical analyses for heavy metals and physical parameters. The 2004 sediment chemistry results for arsenic and chromium were significantly less than the data collected after remediation in 2003, indicating the deposition of

clean sediment and/or mixing. The 2004 results were similar to data collected in 1996 except for a significant reduction in organic chromium. Sediment chemistry results are summarized below:

	1996	DLZ (2003)	AWRI 2004
Total Chromium	2,108 mg/kg	4,463 mg/kg	2,716 mg/kg
Organic Chromium	161 mg/kg	Not Analyzed	58 mg/kg
Arsenic	36 mg/kg	117 mg/kg	30 mg/kg
Mercury	1.6 mg/kg	Not Analyzed	2.0 mg/kg

* Rediske et al. (1998)

These results suggest that sediment arsenic and chromium concentrations have declined after remediation. Possible explanations include the deposition of clean sediment and mixing. The significant reduction in organic chromium is consistent with the removal of visible tannery waste from the sediment.

The following statistically significant toxicity relationships were observed:

Organism	Test Response	Treatment vs. Control	Sites
Hyalella azteca	Survival	78% vs. 83%	TB-5
Hyalella azteca	Growth	0.18 mg vs. 0.09 mg- 0.12 mg	TB-8, TB-9, TB-12, TB-13, TB-16, TB-17, TB-18, and TB-20
Chironomus tentans	Survival	38% vs. 83%	TB-5
Chironomus tentans	Growth	0.74 mg vs. 0.49 mg and 0.54 mg	TB-5 and TB-14

Amphipod survival was close to the EPA's acceptability guideline for controls (78% for TB-5 vs. 80% guideline for amphipods). Chironomid survival was significantly lower than the acceptability guideline (38% vs. 70% guideline for chironomids). Amphipod survival was negatively correlated with sediment arsenic concentrations ($p < 0.01$). For chironomids, no significant correlations were present in the data for survival while growth was negatively correlated with organic chromium at the 5% level. These correlations must be viewed with caution because only one survival or growth data point was statistically different from the control in each case. Amphipod growth was significantly lower than the White Lake control (TB-1) at all Tannery Bay locations and no significant correlations were present with respect to contaminant concentration. The amphipod growth data also was analyzed using a reference sediment from an uncontaminated site in Muskegon County (Cress Creek, CC-1). Statistically significant amphipod growth reductions were present in 8 of the 19 locations. Stations with the highest arsenic and organic chromium concentrations (TB-5 and TB-14, respectively) did not exhibit reduced growth with respect to the reference sediment. Growth measurements per individual were considerably higher (0.33 mg/amphipod vs. 0.15 mg/amphipod) at TB-1 compared to a control sample from Lake Macatawa used in a previous investigation. The results

of amphipod growth measurements suggest that a low level of sediment toxicity remains in Tannery Bay. Since the site control appears to have a positive bias with respect to increased amphipod weights, the amount of growth inhibition specifically related to contaminants cannot be determined from these experiments. Based on this information, future investigations of sediment toxicity in Tannery Bay should involve the evaluation of additional control locations that reflect recent dredging and the absence of macrophytes.

The results of this investigation show that contaminant concentrations have decreased from 2003 levels and that the high level of toxicity previously associated with Tannery Bay sediments was not present after remediation. Only one location (TB-5) showed statistically significant mortality for amphipods and chironomids. Based on these results, the removal of contaminated sediments from Tannery Bay eliminated the toxicity related to decreased survival from all but one location. While some toxicity with respect to reduction in organism growth appears to remain in Tannery Bay, the amount of inhibition related to contaminants could not be determined due to a positive bias in the site control. Since contaminant concentrations appear to be decreasing and there is a rationale to support the selection of different control locations, a second toxicity investigation should be performed in 2005. These results plus data on the composition of the benthic macroinvertebrate community will provide an indication of the degree to which ecosystem recovery has taken place and determine if any residual areas of toxicity are present.

7.0 References

Bolattino, C. and R. Fox. 1995. White Lake Area of Concern: 1994 sediment assessment. EPA Technical Report. Great Lakes National Program Office, Chicago.

Cummins K.W., R.C. Petersen, F.O. Howard, J.C. Wuycheck, and V.I. Holt. 1973. The utilization of leaf litter by stream detritivores. Ecology, 54, 336–345.

EPA 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates Second Edition. EPA Publication EPA/600/R-99/064.

Kuehl, R.O 1999. Design of Experiments: Statistical Principles of Research Design and Analysis Duxbury Press. Pacific Grove, CA. 610 pp.

Rediske, R., G. Fahnenstiel, P. Meier, T. Nalepa, and C. Schelske, 1998. Preliminary Investigation of the Extent and Effects of Sediment Contamination in White Lake, Michigan. EPA-905-R-98-004.

Rediske, R., M. Chu, D. Uzarski, J. Auch, G. Peaslee, and J. Gabrosek. 2004. Phase II Investigation of Sediment Contamination in White Lake, Michigan. EPA-905-R-04-001.

Rediske, R. 2004. Solid Phase Toxicity Assessment Ryerson Creek Muskegon, Michigan. Report submitted to MDEQ Water Division.

Steel, Robert G. D. 1959. A Multiple Comparison Rank Sum Test: Treatments Versus Control. Biometrics, 15:560-572.

Thorp, J.H., and A.P. Covich. (eds.) 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc. ISBN: 0-12-690645-9. xii, 911pp.

Appendix A.

Chain Of Custody Forms

CHAIN OF CUSTODY

Annis Water Resources Institute Laboratory
Grand Valley State University
740 W. Shoreline Dr.
Muskegon, MI 49441
Richard R. Rediske, Lab Manager
(616) 331-3047

Client Name: MDEQ
Address: Surface Water Quality Division
Phone:
Email:
Project Manager:
Project Location: White Lake- Tannery Bay

Sample Date	Sample Time	Sample ID	AWRI Lab ID#	Analysis Requested: Toxicity	TOC	Grain Size				
06/29/2004	10:00	TB-1	12836	X	X	X				
06/29/2004	10:12	TB-2	12837	X	X	X				
06/29/2004	10:19	TB-3	12838	X	X	X				
06/29/2004	10:24	TB-4	12839	X	X	X				
06/29/2004	10:31	TB-5	12840	X	X	X				
06/29/2004	10:40	TB-6	12841	X	X	X				
06/29/2004	10:47	TB-7	12842	X	X	X				
06/29/2004	11:54	TB-8	12843	X	X	X				
06/29/2004	12:03	TB-9	12844	X	X	X				
06/29/2004	12:08	TB-10	12845	X	X	X				
06/29/2004	12:16	TB-11	12846	X	X	X				
06/29/2004	12:26	TB-12	12847	X	X	X				
06/29/2004	12:36	TB-13	12848	X	X	X				
06/29/2004	12:45	TB-14	12849	X	X	X				
06/29/2004	12:54	TB-15	12850	X	X	X				
06/29/2004	13:05	TB-16	12851	X	X	X				

Sampled By: RRR, rh, MR
Relinquished By: rh
Relinquished By:

Date/Time
06/29/2004 10:00
06/29/2004 15:00

Received By: BTS
Received By:

Remarks

CHAIN OF CUSTODY

Annis Water Resources Institute Laboratory
Grand Valley State University
740 W. Shoreline Dr.
Muskegon, MI 49441
Richard R. Rediske, Lab Manager
(616) 331-3047

Client Name: MDEQ
Address: Surface Water Quality Division
Phone:
Email:
Project Manager:
Project Location: White Lake- Tannery Bay

Sample Date	Sample Time	Sample ID	AWRI Lab ID#	Analysis Requested: Toxicity	TOC	Grain Size				
06/29/2004	13:13	TB-17	12852	X	X	X				
06/29/2004	13:32	TB-18	12853	X	X	X				
06/29/2004	13:45	TB-19	12854	X	X	X				
06/29/2004	13:52	TB-20	12855	X	X	X				
06/29/2004	13:52	TB-20 dup	12856	X	X	X				

Sampled By: RRR, rh, MR
Relinquished By: rh
Relinquished By:

Date/Time
06/29/2004 10:00
06/29/2004 15:00

Received By: BTS
Received By: Brian T. Bell

Remarks

Appendix B.

Analytical Results for Tannery Bay Sediments

TABLE B-1. RESULTS OF CHEMICAL ANALYSES PERFORMED ON TANNERY BAY SEDIMENTS (2004).

Station	As mg/kg	Hg mg/kg	Cd mg/kg	Total Cr mg/kg	Organic Cr mg/kg	Cu mg/kg	Pb mg/kg	Ni mg/kg	Zn mg/kg
TB-1	4.6	0.11	<0.5	26	4	23	20	12	83
TB-2	18.8	1.00	<0.5	1900	144	20	48	19	59
TB-3	29	2.30	<0.5	4000	360	36	95	35	110
TB-4	7.5	0.79	<0.5	5200	261	31	93	67	140
TB-5	83	3.00	<0.5	1700	462	24	88	10	83
TB-6	41	4.30	<0.5	2600	78	35	91	19	120
TB-7	10	0.61	<0.5	1800	188	32	56	32	110
TB-8	59	5.30	<0.5	4400	197	32	100	14	110
TB-9	11	0.43	<0.5	1500	608	29	55	21	97
TB-10	7.9	0.38	<0.5	970	159	30	40	20	97
TB-11	51	3.50	<0.5	5900	200	32	100	15	110
TB-12	24	1.80	<0.5	3200	232	39	80	14	120
TB-13	13	0.86	<0.5	1500	261	32	47	19	91
TB-14	31	2.60	<0.5	3400	308	33	89	20	120
TB-15	62	6.10	<0.5	3000	284	33	120	14	140
TB-16	67	2.00	<0.5	4000	420	26	68	14	97
TB-17	12	0.75	<0.5	1300	584	31	48	20	87
TB-18	29	1.80	<0.5	4500	396	34	97	21	120
TB-19	4.7	0.23	<0.5	350	239	33	31	20	95
TB-20	4.9	0.21	<0.5	390	94	29	28	17	77

Appendix C

Summary Of Chemical Measurements For The Toxicity Test With Sediments From Tannery Bay (2004)

Test No:
Toxicant: Tannery Bay Sediment
Organism: *Hyalella azteca*

Analyst: RH, MR, MB, KR
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-1. Summary of Initial and Final Chemical Measurements for *Hyalella azteca* in Tannery Bay Sediments

Sample	Parameter	Day		Difference
		0	10	(%)
12836 TB-1	pH	7.7	7.3	6
	Conductivity (umhos/cm)	445.4	324.3	27
	Alkalinity (mg/l CaCO3)	148	84	43
	Hardness (mg/l CaCO3)	138	81	41
	Ammonia (mg/l NH3)	4.37	0.13	97
12837 TB-2	pH	7.7	7.5	3
	Conductivity (umhos/cm)	486.6	339.4	30
	Alkalinity (mg/l CaCO3)	134	92	31
	Hardness (mg/l CaCO3)	151	89	41
	Ammonia (mg/l NH3)	2.83	0.17	94
12838 TB-3	pH	7.9	6.7	15
	Conductivity (umhos/cm)	521.0	372.7	28
	Alkalinity (mg/l CaCO3)	162	64	60
	Hardness (mg/l CaCO3)	168	101	40
	Ammonia (mg/l NH3)	3.47	0.11	97
12839 TB-4	pH	7.8	7.3	6
	Conductivity (umhos/cm)	480.2	343.2	29
	Alkalinity (mg/l CaCO3)	164	84	49
	Hardness (mg/l CaCO3)	163	85	48
	Ammonia (mg/l NH3)	3.70	0.05	99
12840 TB-5	pH	8.2	7.8	4
	Conductivity (umhos/cm)	640.0	397.2	38
	Alkalinity (mg/l CaCO3)	228	129	43
	Hardness (mg/l CaCO3)	246	117	52
	Ammonia (mg/l NH3)	3.90	0.29	93
12841 TB-6	pH	7.9	7.0	11
	Conductivity (umhos/cm)	496.7	344.8	31
	Alkalinity (mg/l CaCO3)	156	72	54
	Hardness (mg/l CaCO3)	172	89	48
	Ammonia (mg/l NH3)	2.58	0.06	98
12842 TB-7	pH	7.6	8.1	7
	Conductivity (umhos/cm)	487.0	366.7	25
	Alkalinity (mg/l CaCO3)	134	111	17
	Hardness (mg/l CaCO3)	163	97	40
	Ammonia (mg/l NH3)	3.86	0.31	92
12843 TB-8	pH	8.0	8.2	3
	Conductivity (umhos/cm)	558.0	388.6	30
	Alkalinity (mg/l CaCO3)	183	105	43
	Hardness (mg/l CaCO3)	211	93	56
	Ammonia (mg/l NH3)	3.60	0.02	99

Test No:
Toxicant: Tannery Bay Sediment
Organism: *Hyalella azteca*

Analyst: RH, MR, MB, KR
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-1 (Cont). Summary of Initial and Final Chemical Measurements for *Hyalella azteca* in Tannery Bay Sediments

Sample	Parameter	Day		Difference (%)
		0	10	
12844 TB-9	pH	7.8	8.1	4
	Conductivity (umhos/cm)	565.0	351	38
	Alkalinity (mg/l CaCO3)	148	105	29
	Hardness (mg/l CaCO3)	185	97	48
	Ammonia (mg/l NH3)	6.30	0.05	99
12845 TB-10	pH	7.8	8.0	3
	Conductivity (umhos/cm)	506.0	336.4	34
	Alkalinity (mg/l CaCO3)	142	97	32
	Hardness (mg/l CaCO3)	163	85	48
	Ammonia (mg/l NH3)	3.94	0.03	99
12846 TB-11	pH	8.2	8.1	2
	Conductivity (umhos/cm)	617.0	362	41
	Alkalinity (mg/l CaCO3)	212	111	48
	Hardness (mg/l CaCO3)	237	101	57
	Ammonia (mg/l NH3)	5.40	0.08	99
12847 TB-12	pH	7.6	8.1	7
	Conductivity (umhos/cm)	510.0	339.1	34
	Alkalinity (mg/l CaCO3)	140	99	29
	Hardness (mg/l CaCO3)	172	89	48
	Ammonia (mg/l NH3)	3.68	0.10	97
12848 TB-13	pH	7.8	8.1	4
	Conductivity (umhos/cm)	545.0	356.1	35
	Alkalinity (mg/l CaCO3)	154	109	29
	Hardness (mg/l CaCO3)	178	94	47
	Ammonia (mg/l NH3)	5.10	0.17	97
12852 TB-17	pH	7.8	8.2	5
	Conductivity (umhos/cm)	484.2	340.9	30
	Alkalinity (mg/l CaCO3)	140	103	26
	Hardness (mg/l CaCO3)	168	89	47
	Ammonia (mg/l NH3)	4.96	0.05	99
12853 TB-18	pH	8.0	8.2	3
	Conductivity (umhos/cm)	534.0	345.1	35
	Alkalinity (mg/l CaCO3)	146	103	29
	Hardness (mg/l CaCO3)	168	93	45
	Ammonia (mg/l NH3)	3.87	0.04	99
12854 TB-19	pH	8.1	7.9	2
	Conductivity (umhos/cm)	525.0	359.5	32
	Alkalinity (mg/l CaCO3)	138	96	30
	Hardness (mg/l CaCO3)	165	85	48
	Ammonia (mg/l NH3)	4.09	0.07	98
12855 TB-20	pH	7.8	8.2	5
	Conductivity (umhos/cm)	402.4	337.9	16
	Alkalinity (mg/l CaCO3)	113	107	5
	Hardness (mg/l CaCO3)	138	93	33
	Ammonia (mg/l NH3)	1.29	0.25	81
12855 d TB-20	pH	8.2	7.7	6
	Conductivity (umhos/cm)	423.7	356.4	16
	Alkalinity (mg/l CaCO3)	132	92	30
	Hardness (mg/l CaCO3)	153	111	27
	Ammonia (mg/l NH3)	1.32	0.46	65
CC-1 Negative Control	pH	7.8	7.9	1
	Conductivity (umhos/cm)	338.3	336.4	1
	Alkalinity (mg/l CaCO3)	97	97	0
	Hardness (mg/l CaCO3)	103	99	4
	Ammonia (mg/l NH3)	0.03	0.05	67
Culture Water	pH	7.8	7.9	1
	Conductivity (umhos/cm)	338.3	336.4	1
	Alkalinity (mg/l CaCO3)	97	97	0
	Hardness (mg/l CaCO3)	103	99	4
	Ammonia (mg/l NH3)	0.03	0.05	67

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Hyalella azteca*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-2. Summary of Daily Temperature and Dissolved Oxygen Measurements for *Hyalella azteca* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12836	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-1	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.8	5.84	22.5	6.44	22.6	6.15	23.1	5.71	22.0	5.82	22.0	5.77	23.7	6.27	23.1	6.67	22.9	6.93	22.4	6.94
PM	22.9	5.69	22.4	4.61	23.5	4.26	22.6	6.35	24.0	5.86	22.8	5.47	22.3	6.66	22.4	5.41	21.9	7.34	22.1	7.67	22.8	7.85
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12837	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-2	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.3	5.95	22.3	6.51	22.6	6.38	22.4	5.71	22.3	5.51	23.4	5.49	23.1	6.14	23.2	6.52	23.3	6.46	22.3	7.08
PM	22.0	6.16	23.8	4.90	23.3	4.18	22.0	6.38	23.8	5.86	22.5	2.34	23.4	6.36	22.4	5.32	22.5	7.26	22.3	7.66	23.4	7.50
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12838	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-3	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			24.1	5.29	23.3	6.35	23.1	6.55	23.1	5.75	22.4	5.59	22.9	5.40	23.1	6.08	23.1	6.47	23.1	6.40	22.2	7.19
PM	22.1	6.03	22.9	4.81	22.7	4.82	22.0	6.57	24.6	5.65	22.1	6.10	22.7	6.58	22.4	5.62	22.4	7.38	22.1	7.77	22.6	7.60
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12839	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-4	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.5	5.50	22.7	3.38	22.5	6.80	22.9	6.23	22.4	6.32	22.4	5.44	23.1	6.18	23.6	6.47	23.2	6.97	22.3	7.48
PM	22.9	5.66	22.9	4.81	23.9	4.34	22.0	8.65	23.5	5.68	22.2	5.99	22.5	6.75	22.1	5.81	22.4	7.28	22.3	7.57	22.0	7.77
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12840	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-5	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.8	7.52	21.9	8.18	22.6	8.26	22.6	7.91	22.5	7.22	22.7	7.33	22.3	7.83	22.2	8.46	21.8	9.14	22.3	8.90
PM	21.9	0.45	22.5	6.52	23.1	5.25	22.7	6.45	24.6	6.45	22.0	7.68	19.7	8.74	22.4	6.74	22.7	9.05	21.8	9.55	22.1	7.32

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Hyalella azteca*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-2 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Hyalella azteca* in the Solid Phase Toxicity Tests for Tannery BaySediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12841	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-6	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.8	5.56	23.5	6.15	23.2	6.23	22.1	5.98	22.5	6.06	21.9	5.42	23.1	6.37	23.4	6.51	23.5	6.60	22.6	7.39
PM	22.9	5.69	22.6	5.02	22.5	4.16	22.5	8.32	24.2	5.81	22.4	5.81	22.7	6.78	22.6	5.54	22.3	7.25	22.5	7.97	22.6	8.21
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12842	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-7	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.9	5.39	22.0	6.03	23.0	6.13	22.5	5.50	22.4	5.73	22.0	5.16	22.9	6.04	22.8	6.44	22.3	6.40	22.1	7.42
PM	22.4	5.56	21.9	4.86	22.8	4.66	22.5	6.20	22.8	5.80	22.4	5.36	22.5	5.63	22.2	5.41	22.0	7.20	21.9	7.99	22.0	7.03
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12843	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-8	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.2	5.70	23.1	6.35	22.5	6.44	22.7	6.06	22.4	5.74	22.2	4.19	22.8	6.27	22.9	6.68	22.5	6.22	22.4	6.85
PM	22.4	5.80	21.9	4.71	23.0	5.03	22.2	6.52	22.9	5.29	22.1	5.88	22.6	6.74	22.4	5.79	21.8	7.38	21.9	7.83	22.4	7.39
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12844	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-9	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.9	5.61	22.7	6.26	22.7	6.78	22.6	5.24	22.0	5.64	23.0	5.52	22.2	6.01	23.3	6.58	23.3	6.97	21.8	7.18
PM	22.6	5.72	21.9	5.15	23.0	5.08	21.9	6.53	23.3	5.94	22.4	6.27	21.9	7.24	22.6	6.03	21.8	7.25	22.5	7.57	22.1	7.49
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12845	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-10	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.3	5.83	22.2	6.38	22.9	6.33	22.7	6.06	22.6	5.66	22.4	5.74	22.2	5.61	22.7	6.84	22.0	7.04	21.8	7.64
PM	22.9	5.99	22.3	4.79	23.0	5.63	22.5	6.28	23.8	6.37	22.3	6.16	22.7	6.90	22.4	5.69	22.4	7.42	22.7	7.29	22.0	7.74

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Hyalella azteca*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-2 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Hyalella azteca* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12846	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-11	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.5	5.94	22.6	6.39	22.6	6.73	22.1	6.09	21.8	5.90	22.5	5.98	22.2	6.25	22.5	6.59	22.2	6.56	22.1	7.49
PM	22.7	5.67	22.6	5.21	23.3	5.34	22.6	6.58	24.3	5.98	22.2	6.00	22.5	6.69	21.9	5.62	22.5	7.66	22.4	7.85	22.7	8.30
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12847	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-12	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	6.14	23.1	6.03	22.9	6.62	22.9	5.76	22.5	5.57	22.2	5.43	23.1	5.89	23.3	6.23	22.7	6.86	21.9	7.19
PM	22.1	5.80	22.0	5.04	23.0	5.22	23.5	5.99	23.2	6.14	22.5	5.86	21.9	6.43	22.5	5.48	22.5	7.72	22.1	7.66	22.4	7.89
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12848	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-13	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.7	5.51	22.2	6.24	22.2	5.97	22.0	5.89	22.3	4.98	22.4	5.62	22.6	5.75	23.4	6.23	22.3	6.85	22.4	7.15
PM	22.4	5.21	22.3	4.90	23.0	5.38	21.8	6.26	23.3	6.00	22.0	5.35	22.7	6.26	22.6	5.60	22.1	7.10	22.7	7.92	21.8	7.11
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12849	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-14	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.4	4.89	23.0	6.13	22.2	6.31	22.9	5.96	21.9	5.70	21.8	5.62	22.8	6.72	22.8	6.49	22.0	7.22	22.6	7.58
PM	22.1	5.44	22.2	4.64	23.4	5.13	22.4	5.86	24.3	5.98	22.4	5.49	21.9	6.85	22.6	5.82	22.2	7.51	22.4	7.59	21.8	8.04
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12850	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-15	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.3	5.50	22.8	5.93	22.2	6.63	22.1	6.08	22.5	5.36	22.7	5.76	22.4	6.26	22.8	6.51	22.5	7.09	22.6	7.78
PM	22.4	5.37	22.0	5.13	23.4	5.22	22.3	6.17	24.1	6.16	22.7	5.90	22.0	6.43	22.0	5.52	22.0	7.36	22.1	7.36	22.0	7.74

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Hyalella azteca*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-2 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Hyalella azteca* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12851	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-16	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	5.64	22.5	6.38	22.4	6.57	22.6	7.25	22.5	5.76	22.0	5.67	22.6	5.56	22.3	6.58	22.7	7.48	22.3	7.42
PM	22.5	5.33	21.9	5.37	23.4	5.59	22.5	6.51	24.1	6.42	22.5	5.99	21.8	7.52	22.5	5.26	22.0	7.23	22.2	7.76	21.8	7.56
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12852	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-17	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			21.9	5.48	22.8	5.43	22.1	5.67	21.8	5.56	22.1	5.27	22.3	5.20	22.6	5.56	22.9	6.17	22.5	5.98	22.7	6.84
PM	22.7	5.11	22.0	4.60	23.5	5.40	21.8	5.77	23.2	5.56	22.6	5.80	22.3	6.51	22.7	5.35	22.0	7.03	22.4	6.57	22.5	5.34
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12853	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-18	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.6	5.83	22.4	6.04	22.5	6.63	21.9	6.10	22.1	5.27	22.6	5.47	22.2	4.63	22.9	6.17	22.3	6.91	22.6	6.87
PM	22.4	5.31	22.4	5.00	23.0	5.20	22.1	6.41	22.9	5.51	22.5	5.66	22.3	6.30	21.9	5.39	22.3	6.56	22.2	7.60	22.4	7.20
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12854	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-19	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.0	5.33	23.0	5.68	22.1	6.52	22.4	5.48	22.3	5.04	22.5	5.04	22.9	5.85	23.4	6.07	22.2	6.51	22.6	6.64
PM	22.5	5.01	22.2	4.82	22.7	5.17	22.1	5.81	23.4	5.53	22.3	5.05	22.2	6.47	22.2	5.31	22.0	6.68	22.4	6.65	22.6	6.65
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12855	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-20	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.5	5.56	22.8	5.77	22.9	6.25	22.2	5.44	22.0	4.96	22.2	5.01	22.2	5.81	23.0	5.98	22.2	6.63	21.8	6.65
PM	22.4	5.72	22.2	4.94	22.7	5.22	22.2	6.11	23.1	5.76	21.9	5.49	22.3	6.26	22.5	5.11	21.9	6.45	22.2	6.80	22.3	7.25

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Hyalella azteca*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-2 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Hyalella azteca* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																			
	0		1		2		3		4		5		6		7		8		9		10	
12855 dup	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-20	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.4	5.44	23.4	5.83	22.2	6.29	22.0	5.30	22.6	4.55	22.2	5.03	22.7	5.65	23.7	5.61	22.3	6.30	22.5	6.56
PM	22.5	5.62	22.7	4.94	23.0	5.18	22.2	6.02	23.3	5.40	22.5	5.31	22.5	6.25	22.7	5.05	22.4	6.00	22.4	6.56	22.7	6.34
Sample:	Day																			
	0		1		2		3		4		5		6		7		8		9		10	
CC-1	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
Neg Cont	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.5	4.93	22.9	4.39	22.0	5.37	21.8	4.37	22.1	5.01	22.8	5.18	23.0	5.37	22.4	5.64	22.2	6.16	23.0	5.55
PM	22.6	5.80	21.8	5.16	22.1	5.81	22.2	4.40	22.3	5.31	22.0	5.28	22.6	5.40	21.8	5.26	19.9	5.62	22.1	5.67	22.3	5.84

Test No:
Toxicant: Tannery Bay Sediment
Organism: *Chironomus tentans*

Analyst: RH, MR, MB, KR
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-3. Summary of Initial and Final Chemical Measurements for *Chironomus tentans* in Tannery Bay Sediments

Sample	Parameter	Day 0	Day 10	Difference (%)
12836 TB-1	pH	7.4	7.2	3
	Conductivity (umhos/cm)	408.2	309.1	24
	Alkalinity (mg/l CaCO3)	152	103	32
	Hardness (mg/l CaCO3)	133	91	32
	Ammonia (mg/l NH3)	4.37	0.09	98
12837 TB-2	pH	7.2	7.3	0
	Conductivity (umhos/cm)	469	354.2	24
	Alkalinity (mg/l CaCO3)	157	113	28
	Hardness (mg/l CaCO3)	129	97	25
	Ammonia (mg/l NH3)	3.17	0.07	98
12838 TB-3	pH	7.2	7.2	0
	Conductivity (umhos/cm)	510.0	379.9	26
	Alkalinity (mg/l CaCO3)	171	117	32
	Hardness (mg/l CaCO3)	152	101	34
	Ammonia (mg/l NH3)	3.89	0.07	98
12839 TB-4	pH	7.3	7.2	2
	Conductivity (umhos/cm)	454.3	387	15
	Alkalinity (mg/l CaCO3)	154	115	25
	Hardness (mg/l CaCO3)	139	103	26
	Ammonia (mg/l NH3)	4.21	0.07	98
12844 TB-9	pH	7.2	7.2	0
	Conductivity (umhos/cm)	751.0	390.9	48
	Alkalinity (mg/l CaCO3)	340	140	59
	Hardness (mg/l CaCO3)	337	165	51
	Ammonia (mg/l NH3)	3.23	0.01	100
12840 TB-5	pH	7.3	7.1	3
	Conductivity (umhos/cm)	488.3	400	18
	Alkalinity (mg/l CaCO3)	170	119	30
	Hardness (mg/l CaCO3)	159	122	23
	Ammonia (mg/l NH3)	4.08	0.05	99
12845 TB-10	pH	7.3	7.2	1
	Conductivity (umhos/cm)	478.9	426.6	11
	Alkalinity (mg/l CaCO3)	168	113	33
	Hardness (mg/l CaCO3)	157	112	29
	Ammonia (mg/l NH3)	2.82	0.07	98
12841 TB-6	pH	7.2	7.2	0
	Conductivity (umhos/cm)	607.9	417.4	31
	Alkalinity (mg/l CaCO3)	239	139	42
	Hardness (mg/l CaCO3)	217	120	45
	Ammonia (mg/l NH3)	5.75	0.04	99
12746 TB-11	pH	7.2	7.1	1
	Conductivity (umhos/cm)	466.6	385.5	17
	Alkalinity (mg/l CaCO3)	168	115	32
	Hardness (mg/l CaCO3)	154	109	29
	Ammonia (mg/l NH3)	3.75	0.05	99
12842 TB-7	pH	7.3	7.2	1
	Conductivity (umhos/cm)	474.9	376.9	21
	Alkalinity (mg/l CaCO3)	163	113	31
	Hardness (mg/l CaCO3)	147	107	27
	Ammonia (mg/l NH3)	5.32	0.06	99
12747 TB-12	pH	7.2	7.2	0
	Conductivity (umhos/cm)	542.8	380.9	30
	Alkalinity (mg/l CaCO3)	203	117	42
	Hardness (mg/l CaCO3)	180	111	38
	Ammonia (mg/l NH3)	3.97	0.03	99
12843 TB-8	pH	7.2	7.2	0
	Conductivity (umhos/cm)	514.0	387.1	25
	Alkalinity (mg/l CaCO3)	189	109	42
	Hardness (mg/l CaCO3)	169	112	34
	Ammonia (mg/l NH3)	3.67	0.02	99
12848 TB-13	pH	7.2	7.2	0
	Conductivity (umhos/cm)	514.0	387.1	25
	Alkalinity (mg/l CaCO3)	189	109	42
	Hardness (mg/l CaCO3)	149	110	26
	Ammonia (mg/l NH3)	8.62	0.04	100
12849 TB-14	pH	7.3	7.1	2
	Conductivity (umhos/cm)	450.8	374.7	17
	Alkalinity (mg/l CaCO3)	176	109	38
	Hardness (mg/l CaCO3)	168	107	36
	Ammonia (mg/l NH3)	2.76	0.03	99
12850 TB-15	pH	7.2	7.2	0
	Conductivity (umhos/cm)	526.0	398.1	24
	Alkalinity (mg/l CaCO3)	197	123	38
	Hardness (mg/l CaCO3)	184	122	34
	Ammonia (mg/l NH3)	4.35	0.02	100
12851 TB-16	pH	7.3	7.2	2
	Conductivity (umhos/cm)	476.3	415.4	13
	Alkalinity (mg/l CaCO3)	169	127	25
	Hardness (mg/l CaCO3)	144	119	17
	Ammonia (mg/l NH3)	4.68	0.04	99

Test No:
Toxicant: Tannery Bay Sediment
Organism: *Chironomus tentans*

Analyst: RH, MR, MB, KR
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-3 (Cont). Summary of Initial and Final Chemical Measurements for *Chironomus tentans* in Tannery Bay Sediments

Test No:
Toxicant: Tannery Bay Sediment
Organism: *Chironomus tentans*

Analyst: RH, MR, MB, KR
Test Start: 7/9/2004
Test Stop: 7/19/2004

Table C-3 (Cont). Summary of Initial and Final Chemical Measurements for *Chironomus tentans* in Tannery Bay Sediments

Sample	Parameter	Day		Difference (%)
		0	10	
12852 TB-17	pH	7.9	7.6	4
	Conductivity (umhos/cm)	482.4	469.7	3
	Alkalinity (mg/l CaCO3)	174	109	37
	Hardness (mg/l CaCO3)	144	104	28
	Ammonia (mg/l NH3)	8.92	0.05	99
12853 TB-18	pH	7.8	7.7	1
	Conductivity (umhos/cm)	450.3	383.7	15
	Alkalinity (mg/l CaCO3)	162	117	28
	Hardness (mg/l CaCO3)	139	110	21
	Ammonia (mg/l NH3)	5.06	0.03	99
12854 TB-19	pH	7.9	7.6	4
	Conductivity (umhos/cm)	397.9	361.1	9
	Alkalinity (mg/l CaCO3)	136	109	20
	Hardness (mg/l CaCO3)	111	100	10
	Ammonia (mg/l NH3)	4.56	0.02	100
12855 TB-20	pH	7.9	7.7	3
	Conductivity (umhos/cm)	377.5	365.3	3
	Alkalinity (mg/l CaCO3)	119	113	5
	Hardness (mg/l CaCO3)	110	101	8
	Ammonia (mg/l NH3)	1.19	0.08	93
12855 d TB-20	pH	7.8	7.7	1
	Conductivity (umhos/cm)	382.1	365.2	4
	Alkalinity (mg/l CaCO3)	124	109	12
	Hardness (mg/l CaCO3)	111	102	8
	Ammonia (mg/l NH3)	2.06	0.26	87
CC-1 Negative Control	pH	7.9	7.8	1
	Conductivity (umhos/cm)	411.16	377.2	8
	Alkalinity (mg/l CaCO3)	122	97	20
	Hardness (mg/l CaCO3)	145	118	19
	Ammonia (mg/l NH3)	1.42	0.49	65
Culture Water	pH	7.8	7.7	1
	Conductivity (umhos/cm)	330.5	309.1	6
	Alkalinity (mg/l CaCO3)	98	88	10
	Hardness (mg/l CaCO3)	76	64	16
	Ammonia (mg/l NH3)	0.13	0.12	8

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Chironomus tentans*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/23/2004
Test Stop: 8/1/2004

Table C-4. Summary of Daily Temperature and Dissolved Oxygen Measurements for *Chironomus tentans* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12836	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-1	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			23.3	5.40	23.7	5.28	22.1	5.89	22.0	4.26	23.0	5.31	23.0	6.52	22.4	7.39	23.6	6.56	24.0	7.00	22.9	2.81
PM	22.8	6.68	22.3	5.21	22.2	4.70	22.7	4.26	22.6	5.54	22.1	6.27	22.1	6.19	22.5	7.49	22.8	6.37	22.3	6.54	22.2	8.12
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12837	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-2	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.8	5.63	22.4	5.37	23.1	5.90	22.6	4.93	22.4	5.27	22.8	6.63	23.7	7.23	23.4	6.78	23.5	7.27	22.8	7.15
PM	23.0	7.22	21.9	5.66	22.2	4.91	21.9	4.93	22.3	5.60	22.3	6.02	22.0	6.67	22.8	7.62	22.2	6.76	22.6	7.30	22.5	8.15
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12838	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-3	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.3	5.15	22.4	4.93	22.2	5.86	23.1	4.65	22.7	5.35	23.6	6.49	23.7	6.45	23.4	6.59	24.4	6.85	23.1	5.66
PM	22.8	7.09	22.4	5.29	22.4	4.90	22.0	4.65	21.9	5.51	22.5	6.02	22.9	5.92	22.6	7.25	22.2	5.92	22.1	7.33	21.8	6.29
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12839	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-4	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.3	5.49	22.0	5.10	22.1	6.08	22.0	4.65	23.1	5.15	23.7	6.65	23.9	6.65	23.4	6.75	22.3	6.78	23.2	7.08
PM	21.8	7.45	21.9	5.42	22.6	5.05	22.0	4.65	22.5	5.36	22.7	6.01	22.7	6.47	22.4	6.88	22.4	7.20	22.3	5.42	21.9	6.16
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12840	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-5	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.8	6.52	22.9	6.11	22.4	7.40	21.8	5.30	23.3	5.76	22.8	5.50	22.3	4.57	23.4	9.33	21.9	10.0	22.6	10.6
PM	22.6	1.72	22.5	3.31	22.5	5.19	22.6	5.30	22.3	5.86	21.8	8.37	22.0	9.10	22.2	9.87	22.3	5.29	18.7	10.9	22.4	10.1

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Chironomus tentans*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/23/2004
Test Stop: 8/1/2004

Table C-4 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Chironomus tentans* in the Solid Phase Toxicity Tests for Tannery BaySediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12841	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-6	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	5.30	22.1	4.91	22.8	5.59	22.2	4.90	23.1	5.32	23.7	6.12	23.4	6.69	22.9	6.45	23.1	6.48	23.6	5.77
PM	22.0	7.05	22.4	5.34	22.7	4.72	22.1	4.90	22.4	5.52	22.3	6.11	22.0	6.70	21.8	4.47	22.0	6.87	22.6	7.04	22.5	6.42
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12842	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-7	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.0	5.13	22.5	4.31	22.3	5.04	22.3	4.44	22.4	4.94	23.5	4.81	22.7	5.60	22.7	4.62	22.3	4.15	22.9	3.58
PM	21.8	6.97	22.1	4.97	22.6	5.19	21.9	4.44	22.7	5.18	22.4	4.90	22.5	5.92	21.8	5.84	22.5	4.68	22.3	6.18	22.6	4.86
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12843	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-8	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	5.10	21.8	5.15	22.2	6.08	22.1	4.93	21.9	5.30	22.9	6.53	22.8	6.28	23.2	5.82	22.6	6.98	22.0	6.75
PM	22.5	6.59	22.5	4.94	22.6	5.61	21.9	4.93	22.3	5.53	22.1	6.67	22.0	6.93	21.8	6.74	22.8	6.28	19.9	7.18	22.6	6.69
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12844	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-9	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.6	5.38	22.4	5.26	21.9	6.11	22.5	4.55	23.6	5.10	23.4	6.52	23.2	6.45	22.6	6.27	23.4	6.07	23.2	6.50
PM	22.0	6.78	22.4	5.08	22.7	5.19	21.9	4.55	22.7	5.13	22.0	6.62	22.7	6.50	22.4	6.83	19.6	7.08	19.9	6.78	22.0	6.60
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12845	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-10	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.6	5.51	22.7	5.20	22.1	6.01	22.7	4.64	22.3	5.23	22.7	6.59	22.5	6.91	22.8	5.91	22.7	6.12	22.3	6.68
PM	21.8	7.86	23.6	4.99	22.2	5.38	22.9	4.64	22.7	5.44	22.0	6.43	22.0	6.88	22.0	6.75	22.4	7.39	18.8	8.10	22.4	7.50

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Chironomus tentans*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/23/2004
Test Stop: 8/1/2004

Table C-4 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Chironomus tentans* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12846	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-11	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.3	5.60	22.5	5.12	22.7	6.20	22.5	4.63	22.5	2.04	22.6	6.50	22.5	6.37	22.6	6.11	22.7	6.79	22.3	6.77
PM	22.5	7.47	23.6	4.98	22.1	6.70	22.8	4.63	22.8	5.42	21.8	6.11	22.3	6.83	22.3	6.97	22.1	6.35	22.3	7.91	22.6	7.00

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12847	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-12	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.4	5.34	22.2	2.30	22.2	6.02	21.9	4.52	22.3	2.18	23.2	6.35	23.2	5.63	22.7	6.64	23.3	5.94	22.1	6.84
PM	21.8	7.37	22.5	5.36	22.1	6.60	22.2	4.52	22.4	5.56	22.9	6.73	21.9	6.62	22.4	7.13	22.0	6.60	22.2	7.84	22.5	7.22
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12848	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-13	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.3	4.75	22.4	4.67	21.8	5.60	22.3	4.40	22.3	5.02	22.9	5.04	22.9	4.66	22.6	5.49	22.9	5.23	22.3	5.08
PM	22.7	7.32	21.8	5.16	22.1	5.81	22.2	4.40	22.3	5.31	22.0	5.28	22.6	5.40	21.8	5.26	19.9	5.62	22.1	5.67	22.3	5.84
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12849	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-14	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.4	5.14	22.0	5.37	22.5	6.05	21.9	4.80	21.9	5.29	23.4	6.00	23.3	7.04	23.2	6.36	23.0	6.42	22.3	6.73
PM	22.2	7.28	22.8	5.24	21.9	6.93	22.1	4.80	22.4	5.60	22.8	5.95	22.5	6.82	22.4	7.37	22.0	6.52	22.5	7.35	21.9	6.63
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12850	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-16	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.6	5.18	22.0	5.07	21.9	5.90	22.3	4.95	22.5	5.09	22.7	5.58	22.7	6.63	22.2	6.27	22.9	5.56	22.6	6.59
PM	22.6	6.44	22.9	5.25	22.4	6.81	21.9	4.95	22.5	5.32	22.5	5.32	22.3	6.62	19.6	7.58	22.1	6.88	21.9	6.98	22.6	6.86

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Chironomus tentans*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/23/2004
Test Stop: 8/1/2004

Table C-4 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Chironomus tentans* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12851	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-17	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	5.31	22.0	5.02	22.7	6.04	22.3	4.75	22.0	5.09	22.7	6.53	22.8	6.80	22.5	6.49	22.7	6.44	22.5	7.44
PM	22.6	6.93	22.6	5.31	21.9	6.17	21.9	4.75	22.5	5.44	22.5	6.19	22.4	6.63	22.0	7.34	21.9	6.30	21.9	7.81	21.8	7.42

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12852	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-18	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.2	4.75	22.3	4.00	22.5	4.74	22.3	4.94	22.5	4.77	22.6	4.43	22.7	5.85	22.4	6.01	22.8	5.19	22.9	5.92
PM	22.3	7.04	22.5	4.86	22.7	5.57	22.1	4.94	22.0	4.95	22.2	4.18	22.4	4.84	22.5	5.58	22.1	5.90	19.5	5.74	22.6	5.53
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12853	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-19	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.0	5.19	22.8	4.83	22.5	5.62	21.9	4.54	22.0	5.07	22.6	5.77	22.9	6.11	22.4	5.74	21.7	5.95	22.5	5.53
PM	22.5	7.24	22.5	5.14	21.8	6.07	22.1	4.54	21.8	5.54	22.0	5.82	22.5	6.05	22.3	6.30	22.1	5.67	22.4	6.95	22.6	####
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12854	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-20	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.5	4.93	22.9	4.39	22.0	5.37	21.8	4.37	22.1	5.01	22.8	5.18	23.0	5.37	22.4	5.64	22.2	6.16	23.0	5.55
PM	21.8	6.60	21.8	5.22	22.1	5.96	21.9	4.37	21.9	5.28	19.0	5.45	22.1	5.24	22.7	5.79	22.5	4.35	22.4	5.77	22.5	6.04
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12855	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-20	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.4	4.95	22.1	4.41	21.9	4.77	22.5	4.44	22.4	5.56	22.8	4.85	22.9	5.17	22.9	5.89	23.0	5.35	23.1	4.06
PM	22.0	6.65	22.0	4.77	22.3	5.91	22.4	4.44	21.8	5.21	19.4	5.75	22.2	4.93	22.5	5.63	21.8	4.65	22.6	5.42	22.7	5.56

Test No:
Toxicant: Tannery Bay Sediments
Organism: *Chironomus tentans*

Analyst: RH, BTS, BR, SK, MR, KR, JN
Test Start: 7/23/2004
Test Stop: 8/1/2004

Table C-4 (Cont). Summary of Daily Temperature and Dissolved Oxygen Measurements for *Chironomus tentans* in the Solid Phase Toxicity Tests for Tannery Bay Sediments

Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
12855 dup	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
TB-20	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.1	4.92	22.7	4.40	21.9	4.95	22.1	4.14	22.0	4.98	23.3	5.21	23.4	6.06	22.7	5.50	23.4	6.64	22.8	6.71
PM	21.9	7.16	22.4	4.86	22.8	4.99	22.7	4.14	22.1	5.34	22.2	6.03	21.9	5.27	22.4	6.22	22.3	5.12	22.5	5.63	22.0	5.39
Sample:	Day																					
	0		1		2		3		4		5		6		7		8		9		10	
CC-1	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO	Temp	DO
Neg Cont	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l	°C	mg/l
AM			22.7	6.14	23.1	6.03	22.9	6.62	22.9	5.76	22.5	5.57	22.2	5.43	23.1	5.89	23.3	6.23	22.7	6.86	21.9	7.19
PM	22.4	5.90	22.9	5.39	22.0	6.03	23.0	6.13	22.5	5.50	22.4	5.73	22.0	5.16	22.9	6.04	22.8	6.44	22.3	6.40	22.1	7.42