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Sediment Toxicity Study: Mill River, Fairfield, Connecticut

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Acronyms and Abbreviations

ANOVA	analysis of variance
AVS	acid-volatile sulfide
COC	chemical of concern
CTDEP	State of Connecticut Department of Environmental Protection
EGI	Exide Group, Inc.
ERL	effects range low
ERM	effects range median
FSP	field sampling plan
HQ	hazard quotient
MCA	Menzie-Cura & Associates
MRERA	Mill River ecological risk assessment
MRHHERA	Mill River human health risk assessment
PEL	probable effects level
PRG	preliminary remediation goal
QC	quality control
SEM	simultaneously extracted metals
SOP	standard operating procedure
SSI	Supplementary Sediment Investigation
STS	Sediment Toxicity Study
TEL	threshold effect level

Executive Summary

The Mill River Overall Risk-Based Preliminary Remediation Goals report (Menzie-Cura & Assoc., Inc. 2002) proposed a target clean-up level of <400 mg/kg lead in sediments to ensure protection of human health and ecological receptors that may come into contact with sediments of the Mill River. The value of 400 mg/kg was derived specifically to be protective of young children (as well as adults) and of wildlife that forage in the river. Analyses also indicated that the value would be protective of benthic invertebrates that serve as a prey base to fish in the river. There was, however, some uncertainty about the data for benthic invertebrates, and the State of Connecticut Department of Environmental Protection (CTDEP) requested additional information to address these uncertainties. This request led to the development and implementation of a Supplementary Sediment Investigation (SSI) that was designed through discussions with CTDEP and implemented in 2004. Results of the SSI showed that only one measure of effect, the number of taxa, was significantly related to the concentration of lead in Mill River sediments. The number of taxa in Mill River samples with concentrations of lead equal to or greater than 530 mg/kg was significantly reduced in comparison to the reference sites, and the number of taxa was significantly related to the concentration of lead in Mill River sediments. The number of taxa in samples containing lead concentrations below 530 mg/kg was not significantly different from the reference sites. Therefore, 530 mg/kg was considered to represent a threshold for the sustainability of the benthic community and was selected as the preliminary remediation goal (PRG) for the protection of the sustainability of the community of benthic invertebrates in the Mill River.

This document presents the results of the 2009 Sediment Toxicity Study (STS). It provides information on possible levels of lead at which effects may occur and more specifically addresses the question as to whether the 400-mg/kg value would be protective not only of human health and wildlife but also of benthic invertebrates. Exponent conducted the investigation to obtain information that could be used to develop ecological risk-based PRGs for lead in the study area of the Mill River, Fairfield, Connecticut. The results of sediment toxicity tests indicate that survival, growth, and reproduction of aquatic organisms are not related to concentrations of lead in sediment.

A key element that controls the toxicity of lead and similar metals in sediments is sulfide. Sulfides are naturally occurring compounds that bind with certain metals (cadmium, copper, lead, nickel, silver, and zinc), forming insoluble sulfide complexes that have minimal biological availability and toxicity. The role of sulfides has been well tested in laboratory and field sediments, and the ratio of metals to sulfides has been demonstrated to be a reliable predictor of toxicity to aquatic organisms. Results indicate that concentrations of sulfides in all sediment samples were far greater than concentrations of metals, indicating that lead in these sediment samples is highly unlikely to cause toxicity to aquatic organisms.

Although observed toxicity is not likely related to lead, statistical analyses were conducted to compare performance of individual Site samples to the sediments collected from relatively uncontaminated reference sites. Results of the comparison of Site samples to both reference-site samples indicate that:

- Only one sample (MR-B4-B) had significantly reduced survival and reproduction in comparison to the pooled reference-site samples, but the background level of lead in this sample (91 mg/kg) is not likely to be the cause of toxicity.
- Only one sample (MR-SED-10, with 853 mg/kg lead) had significantly reduced growth in comparison to the pooled reference samples.

Reduced survival and reproduction in sample MR-B4-B is not believed to be related to the presence of lead, because:

- The low concentration of lead in sample MR-B4-B (91 mg/kg) is close to background levels and within the range observed at the reference sites.
- Eight Site samples had higher concentrations of lead, but did not have significantly lower survival or reproduction than the reference site samples.
- Simultaneously extracted metals/acid-volatile sulfide (SEM/AVS) data indicate that lead and other metals are not present at levels that are toxic to aquatic invertebrates.
- Concentrations of all metals (except Al, for which a benchmark is not available) are below the effects range median (ERM) and probable effects level (PEL), which are sediment quality benchmarks that represent the lower limit of the range of contaminant concentrations that are usually associated with adverse biological effects (i.e., the lower limit of the probable-effects range).
- The laboratory notes indicate that, during the course of the study, an orange discoloration was observed on the sediment surface of this sample and others. The impact of this material, which may be related to bacterial growth, is unknown, but it could have affected survival in this sample.
- Sample MR-B4-B was collected from an area close to an outfall from the I-95 highway, and therefore may be affected by other contaminants.

In summary, results of the present study indicate that:

- Survival, growth, and reproduction of organisms exposed to concentrations of lead less than 400 mg/kg are not significantly different (with the exception of anomalous sample, MR-B4-B) from organisms exposed to reference site sediments.
- Sediment toxicity is not related to the concentration of lead in sediments of the Mill River.
- Levels of sulfides in the sediments of the Mill River and reference sites are sufficient to bind lead and other metals, rendering them unavailable to benthic organisms and non-toxic.

Adverse effects *that are significantly related to the concentration of lead in sediment* should be used to establish a PRG for lead in sediment. The results of the present study, as well as two previous studies, the Mill River Ecological Risk Assessment (MCA 2001) and the Supplemental Sediment Investigation (SSI, MCA 2005), indicate that lead in sediments is not related to standard measures of sediment toxicity (e.g., survival, growth, and reproduction), and concentrations of lead below a previously established PRG for the protection of human health (400 mg/kg) do not cause significant adverse effects to the community of benthic invertebrates in the Mill River. These results are in agreement with numerous other studies that indicate that lead in sediment is not highly toxic to aquatic invertebrates, particularly when associated with sulfides.

Results of the 2004 SSI (but not the 2001 MRERA) indicated that one line of evidence among several examined, the number of taxa, was significantly related to the concentration of lead in Mill River sediments. However, the number of taxa in samples with concentrations of lead below 530 mg/kg was *not* significantly different from the reference sites. Therefore, the conclusion of the previous study was that 530 mg/kg was considered to represent a threshold for the sustainability of the benthic community and was selected as the PRG to protect the sustainability of the benthic invertebrate community in the Mill River.

This PRG for lead—530 mg/kg for protection of the benthic community—is higher than the PRG for the protection of human health (400 mg/kg). Therefore, the present study and previous studies demonstrate that a PRG of 400 mg/kg is protective of both humans and ecological receptors of the Mill River.

1 Introduction

This document presents the results of the 2009 Sediment Toxicity Study (STS). This study was conducted to support the development of a preliminary remediation goal (PRG) for lead in sediment of the Mill River study area, Fairfield, Connecticut, that will protect the sustainability of the benthic invertebrate community. This additional work is being conducted to supplement prior sediment testing that was performed for the Exide Group, Inc., and Inco United States, Inc., and is intended for use in identifying a risk-based PRG for lead in river sediments that, if met, will protect the sustainability of the benthic invertebrate community in the Mill River.

2 Background

In 2001, Exide submitted to the Connecticut Department of Environmental Protection (CTDEP) the Mill River Human Health and Ecological Risk Assessments (MRHHERA) to address the requirements of CTDEP Administrative Order No. WC4893, dated November 29, 1989, and subsequent directives from CTDEP. This Order concerns contamination that may have emanated from the former Electric Storage Battery, Inc., battery facility, later the former Exide Corporation, at 2190 Post Road, Fairfield, Connecticut. The 2001 Mill River Ecological Risk Assessment (MRERA), which used multiple measures of effect and a weight-of-evidence approach, concluded that the benthic invertebrate community that inhabits the sediments of the Mill River is not adversely affected by the presence of lead at concentrations up to 580 mg/kg. The MRERA and subsequent report (MCA 2002) concluded that greater concordance among various measures of effect for sediments with higher concentrations of lead (>920 mg/kg) indicated that these higher concentrations of lead may be related to adverse effects to the benthic invertebrate community.

In a letter regarding the 2001 MRERA and the proposed remediation goals (CTDEP, April 29, 2004), CTDEP agreed that concentrations of lead above 920 mg/kg may be related to observed impacts to the benthic invertebrate community, but did not necessarily agree that measures of effect observed in certain sediment samples with low levels of lead (220–580 mg/kg) were related to the influence of salinity rather than to the presence of lead. In order to establish an acceptable PRG, CTDEP suggested that additional samples of sediment be collected with concentrations of lead in the range of 200 to 920 mg/kg. In addition, samples were to be collected from areas with a limited range of salinity, so that results would not be confounded by the influence of salinity.

In response to these comments from CTDEP, a Supplementary Sediment Investigation (SSI) was conducted in 2004 (Menzie-Cura & Associates [MCA] 2005). The SSI reported that only one measure of effect, the number of taxa, was significantly related to the concentration of lead in Mill River sediments. On the basis of this measure of effect, the SSI concluded that 530 mg lead/kg sediment represents a threshold for the sustainability of the benthic invertebrate community. Because the proposed PRG of 530 mg/kg for the protection of benthic invertebrate community sustainability is higher than the PRG of 400 mg/kg for the protection of human health, an overall PRG of 400 mg/kg for the protection of human health and all ecological receptors was proposed.

CTDEP reviewed the results of the SSI and posed questions concerning the design and implementation of the study. In particular, CTDEP expressed concerns related to the results for the laboratory control sediment in the 2004 sediment toxicity tests. In response to this, Exide Group, Inc. (EGI) retained two leading experts in the field of sediment quality assessment to technically review the 2004 sediment toxicity tests and the SSI, and to address CTDEP's concern over the reliability of the sediment toxicity tests. The experts concluded that the study results can be relied upon and can be used as part of the evaluation of potential site-specific effects of lead on invertebrates. The experts also concluded that the available data and analyses conducted for the SSI support the PRG of 400 mg lead/kg sediment.

In a letter to Respondents from CTDEP (December 26, 2007; Mill River Sediment Remediation Criteria at the Former Exide Battery Site, 2190 Boston Post Road, Fairfield CT, Administrative Order No. WC4893) the Department stated that it did not believe that existing data support a PRG for the protection of the benthic invertebrate community greater than 220 mg lead/kg sediment. To address this concern, Exponent—on behalf of Respondents—conducted this additional sediment toxicity testing and associated chemical analyses on sediment samples from the Mill River and two reference rivers (Figure 1 shows the geographic location of the Site and the reference rivers). The procedures and protocols used by Exponent to collect and analyze samples of sediment from the Mill River and two reference rivers for chemical and toxicity testing were presented in the Work Plan and Field Sampling Plan for the 2009 Sediment Toxicity Study (STS), Mill River, Fairfield, Connecticut (Exponent 2008). This document describes the results of the STS investigation.

3 Field Sampling

The STS Field Sampling Plan (FSP) describes the sampling and analysis activities that were used to generate valid and usable data in support of the STS (Exponent 2008). Surficial sediment samples (0–6 inches) for chemical analysis were collected from areas of the Mill River and from the Sasco Creek and Patchogue River reference areas. Standard Operating Procedures (SOPs), as described in *Sampling Soft and Fine-Grained Sediments* (MCA 2000) and *Region I, EPA-New England Sediment Sampling Guidance* (U.S. EPA 1998; MCA 2000) were followed. As part of the field sampling effort, various samples were collected from the Mill River study area, including:

- Sediment samples for analysis of metals (aluminum, arsenic, cadmium, chromium, lead, mercury, silver, and zinc), grain size, percent solids, organic carbon content, and porewater salinity
- Sediment samples for toxicity testing (28-day chronic sediment toxicity test with the amphipod *Leptocheirus plumulosus* for survival, growth, and reproduction).

3.1 Selection of Reference Sites

An extensive survey of potential reference sites was conducted in September 2004 (MCA 2005). The goal of the survey was to identify coastal rivers that are comparable to the Mill River in terms of physical and chemical characteristics, such as salinity and sediment grain size. In consultation with CTDEP, Sasco Creek and the Patchogue River were identified as suitable reference rivers for the Mill River SSI. Those same reference sites are used in the current study.

3.2 Selection of Mill River Sample Locations

Sediment sampling locations for the current study targeted the proposed remediation goal of 400 mg lead/kg sediment. Data from sampling in 1999, 2000, and 2004 were used to select potential sample locations with a range of lead concentrations and other physical/chemical parameters. In particular, the sediment toxicity test protocol indicates that sediments should have greater than 5% silt and clay and less than 85% clay.

4 Exposure Assessment

The analysis phase of this STS examines the two primary components of risk: exposure and effects (U.S. EPA 1998). The exposure assessment describes exposure concentrations to which receptors may be exposed.

4.1 Target Analytes

The data collected for the Mill River Ecological Risk Assessment (MCA 2001) and the SSI (MCA 2005) were used to narrow the list of target analytes (Table 1). As agreed upon by CTDEP, samples collected for the SSI were analyzed for aluminum, arsenic, cadmium, chromium, lead, mercury, silver, and zinc. Samples were not analyzed for barium or selenium, because concentrations of these metals were comparable to those at reference sites in previous sampling (MCA 2001), and sediment quality benchmarks are not available for these compounds. Sediments were also analyzed for acid-volatile sulfides (AVS) and simultaneously extracted metals (SEM). The ratio of SEM to AVS is a measure of the bioavailability and associated toxicity of a suite of divalent cationic metals (cadmium, copper, lead, nickel, silver, and zinc). Sediment organic carbon-normalized concentrations of SEM that are less than AVS indicate that these metals are associated with the sulfides and are not likely to cause toxicity to aquatic invertebrates.

4.2 Description of the Analytical Data

During the week of March 9, 2009, Exponent carried out field sampling for the STS. Sediment samples were collected for analysis of a suite of target analytes, physical parameters, and sediment toxicity testing (Table 1).

To ensure that sediment samples from the Mill River covered a range of lead concentrations, a large number of samples were collected and analyzed for lead at a local laboratory (Complete Environmental Testing, Inc. (CET), Stratford, CT) that could provide a rapid turnaround time (e.g., less than 24 hours). These screening data were used only to select and validate the final sample locations, but were not validated or used in the STS.

Ten final sample locations from the Mill River (Figures 1–3) were identified that represent an appropriate range of concentrations of lead in sediment. Samples were also collected from two reference locations—Sasco Creek and the Patchogue River (three sample locations from each reference river; Figures 4 and 5, respectively). These samples were analyzed for the full suite of target analytes and other physical parameters (Tables 1 and A-1).

Concentrations of lead (Figure 6), zinc (Figure 7), aluminum (Figure 8), and chromium (Figure 9) are elevated in certain Mill River sediment samples in comparison to reference site sediments. Concentrations of arsenic, cadmium, mercury, and silver in Mill River sediment samples are more within the range of concentrations observed in the reference site samples (Figure 10). Concentrations of total organic carbon (TOC, Figure 11) and % silt/clay

(Figure 12) for Mill River samples are generally similar to reference-site samples, with the exception that Mill River sample MR-B4-A had comparatively lower TOC and % silt/clay than other samples; this could be because MR-B4-A is closest to a large outfall that drains runoff from I-95, which could wash out fine-grained, organic-rich sediments. Salinity of overlying water (Table A-2) and porewater salinity of the sediments were higher in the Sasco Creek samples than in other samples (Figure 13), but are within acceptable limits for the sediment toxicity test organisms.

4.3 Data Quality

A Data Usability Review was performed by Exponent. The review examined the sensitivity of reporting limits, and the representativeness, accuracy, and precision of the data. All recommendations regarding data usability were adhered to for the purposes of the STS. All data were considered usable for the STS project objectives, and no data were qualified as rejected. Note, however, that all mercury sample results were qualified as estimated (*J*) and may be biased high, as indicated by a high matrix spike recovery. A copy of the Data Usability Review is available from Exponent on request.

5 Effects Assessment

As noted above, the STS examines the two primary components of risk: exposure and effects (U.S. EPA 1998). The goal of effects assessment is to describe the relationship between exposure and potential response.

5.1 Comparison to Screening-Level Sediment Benchmarks

Concentrations of lead and other metals are compared to screening-level sediment quality benchmarks. These screening-level sediment quality benchmarks are typically used to identify samples and contaminants that may be associated with potential risks. The current STS examines two benchmarks: the effects range median (ERM) and the probable-effect level (PEL) benchmarks. The authors of the PEL (MacDonald et al. 1994) define this benchmark as "the lower limit of the range of contaminant concentrations that are usually or always associated with adverse biological effects (i.e., the lower limit of the probable effects range)." The authors of the ERM (Long et al. 1995) define this benchmark as "concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur." Previous assessments for the Mill River used screening-level benchmarks, including effects range low (ERL) and threshold effect level (TEL) benchmarks, to identify contaminants of concern (COC). Because COCs have been indentified, the current STS does not include comparisons to ERL and TEL screening-level benchmarks.

Note that these empirical benchmarks are based on observed toxicity in field-collected sediments that contain various co-occurring contaminants. Therefore, the probability of toxicity reported for one particular compound (e.g., lead) may not be related to the presence of lead, but to the entire suite of contaminants that is present in those samples. If the suite of contaminants present at a particular site differs from the suite typically present in the field samples used in the derivation of the benchmarks, the predictive ability of the benchmarks can be reduced. Therefore, these benchmarks are typically used as an indicator of *potential* risk and to identify the need for more direct measures of sediment toxicity (e.g., sediment toxicity tests) at a particular site.

Samples with sediment concentrations that exceed ERM or PEL sediment benchmarks (Table 2) include:

- Lead: MR-SED-1, MR-SED-2, MR-SED-4, MR-SED-6, MR-SED-7 (PEL only), MR-SED-10, MR-SED-13, and MR-SED-14
- Chromium: MR-SED-10, MR-SED-13 (PEL only), and MR-SED-14 (PEL only)
- Zinc: MR-SED-2, MR-SED-4 (PEL only), MR-SED-10 (PEL only), MR-SED-13, MR-SED-14 (PEL only), MR-B4-B (PEL only).

Hazard quotients (HQs) are presented as the concentration of metal in the sample divided by the benchmark (Table 2). The mean of the HQ for individual metals can also be examined as an indicator of potential risk from exposure to the mixture of metals (Long et al. 1998). The probability of highly toxic responses is relatively low (12%) among samples with mean ERM or PEL quotients less than 0.1, and increases with higher mean quotients.

Samples with mean PEL quotients that exceed 1.0 (Table 2, Figs 14-15) include MR-SED-10, MR-SED-13, MR-SED-14, MR-SED-2, and MR-SED-4. These samples also contain the highest lead concentrations of any samples. No samples exceed the mean ERM quotient (although MR-SED-10 has a mean ERM quotient equal to 1.0).

As noted above, these empirical benchmarks are based on observed toxicity in field-collected sediments that contain various co-occurring contaminants. If the suite of contaminants present at a particular site differs from the suite typically present in the field samples used in the derivation of the benchmarks, the predictive ability of the benchmarks can be reduced. Therefore, these benchmarks are typically used as an indicator of *potential* risk and to identify the need for more direct measures of sediment toxicity (e.g., sediment toxicity tests) at a particular site.

5.2 Acid-Volatile Sulfides and Simultaneously Extracted Metals

The concentrations of AVS and SEM in sediment can be effective predictors of metal bioavailability in sediment and porewater. Within sediments, much or all of the metals can be tied up by sulfides (Ankley et al. 1996; U.S. EPA 2005). The availability of the divalent metals (cadmium, copper, lead, nickel, silver, and zinc) can be estimated by measuring the levels of AVS, SEM, and the fraction of organic carbon (f_{oc}). In this analysis, the AVS, SEM, and f_{oc} data are analyzed using the following guideline:

- The metals are considered unlikely to be bioavailable (and thus unlikely to produce toxicity) if the ratio of (SEM-AVS)/f_{oc} is less than 130 μmol/g_{oc}.
- Toxicity is uncertain when (SEM-AVS)/f_{oc} is between 130 and 3000 μmol/g_{oc}.
- Toxicity is likely when (SEM-AVS)/f_{oc} is greater than 3000 μmol/g_{oc} (U.S. EPA 2005).

The method is used to evaluate whether benthic invertebrates are being exposed to levels of metals that could result in adverse effects (See Figures E-1 and E-2 [Appendix E], reproduced from U.S. EPA 2005 guidance document). Because AVS levels can vary seasonally, EPA guidance (U.S. EPA 2005) recommends that sediment monitoring occur in the months of minimum AVS concentration—typically, November to early May. Therefore, current samples, which were collected in early March, are likely to represent conditions of minimum AVS concentrations, thereby providing a conservative estimate of risk.

Levels of (SEM-AVS)/f_{oc} for Mill River samples ranged from –284 to –5500 μmol/g_{oc} carbon (Table A-1). Levels of (SEM-AVS)/f_{oc} for the reference river samples ranged from –82 to –1465 μmol/g_{oc} carbon (Table A-1). These values are far below 130 μmol/g_{oc}, the level below which metals are considered unlikely to be bioavailable or toxic (Figure 16).

Note that silver is not typically included in the laboratory SEM analysis because of quality control (QC) issues. That is, silver that is added to matrix spike samples precipitates, resulting in QC reports of 0% extraction recovery. However, low levels of silver in these sediment samples would not substantially change the (SEM-AVS)/f_{oc} values or the conclusions related to the SEM-AVS analyses. For example, low molar concentrations of silver, estimated from concentrations of silver in bulk sediment rather than from SEM analyses, are presented in Table A-1.

5.3 Sediment Toxicity Tests

Sediment toxicity tests with the estuarine amphipod, *L. plumulosus*, were conducted according to the standard protocol: *Method for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod* Leptocheirus plumulosus (U.S. EPA 2001). In this test, the reproductive endpoint is more variable than the survival and growth endpoints. To reduce the variability for this endpoint, eight replicates, rather than the standard five replicate samples, were analyzed.

Results of the sediment toxicity test are presented in Table 3 and Appendix B.

5.3.1 Relationship of Sediment Toxicity to Concentrations of Lead in Sediment

Graphs of the concentration of lead in sediment versus survival (%), growth (mg/day), and reproduction (young/survivor) are presented in Figures 17, 18, and 19, respectively. The graphs indicate that concentrations of lead in sediment are not related to sediment toxicity.

High *p* values and low correlation coefficients (r^2) for the relationships presented in these figures indicate that the toxicity measurements (e.g., survival, growth, and reproduction) are not significantly related to the concentration of lead in sediment. Toxicity measurements are also not related to mean ERM-quotients (Figures 20, 21, and 22) or mean PEL-quotients (Figures 23, 24, and 25), values that reflect potential impacts of the full suite of metals present in sediment.

5.3.2 Statistical Analyses

Although data indicate that sediment toxicity is not related to the presence of lead or the suite of metals measured in sediment samples, statistical analyses were conducted to determine whether any samples from the Mill River are significantly different from the laboratory control and reference river samples. The following statistical protocol (described in detail in the Exponent 2008 Work Plan) was developed in consultation with Ms. Florence Fulk of EPA in Cincinnati. For this study, the significance level (i.e., alpha level) of the statistical tests was set to 0.1,

which is the value used previously in the SSI (MCA 2005) at the request of CTDEP. The software program S-Plus® (Insightful) or similar statistical software was used to analyze the data.

To determine which statistical tests to use, the toxicity test data were tested for equal variance and normality. The Levene's test was used to determine whether the data for the groups being compared exhibit equal variance (Table C-1). The Levene's test was selected because it is a robust assessment of the variance regardless of the underlying distribution of the data. The Shapiro-Wilkes test and probability plots were used to determine whether the data are normally distributed (Table C-1). Data that have unequal variance or lack normality were mathematically transformed in accordance with the guidance and re-tested in accordance with the above methods.

If the data had equal variance and were normally distributed, parametric tests were used. Parametric tests are the most statistically powerful methods for detecting a difference when the assumptions of normality and equal variance are met. Below are the steps of the parametric statistical analysis:

1. Perform an ANOVA[1] followed by Dunnett's[2] post-hoc multiple comparison test (alpha = 0.1) for differences between samples from site locations and the laboratory control (Table C-2).
2. Perform an ANOVA followed by Dunnett's post-hoc multiple comparison test (alpha = 0.1) for differences between samples from reference-site locations and the laboratory control (Table C-3).
3. Perform an ANOVA (alpha=0.1) to test for differences between the two reference-site rivers. If differences are identified, Step 4 will be performed with pooled reference samples, as well as for individual reference sites.
4. Perform an ANOVA to test for differences among Site and reference-site samples. Compare each Site sample against the reference-site samples considered as a group using a test of contrast (Table C-4). The significance level for each test will be adjusted to achieve the 0.1 significance level across all tests conducted. This will maintain the significance level of 0.1 used for this study.

If the data do not have equal variance and are not normally distributed, non-parametric tests were used. Below are the steps of the non-parametric statistical analysis:

1. Perform a Kruskal-Wallis followed by Wilcoxon tests (overall alpha = 0.1) for differences between samples from site locations and the laboratory control (Table C-2).

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[1] Analysis of variance

[2] Dunnett's test is most powerful for comparing multiple groups against a single group, such as a laboratory control.

2. Perform a Kruskal-Wallis test followed by a Wilcoxon test (overall alpha = 0.1) for differences between samples from reference-site locations and the laboratory control (Table C-3).

3. Perform a Kruskal-Wallis (alpha=0.1) to test for differences between the two reference-site rivers. If differences are identified, perform Step 4 for pooled samples, as well as for individual reference sites.

4. Perform a Kruskal-Wallis to test for differences among Site and reference-site samples (Table C-4). Compare each Site sample against the reference-site samples considered as a group using a Wilcoxon test. Adjust the significance level for each test for the number of tests conducted, to maintain the significance level of 0.1 used for this study.

Thus, if the data had unequal variance or were not normally distributed, both parametric tests and non-parametric tests were conducted to determine which of the Mill River samples are statistically different, if any, from the laboratory control and reference-site samples. This approach ensures that significant differences do not go undetected due to the lower statistical power of the non-parametric methods. Further, conclusions potentially affected by the unequal variability or lack of normality are confirmed through the non-parametric methods.

5.3.2.1 Survival of Site Samples vs. Reference-Site Samples

Levene's Test indicates that variances were not equal, even after transformation of the data (Table C-1). The Shapiro-Wilkes test indicates that most data are normally distributed after transformation (Table C-1). Because data do not have equal variance, but are normally distributed, results of both parametric and non-parametric comparisons are presented. Survival was not significantly different between reference-site samples; therefore, survival of Site samples is compared to pooled reference-site samples (Table C-4).

- Only one sample (MR-B4-B) had significantly lower survival in comparison to the pooled reference-site samples. However, as discussed in detail in Section 5.3.3, reduced survival in this one sample is not believed to be related to the presence of lead.

5.3.2.2 Growth of Site Samples vs. Reference-Site Samples

Levene's Test indicates that variances were not equal, even after transformation of the data (Table C-1). The Shapiro-Wilkes test indicates that data are normally distributed after transformation (Table C-1). Because data do not have equal variance but are normally distributed, results of both parametric and non-parametric comparisons are presented. Growth was significantly different between the reference sites; therefore, growth of Site samples is compared to pooled reference-site samples, as well as to the separate reference sites (Table C-4). Results are:

- Only one Site sample (MR-SED-10) had significantly lower growth in comparison to the pooled reference site samples.

- Several Site samples (MR-B4-A, MR-B4-B, MR-SED-1, MR-SED-2, MR-SED-10) had significantly lower growth in comparison to only the Patchogue River reference site.
- No Site samples had significantly lower growth in comparison to the Sasco River reference site.

Although growth was significantly different between reference sites, these differences reflect the range of growth in sediments from uncontaminated reference sites. Therefore, only sample MR-SED-10 (853 mg/kg lead) is considered to have reduced growth in comparison to that observed at uncontaminated reference sites.

5.3.2.3 Reproduction of Site Samples vs. Reference-Site Samples

Levene's Test indicates that variances were not equal, even after transformation of the data (Table C-1). The Shapiro-Wilkes test indicates that data are mostly normally distributed after transformation (Table C-1). Because data do not have equal variance, but are generally normally distributed, results of both parametric and non-parametric comparisons are presented. Reproduction was significantly different between the reference sites; therefore, reproduction of Site samples is compared to pooled reference-site samples, as well as to the separate reference sites (Table C-4). Results are:

- Only one Site sample (MR-B4-B) had significantly lower growth in comparison to the pooled reference-site samples.
- Several Site samples (MR-B4-A, MR-B4-B, and MR-SED-2) had significantly lower growth in comparison to only the Patchogue River reference site.
- No Site samples had significantly lower growth in comparison to the Sasco River reference site.

As noted above, although growth was significantly different between reference sites, these differences reflect the range of growth in sediments from uncontaminated reference sites. Therefore, only sample MR-B4-B (91 mg/kg lead) is considered to have reduced growth in comparison to that observed at uncontaminated reference sites. However, as discussed in detail in Section 5.3.3, reduced reproduction in this one sample is not believed to be related to the presence of lead.

5.3.3 Summary of Sediment Toxicity Tests

Although regression analyses indicate that survival, growth, and reproduction of test organisms are not related to concentrations of lead in sediment, performance of certain individual samples was significantly reduced in comparison to the pooled reference samples. Although growth and reproduction for the two reference sites differed significantly from one another, results for both the Patchogue River and Sasco Creek reference sites do represent the full range of test

performance for relatively uncontaminated reference sites to which Site samples should be compared. The current data indicate that:

- Only one sample (MR-B4-B) had significantly reduced survival and reproduction in comparison to the pooled reference-site samples, but the background level of lead in this sample (91 mg/kg) is not likely to be the cause of toxicity.
- Only one sample (MR-SED-10, with 853 mg/kg lead) had significantly reduced growth in comparison to the pooled reference samples.

Reduced survival and reproduction in sample MR-B4-B is not believed to be related to the presence of lead, because:

- The low concentration of lead in sample MR-B4-B (91 mg/kg) is close to background levels and within the range observed at the reference sites.
- Eight Site samples had higher concentrations of lead, but did not have significantly lower survival or reproduction than the reference-site samples.
- SEM/AVS data indicate that lead and other metals in this sample are not present at levels that are toxic to aquatic invertebrates.
- Concentrations of all metals (except Al, for which benchmarks are not available) are below ERM and PEL sediment quality benchmarks that represent the lower limit of the range of contaminant concentrations that are usually associated with adverse biological effects (i.e., the lower limit of the probable-effects range).
- The laboratory notes indicate that, during the course of the study, an orange discoloration was observed on the sediment surface of this sample and others. The effect of this material, which may be related to bacterial growth, is unknown, but it could have affected survival in this sample.
- Sample MR-B4-B was collected from an area close to an outfall from the I-95 highway (Figures 1 and 2), and therefore may be affected by other contaminants.

Note that these results are in agreement with the results of sediment toxicity tests conducted by the U.S. Army Corps of Engineers with sediments that were spiked with lead (USACE 2002, 2003). Those studies found that *L. plumulosus,* though found to be the most sensitive to lead of the four species tested, was not affected significantly by concentrations of lead in sediment as high as 931 mg/kg.

6 Development of Preliminary Remediation Goal

This section describes how the data from this study and the previous SSI are interpreted and used to develop a final PRG that will protect the sustainability of the Mill River benthic community. Remediation goals are based on observed adverse effects that are significantly related to the stressor under consideration. The PRG for the benthic community of the Mill River is defined as a concentration of lead that represents a threshold level for the sustainability of the benthic community. Concentrations of lead below this threshold level are expected to be protective of the sustainability of the benthic community.

6.1 Mill River Preliminary Remediation Goals

Adverse effects *that are significantly related to the concentration of lead in sediment* should be used to establish a PRG for lead in sediment. The results of the present study, as well as two previous studies, the Mill River Ecological Risk Assessment (MCA 2001) and the Supplemental Sediment Investigation (MCA 2005), indicate that concentrations of lead at or below a previously established PRG for the protection of human health (400 mg/kg) are unlikely to result in adverse effects to the community of benthic invertebrates in the Mill River. Results of these studies demonstrate that levels of sulfides in the sediments of the Mill River and reference sites are sufficient to bind lead and other metals, rendering them unavailable to benthic organisms, and the concentration of lead in sediments is not related to standard measures of sediment toxicity.

Results of the SSI study (MCA 2005), but *not* the MRERA (MCA 2001), indicated that one line of evidence among several examined, the number of taxa, was significantly related to the concentration of lead in Mill River sediments. However, the number of taxa in samples with concentrations of lead below 530 mg/kg was *not* significantly different from the reference sites. Therefore, the conclusion of the previous study was that 530 mg/kg was considered to represent a threshold for the sustainability of the benthic community and was selected as the PRG for the protection of the Mill River benthic invertebrate community's sustainability.

This PRG for lead—530 mg/kg—for protection of the benthic community is higher than the PRG for the protection of human health (400 mg/kg). Therefore, the results of the present study and previous studies demonstrate that a PRG of 400 mg/kg is protective of both humans and ecological receptors of the Mill River.

7 References

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Figures

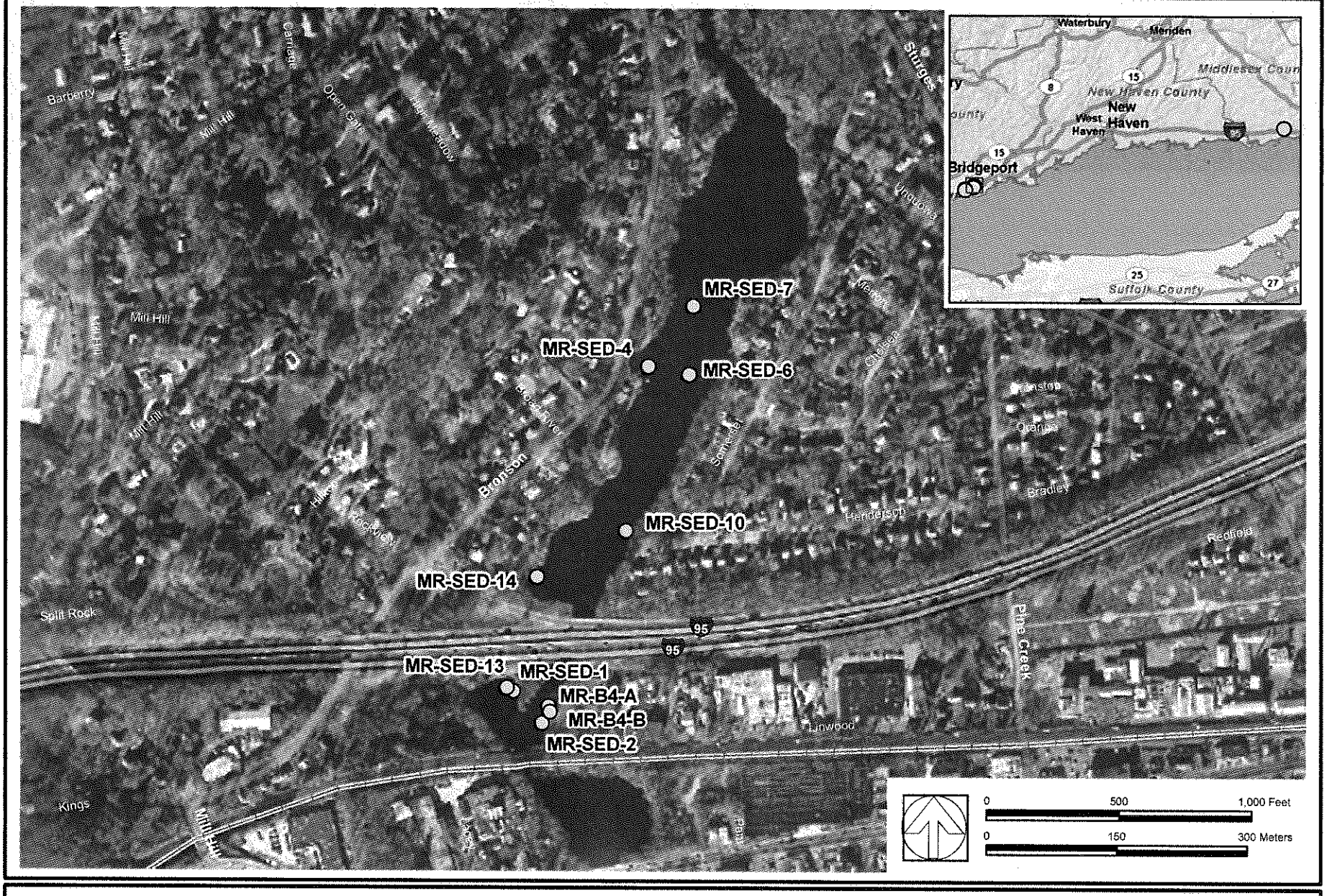

Figure 1. March 2009 sediment toxicity sample locations for Mill River Area I and Area V, Fairfield

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Figure 2. March 2009 sediment toxicity sample locations for Mill River Area I, Fairfield

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June 16, 2009

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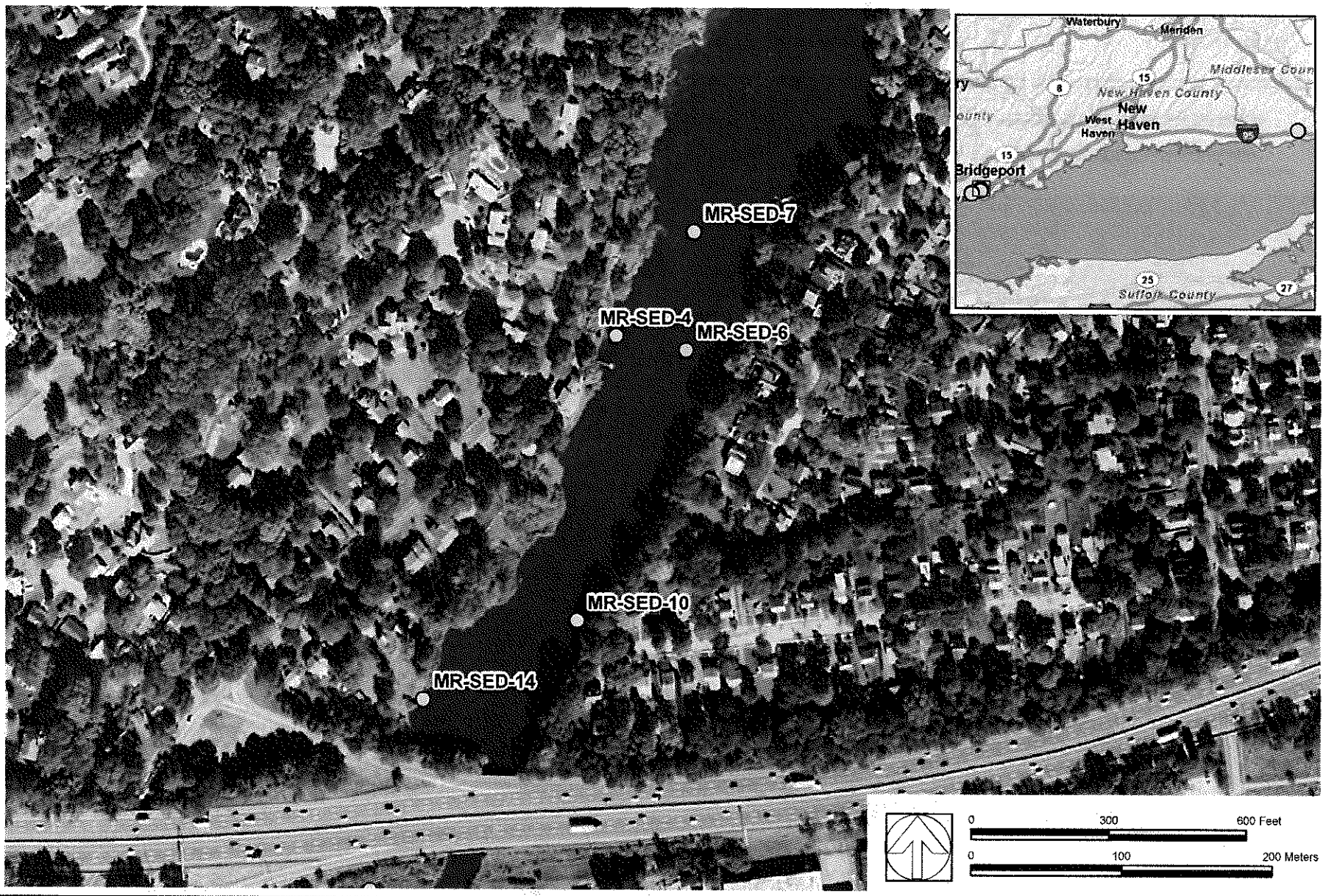

Figure 3. March 2009 sediment toxicity sample locations for Mill River Area V, Fairfield

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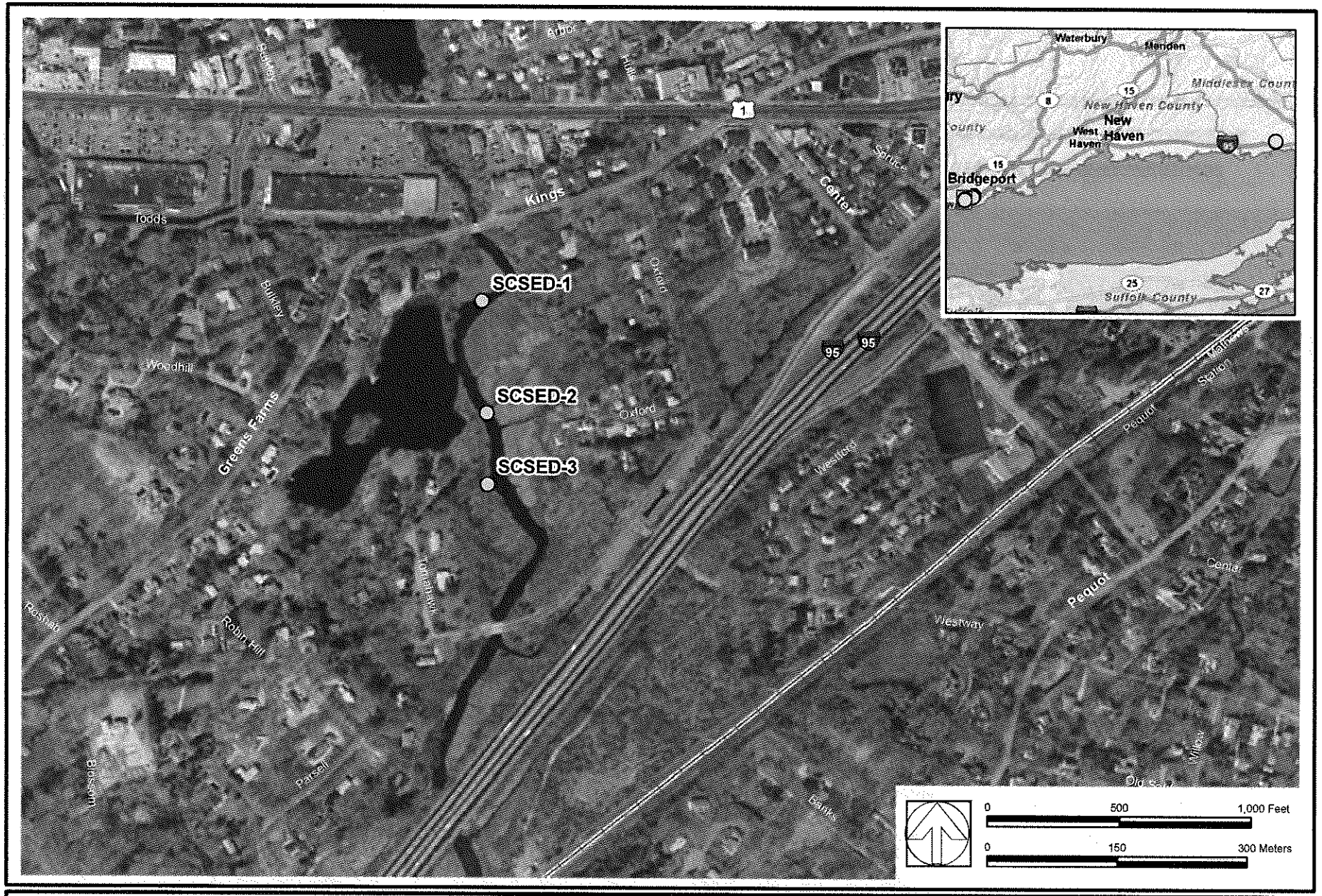

Figure 4. March 2009 sediment toxicity sample locations for Sasco Creek, Westport

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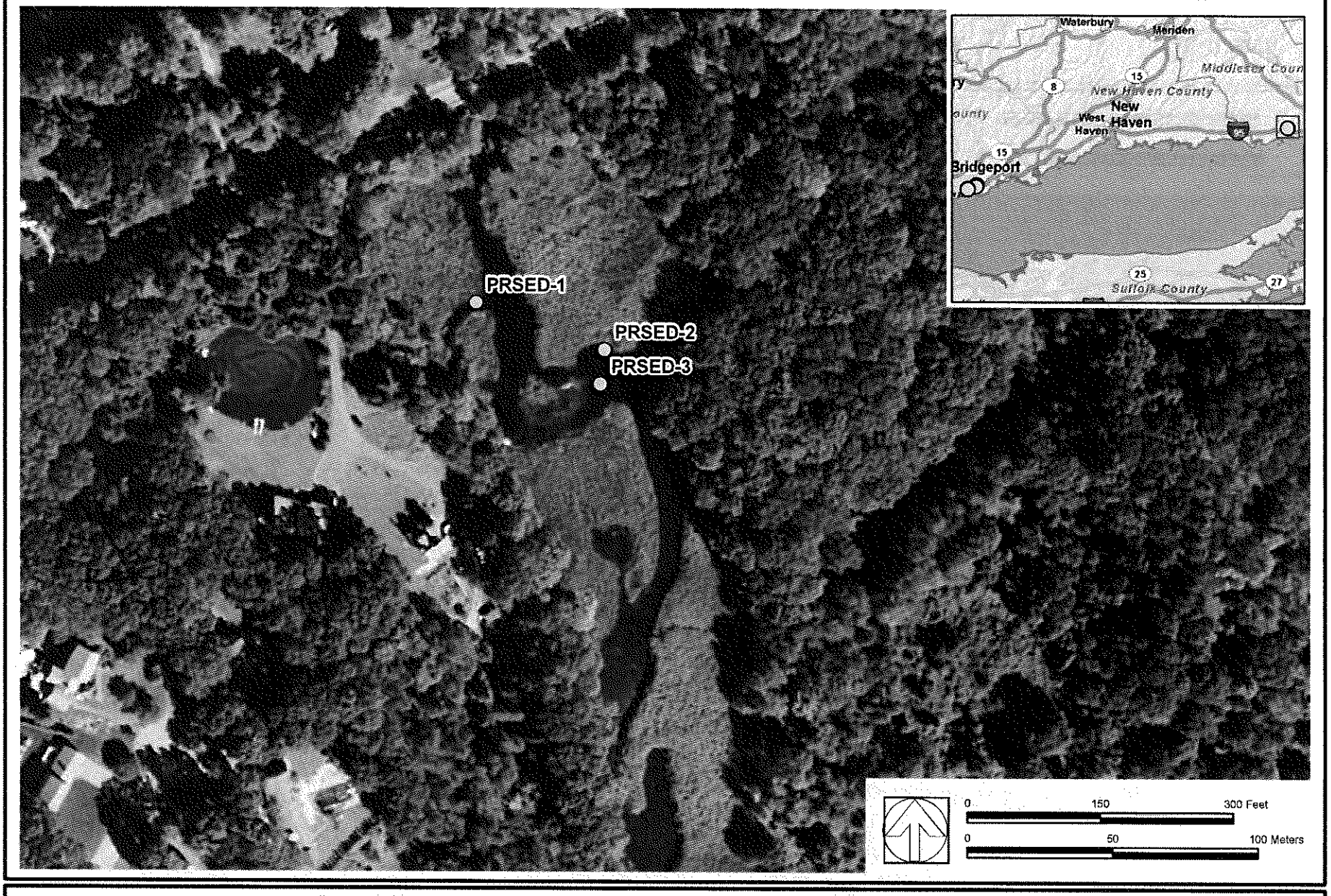

Figure 5. March 2009 sediment toxicity sample locations for Patchogue River, Westbrook

Exponent®

June 16, 2009

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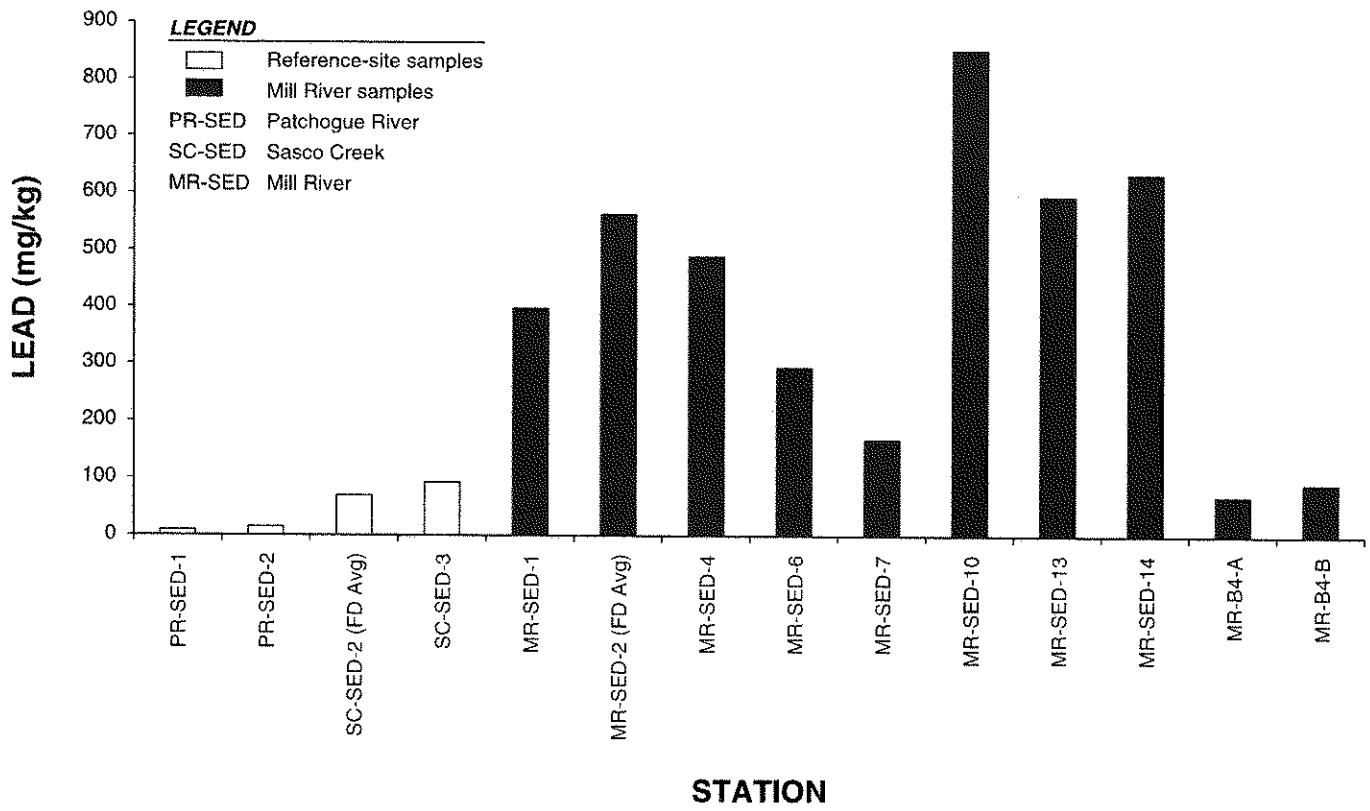


Figure 6. Lead concentrations in sediment

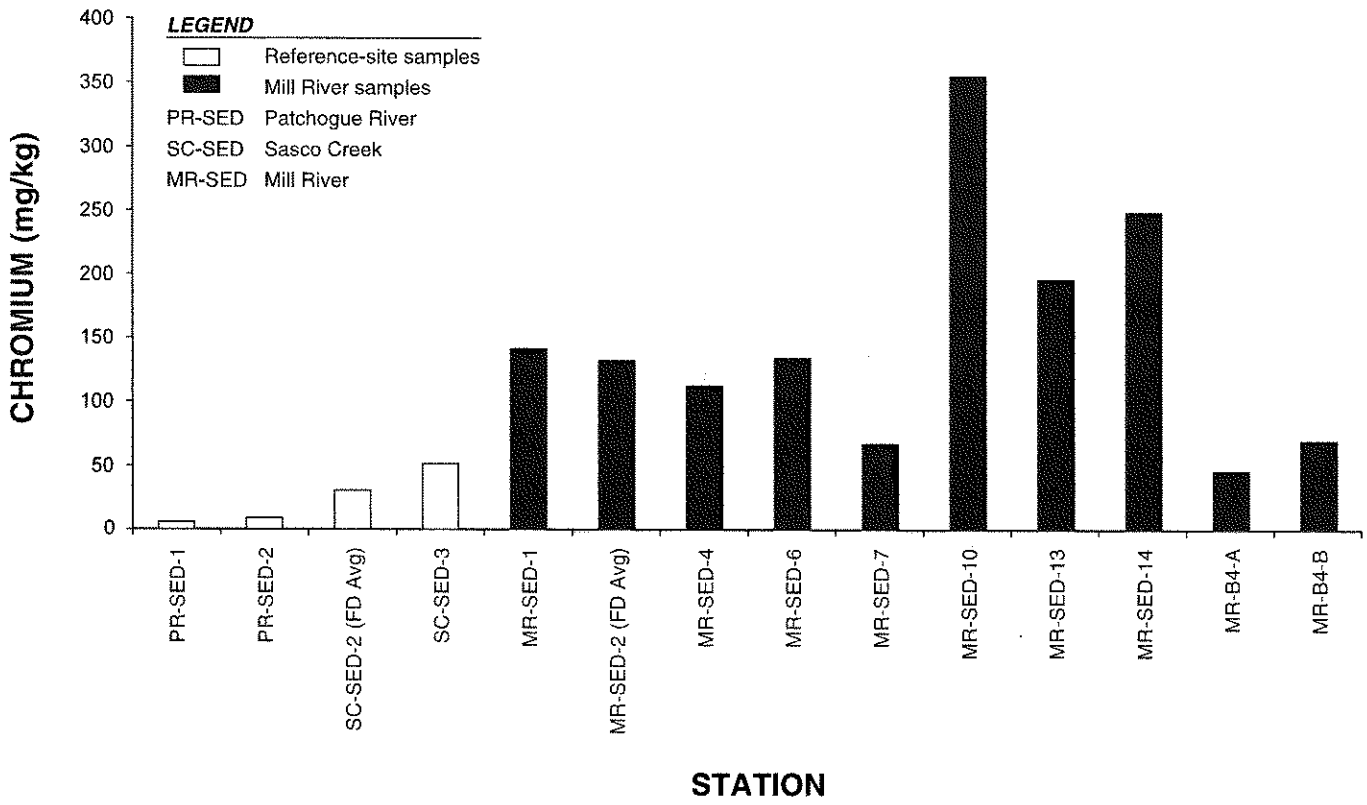


Figure 7. Chromium concentrations in sediment

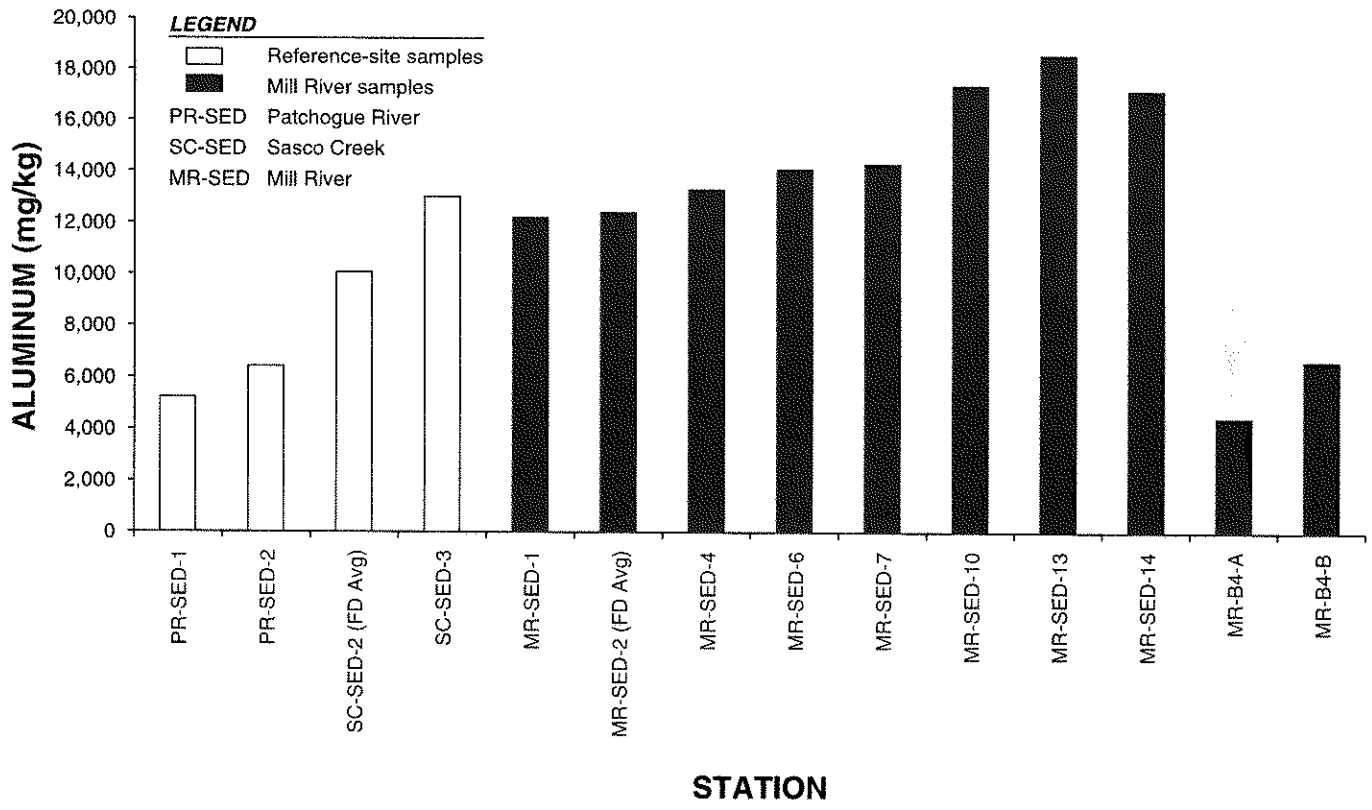


Figure 8. Aluminum concentrations in sediment

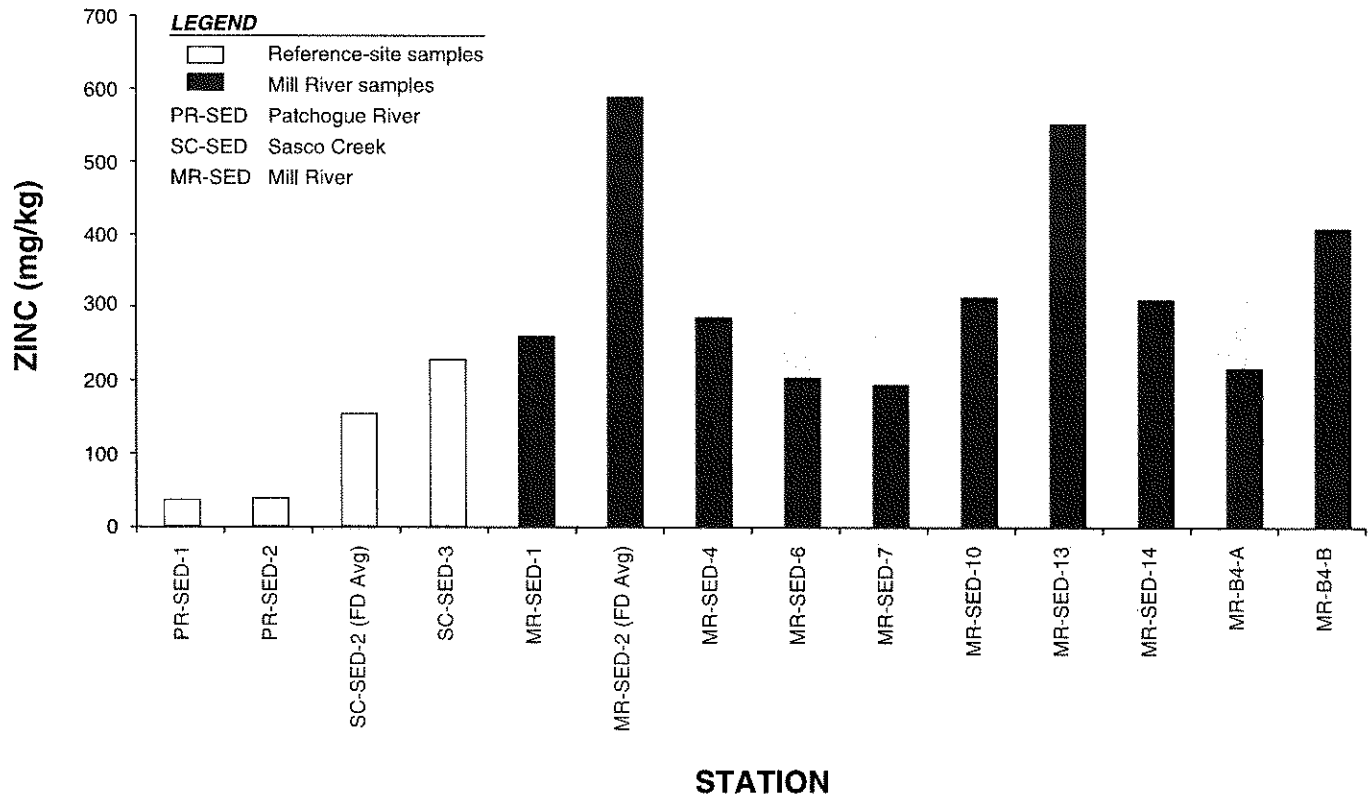


Figure 9. Zinc concentrations in sediment

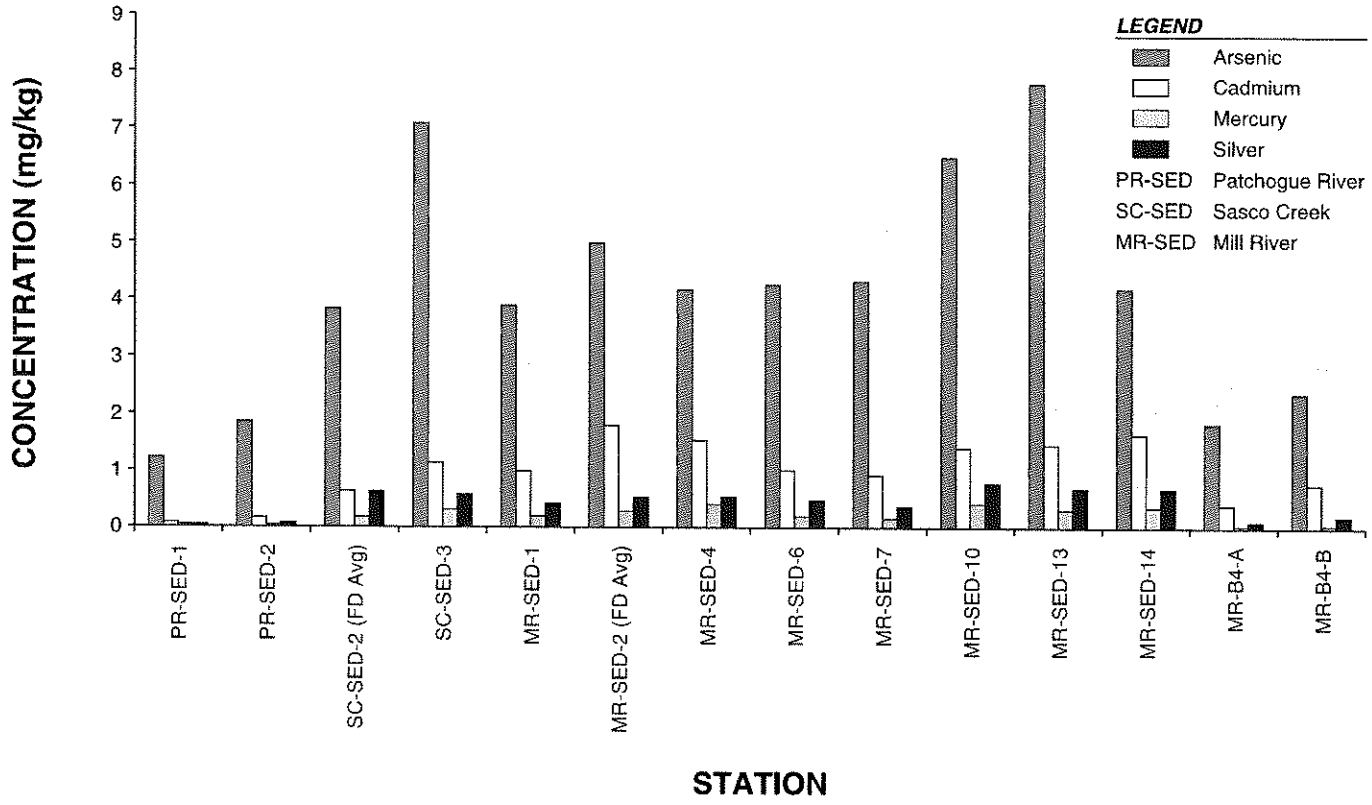


Figure 10. Metals concentrations (As, Cd, Hg, Ag) in sediment

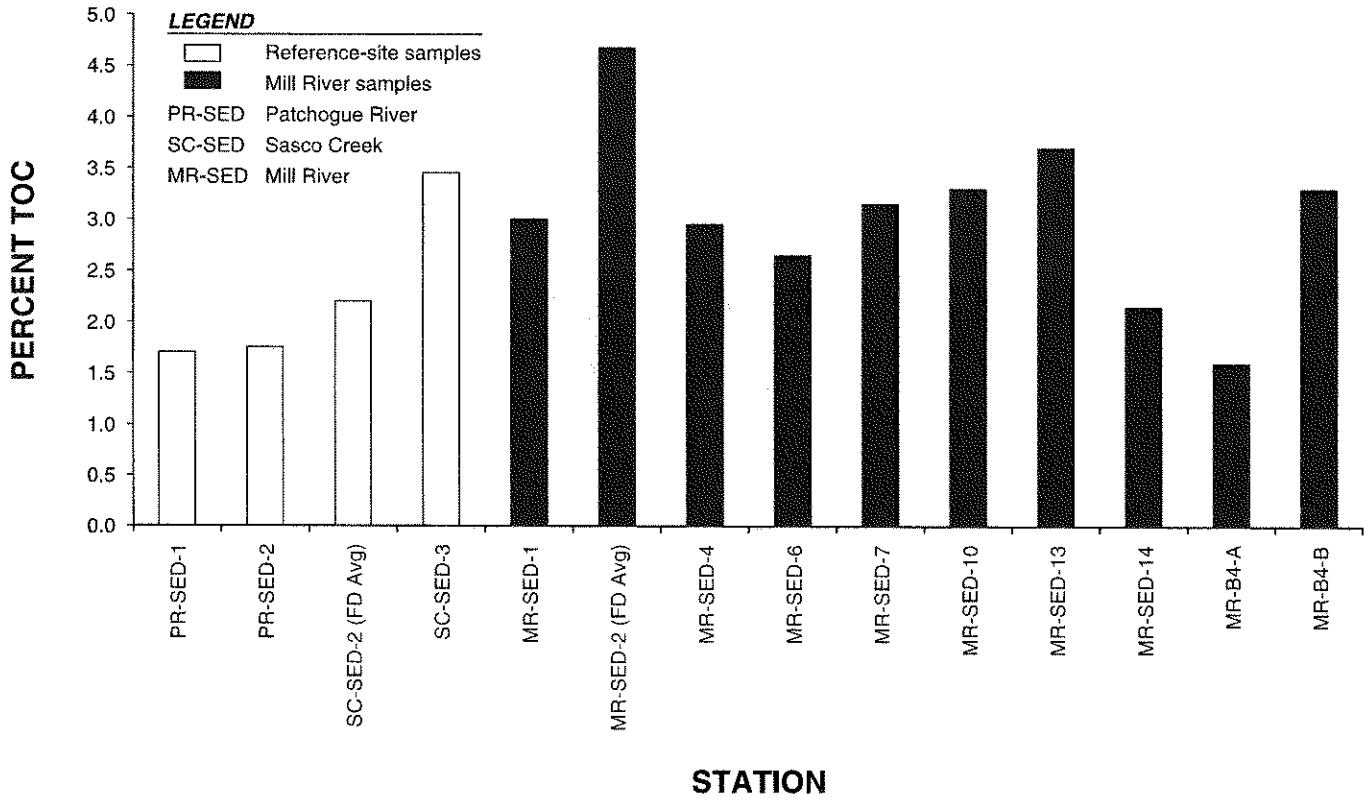


Figure 11. Average percent total organic carbon in sediment

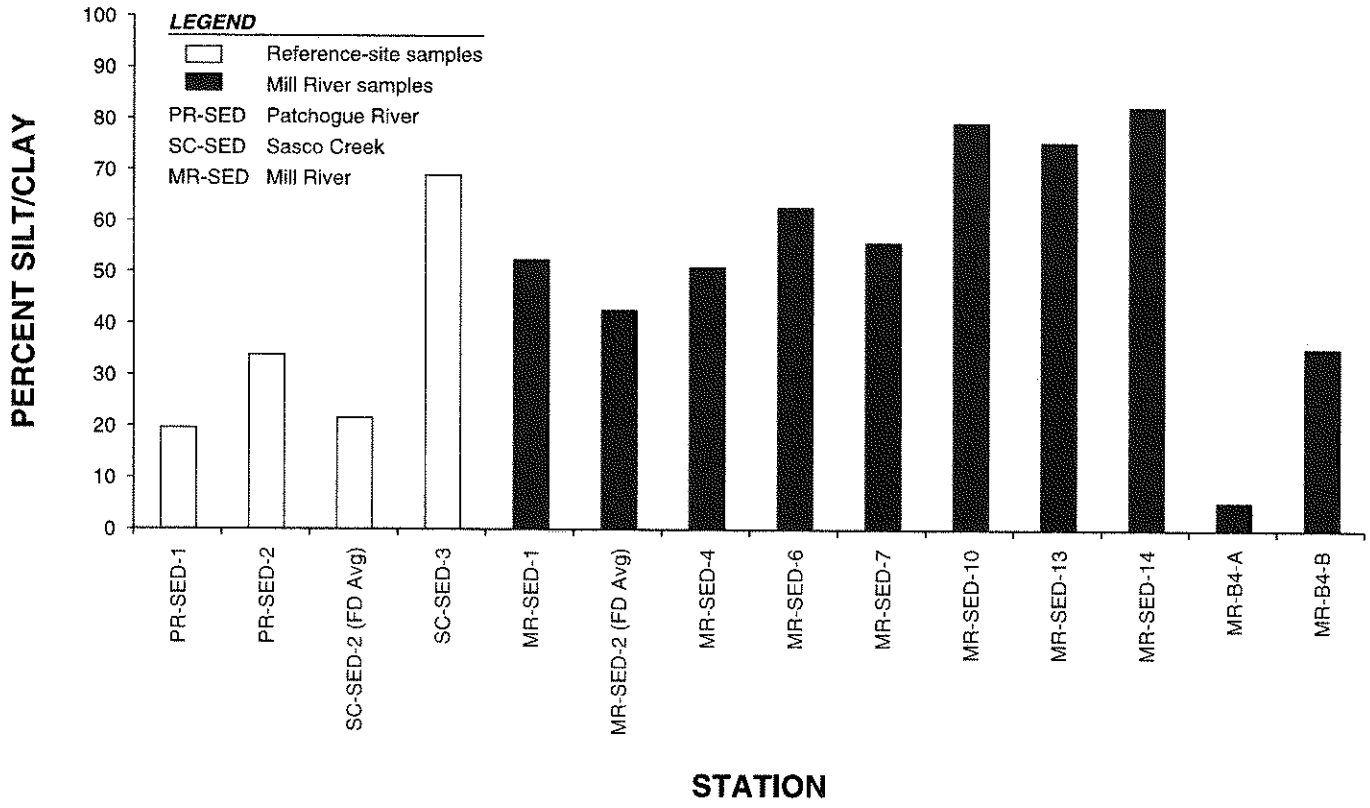


Figure 12. Percent silt/clay in sediment

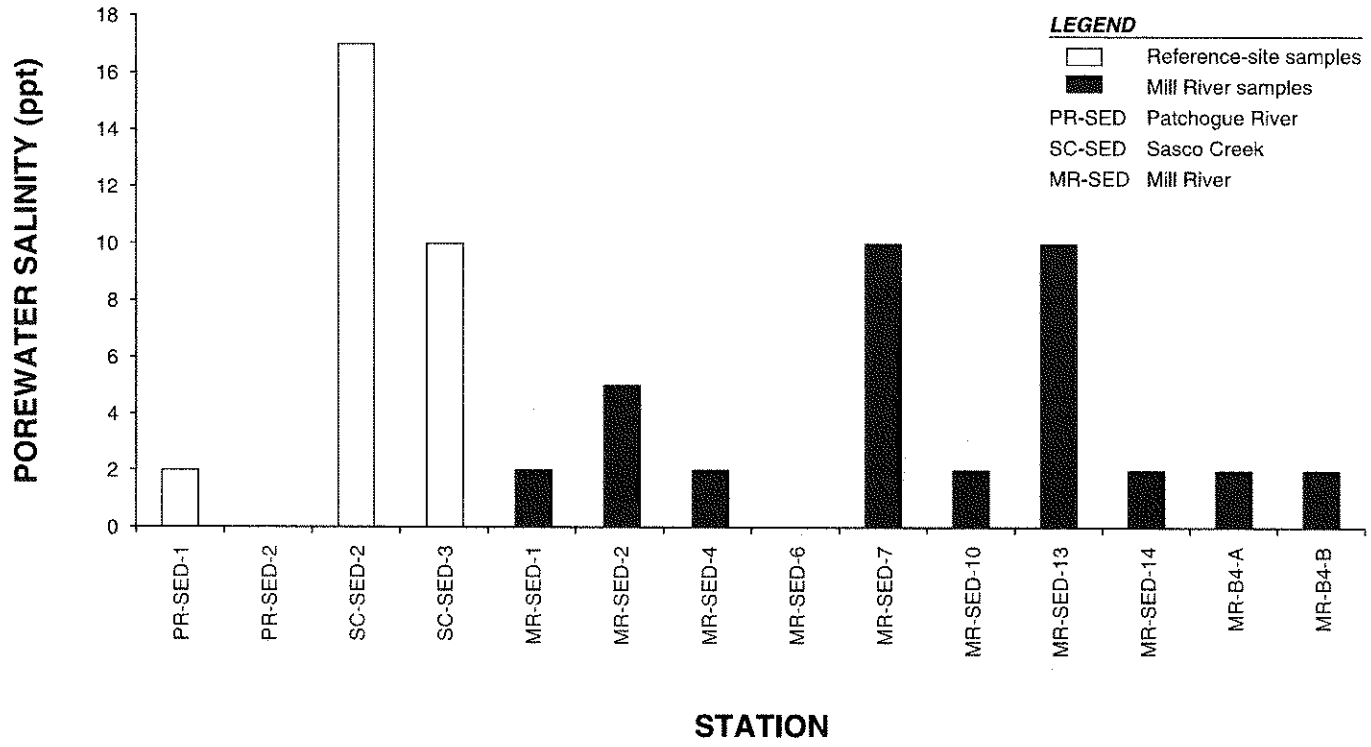


Figure 13. Porewater salinity

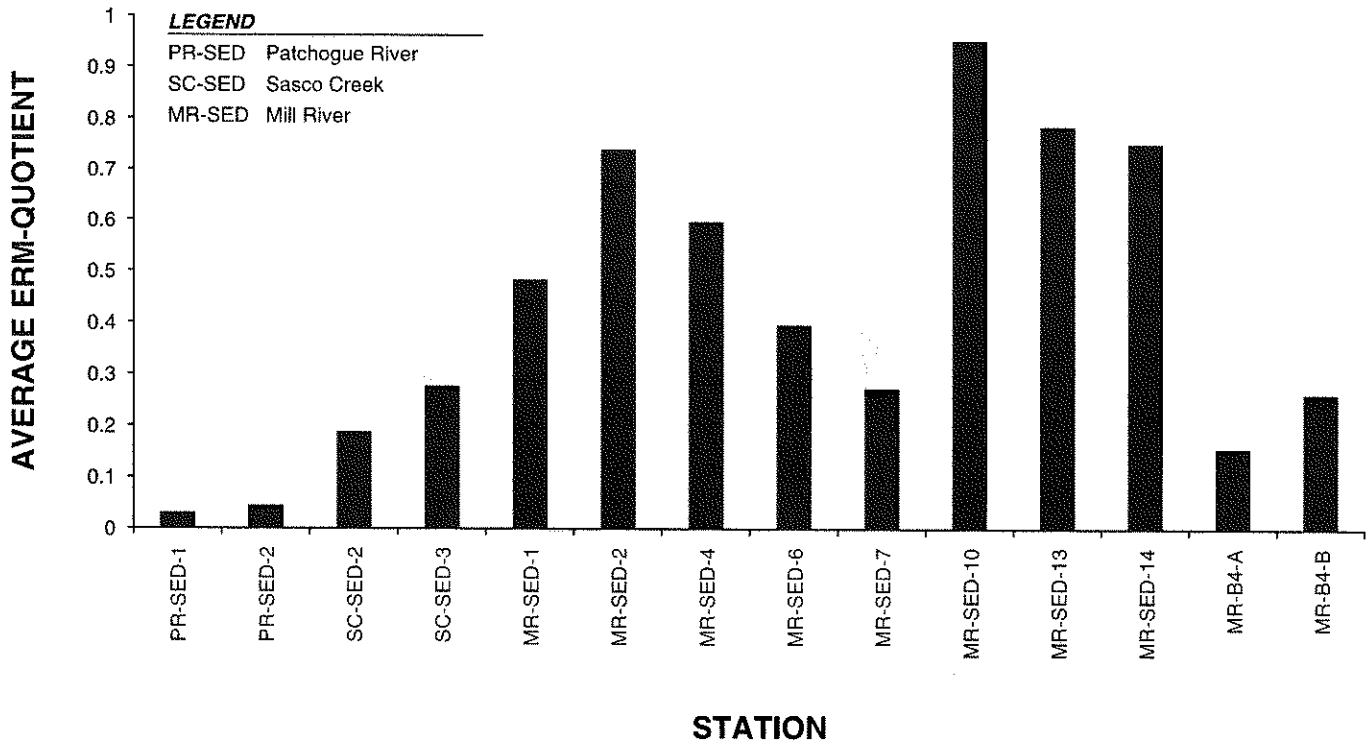


Figure 14. Average ERM-quotient

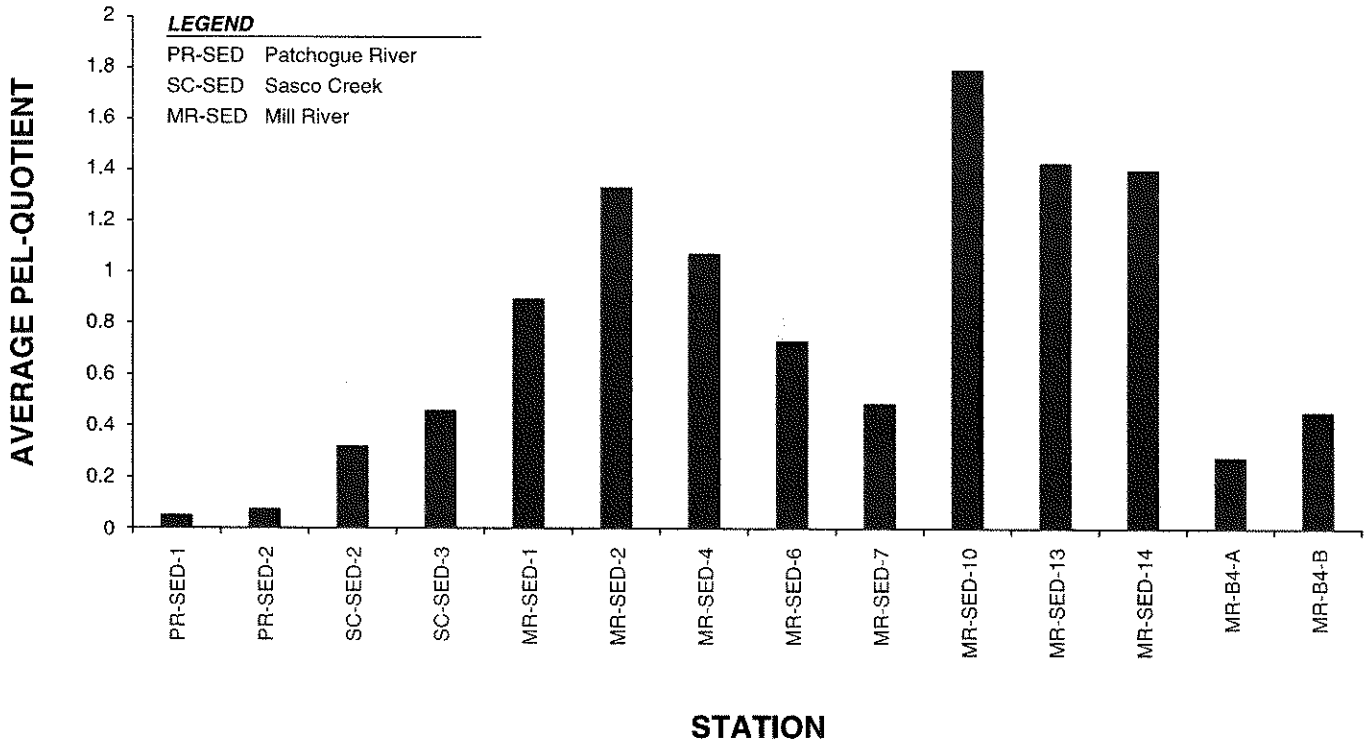


Figure 15. Average PEL-quotient

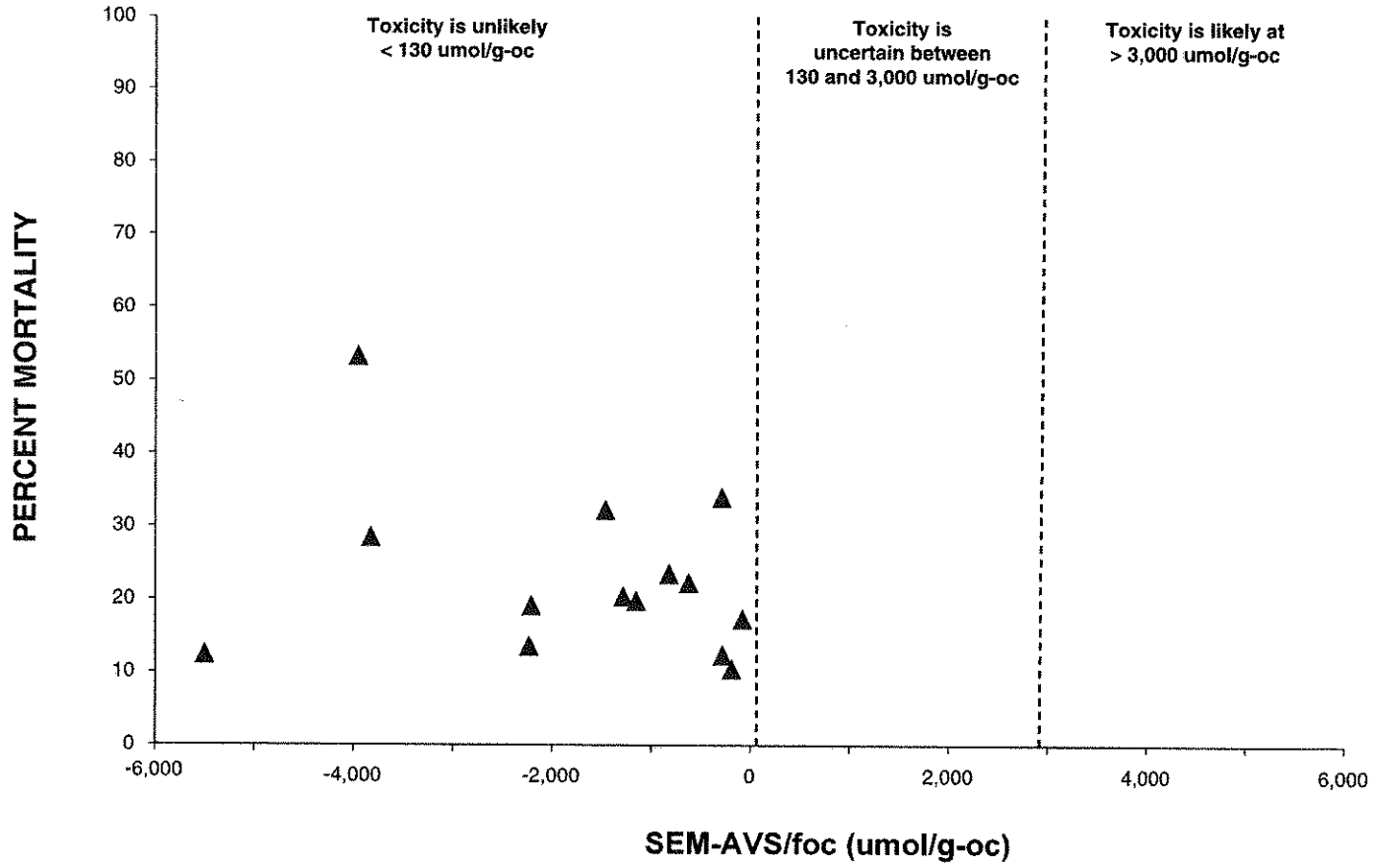
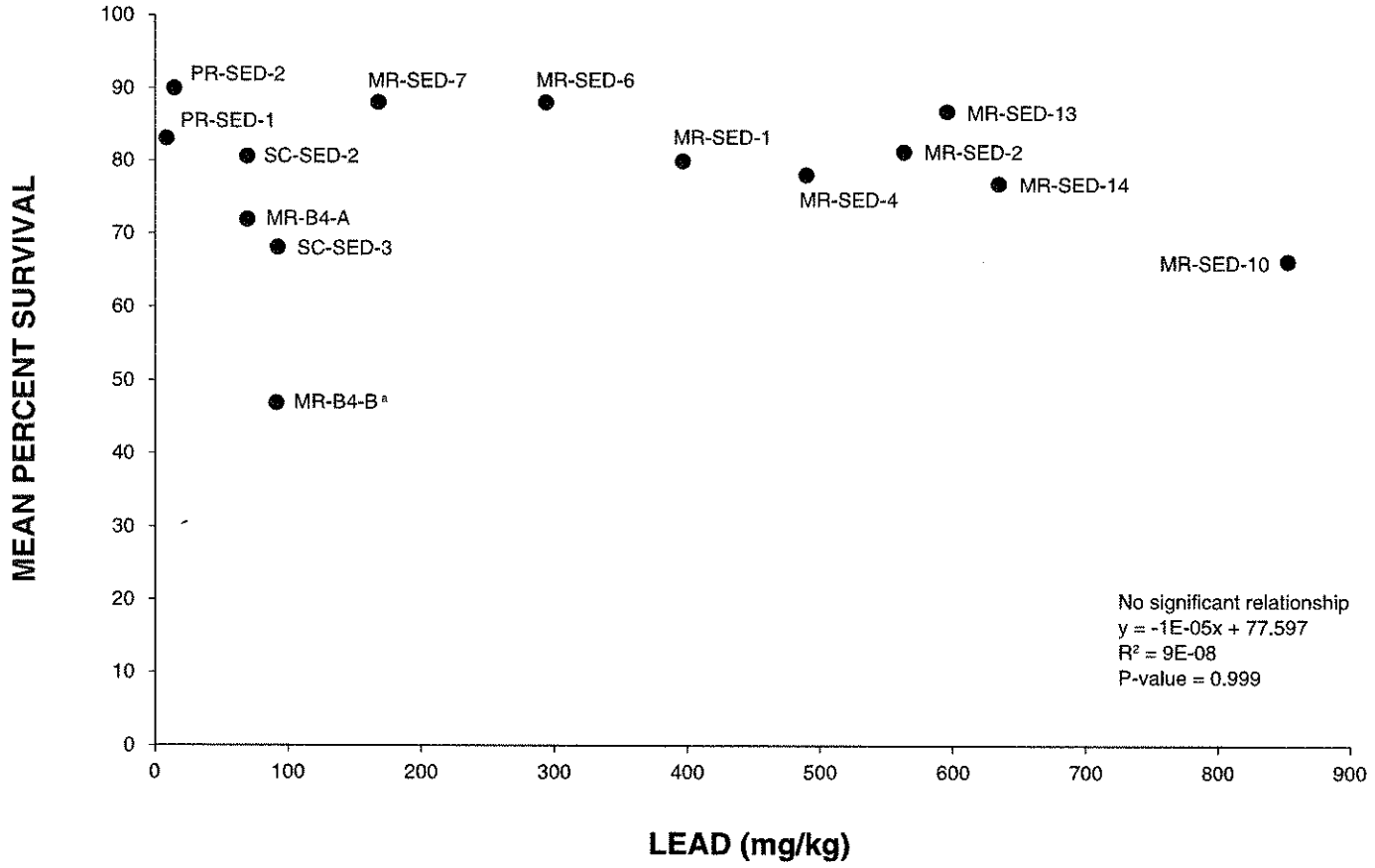


Figure 16. SEM-AVS/f_{oc} versus mortality



[a] Survival significantly lower than pooled reference-site samples

Figure 17. Survival vs. lead (mg/kg) by Alpha Lab

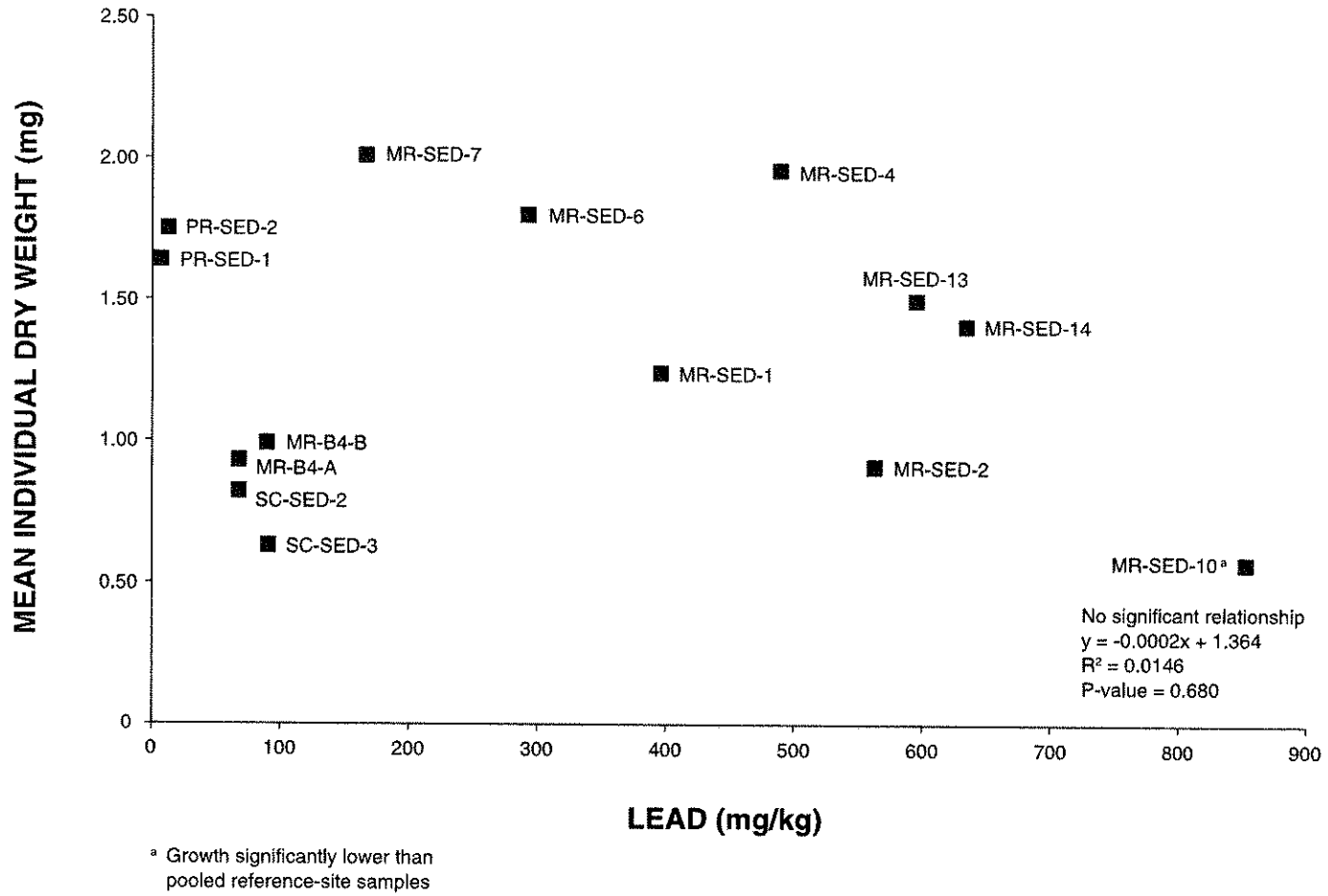
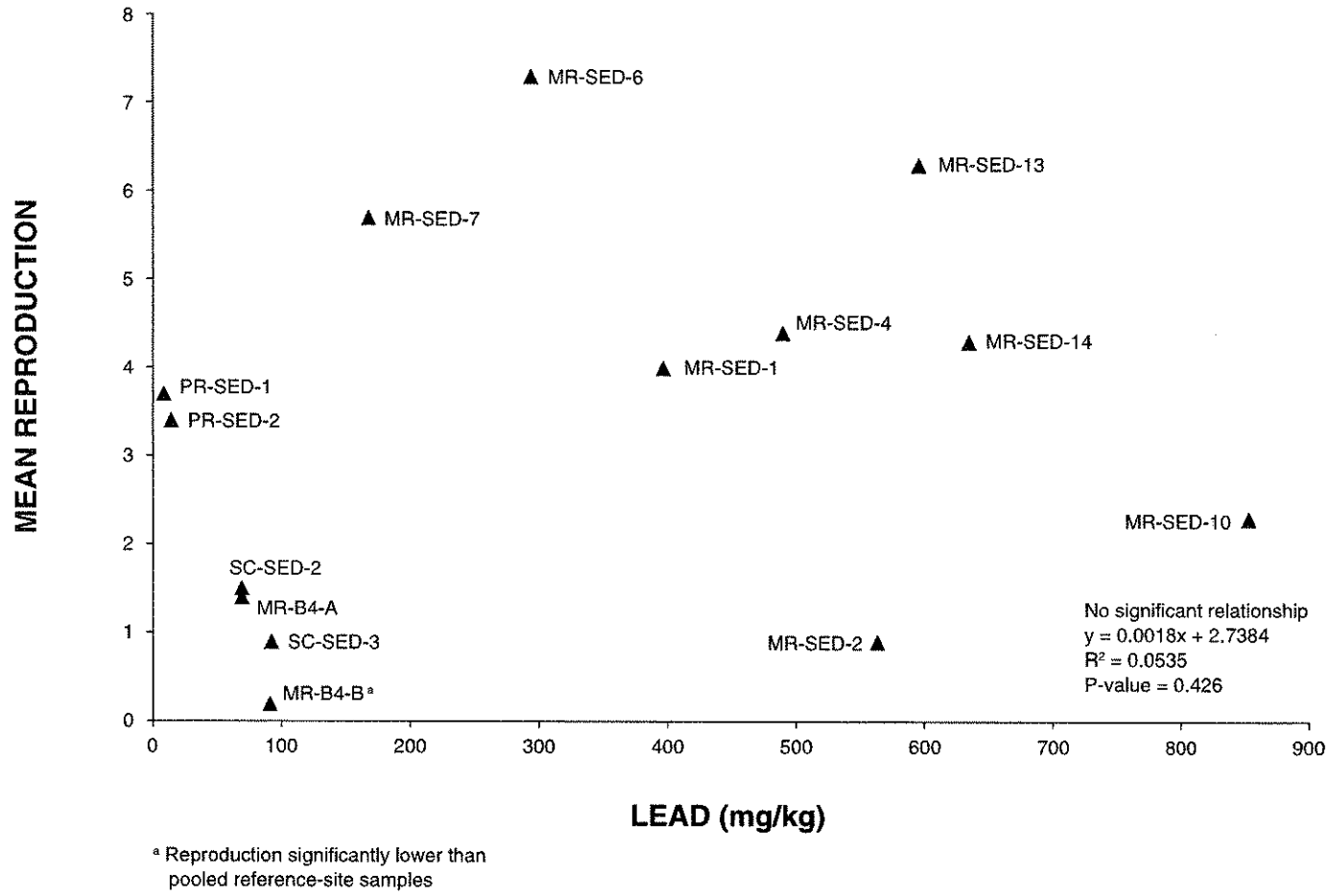


Figure 18. Growth vs. lead (mg/kg) by Alpha Lab



[a] Reproduction significantly lower than pooled reference-site samples

Figure 19. Reproduction vs. lead (mg/kg) by Alpha Lab

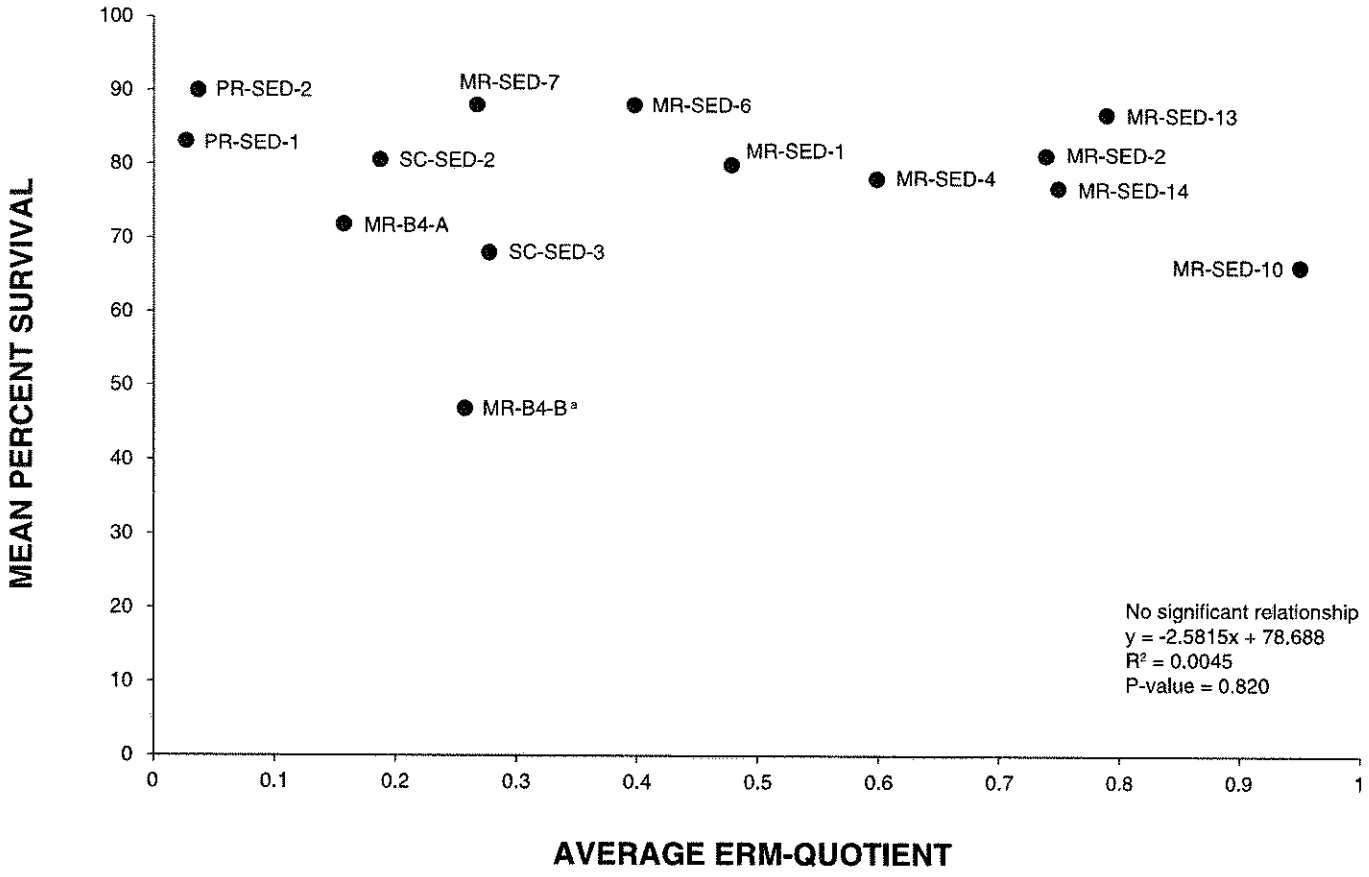


Figure 20. Survival vs. average ERM-quotient

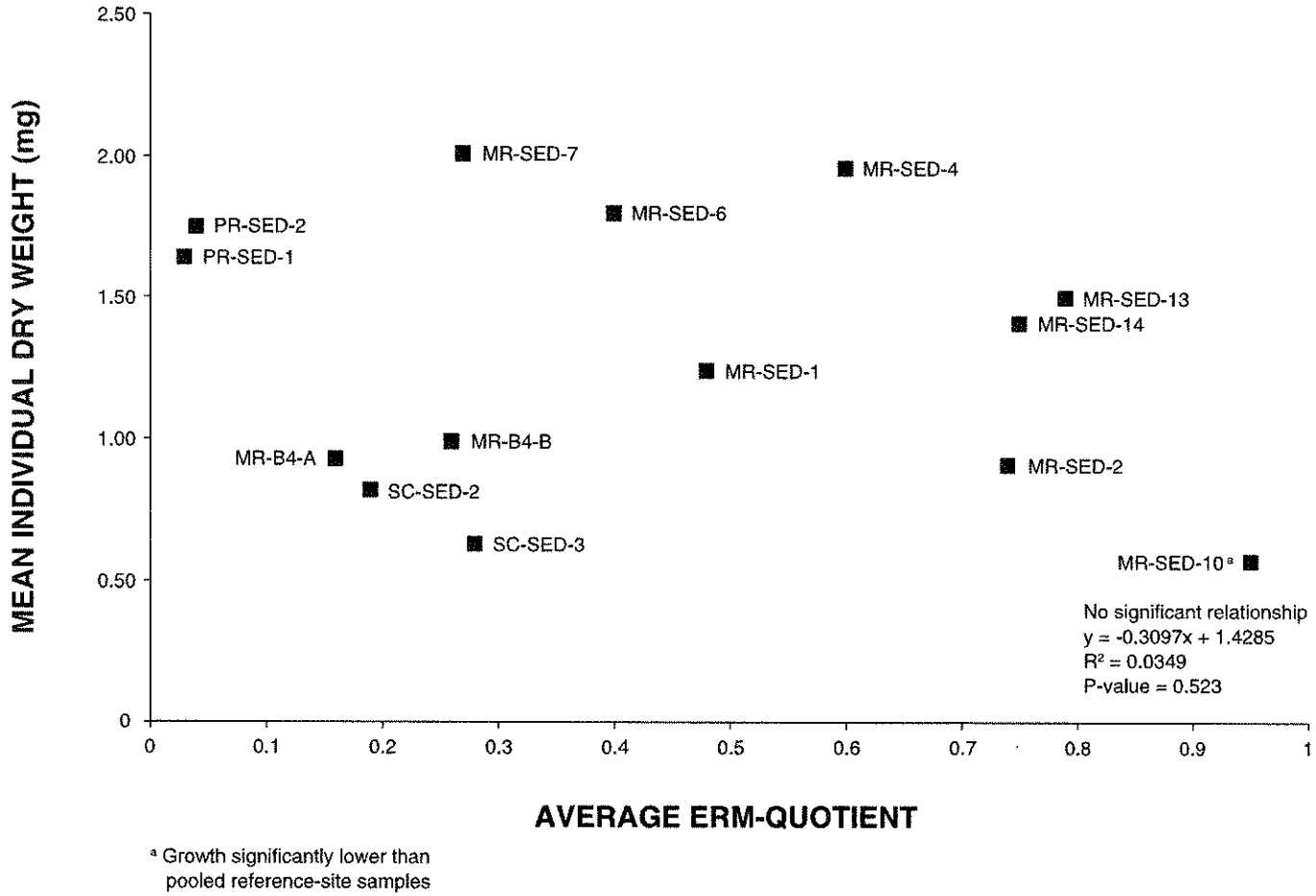
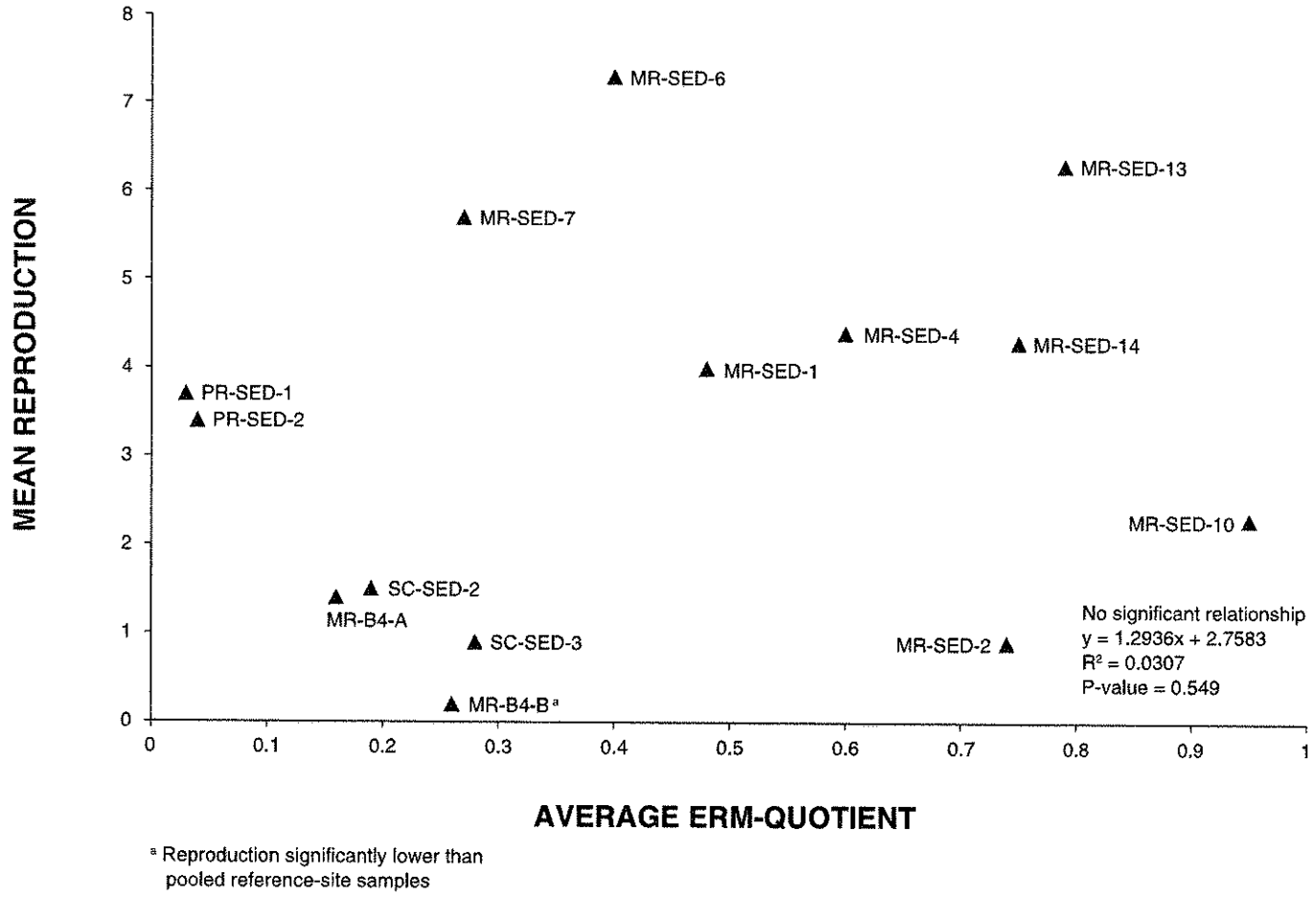
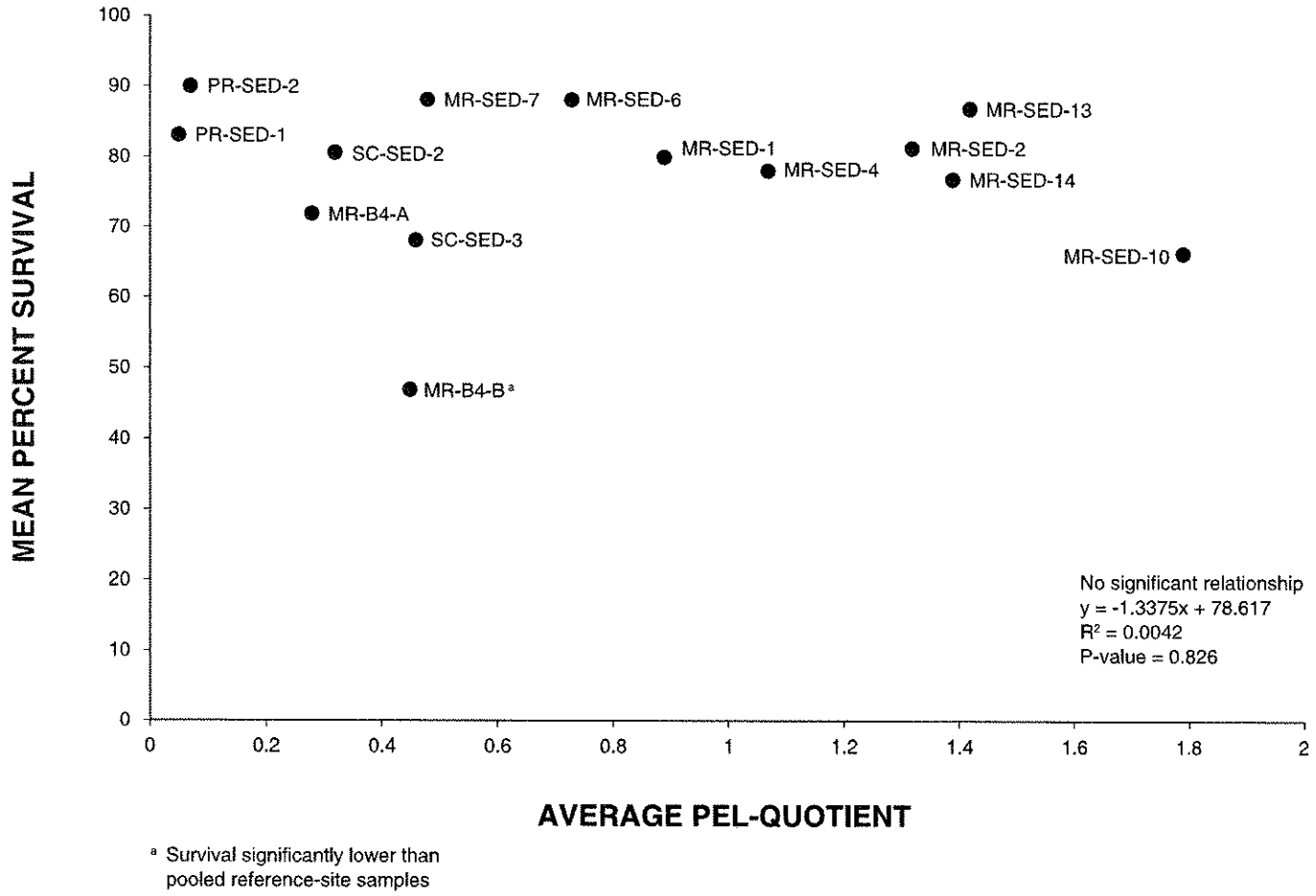


Figure 21. Growth vs. average ERM-quotient



[a] Reproduction significantly lower than pooled reference-site samples

Figure 22. Reproduction vs. average ERM-quotient



[a] Survival significantly lower than pooled reference-site samples

Figure 23. Survival vs. average PEL-quotient

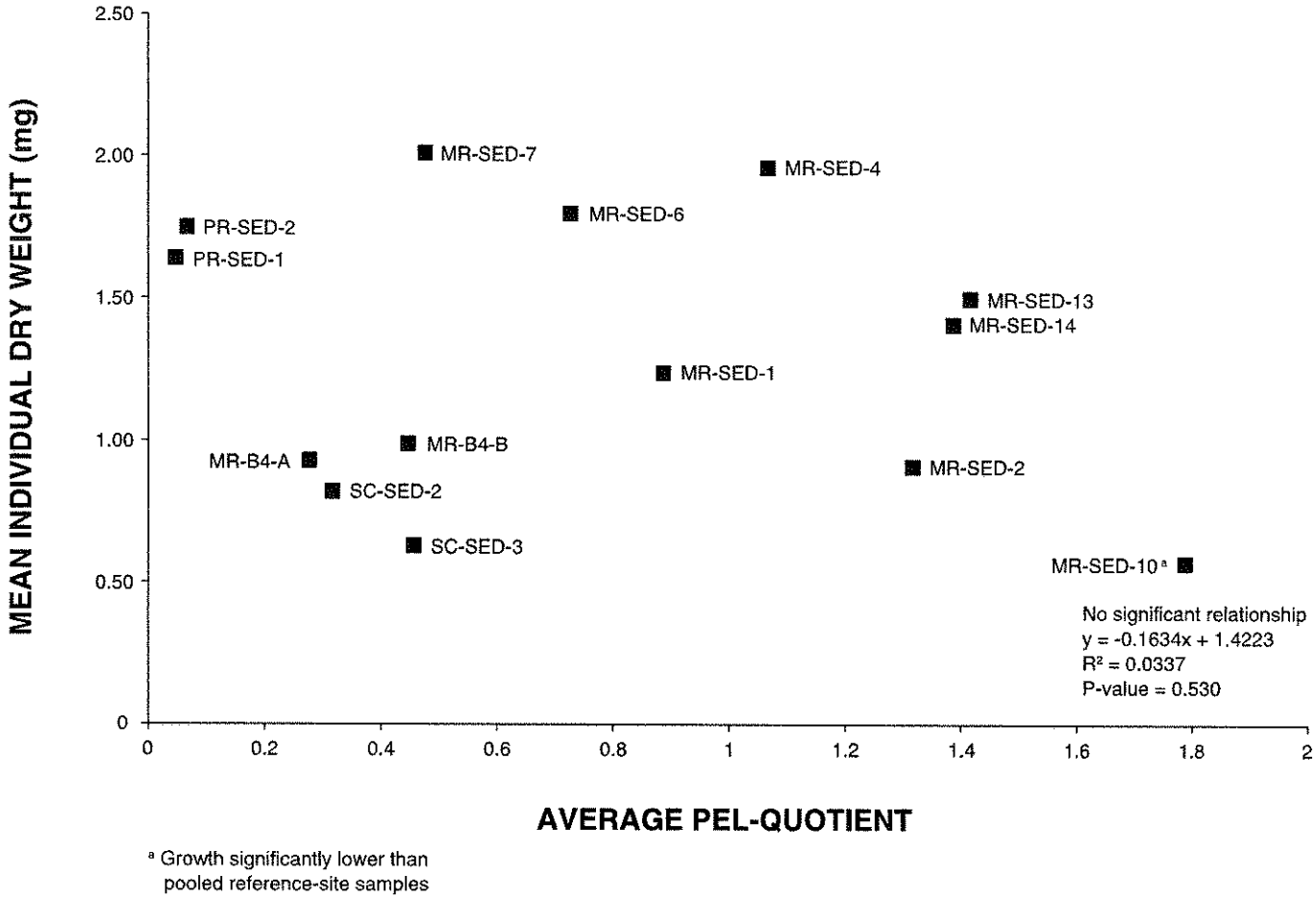
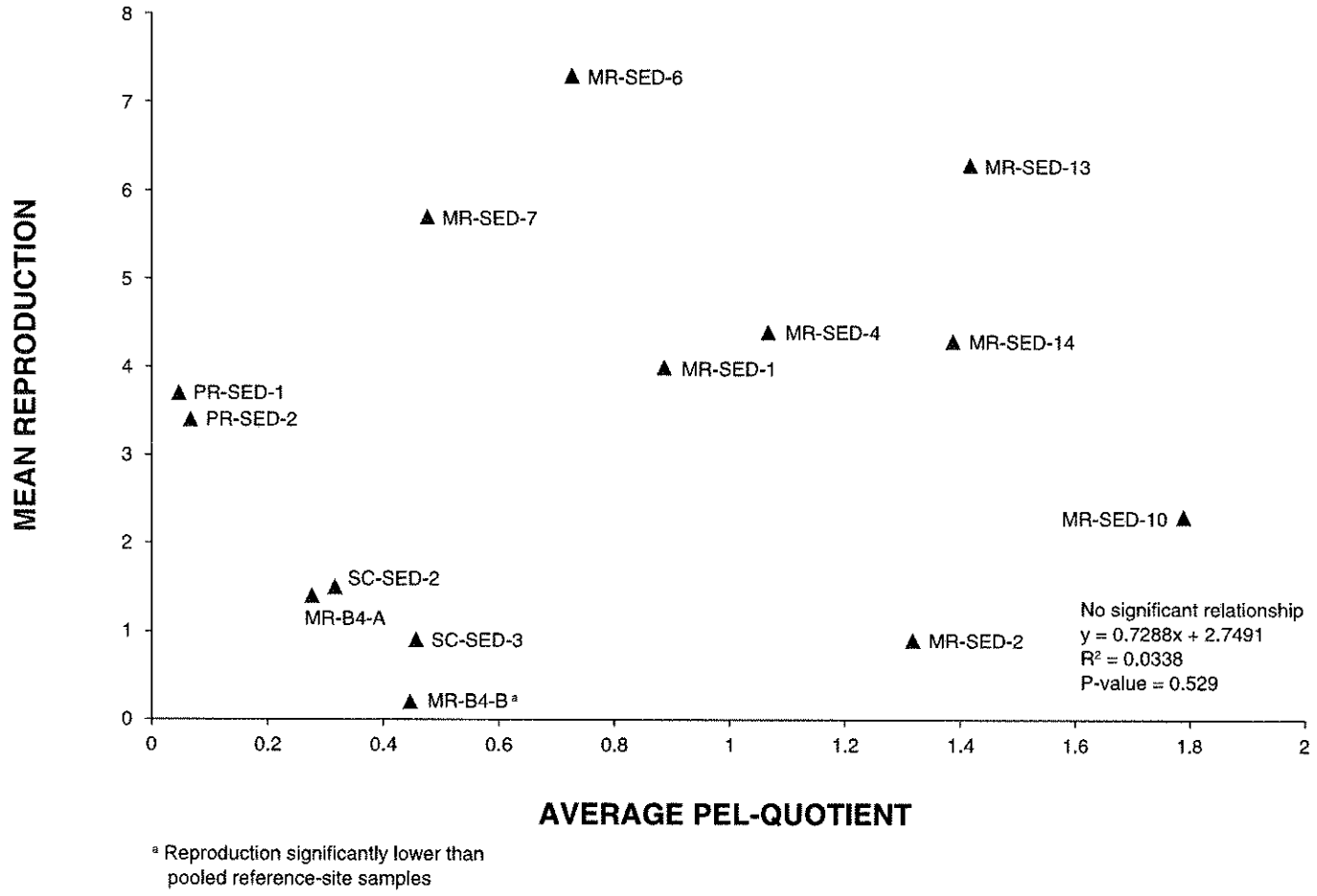


Figure 24. Growth vs. average PEL-quotient



[a] Reproduction significantly lower than pooled reference-site samples

Figure 25. Reproduction vs. average PEL-quotient

Tables

Table 1. Analytical parameters and sample matrix: Mill River sediment investigation, Fairfield, Connecticut

	Mill River	Sasco Creek	Patchogue River
	MR-SED-1, -2, -4, -6, -7, -10, -13, -14, -B4-A, -B4-B	SCSED-2, SCSED-3	PRSED-1, PRSED-2
Metals in Sediment	x	x	x
Aluminum	x	x	x
Arsenic	x	x	x
Cadmium	x	x	x
Chromium (total)	x	x	x
Lead	x	x	x
Mercury	x	x	x
Silver	x	x	x
Zinc	x	x	x
Other Parameters			
SEM-AVS	x	x	x
Grain Size	x	x	x
Total Organic Carbon	x	x	x
Total Percent Solids	x	x	x
Porewater salinity	x	x	x
Sediment Toxicity Tests	x	x	x

Table 2. Comparison of sediment COPCs to ecological risk-based concentrations

			Sample ID:	PRSED-1			PRSED-2		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	5.72	0.04	0.02	9.03	0.06	0.02
Arsenic	mg/kg	41.6	70	1.21	0.03	0.02	1.85	0.04	0.03
Aluminum	mg/kg	NA	NA	5210			6410		
Cadmium	mg/kg	4.21	9.6	0.0775	0.02	0.01	0.159	0.04	0.02
Zinc	mg/kg	271	410	36.1	0.13	0.09	38.6	0.14	0.09
Lead	mg/kg	112	218	8.70	0.08	0.04	14.5	0.13	0.07
Silver	mg/kg	1.77	3.7	0.0353	0.02	0.01	0.0696	0.04	0.02
Mercury	mg/kg	0.696	0.71	0.0182	0.03	0.03	0.0375	0.05	0.05
Avereage Benchmark-Quotient					0.05	0.03		0.07	0.04

Table 2. (cont.)

SAMPLE ID:				SCSED-2 (FD Avg)			SCSED-3		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	30.6	0.2	0.1	51.4	0.3	0.1
Arsenic	mg/kg	41.6	70	3.8	0.1	0.1	7.08	0.2	0.1
Aluminum	mg/kg	NA	NA	10050.0			13000		
Cadmium	mg/kg	4.21	9.6	0.6	0.1	0.1	1.13	0.3	0.1
Zinc	mg/kg	271	410	154.5	0.6	0.4	228	0.8	0.6
Lead	mg/kg	112	218	69.4	0.6	0.3	92.3	0.8	0.4
Silver	mg/kg	1.77	3.7	0.6	0.3	0.2	0.569	0.3	0.2
Mercury	mg/kg	0.696	0.71	0.2	0.2	0.2	0.310	0.4	0.4
Avereage Benchmark-Quotient					0.3	0.2		0.5	0.3

Table 2. (cont.)

SAMPLE ID:				MR-SED-1			MR-SED-2 (FD Avg)		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	141	0.9	0.4	132.0	0.8	0.4
Arsenic	mg/kg	41.6	70	3.89	0.1	0.1	5.0	0.1	0.1
Aluminum	mg/kg	NA	NA	12200			12400.0		
Cadmium	mg/kg	4.21	9.6	0.982	0.2	0.1	1.8	0.4	0.2
Zinc	mg/kg	271	410	260	1.0	0.6	589.0	**2.2**	**1.4**
Lead	mg/kg	112	218	397	**3.5**	**1.8**	563.5	**5.0**	**2.6**
Silver	mg/kg	1.77	3.7	0.417	0.2	0.1	0.5	0.3	0.1
Mercury	mg/kg	0.696	0.71	0.195	0.3	0.3	0.3	0.4	0.4
Avereage Benchmark-Quotient					0.9	0.5		**1.3**	0.7

Table 2. (cont.)

SAMPLE ID:				MR-SED-4			MR-SED-6		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	112	0.7	0.3	134	0.8	0.4
Arsenic	mg/kg	41.6	70	4.17	0.1	0.1	4.26	0.1	0.1
Aluminum	mg/kg	NA	NA	13300			14100		
Cadmium	mg/kg	4.21	9.6	1.53	0.4	0.2	1.00	0.2	0.1
Zinc	mg/kg	271	410	286	**1.1**	0.7	203	0.7	0.5
Lead	mg/kg	112	218	490	**4.4**	**2.2**	294	**2.6**	**1.3**
Silver	mg/kg	1.77	3.7	0.532	0.3	0.1	0.476	0.3	0.1
Mercury	mg/kg	0.696	0.71	0.401	0.6	0.6	0.192	0.3	0.3
Avereage Benchmark-Quotient					**1.1**	0.6		0.7	0.4

Table 2. (cont.)

SAMPLE ID:				MR-SED-7			MR-SED-10		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	67.3	0.4	0.2	355	**2.2**	1.0
Arsenic	mg/kg	41.6	70	4.32	0.1	0.1	6.50	0.2	0.1
Aluminum	mg/kg	NA	NA	14300			17400		
Cadmium	mg/kg	4.21	9.6	0.916	0.2	0.1	1.40	0.3	0.1
Zinc	mg/kg	271	410	194	0.7	0.5	314	**1.2**	0.8
Lead	mg/kg	112	218	168	**1.5**	0.8	853	**7.6**	**3.9**
Silver	mg/kg	1.77	3.7	0.364	0.2	0.1	0.777	0.4	0.2
Mercury	mg/kg	0.696	0.71	0.158	0.2	0.2	0.416	0.6	0.6
Avereage Benchmark-Quotient					0.5	0.3		**1.8**	1.0

Table 2. (cont.)

SAMPLE ID:				MR-SED-13			MR-SED-14		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	196	**1.2**	0.5	249	**1.6**	0.7
Arsenic	mg/kg	41.6	70	7.80	0.2	0.1	4.20	0.1	0.1
Aluminum	mg/kg	NA	NA	18600			17200		
Cadmium	mg/kg	4.21	9.6	1.46	0.3	0.2	1.64	0.4	0.2
Zinc	mg/kg	271	410	553	**2.0**	**1.3**	311	**1.1**	0.8
Lead	mg/kg	112	218	596	**5.3**	**2.7**	635	**5.7**	**2.9**
Silver	mg/kg	1.77	3.7	0.683	0.4	0.2	0.678	0.4	0.2
Mercury	mg/kg	0.696	0.71	0.313	0.4	0.4	0.358	0.5	0.5
Avereage Benchmark-Quotient					**1.4**	0.8		**1.4**	0.8

Table 2. (cont.)

SAMPLE ID:				MR-B4-A			MR-B4-B		
Metals	Units	PEL[a]	ERM[b]		PEL-Quotient	ERM-Quotient		PEL-Quotient	ERM-Quotient
Chromium	mg/kg	160	370	46.5	0.3	0.13	70.0	0.44	0.19
Arsenic	mg/kg	41.6	70	1.83	0.0	0.03	2.37	0.06	0.03
Aluminum	mg/kg	NA	NA	4440			6640		
Cadmium	mg/kg	4.21	9.6	0.400	0.1	0.04	0.753	0.18	0.08
Zinc	mg/kg	271	410	217	0.8	0.53	409	**1.5**	1.0
Lead	mg/kg	112	218	69.4	0.6	0.32	91.2	0.81	0.42
Silver	mg/kg	1.77	3.7	0.104	0.1	0.03	0.192	0.11	0.05
Mercury	mg/kg	0.696	0.71	0.0143	0.0	0.02	0.0449	0.06	0.06
Avereage Benchmark-Quotient					0.28	0.16		0.45	0.26

[a] PEL = Probable effects level. MacDonanald, D.D. 1994. Approach to the assessment of sediment quality in Florida coastal waters. November.

[b] ERM = Effects range median. Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ. Manage. 19:81–97.

Table 3. Sediment toxicity test summary

	Lead Concentration (mg/kg)	Percent Survival		Neonates per Survivor		Dry Weight (mg)	
		Mean	SD	Mean	SD	Mean	SD
Control	NA						
AB	NA	91.9	10.0	4.66	1.91	1.34	0.16
Sequim		84.4	6.8	5.95	1.32	1.41	0.24
Reference							
PRSED-01	8.7	83.1	22.8	3.69	2.03	1.64	0.18
PRSED-02	14.5	90.0	10.7	3.44	1.29	1.75	0.16
SCSED-02	69.4	80.6	17.2	1.53	1.13	0.82	0.52
SCSED-03	92.3	68.1	40.3	0.93	1.27	0.63	0.33
Mill River							
MRB4-A	69.4	71.9	18.1	1.37	2.16 b	0.93	0.28 b
MRB4-B	91.2	46.9	21.7 ab	0.23	0.27 ab	0.99	0.61 b
MRSED-01	397	80.0	12.0	3.98	2.66	1.24	0.33 b
MRSED-02	564	81.3	16.4	0.91	0.93 b	0.91	0.26 b
MRSED-04	490	78.1	23.1	4.37	2.42	1.96	0.17
MRSED-06	294	88.1	10.0	7.31	2.24	1.80	0.12
MRSED-07	168	88.1	8.4	5.68	2.66	2.01	0.34
MRSED-10	853	66.3	29.9	2.30	2.88	0.57	0.40 ab
MRSED-13	596	86.9	21.4	6.34	3.36	1.50	0.64
MRSED-14	635	76.9	20.3	4.27	2.41	1.41	0.57

NA = Not analyzed

Data summary below represents results of non-parametric tests

[a] Mill River sample is signifantly lower than pooled reference sites

[b] Mill River sample is significantly lower than Patchogue River reference site

[c] Mill River sample is significantly lower than Sasco River reference site

Appendix A

Analytical Data

Table A-1. Sediment data

Sample ID		MR-SED-1	MR-SED-2	MR-SED-2-DUP	MR-SED-4	MR-SED-6
Sampling Date		3/9/2009	3/9/2009	3/9/2009	3/10/2009	3/10/2009
Lab Sample ID	Units	0903118-06	0903118-02	0903118-14	0903118-03	0903118-04
Metals						
Chromium	mg/kg	141	127	137	112	134
Arsenic	mg/kg	3.89	5.09	4.89	4.17	4.26
Aluminum	mg/kg	12,200	11,700	13,100	13,300	14,100
Cadmium	mg/kg	0.982	1.89	1.69	1.53	1.00
Zinc	mg/kg	260	599	579	286	203
Lead	mg/kg	397	552	575	490	294
Silver	mg/kg	0.417	0.504	0.545	0.532	0.476
Mercury	mg/kg	0.195 *J*	0.285 *J*	0.277 *J*	0.401 *J*	0.192 *J*
Inorganics						
Solids, Percent	%	91	96	94	94	98
AVS/SEM						
SEM/AVS	ratio	0.112	0.0690		0.196	0.303
Sulfide	µmol/g	43.6 *J*	111 *J*		23.0 *J*	10.8 *J*
Copper	µmol/g	0.313 *J*	0.275 *J*		0.252 *J*	0.357 *J*
Cadmium	µmol/g	0.00893	0.0125		0.0108	0.00822
Nickel	µmol/g	0.0921 *J*	0.105		0.0804 *J*	0.0674
Lead	µmol/g	1.78	1.76		1.53	1.01
Zinc	µmol/g	2.80	5.48		2.70	1.83
Silver (estimated from bulk concentration)	µmol/g	0.00387	0.00467		0.00493	0.00441
(SEM-AVS)/foc	µmol/g-oc	-1448	-2127		-775	-404
Inorganics						
Total Organic Carbon (Run 1)	%	3.0	6.0	3.9	2.7	2.8
Total Organic Carbon (Run 2)	%	3.0	4.4	4.4	3.2	2.5
Average TOC (use for project decisions)	%	3.0	5.2	4.2	3.0	2.7
Grain Size Analysis						
% Cobbles	%	0.0	0.0	0.0	0.0	0.0
% Coarse Gravel	%	0.0	0.0	0.0	0.0	0.0
% Fine Gravel	%	0.4	1.1	1.0	0.4	0.0
% Gravel	%	0.4	1.1	1.0	0.4	0.0
% Coarse Sand	%	1.5	1.8	2.0	4.2	0.1
% Fine Sand	%	32.2	46.1	46.3	29.1	34.6
% Medium Sand	%	13.6	7.9	8.8	15.4	2.6
% Sand	%	47.3	55.8	57.1	48.7	37.3
% Silt	%	42.8	36.4	35.0	39.3	54.6
% Clay	%	9.5	6.7	6.9	11.6	8.1

Table A-1. (cont.)

Sample ID		MR-SED-7	MR-SED-10	MR-SED-13	MR-SED-14	MR-B4-A	MR-B4-B
Sampling Date		3/10/2009	3/9/2009	3/9/2009	3/9/2009	3/11/2009	3/11/2009
Lab Sample ID	Units	0903118-15	0903118-01	0903118-05	0903118-16	0903118-09	0903118-08
Metals							
Chromium	mg/kg	67.3	355	196	249	46.5	70.0
Arsenic	mg/kg	4.32	6.50	7.80	4.20	1.83	2.37
Aluminum	mg/kg	14,300	17,400	18,600	17,200	4,440	6,640
Cadmium	mg/kg	0.916	1.40	1.46	1.64	0.400	0.753
Zinc	mg/kg	194	314	553	311	217	409
Lead	mg/kg	168	853	596	635	69.4	91.2
Silver	mg/kg	0.364	0.777	0.683	0.678	0.104	0.192
Mercury	mg/kg	0.158 *J*	0.416 *J*	0.313 *J*	0.358 *J*	0.0143 *J*	0.0449 *J*
Inorganics							
Solids, Percent	%	86	97	94	96	100	100
AVS/SEM							
SEM/AVS	ratio	0.0156	0.384	0.0826	0.207	0.0439	0.0324
Sulfide	µmol/g	176 *J*	15.8 *J*	90.1 *J*	22.4 *J*	64.1 *J*	135 *J*
Copper	µmol/g	0.192 *J*	0.495 *J*	0.280 *J*	0.230 *J*	0.231 *J*	0.162 *J*
Cadmium	µmol/g	0.00701	0.0101	0.0108	0.0113	0.00255	0.00449
Nickel	µmol/g	0.137	0.0809 *J*	0.271	0.0736 *J*	0.191	0.101
Lead	µmol/g	0.645	2.93	1.85	1.74	0.223	0.284
Zinc	µmol/g	1.76	2.65	5.08	2.64	2.17	3.82
Silver (estimated from bulk concentration)	µmol/g	0.00337	0.00720	0.00633	0.00629	0.00096	0.00178
(SEM-AVS)/foc	µmol/g-oc	-5585	-473	-2428	-1037	-4003	-4087
Inorganics							
Total Organic Carbon (Run 1)	%	2.9	3.0	3.4	1.9	1.6	3.1
Total Organic Carbon (Run 2)	%	3.4	3.6	4.0	2.4	1.6	3.5
Average TOC (use for project decisions)	%	3.2	3.3	3.7	2.2	1.6	3.3
Grain Size Analysis							
% Cobbles	%	0.0	0.0	0.0	0.0	0.0	0.0
% Coarse Gravel	%	0.0	0.0	0.0	0.0	0.0	0.0
% Fine Gravel	%	0.0	0.0	0.0	0.0	0.0	0.3
% Gravel	%	0.0	0.0	0.0	0.0	0.0	0.3
% Coarse Sand	%	0.2	0.4	0.0	0.3	1.4	0.9
% Fine Sand	%	41.3	16.4	18.8	14.1	76.5	58.5
% Medium Sand	%	2.7	3.9	5.7	3.1	17.2	4.9
% Sand	%	44.2	20.7	24.5	17.5	95.1	64.3
% Silt	%	42.8	66.3	62.7	71.4	4.1	28.4
% Clay	%	13.0	13.0	12.8	11.1	1.3	7.0

Table A-1. (cont.)

Sample ID		SC-SED-2	SC-SED-2-DUP	SC-SED-3	PR-SED-1	PR-SED-2
Sampling Date		3/10/2009	3/10/2009	3/10/2009	3/11/2009	3/11/2009
Lab Sample ID	Units	0903118-12	0903118-13	0903118-07	0903118-10	0903118-11
Metals						
Chromium	mg/kg	30.6	30.6	51.4	5.72	9.03
Arsenic	mg/kg	4.04	3.61	7.08	1.21	1.85
Aluminum	mg/kg	10,000	10,100	13,000	5,210	6,410
Cadmium	mg/kg	0.666	0.591	1.13	0.0775	0.159
Zinc	mg/kg	162	147	228	36.1	38.6
Lead	mg/kg	72.2	66.5	92.3	8.70	14.5
Silver	mg/kg	0.531	0.704	0.569	0.0353	0.0696
Mercury	mg/kg	0.171 *J*	0.172 *J*	0.310 *J*	0.0182 *J*	0.0375 *J*
Inorganics						
Solids, Percent	%	99	99	100	100	98
AVS/SEM						
SEM/AVS	ratio	0.0509		0.0493	0.196	0.117
Sulfide	µmol/g	26.8 *J*		53.2 *J*	1.76 *J*	3.81 *J*
Copper	µmol/g	0.134 *J*		0.142 *J*	0.0510 *J*	0.0700 *J*
Cadmium	µmol/g	0.00387		0.00859	0.00058 *U*	0.00112 *J*
Nickel	µmol/g	0.0370 *U*		0.0558 *J*	0.0222 *U*	0.0343 *U*
Lead	µmol/g	0.173		0.317	0.0305	0.0499
Zinc	µmol/g	1.05		2.15	0.263	0.325
Silver (estimated from bulk concentration)	µmol/g	0.00492	0.00653	0.00527	0.00033	0.00065
(SEM-AVS)/foc	µmol/g-oc	-1164	0	-1539	-103	-217
Inorganics						
Total Organic Carbon (Run 1)	%	2.4	2.1	3.4	1.9	1.8
Total Organic Carbon (Run 2)	%	2.2	2.1	3.5	1.5	1.7
Average TOC (use for project decisions)	%	2.3	2.1	3.5	1.7	1.8
Grain Size Analysis						
% Cobbles	%	0.0	0.0	0.0	0.0	0.0
% Coarse Gravel	%	0.0	0.0	0.0	0.0	0.0
% Fine Gravel	%	1.8	0.0	0.0	0.1	0.2
% Gravel	%	1.8	0.0	0.0	0.1	0.2
% Coarse Sand	%	2.2	0.7	1.8	0.9	1.4
% Fine Sand	%	72.1	61.4	19.8	72.9	54.0
% Medium Sand	%	12.7	6.0	9.5	6.5	10.6
% Sand	%	87.0	68.1	31.1	80.3	66.0
% Silt	%	9.7	24.8	57.6	16.6	29.0
% Clay	%	1.5	7.1	11.3	3.0	4.8

Notes: *J* - Result is an estimated value.
U - Analyte was not detected. Value is the sample-specific reporting limit (RL).

Table A-2. Surface water data

Station ID	Temperature (C)	Specific Conductivity (uS/cm)	Conductivity (uS/cm)	DOsat (%)	DO (mg/L)	pH	ORP (mV)	Salinity (ppt)	Notes
MR-B-4	5.78	440	279	94.8	11.85	7.93	84.8	<2	
MR-B-4A	5.78	440	279	94.8	11.85	7.93	84.8	<2	
MR-F-14	5.60	241	151	98.3	12.35	7.37	108.1	<2	
MR-SED-1	6.27	1180	758	113.5	13.98	8.82	10.7	<2	
MR-SED-10	6.07	194	124	112	13.91	5.50	207.7	<2	
MR-SED-11	6.36	192	123	116.7	14.39	7.08	190.7	<2	
MR-SED-12	4.89	254	157	87.7	11.22	6.76	733.6	<2	
MR-SED-13	6.27	1180	758	113.5	13.98	8.82	10.7	<2	
MR-SED-14	6.21	427	274	111.4	13.77	4.96	222.1	<2	
MR-SED-15	4.89	236	146	90.2	11.54	-3.84	1154.2	<2	a
MR-SED-2	6.21	386	247	113.3	14.01	6.42	148	<2	
MR-SED-3	6.14	327	209	115.2	14.28	5.85	181	<2	
MR-SED-4	5.02	245	152	90.6	11.56	2.61	881.6	<2	a
MR-SED-5	5.02	245	152	90.6	11.56	2.61	881.6	<2	a
MR-SED-6	4.87	232	143	91.4	11.71	-0.12	1022.3	<2	a
MR-SED-7	5.04	245	152	91.4	11.65	-0.36	1035	<2	a
MR-SED-8	5.18	248	154	91.3	11.59	0.08	963.6	<2	a
MR-SED-9	6.07	218	139	110.4	13.71	4.79	238.2	<2	a
PRSED-1	5.09	90	56	101.4	12.91	8.02	103.1	<2	
PRSED-2	5.19	120	75	97.3	12.36	7.18	121.6	<2	
PRSED-3	5.19	120	75	97.3	12.36	7.18	121.6	<2	
SCSED-1	4.96	16042	9901	100.4	12.06	3.30	487.9	15.6	a
SCSED-2	5.14	13375	8303	96.1	11.62	2.20	501.3	12.8	a
SCSED-3	5.46	5640	3535	100.5	12.44	-2.44	597.2	5.0	a

Notes:
Salinity calculated from conductivity and temperature using calculator on: http://www.fivecreeks.org/monitor/sal.html
(a) Field notes indicate pH reading at sample location was not reliable

Appendix B

Sediment Toxicity Test Report

Project Report

Evaluation of Mill River Chronic Sediment Toxicity with *Leptocheirus plumulosus*

Prepared for:

Exponent, Inc.

Prepared by:

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Table of Contents

1. Mill River Study Summary

1.1 Test sediment receipt and handling

Sediments were shipped overnight via Federal Express and arrived at the Engineer Research and Development Center on 13 March 2009. Sediment temperature upon arrival ranged from 1 to 3°C (Appendix B). Sediments evaluated, using the nomenclature provided on the chain of custody sheet, included SC-SED-2, SC-SED-3, PR-SED-1, PR-SED-2, MR-SED-1, MR-SED-2, MR-SED-4,MR-SED-6, MR-SED-7, MR-SED-10, M-RSED-13, MR-SED-14, MR-B4-A and MR-B4-B. Sediment interstitial ammonia concentrations were measured upon arrival. Ammonia concentrations are provided in Table 2.

1.2 Methods

The *Leptocheirus plumulosus 28*-d chronic sediment toxicity test was conducted following the methods described in "Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment–associated Contaminants with the amphipod *Leptocheirus plumulosus*" (EPA/600/R-01/020; 2001) and "Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates" (ASTM E-1367; 2003). A performance control collected from Chesapeake Bay, Virginia was included to evaluate test acceptability. A second performance control was also included to evaluate sediment from Sequim Bay, Washington for use as a performance control in future studies. Sediments SC-SED-1, SC-SED-2, PR-SED-1 and PR-SED-2 were designated as the reference sediment for the study. A summary of test conditions is provided in Table 1. Due to logistical constraints presented by the number of sediment samples evaluated, the test was setup over a two day period. Replicates A-D of each sediment treatment were initiated on day 0 followed by replicates E-H on day 1 and were terminated on day 28 and day 29, respectively.

1.3 Statistical Analyses

Survival analysis was conducted using SigmaStat Statistical Software (Systat Software, Inc., San Jose, CA). Survival data was arcsine square root transformed prior to normality analysis using the Kolmogorov-Smirnov procedure. Equal variances were evaluated using the Levene median test. An ANOVA followed by Dunnett's means comparison procedure to the reference sediments was conducted on data that was deemed normally distributed. Non-parametric data was analyzed using Kruskall-Wallis ANOVA on Ranks followed by Dunn's mean comparison method to the reference sediments. Significance level for all tests was set at $\alpha = 0.05$.

1.4 Results and Conclusions

Performance metrics were met with mean Chesapeake Bay and Sequim Bay control survival exceeding 80% and positive growth and reproduction in all replicates (Table 2). Water quality parameters fell within required ranges for both study phases (Table 1). Most sediments contained varying levels of aquatic plants as well as indigenous invertebrates including snails, chironomids and aquatic worms. Indigenous organisms were observed in both reference and site sediments and do not appear to have adversely impacted the study results. Discoloration of the sediment surface was observed in several of the sediments. Orange discoloration was observed on the sediment surface of samples MR-B4-A and MR-B4-B during the course of the study and at test termination. The discoloration was observed to a lesser extent in MR-SED-2, MR-SED-4 and PR-SED-1. The cause of the discoloration is unknown.

Significant effects on survival were detected for sediment MR-B4-B (46.9%) relative to the SC-SED-2, PR-SED-1 and PR-SED-2 sediments. Survival in the remaining sediments ranged from 66.3-86.9% and was not significantly impacted (Table 2).

Most statistically significant effects observed for the growth endpoint were for sediments where biomass exceeded levels observed in the reference sediment. Biomass measurements for sediments MR-SED-4, MR-SED-6 and MR-SED-7 exceeded biomass measurements for the SC-SED-1 and SC-SED-2 reference sediments (Table 2). Sediment MR-SED-13 exceeded biomass measurements for reference sediment SC-SED-3. Sediment MR-SED-10 was the only sediment where a significant reduction in growth was observed. Biomass for sediment MR-SED-10 was approximately three times lower than biomass observed for reference sediments PR-SED-1 and PR-SED-2.

As observed in the growth endpoint, most statistically significant effects observed for the reproduction endpoint were for sediments where reproductive output exceeded levels observed in the reference sediment. Reproduction in sediments MR-SED-6 exceeded reproduction in reference sediments SC-SED-2, SC-SED-3 and PR-SED-2 (Table 2). Sediment MR-SED-7 and MR-SED-13 exceeded reproductive measurements for the SC-SED-2 and SC-SED-3 reference sediments. A significant reduction in reproduction was observed in sediment MR-B4-B with reproductive output that was 17 times lower than that observed in reference sediment PR-SED-2.

In summary, only two sediments demonstrated significant adverse impacts. Sediment MR-B4-B displayed significant reductions in survival and reproduction and sediment MR-SED-10 produced significantly lower growth relative to reference sediments. No effects on survival, growth or reproductions were detected for the remaining sediments.

1.5 References

ASTM. 2003. E-1367-03. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates. American Society for Testing and Materials. West Conshohocken, PA.

USEPA 2001. Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment–associated Contaminants with the amphipod *Leptocheirus plumulosus*. EPA-600-R-01-020. Washington, D.C.

Table 1. Test Conditions: *L. plumulosus* 28-d Chronic Toxicity Test		
Sample Identification	MR-SED-1, MR-SED-2, MR-SED-4,MR-SED-6, MR-SED-7, MR-SED-10, MR-SED-13, MR-SED-14, MR-B4-A, MR-B4-B SC-SED-2, SC-SED-3, PR-SED-1and PR-SED-2	
Date received at US Army ERDC-Vicksburg	13 March 2009	
Sample storage conditions	4°C, dark	
Test Species	***Leptocheirus plumulosus***	
Supplier	US Army ERDC	
Date acquired	24 March 2009	
Acclimation/holding time	1 day	
Age/Size class	250-600µm size class	
Test Procedures	**USEPA (2001); ASTM (2003)**	
Test location	US Army ERDC; Vicksburg MS; Building 6017	
Test type/duration	Static renewal – chronic solid phase/28 days	
Test dates	March 25 – April 23, 2009	
Control water	Artificial seawater; Crystal Sea®	
Test temperature	Target: 25 ± 2°C	Mean: 24.8°C Range: 23.7-27.3°C
Test dissolved oxygen	Target: equivalent to > 2.5 mg/L	Range: 4.18 – 8.79 mg/L
Test pH	Target: Watch for pH drift	Range: 7.06 – 8.66
Salinity	Target: 5 ± 2‰	Mean: 5.2‰ Range: 5-8‰
Test overlying total ammonia	Target: <60 mg/L	Range: <1 - 2 mg/L
Test interstitial total ammonia	Target: <60 mg/L	Range: 1.07 – 19.7 mg/Lat day 0
Test photoperiod	16:8 L:D	
Test chamber	1-L glass beakers	
Replicates/treatment	8	
Organisms/replicate	20	
Exposure volume	2 cm sediment; 725 mL water	
Feeding	Tetramin®three times weekly	
Water renewal	Three times weekly (Mon, Wed. Fri.)	
Deviations from Test Protocol	None	

Table 2. Results of *Leptocheirus plumulosus* Sediment Evaluations						
Sediment Sample	Interstitial Total Ammonia Concentration (mg/L)	Overlying Total Ammonia Concentration (mg/L)		% Survival (SD)	Individual Biomass in mg (SD)	Neonates per Surviving Organism (SD)
		Day 0	Day 28			
Sequim Control	N/A	2	<1	84.4 (6.8)	1.41 (0.24)	6.0 (1.3)
Chesapeake Control	N/A	<1	<1	91.9 (10.0)	1.34 (0.16)	4.7 (1.9)
MR-SED-1	4.72	<1	<1	80.0 (12.0)	1.24 (0.33)	4.0 (2.7)
MR-SED-2	6.88	<1	<1	81.3 (16.4)	0.91 (0.26)	0.9 (0.9)
MR-SED-4	1.12	1	<1	78.1 (23.1)	1.96 (0.17)**ab**	4.4 (2.4)
MR-SED-6	1.77	<1	<1	88.1 (10.0)	1.80 (0.12)**ab**	7.3 (2.2)**abd**
MR-SED-7	19.7	2	<1	88.1 (8.4)	2.01 (0.34)**ab**	5.7 (2.7)**ab**
MR-SED-10	1.07	<1	<1	66.3 (29.9)	0.57 (0.40)**cd**	2.3 (2.9)
MR-SED-13	8.64	2	<1	86.9 (21.4)	1.50 (0.64)**b**	6.3 (3.4)**ab**
MR-SED-14	2.62	1	<1	76.9 (20.3)	1.41 (0.57)	4.3 (2.4)
MR-B4-A	4.31	<1	<1	71.9 (18.1)	0.93 (0.28)	1.4 (2.2)
MR-B4-B	3.02	<1	<1	46.9 (21.7)**acd**	0.99 (0.61)	0.2 (0.3)**d**
SC-SED-2	6.61	1	<1	80.6 (17.2)	0.82 (0.52)	1.5 (1.1)
SC-SED-3	6.18	1	<1	68.1 (40.3)	0.63 (0.33)	0.9 (1.3)
PR-SED-1	2.48	1	<1	83.1 (22.8)	1.64 (0.18)	3.7 (2.0)
PR-SED-2	11.9	<1	<1	90.0 (10.7)	1.75 (0.16)	3.4 (1.3)

N/A=Not measured; a=significantly different from SC-SED-2 reference; b= significantly different from SC-SED-3 reference; significantly different from PR-SED-1 reference; significantly different from PR-SED-2 reference (α=0.5).

Appendix A – Laboratory Bench Sheets

INITIAL WEIGHT DETERMIANTION SHEET				
Project: Exponent-Fairfield				
Laboratory: US Army ERDC				
Test Species: *Leptocheirus plumulosus*				
Exposure duration: 28 day			Mass Measurements by: Goss	
Pan #	# animals on pan	Pan weight (g)	Pan & animal dry weight (g)	Comments
1	20	0.09804	0.09923	
2	20	0.08287	0.08359	DF
3	20	0.06576	0.06624	
		3/27/09	3/31/09	

Signature: Jessica Goss

Disclosed and Understood by: Gail D. Sloan

DF

POREWATER TOTAL AMMONIA TRACKING SHEET

Project: Exponent-Fairfield
Laboratory: US Army ERDC
Test Species: *Leptochierus plumulosus*
Exposure duration: 28 day

Test Initiation Date: 3/26/09 Time:
Test Date(s): Time:

Treatment	Total Pore Water Ammonia (mg/L)	Pore Water pH	Pore Water Salinity	Temperature °C	Date: Time (purge 1)	Time (purge 2)	Date: Time (purge 1)	Time (purge 2)	Date: Time (purge 1)	Time (purge 2)	Date: Time (purge 1)	Time (purge 2)	Total Pore water Ammonia Day 0 (sham 1)	Day 28 (sham 2)
SC	—	—	—	—										
ABC	—	—	—	—										
MR-SED-1	4.72	7.99	2	21.1										
MR-SED-2	6.88	7.76	5	21.2										
MR-SED-4	1.12	7.78	2	20.6					DF					
MR-SED-6	1.77	9.02	Ø	21.1										
MR-SED-7	19.7	7.41	10	20.3										
MR-SED-10	1.07	11.68	2	21.6										
MR-SED-13	8.64	7.80	10	20.3										
MR-SED-14	2.62	7.75	2	19.6										
MR-B4-A	4.31	7.45	2	22.0										
MR-B4-B	3.02	7.65	2	20.0										
SCSED-2	6.61	7.02	17	20.8										
SCSED-3	6.18	7.03	10	21.1										
PRSED-2	2.48	7.36	2	20.4										
PRSED-1	11.9	7.71	Ø	20.9										

3/25/09
Signature: Jennifer D. [illegible]
Disclosed and Understood by: [signature]

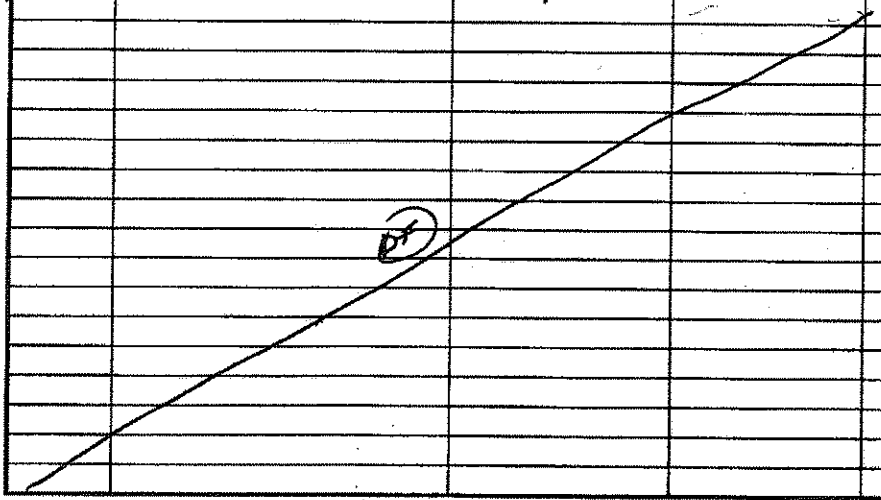
ENVIRONMENTAL CHAMBER DAILY TEMPERATURE MONITORING SHEET				
Project: Exponet-Fairfield				
Laboratory: US Army ERDC				
Test Species: *Leptocheirus plumulosus*				
Exposure duration: 28 day				
Day	Temperature (°C)	Min (°C)/Max (°C)	Comments	Initials
0	20.7	19.6/28.3	Module 1	JB
-1	22.9	22.2/25.2	Module 2	JB
1	22.9	22.5/26.5	Module 1	JB
0	23.6	22.2/26.9	Module 2	JB
2	~~23.7~~ 22.7	22.1/25.6	1	DF
1	23.9	23.0/25.8	2	DF
3	22.8	22.5/24.7	1	DF
2	23.8	23.5/24.1	2	DF
4	25.5	22.8/26.3	1	DF
3	26.4	23.8/25.5	2	DF
5	25.6	25.1/26.5	1	DF
4	25.3	24.8/25.5	2	DF
6	26.2	24.1/26.8	1	DF
5	25.6	25.1/25.6	2	DF
7	24.9	?/27.2	1	JB
6	25.6	25.4/25.8	2	JB
8	25.0	?/25.4	1	JB
~~7~~ 7	25.4	25.4/25.8	2	JB
9	24.4	?/25.3	1	JB
8	25.6	25.3/25.8	2	JB
10	25.0	?/24.7	1	PC
9	24.7	17.7/25.0	2	PC
11	25.0	?/25.0	1	PC
10	25.1	17.7/25.1	2	PC
12	24.0	17.7/25.4	1	JB
11	25.1	?/25.8	2	JB
13	25.2	24.8/26.2	1	~~JB~~
12	25.1	24.0/25.8	2	~~JB~~
14	25.7	N/A/25.7	1	DF
13	25.3	24.8/25.1	2	~~DF~~
15	24.4	22.2/25.7	1	JB
14	25.4	25.1/25.6	2	JB
16	23.7	22.2/25.7	1	JB
15	25.5	25.1/25.7	2	JB
18	25.5	21.5/25.5	1	PC
16	24.0	22.2/24.0	2	PC
18	25.6	25.1/25.6	1	PC
17	24.1	22.2/24.1	2	PC

3/26/09 3/24/09 3/24/09 3/28/09 3/29/09 3/30/09 3/31/09 4/1/09 4/2/09 4/3/09 4/4/09 4/5/09 4/6/09 4/7/09 4/8/09 4/9/09 4/10/09 4/11/09 4/12/09

Signature: Jennifer D. Hall

Disclosed and Understood by:

ENVIRONMENTAL CHAMBER DAILY TEMPERATURE MONITORING SHEET				
Project: Exponet-Fairfield				
Laboratory: US Army ERDC				
Test Species: *Leptocheirus plumulosus*				
Exposure duration: 28 day				
Day	**Temperature (°C)**	**Min (°C)/Max (°C)**	**Comments**	**Initials**
4/18/09 19	23.3	22.2/25.7	1	JG
18	25.6	25.1/25.8	2	JG
4/14/09 20	23.3	20.3/24.3	1	JG
19	25.6	25.4/25.7	2	JG
4/15/09 21	23.9	23.0/24.1	1	JG
20	25.4	25.3/25.7	2	JG
4/16/09 22	23.8	23.1/24.0	1	JG
21	25.4	25.2/25.6	2	JG
4/17/09 23	23.4	22.9/24.1	1	JG
22	25.7	25.3/25.9	2	JG
4/18/09 24	25.9	25.4/25.9	1	PC
23	24.5	23.3/24.5	2	PC
4/19/09 25	26.5	23.3/24.7	1	DF
24	25.8	25.4/26.2	2	DF
4/20/09 26	24.4	23.2/24.6	1	JG
25	25.8	25.5/25.9	2	JG
4/21/09 27	24.4	23.2/24.6	1	JG
26	25.8	25.5/25.9	2	JG
4/22/09 28	23.4	23.0/24.5	1	JG
27	25.6	25.4/25.9	2	JG
4/23/09 28	25.7	25.4/25.9	2	JG



Signature: _____

Disclosed and Understood by: _____

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/24/09		Time:
Laboratory: US Army ERDC				Test Date(s):		Time:
Test Species: *Leptocheirus plumulosus*				Page 1 of 4		Test day: 0
Exposure Duration: 28 days						

Treatment	Repl.	Temp. (°C) (24-26 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
SC	A	24.2	7	8.06	7.52	2
	B	24.0	5	8.33	7.84	
	C	24.3	6	7.95	7.49	
	D	24.7	7	8.22	8.02	
	E	24.2	7	8.32	8.03	
	F	24.3	7	8.27	8.10	
	G	23.8	7	8.03	8.05	
	H	23.9	7	7.94	8.35	
ABC	A	25.3	5	7.97	7.63	<1
	B	25.1	6	7.96	8.79	
	C	25.0	6	7.88	8.09	
	D	25.1	6	7.84	7.95	
	E	24.2	6	8.03	8.13	
	F	24.1	6	8.13	8.18	
	G	24.2	6	8.08	7.85	
	H	24.0	6	8.08	8.38	
MR-SED-1	A	25.3	5	7.77	7.24	<1
	B	25.2	5	7.96	7.95	
	C	25.0	5	8.04	8.06	
	D	25.0	5	8.01	8.01	
	E	24.0	5	8.18	8.31	
	F	24.1	5	8.20	7.66	
	G	24.0	5	8.13	8.19	
	H	24.3	5	8.09	8.02	
MR-SED-2	A	25.4	5	7.88	7.54	<1
	B	24.6	5	7.99	7.80	
	C	25.1	5	8.00	7.88	
	D	24.3	5	8.06	8.03	
	E	24.2	5	8.18	8.22	
	F	~~23.0~~ 24.0	5	8.13	8.41	
	G	24.2	5	8.05	8.28	
	H	24.2	5	8.12	8.05	
MR-SED-4	A	24.7	5	7.95	7.87	1
	B	25.3	5	7.89	7.73	
	C	25.2	5	7.85	7.68	
	D	25.2	5	7.89	7.83	
	E	24.0	5	8.09	7.74	
	F	24.3	5	8.14	8.05	
	G	24.1	5	8.17	8.39	
	H	24.3	5	8.13	8.10	

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/26/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 3/25-3/26/09 Time:		
Test Species: *Leptocheirus plumulosus*				Page 1 of 4 Test day: 0		
Exposure Duration: 28 days						

Treatment	Repl.	Temp. (°C) (24-26 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
MR-SED-6	A	24.8	5	7.95	8.02	<1
	B	25.1	5	7.85	7.85	
	C	25.2	5	7.86	7.83	
	D	24.5	5	7.94	7.99	
	E	24.0	5	8.15	8.00	
	F	24.4	5	8.08	8.25	
	G	23.8	5	8.13	8.38	
	H	23.9	5	8.15	8.18	
MR-SED-7	A	24.8	5	8.11	7.48	2
	B	25.1	5	8.14	7.68	
	C	25.2	5	8.15	7.85	
	D	25.2	5	8.06	7.80	
	E	24.2	5	8.38	7.88	
	F	23.9	5	8.16	8.17	
	G	24.2	5	8.24	8.20	
	H	24.4	5	8.05	7.83	
MR-SED-10	A	25.1	5	7.92	7.77	<1
	B	25.4	5	7.91	7.67	
	C	25.5	5	7.90	7.62	
	D	24.7	5	7.94	7.85	
	E	24.2	5	8.15	7.77	
	F	24.2	5	8.14	8.37	
	G	24.2	5	8.30	8.01	
	H	24.1	5	8.18	7.83	
MR-SED-13	A	25.4	5	7.98	7.34	2
	B	24.6	5	7.95	7.31	
	C	25.0	5	7.97	7.65	
	D	25.1	5	7.91	7.49	
	E	24.0	5	8.21	8.28	
	F	24.0	5	8.19	8.21	
	G	24.3	5	8.12	8.19	
	H	24.1	5	8.12	7.93	
MR-SED-14	A	24.8	6	7.84	7.29	1
	B	24.9	6	7.92	7.55	
	C	24.6	6	7.95	7.58	
	D	25.5	6	7.82	7.36	
	E	24.1	6	8.20	8.24	
	F	24.1	5	8.15	8.27	
	G	24.0	5	8.12	8.16	
	H	23.9	5	8.16	8.24	

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 7/25-26/09		Time:
Laboratory: US Army ERDC				Test Date(s):		Time:
Test Species: *Leptocheirus plumulosus*				Page 3 of 4		Test day: 0
Exposure Duration: 28 days						

Treatment	Repl.	Temp. (°C) (24-26 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
MR-B4-A	A	25.1	6	7.96	6.81	<1
	B	24.9	6	7.99	6.87	
	C	24.7	6	8.01	6.96	
	D	24.5	6	7.95	6.93	
	E	24.2	5	8.15	8.07	
	F	24.1	7	8.24	8.08	
	G	24.2	5	8.16	8.13	
	H	24.0	6	8.24	7.33	
MR-B4-B	A	25.1	5	7.78	6.78	<1
	B	24.6	5	7.78	6.15	
	C	24.4	5	7.73	6.74	
	D	25.0	5	7.69	6.67	
	E	24.1	5	7.98	7.82	
	F	24.1	5	8.15	8.34	
	G	24.1	5	8.12	8.14	
	H	24.2	5	8.18	8.26	
SCSED-2	A	24.9	6	7.83	7.49	1
	B	24.6	6	7.80	7.43	
	C	24.9	6	7.74	7.31	
	D	24.6	6	8.03	7.40	
	E	24.1	7	8.11	8.08	
	F	24.3	7	8.17	8.15	
	G	24.2	7	8.24	8.37	
	H	24.3	6	7.93	8.16	
SCSED-3	A	24.7	5	7.89	7.47	1
	B	25.0	6	7.98	7.59	
	C	24.2	5	7.90	7.63	
	D	24.9	5	7.62	6.74	
	E	24.2	7	8.09	8.19	
	F	24.1	7	8.26	8.18	
	G	24.2	7	8.25	8.24	
	H	24.3	6	8.06	8.06	
PRSED-1	A	24.5	5	7.70	7.67	1
	B	25.1	5	7.75	7.70	
	C	24.9	5	7.71	7.73	
	D	25.3	5	7.78	7.68	
	E	24.1	6	8.04	8.36	
	F	24.3	6	8.14	8.14	
	G	23.9	6	8.02	8.24	
	H	24.2	6	8.04	8.21	

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/24/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 3/25 - 3/24/09 Time:		
Test Species: *Leptocheirus plumulosus*				Page 4 of 4 Test day: 0		
Exposure Duration: 28 days						
Treatment	**Repl.**	**Temp. (°C) (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Ammonia (mg/L)**
PRSED-2	A	26.0	5	7.69	7.69	1
	B	24.6	5	7.71	7.66	
	C	25.1	5	7.70	7.47	
	D	25.1	5	7.72	7.55	
	E	24.1	5	8.17	8.33	
	F	24.0	8	8.15	8.09	
	G	24.3	6	8.07	8.22	
	H	24.0	8	8.34	8.23	

Signature: Jennifer D. Moore

Disclosed and Understood by: Gail D Fox

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WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date:		Time:
Laboratory: US Army ERDC				Test Date(s): 3/27/09		Time:
Test Species: *Leptocheirus plumulosus*				Page 1 of 1		Test day:
Exposure Duration: 28 days				Environmental chamber temperature: 21		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	A	26.3	6	8.21	6.55	NA
ABC		26.7	6	7.51	6.33	
MR-SED-1		26.5	5	8.15	7.21	
MR-SED-2		26.8	5	7.55	6.70	
MR-SED-4		26.9	5	8.06	5.97	
MR-SED-6		26.6	6	7.85	5.46	
MR-SED-7		26.4	6	8.28	6.46	
MR-SED-10		27.0	6	7.93	6.31	
MR-SED-13		26.7	6	8.21	5.69	
MR-SED-14		26.3	6	7.84	6.75	
MR-B4-A		26.5	5	7.86	5.01	
MR-B4-B		26.9	5	8.26	6.12	
SCSED-2		27.0	6	8.16	6.36	
SCSED-3		26.4	6	7.58	8.34	
PRSED-2		26.6	5	7.88	6.56	
PRSED-3	↓	26.8	5	8.07	7.26	

Signature: Jennifer D. Hoos

Disclosed and Understood by: Jed D. Fee

WATER QUALITY MONITORING SHEET							
Project: Exponent-Fairfield				Test Initiation Date: 3/25 - 3/26/09 Time:			
Laboratory: US Army ERDC				Test Date(s): 3/30/09 Time: 10:00			
Test Species: *Leptocheirus plumulosus*				Page 1 of 1 Test day:			
Exposure Duration: 28 days				Environmental chamber temperature: 5/4			

AMMONIA

Treatment	Repl.	Temp. (24-26 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Comments	
SC	D	26.7	6	8.27	7.30	N/A	3
ABC	D	26.7	6	7.76	7.78		<1
MR-SED-1	D	26.9	6	8.06	5.30		<1
MR-SED-2	D	26.3	6	8.28	6.61		1
MR-SED-4	D						
MR-SED-6	D	26.2	6	8.08	5.99		<1
MR-SED-7	D	27.0	6	8.23	6.52		2
MR-SED-10	D	26.6	6	8.06	6.41		<1
MR-SED-13	D	27.0	6	8.18	7.89		2
MR-SED-14	D	26.9	6	7.86	7.06		<1
MR-B4-A	D	26.6	6	8.32	5.93		<1
MR-B4-B	D	27.0	6	8.51	6.36		1
SCSED-2	D	27.0	6	8.13	5.28		<1
SCSED-3	D	27.0	6	8.35	5.91		1
PRSED-2	D	26.0	6	7.88	7.77		<1
PRSED-1	D	27.3	5	7.85	6.39		<1

Signature: _____

Disclosed and Understood by: _____

PF

WATER QUALITY MONITORING SHEET							
Project: Exponent-Fairfield				Test Initiation Date: 3-3-09		Time:	
Laboratory: US Army ERDC				Test Date(s): 4/1/09		Time: 1300	
Test Species: *Leptocheirus plumulosus*				Page 1 of 1		Test day:	
Exposure Duration: 28 days				Environmental chamber temperature: 5/4			
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**	
SC	b	24.5	7	8.22	6.83	N/A	
ABC	b	24.7	7	8.02	6.58		
MR-SED-1	b	24.4	5	8.28	6.38		
MR-SED-2	b	24.5	5	8.37	6.57		
MR-SED-4	b	24.6	6	8.36	6.47		
MR-SED-6	b	24.5	5	8.13	6.39		
MR-SED-7	b	24.5	6	8.49	6.67		
MR-SED-10	b	24.5	5	7.98	6.76		
MR-SED-13	b	24.3	6	8.34	6.51		
MR-SED-14	b	24.2	6	8.23	6.84		
MR-B4-A	b	24.4	5	8.61	5.90		
MR-B4-B	b	24.5	5	8.40	6.74		
SCSED-2	b	24.7	6	8.21	5.78		
SCSED-3	b	24.3	6	8.39	6.20		
PRSED-2	b	24.4	6	7.87	6.75		
PRSED-1	b	24.4	6	8.02	6.53		

Signature: Jennifer O. Hoy

Disclosed and Understood by:

DF

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25 3/26	Time:	
Laboratory: US Army ERDC				Test Date(s): 4/3/09	Time: 1330	
Test Species: *Leptocheirus plumulosus*				Page of	Test day:	
Exposure Duration: 28 days				Environmental chamber temperature: 4/5		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	E	25.0	5	8.04	6.50	N/A
ABC	E	25.0	5	8.15	6.98	
MR-SED-1	E	25.0	5	8.18	7.04	
MR-SED-2	E	25.0	5	8.19	6.28	
MR-SED-4	E	24.8	5	8.25	6.82	
MR-SED-6	E	25.1	5	8.14	7.18	
MR-SED-7	E	25.1	5	8.50	6.84	
MR-SED-10	E	~~25.8~~ 25.0	5	8.18	7.23	
MR-SED-13	E	25.1	5	8.38	7.01	
MR-SED-14	E	25.0	5	8.25	6.64	
MR-B4-A	E	25.0	5	8.15	6.02	
MR-B4-B	E	25.0	5	8.32	6.94	
SCSED-2	E	~~25.8~~ 25.0	5	8.22	6.69	
SCSED-3	E	25.1	5	8.18	6.92	
PRSED-2	E	25.0	5	8.22	6.90	
PRSED-1	E	25.0	5	8.15	7.09	

Signature: Jennifer D Moore

Disclosed and Understood by:

(DF)

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/26/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 4/6/09 Time: 1020		
Test Species: *Leptocheirus plumulosus*				Page of Test day:		
Exposure Duration: 28 days				Environmental chamber temperature: 4/5		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	C	24.1	5	7.92	6.30	N/A
ABC	C	24.6	5	7.75	6.68	
MR-SED-1	C	24.4	5	8.05	6.86	
MR-SED-2	C	24.3	5	8.06	6.67	
MR-SED-4	C	24.4	5	8.19	7.43	
MR-SED-6	C	24.4	5	8.08	7.10	
MR-SED-7	C	24.6	5	8.14	6.98	
MR-SED-10	C	24.7	5	7.83	6.52	
MR-SED-13	C	24.2	5	8.18	6.89	
MR-SED-14	C	24.0	5	7.88	6.75	
MR-B4-A	C	24.4	5	8.35	6.55	
MR-B4-B	C	24.0	5	8.29	7.43	
SCSED-2	C	24.0	5	8.20	6.29	
SCSED-3	C	24.4	5	8.16	6.97	
PRSED-2	C	24.4	5	8.18	7.07	
PRSED-1	C	24.5	5	8.23	7.25	

Signature: _____

Disclosed and Understood by: _____

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/5-3/24/09		Time: 1417
Laboratory: US Army ERDC				Test Date(s): 04/08/09		Time:
Test Species: *Leptocheirus plumulosus*				Page of		Test day:
Exposure Duration: 28 days				Environmental chamber temperature: 415		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	H	24.8	6	8.06	6.36	NA
ABC	H	24.9	5	8.03	7.40	
MR-SED-1	H	24.7	5	8.12	6.74	
MR-SED-2	H	24.8	5	8.34	6.75	
MR-SED-4	H	24.9	5	8.05	7.05	
MR-SED-6	H	24.9	5	8.27	7.31	
MR-SED-7	H	24.8	5	8.00	6.32	
MR-SED-10	H	24.8	5	8.01	6.89	
MR-SED-13	H	25.0	5	8.12	6.70	
MR-SED-14	H	24.9	5	8.02	7.19	
MR-B4-A	H	24.9	5	8.02	6.39	
MR-B4-B	H	24.9	5	7.95	6.27	
SCSED-2	H	24.8	5	8.21	6.85	
SCSED-3	H	24.9	5	8.14	7.06	
PRSED-2	H	24.9	5	7.95	6.71	
PRSED-3	H	24.8	5	8.02	6.35	

Signature: Jennifer D. Hoy

Disclosed and Understood by:

DP

WATER QUALITY MONITORING SHEET

Project: Exponent-Fairfield	Test Initiation Date: 3/20/09 Time:
Laboratory: US Army ERDC	Test Date(s): 4/10/09 Time: 1315
Test Species: *Leptocheirus plumulosus*	Page of Test day:
Exposure Duration: 28 days	Environmental chamber temperature: 15

Treatment	Repl.	Temp. (24-26 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Comments
SC	D	27.9	5	8.08	7.01	N/A
ABC	D	24.0	5	7.89	6.98	
MR-SED-1	D	24.0	5	7.95	6.84	
MR-SED-2	D	23.9	5	6.55	6.84	
MR-SED-4	D	23.9	5	8.00	6.97	
MR-SED-6	D	23.9	5	8.04	7.09	
MR-SED-7	D	23.9	5	7.89	6.89	
MR-SED-10	D	24.0	6	8.01	7.03	
MR-SED-13	D	24.0	5	8.16	6.96	
MR-SED-14	D	24.1	5	8.01	7.19	
MR-B4-A	D	23.9	5	8.25	7.02	
MR-B4-B	D	24.0	5	7.97	6.98	
SCSED-2	D	24.0	5	8.09	6.09	
SCSED-3	D	24.0	5	8.01	6.94	
PRSED-2	D	23.9	5	7.77	6.50	
PRSED-1	D	24.0	5	7.91	6.53	

Signature: Jennifer D. Hoss

Disclosed and Understood by:

DP

WATER QUALITY MONITORING SHEET							
Project: Exponent-Fairfield				Test Initiation Date: 3/25/09 4/1/09 Time:			
Laboratory: US Army ERDC				Test Date(s): 4/13/09 Time: 1410			
Test Species: *Leptocheirus plumulosus*				Page of Test day:			
Exposure Duration: 28 days				Environmental chamber temperature: 4/5			
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**	
SC	E F	25.1	5	7.98	6.40	N/A	
ABC	E F	25.3	5	7.76	6.59		
MR-SED-1	E F	25.1	5	7.70	6.37		
MR-SED-2	E F	25.0	5	7.77	6.06		
MR-SED-4	E F	25.1	5	7.81	6.46		
MR-SED-6	F	25.0	5	7.98	6.98		
MR-SED-7	F	25.2	5	7.79	5.85		
MR-SED-10	F	25.3	5	7.91	6.73		
MR-SED-13	F	25.3	5	7.77	6.22		
MR-SED-14	F	25.1	5	7.77	6.52		
MR-B4-A	F	25.1	5	7.80	5.93		
MR-B4-B	F	25.3	5	7.80	6.18		
SCSED-2	F	25.2	5	7.98	6.14		
SCSED-3	F	25.1	5	7.86	6.50		
PRSED-2	F	25.1	5	7.78	6.60		
PRSED-3	F	25.2	5	7.78	6.02		

Signature: Jennifer R. Hoff

Disclosed and Understood by:

05

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/20/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 4/15/09 Time: 1330		
Test Species: *Leptocheirus plumulosus*				Page of Test day:		
Exposure Duration: 28 days				Environmental chamber temperature: 4/15		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	A	24.1	5	7.78	5.87	
ABC	A	24.6	5	7.76	6.56	
MR-SED-1	A	24.6	5	7.69	0.31	
MR-SED-2	A	24.5	5	7.80	5.46	
MR-SED-4	A	24.4	5	7.85	6.75	
MR-SED-6	A	24.8	5	7.79	6.64	
MR-SED-7	A	24.3	5	7.58	6.64	
MR-SED-10	A	24.8	5	7.80	6.56	
MR-SED-13	A	24.4	5	7.64	5.71	
MR-SED-14	A	24.4	5	7.89	7.74	
MR-B4-A	A	24.6	5	7.06	6.08	
MR-B4-B	A	24.6	5	8.02	5.99	
SCSED-2	A	24.6	5	7.85	5.38	
SCSED-3	A	24.6	5	8.10	6.05	
PRSED-2	A	24.6	5	7.83	6.49	
PRSED-1	A	24.5	5	7.96	6.74	

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WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/20-3/24/09	Time:	
Laboratory: US Army ERDC				Test Date(s): 4/17/09	Time: 1500	
Test Species: *Leptocheirus plumulosus*				Page of	Test day:	
Exposure Duration: 28 days				Environmental chamber temperature: 4/5		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	G	25.5	5	8.08	6.26	
ABC	G	25.1	5	7.75	6.41	
MR-SED-1	G	25.5	5	7.80	6.11	
MR-SED-2	G	25.3	5	7.99	6.44	
MR-SED-4	G	25.2	5	7.99	6.50	
MR-SED-6	G	25.3	5	7.84	6.12	
MR-SED-7	G	25.5	5	8.08	6.40	
MR-SED-10	G	25.6	5	8.16	6.59	DF
MR-SED-13	G	25.5	5	7.87	6.26	
MR-SED-14	G	25.5	5	7.86	5.03	
MR-B4-A	G	25.4	5	7.87	5.73	
MR-B4-B	G	25.5	5	8.15	6.33	
SCSED-2	G	25.7	5	8.08	6.26	
SCSED-3	G	25.3	5	7.98	6.51	
PRSED-2	G	25.4	5	7.74	6.03	
PRSED-21	G	25.5	5	7.79	6.28	

Signature: Jennifer D. Hoy

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WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/26/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 4/20/09 Time: 1007		
Test Species: *Leptocheirus plumulosus*				Page of Test day:		
Exposure Duration: 28 days				Environmental chamber temperature: 4/5		
Treatment	**Repl.**	**Temp. (24-26 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Comments**
SC	B	24.5	5	7.85	6.13	
ABC	B	24.7	5	7.84	6.05	
MR-SED-1	B	24.7	5	7.85	6.22	
MR-SED-2	B	24.5	5	7.88	6.21	
MR-SED-4	B	24.7	5	7.91	6.02	
MR-SED-6	B	24.6	5	7.75	6.24	
MR-SED-7	B	24.8	5	7.93	6.35	
MR-SED-10	B	24.7	5	7.96	6.165	
MR-SED-13	B	24.4	5	7.87	5.65	OD
MR-SED-14	B	24.5	5	7.82	6.32	
MR-B4-A	B	24.5	5	7.84	6.20	
MR-B4-B	B	24.6	5	7.84	6.36	
SCSED-2	B	24.7	5	7.95	6.53	
SCSED-3	B	24.8	5	7.78	5.74	
PRSED-2	B	24.6	5	7.83	6.39	
PRSED-1	B	24.8	5	7.85	6.37	

Signature: Jennifer D. Hoss

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OD

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/30-3/31/09		Time:
Laboratory: US Army ERDC				Test Date(s): 4/22-4/23/09		Time:
Test Species: *Leptocheirus plumulosus*				Page 1 of 4		Test day: 28
Exposure Duration: 28 days						

Treatment	Repl.	Temp. (°C) (22-28 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
SC	A	23.7	5	7.79	7.00	<1
	B	24.0	5	7.67	6.91	
	C	23.8	5	7.68	6.36	
	D	24.0	5	7.67	6.16	
	E	25.2	5	7.88	6.24	
	F	25.3	5	7.68	6.10	
	G	25.3	5	7.71	6.22	
	H	25.4	5	7.73	6.73	
ABC	A	24.3	5	7.90	6.32	<1
	B	24.2	5	7.57	6.83	
	C	24.2	5	7.88	6.73	
	D	24.2	5	7.63	6.80	
	E	25.5	5	7.86	6.75	
	F	25.3	5	7.52	5.83	
	G	25.2	5	7.63	6.62	
	H	25.3	5	7.68	6.79	
MR-SED-1	A	24.4	5	7.50	6.85	<1
	B	24.2	5	7.68	6.71	
	C	24.2	5	7.75	6.65	
	D	24.2	5	7.53	6.93	
	E	25.2	5	7.62	6.52	
	F	25.1	5	7.66	6.15	
	G	24.2	5	7.83	6.90	
	H	25.4	5	8.17	5.01	
MR-SED-2	A	24.3	5	7.74	6.79	<1
	B	23.9	5	7.81	6.62	
	C	24.2	5	7.65	6.03	
	D	23.7	5	7.58	6.88	
	E	25.3	5	8.21	7.32	
	F	25.3	5	7.71	6.73	
	G	25.5	5	7.69	5.68	
	H	25.4	5	7.52	6.22	
MR-SED-4	A	23.9	5	7.57	7.03	<1
	B	24.3	5	7.47	6.34	
	C	24.2	5	7.61	6.52	
	D	24.1	5	7.70	6.62	
	E	25.1	5	7.65	7.42	
	F	25.4	5	7.67	6.18	
	G	25.4	5	7.62	6.31	
	H	25.4	5	7.63	6.76	

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/26/09 Time:		
Laboratory: US Army ERDC				Test Date(s): 4/22-4/23/09 Time:		
Test Species: *Leptocheirus plumulosus*				Page 2 of 4 Test day: 28		
Exposure Duration: 28 days						
Treatment	**Repl.**	**Temp. (°C) (22-28 °C)**	**Salinity (4-6 ppt)**	**pH (6.5 - 9.0)**	**D.O. (>4 mg/L)**	**Ammonia (mg/L)**
MR-SED-6	A	24.1	5	7.53	6.82	<1
	B	24.0	5	7.74	6.83	
	C	24.2	5	7.63	6.96	
	D	23.8	5	7.62	6.90	
	E	25.4	5	7.75	6.24	
	F	25.3	5	7.53	6.62	
	G	25.2	5	7.78	6.90	
	H	25.3	5	7.77	6.93	
MR-SED-7	A	23.9	5	7.59	6.07	<1
	B	24.2	5	7.80	6.50	
	C	24.3	5	7.53	6.82	
	D	24.1	5	7.45	6.73	
	E	25.2	5	7.64	6.35	
	F	25.4	5	7.50	6.44	
	G	25.2	5	7.69	6.39	
	H	25.3	5	7.54	6.19	
MR-SED-10	A	24.3	5	7.52	7.03	<1
	B	24.2	5	7.88	7.34	
	C	24.3	5	7.69	6.85	
	D	23.8	5	7.53	7.53	
	E	25.5	5	7.66	6.58	
	F	25.4	5	7.78	6.98	
	G	25.4	5	7.83	6.55	
	H	25.3	5	7.79	6.70	
MR-SED-13	A	24.2	5	7.41	5.93	<1
	B	23.9	5	7.59	7.38	
	C	23.9	5	7.55	6.50	
	D	24.2	5	7.71	6.84	
	E	25.3	5	7.58	6.37	
	F	25.4	5	7.58	6.35	
	G	25.4	5	7.73	6.80	
	H	25.5	5	7.53	5.93	
MR-SED-14	A	23.7	5	7.73	6.74	<1
	B	23.9	5	7.54	6.74	
	C	23.8	5	7.48	7.14	
	D	24.3	5	7.66	6.04	
	E	25.4	5	7.41	6.36	
	F	25.3	5	7.41	4.18	
	G	25.5	5	7.79	7.08	
	H	25.3	5	7.63	5.65	

WATER QUALITY MONITORING SHEET

Project: Exponent-Fairfield	Test Initiation Date: 3/25-3/26/09 Time:
Laboratory: US Army ERDC	Test Date(s): 4/22-4/23/09 Time:
Test Species: *Leptocheirus plumulosus*	Page 3 of 4 Test day: 28
Exposure Duration: 28 days	

Treatment	Repl.	Temp. (°C) (22-28 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
MR-B4-A	A	24.4	5	7.58	5.79	<1
	B	24.3	5	7.74	6.44	
	C	24.3	5	7.51	6.74	
	D	24.1	5	7.50	6.89	
	E	25.1	5	7.63	6.73	
	F	25.3	5	7.76	6.83	
	G	25.2	5	7.94	6.80	
	H	25.2	5	7.64	6.13	
MR-B4-B	A	24.3	5	7.79	6.13	<1
	B	23.9	5	7.65	5.66	
	C	23.7	5	7.68	6.67	
	D	24.3	5	7.86	6.65	
	E	25.5	5	7.84	6.18	
	F	24.9	5	7.73	5.48	
	G	25.1	5	7.61	4.85	
	H	25.3	5	8.10	6.75	
SCSED-2	A	24.3	5	7.70	5.86	<1
	B	24.3	5	7.76	6.52	
	C	24.3	5	7.73	6.94	
	D	24.2	5	7.55	6.55	
	E	25.4	5	7.87	7.23	
	F	25.4	5	7.78	7.83	
	G	25.3	5	7.83	6.99	
	H	25.4	5	7.96	6.76	
SCSED-3	A	24.0	5	7.87	7.23	<1
	B	24.2	5	7.73	6.48	
	C	23.9	5	7.60	7.46	
	D	24.2	5	7.91	6.48	
	E	25.3	5	7.78	6.18	
	F	25.3	5	7.66	5.79	
	G	25.4	5	7.69	6.73	
	H	25.3	5	8.37	5.81	
PRSED-1	A	23.9	5	7.71	7.06	<1
	B	24.1	5	7.53	6.21	
	C	24.3	5	7.56	7.30	
	D	24.3	5	7.70	6.48	
	E	25.3	5	7.76	6.86	
	F	25.3	5	7.81	6.17	
	G	25.4	5	7.93	6.88	
	H	25.2	5	7.67	6.90	

WATER QUALITY MONITORING SHEET						
Project: Exponent-Fairfield				Test Initiation Date: 3/25-3/26		Time:
Laboratory: US Army ERDC				Test Date(s): 4/22-4/23/04		Time:
Test Species: *Leptocheirus plumulosus*				Page 4 of 4		Test day: 28
Exposure Duration: 28 days						

Treatment	Repl.	Temp. (°C) (22-28 °C)	Salinity (4-6 ppt)	pH (6.5 - 9.0)	D.O. (>4 mg/L)	Ammonia (mg/L)
PRSED-2	A	24.1	5	7.73	6.54	2
	B	23.8	5	7.15	6.63	
	C	24.3	5	7.53	6.77	
	D	24.2	5	7.57	6.00	
	E	25.3	5	7.72	6.98	
	F	25.3	5	7.85	6.80	
	G	25.4	5	7.81	6.36	
	H	25.3	5	7.73	6.13	

Signature: _____

Disclosed and Understood by: _____

DF

DAILY NOTES SHEET

Day: ______

Date: 3/13/09

Initials: DF

Observations/notes: Received sediment from expedient. Received 7 coolers containing sealed buckets (1 gal) All sediment were below 4°C. Sediments were placed in Cold Storage at 4°C.

DF

Day: –

Date: 3/24/09

Initials: DF

Observations/notes: Sediment were removed from the cold room. Each sediment was mixed using an impeller mixer under a nitrogen blanket to minimize oxidation. 175 mL of each sediment was added to replicate beakers. Sediment samples were collected before removal of the sediment from the nitrogen bag for AVS-SEM ~~measurements~~. ~~Beakers~~ Sediment was overlain with 5ppt seawater and placed in two water baths (reps A-D) in waterbath #1 and reps (E-H) in water bath #2. Beakers were placed on air and allowed to equilibrate overnight.

Day: ______

Date: 3/25/09

Initials: DF, JL, JG

Observations/notes: Lepto (test ~~letter~~ species as described in the EPA Sediment document) Ncaputer were counted into counting chambers (10 per chamber). Water quality parameters were measured & recorded. 2 counting chambers were gently added to each beaker in water bath 1 (reps A-D). Beakers checked for floaters and any found were sunk.

DF

Signature: Jennifer Gon

Disclosed and Understood by: [signature]

DAILY NOTES SHEET

Day:
Date: 3/26/08
Initials: DF, JT, JW, JM, JG
Observations/notes: Final report ; water bath #2 (reps E-H) were setup as described in the EPA guidance document and as described in the notes of 3/25/06

DF

Day:
Date: 3/27/08
Initials: DF, JT
Observations/notes: Parameters recorded and water exchange conducted. Beakers checked for floater prior to exchange. Animals fed. see Temp recorded

DF

Day: 3/28/08
Date: DF
Initials:
Observations/notes: Temperature recorded, Checked beakers for floaters as described, Only two floaters observed,

DF

Signature: [signature]
Disclosed and Understood by: [signature]

DAILY NOTES SHEET

Day:
Date: 3/25/08
Initials: DF
Observations/notes: Checked heaters for floaters. None observed, Replaced overhead lights.

DF

Day:
Date: 3/26/08
Initials: DF, JS
Observations/notes: Recorded WQ parameters. Performed water exchange. Fed animals, No floaters observed.

DF

Day:
Date: 3/31/09
Initials: DF, JG
Observations/notes: recorded daily temps. on modules & heater check. NO heaters seen & all heaters w/ adequate air flow

JG

Signature:
Disclosed and Understood by:

DAILY NOTES SHEET

Day:
Date: 4/1/09
Initials: JG, JW
Observations/notes: Water change on all beakers, module temperatures recorded, all beakers w/ good air flow, all beakers fed 1mL of tetramin food, parameters taken on 1 rep of each treatment

JG

Day:
Date: 4/2/09
Initials: JG
Observations/notes: recorded module temps, all beakers with good air flow, no floaters observed

JG

Day:
Date: 4/3/09
Initials: JG/JW
Observations/notes: parameters on Rep E of all treatments, module temps recorded, all beakers w/ good air flow, water change conducted on all beakers

JG

Signature: Jennifer D. Gan
Disclosed and Understood by:

DAILY NOTES SHEET

Day: 4/4/09
Date:
Initials: PC
Observations/notes: Recorded Module temp, all beakers good

Day: 4/5/09
Date:
Initials: PC
Observations/notes: recorded Module temp., all beakers good.

Day: 4/6/09
Date:
Initials: JB/JW
Observations/notes: recorded daily module temperatures, water change conducted on all beakers, all beakers with good aer flow), all beakers fed 1ml of tetramin food
MK-BH-B rep A- sediment completely orange on top, all MK-BH-B (B) all orange sediment on top. MK-SED-H solid to diseased organisms (i.e. snails) & MK-SED-6.

Signature: Jennifer R Jones
Disclosed and Understood by:

DAILY NOTES SHEET

Day:

Date: 04/07/09

Initials: [illegible]

Observations/notes: BOTH MODULES 1, AND 2 ARE AT SUFFICIENT TEMPERATURES. ALL BEAKERS AERATED.

[illegible initials]

Day: ~~4/8/09~~

Date: 4/8/09

Initials: DF

Observations/notes: Recorded WQ parameters. H_2O Δ conducted. Animals fed. MR-Sed-4 rep A contains snails. MRB4-A rep 2 [illegible] orange coloration on [illegible] surface. MRB4-B rep [illegible] [illegible] [illegible] observed.

DF

Day:

Date: 4/9/09

Initials: JG

Observations/notes: recorded daily temp. in modules, all beakers with good air flow

JG

Signature: [signature]

Disclosed and Understood by: [signature]

DAILY NOTES SHEET

Day:
Date: 4/10/09
Initials: JB
Observations/notes: water change conducted on all beakers, all beakers w/ good air flow, 1mL of food per beakers (1g/200mL 5ppt)

JB

Day: 4/11/09
Date:
Initials: RC
Observations/notes: all beakers good

RC

Day:
Date: 4/12/09
Initials: RC
Observations/notes: all beakers good

RC

Signature: Jennifer D. Hall
Disclosed and Understood by:

DAILY NOTES SHEET

Day:
Date: 4/13/09
Initials: JB
Observations/notes: all beakers with good air flow, water change conducted on all beakers, gave 1mL food of mixture (1eg w/ 200mL 5ppt), module temperatures recorded for all parameters taken on Rep F of all treatments

JB

Day:
Date: 4/14/09
Initials: JB
Observations/notes: recorded daily module temperatures with min & max temps, all beakers with good air flow

JB

Day:
Date: 4/15/09
Initials: JB
Observations/notes: all beakers with good air flow recorded module temperatures, parameters taken on Rep A of all treatments, gave 1mL of food to each beaker, water change conducted on all beakers

JB

Signature:
Disclosed and Understood by:

DAILY NOTES SHEET

Day:
Date: 4/16/09
Initials: JG
Observations/notes: all beakers w/good air flow, recorded module temps.

JG

Day:
Date: 4/17/09
Initials: JG
Observations/notes: all beakers with good air flow, parameters taken on Rep G of all treatments, water change conducted on all beakers, each beaker fed 1mL of tetramin mix.

JG

Day:
Date: 4/18/09
Initials: PC
Observations/notes: all beakers good

PC

Signature: Jennifer Hogan
Disclosed and Understood by:

DAILY NOTES SHEET

Day:
Date: 4/15/09
Initials: DF
Observations/notes: Oligochaetes set up in few beakers in Module 2. Controls look good. beakers cloudy initially, bioturbation.

DF

Day:
Date: 4/20/09
Initials: JB
Observations/notes: water change conducted on all beakers, 1mL food of tetramin mix given to each beaker, parameters taken on Rep B of all treatments, air flow good in all beakers, lots of exuvia on the water & sediment surface

JB

Day:
Date: 4/21/09
Initials: JB
Observations/notes: all beakers good on air flow

JB

Signature: Jennifer D. Jones
Disclosed and Understood by:

DAILY NOTES SHEET

Day:
Date: 4/22/09
Initials: JB
Observations/notes: all beakers with good air flow, parameters taken on beakers Rep A-D for 28 day breakdown, all parameters look good. Observations of sole & nonindigenous organisms will be recorded as well as growth weight survival & reproduction.

Day:
Date: 4/23/09
Initials: JB
Observations/notes: parameters taken on Reps E-H, all parameters look good, breakdown data on app. sheets, weights on sheets also

Day:
Date:
Initials:
Observations/notes:

Signature:
Disclosed and Understood by:

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test initiation date: 3/25-3/26-01

Test termination date: _____

Test Species: *L. plumulosus*

~~Mass Measurements by:~~ DM

Exposure Duration: 28 d

Treatment	Repl.	Initials	# Indigenous Organisms	Comments
SC	A		Ø	
	B		Ø	
	C		Ø	
	D		Ø	
	E		Ø	
	F		Ø	
	G		Ø	
	H		Ø	
ABC	A		Ø	
	B		Ø	
	C		Ø	
	D		Ø	
	E		Ø	
	F		Ø	
	G		Ø	
	H		Ø	
MR-SED-1	A	JS	2 snails, many worms	
	B	JM	1 snail, many worms	
	C	AG	1 chironomid worm	
	D	AG	2 " "	
	E		Ø	
	F		Numerous worms	
	G	[illegible]	19 SNAILS, 7 WORMS	
	H			
MR-SED-2	A	JS	NUMEROUS worms	
	B	DY	2 snails	
	C	JS	2 worms	
	D	DY	numerous worms (very hard to ct)	
	E			
	F	[illegible]	NUMEROUS WORMS	
	G	SC	few worms, 8 snails	6 organisms to Salinas
	H			
MR-SED-4	A		Ø	
	B		Ø	
	C		Ø	
	D		Ø	
	E		Ø	0 organisms to Salinas
	F		Ø	
	G	AG	17 snails	few adults, lots of juveniles
	H		Ø	

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test Species: *L. plumulosus*

Exposure Duration: 28 d

Test initiation date: 3/20-3/26-01

Test termination date:

Mass Measurements by:

Treatment	Repl.	Initials	# Indigenous Organisms	Comments
MR-SED-6	A	JS	22 snails	
	B	JS	29 snails	plant & algal growth
	C	JM	25 snails	plant & algal growth
	D	[illegible]		PLANT & ALGAE GROWTH
	E	JM	21 snails	algal growth
	F	JS	22 snails	algal growth
	G	[illegible]	17 SNAILS	
	H	PC	32 snails	
MR-SED-7	A		Ø	
	B		Ø	
	C	DF	Ø	plant material
	D	JM	Ø	
	E		Ø	
	F		Ø	
	G	JM	Ø	
	H	JS	2 snails	
MR-SED-10	A	JS	4 snails	
	B		2 snails	snail & many small worms
	C	[illegible]	4 SNAILS	
	D	[illegible]	10 SNAILS	
	E	JS	7 SNAILS	
	F	AF	numerous worms (20), 17 snails	
	G	JS	12 SNAILS	
	H	JS	8 Snails, 2 worms	
MR-SED-13	A	JS	12 snails, 3 worms	some algae
	B	DF	Ø	
	C	JS	12 snails, 1 worm	algal growth
	D	JS	10 snails, 1 worm	algal growth
	E	JS	6 snails, 1 worm	
	F	JS	7 snails	algal growth
	G	JM	9 snails	algae growth
	H	JS	10 snails	algal growth
MR-SED-14	A	CB	10 snails	ALGAE;
	B	JM	6 snails	
	C	[illegible]	4 SNAILS	ALGAE
	D		Ø	
	E	JS	30 worms, 2 SNAILS	algal growth
	F		~~2 SNAILS~~	
	G	JM	4 snails, 1 worms	algal growth
	H		2 snails	

Some jackets smaller

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test initiation date: 3/21-3/26-05

Test termination date: _____

Test Species: *L. plumulosus*

~~Mass Measurements by:~~ _____

Exposure Duration: 28 d

05

Treatment	Repl.	Initials	# Indigenous Organisms	Comments
MR-B4-A	A	[illegible]	7300 SMALL WORMS	TOP LAYER OF SED. ORANGE
	B	JW	4 (3snails, 1worm)	top sediment orange color
	C		Ø	
	D	JM	many worms	top sediment orange tint
	E	[illegible]	NUMEROUS WORMS	
	F	JS	1 worm	
	G	JS	4 snails 1 worm	
	H	JM	3 snails	top sediment orange color
MR-B4-B	B		Ø	
	A	JM.	2 SNAILS 2 WORMS	ORANGE TOP SED.
	C	JS	Ø	orange sediment on top, oil sheen
	D	JS	5 (4snails, 1worm)	" "
	E		Ø	
	F	JM	11 snails 1 worm	orange top sediment
	G	JS	2 snails 1 worm	
	H	JS	Ø	orange sediment on top
SCSED-2	A	AG	9 worms	plant material
	B	[illegible]	10 (9 SNAILS, 1 WORM)	
	C	AG	2 worms, 1 snails	plant material
	D		Ø	
	E	JS	8 snails	
	F	AG	25 snails	small animals
	G		Ø	
	H	[illegible]	3 LARGE WORMS, NUMEROUS OTHERS	
SCSED-3	A	JS	13 worms	
	B	PC	alot of worms	
	C		Ø	
	D	JS	13 worms	
	E		Ø	
	F	[illegible]	SEVERAL WORMS	
	G	PC	many worms	
	H	JS	47 worms, 1 snail	plant growth
PRSED-1	A		Ø	
	B	JS	Ø	Ø
	C	JS	78 worms	sand & sticks
	D	JS	Ø	plant growth
	E	[illegible]	6 WORMS, 3 SNAILS	ORANGE TOP SEDIMENT
	F	[illegible]	1 SNAIL	" "
	G		Ø	
	H	[illegible]	3 WORMS, 1 SNAIL	ORANGE TOP SEDIMENT

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test initiation date: 3/25 - 3/26-05

Test termination date: _____

Test Species: *L. plumulosus*

Mass Measurements by: DF

Exposure Duration: 28 d

Treatment	Repl.	Initials	# Indigenous Organisms	Comments
PRSED-2	A	JM	1 Snail & worms	plant growth
	B	JB	0	plant growth
	C		0	
	D	DF	0	Lots of Detritus
	E	JS	0	plant growth
	F	JS	1 worm	plant growth
	G	JM	0	plant growth
	H	[illegible]	several worms	

Signature: [signature]

Disclosed and Understood by: [signature]

DF

TEST TERMINATION SHEET

Project: Exponent-Fairfield

Test Species: *L. plumulosus*

Exposure Duration: 28 d

1 of 4

Test initiation date: 3/25 - 3/26/09

Test termination date: 4/22-4/23/09

Mass Measurements by: JG

Treatment	Repl.	Initials	# Recovered	% Survival	# Neonates Recovered	Neonates/Survivor	Pan #	# Animals on Pan	Pan Weight (mg)	Pan & animal dry weight (mg)	Individual dry weight (mg)	Comments
SC	A	JG	17	85	111	6.53	1	17	0.17839	0.20166	1.369	
	B	JG	16	80	69	4.31	2	16	0.14083	0.14089	1.879	
	C	DF	17	85	81	4.76	3	17	0.11452	0.11741	1.523	
	D	JG	20	100	122	6.10	4	20	0.15795	0.16088	1.447	
	E	DF	16	80	124	7.75	65	16	0.18794	0.20876	1.326	
	F	JG	17	85	75	4.41	66	17	0.22906	0.22968	1.162	
	G	DF	16	80	102	6.38	67	16	0.18518	0.20671	1.471	
	H	DF	16	80	118	7.38	68	16	0.22572	0.24138	1.104	
ABC	A	DF	20	100	68	3.40	5	20	0.18663	0.20593	1.465	
	B	DF	19	95	41	2.16	6	20	0.15113	0.17749	1.318	
	C	JG	16	80	51	3.19	7	16	0.19167	0.21071	1.317	
	D	DF	20	100	65	3.25	8	20	0.19605	0.22243	1.274	
	E	DF	16	80	115	7.19	69	16	0.24828	0.32111	0.989	
	F	JG	16	80	110	6.88	70	16	0.20918	0.22480	1.364	
	G	JG	20	100	103	5.15	71	20	0.17298	0.20142	1.537	
	H	JG	20	100	121	6.05	72	20	0.17295	0.20162	1.414	
MR-SED-1	A	JG	20	100	173	8.65	9	20	0.18572	0.22211	1.670	
	B	JM	17	85	0	0	10	17	0.18136	0.19726	0.935	
	C	AG	18	90	46	2.56	11	18	0.18499	0.20593	1.163	
	D	AG	16	80	42	2.63	12	16	0.18412	0.20080	1.071	
	E	JG	15	75	92	10.13	73	15	0.21536	0.22768	0.827	
	F	DF	15	75	70	4.67	74	15	0.18489	0.20700	1.474	
	G	JM	12	60	57	4.75	75	12	0.18182	0.19314	0.997	
	H	JS	15	75	37	2.47	76	15	0.18088	0.18523	1.143	
MR-SED-2	A	JJ	16	80	20	1.25	13	17	0.10849	0.11880	1.118	
	B	DF	19	95	46	2.42	50	19	0.24049	0.25525	1.303	
	C	JS	20	100	9	0.45	15	16	0.20082	0.21740	1.036	
	D	DF	17	85	0	0	16	17	0.18933	0.20420	0.875	
	E	JS	13	65	22	1.69	77	13	0.10068	0.10449	0.599	
	F	JM	20	100	0	0	78	20	0.15441	~~0.16491~~ 0.16498	~~0.7781~~ 0.7781	DEL
	G	DF	12	60	18	1.50	79	12	0.16276	~~0.16891~~ 0.16890	~~0.2615~~ 0.1689	DEL
	H	JM	13	65	0	0	80	13	0.17480	0.18880	0.928	
MR-SED-4	A	AG	17	85	83	4.88	17	17	0.19838	0.23241	2.002	
	B	DF	20	100	52	2.60	18	20	0.23324	0.27608	2.142	
	C	JS	20	100	98	4.90	19	20	0.24842	0.30602	1.880	
	D	DF	20	100	56	2.80	20	20	0.22076	0.26526	1.925	
	E	DF	14	70	94	6.71	81	14	0.16923	0.19347	1.731	
	F	DF	9	45	31	3.44	82	10	0.11320	0.13487	2.167	
	G	AG	9	45	77	8.56	83	9	0.10510	0.12391	2.091	
	H	AG	16	80	17	1.06	84	17	0.21300	0.24360	1.744	

TEST TERMINATION SHEET

Project: Exponent-Fairfield

Test initiation date: 3/25-3/26/09

Test termination date: 4/22-4/23/09

Test Species: *L. plumulosus*

2 of 4

Mass Measurements by: JS

Exposure Duration: 28 d

Treatment	Repl.	Initials	# Recovered	% Survival	# Neonates Recovered	Neonates/Survivor	Pan #	# Animals on Pan	Pan Weight (mg)	Pan & animal dry weight (mg)	Individual dry weight (mg)	Comments
MR-SED-6	A	JG	20	100	205	10.25	21	20	0.21094	0.25085	1.996	
	B	JG	20	100	77	3.85	22	20	0.19154	0.22868	1.857	
	C	JM	16	80	98	6.13	23	16	0.1559	0.21446	1.784	
	D	JW	20	100	187	9.35	24	20	0.22056	0.27959	1.1652	
	E	JM	16	80	151	9.44	85	17	0.21678	0.24136	1.744	
	F	JG	16	80	101	6.31	86	16	0.21430	0.25046	1.685	
	G	JW	17	85	93	5.47	87	17	0.21835	0.23989	1.855	
	H	PC	16	80	123	7.69	88	16	0.11072	0.14211	1.899	
MR-SED-7	A	DF	19	95	67	3.53	25	19	0.24133	0.28314	1.885	
	B	JM	18	90	24	1.33	20	18	0.21039	0.23440	1.337	
	C	DF	19	95	95	5.00	27	19	0.21614	0.25906	2.292	
	D	JM	20	100	110	5.50	28	20	0.21827	0.25826	1.999	
	E	JS	16	80	116	7.25	89	16	0.23341	0.26814	2.050	
	F	JG	17	85	136	8.00	90	17	0.23541	0.26133	1.816	
	G	JM	15	75	75	5.00	91	15	0.20910	0.23782	2.328	
	H	JG	17	85	167	9.82	92	17	0.20633	0.24520	2.375	
MR-SED-10	A	JG	20	100	165	8.25	29	20	0.26550	0.28542	1.436	
	B	DF	11	55	0	0	30	11	0.21337	0.23596	0.235	
	C	JW	19	95	47	2.47	31	19	0.21725	0.23428	0.370	
	D	JW	17	85	83	4.88	32	17	0.19840	0.21201	0.801	
	E	JG	16	80	19	1.19	93	16	0.17680	0.18092	0.1668	
	F	AG	13	65	8	0.62	94	13	0.23355	0.24361	0.366	
	G	JG	3	15	2	0.67	95	3	0.17194	0.17307	0.370	
	H	JG	7	35	2	0.29	96	7	0.16614	0.16842	0.326	
MR-SED-13	A	JS	18	90	99	5.50	33	18	0.24916	0.25065	1.783	
	B	DF	19	95	215	11.32	34	19	0.17489	0.21393	2.055	
	C	JG	19	95	201	10.58	35	19	0.21671	0.24715	1.602	
	D	JG	7	35	60	8.57	36	7	0.20124	0.21631	2.153	
	E	JS	20	100	61	3.05	97	20	0.14611	0.17912	1.651	
	F	JG	20	100	55	2.75	98	20	0.21629	0.24422	1.397	
	G	JM	18	90	78	4.33	99	18	0.15942	0.18318	1.337	
	H	JM	18	90	83	4.61	100	18	0.16843	0.19279	1.326	
MR-SED-14	A	PC	20	100	68	3.40	37	20	0.18656	0.20518	0.931	
	B	JM	17	85	109	6.41	38	17	0.23131	0.26076	1.544	
	C	AG	18	90	21	1.17	39	18	0.23133	0.26512	1.877	
	D	JW	18	90	107	5.94	40	18	0.23135	0.29130	1.775	
	E	JW	8	40	11	1.38	101	8	0.17193	0.17404	0.264	
	F	JG	14	70	38	2.71	102	14	0.22655	0.25284	1.724	
	G	JM	11	55	81	7.36	103	11	0.20891	0.22915	1.242	
	H	DF	17	85	99	5.82	104	17	0.22536	0.25742	1.886	

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test Species: *L. plumulosus*

Exposure Duration: 28 d

3 of 4

Test initiation date: 3/25 - 3/26/09

Test termination date: 4/22 - 4/23/09

Mass Measurements by: JB

Treatment	Repl.	Initials	# Recovered	% Survival	# Neonates Recovered	Neonates/Survivor	Pan #	# Animals on Pan	Pan Weight (mg)	Pan & animal dry weight (mg)	Individual dry weight (mg)	Comments
MR-B4-A	A	JW	17	85	111	6.53	41	17	0.21945	0.38390	0.850	
	B	JW	20	100	24	1.20	42	19	0.25010	0.27358	1.327	
	C	AG	15	75	Ø	Ø	43	17	0.25536	0.24045	0.899	
	D	AM	15	75	Ø	Ø	44	15	0.21928	0.22819	0.594	
	E	JW	8	40	Ø	Ø	105	8	0.19930	0.19960	0.4059	G-5-79
	F	JS	15	75	15	1.00	106	15	0.31931	0.33104	0.982	
	G	JS	11	55	16	1.45	107	11	0.28164	0.29242	0.889	
	H	JW	14	70	11	0.79	108	14	0.23385	0.25503	1.291	
MR-B4-B	A	JM	10	50	1	0.10	45	10	0.25258	0.26111	0.853	
	B	DF	12	60	5	0.42	46	12	0.21950	0.23235	1.071	
	C	JW	0	Ø	Ø	Ø	47	0	Ø	Ø	Ø	
	D	JG	15	75	8	0.53	48	15	0.16872	0.18213	0.894	
	E	DF	10	50	Ø	Ø	109	10	0.20545	0.21348	0.803	
	F	JM	11	55	Ø	Ø	110	11	0.35140	0.36178	1.029	
	G	JS	8	40	1	0.13	111	8	0.32190	0.33109	2.224	
	H	JS	9	45	6	0.67	112	10	0.29582	0.30421	1.039	
SCSED-2	A	AG	13	65	24	1.85	49	14	0.22275	0.24116	0.974	
	B	JW	20	100	17	0.85	14	14	0.11477	0.11601	1.341	
	C	AG	20	100	62	3.10	51	20	0.24877	0.27385	1.354	
	D	AG	18	90	43	2.39	52	18	0.21959	0.24503	1.413	
	E	JG	16	80	12	0.75	113	16	0.37795	0.38832	0.648	
	F	AG	18	90	49	2.72	114	18	0.28120	0.29447	0.297	
	G	JC	13	65	8	0.62	115	13	0.20918	0.21412	0.380	
	H	JW	11	55	Ø	Ø	116	11	0.22019	0.22176	0.143	
SCSED-3	A	JS	2	10	3	1.50	53	2	0.25085	0.25582	0.370	
	B	DC	17	85	1	0.06	54	15	0.18414	0.19097	0.455	
	C	AG	20	100	74	3.70	55	20	0.22210	0.24807	1.299	
	D	JS	20	100	28	1.40	56	20	0.20878	0.22151	0.1637	
	E	DF	9	45	Ø	Ø	117	9	0.30006	0.30277	0.301	
	F	JW	20	100	Ø	Ø	118	20	0.23106	0.25179	0.857	
	G	AG	19	95	6	0.32	119	19	0.17160	0.18818	0.715	
	H	JG	2	10	1	0.50	120	2	0.23820	0.24100	0.400	
PRSED-1	A	AG	19	95	45	2.37	57	19	0.23231	0.26854	1.923	
	B	JG	19	95	82	4.32	58	19	0.20748	0.24314	1.908	
	C	JG	20	100	156	7.80	59	20	0.21320	0.23704	1.696	
	D	JG	19	95	42	2.21	60	19	0.24976	0.27621	1.497	
	E	JW	18	90	71	3.94	121	18	0.21779	0.23873	1.497	
	F	JW	15	75	71	4.73	122	15	0.18330	0.20080	1.507	
	G	JW	6	30	17	2.83	123	6	0.17240	0.18214	1.013	
	H	JW	17	85	22	1.29	124	17	0.18229	0.20164	1.450	

TEST TERMINATION SHEET

Project: Exponent-Fairfied

Test Species: *L. plumulosus*

Exposure Duration: 28 d

4 of 4

Test initiation date: 3/25-3/26/09

Test termination date: 4/22-4/23/09

Mass Measurements by: JS

Treatment	Repl.	Initials	# Recovered	% Survival	# Neonates Recovered	Neonates/Survivor	Pan #	# Animals on Pan	Pan Weight (mg)	Pan & animal dry weight (mg)	Individual dry weight (mg)	Comments
PRSED-2	A	JM	17	85	89	4.94	101	17	0.2272	0.2602	2.046	
	B	JS	20	100	90	4.50	102	20	0.2565	0.2467	1.535	
	C	DF	20	100	60	3.00	103	20	0.2274	0.2411	1.702	
	D	DF	19	95	65	3.42	104	19	0.1824	0.2048	1.797	
	E	JS	17	85	25	1.47	125	17	0.2273	0.2542	1.582	
	F	JS	20	100	50	2.50	126	20	0.1755	0.2086	1.654	
	G	JM	14	70	71	5.07	127	14	0.1931	0.2174	1.867	
	H	JS	17	85	44	2.59	128	17	0.1655	0.1984	1.771	

Signature: [signature]

Disclosed and Understood by: [signature] 4/10

Appendix B – Sediment Chain of Custody

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

Page 1 of 1

Project: (Name and Number) Mill River MY03147.001.0601

Exponent Environmental Group
Bellevue, WA (425) 643-9803
Boston, MA (781) 466-6681
Boulder, CO (303) 444-7270
Portland, OR (503) 636-4338
Washington, D.C. (301) 577-7830

Exponent Contact: Meg McArdle Office:
Ship to: 3 Clock Tower Place Ste 205, Maynard MA 01754, 978-461-1238
Lab Contact/Phone: US Army ERDC
Samplers: Ben Amos, Ken Currets

Sample No.	Tag No.	Date	Time	Matrix	Analyses Requested: 28-Day Lepidurus Solid Toxicity	Analyses Requested: AVS/SEM	Extra Container	Archive	Remarks
MR-SED-2		3/9/09	1300	SED	X	X			
MR-SED-4		3/10/09	0830						
SCSED-2		3/10/09	1135				1		
SCSED-3		3/10/09	1200				1		
PRSED-2		3/11/09	1115				1		
PRSED-1		3/11/09	1015				1		7 Coolers
MR-B4-A		3/11/09	1430						
MR-B4-B		3/11/09	1445						
MR-SED-13		3/9/09	1245						
MR-SED-14		3/9/09	1340						
MR-SED-10		3/9/09	1415						
MR-SED-6		3/10/09	0900						
MR-SED-7		3/10/09	0930						
MR-SED-1		3/9/09	1230						

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water
OTHER - Please identify codes

Priority: [X] Normal [ ] Rush Rush time period

Shipped via: [X] FedEx/UPS [ ] Courier Other

Condition of Samples Upon Receipt:

Custody Seal Intact: [ ] Yes [ ] No [ ] None

Relinquished by: (Signature) Date/Time: 3/12/09 1700
Received by: Fedex Airbill # 8620 7633 6997 (Signature) Date/Time: 3/12/09 1700

Relinquished by: (Signature) Date/Time:
Received by: (Signature) Date/Time: 3/13/09 1345

Distribution: White and Yellow Copies - Accompany Shipment; Pink Copy - Project File

06258

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 13:45
Collection date/time: 3/10/09
Courier/airbill: FEDEX 795500708297
Container type: Cooler
Custody seal intact?: NO seal on cooler
Temperature: 1°C (sample or temp. bottle)
Technician initials: VG

Project: Exponent Fairfield
Client: Exponent
Container Number: 1 of 7
POC: Daniel Farrar
COC present?: YES
Page 1 of 7

Samples included in container:

Sample Number:	Sample Number:
1 SCSED-3 20f2 12:00 3/10/09	21
2 SCSED-2 20f2 11:35 3/10/09	22
3 SCSED-2 10f2 11:35 3/10/09	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	38
19	39
20	40

Notes: Seals present on each bucket but only tape on the cooler, NO seal

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 1315
Collection date/time: 3/11/09
Courier/airbill: FedEx / 795500708297
Container type: Cooler
Custody seal intact? NO seal on cooler
Temperature: <1 °C (sample or temp. bottle)
Technician initials: JG

Project: Exponent-Fairfield
Client: Exponent
Container Number: 2 of 7
POC: Daniel Farmar
COC present?: YES
Page 2 of 7

Samples included in container:

Sample Number:		Sample Number:	
1	PRSED-1 1015	21	
2	MR-B1-A 1430 3/11/09	22	
3	PRSED-1 10.15	23	
4		24	
5		25	
6		26	
7		27	
8		28	
9		29	
10		30	
11		31	
12		32	
13		33	
14		34	
15		35	
16		36	
17		37	
18		38	
19		39	
20		40	

Notes: Seals present on buckets, only tape on coolers

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 13:45
Collection date/time: 3/9/09 & 3/10/09
Courier/airbill: FedEx / 795007082977
Container type: Cooler
Custody seal intact?: NO seal on cooler
Temperature: 3°C (sample or temp. bottle)
Technician initials: JG

Project: Exponent / Fairfield
Client: Exponent
Container Number: 3 of 7
POC: Daniel Farrar
COC present?: YES
Page 3 of 7

Samples included in container:

Sample Number:	Sample Number:
1 MR-SED-10 1415 3/9/09	21
2 MR-SED-6 0900 3/10/09	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	38
19	39
20	40

Notes: Seals present on buckets, only tape on coolers

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 1345
Collection date/time: 3/9/09 & 3/11/09
Courier/airbill: FedEx / 795500708297
Container type: Cooler
Custody seal intact?: NO seal on cooler
Temperature: 1°C (sample or temp. bottle)
Technician initials: JG

Project: Exponent / Fairfield
Client: Exponent
Container Number: 4 of 7
POC: Daniel Farrar
COC present?: YES
Page 4 of 7

Samples included in container:

Sample Number:		Sample Number:	
1	MR-SED-14 1340 3/9/09	21	
2	MR-SED-13 1245 3/9/09	22	
3	MR-BH-B 1445 3/11/09	23	
4		24	
5		25	
6		26	
7		27	
8		28	
9		29	
10		30	
11		31	
12		32	
13		33	
14		34	
15		35	
16		36	
17		37	
18		38	
19		39	
20		40	

Notes: Seals present on each bucket, only tape on cooler

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 1315
Collection date/time: 3/9/09 & 3/10/09
Courier/airbill: FedEX / 795500708297
Container type: Cooler
Custody seal intact?: ND seal on cooler
Temperature: 2°C (sample or temp. bottle)
Technician initials: JG

Project: Exponent / Fairfield
Client: Exponent
Container Number: 5 of 7
POC: Daniel Farvar
COC present?: YES
Page 5 of 7

Samples included in container:

Sample Number:	Sample Number:
1 MR-SED-2 1300 3/9/09	21
2 SC-SED-3 1200 3/10/09	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	38
19	39
20	40

Notes: Seals present on each bucket, only tape on cooler

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 1345
Collection date/time: 3/10/09 & 3/11/09
Courier/airbill: FedEx/ 795520708297
Container type: Cooler
Custody seal intact?: No seal on cooler
Temperature: 3°C (sample or temp. bottle)
Technician initials: JG

Project: Exponent/Fairfield
Client: Exponent
Container Number: 1e of 7
POC: Daniel Farrar
COC present?: YES
Page 1e of 7

Samples included in container:

Sample Number:		Sample Number:	
1	PR-SED-2 1of2 3/11/09 1115	21	
2	PR-SED-2 2of2 3/11/09 1115	22	
3	MR-SED-4 3/10/09 0830	23	
4		24	
5		25	
6		26	
7		27	
8		28	
9		29	
10		30	
11		31	
12		32	
13		33	
14		34	
15		35	
16		36	
17		37	
18		38	
19		39	
20		40	

Notes: Seals on each bucket, only tape on cooler

Revised: August 2008

EERT SAMPLE RECEIPT

Date/time received: 3/13/09 1345
Collection date/time: 3/9/09 & 3/10/09
Courier/airbill: FedEx / 795500708297
Container type: Cooler
Custody seal intact?: NO Seal on cooler
Temperature: 2°C (sample or temp. bottle)
Technician initials: JB

Project: Exponent/ Fairfield
Client: Exponent
Container Number: 7 of 7
POC: Daniel Farrar
COC present?: YES
Page 7 of 7

Samples included in container:

Sample Number:	Sample Number:
1 MR-SED-1 1230 3/9/09	21
2 MR-SED-7 0920 3/10/09	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29
10	30
11	31
12	32
13	33
14	34
15	35
16	36
17	37
18	38
19	39
20	40

Notes: Seals present on each bucket, only tape on cooler

Revised: August 2008

Appendix C –Statistical Analysis

Survival versus SC-SED-2 Reference

One Way Analysis of Variance Monday, April 27, 2009, 4:28:01 PM

Data source: Data 1 in Notebook 1

Dependent Variable: Suvival SC-SED-2

Normality Test: Passed (P = 0.372)

Equal Variance Test: Passed (P = 0.698)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	1.141	0.204	0.0720
MR-SED-2	8	0	1.191	0.278	0.0983
MR-SED-4	8	0	1.182	0.358	0.126
MR-SED-6	8	0	1.289	0.234	0.0828
MR-SED-7	8	0	1.251	0.167	0.0589
MR-SED-10	8	0	1.000	0.381	0.135
MR-SED-13	8	0	1.277	0.293	0.103
MR-SED-14	8	0	1.116	0.275	0.0972
MR-B4-A	8	0	1.050	0.259	0.0915
MR-B4-B	8	0	0.720	0.311	0.110
SC-SED-2	8	0	1.182	0.282	0.0997

Source of Variation	DF	SS	MS	F	P
Between Groups	10	2.100	0.210	2.629	0.008
Residual	77	6.149	0.0799		
Total	87	8.248			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.008).

Power of performed test with alpha = 0.050: 0.743

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Col 1**

Comparison	Diff of Means	q'	P	P<0.050
SC-SED-2 vs. MR-B4-B	0.462	3.272	--	Yes
SC-SED-2 vs. MR-SED-10	0.182	1.289	--	No
SC-SED-2 vs. MR-B4-A	0.133	0.939	--	Do Not Test
SC-SED-2 vs. MR-SED-6	0.107	0.758	--	Do Not Test
SC-SED-2 vs. MR-SED-13	0.0943	0.668	--	Do Not Test
SC-SED-2 vs. MR-SED-7	0.0691	0.489	--	Do Not Test
SC-SED-2 vs. MR-SED-14	0.0664	0.470	--	Do Not Test
SC-SED-2 vs. MR-SED-1.	0.0413	0.292	--	Do Not Test
SC-SED-2 vs. MR-SED-2	0.00886	0.0627	--	Do Not Test
SC-SED-2 vs. MR-SED-4	0.000423	0.00299	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Survival versus SC-SED-3 Reference

One Way Analysis of Variance Monday, April 27, 2009, 4:28:34 PM

Data source: Data 1 in Notebook 1

Dependent Variable: Survival SC-SED-3

Normality Test: Passed (P = 0.229)

Equal Variance Test: Passed (P = 0.143)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	1.141	0.204	0.0720
MR-SED-2	8	0	1.191	0.278	0.0983
MR-SED-4	8	0	1.182	0.358	0.126
MR-SED-6	8	0	1.289	0.234	0.0828
MR-SED-7	8	0	1.251	0.167	0.0589
MR-SED-10	8	0	1.000	0.381	0.135
MR-SED-13	8	0	1.277	0.293	0.103
MR-SED-14	8	0	1.116	0.275	0.0972
MR-B4-A	8	0	1.050	0.259	0.0915
MR-B4-B	8	0	0.720	0.311	0.110
SC-SED-3	8	0	1.076	0.544	0.192

Source of Variation	DF	SS	MS	F	P
Between Groups	10	2.088	0.209	2.098	0.035
Residual	77	7.663	0.0995		
Total	87	9.751			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.035).

Power of performed test with alpha = 0.050: 0.528

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Col 5**

Comparison	Diff of Means	q'	P	P<0.050
SC-SED-3 vs. MR-B4-B	0.356	2.259	--	No
SC-SED-3 vs. MR-SED-6	0.213	1.351	--	Do Not Test
SC-SED-3 vs. MR-SED-13	0.200	1.270	--	Do Not Test
SC-SED-3 vs. MR-SED-7	0.175	1.111	--	Do Not Test
SC-SED-3 vs. MR-SED-2	0.115	0.728	--	Do Not Test
SC-SED-3 vs. MR-SED-4	0.106	0.670	--	Do Not Test
SC-SED-3 vs. MR-SED-10	0.0762	0.483	--	Do Not Test
SC-SED-3 vs. MR-SED-1.	0.0648	0.411	--	Do Not Test
SC-SED-3 vs. MR-SED-14	0.0396	0.251	--	Do Not Test
SC-SED-3 vs. MR-B4-A	0.0266	0.169	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Survival versus PR-SED-1

One Way Analysis of Variance Monday, April 27, 2009, 4:29:12 PM

Data source: Data 1 in Notebook 1

Dependent Variable: Survival PR-SED-01

Normality Test: Passed (P = 0.249)

Equal Variance Test: Passed (P = 0.767)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	1.141	0.204	0.0720
MR-SED-2	8	0	1.191	0.278	0.0983
MR-SED-4	8	0	1.182	0.358	0.126
MR-SED-6	8	0	1.289	0.234	0.0828
MR-SED-7	8	0	1.251	0.167	0.0589
MR-SED-10	8	0	1.000	0.381	0.135
MR-SED-13	8	0	1.277	0.293	0.103
MR-SED-14	8	0	1.116	0.275	0.0972
MR-B4-A	8	0	1.050	0.259	0.0915
MR-B4-B	8	0	0.720	0.311	0.110
PR-SED-1	8	0	1.207	0.296	0.105

Source of Variation	DF	SS	MS	F	P
Between Groups	10	2.126	0.213	2.638	0.008
Residual	77	6.204	0.0806		
Total	87	8.330			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.008).

Power of performed test with alpha = 0.050: 0.746

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Col 9**

Comparison	Diff of Means	q'	P	P<0.050
PR-SED-1 vs. MR-B4-B	0.487	3.431	--	Yes
PR-SED-1 vs. MR-SED-10	0.207	1.458	--	No
PR-SED-1 vs. MR-B4-A	0.157	1.109	--	Do Not Test
PR-SED-1 vs. MR-SED-14	0.0911	0.642	--	Do Not Test
PR-SED-1 vs. MR-SED-6	0.0823	0.580	--	Do Not Test
PR-SED-1 vs. MR-SED-13	0.0696	0.490	--	Do Not Test
PR-SED-1 vs. MR-SED-1.	0.0660	0.465	--	Do Not Test
PR-SED-1 vs. MR-SED-7	0.0444	0.313	--	Do Not Test
PR-SED-1 vs. MR-SED-4	0.0252	0.177	--	Do Not Test
PR-SED-1 vs. MR-SED-2	0.0159	0.112	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Survival versus PR-SED-2

One Way Analysis of Variance Monday, April 27, 2009, 4:29:47 PM

Data source: Data 1 in Notebook 1

Dependent Variable: Survival PR-SED-2

Normality Test: Passed (P = 0.458)

Equal Variance Test: Passed (P = 0.706)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	1.141	0.204	0.0720
MR-SED-2	8	0	1.191	0.278	0.0983
MR-SED-4	8	0	1.182	0.358	0.126
MR-SED-6	8	0	1.289	0.234	0.0828
MR-SED-7	8	0	1.251	0.167	0.0589
MR-SED-10	8	0	1.000	0.381	0.135
MR-SED-13	8	0	1.277	0.293	0.103
MR-SED-14	8	0	1.116	0.275	0.0972
MR-B4-A	8	0	1.050	0.259	0.0915
MR-B4-B	8	0	0.720	0.311	0.110
PR-SED-2	8	0	1.321	0.227	0.0804

Source of Variation	DF	SS	MS	F	P
Between Groups	10	2.362	0.236	3.054	0.003
Residual	77	5.955	0.0773		
Total	87	8.317			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.003).

Power of performed test with alpha = 0.050: 0.858

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Col 13**

Comparison	Diff of Means	q'	P	P<0.050
PR-SED-2 vs. MR-B4-B	0.601	4.323	--	Yes
PR-SED-2 vs. MR-SED-10	0.321	2.308	--	No
PR-SED-2 vs. MR-B4-A	0.271	1.952	--	Do Not Test
PR-SED-2 vs. MR-SED-14	0.205	1.476	--	Do Not Test
PR-SED-2 vs. MR-SED-1.	0.180	1.295	--	Do Not Test
PR-SED-2 vs. MR-SED-4	0.139	1.001	--	Do Not Test
PR-SED-2 vs. MR-SED-2	0.130	0.934	--	Do Not Test
PR-SED-2 vs. MR-SED-7	0.0696	0.501	--	Do Not Test
PR-SED-2 vs. MR-SED-13	0.0445	0.320	--	Do Not Test
PR-SED-2 vs. MR-SED-6	0.0318	0.228	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Biomass versus SC-SED-2

One Way Analysis of Variance Tuesday, May 05, 2009, 12:28:02 PM

Data source: Data 3 in Stats

Dependent Variable: Biomass

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, May 05, 2009, 12:28:02 PM

Data source: Data 3 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	1.153	0.966	1.572
MR-SED-2	8	0	0.922	0.737	1.077
MR-SED-4	8	0	1.963	1.812	2.117
MR-SED-6	8	0	1.820	1.698	1.878
MR-SED-7	8	0	2.024	1.851	2.310
MR-SED-10	8	0	0.370	0.346	0.734
MR-SED-13	8	0	1.626	1.331	1.919
MR-SED-14	8	0	1.634	1.086	1.826
MR-B4-A	8	0	0.894	0.722	1.137
MR-B4-B	8	0	0.962	0.828	1.055
SC-SED-2	8	0	0.811	0.339	1.347

H = 52.816 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-SED-7 vs SC-SED-2	48.563	3.802	Yes
MR-SED-4 vs SC-SED-2	47.625	3.728	Yes
MR-SED-6 vs SC-SED-2	39.125	3.063	Yes
MR-SED-13 vs SC-SED-2	27.063	2.119	No
MR-SED-14 vs SC-SED-2	22.625	1.771	Do Not Test
MR-SED-1. vs SC-SED-2	14.625	1.145	Do Not Test
MR-SED-10 vs SC-SED-2	11.250	0.881	Do Not Test
MR-B4-B vs SC-SED-2	5.625	0.440	Do Not Test
MR-SED-2 vs SC-SED-2	0.875	0.0685	Do Not Test
MR-B4-A vs SC-SED-2	0.375	0.0294	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Biomass versus SC-SED-3

One Way Analysis of Variance Tuesday, May 05, 2009, 12:28:46 PM

Data source: Data 3 in Stats

Dependent Variable: Biomass

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, May 05, 2009, 12:28:46 PM

Data source: Data 3 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	1.153	0.966	1.572
MR-SED-2	8	0	0.922	0.737	1.077
MR-SED-4	8	0	1.963	1.812	2.117
MR-SED-6	8	0	1.820	1.698	1.878
MR-SED-7	8	0	2.024	1.851	2.310
MR-SED-10	8	0	0.370	0.346	0.734
MR-SED-13	8	0	1.626	1.331	1.919
MR-SED-14	8	0	1.634	1.086	1.826
MR-B4-A	8	0	0.894	0.722	1.137
MR-B4-B	8	0	0.962	0.828	1.055
SC-SED-3	8	0	0.546	0.385	0.786

H = 56.015 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-SED-7 vs SC-SED-3	57.688	4.516	Yes
MR-SED-4 vs SC-SED-3	56.375	4.413	Yes
MR-SED-6 vs SC-SED-3	47.875	3.748	Yes
MR-SED-13 vs SC-SED-3	36.563	2.862	Yes
MR-SED-14 vs SC-SED-3	31.875	2.495	No
MR-SED-1. vs SC-SED-3	24.750	1.938	Do Not Test
MR-B4-B vs SC-SED-3	16.000	1.253	Do Not Test
MR-SED-2 vs SC-SED-3	11.875	0.930	Do Not Test
MR-B4-A vs SC-SED-3	11.250	0.881	Do Not Test
MR-SED-10 vs SC-SED-3	2.750	0.215	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Biomass versus PR-SED-1

One Way Analysis of Variance Tuesday, May 05, 2009, 12:29:29 PM

Data source: Data 3 in Stats

Dependent Variable: Biomass

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, May 05, 2009, 12:29:29 PM

Data source: Data 3 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	1.153	0.966	1.572
MR-SED-2	8	0	0.922	0.737	1.077
MR-SED-4	8	0	1.963	1.812	2.117
MR-SED-6	8	0	1.820	1.698	1.878
MR-SED-7	8	0	2.024	1.851	2.310
MR-SED-10	8	0	0.370	0.346	0.734
MR-SED-13	8	0	1.626	1.331	1.919
MR-SED-14	8	0	1.634	1.086	1.826
MR-B4-A	8	0	0.894	0.722	1.137
MR-B4-B	8	0	0.962	0.828	1.055
PR-SED-1	8	0	1.590	1.497	1.802

H = 55.204 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-SED-10 vs PR-SED-1	42.750	3.347	Yes
MR-B4-A vs PR-SED-1	32.125	2.515	No
MR-SED-2 vs PR-SED-1	31.625	2.476	Do Not Test
MR-B4-B vs PR-SED-1	26.125	2.045	Do Not Test
MR-SED-7 vs PR-SED-1	19.063	1.492	Do Not Test
MR-SED-4 vs PR-SED-1	18.500	1.448	Do Not Test
MR-SED-1. vs PR-SED-1	18.250	1.429	Do Not Test
MR-SED-6 vs PR-SED-1	8.750	0.685	Do Not Test
MR-SED-14 vs PR-SED-1	8.625	0.675	Do Not Test
MR-SED-13 vs PR-SED-1	3.688	0.289	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Biomass versus PR-SED-2

One Way Analysis of Variance Tuesday, May 05, 2009, 12:30:19 PM

Data source: Data 3 in Stats

Dependent Variable: Biomass

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, May 05, 2009, 12:30:19 PM

Data source: Data 3 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	1.153	0.966	1.572
MR-SED-2	8	0	0.922	0.737	1.077
MR-SED-4	8	0	1.963	1.812	2.117
MR-SED-6	8	0	1.820	1.698	1.878
MR-SED-7	8	0	2.024	1.851	2.310
MR-SED-10	8	0	0.370	0.346	0.734
MR-SED-13	8	0	1.626	1.331	1.919
MR-SED-14	8	0	1.634	1.086	1.826
MR-B4-A	8	0	0.894	0.722	1.137
MR-B4-B	8	0	0.962	0.828	1.055
PR-SED-2	8	0	1.736	1.618	1.832

H = 55.329 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-SED-10 vs PR-SED-2	46.375	3.631	Yes
MR-B4-A vs PR-SED-2	35.750	2.799	No
MR-SED-2 vs PR-SED-2	35.250	2.760	Do Not Test
MR-B4-B vs PR-SED-2	29.750	2.329	Do Not Test
MR-SED-1. vs PR-SED-2	22.500	1.761	Do Not Test
MR-SED-7 vs PR-SED-2	15.438	1.209	Do Not Test
MR-SED-4 vs PR-SED-2	14.250	1.116	Do Not Test
MR-SED-14 vs PR-SED-2	12.750	0.998	Do Not Test
MR-SED-13 vs PR-SED-2	8.063	0.631	Do Not Test
MR-SED-6 vs PR-SED-2	4.000	0.313	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Reproduction versus SC-SED-2

One Way Analysis of Variance Monday, April 27, 2009, 4:36:22 PM

Data source: Data 2 in Stats

Dependent Variable: Reproduction SC-SED-2

Normality Test: Passed (P = 0.053)

Equal Variance Test: Passed (P = 0.063)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	3.981	2.659	0.940
MR-SED-2	8	0	0.914	0.930	0.329
MR-SED-4	8	0	4.370	2.419	0.855
MR-SED-6	8	0	7.310	2.243	0.793
MR-SED-7	8	0	5.679	2.659	0.940
MR-SED-10	8	0	2.295	2.883	1.019
MR-SED-13	8	0	6.339	3.362	1.189
MR-SED-14	8	0	4.275	2.407	0.851
MR-B4-A	8	0	1.371	2.163	0.765
MR-B4-B	8	0	0.230	0.268	0.0949
SC-SED-2	8	0	1.534	1.132	0.400

Source of Variation	DF	SS	MS	F	P
Between Groups	10	449.102	44.910	8.615	<0.001
Residual	77	401.382	5.213		
Total	87	850.484			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Sediment**

Comparison	Diff of Means	q'	P	P<0.050
SC-SED-2 vs. MR-SED-6	5.776	5.060	--	Yes
SC-SED-2 vs. MR-SED-13	4.805	4.209	--	Yes
SC-SED-2 vs. MR-SED-7	4.145	3.631	--	Yes
SC-SED-2 vs. MR-SED-4	2.836	2.484	--	No
SC-SED-2 vs. MR-SED-14	2.741	2.401	--	Do Not Test
SC-SED-2 vs. MR-SED-1.	2.447	2.143	--	Do Not Test
SC-SED-2 vs. MR-B4-B	1.304	1.142	--	Do Not Test
SC-SED-2 vs. MR-SED-10	0.761	0.667	--	Do Not Test
SC-SED-2 vs. MR-SED-2	0.620	0.543	--	Do Not Test
SC-SED-2 vs. MR-B4-A	0.163	0.143	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Reproduction versus SC-SED-03

One Way Analysis of Variance Monday, April 27, 2009, 4:37:57 PM

Data source: Data 2 in Stats

Dependent Variable: Reproduction SC-SED-03

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Monday, April 27, 2009, 4:37:57 PM

Data source: Data 2 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	3.646	2.511	5.442
MR-SED-2	8	0	0.850	0.000	1.596
MR-SED-4	8	0	4.163	2.700	5.807
MR-SED-6	8	0	7.000	5.798	9.394
MR-SED-7	8	0	5.250	4.263	7.625
MR-SED-10	8	0	0.927	0.451	3.678
MR-SED-13	8	0	5.056	3.692	9.575
MR-SED-14	8	0	4.612	2.045	6.178
MR-B4-A	8	0	0.893	0.000	1.327
MR-B4-B	8	0	0.113	0.000	0.475
SC-SED-3	8	0	0.408	0.0294	1.450

H = 50.530 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-SED-6 vs SC-SED-3	49.438	3.870	Yes
MR-SED-13 vs SC-SED-3	42.000	3.288	Yes
MR-SED-7 vs SC-SED-3	40.125	3.141	Yes
MR-SED-4 vs SC-SED-3	31.625	2.476	No
MR-SED-14 vs SC-SED-3	31.188	2.442	Do Not Test
MR-SED-1. vs SC-SED-3	26.313	2.060	Do Not Test
MR-SED-10 vs SC-SED-3	11.188	0.876	Do Not Test
MR-B4-B vs SC-SED-3	9.375	0.734	Do Not Test
MR-B4-A vs SC-SED-3	2.688	0.210	Do Not Test
MR-SED-2 vs SC-SED-3	0.375	0.0294	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties

Reproduction versus PR-SED-1

One Way Analysis of Variance Monday, April 27, 2009, 4:38:42 PM

Data source: Data 2 in Stats

Dependent Variable: Reproduction PR-SED-01

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Monday, April 27, 2009, 4:38:42 PM

Data source: Data 2 in Stats

Group	N	Missing	Median	25%	75%
MR-SED-1.	8	0	3.646	2.511	5.442
MR-SED-2	8	0	0.850	0.000	1.596
MR-SED-4	8	0	4.163	2.700	5.807
MR-SED-6	8	0	7.000	5.798	9.394
MR-SED-7	8	0	5.250	4.263	7.625
MR-SED-10	8	0	0.927	0.451	3.678
MR-SED-13	8	0	5.056	3.692	9.575
MR-SED-14	8	0	4.612	2.045	6.178
MR-B4-A	8	0	0.893	0.000	1.327
MR-B4-B	8	0	0.113	0.000	0.475
PR-SED-1	8	0	3.389	2.289	4.525

H = 48.222 with 10 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
MR-B4-B vs PR-SED-1	35.438	2.774	No
MR-SED-2 vs PR-SED-1	27.000	2.114	Do Not Test
MR-SED-6 vs PR-SED-1	25.250	1.977	Do Not Test
MR-B4-A vs PR-SED-1	23.500	1.840	Do Not Test
MR-SED-13 vs PR-SED-1	17.313	1.355	Do Not Test
MR-SED-7 vs PR-SED-1	15.563	1.218	Do Not Test
MR-SED-10 vs PR-SED-1	15.000	1.174	Do Not Test
MR-SED-4 vs PR-SED-1	6.063	0.475	Do Not Test
MR-SED-14 vs PR-SED-1	5.500	0.431	Do Not Test
MR-SED-1. vs PR-SED-1	1.000	0.0783	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Reproduction versus PR-SED-2

One Way Analysis of Variance Monday, April 27, 2009, 4:39:29 PM

Data source: Data 2 in Stats

Dependent Variable: Reproduction PR-SED-2

Normality Test: Passed (P = 0.051)

Equal Variance Test: Passed (P = 0.072)

Group Name	N	Missing	Mean	Std Dev	SEM
MR-SED-1.	8	0	3.981	2.659	0.940
MR-SED-2	8	0	0.914	0.930	0.329
MR-SED-4	8	0	4.370	2.419	0.855
MR-SED-6	8	0	7.310	2.243	0.793
MR-SED-7	8	0	5.679	2.659	0.940
MR-SED-10	8	0	2.295	2.883	1.019
MR-SED-13	8	0	6.339	3.362	1.189
MR-SED-14	8	0	4.275	2.407	0.851
MR-B4-A	8	0	1.371	2.163	0.765
MR-B4-B	8	0	0.230	0.268	0.0949
PR-SED-2	8	0	3.437	1.294	0.457

Source of Variation	DF	SS	MS	F	P
Between Groups	10	416.140	41.614	7.929	<0.001
Residual	77	404.130	5.248		
Total	87	820.270			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

Multiple Comparisons versus Control Group (Dunnett's Method) :

Comparisons for factor: **Sediment**

Comparison	Diff of Means	q'	P	P<0.050
PR-SED-2 vs. MR-SED-6	3.874	3.382	--	Yes
PR-SED-2 vs. MR-B4-B	3.206	2.799	--	Yes
PR-SED-2 vs. MR-SED-13	2.902	2.534	--	No
PR-SED-2 vs. MR-SED-2	2.522	2.202	--	Do Not Test
PR-SED-2 vs. MR-SED-7	2.243	1.958	--	Do Not Test
PR-SED-2 vs. MR-B4-A	2.065	1.803	--	Do Not Test
PR-SED-2 vs. MR-SED-10	1.141	0.996	--	Do Not Test
PR-SED-2 vs. MR-SED-4	0.933	0.815	--	Do Not Test
PR-SED-2 vs. MR-SED-14	0.838	0.732	--	Do Not Test
PR-SED-2 vs. MR-SED-1.	0.544	0.475	--	Do Not Test

Note: The P values for Dunnett's and Duncan's tests are currently unavailable except for reporting that the P's are greater or less than the critical values of .05 and .01.

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Appendix C

Statistical Analyses

Table C-1. Summary of Levene's variance test and Shapiro-Wilkes distribution test results

	Percent Survival				Neonates per Survivor				Dry Weight (mg)			
	As measured		Arcsine Square-root		As measured		Square-root		As measured		Square-root	
Levene's Test for Equal Variances												
All locations	<0.0001	Not equal	0.0001	Not equal	<0.0001	Not equal	0.0035	Not equal	<0.0001	Not equal	<0.0001	Not equal
Shapiro-Wilkes Test for Normality												
Control												
AB	0.0028	Not normal	0.0057	Not normal	0.3149	Normal	0.3719	Normal	0.1066	Normal	0.0621	Normal
Sequim	0.0015	Not normal	0.0001	Not normal	0.3592	Normal	0.3180	Normal	0.5637	Normal	0.7033	Normal
Reference												
PRSED-01	0.0026	Not normal	0.1512	Normal	0.3928	Normal	0.8874	Normal	0.1324	Normal	0.1583	Normal
PRSED-02	0.0972	Normal	0.1028	Normal	0.5584	Normal	0.5898	Normal	0.7481	Normal	0.8097	Normal
SCSED-02	0.3044	Normal	0.2901	Normal	0.4981	Normal	0.4008	Normal	0.1946	Normal	0.2671	Normal
SCSED-03	0.0117	Normal	0.0526	Normal	0.0160	Normal	0.4896	Normal	0.2114	Normal	0.5403	Normal
Mill River												
MRB4-A	0.6919	Normal	0.3384	Normal	0.0007	Not normal	0.1070	Normal	0.3277	Normal	0.3656	Normal
MRB4-B	0.1401	Normal	0.0094	Normal	0.0579	Normal	0.1295	Normal	0.0744	Normal	0.0155	Normal
MRSED-01	0.8084	Normal	0.1670	Normal	0.8085	Normal	0.2634	Normal	0.2782	Normal	0.3624	Normal
MRSED-02	0.1986	Normal	0.1853	Normal	0.1880	Normal	0.0830	Normal	0.8034	Normal	0.6466	Normal
MRSED-04	0.0813	Normal	0.1091	Normal	0.8498	Normal	0.9735	Normal	0.4393	Normal	0.4227	Normal
MRSED-06	0.0028	Not normal	0.0015	Not normal	0.6609	Normal	0.6512	Normal	0.7997	Normal	0.7877	Normal
MRSED-07	0.8624	Normal	0.5722	Normal	0.9744	Normal	0.7645	Normal	0.3450	Normal	0.2323	Normal
MRSED-10	0.5958	Normal	0.9983	Normal	0.0251	Normal	0.7281	Normal	0.0180	Normal	0.0928	Normal
MRSED-13	0.0001	Not normal	0.0274	Normal	0.1985	Normal	0.3326	Normal	0.0842	Normal	0.0037	Not normal
MRSED-14	0.2522	Normal	0.7958	Normal	0.2949	Normal	0.2432	Normal	0.0860	Normal	0.0198	Normal

Note: *P* -values reported have not been adjusted for the number of comparisons.

Table C-2. Summary of comparisons between laboratory control and site locations

	Percent Survival			Neonates per Survivor			Dry Weight (mg)		
	Wilcoxon[a]		Dunnett's[b,c]	Wilcoxon[a]		Dunnett's[b,d]	Wilcoxon[a]		Dunnett's[b]
MRB4-A	0.0093	Sig.Lower	--	0.0014	Sig.Lower	Sig.Lower	0.0004	Sig.Lower	Sig.Lower
MRB4-B	0.0001	Sig.Lower	Sig.Lower	0.0001	Sig.Lower	Sig.Lower	0.0045	Sig.Lower	--
MRSED-01	0.0773	--	--	0.1719	--	--	0.3826	--	--
MRSED-02	0.3750	--	--	0.0001	Sig.Lower	Sig.Lower	0.0001	Sig.Lower	Sig.Lower
MRSED-04	0.4830	--	--	0.3503	--	--	<0.0001	Sig.Higher	Sig.Higher
MRSED-06	0.9737	--	--	0.0607	--	--	0.0001	Sig.Higher	Sig.Higher
MRSED-07	0.9748	--	--	0.6460	--	--	0.0004	Sig.Higher	Sig.Higher
MRSED-10	0.0830	--	--	0.0131	--	Sig.Lower	0.0004	Sig.Lower	Sig.Lower
MRSED-13	0.3954	--	--	0.7875	--	--	0.1200	--	--
MRSED-14	0.4144	--	--	0.2702	--	--	0.3826	--	--

Notes:

There were no significant differences between the laboratory controls (Sequim and AB), therefore they were pooled for comparison with the site locations.

Significance was determined using two-sided comparisons with an overall alpha level of 0.10.

[a] - Wilcoxon test *P*-values are for two-sided tests for differences without an adjustment for the number of comparisons.

[b] - Dunnett's test was conducted after an initial ANOVA comparison.

[c] - Arcsine square-root transform was applied to the survival fraction.

[d] - Square-root transform was applied to the neonates per survivor.

Table C-3. Summary of comparisons between laboratory control and reference-site locations

	Percent Survival			Neonates per Survivor			Dry Weight (mg)		
	Wilcoxon[a]		Dunnett's[b,c]	Wilcoxon[a]		Dunnett's[b,d]	Wilcoxon[a]		Dunnett's[b]
PRSED-01	1.0000	--	--	0.0702	--	--	0.0013	Sig.Higher	--
PRSED-02	0.4445	--	--	0.0230	Sig.Lower	--	0.0001	Sig.Higher	Sig.Higher
SCSED-02	0.4107	--	--	0.0000	Sig.Lower	Sig.Lower	0.0107	Sig.Lower	Sig.Lower
SCSED-03	0.7999	--	--	0.0003	Sig.Lower	Sig.Lower	0.0000	Sig.Lower	Sig.Lower

Notes:

There were no significant differences between the laboratory controls (Sequim and AB); therefore, they were pooled for comparison with the site locations.

Significance was determined using two-sided comparisons with an overall alpha level of 0.10.

[a] - Wilcoxon test *P*-values are for two-sided tests for differences without an adjustment for the number of comparisons.

[b] - Dunnett's test was conducted after an initial ANOVA comparison.

[c] - Arcsine square-root transform was applied to the survival fraction.

[d] - Square-root transform was applied to the neonates per survivor.

Table C-4. Summary of comparisons between reference-site locations and site locations

	Combined Reference-Sites			Patchogue River only			Sasco River only		
	Wilcoxon[a]		Dunnett's[b,c]	Wilcoxon[a]		Dunnett's[b,d]	Wilcoxon[a]		Dunnett's[b]
Percent Survival									
MRB4-A	0.1080	--	--	0.0376	--	--	0.4215	--	--
MRB4-B	0.0012	Sig.Lower	Sig.Lower	0.0007	Sig.Lower	Sig.Lower	0.0150	--	Sig.Lower
MRSED-01	0.2890	--	--	0.1135	--	--	0.7570	--	--
MRSED-02	0.6556	--	--	0.3665	--	--	0.9504	--	--
MRSED-04	0.7701	--	--	0.5323	--	--	0.9502	--	--
MRSED-06	0.8769	--	--	0.7783	--	--	0.5512	--	--
MRSED-07	1.0000	--	--	0.6846	--	--	0.6874	--	--
MRSED-10	0.1508	--	--	0.0770	--	--	0.4214	--	--
MRSED-13	0.4920	--	--	0.6619	--	--	0.4357	--	--
MRSED-14	0.3552	--	--	0.1915	--	--	0.7333	--	--
Neonates per Survivor									
MRB4-A	0.0625	--	--	0.0036	Sig.Lower	Sig.Lower	0.6658	--	--
MRB4-B	0.0010	Sig.Lower	Sig.Lower	0.0001	Sig.Lower	Sig.Lower	0.0417	--	--
MRSED-01	0.1118	--	--	0.6968	--	--	0.0141	--	Sig.Higher
MRSED-02	0.0243	--	--	0.0007	Sig.Lower	Sig.Lower	0.5169	--	--
MRSED-04	0.0292	--	--	0.4167	--	--	0.0020	Sig.Higher	Sig.Higher
MRSED-06	0.0001	Sig.Higher	Sig.Higher	0.0005	Sig.Higher	Sig.Higher	0.0001	Sig.Higher	Sig.Higher
MRSED-07	0.0020	Sig.Higher	Sig.Higher	0.0297	--	--	0.0007	Sig.Higher	Sig.Higher
MRSED-10	0.4670	--	--	0.0607	--	--	0.6018	--	--
MRSED-13	0.0012	Sig.Higher	Sig.Higher	0.0274	--	--	0.0003	Sig.Higher	Sig.Higher
MRSED-14	0.0560	--	--	0.5283	--	--	0.0053	Sig.Higher	Sig.Higher
Dry Weight (mg)									
MRB4-A	0.1344	--	--	0.0000	Sig.Lower	Sig.Lower	0.2636	--	--
MRB4-B	0.3421	--	--	0.0022	Sig.Lower	Sig.Lower	0.2636	--	--
MRSED-01	0.8553	--	--	0.0028	Sig.Lower	Sig.Lower	0.0107	--	Sig.Higher
MRSED-02	0.1437	--	--	0.0000	Sig.Lower	Sig.Lower	0.2381	--	--
MRSED-04	0.0000	Sig.Higher	Sig.Higher	0.0028	Sig.Higher	--	0.0000	Sig.Higher	Sig.Higher
MRSED-06	0.0022	Sig.Higher	Sig.Higher	0.1719	--	--	0.0000	Sig.Higher	Sig.Higher
MRSED-07	0.0002	Sig.Higher	Sig.Higher	0.0131	--	--	0.0000	Sig.Higher	Sig.Higher
MRSED-10	0.0054	Sig.Lower	Sig.Lower	0.0000	Sig.Lower	Sig.Lower	0.3503	--	--
MRSED-13	0.2630	--	--	0.6529	--	--	0.0087	Sig.Higher	Sig.Higher
MRSED-14	0.3959	--	--	0.4167	--	--	0.0131	--	Sig.Higher

Notes:

Analyses shaded in gray represent most appropriate statistical analyses, given distribution and variation of data and risk questions under consideration. Other analyses provided for completeness.

Significant differences were found between the Patchogue and Sasco rivers for neonates per survivor and dry weight, though no differences were found between locations on the same river.

Significance was determined using two-sided comparisons with an overall alpha level of 0.10.

[a] - Wilcoxon test *P*-values are for two-sided tests for differences without an adjustment for the number of compari

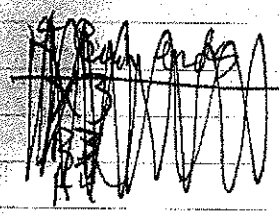
[b] - Dunnett's test was conducted after an initial ANOVA comparison.

[c] - Arcsine square-root transform was applied to the survival fraction.

[d] - Square-root transform was applied to the neonates per survivor.

Appendix D

Chain of Custody and Field Notes



3/9/04 Mill Run Sed/Tox Sampling

Sampled sediment for metals & sediment toxicity analyses
Weather is rain & 40°F

1130

Launched boat from former plant area and raced north under RR tracks to MR Arm #4.

Tide appeared ebbing.

1230 Arrived at first location SED-1
GPS cannot receive waypts - used map to navigate.
Simply using planar threads.

SED-1 1230
Sed is black. Water ~ 2' deep. 2 grabs.
Very wet, high organic, mild H2S
Hydrogen sulfide odor, mild flecks of
sheen, high organic content
VI by SED-1

SED-13 1245
YSI by SED-1
Sed is black fine, watery w/
olive gray, organic matter
hydrogen sulfide odor & sheen.
2 grabs. Water ~ 1' deep

1300 moved to SED-2
will pull deep later
Sed is fine, brown
brown/black w/
high organic
Sulfide odor & sheen
YSI SED-2
Large amount of leaf litter
Heavy sheen when raked.
Water ~ 3' deep. 4 grabs.

1335 Moved to SED-3 by map
YSI: SED-3
Sed. is sandy fine w/ brown/black color
light organic, coarse sand w/ some fine gravel
Water ≈ 1-2' deep.
Worms in sed; Mildly chlorine smell
Light H2S odor
2 grabs

1340 SED-14
by map
YSI: SED-14

Sed. is fine brown
Watery, fine organic matter, sticky
no odor, no clam
Water ≈ 1' deep.
2 grabs.

1400 SED-9 by map
VSI: SED-9
≈ 2% med-coarse sand, mostly silt w/ fine organic matter, sticks, some rock, brown in color. Water ≈ 3' deep. 2 grabs. No odor or sheen - small dollop of sheen when mixed.

1415 SED-10 by map
VSI SED-10
Sed is olive brown fine silt/clay w/ organic sticks.
Water ≈ 3' deep. 2 grabs.
Light H2S/thick odor.
No sheen noted.

1430 SED-11 by map
VSI: SED-11
Sed is olive brown fines w/ fine organic matter. Firm, watery. Thin layer of black material on surface. Faint sulfide odor.
Water ≈ 1' deep. 2 grabs

1500 Returned to shore. Left site & dropped GS samples at CET.

3/10/09 Mill River Sediment Toxicity Collection
cont Cont.
~~Clear~~ ≈ 38°F overcast

0730 Arrived at site. Calibrated YSI for DO, Cond, pH.

0820 MR-SED-12 via GPS & map
YSI: SED-12
Sed is loose, wet silt mucky. Black/dark olive, large amount of fine organic matter, some coarse organic matter. Sulfides small. Water ≈ 1' deep, 2 grabs.

Note: pH on YSI reading was bad: went back to yesterdays readings & found near average of 6.5; re-calibrated to that. pH may be inaccurate

0830: MR-SED-4 by map & GPS
YSI: SED-4
Loose wet silty mud, black/dark olive, high organic matter, leaves, wood, sulfide smell.
YSI: SED-4
Water ≈ 2' deep, 2 grabs
MS/MSD volume taken here

MR-SED-5 0845 by map & GPS
YSI: ~~MR-SED-4~~ SED-4
Wet mucky silt, black/dark olive, light fine organic matter, faint sulfide odor.
Water ≈ 3' deep, 2 grabs.

Note: YSI pH clearly off.

MR-SED-6 0900 by map & GPS
YSI: SED-6

Sed is firm silt, dark olive/black, trace organic matter.
Water 4' deep, 2 grabs
Few leaves in sed.

MR-SED-15 0910 by map & GPS
YSI: SED-15

Sed is loose, olive/black silt w/ light organic matter & leaves
Light sulfide odor
Water ≈ 1' deep, 2 grabs.

MR-SED-7 0920 by map & GPS
YSI: SED-7
Water ≈ 6' deep

Sed is very fine black w/ fine organic matter, strong sulfide odor. ~~#~~
2 grabs

MR-SED-8 0930 by map & GPS
YSI: SED-8
Water 4' deep. 2 grabs

Sed is olive/black, firm silt, trace organic matter.
Sulfide odor.

1015 - departed site for Sasco Creek
1030 - Arrived at Sasco Creek launch on Kings Highway Cutoff Rd.

Re-calibrated YSI pH.

Weather clear ≈ 40-45°F
Sasco has slight downstream current.

1100 launched boat on Sasco Creek

1110 SCSED-1. by map & GPS
YSI: SCSED-1

Note: YSI shows very high Sp.Cond near bottom, less near top. logged at mid point of 3' water

Top: 3" below surface 338 ms/cm³
200 ms/cm

Mid: 1' below surface 9060 ms/cm³
6114 ms/cm

Bottom: 3' below surface 27647 ms/cm³
17390 ms/cm

Conductivity is varying widely over mid & deep.
Plume of sed flowing upstream from sample.
Clearly tidal flow, largely, layer of fresh water on surface.

Sed is very loose, watery fine silt, high organic content, mostly phragmites. Brown/black color.
No sheen or odor
4 grabs.

1135 SCSED-2 by map & GPS
Dup taken here

Cond. reading showing high salinity over range of water column. logged near surface, near mid & bottom
37697 ms/cm³
23560 ms/cm

Water ≈ 5' deep 4 grabs
Sed is very fine loose silty silt with high organic matter.

1200 SCSED-3

VSI: SCSED-3

Conductivity fluctuates over depths based near surface ~6" & mid 2': 13175 us/cm³

8944 us/cm

Sed is fairly firm silt, dk grey/black, moderate organic matter, strong sulfide smell.

1245 Departed Sasco Creek. Dropped 24-hr. Pb Samples at CET at 1300.

1400 Returned to site.

COA

Pulled equipment blank: ~~MR-EB-1~~ MR-EB-1 at 1315 using bowl, pour, spoon.

1500 Departed site. Shipped EB sample to Alpha Analytical.

3/11/09 Mid-Plain Sediment Transport Sampling Cont.

0900 Arrived at OBC Clinton Rd. crossing of Pachaug River in Westbrook CT. Will launch boat here and go upstream to sample.

Weather is overcast with light drizzle. ~ 40°F

0930: Calibrated YSI: pH, Cond., DO.

Tide is flowing.

1015: Arrived at former location PRSED-1 by map & GPS.

YSI: PRSED-1

R[illegible] is flowing downstream.

Water ~ 1-2' deep. Fairly firm sediment near edge of channel of small inlet.

B3

Sed is fines w/ light sand, brown color, firm silt, small fines and, high organic content, leaves. Very faint sulfide odor.
8 grabs.

-CBA

1050 PRSED-3 by map & GPS
Water ≈ 1' deep.
VSI: PRSED-3

Sed is loose, watery, brown silt w/ light fine sand & high organic content.
Scan

PRSED-2 1115: by map & GPS.
VSI: PRSED-3
Water ≈ 45' deep.

Sed is olive/brown fine silty, sticky mush, moderately firm, high fine organic content, & some coarse organic content
6 grabs.

1200 Departed Patchogue River. Dropped samples at CFT

1345: Arrived at Mill River f/ 3 additional samples
1400: Launched boat on Mill River.

140 Navigated to CCA location F-14
using CCA map.
VSI: F-14
SampleID: MR-F-14
coordinates: ~~767~~
767851.75 mN
511980.45 mE
Water ≈ 10' deep
Sed is liquidy black organic muck.
Very strong sulfide odor. Anoxic.
Undecomposed leaf litter, twigs.
Small blotches of algae.
2 grabs.

1430: Navigated to CCA location B-4 by CCA map.
YSI: B-4
Water ≈ 2' deep ~~4'~~ 4' deep.
Coordinates ~~7657~~ 767278.06 mN
509772.06 mE

MR-B4-A
Coarse blade, some light brown silt, moderate fine sand, trace coarse sand. Large amounts of algae. Moderate small organic matter, moderate sulfide odor.
2 grabs
Small bits of various-colored small plastic pieces.

Moved slightly S and E of MR-B4-B
YSI: B4
Water ≈ 2' deep
GPS not receiving enough satellites to log.

1445
Sed is loose black/dark brown silt, NAAV
High amount of algae. High organic content.
Amphipods noted. Looser texture than previous station.
2 grabs

1510 Returned to staging area. Processed 24-hr. Pb Samples.

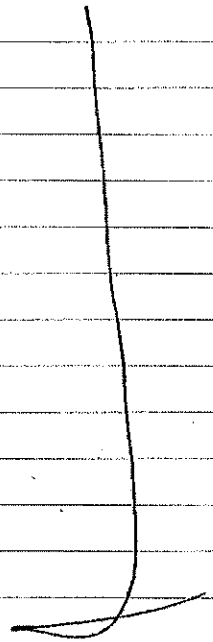
Pulled equipment blank: MR-EB-2 at 1515.

1530: Departed site for CET & Fecker

3/12/09 Mill River Sediment Toxicity Cont'

0900 Arrived at staging area. Packed & shipped samples for chemistry and freeze-dry.

1500: Packed & shipped samples f/ sediment toxicity samples.
1600: Departed site f/ Fairfax.



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-1, -2, -13 Date 3/9/09

Project Name Mill River Time 1230, 1245, 1300

Contract No. Location MR area III

Field Conditions/Weather Rain ≈ 40°F

Field Team Ben Ames, Ken Ceretto

Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/9/09 1230	MR-SED-1			0-6"		Full
2		3/9/09 1245	MR-SED-13			0-6"		Full
3		3/9/09 1300	MR-SED-2			0-6"		Full + DUP
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

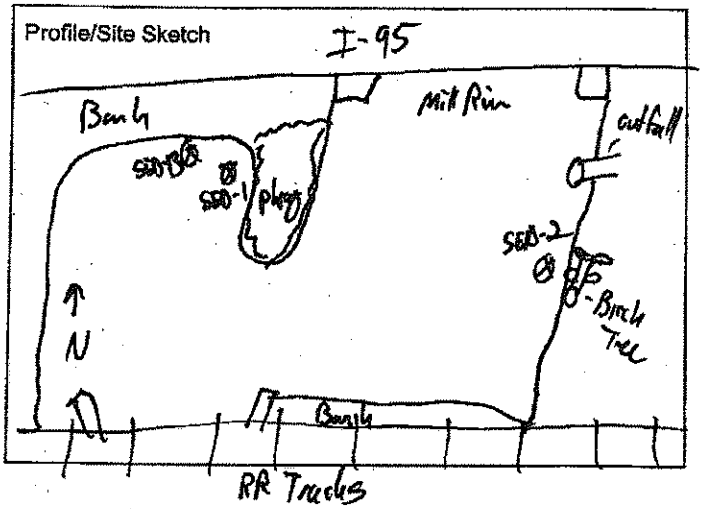
Comments

MR-SED-1: Sed is black, watery, high organic fines. Talus ≈ 6' from plugs bank to east. 1m x 2' water.

MR-SED-13: Sed is Black, fine, watery, olive grey, high organic matter. Talus ≈ 5' south of I-95 bank/mat. Water ≈ 1' deep

MR-SED-2: Sed. is brown/black fines w/ high organic content. Large amount of leaf litter. Talus ≈ 10' west of bank near birch tree. Water ≈ 3' deep

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-3, -14, -9 Date 3/9/09

Project Name Mill River Time 1325, 1340, 1400

Contract No. Location Mill River Area II

Field Conditions/Weather Rain ≈ 40°F

Field Team Ben Amos, Ken Ferretti

Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/9/09 1325	MR-SED-3			0-6"		Full
2		3/9/09 1340	MR-SED-14			0-6"		Full
3		3/9/09 1400	MR-SED-9			0-6"		Full
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

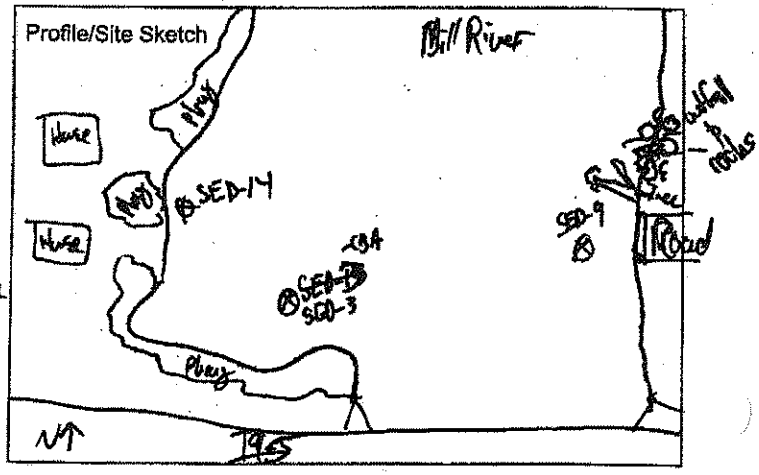
Comments

MR-SED-3: Sed is sandy fines, black/brown, light organic, some coarse sand & fine gravel. Taken in 1-2' deep water ≈ 20' north of bank of I-95 to South

MR-SED-14: Sed is fine brown, watery, storm w/ organic matter. Stinky. Water ≈ 1' deep. Taken ≈ 6' East of pkwy patch of W shore to CBA

MR-SED-9: Sed is mud to coarse sand, mostly fine silt w/ fine organic matter, sticks, some rock. Taken in 3' of water near southern end of road on E bank, ≈ 10' offshore, 20' south of outfall.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-10, -11
Date 3/4/09
Project Name Mill River
Time ~~1400~~, 1415, 1430
Contract No.
Location Mill River Area IC
Field Conditions/Weather Cloudy, drizzly, ≈ 40°F
Field Team Ben Amos, Ken Cerreto

Signature(s)

SOIL SAMPLES

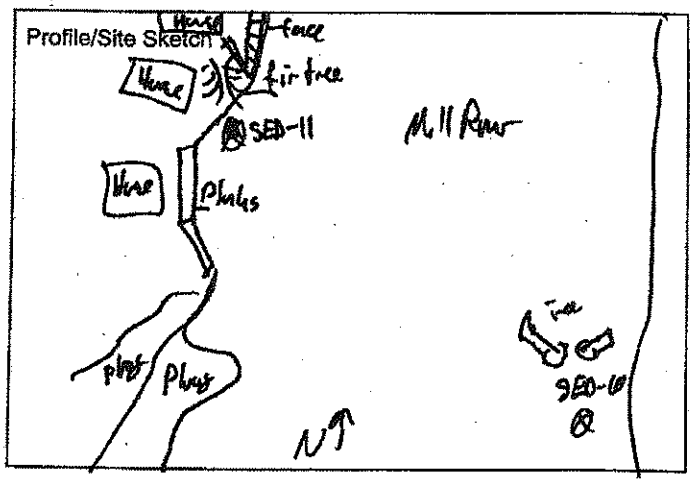
	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/4/09 1415	MR-SED-10		~~C~~ cont	0-6"		Full
2		3/4/09 1430	MR-SED-11			0-6"		Full
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

MR-SED-10: Sed is olive brown fine silt/clay w/ organics. Sticky. Water ≈ 3' deep. Taken ≈ 15' west of east bank & 10' South of submerged fallen tree

MR-SED-11: Sed is olive brown fine w/ fine organic matter. Firm, wet w/ thin layer of black material on top. Water ≈ 1' deep. Taken ≈ 6' east of west bank near fir tree.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-12 Date ~~0820~~ 3/10/09

Project Name Mill River Time 0820

Contract No. Location Mill River Area 5

Field Conditions/Weather Clear & 40°F

Field Team Ben Ames, Ken Carreto

Signature(s)

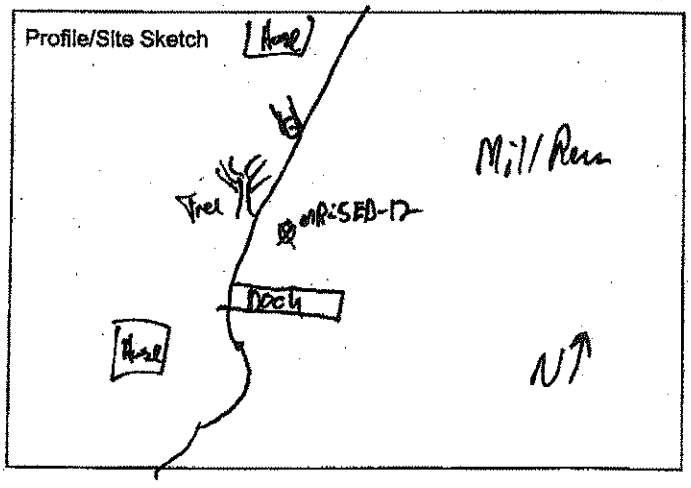
SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/09 0820	MR-SED-12			0-6"		Full
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

MR-SED-12: Appx 10' east of west bank 20' north of dock. Surface small fine. Sed is loose, wet, silty mucky w/ large amount of fine organic matter. Some coarse organic matter. Water ≈ 1' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-4, -5, -6
Time Date 0830, 0845, 0900
Project Name Mill River
Date Time 3/10/09
Contract No.
Location Mill River Areas
Field Conditions/Weather Clear ≈ 40°F
Field Team Ben Amos, Ken Cesrete
Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/09 0830	MR-SED-4			0-6"		Full, MS/MSD
2		3/10/09 0845	MR-SED-5			0-6"		Full
3		3/10/09 0900	MR-SED-6			0-6"		Full
4								
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10								
11								
12								
13								
14								
15								

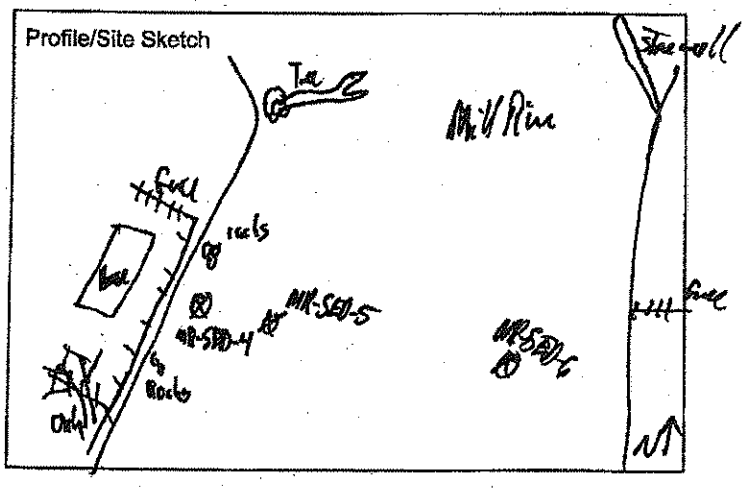
Comments

MR-SED-4: Tdln ≈ 5' east of west bank, at mid pt. of inlet, from line on shore. Sed is loose wet silty muck, Black/dk olive, high organic matter, Less road water ≈ 2' deep.

MR-SED-5 tdln ≈ 30' from west bank east of location SED-4. Sed is wet, mucky silt, dk olive/black, light fine organic matter. Water ≈ 3' deep.

MR-SED-6: ≈ 50' west of east shore, south of inlet Creekline. Sed is fine silt, dk olive/black w/ trace organic matter. Water ≈ 4' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-SED-15, -7, -8 Date 3/10/09

Project Name Mill River Time 0910, 0920, 0930

Contract No. Location Mill River Area 5

Field Conditions/Weather Clear ≈ 40°F

Field Team Ben Amos, Ken Ferretti

Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/09 0910	MR-SED-15			0-6"		Full
2		3/10/09 0920	MR-SED-7			0-6"		Full
3		3/10/09 0930	MR-SED-8			0-6"		Full
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

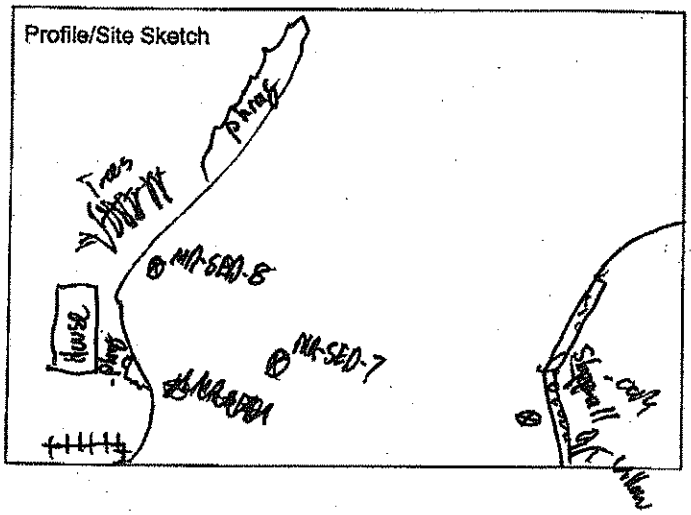
Comments

MR-SED-15: 5' west of stone wall on east bank, between willow and cattails. Sed is loose silt w/ light organic matter & leaves. Water ≈ 1' deep

MR-SED-7: near middle of river ≈ 150' east of west bank. Sed is very fine black w/ fine organic matter. Water ≈ 6' deep

MR-SED-8: Tidy ≈ 10' off east shore, north of house. Sed is olive black fine silt w/ trace organic matter. Water 4' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification SCSED-1 Date 3/10/09

Project Name Mill River Time 1110

Contract No. Location Sasco Creek

Field Conditions/Weather Clear ≈ 45°F

Field Team Ben Amos, Ken Ciancetta

Signature(s)

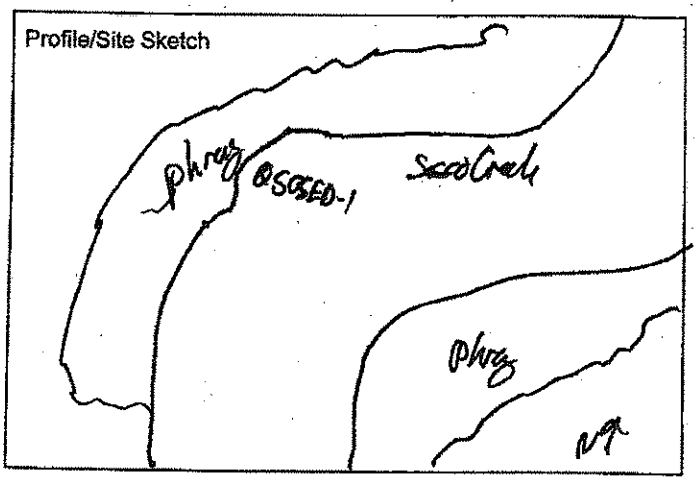
SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/09 1110	SCSED-1			0-6"		Full
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

SCSED-1: Take 0-6" south of phrag line on sandy bank. Sed is low density with fine silt. High organic content. Brown/black color. Water 3' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification SCSED-2 Date 3/10/09

Project Name Mill River Time 1135

Contract No. Location Sasco Creek

Field Conditions/Weather Clear ≈ 45°F

Field Team Ben Amos, Ken Cerretta

Signature(s)

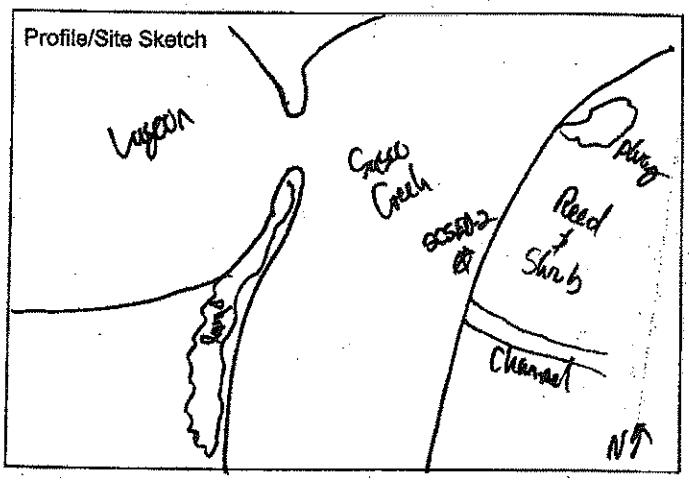
SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/09 1135	SCSED-2			0-6"		Full + Dup
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

SCSED: Taken ≈ 5' west of eastern bank of Sasco. Sed is very fine loose gritty silt w/ high organic content. Water ≈ 5' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification SCSED-3 Date 3/10/04

Project Name Mtl River Time 1200

Contract No. Location Sasco Creek

Field Conditions/Weather Clear ≈ 45°F

Field Team Ben Amos, Ken Cerretti

Signature(s)

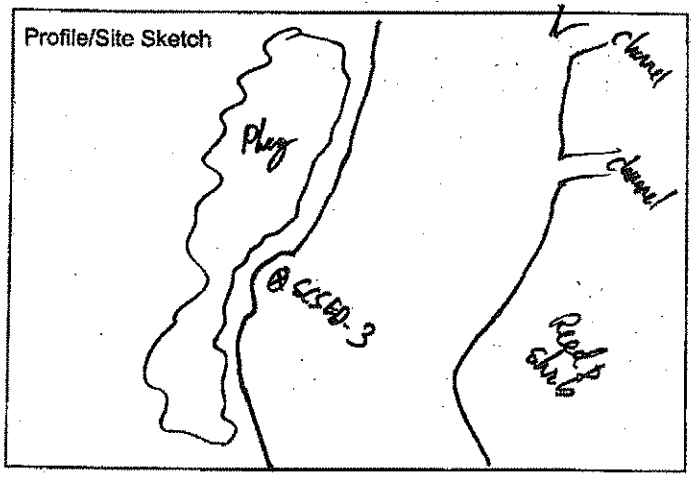
SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/10/04 1200	SCSED-3			0-6"		Full + MS/MSD
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

SCSED-3: Taken ≈ 6' from west bank in small cove of plug. Sed is fairly fine silt, dark grey/black w/ moderate organic content. Water ≈ 2' deep.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification PRSED-1, -2, -3 Date 3/11/09

Project Name Mill River Time 1015, 1115, 1050

Contract No. Location Patchogue River

Field Conditions/Weather Overcast, drizzle, 48°F

Field Team Ben Amos, Ken Cerreto

Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/11/09 1015	PRSED-1			0-6"		Full
2		3/11/09 1050	PRSED-3			0-6"		Full
3		3/11/09 1115	PRSED-2			0-6"		Full
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

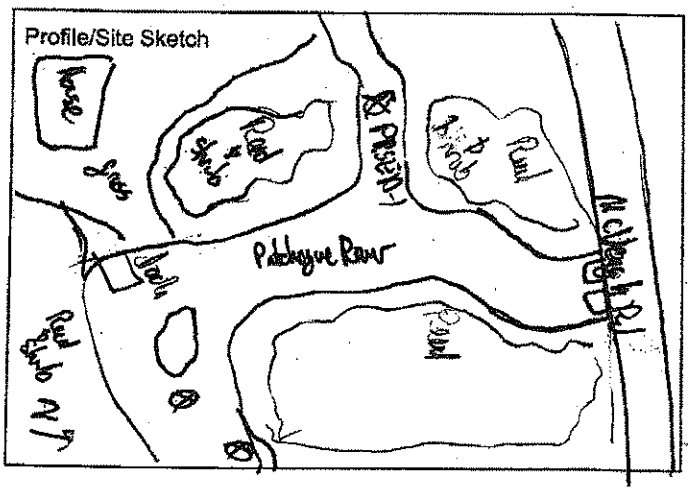
Comments

PRSED-1: Taken 4 boxy bombs of small inlet on east bank of River. Sed is fine, light sand brown, firm silt high organic content. Water 1-2' deep.

PRSED-2: Sed is olive/brown fine silty, sticky mud, moderately firm, high fine organic content, moderate coarse organic content. Water 4-5' deep. Taken off point of small island.

PRSED-3: Sed is loose, watery, brown silt w/ light fine sand and high organic content. Water is ≈1' deep. Taken on W end of small cove on north end of River.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-F-14 Date 3/11/09

Project Name Mill River Time 1410

Contract No. Location Mill River Area 5

Field Conditions/Weather Overcast, drizzly, 45°F

Field Team Ben Ames, Ken Ceretto

Signature(s)

SOIL SAMPLES

	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/11/09 1410	MR-F-14			0-6"		Full
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

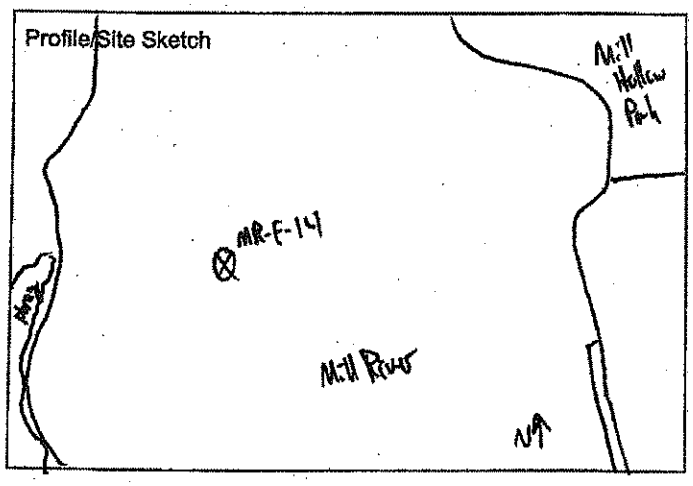
Taken ≈ 100' east of western bank at MR. South of mill Hollow Park.

Coordinate: 767851.25 m N

511990.45 m E

Soil is black, liquidy, much Anoxic, uncompacted leaf litter and twigs.

Profile/Site Sketch



SOIL SAMPLING FIELD DATA FORM

Exponent

Station Identification MR-B4-A MR-B4-B
Date 3/11/09
Project Name Mill River
Time 1430, 1445
Contract No.
Location Mill River Area IV
Field Conditions/Weather Overcast, drizzly, 45° F
Field Team Ben Amos, Ken Carretta
Signature(s)

SOIL SAMPLES

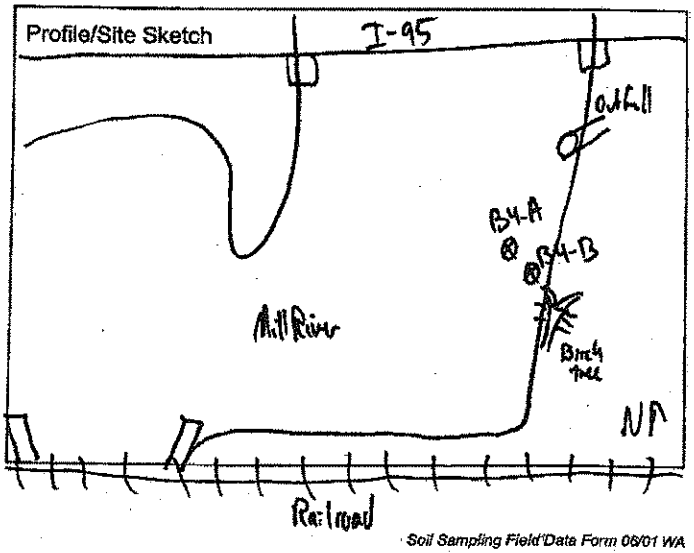
	Tag No.	Date/Time	Sample ID: Station	Sample ID: Sample No.	Sample ID: Replicate	Depth Interval	Soil Type/Layer	Analysis Code
1		3/11/09 1430	MR-B4-A			0-6"		Full
2		3/11/09 1445	MR-B4-B			0-6"		Full
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Comments

MR-B4-A: Taken in 4' water, appx 20' S of outfall, N of bank tree, ≈ 15' W of east bank. Sed is Coarse black, some fine brown silt, moderate fine sand, trace coarse sand.

MR-B4-B: Taken in 2' water ≈ 10' SE of B4-A. Sed is loose black/dark brown silt. High organic content. Softer and looser than B4-A

Profile/Site Sketch



USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

0903127

PROJECT NAME: Exponent Fairfield

SAMPLERS: (Signature) Joel D. Farmer

	DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
-1	3/24/09	1416	MR-SED-1	1	
-2	"	1414	MR-SED-2	1	
-3	"	1418	MR-SED-4	1	
-4	"	1342	MR-SED-6	1	
-5	"	1410	MR-SED-7	1	
-6	"	1344	MR-SED-10	1	
-7	"	1348	MR-SED-13	1	
-8	"	1350	MR-SED-14	1	
-9	"	1346	MR-B4-A	1	
-10	"	1305	MR-B4-B	1	
-11	"	1412	SCSED-2	1	
-12	"	1420	SCSED-3	1	
-13	"	1307	PRSED-1	1	
-14	"	1309	PRSED-2	1	

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Joel D. Farmer	3/25/09 1130	FED EX	FED EX	3/26/09 0945	
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM R Nov 89 2196 PREVIOUS EDITIONS OBSOLETE

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

0903060 Page 1 of 2

Project: (Name and Number) Mill River MY 03147.001.0601

Exponent Contact: Meg McArdle Office: MY

Ship to: 3 Clock Tower Place St 205
Maynard MA 01754
978-461-1338

Lab Contact/Phone: Alpha Analytical

Samplers: Ben Ames, Ken Gerrety

Analyses Requested

Sample No.	Tag No.	Date	Time	Matrix	TOC	Grain Size					Extra Container	Archive	Remarks
-1 MR-SED-1		3/9/09	1230	SED	X	X							
-8 MR-SED-13			1245										
-2 MR-SED-2			1300										
-3 MR-SED-2-DUP			1300										Please hold analysis until Meg McArdle has given list of samples for analysis. Disposal Remaining.
MR-SED-3			1325										
-9 MR-SED-14			1340										
MR-SED-9			1400										
-7 MR-SED-10			1415										
MR-SED-11			1430										
MR-SED-12		3/10/09	0630										
-4 MR-SED-4			0630										
MR-SED-4 MS/MSD			0630										
MR-SED-5			0645										
-5 MR-SED-6			0900										
MR-SED-15			0910										
-6 MR-SED-7			0920										
MR-SED-8			0930										
SCSED-1			1110										
-12 SCSED-2			1135										
-13 SCSED-2-DUP			1135										

Exponent Environmental Group
Bellevue, WA (425) 643-9803
Boston, MA (781) 466-8881
Boulder, CO (303) 444-7270
Portland, OR (503) 636-4338
Washington, D.C. (301) 577-7830

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water
OTHER - Please identify codes

Priority: ☒ Normal ☐ Rush Rush time period

Shipped via: ☒ FedEx/UPS ☐ Courier Other

Condition of Samples Upon Receipt:

Custody Seal Intact: ☐ Yes ☐ No ☐ None

Relinquished by: CB/hm (Signature) Date/Time: 3/12/09 1400 Received by: FedEx Airbill # 870763360975 (Signature) Date/Time: 3/12/09 1400

Relinquished by: FED EX (Signature) Date/Time: 3/13/09 0930 Received by: (Signature) Date/Time: 3/13/09 0930

122 of 126

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06255

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

0903060 Page 2 of 2

Project: (Name and Number) MY 03147.001 0601 Mill River

Exponent

Environmental Group

Bellevue, WA (425) 643-9803
Boston, MA (781) 466-6681
Boulder, CO (303) 444-7270
Portland, OR (503) 636-4338
Washington, D.C. (301) 577-7830

Exponent Contact: Meg McArdle Office: MY

Ship to: 3 Clock Tower Place Ste 205
Maynard MA 01754
978-461-1236

Lab Contact/Phone: Alpha Woburn

Samplers: Ben Amos Ken Corretti

Analyses Requested

	Sample No.	Tag No.	Date	Time	Matrix	TOC	Grain Size					Extra Container	Archive	Remarks
4	SCSED-3		3/10/09	1000	SED	X	X							
	SCSED-3 MS/MSD			1200										
5	PRSED-1		3/11/09	1015										
6	PRSED-2			1115										
	PRSED-3			1050										
	MR-F-14			1410										
10	MR-B4-A			1430										
11	MR-B4-B			1445										Please hold analysis until Meg McArdle has given list of samples for analysis. Dispose remaining.

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water
OTHER - Please identify codes

Priority: ☒ Normal ☐ Rush Rush time period

Shipped via: ☒ FedEx/UPS ☐ Courier Other

Condition of Samples Upon Receipt:

Custody Seal Intact: ☐ Yes ☐ No ☐ None

Relinquished by: CB/m (Signature) Date/Time: 3/12/09 1400

Received by: Fedex Airbill # 8620763360475 (Signature) Date/Time: 3/12/09 1400

Relinquished by: Fed Ex (Signature) Date/Time: 3/13/09 0930

Received by: (Signature) Date/Time: 3/13/09 0930

06256

Distribution: White and Yellow Copies - Accompany Shipment; Pink Copy - Project File

123 of 126

Columbia Analytical Services™

CHAIN OF CUSTODY

SR#: 0903118

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

PAGE _____ OF _____ COC #_____

PROJECT NAME: Exponent
PROJECT NUMBER:
PROJECT MANAGER:
COMPANY/ADDRESS:
CITY/STATE/ZIP:
E-MAIL ADDRESS:
PHONE #: FAX #:
SAMPLER'S SIGNATURE:

	SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	REMARKS
1	MR-SED-10				1		
2	MR-SED-2				1		
3	MR-SED-4				1		
4	MR-SED-6				1		
5	MR-SED-13				1		
3	MR-SED-4				1		
6	MR-SED-1				1		
7	SCSED-3				1		
					1		
					1		

Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐
Volatile Organics 624☐ 8260☐ Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐ BTEX☐ 8021☐
Fuel Fingerprint (FIQ)☐ NW-HCID Screen☐ Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐
PCB's Aroclors☐ Congeners☐
Pesticides/Herbicides 608☐ 8081A☐ 8141A☐ 8151A☐
Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐
PAHs 8310☐ SIM☐
Metals, Total or Dissolved (See list below)
Cyanide☐ Hex-Chrom☐
pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)
NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3
TOX 9020☐ AOX 1650☐ 506☐
Relinquished Custody

1	10
2	10
3	10
4	10
5	10
3	10
6	10
7	10

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.
____ 5 Day
____ Standard (10-15 working days)
____ Provide FAX Results
_____ Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER:_____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

ATTN: Maura K. Surpenant

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: R	Signature: UPS	Signature: UPS	Signature: Dianne Janke
Date/Time: 3-23-09 1400	Date/Time:	Date/Time:	Date/Time: 3/24/09 1030
Printed Name: Richard Thom	Printed Name:	Printed Name:	Printed Name:
Firm: CAS	Firm:	Firm:	Firm: ACPHA

RCOC #1 08/08

CHAIN OF CUSTODY

Columbia Analytical Services

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SR#: 0903118

PAGE _____ OF _____ COC #_____

PROJECT NAME: Exponent

PROJECT NUMBER:

PROJECT MANAGER:

COMPANY/ADDRESS:

CITY/STATE/ZIP:

E-MAIL ADDRESS:

PHONE # | FAX #:

SAMPLER'S SIGNATURE:

	SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐	Volatile Organics 624☐ 8260☐	Hydrocarbons Gas☐ BTEX☐ 8021☐ Diesel☐ (*see below) Oil☐ Fuel Fingerprint (FIO)☐ NW-HCID Screen	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	PCB's Aroclors☐ Congeners☐	Pesticides/Herbicides 608☐ 8081A☐ 8141A☐ 8151A☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	PAHs 8310☐ SIM☐	Metals, Total or Dissolved (See list below)	Cyanide☐	pH, Cond., Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle) Hex-Chrom☐	NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3	TOX 9020☐ AOX 1650☐ 506☐	Relinquish Custody			REMARKS
-8	MR-BH-13					1															X				
-9	MR-BH-A					1															X				
-10	DR SED-1					1															X				
-7	SCSED-3					1															X				
-11	DR SED-2					1															X				
-12	SC-SED-2					1															X				
-13	SCSED-2DUP					1															X				
-14	MR-SED-2 DUP					1															X				
-15	MR-SED-7					1															X				
-16	MR-SED-14					1															X				

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # _____

Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.

____ 5 Day

____ Standard (10-15 working days)

____ Provide FAX Results

_____ Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER:_____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

ATTN: Maura R. Suprenant

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 3-23-09 1400	Signature: UPS Date/Time:	Signature: UPS Date/Time:	Signature: [signature] Date/Time: 3/24/09 1030
Printed Name: Brad Wain Firm: CAS	Printed Name: Firm:	Printed Name: Firm:	Printed Name: Diandra M Tejada Firm: ADHA

RCOC #1 06/08

Columbia Analytical Services

CHAIN OF CUSTODY

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SR#: KO4624le9 PAGE 1 OF 3 COC #

PROJECT NAME: MillRiver
PROJECT NUMBER: MY03147-001 0601
PROJECT MANAGER: Mex McArdle
COMPANY/ADDRESS: Expanet 3 Clock Tower Place, Ste 205
CITY/STATE/ZIP: Maynard MA 01754
E-MAIL ADDRESS: MCARDLE@EXPANET.COM
PHONE #: 978-461-1238 FAX #: 978-461-1223
SAMPLER'S SIGNATURE: CB/h

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (F/O) ☐ NW-HCID Screen ☐	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	Freeze Dry	See Spec. List			REMARKS
MR-SED-1	3/9/09	1230		SED	1															X	X			
MR-SED-13	"	1245		"	"															"	"			
MR-SED-2	"	1300		"	"															"	"			
MR-SED-2 DUP	"	1300		"	"															"	"			
MR-SED-3	"	1325		"	"															"	"			
MR-SED-14	"	1340		"	"															"	"			
MR-SED-9	"	1400		"	"															"	"			
MR-SED-10	"	1415		"	"															"	"			
MR-SED-11	"	1430		"	"															"	"			
MR-SED-12	3/10/09	0820		"	"															"	"			

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. #
Bill To:

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
___ 5 Day
X Standard (10-15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER:_____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

Freeze dry samples. Then ship to Alpha Analytical for metals analysis

Container Supply Number

11619

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: CB/h	Signature: Fedex	Signature:	Signature:
Date/Time: 3/12/09 1400	Date/Time: 3/12/09 1400	Date/Time:	Date/Time: 3/13/09 0915
Printed Name: Ben Ames	Printed Name: Airbill # 8629 7633 6486	Printed Name:	Printed Name:
Firm: Expanet	Firm:	Firm:	Firm: CAS

RC[illegible] #1 06/08

Columbia Analytical Services

CHAIN OF CUSTODY

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

PAGE 2 OF 3 SR#: _____ COC #: _____

PROJECT NAME: Mill River
PROJECT NUMBER: NY03147.001 0601
PROJECT MANAGER: Meg Mitchell
COMPANY/ADDRESS: Exponent
3 Clock Tower Place Ste 205
CITY/STATE/ZIP: Maynard MA 01754
E-MAIL ADDRESS: MGRDEE@EXPONENT.COM
PHONE #: 978-461-1235 FAX #: 978-461-1237
SAMPLER'S SIGNATURE: CBR

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐	Hydrocarbons Gas ☐ 8021 ☐ BTEX ☐	Diesel ☐ Oil ☐ Fuel Fingerprint (FIQ)	NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐ Hex-Chrom ☐	pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	Freeze dry See Page 1 for Analysis	REMARKS
MRSED-4	3/10/09	0530		SED																X	X		
MR-SED-4 MS/MSD		0830																					
MR-SED-5		0845																					
MR-SED-6		0900																					
MR-SED-TS		0910																					
MR-SED-7		0920																					
MR-SED-8		0930																					
SCSED-1		1110																					
SCSED-2		1135																					
SCSED-3-DUP		1135																					

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION

P.O. # _____
Bill To: _____

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.
____ 5 Day
____ Standard (10-15 working days)
____ Provide FAX Results

_____ Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: _____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

Freeze dry samples, Hum shipt
Aliquot trip blk f/ metals analysis.

Container Supply Number

11619

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: CBR	Signature: Fedex	Signature:	Signature:
Date/Time: 3/12/09 1400	Date/Time: 3/12/09 1400	Date/Time:	Date/Time: 3/13/09 0915
Printed Name: Brad Mrs	Printed Name: Air-bill # 8630 1633 6856	Printed Name:	Printed Name:
Firm: Exponent	Firm:	Firm:	Firm:

RCOC #1 06/08

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

Exponent™

Project: (Name and Number) Mill River MYOB147.001 0601

Exponent Contact: Meg McArdle Office:

Ship to: 3 Clock Tower Place
St 205 Maynard MA 01754
P 978-461-1238 F: 978-461-1223

Lab Contact/Phone: CAS

Samplers: CB/h

Environmental Group
Bellevue, WA (425) 643-9803
Boston, MA (781) 466-6681
Boulder, CO (303) 444-7270
Portland, OR (503) 636-4338
Washington, D.C. (301) 577-7830

Sample No.	Tag No.	Date	Time	Matrix	Analyses Requested: Freeze Dry	Analyses Requested: Sht + Amp Analysis					Extra Container	Archive	Remarks
SCSED-3		3/10/09	1200	SED	X	X							
SCSED-3 MS/MSD		↓	1200	|	|	|							
PRSED-1		3/11/09	1015	|	|	|							
PRSED-2		|	1115	|	|	|							
PRSED-3		|	1050	|	|	|							
MR-F-14		|	1410	|	|	|							
MR-B4-A		|	1430	|	|	|							
MR-B4-B		↓	1445	↓	↓	↓							

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water
OTHER - Please identify codes

Priority: ☐ Normal ☐ Rush Rush time period

Shipped via: ☒ FedEx/UPS ☐ Courier Other

Condition of Samples Upon Receipt:

Custody Seal Intact: ☐ Yes ☐ No ☐ None

Relinquished by: CB/h (Signature) Date/Time: 3/12/09 1400 Received by: FedEx Airbill # 862071330486 (Signature) Date/Time: 3/12/09 1400

Relinquished by: (Signature) Date/Time: Received by: [signature] CAS (Signature) Date/Time: 3/13/09 0915

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Distribution: White and Yellow Copies - Accompany Shipment; Pink Copy - Project File

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC LH

Client / Project: Exponent Service Request K09 0216 9

Received: 3/13/09 Opened: 3/13/09 By: KO

1. Samples were received via? *US Mail* (*Fed Ex*) *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) (*Cooler*) *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA (Y) N If yes, how many and where? one, front
   If present, were custody seals intact? (Y) N If present, were they signed and dated? (Y) N
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA (Y) N

5. Temperature of cooler(s) upon receipt (°C): -.1C
   Temperature Blank (°C): .1C
   Thermometer ID: 202
6. If applicable, list Chain of Custody Numbers: _____
7. Packing material used. *Inserts* *Baggies* (*Bubble Wrap*) *Gel Packs* (*Wet Ice*) *Sleeves* *Other* _____
8. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA (Y) N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? NA (Y) N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* NA (Y) N
12. **Were appropriate bottles/containers and volumes received for the tests indicated?** NA (Y) N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* (NA) Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* (NA) Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** (NA) Y N
16. Was C12/Res negative? (NA) Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

Appendix B – Sediment Chain of Custody

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

Page 1 of 1

Project: (Name and Number) Mill River MY03147.001.0601

Exponent Contact: Meg McArdle Office:

Ship to: 3 Clock Tower Place Ste 205
Maynard MA 01754
978-461-1238

Lab Contact/Phone: US Army ERDC

Samplers: Ben Amos Ken Currie

Exponent Environmental Group
Bellevue, WA (425) 643-9803
Boston, MA (781) 466-6681
Boulder, CO (303) 444-7270
Portland, OR (503) 636-4338
Washington, D.C. (301) 577-7930

Sample No.	Tag No.	Date	Time	Matrix	28-Day Reproductive Solid Phase Toxicity	AVS/SEM					Extra Container	Archive	Remarks
MR-SED-2		3/9/09	1300	SED	X	X							
MR-SED-4		3/10/09	0830										
SCSED-2		3/10/09	1135								1		
SCSED-3		3/10/09	1200								1		
ARSED-2		3/11/09	1115								1		
ARSED-1		3/11/09	1045								1		
MR-Bul-A		3/11/09	1430										
MR-Bul-B		3/11/09	1445										
MR-SED-13		3/9/09	1245										
MR-SED-14		3/9/09	1340										
MR-SED-10		3/9/09	1415										
MR-SED-6		3/10/09	0900										
MR-SED-7		3/10/09	0920										
MR-SED-1		3/9/09	1230										

Cool 2-5

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water
OTHER - Please identify codes

Priority: ☒ Normal ☐ Rush Rush time period

Shipped via: ☒ FedEx/UPS ☐ Courier Other

Condition of Samples Upon Receipt:

Custody Seal Intact: ☐ Yes ☐ No ☐ None

Relinquished by: (Signature) Date/Time: 3/12/09 1700

Received by: Fedex Airbill # 8620 7633 6997 (Signature) Date/Time: 3/12/09 1700

Relinquished by: (Signature) Date/Time:

Received by: (Signature) Date/Time: 3/13/09 1345

Distribution: White and Yellow Copies - Accompany Shipment; Pink Copy - Project File

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Appendix E

SEM-AVS Figures

Figure E-1. Reprinted from U.S. EPA (2005). Acute mortality versus SEM-AVS and (SEM-AVS)/f_{oc}.

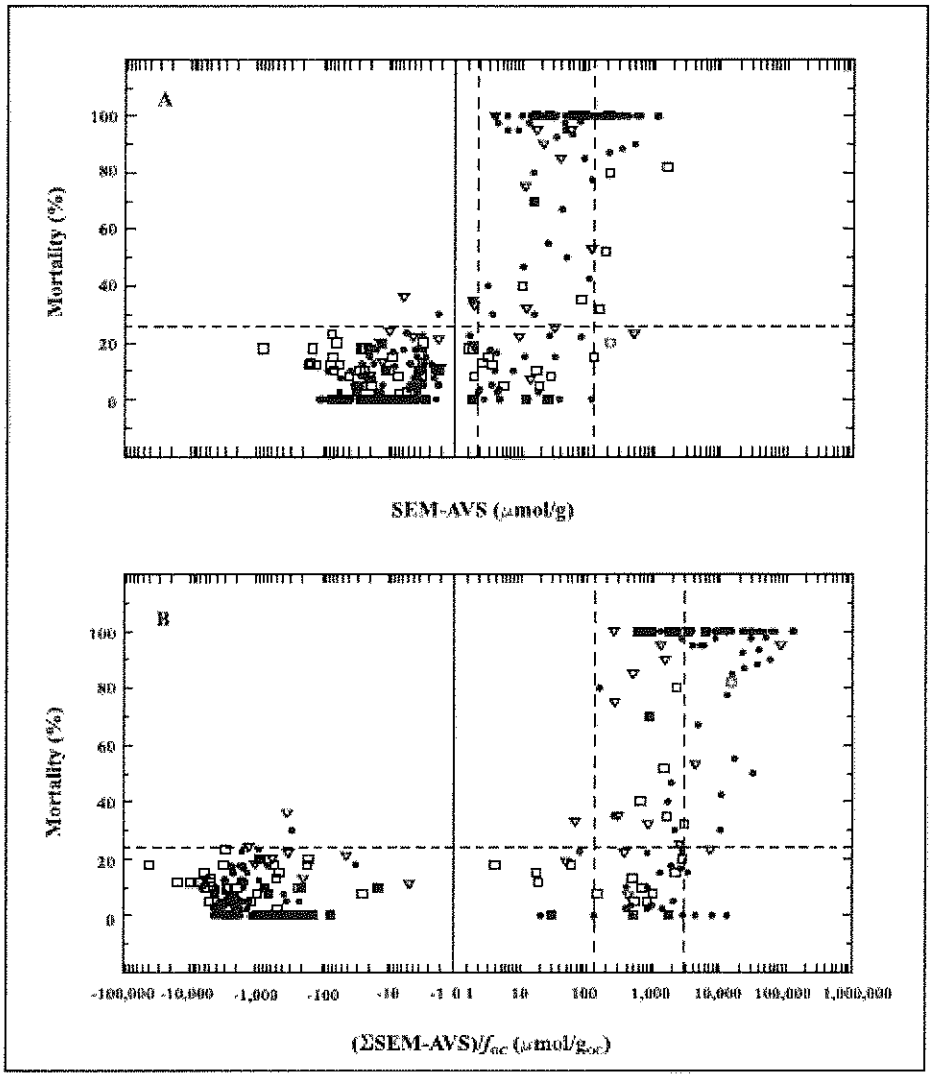

Figure 3-8. Percent mortality versus SEM-AVS (A) and (ΣSEM-AVS)/f_{OC} (B) for saltwater field data without Bear Creek and Jinzhou Bay (□), freshwater field data (▽), freshwater spiked data (-), and saltwater spiked data (•); silver data excluded. Vertical dashed lines are the 90% uncertainty bound limits (figure from Di Toro et al., 2000).

Figure E-2. Reprinted from U.S. EPA (2005). Chronic toxicity versus (SEM-AVS)/f_{oc}.

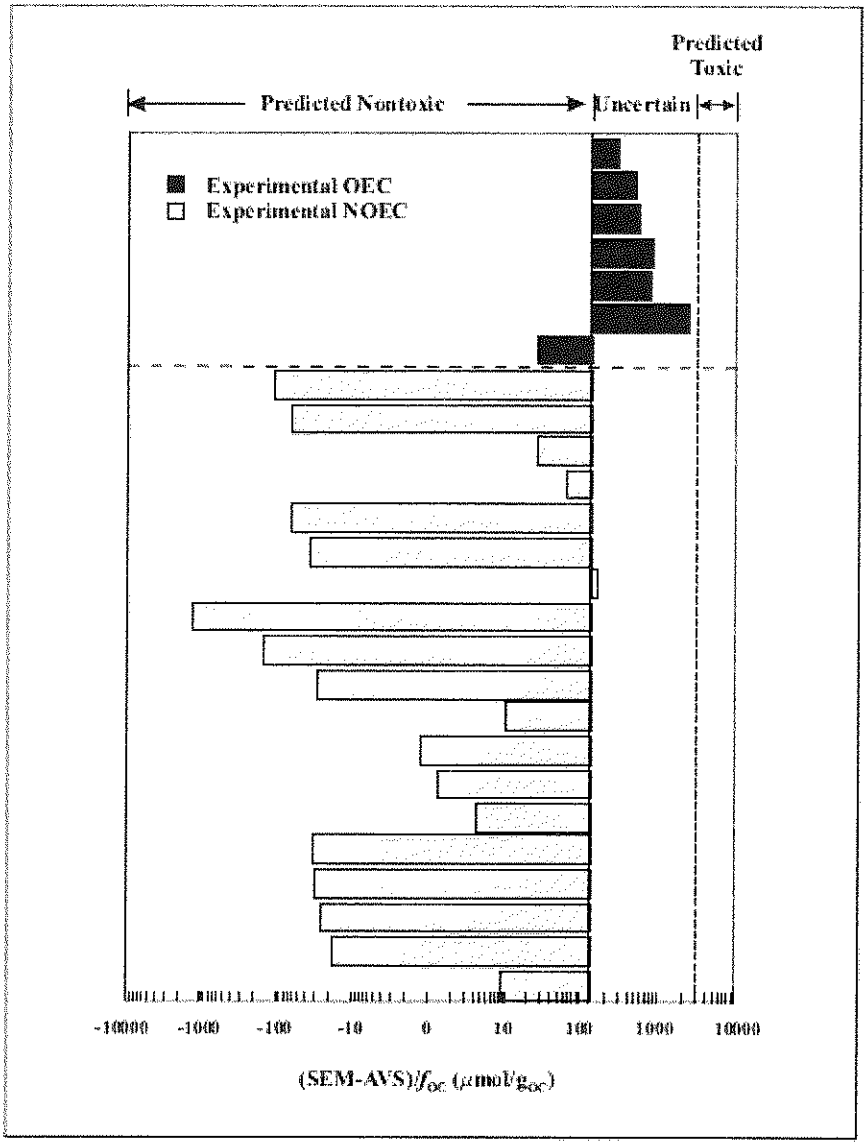

Figure 3-11. Comparison of the chronic toxicity of sediments spiked with individual metals or metal mixtures to predicted toxicity based on (SEM-AVS)/f_{oc} (data from Table 3-3). Horizontal dashed line separates experimental observed effect concentrations (solid columns) from no observed effect concentrations (shaded columns). Values at (SEM-AVS)/f_{oc} $\leq$ 130 μmol/g_{oc} are predicted to be nontoxic. Values between 130 and 3,000 μmol/g_{oc} lie where the prediction of toxicity is uncertain, and values greater than 3,000 μmol/g_{oc} are predicted to be toxic.