



US ARMY CORPS  
OF ENGINEERS  
New England District

\_\_\_\_\_ Contract No. DACW33-01-D-0004

\_\_\_\_\_ Delivery Order No. 02

\_\_\_\_\_ October 2002

## *Final Report*

# **SPRING 2002 WATER COLUMN CHARACTERIZATION REPORT**

**RHODE ISLAND REGION LONG-TERM DREDGED  
MATERIAL DISPOSAL SITE EVALUATION PROJECT**

**FINAL**

**Spring 2002 Water Column Characterization Report**

**Rhode Island Region  
Long-Term Dredged Material Disposal Site Evaluation Project**

**Contract Number DACW33-01-D-004  
Delivery Order 0002**

**to**

**U.S. Army Corps of Engineers  
North Atlantic Division  
New England District  
696 Virginia Road  
Concord, MA 01742-2751**

**By:**

**Battelle  
397 Washington Street  
Duxbury, MA 02332  
(781) 934-0571**

**October 28, 2002**

## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1
2.0	METHODS .....	1
2.1	Navigation.....	2
2.2	Vessel Handling.....	2
2.3	Hydrographic Profiling .....	2
2.4	Water Sampling .....	4
2.5	Water Analysis Tasks .....	6
2.5.1	Chlorinated Pesticides and PCB Congeners .....	6
2.5.2	Metals.....	6
2.5.3	Total Suspended Solids (TSS).....	7
2.5.4	Data Quality Objectives.....	7
2.6	Deviations from the QAPP .....	10
2.7	General Data Treatment and Reduction.....	11
3.0	RESULTS .....	12
3.1	<i>In situ</i> Data.....	12
3.2	Results <sup>14</sup>	
3.2.1	PCB Congeners.....	14
3.2.2	Pesticides.....	14
3.2.3	Metals.....	17
3.2.4	Rinsate Blank Results .....	18
3.3	Quality Control Results.....	18
3.3.1	Accuracy .....	18
3.3.2	Precision.....	19
3.3.3	Completeness .....	19
4.0	CONCLUSIONS AND DISCUSSION .....	20
4.1	Comparison to Fall 2001 Data .....	22
4.1.1	<i>In situ</i> Data.....	22
4.1.2	Contaminant Data .....	24
5.0	REFERENCES .....	25

## LIST OF TABLES

Table 1. Samples Collected and Measurements Made During the May 30, 2002 Water Quality Survey. ....	4
Table 2. Listing of Field Data from the May 30, 2002 Water Quality Survey. ....	4
Table 3. Sample Collection and Shipboard Processing for Water Samples. ....	5
Table 4. Data Quality Objectives for the Analysis of Water Samples. ....	8
Table 5. Achieved Method Detection Limits for Target Analytes in Waters. ....	9
Table 6. Data Qualifiers and Definitions for Water Analysis. ....	11
Table 7. <i>In situ</i> Results for Site 69B in Rhode Island Sound, May 2002. ....	13
Table 8. Concentrations of PCBs in Unfiltered Water at Site 69B in Rhode Island Sound, May 2002. Concentrations are ng/L. $n = 1$ . ....	16
Table 9. Concentrations of Pesticides in Unfiltered Water at Site 69B in Rhode Island Sound, May 2002. Concentrations are ng/L. $n = 1$ . ....	17
Table 10. Concentrations of Dissolved Metals in Water at Site 69B in Rhode Island Sound, May 2002. Values are $\mu\text{g/L}$ . $n = 1$ . ....	18
Table 11. RIDEM Ambient Water Quality Guidelines for Toxic Pollutants. ....	21

## LIST OF FIGURES

Figure 1. dGPS Master Stations Coverage. ....	2
Figure 2. May 2002 Water Quality Sampling Locations. ....	3
Figure 3. Temperature and Sigma- $t$ versus Depth at Site 69B in May 2002. ....	12
Figure 4. Chlorophyll $a$ and Dissolved Oxygen versus Depth at Site 69B in May 2002. ....	13
Figure 5. Linear Regression Comparing Total Suspended Solids and Beam Attenuation at Site 69B in May 2002. ....	15
Figure 6. Comparison of Temperature and Sigma- $t$ Values Between October 2001 and May 2002 Water Column Surveys at Site 69B. ....	22
Figure 7. Comparison of Dissolved Oxygen and Chlorophyll $a$ Values Between October 2001 and May 2002 Water Column Surveys at Site 69B. ....	23
Figure 8. Comparison of Beam Attenuation and Total Suspended Solid Values Between October 2001 and May 2002 Water Column Surveys at Site 69B. ....	24

## APPENDICES

- Appendix A: Water Contaminant Sample and Quality Control Data
- Appendix B: Rinsate Blank Sample and Quality Control Data

### Acronyms

Ag	silver
As	arsenic
BOSS	Battelle Ocean Sampling System
CMC	Criteria Maximum Concentration
CVAF	cold vapor atomic fluorescence
Cd	cadmium
Corps	U.S. Army Corps of Engineers
Cr	chromium
Cu	copper
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
Fe	iron
FIAS	flow injection atomic spectroscopy
GC/ECD	gas chromatography/electron capture detection
GFAA	graphite-furnace atomic absorption
GPS	Global Positioning System
Hg	mercury
HGAA	hydride atomic absorption
HPLC	high-pressure liquid chromatography
ICP-MS	inductively-coupled-plasma-mass spectrometry
L	liter
m	meter
MDL	Method Detection Limit
mL	milliliter
MADEM	Massachusetts Department of Environmental Management
MPRSA	Marine Protection Research and Sanctuaries Act
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NOAA	National Oceanic and Atmospheric Administration
Ni	nickel
Pb	lead
PCB	Polychlorinated biphenyl
PD	Percent Difference
Pd	palladium
QAPP	Quality Assurance Project Plan
QC	quality control
RIDEM	Rhode Island Department of Environmental Management
RI Disposal Study	Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project
RIS	Recovery Internal Standard
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
Se	selenium
SIS	Surrogate Internal Standard
SOP	Standard Operating Procedure
SRM	Standard Reference Material
TSS	Total Suspended Solids
URI	University of Rhode Island
Zn	zinc

## **1.0 INTRODUCTION**

The Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (RI Disposal Study) includes the collection of environmental baseline data at Rhode Island Sound Sites 16, 18, 69A, and 69B. Site 16 is the only site that had been used previously for disposal of dredge material. Site characterization efforts are designed to fulfill the baseline monitoring requirements defined in the Marine Protection Research and Sanctuaries Act (MPRSA) regulations at Part 228.13. This includes obtaining information on a contiguous area around each site, which will be used to evaluate secondary impacts from disposal, and also to assist in the identification of suitable reference areas for long-term monitoring.

Site characterization goals include documentation of existing physical, chemical, and biological conditions at the sites to (a) provide a basis for comparison of the biological value of the sites (habitat characterizations), (b) assess the suitability of each site for dredge material disposal (bathymetry, sediment type, hydrodynamics), and (c) assess potential short and long-term impacts from dredge material disposal at each site.

This report characterizes the water column in Rhode Island Sound based on a water quality survey performed at Site 69B on May 30, 2002. The purpose of the Spring 2002 water quality survey was to (1) collect water column data during spring, (2) determine the presence of and characterize any physical or biological stratification in the water column, such as thermoclines, haloclines, and zones of pronounced biological activity, and (3) obtain the typical values or range of values for the properties measured. The properties measured included temperature, salinity, dissolved oxygen, total suspended solids (TSS), turbidity, chlorophyll *a*, dissolved metals, pesticides, and polychlorinated biphenyls (PCBs). This report also compares the results of the Spring 2002 water quality survey to the Fall 2001 water quality survey results at Site 69B. This information was also needed for use in future modeling efforts and evaluations of particle settling and transport.

## **2.0 METHODS**

An overview of the methods and protocols used in the collection and analysis of water samples during the May 30, 2002 water quality survey are presented in this section. Complete descriptions and details of those methods are presented in the project-specific Quality Assurance Project Plan (QAPP) (Battelle 2001).

## 2.1 Navigation

The Battelle-owned R/V *Aquamonitor* served as the sampling platform. Vessel positioning during water sampling operations was accomplished with the Battelle Ocean Sampling System (BOSS). This system consists of a Northstar dGPS interfaced to the BOSS computer. The Global Positioning System (GPS) receiver has six dedicated channels and is capable of locking onto six different satellites at one time. To correct the GPS calculations, the Northstar dGPS received correction data from one of three USCG dGPS broadcast sites: Montauk Point, NY, Chatham, MA, or Portsmouth Harbor, NH (Figure 1). Vessel position was obtained every five minutes while in transit.

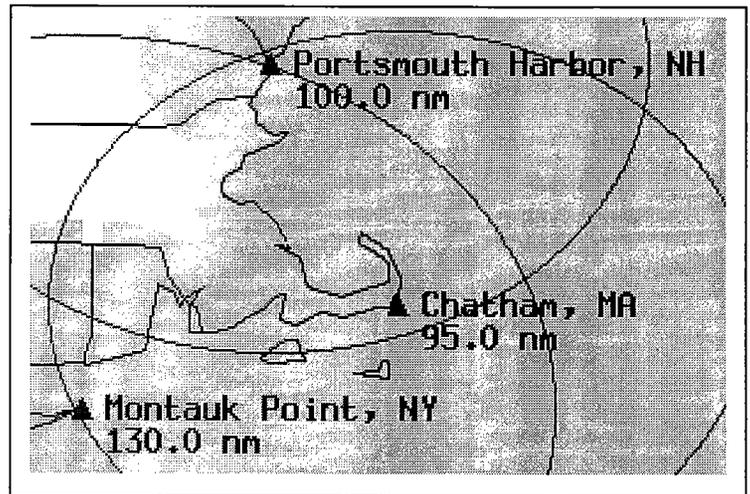


Figure 1. dGPS Master Stations Coverage.

## 2.2 Vessel Handling

At the sampling station, the vessel was positioned about 300 meters (m) upwind/upcurrent of the target station position so that the entire profile cast would be completed within a radius of 300 m from the station. At the sampling station, the vessel was well within the targeted 300 m radius from station. The vessel heading was selected such that the underwater unit was deployed on the side of the boat facing the sun and relative to the prevailing seas, which minimized cable loading. The vessel maintained this position throughout the duration of the cast.

## 2.3 Hydrographic Profiling

Duplicate continuous hydrographic profiles were taken from near-surface (1 m to 2 m deep) to within 5 m of the seafloor at Site 69B, using the BOSS integrated sampling/ hydrographic profiling/navigation system. These *in situ* profiles provided real-time information on water properties and water column structure at the targeted sites. The real-time data derived from these profiles were used to determine sampling depths, and to direct water-sampling operations at Site 69B. Hydrographic measurements were collected for conductivity, temperature, depth, dissolved oxygen, chlorophyll *a*, beam attenuation, irradiance, and altitude above seafloor. Salinity and water density ( $\text{Sigma-t}$ ) were calculated from conductivity, temperature, and depth measurements. Figure 2 shows the location where hydrographic profiles and samples were collected.

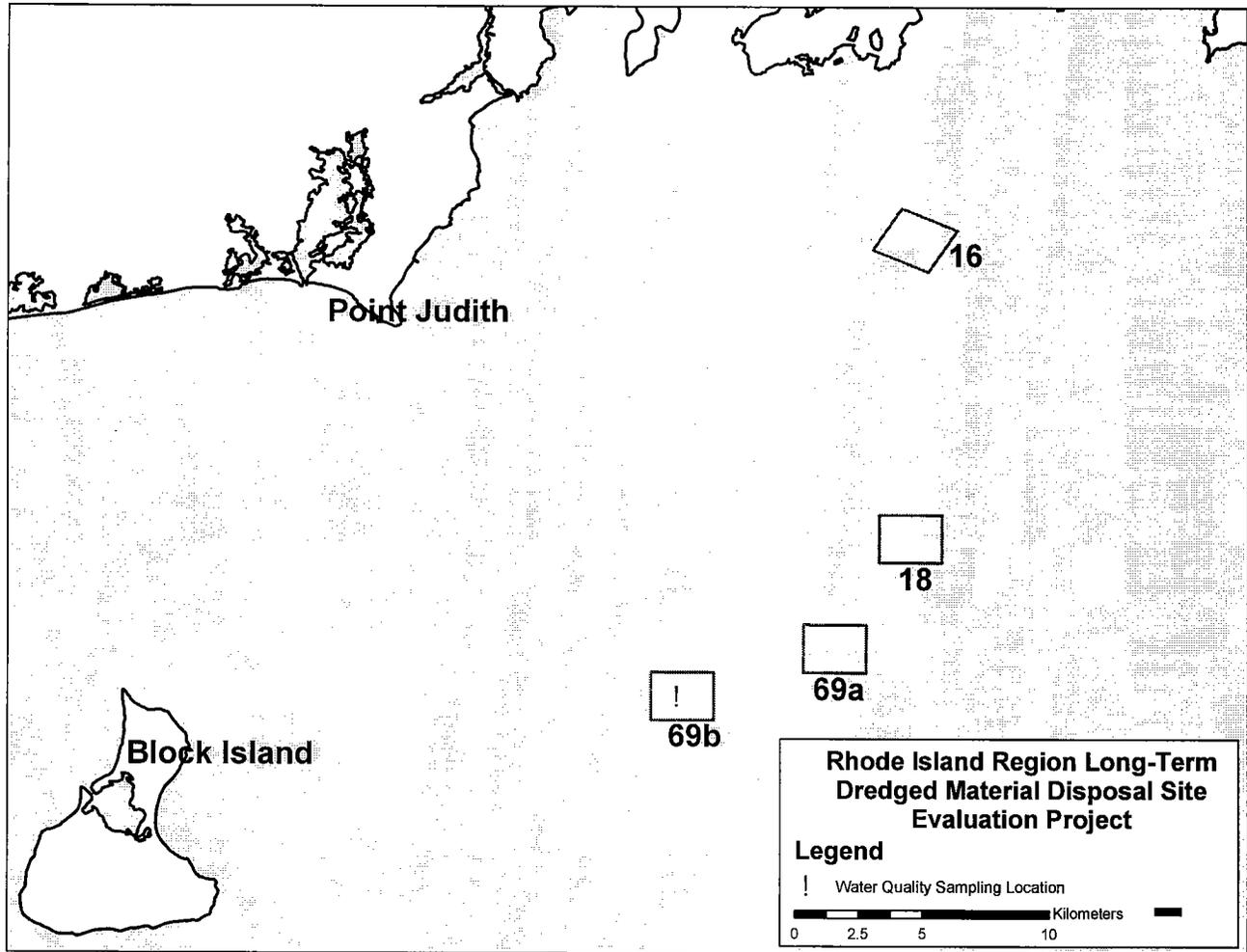


Figure 2. May 2002 Water Quality Sampling Locations.

## 2.4 Water Sampling

Discrete water samples were collected at Site 69B for the water quality survey. Sampling was accomplished in approximately 1 hour. Figure 2 shows the survey station sampled at Site 69B. The rosette system, composed of the rosette sampling device, the water column profiling instrument package, and Go-Flo® sampling bottles, was used to collect discrete water samples at four depths: bottom, mid-depth (chlorophyll *a* max), mid-surface, and surface at each of the targeted sites. The water samples were subsampled onboard for the various chemical analyses listed in Table 1. Table 2 provides the field data (date, time, coordinates, sample ID, weather conditions, and sampling depth) for each sampling site by station. Sample collection and shipboard processing information is provided in Table 3.

**Table 1. Samples Collected and Measurements Made During the May 30, 2002 Water Quality Survey.**

Parameter	Number of Planned Sites	Planned Samples per Site	Total Planned Samples	Number of Actual Sites	Total Actual Samples
Dissolved Metals <sup>a</sup>	1	3	3	1	14 <sup>b</sup>
PCB/Pesticides	1	3	3	1	14 <sup>b</sup>
Dissolved Mercury	1	3	3	1	14 <sup>b</sup>
Chlorophyll <i>a</i> and phaeopigments	1	3	3	1	5 <sup>c</sup>
Total suspended solids	1	3	3	1	4
Dissolved oxygen	1	3	3	1	4 <sup>c</sup>

<sup>a</sup> Ag, As, Cd, Cr, Cu, Ni, Pb, Se, and Zn.

<sup>b</sup> Includes rinsate blanks and field duplicate samples.

<sup>c</sup> Collected for sensor calibration only.

**Table 2. Listing of Field Data from the May 30, 2002 Water Quality Survey.**

Sample ID	Station ID	Longitude °W Xposition	Latitude °N Yposition	Sampling Depth (m)	Sample Date/Time	Weather Conditions
RIS2W042	69B	-71.3804	41.23082	35.09736	5/30/02 15:34	Overcast and fog
RIS2W043	69B	-71.3803	41.23083	18.92124	5/30/02 15:35	Overcast and fog
RIS2W044	69B	-71.3803	41.23083	9.447216	5/30/02 15:35	Overcast and fog
RIS2W045	69B	-71.3803	41.23082	1.472939	5/30/02 15:36	Overcast and fog

**Table 3. Sample Collection and Shipboard Processing for Water Samples.**

Parameter	Station ID	Sample Volume (Target) (mL) <sup>a</sup>	Sample Containers <sup>c</sup>	Shipboard Processing/ Preservation <sup>c</sup>	Maximum Holding Time to Analysis
Hydrographic Profiles <sup>b</sup>	69B	NA	NA	Record data to floppy diskette.	NA
<b>Subsamples from PVC Rosette Bottles</b>					
PCB/Pesticide	69B	Full (with ½ inch headspace)	2 L pre-cleaned amber glass bottle	Store water at 4°C up to and during transport to Battelle.	7 days
Dissolved Metals/ Dissolved Mercury	69B	Full (w/ ½ inch headspace)	500 mL pre-cleaned Teflon® bottle	Pass through 0.45 µm filter. Acidify to pH 2. Store water at 4°C up to and during transport to Sequim.	6 months/ 28 days
Chlorophyll <i>a</i> and phaeopigments <sup>d</sup>	69B	25 – 400 (400)	Whatman GF/F in foil	Pass through GF/F. Fix with a saturated MgCO <sub>3</sub> solution. Freeze filter until analysis.	4 weeks
Total suspended solids	69B	100 – 500 (500)	1-L dark bottle	Store water in 1-L dark bottle at 4°C up to and during transport to URI for filtration.	1 week
Dissolved oxygen <sup>d</sup>	69B	300	300 mL glass BOD bottle	Fix per Oudot <i>et al</i> (1988) and APHA (1989). Titrate 2-24h later.	24 hours

GF/F: pre-ashed glass fiber filter

<sup>a</sup>Volume processed for analysis.

<sup>b</sup>*In situ* conductivity, temperature, pressure, dissolved oxygen, chlorophyll *a* fluorescence, transmissometry, irradiance, surface irradiance, bottom depth, navigational position

<sup>c</sup>Name brand items (e.g., Nuclepore, Whatman) may be substituted with comparable items from a different manufacturer.

<sup>d</sup>A limited number of chlorophyll *a* and DO samples were collected to confirm the *in situ* hydrographic profile data. These data are not presented in this report.

Subsamples were taken from each discrete water sampling depth for PCBs/pesticides, dissolved metals (including mercury (Hg)), and total suspended solids (TSS). Chlorophyll *a* and dissolved oxygen (DO) samples were collected to confirm *in situ* data. PCB/pesticides and metals were collected in triplicate at each depth, with the first replicate designated for analysis (Table 1). A field duplicate sample was collected at bottom depth at Site 69B for PCB/pesticides and metals. Chlorophyll *a*, DO, and TSS samples were not collected in triplicate.

PCB/pesticides samples (not filtered upon collection) were collected directly from the Go-Flo® bottles into measurement-specific sample bottles using clean techniques. Water collected for the dissolved metals analyses (including dissolved Hg) were transferred directly from the Go-Flo® bottles into a clean filtering apparatus (using clean metals methods) and filtered onboard using a vacuum pump. After filtration, the filtered water was transferred directly from the collection vessel of the filtering apparatus into clean sample bottles and acidified onboard.

Filtration (through a glass fiber filter) for chlorophyll *a* analysis was conducted onboard the vessel immediately upon collection. All of the sample filters were folded, stored in aluminum foil, and frozen onboard until analysis. DO samples were fixed onboard immediately after sampling. Samples were analyzed within 24 hours of initial fixing.

Samples for TSS analysis were collected but not filtered aboard the R/V *Aquamonitor*. These samples were stored in the dark and chilled (~4° C) until analysis. TSS samples collected from Site 69B were delivered to the University of Rhode Island (URI) for processing and analysis.

## **2.5 Water Analysis Tasks**

Surface-water samples were analyzed for PCB congeners, chlorinated pesticides, dissolved metals, and TSS. General descriptions of the analytical methods used are provided below. Details of the analytical methods used are presented in the project-specific QAPP (Battelle 2001).

### **2.5.1 Chlorinated Pesticides and PCB Congeners**

Water samples were extracted for chlorinated pesticides/PCB congeners following Battelle Duxbury Standard Operating Procedure (SOP) 5-200. Briefly, 2 Liters (L) of water (measured using a graduated cylinder) was transferred to a separatory funnel, extraction solvent was added (120 milliliters (mL) methylene chloride), and the sample was fortified with surrogate internal standard (SIS) compounds. Each sample was serially extracted three times using separatory-funnel techniques. The combined extract of each sample was dried over sodium sulfate and concentrated to 1 mL using Kuderna-Danish and nitrogen evaporation techniques. Alumina column and high-pressure liquid chromatography (HPLC) (SOP 5-191) cleanup were performed. The final extract (0.5 mL) was fortified with recovery internal standard (RIS), solvent exchanged into hexane, and submitted for analysis.

Pesticides and PCB congeners were analyzed and quantified using gas chromatography/electron capture detection (GC/ECD) (Hewlett Packard 5890 Series 2 GC) using a 60 m DBS column and hydrogen as the carrier gas following Battelle SOP 5-128, including a second column for confirmation. Concentrations for all target analytes were determined by the method of internal standards, using RIS compounds for quantification. Results were reported on a volume basis.

### **2.5.2 Metals**

The water samples were analyzed for nine metals: silver (Ag), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), selenium (Se), and zinc (Zn). The water samples were also analyzed for dissolved Hg.

Prior to analysis for Ag, As, Cd, Cr, Cu, Ni, Pb, and Zn, seawater samples were preconcentrated using iron (Fe) and palladium (Pd) according to Battelle SOP MSL-I-025, *Methods of Sample Preconcentration*, which is derived from the U.S. Environmental Protection Agency (EPA) Method 1640.

As, Cd, Cr, Cu, Ni, Pb, and Zn were analyzed by inductively-coupled-plasma-mass spectrometry (ICP-MS) following Battelle SOP MSL-I-022, *Determination of Elements in Aqueous and Digestate Samples by ICP-MS*, which is based on EPA Method 200.8. Equipment blank samples were not preconcentrated, but were analyzed directly by ICP-MS.

Ag was analyzed in the Fe-Pd preconcentrate by graphite-furnace atomic absorption (GFAA) following Battelle SOP MSL-I-029, *Determination of Metals in Aqueous and Digestate Samples by GFAA*, based on EPA Method 200.9.

Se was analyzed directly (with no preconcentration step) by hydride atomic absorption (HGAA) with flow-injection atomic spectroscopy (FIAS) following Battelle SOP MSL-I-030, *Determination of Metals in Aqueous and Digestate Samples by HGAA/FIAS*.

Dissolved Hg was analyzed directly (with no preconcentration step) using cold-vapor atomic fluorescence (CVAF) spectroscopy according to Battelle SOP MSL-I-013, *Total Mercury in Aqueous Samples by CVAF*, which is derived from EPA Method 1631.

All results were reported in units of  $\mu\text{g/L}$ . None of the results were blank corrected.

### **2.5.3 Total Suspended Solids (TSS)**

Within seven days of delivery to the URI analytical laboratory, samples for TSS determination were processed in a particulate-free area following procedures in Battelle SOP 5-053, *Suspended Particulate Matter Measurements (Total Suspended Solids [TSS])*. Using a vacuum-filter system, up to 500 mL of seawater were passed through a precleaned and preweighed 0.4-mm-pore-size, 47-mm-diameter Nuclepore® membrane filter. The filter was then rinsed three times with pH 8 deionized water to remove salt. Duplicate filters were processed in parallel for each sample. Filters were folded in quarters, placed in petri dishes, and dried in a class 100 clean bench for at least 48 hours, then stored at room temperature for gravimetric analysis. TSS was calculated as the net filter weight (loaded – tare weight divided by the volume filtered) and reported as the mean of the laboratory duplicate samples.

### **2.5.4 Data Quality Objectives**

Table 4 provides the data quality objectives for accuracy, precision, and completeness for chemical analyses. Appendix A shows the individual data results for each of the water samples and the associated quality control results for each of the analyses.

**Table 4. Data Quality Objectives for the Analysis of Water Samples.**

QC Type and Frequency	Acceptance Criteria	Corrective Action
<b>Procedural Blanks</b>		
Organics 1 per analytical batch	< RL or associated samples > 10x blank values	Reextract and/or reanalyze; document corrective actions
Metals 1 per analytical batch	< 5X MDL or associated samples > 10x blank values	Reextract, reanalyze, and/or blank subtract; document corrective action
TSS (Method Blank) 3 per day (Filter Blank) 1 per 20 samples	≤ 5X MDL ≤ 5X MDL	Review with Project Manager; reanalyze or justify project records
<b>Accuracy</b>		
<b>Surrogate Internal Standards (SIS)</b>		
Organics	40-125% recovery	Reextract, reanalyze or justification documented
<b>Laboratory Control Sample/ Matrix Spikes</b>		
Organics 1 per analytical batch	40-120% recovery for 90% of analytes	LCS: Review with Project Manager; reanalyze or justify in project records
Metals 1 per analytical batch	70-130% recovery <sup>a</sup>	MS: Reextract, reanalyze or justification documented.
<b>Standard Reference Material (SRM)</b>		
Metals 1 per analytical batch	PD ≤ 25% from certified values (for certified values >5X MDL)	Reextract, reanalyze or justification documented.
<b>Precision</b>		
<b>Field Duplicates</b>		
Organics 1 per 20	≤50% RPD for at least 90% of analytes (for analytes detected at level >3X RL) ≤50% RPD	Inform Project Manager; Document in QA/QC Narrative
Metals 1 per 20		
TSS 1 per 20		
<b>Laboratory Duplicates</b>		
Organics (MS/MSD/Lab Duplicates) 1 per analytical batch	≤ 30% RPD for at least 90% of analytes (for analytes detected at level >3x RL) <sup>a</sup>	Lab Duplicates: Review with Project Manager; reanalyze or justify project records
Metals (MS/MSD/Lab Duplicates) 1 per analytical batch	≤ 30% RPD <sup>a</sup>	MS/MSD: Reextract, reanalyze or justification documented.
TSS (Lab Duplicates) Every sample	≤ 10% RPD (when TSS measured at level >10X MDL)	

RL = Reporting Limit; MDL=Method Detection Limit; SRM=Standard Reference Material; PD=Percent Difference; SIS=Surrogate Internal Standard; MS/MSD = Matrix Spike/Matrix Spike Duplicate; RPD=Relative Percent Difference; RSD=Relative Standard Deviation;.

<sup>a</sup> Concentration of spiked analytes in MS/MSD must be >5x background concentration to be used for data quality assessment.

### **Accuracy**

Analytical accuracy was evaluated based on percent recoveries of analytes in blank and matrix spike samples and the SIS that were added to every sample (organics only), as well as the results of the procedural blank and standard reference material (SRM) samples (metals only) that were analyzed with each batch of up to 20 field samples. Specific accuracy goals are listed in Table 4. Achieved method detection limits (MDLs) and project quantitation limit goals (QLs) for analytes of interest are presented in Table 5. MDLs are the lower limit of reporting. The project QL goals are the upper limit of reporting, as specified by the client.

**Table 5. Achieved Method Detection Limits for Target Analytes in Waters.**

Parameter	MDL	Project QL Goal <sup>c</sup>
Total Suspended Solids	0.1 mg/L <sup>a</sup>	Not available
<b>PCBs (ng/L)<sup>b</sup></b>		
PCB8	4.8	30.53
PCB18	0.42	2.64
PCB28	0.52	3.31
PCB44	0.44	2.77
PCB52	0.43	2.73
PCB66	0.45	2.83
PCB101	0.34	2.19
PCB105	0.17	1.11
PCB118	0.26	1.65
PCB128	0.42	2.67
PCB138	0.4	2.54
PCB153	0.32	2.04
PCB170	0.3	1.94
PCB180	0.29	1.84
PCB187	0.26	1.65
PCB195	0.33	2.07
PCB206	0.37	2.32
PCB209	0.38	2.42
<b>Pesticides (ng/L)<sup>b</sup></b>		
4,4'-DDD	0.18	1.14
4,4'-DDE	0.25	1.59
4,4'-DDT	0.17	1.05
2,4'-DDD	0.22	1.43
2,4'-DDE	0.51	3.24
2,4'-DDT	0.6	3.78
Aldrin	0.85	5.41
alpha-Chlordane	0.32	2.07
Dieldrin	0.29	1.88
Endosulfan I	0.33	2.13
Endosulfan II	0.15	0.99
Endosulfan Sulfate	0.17	1.08
Endrin	0.29	1.88
gamma-BHC	0.25	1.84
Heptachlor	0.35	2.23
Heptachlor Epoxide	0.28	1.81
Toxaphene	50	Not available

<sup>a</sup> Achievable MDLs are limits that an individual laboratory can achieve when performing a specific analytical method. The MDL values are three times the standard deviation of seven replicates of low-level samples.

<sup>b</sup> Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 1-L. Actual sample-specific MDLs varied depending upon sample processing factors and are reported with the analytical data in Appendix A.

<sup>c</sup> The Project Quantitation Limit Goal (QL) = 3.18 \* Target Laboratory MDL, as defined by NELAC (Battelle 2001).

<sup>d</sup> Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 500-mL. Actual sample-specific MDLs varied depending upon sample processing factors and are reported with the analytical data in Appendix A.

**Table 5 (cont.).**

Parameter	MDL	Project QL Goal <sup>c</sup>
<b>Metals (µg/L)<sup>d</sup></b>		
Arsenic	0.16	0.32
Cadmium	0.0069	0.048
Chromium	0.067	9.54
Copper	0.034	2.58
Lead	0.0049	0.016
Mercury	0.0002	0.0006
Nickel	0.059	11.35
Selenium	0.049	0.318
Silver	0.016	0.095
Zinc	0.087	3.82

<sup>a</sup> Achievable MDLs are limits that an individual laboratory can achieve when performing a specific analytical method. The MDL values are three times the standard deviation of seven replicates of low-level samples.

<sup>b</sup> Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 1-L. Actual sample-specific MDLs varied depending upon sample processing factors and are reported with the analytical data in Appendix A.

<sup>c</sup> The Project Quantitation Limit Goal (QL) = 3.18 \* Target Laboratory MDL, as defined by NELAC (Battelle 2001).

<sup>d</sup> Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 500-mL. Actual sample-specific MDLs varied depending upon sample processing factors and are reported with the analytical data in Appendix A.

### ***Precision***

Analytical precision was determined using the results from laboratory duplicate samples (matrix spikes and laboratory duplicates for organics samples, matrix spikes and laboratory duplicates for metals samples), with the relative percent differences (RPD) or relative standard deviation (RSD) serving as a measure of precision. Target RPDs and RSDs are provided in Table 4.

### ***Completeness***

The completeness of chemical analyses was ensured by comparing the chain-of-custody forms received by the laboratory with the list of samples analyzed.

## **2.6 Deviations from the QAPP**

Based on the preliminary examination of the water column profile data, the U.S. Army Corps of Engineers (the Corps) and EPA Region 1 requested samples be analyzed from four depths (bottom, mid-depth (chlorophyll *a* max), mid-surface, and surface) instead of the required three depths (bottom, mid-depth, and surface).

Samples were mistakenly collected in triplicate for PCB/pesticides, dissolved metals, and Hg. Only the first replicate sample was analyzed for each analysis.

The field duplicate sample collected for PCB/pesticides was used as a matrix spike/matrix spike duplicate sample and was not analyzed as a field duplicate.

The recommended holding time of 28 days for Hg analysis was exceeded by 4 days, and water samples were analyzed for Hg 32 days after collection. It is unlikely that exceeding the holding time affected the results of the Hg analysis. EPA Method 1631, Revision D (draft) states that acid-preserved water samples are stable for 90 days from collection. Please note, however, that Method 1613, Revision D (draft) has been released for comment but has not yet been promulgated as a final method.

## 2.7 General Data Treatment and Reduction

This section describes the data reduction performed on the Spring 2002 water quality data.

Specifics of data reduction and handling are listed below.

- All *in situ* data and sample collection information were loaded directly into the project database from Battelle's NavSam<sup>®</sup> software.
- *In situ* data were reported at depths where discrete water samples were collected.
- All analytical data were generated by Battelle laboratories and qualified when necessary (Table 6). Data were loaded directly into the project database. Data loading applications were provided to the subcontractor laboratory (URI) to facilitate the loading of the TSS data.
- All data were extracted directly from the database and exported into MS Excel<sup>®</sup> files, where graphical presentations were performed.
- Contaminant data were reported as mean, standard deviation, and number of samples by station.
- Total PCB was calculated as the sum of twenty PCB congeners (Table 5). In case of a "not detected", 1/2 the MDL value was used for the non-detected congeners.
- Total DDT was calculated as the sum of six DDT-related compounds: 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT (Table 5).

**Table 6. Data Qualifiers and Definitions for Water Analysis.**

<b>Qualifier</b>	<b>Definition</b>
U	compound not detected; MDL reported as value.
f	compound quantified but value reported was below the MDL.
J	compound quantified above the MDL but was below the Project QL Goal.
T	holding time exceeded

### 3.0 RESULTS

#### 3.1 *In situ* Data

Vertical stratification is defined for this report by the presence of a pycnocline with a density (Sigma -  $t$ ) gradient of greater than 1.0 over a relatively narrow depth range (~10 m). Using this definition, the two profile downcasts at Site 69B indicate that there was a moderate thermocline and pycnocline present from surface to bottom (Figure 3). A double thermocline was present in the water column. One thermocline was present at 16 – 17 m depth. A second possible thermocline was present in the surface water, where the waters were warmer and fresher. The difference in surface water temperature and salinity could be due to diurnal solar heating and surficial run-off of freshwater.

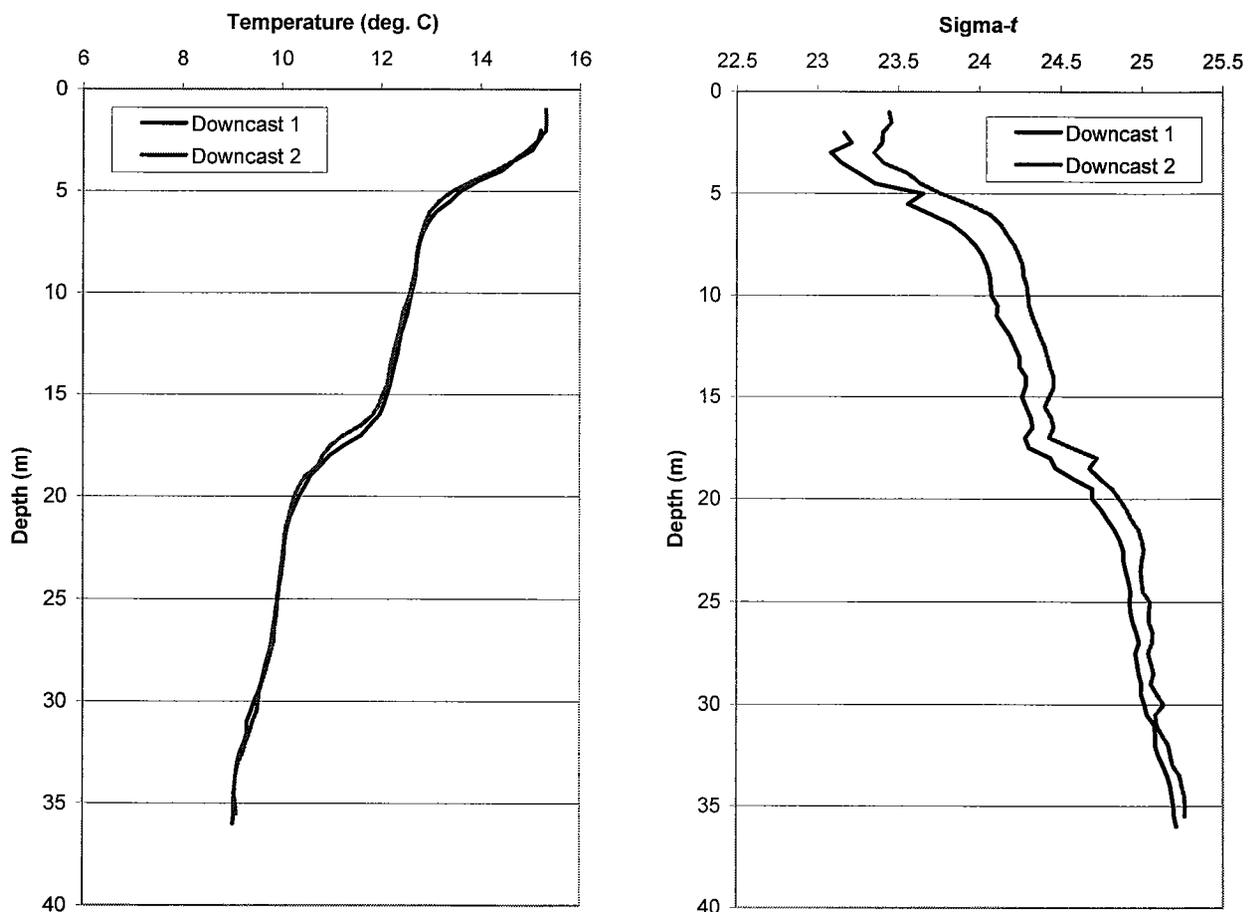


Figure 3. Temperature and Sigma- $t$  versus Depth at Site 69B in May 2002.

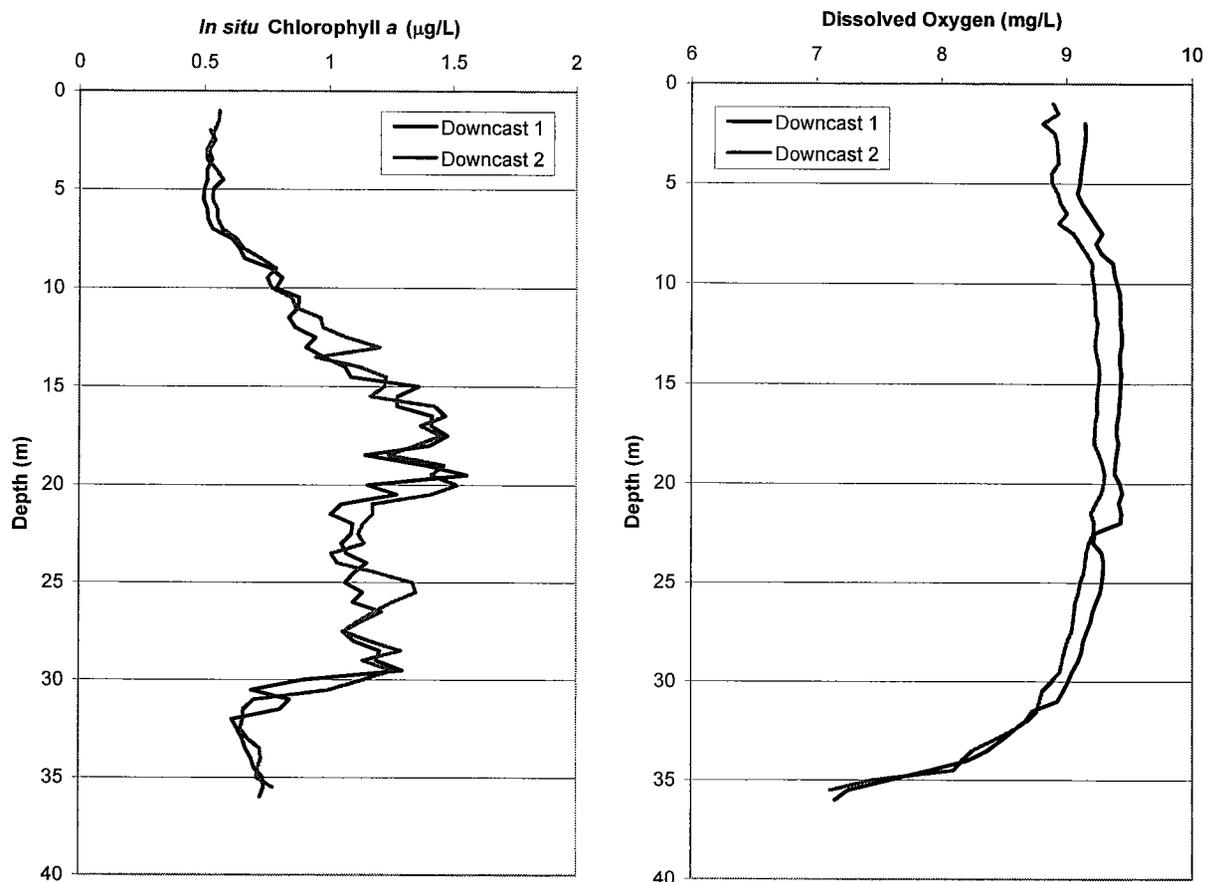
Calibrated chlorophyll  $a$  concentrations (based on *in situ* fluorescence measurements) were generally low, ranging from 0.6 to 1.3  $\mu\text{g/L}$  (Table 7). A review of the downcast profile data indicates that the chlorophyll  $a$  concentrations began to slowly increase at approximately 7 m and reached a subsurface chlorophyll  $a$  maximum (~ 2  $\mu\text{g/L}$ ) at a depth of approximately 20 m

(Figure 4). The discrete sampling on the upcast also showed maximum chlorophyll *a* concentrations at 18.8 m (Table 7).

**Table 7. *In situ* Results for Site 69B in Rhode Island Sound, May 2002.**

Parameter	Station	Site 69B			
	Depth (m)	1.48	9.43	18.8	35.23
Temperature	Unit	Value	Value	Value	Value
Temperature	°C	15.2	12.5	10.2	9.0
Salinity	PSU	32	32.3	32.6	32.7
Sigma- <i>t</i>	N/A	23.6	24.4	25	25.3
Beam Attenuation	m <sup>-1</sup>	0.9	0.8	0.7	1.3
Conductivity	mS/cm	39.8	37.7	35.9	35
<i>In situ</i> Dissolved Oxygen (DO) Concentration	mg/L	9.4	9.7	9.5	7.2
<i>In situ</i> DO Saturation	PCT	113.4	110.2	103.1	75.9
<i>In situ</i> Chlorophyll Fluorescence	µg/L	0.6	0.8	1.3	0.8
Light	µEm <sup>-2</sup> sec <sup>-1</sup>	547.8	141.6	31.3	2.5
Total Suspended Solids*	mg/L	0.28	0.64	0.56	1.26

\* Measured during laboratory analysis of water samples.



**Figure 4. Chlorophyll *a* and Dissolved Oxygen versus Depth at Site 69B in May 2002.**

DO concentrations ranged from 9.4 mg/L at the surface to 7.2 mg/L in the bottom waters (Table 7). In general, the structure of the DO downcast profile exhibited no appreciable increase or decrease in concentration from the surface to approximately 25 m (Figure 4). DO concentrations began to decline at approximately 25 m and continued to decline to the bottom. The concentrations of DO measured in the bottom waters were unexpectedly low compared to typical values for coastal bottom waters in May. Further investigation of the laboratory chlorophyll *a* data collected for *in situ* sensor calibration provided a possible explanation for the low DO measured in the bottom waters. Phaeophytin, which was measured along with chlorophyll *a* in the laboratory calibration samples, is the primary degradation product of chlorophyll. The ratio of extractable chlorophyll *a* to phaeophytin in the bottom water samples at Site 69B (0.922) was indicative of degraded phytoplankton. Therefore, the low DO condition was most likely due to the degradation of remnants of a spring phytoplankton bloom in Rhode Island Sound. These remnants may have been resuspended from the bottom sediments along with particulate matter, as indicated by the TSS results (see below).

Bottom TSS was generally higher in bottom waters than in surface waters (Table 7). This is most likely due to the resuspension of bottom sediments into the water column. There was a fairly strong correlation between beam attenuation and TSS ( $r^2 = 0.6335$ ), except in surface waters (Figure 5). If the data for surface waters is removed from the graph, the correlation becomes much stronger ( $r^2 = 0.9973$ ). Some compounds, such as humic acids, affect beam attenuation. The presence of these compounds may account for the lack of correlation between beam attenuation and TSS in surface waters at Site 69B.

## 3.2 Results

The results of the PCB/pesticide and trace metals analyses are presented in following sections.

### 3.2.1 PCB Congeners

PCB congeners were undetected in all samples and at all depths at Site 69B (Table 8).

### 3.2.2 Pesticides

Most pesticides were also not detected at any depth at Site 69B (Table 9). The only pesticide that was detected, g-BHC, was either at concentrations below the MDL (0.25 ng/L) (at 9.45 and 18.92 m) or below the Project QL Goal (1.84 ng/L) (at 1.47 and 35.10 m).

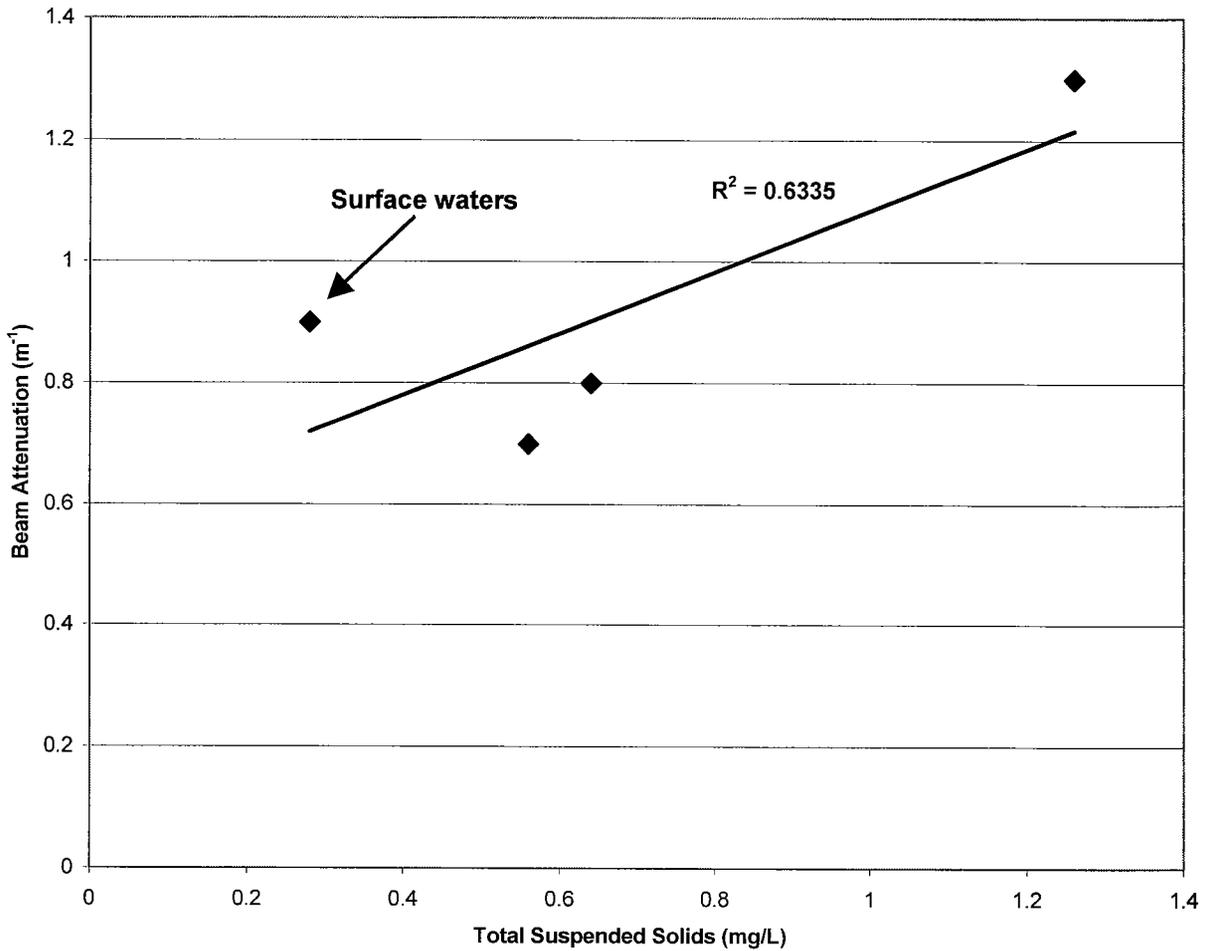


Figure 5. Linear Regression Comparing Total Suspended Solids and Beam Attenuation at Site 69B in May 2002.

**Table 8. Concentrations of PCBs in Unfiltered Water at Site 69B in Rhode Island Sound, May 2002. Concentrations are ng/L. *n* = 1.**

Site	Site 69B							
Sample ID	RISW045		RISW044		RISW043		RISW042	
Depth (m)	1.47		9.45		18.92		35.10	
Parameter	Concentration (ng/L)	Q						
Cl2(08)	4.8	U	4.8	U	4.8	U	4.8	U
Cl3(18)	0.42	U	0.42	U	0.42	U	0.42	U
Cl3(28)	0.52	U	0.52	U	0.52	U	0.52	U
Cl4(44)	0.44	U	0.44	U	0.44	U	0.44	U
Cl4(52)	0.43	U	0.43	U	0.43	U	0.43	U
Cl4(66)	0.45	U	0.45	U	0.45	U	0.45	U
Cl5(101)	0.34	U	0.34	U	0.34	U	0.34	U
Cl5(105)	0.17	U	0.17	U	0.17	U	0.17	U
Cl5(118)	0.26	U	0.26	U	0.26	U	0.26	U
Cl6(128)	0.42	U	0.42	U	0.42	U	0.42	U
Cl6(138)	0.4	U	0.4	U	0.4	U	0.4	U
Cl6(153)	0.32	U	0.32	U	0.32	U	0.32	U
Cl7(170)	0.3	U	0.3	U	0.3	U	0.3	U
Cl7(180)	0.29	U	0.29	U	0.29	U	0.29	U
Cl7(187)	0.26	U	0.26	U	0.26	U	0.26	U
Cl8(195)	0.33	U	0.33	U	0.33	U	0.33	U
Cl9(206)	0.37	U	0.37	U	0.37	U	0.37	U
Cl10(209)	0.38	U	0.38	U	0.38	U	0.38	U
Total PCB <sup>a</sup>	5.45	U	5.45 <sup>a</sup>	U	5.45 <sup>a</sup>	U	5.45 <sup>a</sup>	U

Q = qualifier (Table 6).

U = analyte undetected; value reported is method detection limit (MDL).

<sup>a</sup> For calculating totals, 1/2 the reported MDL was used for undetected analytes.

**Table 9. Concentrations of Pesticides in Unfiltered Water at Site 69B in Rhode Island Sound, May 2002. Concentrations are ng/L.  $n = 1$ .**

Site	Site 69B							
Sample ID	RISW045		RISW044		RISW043		RISW042	
Depth (m)	1.47		9.45		18.92		35.10	
Parameter	Concentration (ng/L)	Q						
2,4 DDD	0.22	U	0.22	U	0.22	U	0.22	U
2,4 DDE	0.51	U	0.51	U	0.51	U	0.51	U
2,4 DDT	0.6	U	0.6	U	0.6	U	0.6	U
4,4 DDD	0.18	U	0.18	U	0.18	U	0.18	U
4,4 DDE	0.25	U	0.25	U	0.25	U	0.25	U
4,4 DDT	0.17	U	0.17	U	0.17	U	0.17	U
Aldrin	0.85	U	0.85	U	0.85	U	0.85	U
cis Chlordane	0.32	U	0.32	U	0.32	U	0.32	U
Dieldrin	0.29	U	0.29	U	0.29	U	0.29	U
Endosulfan I	0.33	U	0.33	U	0.33	U	0.33	U
Endosulfan II	0.15	U	0.15	U	0.15	U	0.15	U
Endosulfan sulfate	0.17	U	0.17	U	0.17	U	0.17	U
Endrin	0.29	U	0.29	U	0.29	U	0.29	U
g-BHC	0.385	J	0.25	f	0.2885	f	0.5285	J
Heptachlor	0.35	U	0.35	U	0.35	U	0.35	U
Heptachlor epoxide	0.28	U	0.28	U	0.28	U	0.28	U
Toxaphene	50	U	50	U	50	U	50	U

Q = qualifier (Table 6).

U = analyte undetected; value reported is method detection limit (MDL).

f = compound quantified but value reported was below the MDL.

J = compound quantified above the MDL but below the Project QL Goal.

### 3.2.3 Metals

Concentrations of dissolved As and Pb were greater than the Project QL Goal in all samples collected at Site 69B. Dissolved Ag, Cd, Cr, Cu, Hg, Ni, and Zn were detected at concentrations above the MDL but below the Project QL Goal in all samples. Se was detected at concentrations below the MDL at all depths at Site 69B. Table 10 shows the concentrations of dissolved metals in the water samples collected.

Concentrations of most dissolved metals varied with depth (Table 10). Ag and As increased with depth. This increase was fairly linear for both metals ( $r^2 = 0.76$  for Ag,  $r^2 = 0.98$  for As). Concentrations of Pb and Zn, however, tended to decrease with depth, with the largest decrease in concentration occurring between the surface and mid-surface depths. Other dissolved metals, such as Cd, Cr, Ni, and Hg, varied with depth, with the largest concentrations found at mid-surface, but no clear trend was observed. The highest concentration of Cu was in the surface water.

**Table 10. Concentrations of Dissolved Metals in Water at Site 69B in Rhode Island Sound, May 2002. Values are µg/L. n = 1.**

Site	Site 69B							
	Sample ID		RISW045		RISW044		RISW043	
Depth (m)	1.47		9.45		18.92		35.10	
Parameter	Concentration (µg/L)	Q						
Arsenic	0.97		1.02		1.10		1.17	
Cadmium	0.027	J	0.029	J	0.028	J	0.027	J
Chromium	0.17	J	0.24	J	0.17	J	0.22	J
Copper	0.39	J	0.38	J	0.31	J	0.37	J
Lead	0.28		0.04		0.06		0.05	
Mercury	0.0007	JT	0.0008	JT	0.0007	JT	0.0006	JT
Nickel	0.42	J	1.15		0.37	J	0.66	J
Selenium	0.013	f	0.037	f	0.034	f	0.045	f
Silver	0.018	J	0.028	J	0.037	J	0.037	J
Zinc	2.36	J	1.18	J	1.08	J	0.739	J

Q = qualifier (Table 6).  
 U = analyte undetected; value is reported method detection limit (MDL).  
 f = compound quantified but value reported was below the MDL.  
 J = compound quantified above the MDL but below the Project QL Goal.  
 T = holding time exceeded.

### 3.2.4 Rinsate Blank Results

#### PCB/Pesticides

All PCB congeners were undetected in the rinsate blank sample (Appendix B). All pesticides were undetected in the rinsate blank, except for cis Chlordane (2.51 ng/L). cis Chlordane, however, was undetected in all of the field samples. g-BHC was detected in the rinsate blank but at a concentration below the MDL.

#### Metals

Pb was the only metal detected in the rinsate blank at concentrations above the Project QL Goal (Appendix B). Cr, Cu, Hg, Ni, and Zn were all detected below the Project QL Goal. Ag, As, and Cd were detected in the rinsate blank but at concentrations below the MDL. Se was undetected in the rinsate blank.

## 3.3 Quality Control Results

### 3.3.1 Accuracy

Laboratory-achieved MDLs were less than the project QLs for all target analytes. Therefore, the required level of detection for this project was achieved for the analyses performed.

TSS were measured at levels less than five times the MDL in all blank samples. Target organic analytes were not detected in the procedural blanks analyzed with the field samples. Most dissolved metals were either not detected in the procedural blank or detected at concentrations less than five times the MDL. The only exception was Pb, which was detected at concentrations slightly above five times the MDL, but below the Project QL Goal.

Recoveries for all organic blank spike samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and surrogate recoveries were within quality control (QC) acceptance criteria.

Blank spike (BS) recoveries for dissolved metals and total/dissolved Hg were within the QC criteria except for Ag (37%) in one of two BS samples. No corrective action was taken; acceptable spike recovery was demonstrated for Ag in the second BS sample. MS/MSD recoveries for all target metals were within QC acceptance criteria.

The standard reference materials (SRMs) CASS-4 (for dissolved metals) and SRM 1641d (for Hg) were analyzed at a minimum frequency of 1 per 20 samples. In the absence of an SRM with a certified concentration for Ag, a laboratory-achieved consensus value was calculated for Ag to allow for assessment of accuracy of Ag recovery. SRM 1640, an aqueous laboratory control sample, was also analyzed for all ICP-MS metals and Se. All SRM CASS-4, 1641d, and 1640 recoveries were within QC acceptance criteria.

### **3.3.2 Precision**

The RPDs for TSS exceeded the MPC of  $\leq 10\%$  for two pairs of sample replicates. In cases where the RPD between TSS replicates exceeded the MPC, the mean concentration for TSS was detected at levels less than 10 times the MDL and, as a result, the MPC was not applicable to those samples.

The RPD values for the MS/MSD samples ranged from 0.6 – 8.9% for all pesticides and PCB congeners analyzed. The only target organic analytes detected in laboratory duplicate samples were cis chlordane and g-BHC. The RPD values for these analytes were 7.5 and 2.3%, respectively. All RPD values were well within the MPC of  $\leq 30\%$  for the organic analyses.

For metals, RPDs for MS/MSD samples were within the QC acceptance criteria. Laboratory duplicate samples were analyzed for all dissolved metals. The RPDs of duplicate samples were within the QC acceptance criteria of  $\pm 30\%$  for all detected metals with the exception of Cr in one set of duplicates (113%). However, the concentrations of Cr in the set of duplicates samples were less than five times the MDL and should not be used for data quality assessment. Acceptable precision for analysis of Cr was demonstrated by the MS/MSD analysis.

### **3.3.3 Completeness**

All of the field samples received by the laboratories were analyzed and results reported.

## 4.0 CONCLUSIONS AND DISCUSSION

The Spring 2002 water quality survey was completed successfully, with the collection and analysis of 100% of the planned water samples. Two water column profiles were successfully completed at Site 69B. Deviations from the QAPP, such as collecting additional samples and exceeding the holding time for Hg analysis, did not affect the quality of data collected during this survey. Results in this report document the baseline water quality conditions at Rhode Island Sound Site 69B in May 2002.

Moderate stratification of the water column (i.e. thermocline or pycnocline) was observed during the May 2002 water quality survey. Surface waters were much warmer and fresher than bottom waters. Though DO concentrations were unexpectedly low in the bottom waters, the measured concentrations of DO in both the surface and bottom waters were above the Rhode Island Department of Environmental Management (RIDEM) DO criteria for Class SA waters (> 6.0 mg/L). Class SA waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. The maximum chlorophyll *a* concentration of ~2 µg/L was measured at about 20 m (Figure 4).

With the exception of g-BHC, concentrations of organic contaminants were undetected in the four water samples collected from Site 69B in Rhode Island Sound in May 2002. Metals were detected at low concentrations in all samples, and concentrations of some metals varied with depth. Ag and As increased with depth, and Pb and Zn decreased with depth. Detected levels of organic and inorganic contaminants in the water column were well below the ambient water quality guidelines for toxic pollutants (Table 11) adopted by RIDEM, as required by Section 303(c)(2)(B) of the Clean Water Act (RIDEM 2000).

**Table 11. RIDEM Ambient Water Quality Guidelines for Toxic Pollutants.**

Chemical Name	Aquatic Life Criteria (µg/L)		Maximum Measured Value (µg/L)
	Saltwater (Acute)	Saltwater (Chronic)	
Arsenic <sup>c</sup>	69	36	1.17
Cadmium <sup>c</sup>	42	9.3	0.029
Chromium VI <sup>c</sup>	1100	50	0.24
Copper <sup>c</sup>	4.8	3.1	0.39
Lead <sup>c</sup>	210	8.1	0.28
Mercury <sup>c</sup>	1.8	0.025	0.0008
Nickel <sup>c</sup>	74	8.2	1.15
Selenium <sup>c</sup>	290	71	0.045
Silver <sup>c</sup>	1.9	-	0.037
Zinc <sup>c</sup>	90	81	2.36
Polychlorinated Biphenyls <sup>b</sup>	-	0.03	0.005 <sup>d</sup>
Aldrin	1.3 <sup>a</sup>	-	0.00085 <sup>d</sup>
Chlordane	0.09 <sup>a</sup>	0.004	0.00032 <sup>d</sup>
4,4-DDT	0.13 <sup>a</sup>	0.001	0.00017 <sup>d</sup>
4,4-DDE	-	-	0.00025 <sup>d</sup>
4,4-DDD	-	-	0.00018 <sup>d</sup>
Dieldrin	0.71 <sup>a</sup>	0.0019	0.00029 <sup>d</sup>
Endosulfan (Alpha, Beta)	0.034 <sup>a</sup>	0.0087	0.00033 <sup>d</sup>
Endosulfan Sulfate	-	-	0.00017 <sup>d</sup>
Endrin	0.037 <sup>a</sup>	0.0023	0.00029 <sup>d</sup>
g-BHC (Lindane)	0.16 <sup>a</sup>	-	0.00053
Heptachlor	0.053 <sup>a</sup>	0.0036	0.00035 <sup>d</sup>
Heptachlor Epoxide	0.053 <sup>a</sup>	0.0036	0.00028 <sup>d</sup>
Toxaphene	0.21	0.0002	0.05 <sup>d</sup>

- = No criteria recommendation.

<sup>a</sup> The aquatic life criteria for these compounds were issued in 1980 utilizing the 1980 Guidelines for Criteria Development. The acute values shown are final acute values that, by the 1980 Guidelines, are instantaneous values as contrasted with a Criteria Maximum Concentration (CMC), which is a one-hour average.

<sup>b</sup> Polychlorinated Biphenyls criteria apply to each of the following:

PCB 1016, PCB 1248, PCB 1242, PCB 1232, PCB 1254, PCB 1260, PCB 1221

<sup>c</sup> Values for metals represent dissolved criteria using the EPA recommended conversion factors, as listed: As = 1.000; Cd = 0.994; Cr (VI) 0.993; Cu = 0.83; Pb = 0.951; Hg = 0.85 (see Note below); Ni = 0.990; Se = 0.998; Ag = 0.85; Zn = 0.946

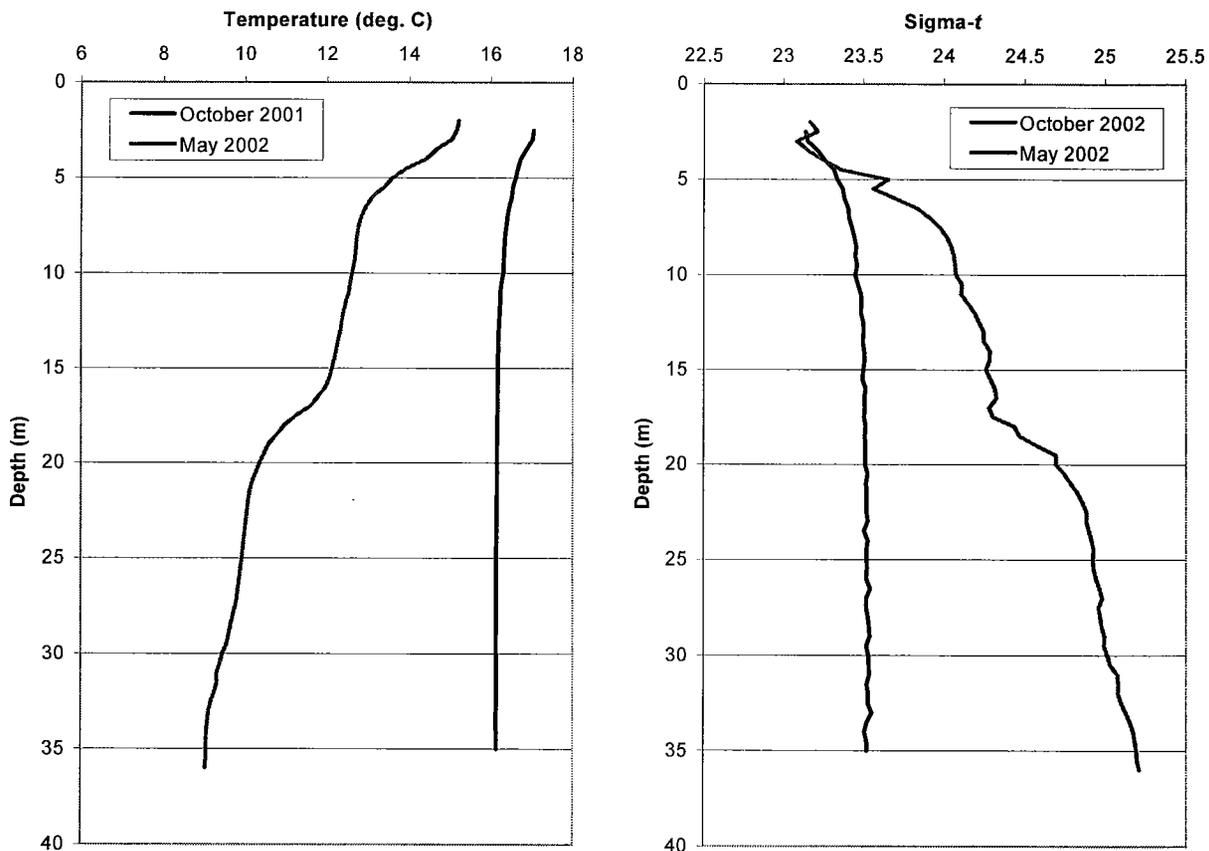
NOTE: Conversion factors on this table were calculated for acute criteria only. Conversion factors for chronic criteria are not currently available. In the absence of chronic conversion factors, saltwater acute conversion factors were used. Chronic criteria for mercury cannot be converted to dissolved because it is based on mercury residues rather than toxicity.

<sup>d</sup> Analyte was not detected in any of the sample replicates. The maximum sample-specific MDL is listed.

## 4.1 Comparison to Fall 2001 Data

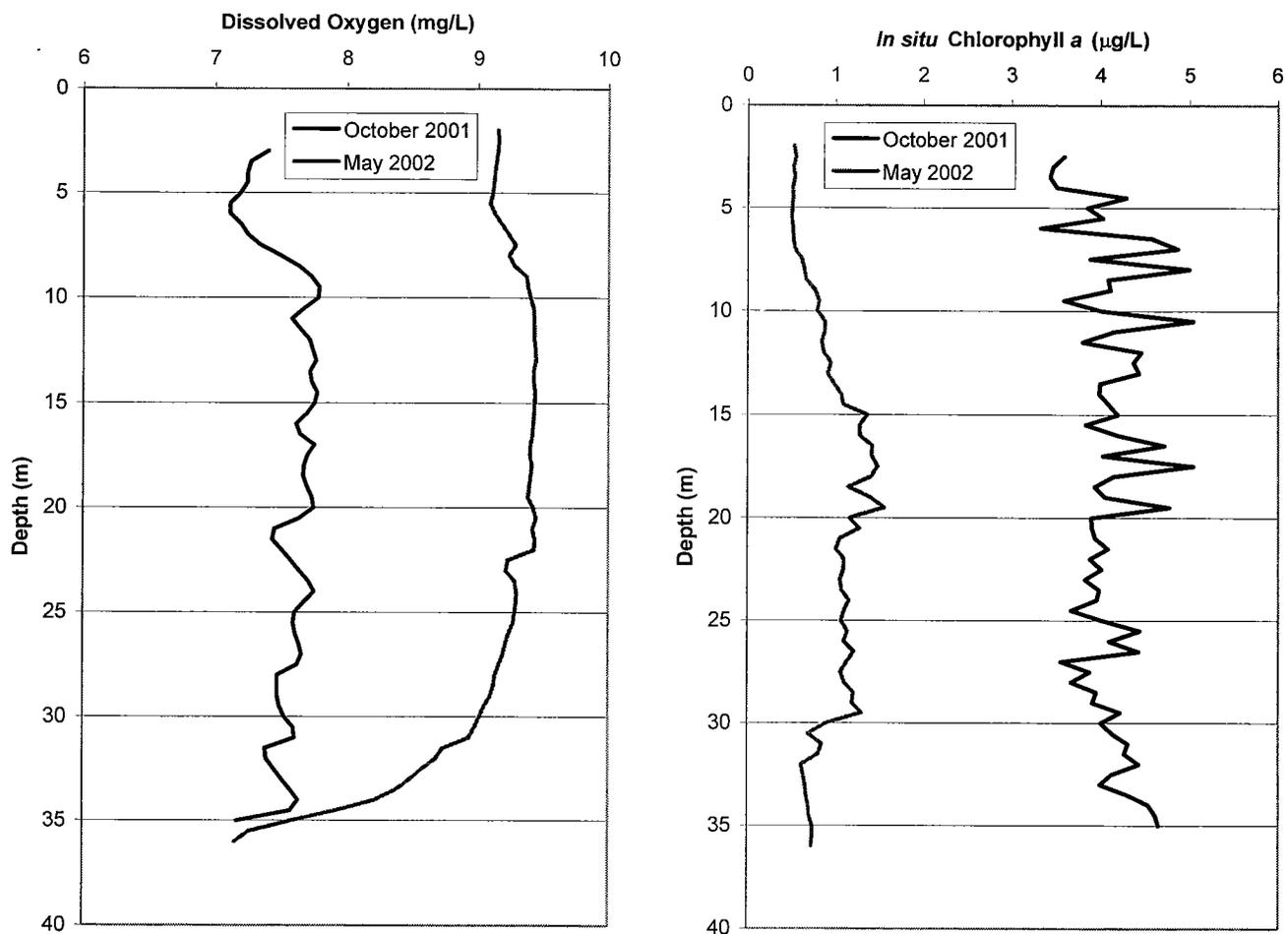
### 4.1.1 In situ Data

The water column in Rhode Island Sound was more stratified in May 2002 than in October 2001 (Figure 6). The October survey occurred after the water column had become mixed and unstratified. The results from the May 2002 survey showed the development of seasonal stratification in the water column with the presence of temperature and Sigma-*t* gradients from surface to bottom. Water temperatures were also cooler in May than in October.



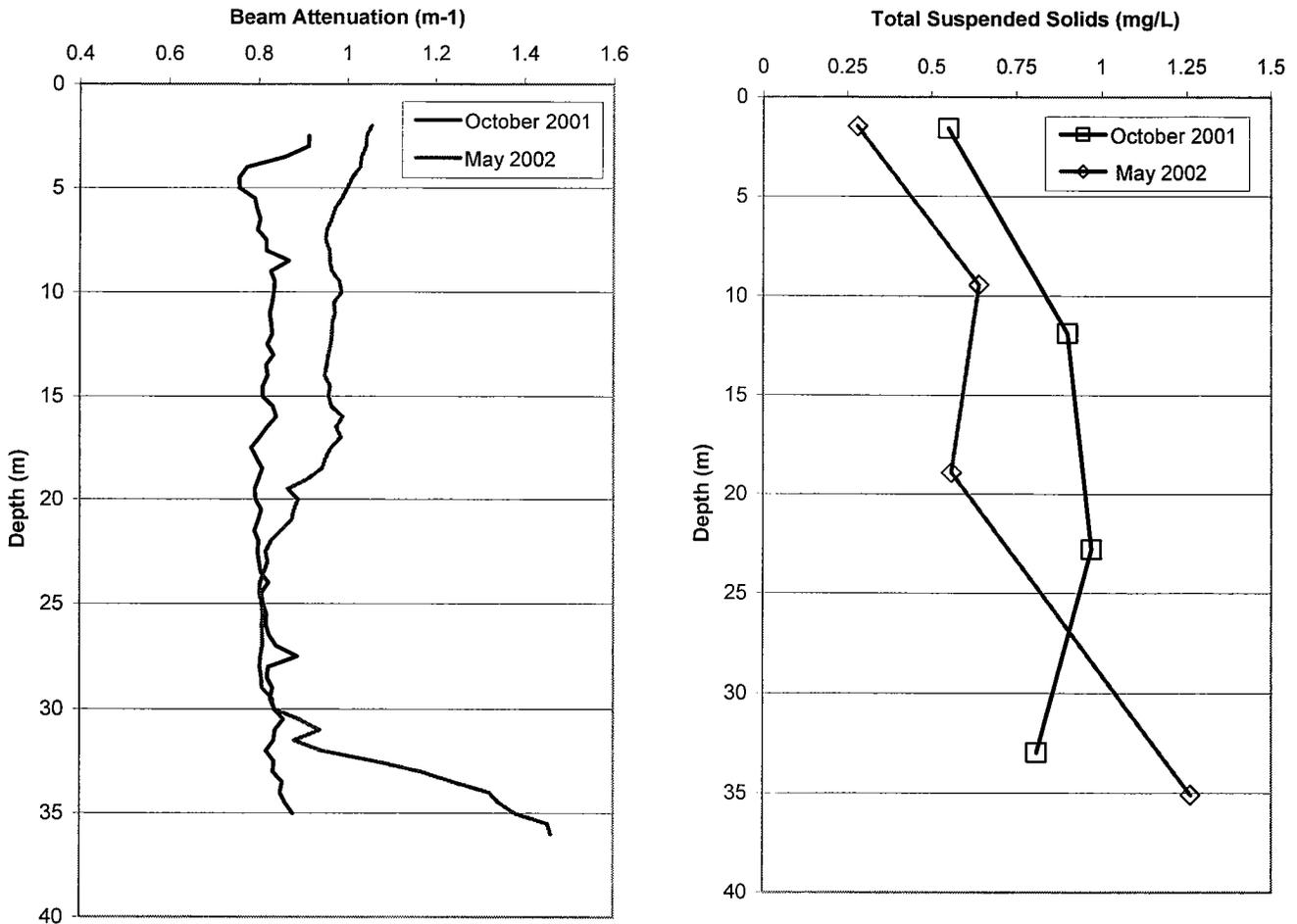
**Figure 6. Comparison of Temperature and Sigma-*t* Values Between October 2001 and May 2002 Water Column Surveys at Site 69B.**

Concentrations of DO were greater in May 2002 than in October 2001, except for bottom water DO, which was very similar in May and October (Figure 7). DO concentrations are usually lowest in the fall, due to warmer water temperatures and the presence of biological activity (i.e., fall phytoplankton bloom). DO concentrations increase again during the winter, when water temperatures cool, the water column becomes well mixed, and most biological activity ceases. The unexpectedly low DO concentration in the bottom waters in May was most likely due to the degradation of remnant material from a spring phytoplankton bloom in Rhode Island Sound.



**Figure 7. Comparison of Dissolved Oxygen and Chlorophyll *a* Values Between October 2001 and May 2002 Water Column Surveys at Site 69B.**

Chlorophyll *a* concentrations were lower in May 2002 than in October 2001 (Figure 7). TSS concentrations were also lower in surface and mid-depth waters in May but were greater in bottom waters in May than in October (Figure 8). TSS and beam attenuation were better correlated in May than in October, when no correlation was found. Re-suspension of bottom sediments, along with the degradation of the remnant phytoplankton bloom, are possible reasons for the increased TSS concentrations and beam attenuation in the bottom waters in May. Weather conditions at the National Oceanic and Atmospheric Administration (NOAA) weather buoy in Buzzards Bay, Massachusetts (BUZM3) indicated that the weather was windy and stormy during the middle and latter part of May 2002 (NOAA 2002). Also, the Massachusetts Department of Environmental Management (MA DEM) reported substantial amounts of rain fall on May 12 – 13 and again on May 18, 2002. These stormy weather conditions could have acted to disturb the bottom sediments at Site 69B.



**Figure 8. Comparison of Beam Attenuation and Total Suspended Solid Values Between October 2001 and May 2002 Water Column Surveys at Site 69B.**

#### 4.1.2 Contaminant Data

Organic contaminants were mostly undetected during both the May 2002 and October 2001 water column surveys at Site 69B. The only pesticide that was detected, g-BHC, was detected at greater concentrations in bottom waters during both surveys but at concentrations below the Project QL Goal (1.84 ng/L) in both cases.

Concentrations of metals were fairly low in May 2002 and were similar to October 2001 concentrations. Metal concentrations tended to vary with depth in May 2002, unlike in October 2001 when there was no clear pattern observed with depth. The variation with depth could be due to the fact that the water column was becoming more stratified in May, whereas the water column was well mixed and unstratified in October.

## 5.0 REFERENCES

- APHA (American Public Health Association), American Water Works Association, and Water Pollution Control Federation. 1989. Standard Methods for the Examination of Water and Wastewater. 17th Edition. Washington, DC.
- Battelle 2001. Final Quality Assurance Project Plan Rhode Island Sound Disposal Site Study. Task 1 QAPP: Field Sampling, Chemical, and Toxicity Testing. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02. September 2001. 408 pp + Appendices.
- Battelle. 2002. Final Fall 2001 Water Column Characterization Report. Prepared under Contract No. DACW33-01-D-0004, Delivery Order No. 02. July 2002. 26 pp + Appendices.
- MA DEM. 2002. Current Water Conditions in Massachusetts, June 6, 2002. <http://www.state.ma.us/dem/programs/rainfall/reports/060602con.doc>.
- Oudot, C., R. Gerard, and P. Morin. 1988. Precise Shipboard Determination of Dissolved Oxygen (Winkler Procedure) for Productivity Studies with a Commercial System. *Limnol. Oceanogr.* 33:146-150.
- NOAA. 2002. National Data Buoy Center. <http://www.ndbc.noaa.gov/Maps/Northeast.shtml>.
- RIDEM. 2000. State of Rhode Island and Providence Plantations Department of Environmental Management. Water Quality Regulations: Regulation EVM 112-88.97-1, Amended June 23, 2000. 34 pp.

## **APPENDIX A**

### **Water Contaminant Sample and Quality Control Data**

## Pesticide/PCB – Water QA/QC SUMMARY

### QC Batches 02-304

**PROJECT:** Rhode Island Sound Disposal Site Study  
**PARAMETER:** Pesticides/PCB  
**LABORATORY:** Battelle, Duxbury, MA  
**MATRIX:** Water  
**SAMPLE CUSTODY:** Water samples were collected on 5/30/02. The Battelle Field Team collected the samples and hand delivered them directly to Battelle, Duxbury. Custody of samples was transferred to the chemistry department on 5/31/02. Temperatures of coolers containing organic samples were recorded at 0.3°C and 0.2°C upon arrival. All samples were labeled properly, containers were intact, and no custody issues were noted. Samples were stored in the walk-in refrigerator at 4°C until processing could begin.

#### QA/QC DATA QUALITY OBJECTIVES:

	Reference Method	Blank	Surrogate Recovery	LCS/MS Recovery	SRM % Diff.	Sample Replicate Relative Precision
Pesticide PCB	General NS&T	<RL, or associated samples >10X blank values	40-125% Recovery	40-120% Recovery for at least 90% of analytes. Must be >5x background level.	NA	RPD ≤ 30% for at least 90% of analytes (for analytes detected > 3x RL in dups. and >5x background for MS/MSD)

**METHOD:** Water samples were extracted for Organics following general NS&T methodologies. Approximately 2 L of water were spiked with SIS and extracted three times with dichloromethane utilizing manual shaking techniques. The combined extract was dried over anhydrous sodium sulfate, concentrated, then cleaned using alumina column. Extracts were then further concentrated and fortified with RIS for Pesticide/PCB analysis. Finally, Pesticide/PCB extracts were solvent exchanged into hexane, and analyzed using gas chromatography/electron capture detection (GC/ECD), following general NS&T methods. Quantification was performed using RIS compounds.

**HOLDING TIMES:** Water samples were stored at 4°C until extraction could begin. All samples were extracted within the 7-day holding time and extracts were analyzed within 40 days.

Samples were extracted in one analytical batch.

Batch	Extraction Date	Analysis Date
02-304	6/4/02	6/7/02

**BLANKS:** A procedural blank (PB) was prepared with the analytical batch. Blanks were analyzed to ensure the sample extraction and analysis methods were free of contamination.

01-304 – 0 exceedences noted.

**Pesticide/PCB – Water QA/QC SUMMARY**  
**QC Batches 02-304**

---

**Comments** – All analytes were not detected in the blank.

**LABORATORY  
CONTROL  
SAMPLE (Blank  
Spike)**

A laboratory control sample (LCS) was prepared with the analytical batch. The percent recoveries of Pesticides and PCBs were calculated to measure data quality in terms of accuracy.

**02-304** – 0 exceedences noted.

**Comments** – Percent recoveries ranged from 63% to 118%.

**MATRIX  
SPIKES/MATRIX  
SPIKE  
DUPLICATE:**

A pair of matrix spike (MS)/matrix spike duplicate (MSD) samples was prepared with the analytical batch. The percent recoveries of Pesticides and PCBs were calculated to measure data quality in terms of accuracy. The relative percent difference (RPD) between the two samples was calculated to measure data in terms of precision.

**01-304** – 0 exceedences noted.

**Comments** – Percent recoveries ranged from 85% to 115%. RPDs were excellent ranging from 0.6% to 8.9%.

**SURROGATES:**

Two surrogate compounds were added prior to extraction, including PCB (34) and PCB (112). The recovery of each surrogate compound was calculated to measure data quality in terms of accuracy (extraction efficiency).

**02-304** – 0 exceedences noted.

**Comments** – Surrogate recoveries were excellent ranging from 79% to 92%.

**DUPLICATES:**

Duplicate samples for waters were prepared with the analytical batch. The RPD between replicate analyses for Pesticide/PCB is calculated to measure data quality in terms of precision.

**02-304** – 0 exceedences noted.

**Comments** – Only two analytes were detected in the sample V5319 and V5319, g-BHC and cis Chlordane. The RPDs for these two compounds were 2.3% and 7.5% respectively.

**SRM:**

NA



Matrix Spike Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	RIS2W042PT1	RIS2W042PT4		RIS2W042PT4				
Station ID	69B	69B		69B				
Battelle ID	V5306	AA326MS		AA327MSD				
Sample Type	Water	Water		Water				
Batch ID	02-304	02-304		02-304				
Extraction Date	06/04/02	06/04/02		06/04/02				
Analysis Date	06/07/02	06/07/02		06/07/02				
Sample Volume (L)	2.00	1.30		1.30				
Reporting Units	ng/L	ng/L		ng/L		% Recovery	% Recovery	% RPD
	FU17							
4,4 DDD	60.01	0.18 U	47.73	103	47.37	103	0.8	
4,4 DDE	60.00	0.25 U	49.68	108	49.07	106	1.2	
4,4 DDT	60.00	0.17 U	43.74	95	43.34	94	0.9	
2,4 DDD	60.02	0.22 U	44.65	97	44.74	97	0.2	
2,4 DDE	60.19	0.51 U	52.05	112	53.03	115	1.9	
2,4 DDT	60.19	0.60 U	26.59	57	26.16	56	1.6	
Aldrin	60.02	0.85 U	50.20	109	51.57	112	2.7	
cis Chlordane	60.30	0.32 U	50.32	108	50.76	109	0.9	
Dieldrin	60.00	0.29 U	45.49	99	45.28	98	0.5	
Endosulfan I	60.00	0.33 U	48.79	106	48.41	105	0.8	
Endosulfan II	60.01	0.15 U	42.50	92	42.24	92	0.6	
Endosulfan sulfate	60.00	0.17 U	44.29	96	43.78	95	1.2	
Endrin	60.01	0.29 U	46.76	101	45.05	98	3.7	
g-BHC	60.00	0.53 J	48.49	104	50.16	108	3.4	
Heptachlor	60.00	0.35 U	42.55	92	44.22	96	3.9	
Heptachlor epoxide	60.00	0.28 U	42.62	92	44.04	95	3.3	
Toxaphene	NA	50.00 U	76.92 U	NA	76.92 U	NA	NA	
Cl2(08)	60.12	4.80 U	31.75	69	34.69	75	8.9	
Cl3(18)	60.12	0.42 U	39.09	85	39.78	86	1.7	
Cl3(28)	60.00	0.52 U	43.93	95	44.48	96	1.3	
Cl4(44)	60.00	0.44 U	43.89	95	44.43	96	1.2	
Cl4(52)	60.36	0.43 U	41.02	88	41.79	90	1.8	
Cl4(66)	60.00	0.45 U	47.79	104	48.29	105	1.0	
Cl5(101)	60.24	0.34 U	45.47	98	45.90	99	0.9	
Cl5(105)	60.00	0.17 U	46.52	101	45.51	99	2.2	
Cl5(118)	60.12	0.26 U	43.44	94	42.86	93	1.4	
Cl6(128)	60.36	0.42 U	43.57	94	42.86	92	1.6	
Cl6(138)	60.12	0.40 U	45.27	98	44.88	97	0.9	
Cl6(153)	60.12	0.32 U	42.05	91	41.60	90	1.1	
Cl7(170)	60.24	0.30 U	44.63	96	43.73	94	2.0	
Cl7(180)	60.24	0.29 U	45.03	97	44.75	97	0.6	
Cl7(187)	60.00	0.26 U	38.91	84	42.07	91	7.8	
Cl8(195)	60.24	0.33 U	43.65	94	42.81	92	1.9	
Cl9(206)	60.12	0.37 U	42.10	91	42.58	92	1.1	
Cl10(209)	60.00	0.38 U	39.37	85	39.19	85	0.4	

Surrogate Recoveries %:

Cl3(34)	81	87	90
Cl5(112)	92	89	89

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL



Procedural Blank Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
Project Number G487001-T7WATERDUX02

Client ID NA  
Battelle ID AA324PB  
Sample Type Water  
Batch ID 02-304  
Extraction Date 06/04/2002  
Analysis Date 06/07/2002  
Sample Volume (L) 2.00  
Reporting Units ng/L

---

4,4 DDD	0.18 U
4,4 DDE	0.25 U
4,4 DDT	0.17 U
2,4 DDD	0.22 U
2,4 DDE	0.51 U
2,4 DDT	0.60 U
Aldrin	0.85 U
cis Chlordane	0.32 U
Dieldrin	0.29 U
Endosulfan I	0.33 U
Endosulfan II	0.15 U
Endosulfan sulfate	0.17 U
Endrin	0.29 U
g-BHC	0.29 U
Heptachlor	0.35 U
Heptachlor epoxide	0.28 U
Toxaphene	50.00 U
CI2(08)	4.80 U
CI3(18)	0.42 U
CI3(28)	0.52 U
CI4(44)	0.44 U
CI4(52)	0.43 U
CI4(66)	0.45 U
CI5(101)	0.34 U
CI5(105)	0.17 U
CI5(118)	0.26 U
CI6(128)	0.42 U
CI6(138)	0.40 U
CI6(153)	0.32 U
CI7(170)	0.30 U
CI7(180)	0.29 U
CI7(187)	0.26 U
CI8(195)	0.33 U
CI9(206)	0.37 U
CI10(209)	0.38 U

---

Surrogate Recoveries %:

CI3(34)	83
CI5(112)	92

U = Not detected MDL reported  
J = Detected between MDL and RL  
f = Detected less than the MDL



Laboratory Control Spike Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	NA		
Battelle ID	AA325LCS		
Sample Type	Water		
Batch ID	02-304		
Extraction Date	06/04/2002		
Analysis Date	06/07/2002		
Sample Volume (L)	2.00		
Reporting Units	FU17	ng/L	% Recovery
4,4 DDD	60.01	31.70	106
4,4 DDE	60.00	33.13	110
4,4 DDT	60.00	30.00	100
2,4 DDD	60.02	29.89	100
2,4 DDE	60.19	31.86	106
2,4 DDT	60.19	18.82	63
Aldrin	60.02	35.01	117
cis Chlordane	60.30	34.39	114
Dieldrin	60.00	31.10	104
Endosulfan I	60.00	35.39	118
Endosulfan II	60.01	27.57	92
Endosulfan sulfate	60.00	28.60	95
Endrin	60.01	31.00	103
g-BHC	60.00	34.41	115
Heptachlor	60.00	30.85	103
Heptachlor epoxide	60.00	29.40	98
Toxaphene	NA	50.00 U	NA
Cl2(08)	60.12	21.40 J	71
Cl3(18)	60.12	24.72	82
Cl3(28)	60.00	29.13	97
Cl4(44)	60.00	28.69	96
Cl4(52)	60.36	26.83	89
Cl4(66)	60.00	31.03	103
Cl5(101)	60.24	29.24	97
Cl5(105)	60.00	30.63	102
Cl5(118)	60.12	27.94	93
Cl6(128)	60.36	28.35	94
Cl6(138)	60.12	28.69	95
Cl6(153)	60.12	26.13	87
Cl7(170)	60.24	28.35	94
Cl7(180)	60.24	29.26	97
Cl7(187)	60.00	27.20	91
Cl8(195)	60.24	28.09	93
Cl9(206)	60.12	27.07	90
Cl10(209)	60.00	25.36	85

Surrogate Recoveries %:

Cl3(34)	90
Cl5(112)	90

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL



Matrix Spike Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	RIS2W042PT1	RIS2W042PT4	RIS2W042PT4					
Station ID	69B	69B	69B					
Battelle ID	V5306	AA326MS	AA327MSD					
Sample Type	Water	Water	Water					
Batch ID	02-304	02-304	02-304					
Extraction Date	06/04/02	06/04/02	06/04/02					
Analysis Date	06/07/02	06/07/02	06/07/02					
Sample Volume (L)	2.00	1.30	1.30					
Reporting Units	ng/L	ng/L	ng/L	%	%	%	%	%
	FU17			Recovery		Recovery		RPD
4,4 DDD	60.01	0.18 U	47.73	103	47.37	103	0.8	
4,4 DDE	60.00	0.25 U	49.68	108	49.07	106	1.2	
4,4 DDT	60.00	0.17 U	43.74	95	43.34	94	0.9	
2,4 DDD	60.02	0.22 U	44.65	97	44.74	97	0.2	
2,4 DDE	60.19	0.51 U	52.05	112	53.03	115	1.9	
2,4 DDT	60.19	0.60 U	26.59	57	26.16	56	1.6	
Aldrin	60.02	0.85 U	50.20	109	51.57	112	2.7	
cis Chlordane	60.30	0.32 U	50.32	108	50.76	109	0.9	
Dieldrin	60.00	0.29 U	45.49	99	45.28	98	0.5	
Endosulfan I	60.00	0.33 U	48.79	106	48.41	105	0.8	
Endosulfan II	60.01	0.15 U	42.50	92	42.24	92	0.6	
Endosulfan sulfate	60.00	0.17 U	44.29	96	43.78	95	1.2	
Endrin	60.01	0.29 U	46.76	101	45.05	98	3.7	
g-BHC	60.00	0.53 J	48.49	104	50.16	108	3.4	
Heptachlor	60.00	0.35 U	42.55	92	44.22	96	3.9	
Heptachlor epoxide	60.00	0.28 U	42.62	92	44.04	95	3.3	
Toxaphene	NA	50.00 U	76.92 U	NA	76.92 U	NA	NA	
Cl2(08)	60.12	4.80 U	31.75	69	34.69	75	8.9	
Cl3(18)	60.12	0.42 U	39.09	85	39.78	86	1.7	
Cl3(28)	60.00	0.52 U	43.93	95	44.48	96	1.3	
Cl4(44)	60.00	0.44 U	43.89	95	44.43	96	1.2	
Cl4(52)	60.36	0.43 U	41.02	88	41.79	90	1.8	
Cl4(66)	60.00	0.45 U	47.79	104	48.29	105	1.0	
Cl5(101)	60.24	0.34 U	45.47	98	45.90	99	0.9	
Cl5(105)	60.00	0.17 U	46.52	101	45.51	99	2.2	
Cl5(118)	60.12	0.26 U	43.44	94	42.86	93	1.4	
Cl6(128)	60.36	0.42 U	43.57	94	42.86	92	1.6	
Cl6(138)	60.12	0.40 U	45.27	98	44.88	97	0.9	
Cl6(153)	60.12	0.32 U	42.05	91	41.60	90	1.1	
Cl7(170)	60.24	0.30 U	44.63	96	43.73	94	2.0	
Cl7(180)	60.24	0.29 U	45.03	97	44.75	97	0.6	
Cl7(187)	60.00	0.26 U	38.91	84	42.07	91	7.8	
Cl8(195)	60.24	0.33 U	43.65	94	42.81	92	1.9	
Cl9(206)	60.12	0.37 U	42.10	91	42.58	92	1.1	
Cl10(209)	60.00	0.38 U	39.37	85	39.19	85	0.4	

Surrogate Recoveries %:

Cl3(34)	81	87	90
Cl5(112)	92	89	89

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL



**Sample Duplicate Data**

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	RIS2W048BB1	RIS2W048BB1			
Station ID	69B	69B			
Battelle ID	V5319	V5319Dup			
Sample Type	Water	Water			
Batch ID	02-304	02-304			
Extraction Date	06/04/02	06/04/02			
Analysis Date	06/07/02	06/07/02			
Sample Volume (L)	1.30	1.30			
Reporting Units	ng/L	ng/L			% RPD
<hr/>					
4,4 DDD	0.27 U	0.27 U			NA
4,4 DDE	0.39 U	0.39 U			NA
4,4 DDT	0.26 U	0.26 U			NA
2,4 DDD	0.34 U	0.34 U			NA
2,4 DDE	0.79 U	0.79 U			NA
2,4 DDT	0.92 U	0.92 U			NA
Aldrin	1.30 U	1.30 U			NA
cis Chlordane	2.51	2.33			7.5
Dieldrin	0.45 U	0.45 U			NA
Endosulfan I	0.51 U	0.51 U			NA
Endosulfan II	0.24 U	0.24 U			NA
Endosulfan sulfate	0.26 U	0.26 U			NA
Endrin	0.45 U	0.45 U			NA
g-BHC	0.34 f	0.33 f			2.3
Heptachlor	0.54 U	0.54 U			NA
Heptachlor epoxide	0.44 U	0.44 U			NA
Toxaphene	76.92 U	76.92 U			NA
CI2(08)	7.39 U	7.39 U			NA
CI3(18)	0.64 U	0.64 U			NA
CI3(28)	0.80 U	0.80 U			NA
CI4(44)	0.67 U	0.67 U			NA
CI4(52)	0.66 U	0.66 U			NA
CI4(66)	0.69 U	0.69 U			NA
CI5(101)	0.53 U	0.53 U			NA
CI5(105)	0.27 U	0.27 U			NA
CI5(118)	0.40 U	0.40 U			NA
CI6(128)	0.65 U	0.65 U			NA
CI6(138)	0.61 U	0.61 U			NA
CI6(153)	0.49 U	0.49 U			NA
CI7(170)	0.47 U	0.47 U			NA
CI7(180)	0.44 U	0.44 U			NA
CI7(187)	0.40 U	0.40 U			NA
CI8(195)	0.50 U	0.50 U			NA
CI9(206)	0.56 U	0.56 U			NA
CI10(209)	0.58 U	0.58 U			NA
<hr/>					

*Surrogate Recoveries %:*

CI3(34)	79	82
CI5(112)	90	91

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL

**PROJECT:** Rhode Island Sound Disposal Study  
**PARAMETER:** Metals (Dissolved)  
**LABORATORY:** Battelle Marine Sciences Laboratory, Sequim, Washington  
**MATRIX:** Seawater

**SAMPLE CUSTODY AND PROCESSING:** Five seawater samples were received for metals analysis. All samples were received in good condition (i.e., all sample containers were intact). Samples were preserved on arrival at the laboratory with 2% nitric acid to a pH of < 2. Samples were assigned a Battelle Central File (CF) identification number (1722) and were entered into Battelle's log-in system. The following lists information on sample receipt and processing activities:

Lab Sample IDs:	1722-253 through -257
Description:	Seawater samples
Sampling date	5/30/02
Sample shipping date	6/3/02
Laboratory arrival date	6/4/02
Cooler temperature on arrival	5.6°C
Fe-Pd preconcentration (1 <sup>st</sup> analysis)	6/25/02
ICP-MS analysis (Cr, Cu, Ni, Pb)	6/25/02
CVAF analysis (Hg)	7/1/02
FIAS analysis (As)	7/15/02
FIAS analysis (Se)	7/15/02
GFAA analysis (Ag)	7/17/02
Fe-Pd preconcentration (2nd analysis)	8/5/02
ICP-MS analysis (Cd and Zn reanalysis)	8/5/02

**DATA QUALITY OBJECTIVES:**

Analyte	Analytical Method	Range of Recovery	Relative Precision	SRM Accuracy	Project Detection Limit Goal (µg/L)	Project Quantitation Limit Goal (µg/L)	Achieved Detection Limits (µg/L)
Ag	GFAA	70-130%	<30%	<25%	0.5	0.095	0.016
As	FIAS	70-130%	<30%	<25%	0.5	0.32	0.16
Cd	ICP-MS	70-130%	<30%	<25%	0.5	0.048	0.0069
Cr	ICP-MS	70-130%	<30%	<25%	1.0	9.54	0.067
Cu	ICP-MS	70-130%	<30%	<25%	0.5	2.58	0.034
Hg	CVAF	70-130%	<30%	<25%	0.2	0.0006	0.0002
Ni	ICP-MS	70-130%	<30%	<25%	0.5	11.35	0.059
Pb	ICP-MS	70-130%	<30%	<25%	10	0.016	0.0049
Se	FIAS	70-130%	<30%	<25%	0.5	0.318	0.049
Zn	ICP-MS	70-130%	<30%	<25%	20	3.82	0.087

(b) ICP-MS Model 6100/ICP-MS Model 5000

**METHODS:** Ten metals were analyzed: silver, (Ag), arsenic (As), cadmium (Cd), chromium (Cr) copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), and zinc (Zn). Prior to ICP-MS analysis for Cd, Cr, Cu, Ni, Pb, and Zn, seawater samples were preconcentrated using iron (Fe) and palladium (Pd) according to Battelle SOP MSL-I-025, *Methods of Sample Preconcentration*, which is derived from EPA Method 1640. Cd, Cr, Cu, Ni, Pb, and Zn were analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) following Battelle SOP MSL-I-022, *Determination of Elements in Aqueous and Digestate Samples by ICP-MS*, which is based on EPA Method 200.8.

Ag was analyzed in the Fe-Pd preconcentrate by graphite furnace atomic absorption (GFAA) following Battelle SOP MSL-I-029, *Determination of Metals in*

## QA/QC NARRATIVE

*Aqueous and Digestate Samples by GFAA, based on EPA Method 200.9.*

As and Se were analyzed directly (with no preconcentration step) by hydride atomic absorption (HGAA) with flow injection atomic spectroscopy (FIAS) following Battelle SOP MSL-I-030, *Determination of Metals in Aqueous and Digestate Samples by HGAA/FIAS*.

Hg was analyzed directly (with no preconcentration step) using cold-vapor atomic fluorescence (CVAF) spectroscopy according to Battelle SOP MSL-I-013, *Total Mercury in Aqueous Samples by CVAF*, which is derived from EPA Method 1631.

All results were reported in units of  $\mu\text{g/L}$ . None of the results were blank corrected.

**HOLDING TIMES:** The recommended holding time for metals analyses is 28 days from sample collection for Hg, and 6 months from sample collection for all other metals. Water samples were analyzed for Hg 32 days after collection and for all other metals within 6 months of collection. It is unlikely that exceeding the holding time affected the results of the Hg analysis. EPA Method 1631, Revision D (draft) states that acid-preserved water samples are stable for 90 days from collection. Please note, however, that Method 1631 Revision D (draft) has been released for comment but has not been promulgated as a final method yet.

**DETECTION LIMITS:** Laboratory-achieved MDLs were calculated for Ag, As, and Se using replicate analyses of blank or low level samples analyzed with this data set. MDLs for metals analyzed by ICP-MS and for Hg were determined from 4-replicate practical quantitation limit studies conducted in a seawater matrix. Laboratory-achieved MDLs for all metals were less than project DL goals.

**METHOD BLANKS:** Method blanks were analyzed at a minimum frequency of 1 per 20 samples. Metals concentrations in all blanks corresponding to seawater were either undetected or detected at concentrations less their project quantitation limits (QL). Blank samples with concentrations greater than the MDL and less than the QL were flagged with a "J".

**BLANK SPIKE ACCURACY:** Blank spike samples were analyzed at a minimum frequency of 1 per 20 samples and spiked at 0.005  $\mu\text{g/L}$  for Hg; 1.0  $\mu\text{g/L}$  for Ag; and 5  $\mu\text{g/L}$  for As, Cd, Cr, Cu, Ni, Pb, Se, and Zn. BS recoveries among all metals analyzed were within the QC acceptance criteria of 70% to 130% with the exception of Ag in one of two BS samples (37%). No corrective action was taken; acceptable spike recovery was demonstrated for Ag by the second BS analysis.

**REPLICATE PRECISION:** Laboratory duplicate samples were analyzed at a minimum frequency of 1 per 20 samples for all metals. Replicate precision was expressed as the relative percent difference (RPD) of duplicate sample results. RPDs were within the QC acceptance criteria of  $\pm 30\%$  for all detected metals with the exception of Cr in one set of duplicates (113% RPD); however, note that the concentrations of Cr in the set of duplicate samples are less than 5 times the MDL for Cr. The precision results were flagged with an "n", and this set of duplicate analyses for Cr should not be used for data quality assessment. Acceptable precision for analysis of Cr was demonstrated by the MS/MSD analysis (see below).

**MATRIX SPIKE/MATRIX SPIKE DUPLICATE ACCURACY:** MS/MSD samples were analyzed at a minimum frequency of 1 per 20 samples for all metals. MS/MSDs were spiked at several levels. Recoveries were reported for MS/MSD samples spiked at 0.01  $\mu\text{g/L}$  for Hg; and 5  $\mu\text{g/L}$  for Ag, As, Cd, Cr, Cu, Ni, Pb, Se, and Zn. Matrix spike recoveries for all metals analyzed were

## QA/QC NARRATIVE

within QC acceptance criteria of 70%-130% recovery.

Precision of MS/MSD pairs, expressed as the RPD, was within QC acceptance criteria of  $\pm 30\%$  for all metals.

### **STANDARD REFERENCE MATERIAL ACCURACY:**

SRMs CASS-4 (certified for As, Cd, Cr, Cu, Ni, Pb, Se, and Zn) and 1641d (certified for Hg), were analyzed at a minimum frequency of 1 per 20 samples. In the absence of an SRM with a certified concentration for Ag, a laboratory-achieved consensus value was calculated for Ag to allow for assessment of accuracy of Ag recovery. SRM 1640, an aqueous laboratory control sample, was also analyzed for all ICP-MS metals and Se.

Accuracy of recovery of SRM analytes was expressed as the percent difference (PD) between the measured and certified SRM concentration. Because the certified concentrations of Cr, Ni, and Pb in CASS-4 are less than 5 times their respective MDLs, the SRM recovery results should not be used for data quality assessment. A laboratory-achieved consensus value and range was determined for each of these metals in SRM CASS-4 from the means and standard deviations of 16 analyses of CASS-4 conducted over the past year. SRM recoveries of Cr, Ni, and Pb were evaluated against the calculated laboratory consensus value. SRM CASS-4 is not certified for Ag; SRM recoveries of Ag were also evaluated against a laboratory consensus value.

All SRM CASS-4, 1641d, and 1640 recoveries were within QC acceptance criteria of  $\pm 25\%$  (PD).

BATTELLE MARINE SCIENCES LABORATORY  
 1597 West Sequim Bay Road  
 Sequim, WA 98382  
 (360) 681-3643

Rhode Island Sound Disposal Study (RIS2W)  
 Metals in Seawater

(Concentrations in µg/L. Data are not blank corrected)

Metals Lab Sample ID	Duxbury ID	Sponsor/Field ID	7/17/02		7/15/02		8/5/02		6/25/02		7/1/02		6/25/02		6/25/02		7/15/02		8/5/02		
			GFAA	Ag	FIAS	As	ICP-MS	Cd (114)	ICP-MS	Cr (52)	ICP-MS	Cu (65)	CVAF	ICP-MS	Ni (60)	ICP-MS	Pb (208)	FIAS	Se	ICP-MS	Zn (66)
1722-253 r1	V5320	RIS2W042ME1	0.0367 J	1.17	0.0274 J	0.215 J	0.365 J	0.000615 J	0.663 J	0.0501	0.0454 f	0.739 J									
1722-253 r2	V5320	RIS2W042ME1	0.0275 J	--	0.0267 J	0.774 J	0.412 J	--	0.677 J	0.0524	--	0.777 J									
1722-254 r1	V5323	RIS2W042ME4	0.0275 J	1.18	0.0269 J	0.178 J	0.325 J	0.000424 J	0.536 J	0.0361	0.0179 f	0.524 J									
1722-254 r2	V5323	RIS2W042ME4	--	1.16	--	--	--	0.000502 J	--	--	0.0241 f	--									
1722-255	V5324	RIS2W043ME1	0.0367 J	1.10	0.0284 J	0.169 J	0.305 J	0.000665 J	0.371 J	0.0553	0.0342 f	1.08 J									
1722-256	V5327	RIS2W044ME1	0.0275 J	1.02	0.0292 J	0.236 J	0.379 J	0.000817 J	1.15	0.0448	0.0369 f	1.18 J									
1722-257	V5330	RIS2W045ME1	0.0183 J	0.973	0.0272 J	0.169 J	0.391 J	0.000679 J	0.416 J	0.279	0.0131 f	2.36 J									
<b>DETECTION/REPORTING LIMITS</b>																					
Project DL Goal			0.05	0.05	0.05	1.0	0.5	0.2	0.5	10	0.5	20									
Project QL Goal			0.095	0.32	0.048	9.54	2.58	0.0006	11.35	0.016	0.318	3.82									
Achieved Detection Limit			0.016 (e)	0.16 (e)	0.0069	0.067	0.034	0.0002	0.059	0.0049	0.049 (e)	0.087									
<b>METHOD BLANKS</b>																					
blk r1			0.0183 J	0.03 U	0.00587 f	0.164 J	0.125 J	0.0000797 f	0.0558 J	0.0314 J	0.00117 f	0.0802 J									
blk r2			0.0183 J	--	0.00819 J	0.0977 J	0.0599 J	0.0000828 f	0.0585 J	0.0305 J	--	0.0858 J									
<b>BLANK SPIKE RECOVERY</b>																					
Spike Concentration			1.0	5.0	5.0	5.0	5.0	0.00495	5.0	5.0	5.0	5.0									
BS r1			0.367	4.97	4.23	4.56 J	4.09	0.00523	4.10 J	4.17 J	5.24	5.11									
BS r2			0.806	--	4.11	4.62 J	4.54	0.00549	4.24 J	4.64 J	--	4.98									
Percent Recovery r1			37% N	99%	85%	91%	82%	106%	82%	83%	105%	102%									
Percent Recovery r2			81%	--	82%	92%	91%	111%	85%	93%	--	100%									
<b>REPLICATE PRECISION</b>																					
1722-253 r1	V5320	RIS2W042ME1	0.0367	--	0.0274 J	0.215 J	0.365 J	--	0.663	0.0501 J	--	0.739 J									
1722-253 r2	V5320	RIS2W042ME1	0.0275	--	0.0267 J	0.774 J	0.412 J	--	0.677	0.0524 J	--	0.777 J									
Mean			0.0321	--	0.0271 J	0.495	0.389	--	0.670	0.0513	--	0.758									
RPD			29%	--	3%	113% n	12%	--	2%	4%	--	5%									
1722-254 r1	V5323	RIS2W042ME4	--	1.18	--	--	--	0.000424 J	--	--	0.0179 f	--									
1722-254 r2	V5323	RIS2W042ME4	--	1.16	--	--	--	0.000502 J	--	--	0.0241 f	--									
Mean			--	1.17	--	--	--	0.000463 J	--	--	--	--									
RPD			--	2%	--	--	--	17%	--	--	--	--									

BATTELLE MARINE SCIENCES LABORATORY  
 1597 West Sequim Bay Road  
 Sequim, WA 98382  
 (360) 681-3643

Rhode Island Sound Disposal Study (RIS2W)  
 Metals in Seawater

(Concentrations in µg/L. Data are not blank corrected)

Metals Lab	Date:	7/17/02	7/15/02	8/5/02	6/25/02	6/25/02	7/1/02	6/25/02	6/25/02	7/15/02	8/5/02
Sample ID	Analysis:	GFAA	FIAS	ICP-MS	ICP-MS	ICP-MS	CVAF	ICP-MS	ICP-MS	FIAS	ICP-MS
Duxbury ID	Sponsor/Field ID	Ag	As	Cd (114)	Cr (52)	Cu (65)	Hg	Ni (60)	Pb (208)	Se	Zn (66)
<b>MATRIX SPIKE ACCURACY</b>											
Spike Concentration		5.0	--	5.0	5.0	5.0	--	5.0	5.0	--	5.0
1722-253 (mean)	V5320 RIS2W042ME1	0.0321	--	0.0271 J	0.495 J	0.389 J	--	0.670	0.0513 J	--	0.758 J
1722-253 MS		4.84	--	4.17	4.80	4.43	--	4.73	4.41	--	4.25
Concentration Recovered		4.81	--	4.14	4.31	4.04	--	4.06	4.36	--	3.49
Percent Recovery		96%	--	83%	86%	81%	--	81%	87%	--	70%
1722-253 MSD		4.84	--	4.37	4.72	4.36	--	4.70	4.41	--	4.42
Concentration Recovered		4.81	--	4.34	4.23	3.97	--	4.03	4.36	--	3.66
Percent Recovery		96%	--	87%	85%	79%	--	81%	87%	--	73%
1722-253 MS/MSD RPD		0%	--	5%	2%	2%	--	1%	0%	--	5%
Spike Concentration		--	5.0	1.0	--	5.0	--	5.0	5.0	5.0	--
1722-255	V5324 RIS2W043ME1	--	1.10	0.0404 J	--	0.389 J	--	0.670	0.0513 J	0.0342 f	--
1722-255 MS		--	6.24	0.910	--	4.43	--	4.73	4.41 J	5.15	--
Concentration Recovered		--	5.14	0.883	--	4.04	--	4.06	4.36 J	5.15	--
Percent Recovery		--	103%	88%	--	81%	--	81%	87%	103%	--
1722-255 MSD		--	6.21	0.900	--	4.36	--	4.70	4.41 J	5.26	--
Concentration Recovered		--	5.11	0.873	--	3.97	--	4.03	4.36 J	5.26	--
Percent Recovery		--	102%	87%	--	79%	--	81%	87%	105%	--
1722-255 MS/MSD RPD		--	1%	1%	--	2%	--	1%	0%	2%	--
Spike Concentration		--	--	--	--	--	0.00967 J	--	--	--	--
1722-256	V5327 RIS2W044ME1	--	--	--	--	--	0.000817 J	--	--	--	--
1722-256 MS		--	--	--	--	--	0.0102 J	--	--	--	--
Concentration Recovered		--	--	--	--	--	0.00938 J	--	--	--	--
Percent Recovery		--	--	--	--	--	97%	--	--	--	--
1722-256 MSD		--	--	--	--	--	0.00958 J	--	--	--	--
Concentration Recovered		--	--	--	--	--	0.00876 J	--	--	--	--
Percent Recovery		--	--	--	--	--	91%	--	--	--	--
1722-256 MS/MSD RPD		--	--	--	--	--	7%	--	--	--	--

BATTELLE MARINE SCIENCES LABORATORY  
 1597 West Sequim Bay Road  
 Sequim, WA 98382  
 (360) 681-3643

Rhode Island Sound Disposal Study (RIS2W)  
 Metals in Seawater

(Concentrations in µg/L. Data are not blank corrected)

Metals Lab	Date:	7/17/02	7/15/02	8/5/02	6/25/02	7/1/02	6/25/02	6/25/02	6/25/02	7/15/02	8/5/02
Sample ID	Analysis:	GFAA	FIAS	ICP-MS	ICP-MS	CVAF	ICP-MS	ICP-MS	ICP-MS	FIAS	ICP-MS
Duxbury ID	Sponsor/Field ID	Ag	As	Cd (114)	Cr (52)	Hg	Ni (60)	Pb (208)	Se		Zn (66)
CASS-4 r1		0.0275	1.07	0.0221 J	0.220 J	--	0.412 J	0.0383 J	--		0.402 J
CASS-4 r2		0.0092 f	--	0.0230 J	0.225 J	--	0.412 J	0.0388 J	--		0.415 J
SRM Certified or Laboratory Consensus Value		0.0224 (b)	1.11	0.026	0.224 (b)	NC	0.396 (e)	0.0214 (b)	NC		0.381
Range		±0.005	±0.16	±0.003	±0.02	--	±0.06	±0.01	--		±0.057
PD r1		23%	4%	15%	2%	--	4%	22%	--		6%
PD r2		--	--	12%	0%	--	4%	24%	--		9%
1640 Direct r1		7.48	--	23.0	39.1	--	27.3	26.8	22.8		57.6
1640 Direct r2		--	--	22.5	34.6	--	24.8	28.9	--		59.0
SRM Certified or Reference Value		7.62	--	22.79	38.6	--	27.4	27.89	21.96		53.2
Range		±0.25	--	±0.96	±1.6	--	±0.8	±0.14	±0.51		±1.1
PD r1		2%	--	1%	1%	--	0%	4%	4%		8%
PD r2		--	--	1%	10%	--	9%	4%	--		11%
1641d		--	--	--	--	1510	--	--	--		--
SRM Certified or Reference Value		--	--	--	--	1590	--	--	--		--
Range		--	--	--	--	±40	--	--	--		--
PD r1		--	--	--	--	5%	--	--	--		--

U Compound not detected; MDL reported as value

f Compound quantified but value reported was below the MDL

J Compound quantified above the MDL but below the Project QL Goal

N QC value outside accuracy or precision QC criteria

n QC value outside QC criteria but meets contingency criteria

(RPD ≤30% for analytes detected at level >10X MDL).

(a) Ag, As, and Se MDLs calculated for this analytical run; Hg from annual MDL study;

Cd, Cr, Cu, Ni, Pb, Zn MDLs from PDL verification study.

(b) SRM recovery is evaluated against laboratory-achieved consensus value (see narrative)

-- No analysis/not applicable

NC Not certified

RPD Relative percent difference

PD Percent difference

## **APPENDIX B**

### **Rinsate Blank Sample and Quality Control Data**

## QC Batches 02-304

**PROJECT:** Rhode Island Sound Disposal Site Study  
**PARAMETER:** Pesticides/PCB  
**LABORATORY:** Battelle, Duxbury, MA  
**MATRIX:** Water  
**SAMPLE CUSTODY:** Water samples were collected on 5/30/02. The Battelle Field Team collected the samples and hand delivered them directly to Battelle, Duxbury. Custody of samples was transferred to the chemistry department on 5/31/02. Temperatures of coolers containing organic samples were recorded at 0.3°C and 0.2°C upon arrival. All samples were labeled properly, containers were intact, and no custody issues were noted. Samples were stored in the walk-in refrigerator at 4°C until processing could begin.

### QA/QC DATA QUALITY OBJECTIVES:

	Reference Method	Blank	Surrogate Recovery	LCS/MS Recovery	SRM % Diff.	Sample Replicate Relative Precision
Pesticide PCB	General NS&T	< RL, or associated samples >10X blank values	40-125% Recovery	40-120% Recovery for at least 90% of analytes. Must be >5x background level.	NA	RPD ≤ 30% for at least 90% of analytes (for analytes detected > 3x RL in dups. and >5x background for MS/MSD)

**METHOD:** Water samples were extracted for Organics following general NS&T methodologies. Approximately 2 L of water were spiked with SIS and extracted three times with dichloromethane utilizing manual shaking techniques. The combined extract was dried over anhydrous sodium sulfate, concentrated, then cleaned using alumina column. Extracts were then further concentrated and fortified with RIS for Pesticide/PCB analysis. Finally, Pesticide/PCB extracts were solvent exchanged into hexane, and analyzed using gas chromatography/electron capture detection (GC/ECD), following general NS&T methods. Quantification was performed using RIS compounds.

**HOLDING TIMES:** Water samples were stored at 4°C until extraction could begin. All samples were extracted within the 7-day holding time and extracts were analyzed within 40 days.

Samples were extracted in one analytical batch.

<u>Batch</u>	<u>Extraction Date</u>	<u>Analysis Date</u>
02-304	6/4/02	6/7/02

**BLANKS:** A procedural blank (PB) was prepared with the analytical batch. Blanks were analyzed to ensure the sample extraction and analysis methods were free of contamination.

01-304 – 0 exceedences noted.

**Pesticide/PCB – Water QA/QC SUMMARY**  
**QC Batches 02-304**

---

**Comments** – All analytes were not detected in the blank.

**LABORATORY  
CONTROL  
SAMPLE (Blank  
Spike)**

A laboratory control sample (LCS) was prepared with the analytical batch. The percent recoveries of Pesticides and PCBs were calculated to measure data quality in terms of accuracy.

**02-304** – 0 exceedences noted.

**Comments** – Percent recoveries ranged from 63% to 118%.

**MATRIX  
SPIKES/MATRIX  
SPIKE  
DUPLICATE:**

A pair of matrix spike (MS)/matrix spike duplicate (MSD) samples was prepared with the analytical batch. The percent recoveries of Pesticides and PCBs were calculated to measure data quality in terms of accuracy. The relative percent difference (RPD) between the two samples was calculated to measure data in terms of precision.

**01-304** – 0 exceedences noted.

**Comments** – Percent recoveries ranged from 85% to 115%. RPDs were excellent ranging from 0.6% to 8.9%.

**SURROGATES:**

Two surrogate compounds were added prior to extraction, including PCB (34) and PCB (112). The recovery of each surrogate compound was calculated to measure data quality in terms of accuracy (extraction efficiency).

**02-304** – 0 exceedences noted.

**Comments** – Surrogate recoveries were excellent ranging from 79% to 92%.

**DUPLICATES:**

Duplicate samples for waters were prepared with the analytical batch. The RPD between replicate analyses for Pesticide/PCB is calculated to measure data quality in terms of precision.

**02-304** – 0 exceedences noted.

**Comments** – Only two analytes were detected in the sample V5319 and V5319, g-BHC and cis Chlordane. The RPDs for these two compounds were 2.3% and 7.5% respectively.

**SRM:**

NA



Sample Duplicate Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	RIS2W048BB1	RIS2W048BB1			
Station ID	69B	69B			
Battelle ID	V5319	V5319Dup			
Sample Type	Water	Water			
Batch ID	02-304	02-304			
Extraction Date	06/04/02	06/04/02			
Analysis Date	06/07/02	06/07/02			
Sample Volume (L)	1.30	1.30			
Reporting Units	ng/L	ng/L			% RPD
4,4 DDD	0.27 U	0.27 U			NA
4,4 DDE	0.39 U	0.39 U			NA
4,4 DDT	0.26 U	0.26 U			NA
2,4 DDD	0.34 U	0.34 U			NA
2,4 DDE	0.79 U	0.79 U			NA
2,4 DDT	0.92 U	0.92 U			NA
Aldrin	1.30 U	1.30 U			NA
cis Chlordane	2.51	2.33			7.5
Dieldrin	0.45 U	0.45 U			NA
Endosulfan I	0.51 U	0.51 U			NA
Endosulfan II	0.24 U	0.24 U			NA
Endosulfan sulfate	0.26 U	0.26 U			NA
Endrin	0.45 U	0.45 U			NA
g-BHC	0.34 f	0.33 f			2.3
Heptachlor	0.54 U	0.54 U			NA
Heptachlor epoxide	0.44 U	0.44 U			NA
Toxaphene	76.92 U	76.92 U			NA
Cl2(08)	7.39 U	7.39 U			NA
Cl3(18)	0.64 U	0.64 U			NA
Cl3(28)	0.80 U	0.80 U			NA
Cl4(44)	0.67 U	0.67 U			NA
Cl4(52)	0.66 U	0.66 U			NA
Cl4(66)	0.69 U	0.69 U			NA
Cl5(101)	0.53 U	0.53 U			NA
Cl5(105)	0.27 U	0.27 U			NA
Cl5(118)	0.40 U	0.40 U			NA
Cl6(128)	0.65 U	0.65 U			NA
Cl6(138)	0.61 U	0.61 U			NA
Cl6(153)	0.49 U	0.49 U			NA
Cl7(170)	0.47 U	0.47 U			NA
Cl7(180)	0.44 U	0.44 U			NA
Cl7(187)	0.40 U	0.40 U			NA
Cl8(195)	0.50 U	0.50 U			NA
Cl9(206)	0.56 U	0.56 U			NA
Cl10(209)	0.58 U	0.58 U			NA

Surrogate Recoveries %:

Cl3(34)	79	82
Cl5(112)	90	91

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL



Field Sample Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
 Project Number G487001-T7WATERDUX02

Client ID	RIS2W042PT1	RIS2W043PT1	RIS2W044PT1	RIS2W045PT1	RIS2W048BB1
Station ID	69B	69B	69B	69B	69B
Battelle ID	V5306	V5310	V5313	V5316	V5319
Sample Type	Water	Water	Water	Water	Water
Batch ID	02-304	02-304	02-304	02-304	02-304
Extraction Date	06/04/2002	06/04/2002	06/04/2002	06/04/2002	06/04/2002
Analysis Date	06/07/2002	06/07/2002	06/07/2002	06/07/2002	06/07/2002
Sample Volume (L)	2.00	2.00	2.00	2.00	1.30
Reporting Units	ng/L	ng/L	ng/L	ng/L	ng/L
<hr/>					
4,4 DDD	0.18 U	0.18 U	0.18 U	0.18 U	0.27 U
4,4 DDE	0.25 U	0.25 U	0.25 U	0.25 U	0.39 U
4,4 DDT	0.17 U	0.17 U	0.17 U	0.17 U	0.26 U
2,4 DDD	0.22 U	0.22 U	0.22 U	0.22 U	0.34 U
2,4 DDE	0.51 U	0.51 U	0.51 U	0.51 U	0.79 U
2,4 DDT	0.60 U	0.60 U	0.60 U	0.60 U	0.92 U
Aldrin	0.85 U	0.85 U	0.85 U	0.85 U	1.30 U
cis Chlordane	0.32 U	0.32 U	0.32 U	0.32 U	2.51
Dieldrin	0.29 U	0.29 U	0.29 U	0.29 U	0.45 U
Endosulfan I	0.33 U	0.33 U	0.33 U	0.33 U	0.51 U
Endosulfan II	0.15 U	0.15 U	0.15 U	0.15 U	0.24 U
Endosulfan sulfate	0.17 U	0.17 U	0.17 U	0.17 U	0.26 U
Endrin	0.29 U	0.29 U	0.29 U	0.29 U	0.45 U
g-BHC	0.53 J	0.29 f	0.25 f	0.39 J	0.34 f
Heptachlor	0.35 U	0.35 U	0.35 U	0.35 U	0.54 U
Heptachlor epoxide	0.28 U	0.28 U	0.28 U	0.28 U	0.44 U
Toxaphene	50.00 U	50.00 U	50.00 U	50.00 U	76.92 U
Cl2(08)	4.80 U	4.80 U	4.80 U	4.80 U	7.39 U
Cl3(18)	0.42 U	0.42 U	0.42 U	0.42 U	0.64 U
Cl3(28)	0.52 U	0.52 U	0.52 U	0.52 U	0.80 U
Cl4(44)	0.44 U	0.44 U	0.44 U	0.44 U	0.67 U
Cl4(52)	0.43 U	0.43 U	0.43 U	0.43 U	0.66 U
Cl4(66)	0.45 U	0.45 U	0.45 U	0.45 U	0.69 U
Cl5(101)	0.34 U	0.34 U	0.34 U	0.34 U	0.53 U
Cl5(105)	0.17 U	0.17 U	0.17 U	0.17 U	0.27 U
Cl5(118)	0.26 U	0.26 U	0.26 U	0.26 U	0.40 U
Cl6(128)	0.42 U	0.42 U	0.42 U	0.42 U	0.65 U
Cl6(138)	0.40 U	0.40 U	0.40 U	0.40 U	0.61 U
Cl6(153)	0.32 U	0.32 U	0.32 U	0.32 U	0.49 U
Cl7(170)	0.30 U	0.30 U	0.30 U	0.30 U	0.47 U
Cl7(180)	0.29 U	0.29 U	0.29 U	0.29 U	0.44 U
Cl7(187)	0.26 U	0.26 U	0.26 U	0.26 U	0.40 U
Cl8(195)	0.33 U	0.33 U	0.33 U	0.33 U	0.50 U
Cl9(206)	0.37 U	0.37 U	0.37 U	0.37 U	0.56 U
Cl10(209)	0.38 U	0.38 U	0.38 U	0.38 U	0.58 U

Surrogate Recoveries %:

Cl3(34)	81	82	79	82	79
Cl5(112)	92	90	87	90	90

U = Not detected MDL reported  
 J = Detected between MDL and RL  
 f = Detected less than the MDL



Procedural Blank Data

Project Name Rhode Island Sound Disposal Site Study - Task 7  
Project Number G487001-T7WATERDUX02

Client ID NA  
Battelle ID AA324PB  
Sample Type Water  
Batch ID 02-304  
Extraction Date #####  
Analysis Date #####  
Sample Volume (L) 2.00  
Reporting Units ng/L

---

4,4 DDD	0.18 U
4,4 DDE	0.25 U
4,4 DDT	0.17 U
2,4 DDD	0.22 U
2,4 DDE	0.51 U
2,4 DDT	0.60 U
Aldrin	0.85 U
cis Chlordane	0.32 U
Dieldrin	0.29 U
Endosulfan I	0.33 U
Endosulfan II	0.15 U
Endosulfan sulfate	0.17 U
Endrin	0.29 U
g-BHC	0.29 U
Heptachlor	0.35 U
Heptachlor epoxide	0.28 U
Toxaphene	50.00 U
CI2(08)	4.80 U
CI3(18)	0.42 U
CI3(28)	0.52 U
CI4(44)	0.44 U
CI4(52)	0.43 U
CI4(66)	0.45 U
CI5(101)	0.34 U
CI5(105)	0.17 U
CI5(118)	0.26 U
CI6(128)	0.42 U
CI6(138)	0.40 U
CI6(153)	0.32 U
CI7(170)	0.30 U
CI7(180)	0.29 U
CI7(187)	0.26 U
CI8(195)	0.33 U
CI9(206)	0.37 U
CI10(209)	0.38 U

---

Surrogate Recoveries %:

CI3(34) 83  
CI5(112) 92

U = Not detected MDL reported  
J = Detected between MDL and RL  
f = Detected less than the MDL