# DRAFT PARTIAL-RESPONSE ACTION OUTCOME (RAO) STATEMENT FOR CENTRAL BROOK AND ASSOCIATED WETLANDS FORMER RCA FACILITY 1 NETWORK DRIVE (FORMERLY 183 BEDFORD STREET) BURLINGTON, MASSACHUSETTS

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# EXECUTIVE SUMMARY

This partial Response Action Outcome Statement (RAO) has been prepared by Shaw Environmental, Inc. (Shaw, formerly IT Corporation) for Lockheed Martin Corporation (LMC), the former owner and operator of the property located at 1 Network Drive (formerly 183 Bedford Street), Burlington, Massachusetts. LMC transferred ownership of the property to Sun Microsystems, Inc. (Sun) in August 1997. This partial-RAO documents that a condition of No Significant Risk has been achieved for sediments and surface water in the Central Brook and associated wetlands area of the site in accordance with 310 CMR 40.1000. Note that the DEP approved a Tier IB permit for the site on December 11, 1995 (permit number 102258). A Tier IB Permit Extension Application was approved by the DEP in March 2001; the current Permit expires March 7, 2003. A second Tier IB permit extension application was submitted to DEP on January 30, 2003.

A Permanent Solution has already been achieved for a majority of the site as documented by the Class A-2 partial-RAO submitted to the DEP on January 22, 2002. The January 2002 partial-RAO addressed all media and areas at the site except for: 1) groundwater associated with a well-defined chlorinated VOC plume, and 2) sediments and surface water in the Central Brook and associated wetlands area. This March 2003 partial-RAO addresses the latter media/area.

As part of a Phase IV comprehensive response action, a total of 491 tons of metals-impacted sediments were dredged from the Central Brook and associated wetlands area between September and December 2003. The sediment was dredged from selected stream channels and a pond in accordance with the Phase IV RIP Addendum (Shaw, July 2002). Sediments were transported offsite and disposed at a permitted facility. Comprehensive response actions were performed in accordance with 310 CMR 40.0000 and other applicable local, state, and federal regulations.

Following completion of the comprehensive response action, a combined Method 2 and Method 3 Risk Characterization was prepared. Method 1 standards were used where available and Method 2 was used to derive standards for OHM of concern for which no standards exist. Method 3 was used to evaluate the risk of harm to public welfare, safety and the environment. The risk characterization concluded that a condition of No Significant Risk has been achieved for the areas and media addressed by this partial-RAO.

A Class A-2 RAO is applicable to the sediments and surface water in the Central Brook and associated wetlands area of the site, as described in this report because:

- Response actions were conducted and a condition of No Significant Risk has been achieved; no additional Phase V active operation, maintenance, and/or monitoring activities are required;

- No continuing sources exist;

- A Permanent Solution has been achieved;

- OHM in the environment were not reduced to background, however, background was approached; and

- One or more Activity and Use Limitations are not required to maintain a Level of No Significant Risk.

A copy of the RAO Statement (BWSC [Bureau of Waste Site Cleanup] Form 104) is included in Appendix E of this report.

# 1 INTRODUCTION

On behalf of Lockheed Martin Corporation (LMC), Shaw Environmental, Inc. (Shaw, formerly IT Corporation) has prepared this report documenting the completion of a partial-Response Action Outcome (RAO) for the Central Brook and associated wetlands area at the former RCA facility site. A copy of the RAO Statement (BWSC [Bureau of Waste Site Cleanup] Form 104) is included in Appendix E of this report. LMC is a previous owner of the former RCA facility located at 1 Network Drive 183 (formerly 183 Bedford Street), Burlington, Massachusetts. The property was originally listed as a Confirmed Disposal Site by DEP on January 15, 1987 with the Site Number 3-0265 assigned. A Phase I Site Investigation Report (Phase I) was prepared by Geraghty & Miller, Inc. in August 1995 and submitted to the Massachusetts Department of Environmental Protection (DEP) along with a Tier IB permit application. On December 11, 1995, DEP approved a Tier IB permit for the site (Permit No. 102258). A Tier IB Permit Extension Application was approved by DEP in March 2001; the current permit expires March 7, 2003. A second Tier IB Permit Extension Application was submitted to DEP January 30, 2003.

Consistent with the Response Action Deadlines and Requirements for Tier I disposal sites specified in the Massachusetts Contingency Plan (MCP: 310 CMR 40.0550), a Phase II Comprehensive Site Assessment (Phase II CSA), Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives Evaluation (Phase III), and Phase IV Remedy Implementation Plan (Phase IV RIP) have been completed for the site and previously submitted to DEP. On January 22, 2002, a partial-RAO Statement was submitted for a majority of the site. With submission of the January 22, 2002 partial-RAO, a condition of no significant risk had been achieved over the entire site with the exception of: 1) groundwater in the vicinity of a well-defined chlorinated VOC plume, and 2) surface water and sediments in the Central Brook and associated wetlands area. This current partial-RAO Statement is being submitted in accordance with the provisions of 310 CMR 40.1000 and also documents the achievement of a Class A-2 RAO. This Class A-2 RAO is partial and it applies to surface water and sediment in the Central Brook and associated wetlands area. The well-defined chlorinated VOC plume, which is in a monitored natural attenuation program, is subject to a separate, but concurrent, Remedy Operation Status (ROS) submittal. The remainder of this section describes the property, site location, background information regarding the release, and report organization.

## 1.1 Description of Property and Site Location

The property located at 1 Network Drive is approximately 158 acres in size, with approximately 140 acres in the Town of Burlington and the remainder in the Town of Bedford (see Figure 1-1). It is bounded to the north by Vine Brook, to the east by Middlesex Turnpike and to the west by U.S. Route 3. The property is a former industrial facility that included two large buildings (which were demolished in 1996) and several smaller buildings (which were demolished in 1996 and 1997) where industrial activities (primarily manufacturing and testing of military electronics equipment) occurred between 1958 and 1994. Undeveloped wooded land and wetlands surround these areas. In addition, three brooks are located on the property: Vine Brook which flows along the northeastern portion of the property from southeast to northwest, a tributary to Vine Brook in the central portion of the property (Central Brook), and a tributary to Vine Brook in the western portion of the property (West Brook). The property is partially located within the Zone II of a water supply well in the Town of Bedford.

All of the buildings at the site (excluding the Baxter House which was a former farmhouse) were removed from the property by LMC in 1996 and 1997. Sun Microsystems, Inc. purchased the property in August 1997. Sun is currently redeveloping the property as a corporate office complex for their east coast regional headquarters. Figure 1-2 shows the new office buildings as well as the new four lane Network Drive that replaces the previous Kent Road.

This partial-RAO, which addresses the risk of harm to health, public welfare, safety and the environment, is considered partial in that it addresses the following media/area:

- surface water and sediment within the Central Brook area northeast of Network Drive (e.g., sediments and associated wetlands in the Central Brook area. This area and media will be referred to as "Central Brook and associated wetlands" in this report).

The delineation of the entire disposal site boundaries in relation to the boundaries of the Central Brook and associated wetlands area is depicted on Figure 1-2.

## 1.2 Background and Release Description

Between 1958 and 1994, the property was used as an industrial facility, primarily for manufacturing and testing of military electronics equipment. Prior to 1958, the property was used for agricultural purposes, which included a piggery. A small quarry for sand and gravel, located in the southwestern portion of the property, was also used prior to 1958.

During the operational history of the facility, industrial activities were limited to buildings located in the north-central portion of the property. The two main buildings (Buildings 1 and 2) were also used for office space. Three additional smaller buildings used as part of a vehicle testing facility were located east of the two manufacturing buildings and Central Brook. The entire disposal site history is described in detail in the partial-RAO Statement submitted January 22, 2002.

The western portion of Central Brook historically flowed through a culvert beneath a former asphalt parking lot and received discharges from an area on the RCA property referred to as "Site 1" and from several outfalls to the Brook. The "Site 1" area formerly contained subsurface structures that were part of a former industrial process, including influent lines, a settling tank, an acid pump pit, a leaching line, and associated manholes and piping. Discharges to Central Brook from this area occurred over an extended period of time and the total volume discharged has not been determined.

## 1.3 Report Organization

Shaw has organized this partial-RAO Statement Report as specified below:

- Section 2.0: Provides a description of response actions performed in the Central Brook and Associated Wetlands area including a summary of the Phase II CSA, Central Brook RAM, Predator Study, Phase III Investigations and Treatability Study, and the Comprehensive Response Action. This section also presents the most recent Phase V monitoring rounds of sediment and surface water data;

- Section 3.0: This section presents a summary that all of the requirements for a RAO have been met in the Central Brook and Associated wetlands area;

- Section 4.0: This section presents the Method 3 risk characterization supporting that a condition of no significant risk has been achieved;

- Section 5.0: Presents a summary of conclusions that form the basis for the RAO Statement;

- Section 6.0: Describes Public Involvement Activities performed as part of this submittal;

- Section 7.0: Provides a list of references; and

- Section 8.0: Provides a list of acronyms.

# 2 DESCRIPTION OF RESPONSE ACTIONS IN CENTRAL BROOK AND ASSOCIATED WETLANDS

Numerous investigations and remedial activities have occurred in the Central Brook and associated wetlands area culminating in the Comprehensive Response Action performed in the fall of 2002. These response actions are discussed in three sections below:

- Section 2.1 discusses investigation, risk-reduction, evaluation, and characterization activities performed prior to the comprehensive response action;
- Section 2.2 discusses the comprehensive response action performed during the fall of 2002; and
- Section 2.3 discusses sampling activities performed post-remediation.

## 2.1 Investigations Performed Prior to Comprehensive Response Action

Numerous response activities have been conducted in the Central Brook and associated wetlands area since 1986. This section discusses the following response actions which were performed prior to the comprehensive response action:

- Preliminary and Phase I investigations (1986 – 1994);
- Phase II Comprehensive Site Assessment (1997);
- RAM – removal of 527.25 tons of sediments from Central Brook west of Network Drive (1997);
- Phase III RAP (1998);
- Phase IV RIP (1998);
- Predator study (1999);
- Sequential extraction Procedure testing (2000);
- Phase III Investigations and Treatability Study (2001); and

- Phase III RAP and Phase IV RIP Addenda (2002).

Historical investigations at the site included Phase I and Phase II Environmental Studies in 1986 by Goldberg-Zoino & Associates, Inc, subsurface investigations in 1992 by Wehran Engineering Corporation (EMCON), and a Phase I Site Investigation in 1994 by Geraghty & Miller. Of the sediment samples collected from Central Brook prior to 1997, the only detected compounds were ethylbenzene (6 ug/kg), xylenes (49 ug/kg), arsenic (1.8 – 11 mg/kg), copper (6 – 1600 mg/kg), lead (12 – 390 mg/kg), nickel (6 – 19 mg/kg), zinc (23 – 253 mg/kg), chromium (7 – 2800 mg/kg), beryllium (0.14 – 0.34 mg/kg), silver (2 – 18 mg/kg), and mercury (0.2 – 0.4 mg/kg). Several isolated, but significantly higher concentrations of some metals were detected in samples CB-3 and ESD-6; however, the 1997 Phase II Comprehensive Site Assessment (CSA) concluded that these locations likely represent the effects of re-suspension and subsequent deposition of impacted sediment transported from upstream.

Investigations of sediment quality in Central Brook were conducted in 1997 as part of the Phase II CSA for the former RCA facility. During the sediment quality investigations the following maximum concentrations of metals were detected in Central Brook and wetlands west of Kent Road (presently Network Drive): chromium (680 mg/kg), copper (750 mg/kg), lead (430 mg/kg), and silver (130 mg/kg). The subsequent risk assessment for Central Brook sediments, presented in the Phase II CSA, was conducted using a Method 3 approach for evaluating the environment. There was no indication that the concentrations of these metals in Central Brook wetlands posed a risk to public health, safety or public welfare. However, the risk characterization for the environment indicated that "a condition of No Significant Risk does not exist for Central Brook sediments in the stream, pond and channels".

In July of 1997 a Release Abatement Measure (RAM) was conducted at the site to prepare the site for development by Sun Microsystems. As part of this RAM, 527.25 tons of sediments were removed from the portion of Central Brook, which was southwest of Kent Road (presently Network Drive). The RAM was necessary since historical industrial discharges from RCA operations to Central Brook and the associated wetlands had resulted in elevated levels of chromium, copper, lead and silver in sediments.

Following the completion of Central Brook RAM activities in the summer of 1997, eight confirmatory samples were collected from Central Brook on the south side of Kent Road (collected every 25 feet along the brook) and two confirmatory samples were collected from the wetland areas on the north side of Kent Road. Composite sediment samples were also collected from the base and embankments of the channel. Four confirmatory base samples were collected from the large wetland area on the south side of Central Brook. Note that the Central Brook area west of Network Drive was included in the partial-RAO submitted January 22, 2002.

A Phase III RAP was submitted by EMCON in November 1997, which with respect to Central Brook and associated wetlands, identified and screened five remedial action alternatives (RAAs) for remediating sediments at the site. The detailed evaluation and comparison resulted in the selection of No Action as a Temporary Solution for sediments based on feasibility, cost to benefit ratio, and previous available information.

A Phase IV RIP was submitted by EMCON in December 1998. Key elements of the RIP relative to Central Brook and associated wetlands, were monitoring plans to assure that a Substantial Hazard would not exist in the future, contingency plans that would be implemented should conditions be identified that could pose a Substantial Hazard, and a predator study plan to gather information to provide direct evidence of whether impacted sediment poses a Significant Risk to the environment. Based on Phase V monitoring data, a condition of Substantial Hazard never occurred, nor was sediment ever found to be migrating offsite. The conclusions of the predator study were that while various life stages of amphibians were observed, in general the study area was not a good habitat for the predators of interest (amphibians and aquatic birds) due to its physical characteristics. The survey indicated that the area is unlikely to represent an important breeding or feeding habitat for aquatic birds, since they prefer areas with dense wetland vegetation, which were not found at this site.

Three sediment samples were collected on May 16, 2001 from locations SED-D, ESD-11 and ESD-56. These samples were collected so that sequential extraction procedure (SEP) testing for metals could be performed. The SEP test provides data about the partitioning of metals into various phases of sediment. These phases may include a readily exchangeable fraction (e.g., dissolves readily), carbonate bound metals (such as lead carbonate), iron oxyhydroxide bound metals, metal sulfides (precipitated salts), organic bound metals (e.g. humic material), and residuals that include the metal in the sediment mineral structure (clays). Based on the results of the SEP tests, the four target metals are largely present in inert fractions in the sediments (e.g., 50%-95% of the metals are essentially “bound up” and not normally bio-available). Of the four metals, copper has the most potential to be mobile and bioavailable at high total concentrations due to its concentrations and speciation.

In September 2001, in accordance with a Phase III Investigation and Treatability Study Workplan, numerous investigative activities were performed in order to re-evaluate remedial alternatives. These investigations included: field investigation activities to further evaluate the vertical and lateral extent of metals-impacted sediments, the feasibility of in-situ metals stabilization was tested via sediment sampling and a bench-scale treatability study, and field investigations to evaluate in-situ stabilization delivery options via a field tracer test were performed. These results were presented in the Phase II RAP as discussed further below.

A partial-RAO was filed on January 22, 2002 for the entire disposal site. The only areas/media not included in the partial RAO were: 1) groundwater associated with a well-defined chlorinated volatile organic compound (VOC) plume, and 2) surface water and sediments in the Central Brook and associated wetlands area. These areas are identified on the Site RAO Map (Figure 1-2). This partial RAO addresses the second area/media.

A Phase III RAP Addendum was prepared in July 2002, which identified and evaluated two RAAs in addition to the five previously screened technologies in the 1997 Phase III RAP. This evaluation relied on all previous data including the Phase III Investigation and Treatability Study activities performed in the fall of 2001. The additional RAAs (S-6 and S-7) addressed the sediment in Central Brook and/or associated wetlands based on findings from the Phase III Investigation and Treatability Study. The detailed evaluation and comparison of sediment alternatives resulted in the selection of the Focused Excavation Alternative (S-6) via vacuum dredging, as the Permanent Solution for the sediment in Central Brook and/or associated wetlands.

A Phase IV RIP Addendum was prepared in July 2002, which presented detailed plans relating to the implementation of sediment removal by vacuum dredging and off site disposal The Phase IV RIP Addendum focused solely on addressing impacted sediments and outlined the implementation of the remedial alternative selected in the Phase III RAP Addendum.

## 2.2 Comprehensive Response Action (Fall 2002)

A comprehensive response action was performed in the Central Brook and associated wetlands area in the fall of 2002. The primary objectives of this comprehensive response action (CRA) included reducing sediment concentrations (primarily copper and chromium), via sediment removal in selected stream and pond sediments to acceptable EPC levels (survival of greater than 50% of the sensitive laboratory-raised benthic organisms) such that a Permanent Solution would be achieved and a condition of No Significant Risk would exist in the Central Brook and associated wetlands area. The locations where sediments were removed, which included the lower half of the Upper Brook, the entire pond, the entire Northern Channel, and the lower section of the Southern Channel, are shown on Figure 2-1.

A total of 491 tons of metals-impacted sediments were dredged from the Central Brook and associated wetlands area between October and November 2003 as part of a comprehensive response action at the subject site (see Phase IV Final Inspection Report and Completion Statement [FIR], Shaw March 2003). The sediment was dredged from selected stream channels and a pond in accordance with the Phase IV RIP Addendum (Shaw, July 2002). As part of these remediation activities, the pond was dewatered and

water was treated through fractionation tanks and filters prior to discharge to an existing detention pond in accordance with a 401 Water Quality Certification permit. Sediments were transported offsite and disposed at a permitted facility. Numerous samples were collected for field screening and/or laboratory analysis during the remediation project to confirm that remediation was complete and that it was being performed in accordance with existing plans and permits. Quality Assurance and Quality Control samples were collected and procedures were followed by the sampling crew and the laboratory to ensure that the data are usable for the intended purpose. The LSP-of-Record, Mr. Olaf Westphalen, performed numerous site inspections before, during and after remediation activities. Complete details of the Central Brook remediation project are included in the Phase IV FIR (Shaw, March 2003).

## 2.3 Post-Comprehensive Response Action Sampling

Since the last Phase V monitoring report, additional Phase V sediment quality data have been obtained. These data include the four sediment samples (SED-A, SED-D, SED-E, and SED-F) collected from Vine Brook on November 19, 2002 prior to the completion of the Central Brook remediation project. These samples were analyzed for the four target metals (copper, chromium, silver, and lead).

One final round of Phase V sediment and surface water samples were also collected on December 13, 2002 after completion of the Central Brook remediation project. The sediment samples (SED-A, SED-D, SED-E, and SED-F) were analyzed for the four target metals. The surface water samples (CVB-1 through CVB-6, SD-09, and SD-16) were analyzed for the four target metals (dissolved and total), turbidity, total suspended solids, and hardness. The purpose of this last round of sediment data was to demonstrate that remediation activities did not impact sediments in Vine Brook. The purpose of the last round of surface water data is to demonstrate that surface water quality in Central Brook (including the pond, North and South Channels) and Vine Brook has not been adversely impacted by remediation activities.

Finally, two surface water samples (SD-09 and SD-16) were collected from the pond on January 14, 2003. These samples were analyzed for total/dissolved copper and hardness in order to confirm that copper concentrations were below ambient water quality criteria. For QA/QC purposes, MS/MSD and duplicate samples were collected at a frequency of 1:20. Samples were analyzed for metals via EPA Method 6020 and EPA Method 200.8, total suspended solids via EPA Method 160.2, total/dissolved hardness via EPA Method 200.7/SM2340B, and turbidity via EPA Method 180.1 by Columbia Analytical (Jacksonville, FL). Analytical data are included in Appendix A. The following sections discuss the laboratory QA/QC results, sediment results, and surface water results.

Note that these Phase V Monitoring results are being presented here in lieu of the Phase V Monitoring Report in order to provide one location for all sediment and surface water data associated with Central Brook and associated wetlands.

### 2.3.1 QA/QC Evaluation

The analytical results for Phase V sediment sampling activities were electronically entered into the GIS/Key database and tabulated/validated by Shaw. Validation included a review of all laboratory and field quality control samples including a check of: sample log in and custody; preservation; analytical holding times; surrogate recoveries; detected results for method blank samples; calculated relative percent differences (comparing field and laboratory primary and duplicate samples); matrix spike recoveries and calculated relative percent differences on matrix spike recovery duplicates; laboratory control standard recoveries; and miscellaneous observations. In addition, detection limits were reviewed for appropriateness for this project and analytical data were compared to field data for consistency. Based on the validation of the Phase V sediment and surface water sampling data, the data required no qualification and are considered usable for this sampling program with the exception listed below. The following sample results were qualified for various laboratory-related quality control issues, but are still considered usable:

- The lead results for sediment samples SED-D1, SED-E, and SED-F collected on November 19, 2002 were qualified as estimated (flagged with a "J") to satisfy project convention and to indicate that the reported concentration is below the method reporting limit (MRL) for the particular sample.

Note that the laboratory narrative from the surface water samples collected on December 13, 2002 (SDG J220396) mentions that the MRL for total suspended solids on sample SD-9 had to be raised due to low sample volume issues. This slightly elevated detection limit is acceptable for these data and their intended use.

Quality control samples were collected at the frequency required for presumptive certainty and all Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS) criteria were met. The analysis of Tentatively Identified Compounds (TICs) was not warranted given that these samples were analyzed for inorganics. Analyses of metals deviated from draft MCP Methods since only four metals were reported (these are the four primary metals of concern at a site which has been well-characterized). No other deviations from the draft MCP methods were made. Therefore, the data set may be used to support associated MCP opinions.

### 2.3.2 Surface Water

2.3.2.1 Sampling Activities

Surface water in Vine Brook and the Central Brook pond was sampled by Shaw for metals on December 13, 2002. The sampling in Central and Vine Brook was conducted to evaluate the potential for dissolution of metals as a result of remediation activities. The samples were analyzed for chromium (EPA Method 218.2), copper (EPA Method 220.2), lead and silver (EPA Method 200.8), hardness (Method SM2340B), total suspended solids (EPA Method 160.2), pH (EPA Method 150.1) and turbidity (EPA Method 180.1). Parameters that were analyzed in the field included pH, temperature, and turbidity. The samples collected by Shaw (along with one duplicate sample) were sent to Columbia Analytical Services (CAS) for analysis. To avoid potential sampling artifacts, samples collected during these sampling rounds for dissolved metals analysis were filtered in the laboratory.

In accordance with the 1998 Phase IV RIP, Shaw selected the surface water sampling date based on heavy rainfall events (e.g. within 24 hours of > 0.5 inches precipitation). The amount of rainfall for these events were subsequently confirmed by measurements taken at the U.S. Weather Service station at Hanscom Field in Bedford (located approximately three miles from the site and considered representative of rainfall conditions at the site). Surface water samples collected on December 13, 2002 were within a 24-hour period following a rainfall event of greater than 0.5 inches of precipitation.

Surface water in the Central Brook pond was resampled by Shaw for total and dissolved copper on January 14, 2003 to confirm that copper concentrations in Central Brook are below Ambient Water Quality Criteria (AWQC). Parameters that were analyzed in the field included pH, temperature, and turbidity. The samples were sent to CAS for analysis. To avoid potential sampling artifacts, samples collected during these sampling rounds for dissolved metals analysis were filtered in the laboratory.

2.3.2.2 Results

Field chemistry parameters which were measured during the collection of surface water samples for metals in December 2002 and January 2003 are presented in Table 2-1. These parameters included sample depth, water column thickness, temperature, pH, and turbidity measurements measured with a portable water quality meter and turbidity meter.

The analytical results from the surface water sampling conducted on December 13, 2002 and January 14, 2003 are summarized on Table 2-2. Dissolved-phase concentrations of chromium, copper, lead and silver were compared to their respective trigger levels for Vine Brook samples downstream of Central Brook. Note that only dissolved

concentrations in samples collected from Vine Brook (CVB-01, CVB-04 and CVB-05) are compared to the trigger levels. The results of these events indicate that no trigger levels were exceeded during the reporting period. In addition, dissolved metal concentrations in Central Brook and Vine Brook were below AWQC standards.

Trend analyses were conducted for the eleven rounds of dissolved metals results at each of the surface water sampling stations on Vine Brook and Central Brook (except for ten rounds at CVB-02 and not including Central Brook pond samples) using the Mann-Kendall Trend Test (Appendix B). This test is an EPA-approved nonparametric procedure that identifies statistically significant upward or downward trends in data sets. Appendix B also includes a tabulation for each sampling station used in the Mann-Kendall Trend test, and a graphical display of dissolved metals versus time for each sampling station is shown in Appendix C. A summary of Mann-Kendall statistics for surface water metals is included in Table B-1 (Appendix B). It should be noted that during the statistical analysis, a set value based on the most common detection limit has been used when a compound is not detected in a sample. In previous monitoring reports, half the detection limit was used. This change was incorporated since the detection limit has decreased during the course of this project, which has caused some false "downward" trends in samples with non detects. As discussed in previous Phase V Monitoring reports, based to the low detection limits of recent analyses (February 2001 and February 2002), some false "downward" trends for CVB-02 have been identified due to detected results with very low concentration levels. The most common detection limits for dissolved chromium, copper, lead, and silver have been 5, 5, 1, and 0.5 ug/L respectively.

These most common detection limits have also been incorporated for non detects when generating the graphical displays of concentration over time included in Appendix C. Previous reports had incorporated half the detection limit for these graphs.

Based on a review of the Mann-Kendall Trend Test results, except for the false decreasing trends in some locations due to recent low detection values, no statistically significant trends were observed at any of the surface water sampling locations at the 90% confidence level. Based on this study, there appears to be no long or short-term impact from impacted sediments to surface water.

### 2.3.3 Sediment Monitoring Activities

#### 2.3.3.1 Sampling Activities

As described in the August 2001 Phase V Addendum, composite sediment samples were collected using a standard hand auger to capture representative sediment samples. This process was demonstrated through field testing to be an efficient and effective approach to collecting sediment samples. The sampling method provides reproducible and correct

sample delimitation with minimal recovery of water in the sediment. By compository sampling, spatio-temporal variations have been minimized and precision and accuracy have been gained.

Sampling at each established station was performed using one or two random transects through the depositional areas that are covered with water year round. Three samples were collected at equal intervals along each transect. The transects ran diagonally (approximately 45 degrees) across the target sampling area and parallel to each other. They were determined by selecting a random offset (0-10 feet) along the bank from the steel pipe used to mark the sampling station. One composite sample was prepared from the six samples collected at each station by the laboratory.

The following example illustrates the design. To collect a composite of six samples at a station, two random numbers between 0 and 10 were chosen, say 6.5 and 2.3. Points on the bank 6.5 feet upstream of and 2.3 feet downstream of the steel pipe were marked with temporary stakes. The first transect ran at approximately 45 degrees across the target area starting at a point even with the first mark and running downstream. Samples were collected from the portion of the transect going over the target area at approximately ¼, ½, and ¾ of its length. The second transect was similar but based on the second mark. The second group of three samples was collected from the second transect following the same procedure. Decontamination of sampling equipment was not required within a station, as long as the equipment did not come into contact with the ground or other potential sources of contamination between samples.

Each sediment sample was geologically classified by a Shaw geologist during the sampling process to document variability between composite samples. Sediments ranged from light brown/grey medium sand with some silt to dark brown heavy silt with organics. Typically, sediments consisted of an organic top layer underlain by silt and sand, with sand content increasing with depth.

In both sampling rounds, one or two composites per station were taken and the samples from each transect were mixed into the same composite. Very thorough mixing of composites was absolutely essential; therefore, this step was performed by the laboratory. Since the material is likely to form a slurry, care was exercised in the subsampling portion of composite preparation to avoid introducing significant particle size bias.

These sampling rounds represent the fifth and sixth successive sampling events following the August 2001 submittal of the Phase V Addendum. Sediment samples SED-B and SED-C, which are located in Central Brook, were discontinued from the sampling plan in November 2002 due to the completion of sediment remediation activities in Central Brook in the fall of 2002.

Sampling proceeded from downstream to upstream locations to prevent cross contamination of samples. At each location, a sediment sample was collected between 0 and 12 inches below the sediment surface to be representative of recent deposition. The sample was transferred directly from the sampler to the laboratory supplied jars. One field duplicate sample was also collected per sampling round.

The sediment samples collected during each sampling event in November and December 2002 were analyzed by CAS for the four metals of concern (chromium, copper, lead, and silver via EPA Method 6000 series) and total solids content. Laboratory analytical results for the November and December 2002 sampling events are included in Appendix A.

The depth of sediment was also measured from the top of the staff gauge at each location during the November and December sampling rounds to provide an indication of significant erosional/depositional events.

2.3.3.2 Results

The analytical results for quarterly sediment samples collected from Central Brook and Vine Brook on November 19, 2002 and December 13, 2002 are summarized on Table 2-3.

In order to evaluate the sediment data using control charts as described in the August 2001 Phase V Addendum, samples were collected as described in the sample collection protocol in Section 2.3.2. During sampling rounds sixteen and seventeen (November and December 2002), the average of both composite samples at each location was used to establish the concentration of a given metal at a given station. The difference between a given metal at the downstream location minus the upstream location will then be compared to the Upper Concentration Limit (UCL) for that station. If that difference exceeds the UCL or the Effects Range Median[1] (ERM) sediment benchmark, then contingency actions as specified in the Phase IV RIP will be initiated, as appropriate, after the exceedance has been confirmed.

In a hypothetical example, if lead is 200 mg/kg at SED-F and 100 mg/kg at SED-A, then the difference is 100 mg/kg. This is greater than the UCL for lead at SED-F (81.3 mg/kg). This value would be viewed as "out-of-control", and contingency actions would be performed, if warranted, if the results were confirmed through re-sampling. In the second example, if lead was 300 mg/kg at SED-F and 250 mg/kg at SED-A, even though

[1] Effects Range Median (ERM) sediment benchmarks from Long, et al. (1995) based on marine/estuarine spiked sediment toxicity studies. The ERM values represent 50$^{th}$ percentile concentrations at which effects were observed

the difference is less than the UCL, since the value at SED-F exceeded the ERM (218 mg/kg), this would be viewed as an exceedance warranting contingency actions.

For example, the copper result for the December 2002 sampling event was 11.8 mg/kg at SED-F and 17.0 mg/kg at SED-A, therefore, the difference is 5.2 mg/kg. This is less than the UCL for copper at SED-F (47.9) mg/kg. This value would be viewed as statistically "in-control". No further action is necessary. A detailed description of the control charting method is provided in the August 2001 Phase V Monitoring Report Addendum.

Based on the analytical sampling data for November and December 2002, concentrations of metals (chromium, copper, silver, lead) in sediment samples (SED-D, SED-E, SED-F) are "in control." As demonstrated in the Control Charts for SED-D, SED-E, and SED-F for the four metals of concern (attached as Appendix D), all values are between the upper and lower concentration limit (Table D-1 in Appendix D), and below ERM benchmark levels.

Modifications to the sampling plan, as previously described have helped in more accurately quantifying the concentrations of metals in sediments at these locations. During the November and December 2002 sampling events, some former trigger levels were slightly exceeded at locations SED-A and SED-D. Several of these exceedances are due to spatio-temporal variations as indicated below. Furthermore, using the control charting approach, all concentrations are considered "in control."

Former trigger levels for silver were slightly exceeded in the secondary sample collected at Station SED-D in November 2002. The silver concentration obtained by averaging the composites at this location exceeded the former trigger levels, however, silver concentrations are consistent with previous data and considered "in control" per the control charting method.

Former trigger levels for lead were slightly exceeded in the duplicate sample collected at upstream Station SED-A in November 2002. The lead concentration obtained by averaging the composites at this location exceeded the former trigger levels, however, lead concentrations are consistent with previous data and considered "in control" per the control charting method.

Copper concentrations exceeded former trigger levels at Stations SED-A and SED-D in either the primary, secondary and/or duplicate sample. The average copper concentration in SED-A and SED-D exceeded the former trigger levels in November 2002 (19 mg/kg in SED-A and 66.5 mg/kg compared to the 17 mg/kg former trigger level), however, copper concentrations are consistent with previous data and considered "in control" per the control charting method. The copper concentration in SED-D also exceeded the former trigger levels in December 2002 (47 mg/kg), however, copper concentrations are considered "in control" per the control charting method

Chromium concentrations exceeded former trigger levels at Station SED-D in both the primary and secondary samples in November 2002. The average chromium concentration in SED-D exceeded the former trigger level (81.5 mg/kg compared to the 40 mg/kg former trigger level), however, copper concentrations are consistent with previous data and considered "in control" per the control charting method. The chromium concentration in SED-D also exceeded the former trigger levels in December 2002 (69 mg/kg), however, copper concentrations are considered "in control" per the control charting method.

The appropriateness of using control charts for SED-D was discussed in the August 2001 Phase V Addendum due to apparently high metals concentrations at this location, however, it was believed that the previous concentrations at SED-D were attributed to spatio-temporal sampling variability, and were anomalous. Changes to the sampling methodology have minimized this variability. For the purpose of the most recent data, control charting for SED-D seems to be useful and appropriate and indicates that metals concentrations at this location are "in control".

Trend analyses were conducted for the sixteen to eighteen rounds (depending on location) of sediment results at each of the four sediment sampling stations on Vine Brook using the Mann-Kendall Trend Test (Appendix B). A summary for each sampling station of metals data used in the Mann-Kendall Trend Test (Table B-2), and a graphical display of metals versus time for each sampling station are presented in Appendix B and C respectively. As established in the June 2001 Phase V report, a set value based on the most common detection limit was used when a compound was not detected in a sample. This was done to minimize false trends associated with variations in the detection limit.

Statistically significant upward trends at the 90% confidence level for sediment sampling locations in Vine Brook downstream of Central Brook, were observed at sediment sampling locations SED-D, SED-E, and SED-F. At location SED-D, chromium, copper, and lead, exhibit upward trends, however, Control Charting demonstrates that chromium and copper are "in control" and concentrations are below ERM levels. Although lead concentrations in SED-D and SED-E exhibit an upward trend, the latest concentrations are below the former trigger level, ERM levels, and are considered "in control." Similarly, chromium and copper concentrations in SED-F exhibit an upward trend, however, the latest concentrations are below the former trigger level, ERM levels, and are considered "in control."

Statistical trends have not been performed by sediments in Central Brook (SED-B and SED-C) since August 2002 due to the sediment removal activities in Central Brook during the fall of 2002.

The depth of sediment was measured from the top of the staff gauge at each location during the November and December sampling rounds to provide an indication of

significant erosional/depositional events. These results are summarized on Table 2-4. The measurements indicate that during this reporting period, up to 11 inches of erosion at SED-A and up to 3 inches of deposition at SED-E had occurred. Erosion also took place at SED-D (3 inches). Deposition took place at SED-F (2 inches). This amount of erosion/deposition would not be expected to adversely impact the results or interpretation given the present sampling protocol.

Based on the recent Phase V monitoring data for sediments, there appear to be no short-term impacts associated with the remediation project. In addition, a review of the long-term trends does not indicate an impact from the Central Brook sediments. Furthermore, since the source has been removed, the concentrations of remaining heavy metals in Vine Brook associated with the site will continue to decrease over time.

# 3 RESPONSE ACTION OUTCOME

## 3.1 Class of RAO

This RAO Completion Statement has been prepared in support of a Class A-2 RAO for the Central Brook and associated wetlands area of the site (see Figure 1-2) for RTN 3-0265.

## 3.2 Risk Characterization Method

A combined Method 2 and Method 3 Risk Characterization has been prepared for and is included as Section 4. Method 1 standards were used where available and Method 2 was used to derive standards for OHM of concern for which no standards exist. Method 3 is used to evaluate the risk of harm to public welfare and the environment.

## 3.3 Relationship of RAO to other RAOs

This partial-RAO is for sediments and surface water in the Central Brook and associated wetlands area at the site. A partial-RAO was submitted on January 22, 2002 which addressed soil for the entire site, groundwater for the entire site except for a well-defined chlorinated VOC plume, and sediments/surface water in the Central Brook and associated wetlands area. No other RAOs are known to exist at the site.

## 3.4 Post-RAO Active O&M

Post-RAO operation and maintenance remedial actions are not applicable to this Class A-2-RAO.

## 3.5 Elimination of Uncontrolled Sources

Potential sources of OHM were removed from the Central Brook and associated wetlands area during the comprehensive response action performed in the fall of 2002. No uncontrolled sources of the constituents of concern remain in the portion/media of the disposal site subject to this RAO.

## 3.6 Condition of No Significant Risk

A combined Method 2 and Method 3 risk assessment was prepared for this site and is included as Section 4. The risk characterization concluded that a condition of No

Significant Risk of harm to human health, welfare, safety or the environment exists for the areas and media addressed by this partial-RAO as shown on Figure 1-2. This risk assessment relied on the risk assessment performed as part of the Phase II CSA (EMCON, 1997b), and additional data collected at the site during and after the comprehensive action completed in the fall of 2002

## 3.7 Substantial Hazards

No substantial hazards exist at the entire site including the Central Brook and associated wetlands area.

## 3.8 Feasibility of Approaching and/or Achieving Background

Comprehensive Remediation Actions in Central Brook and Associated wetlands have achieved a condition of No Significant Risk for sediments and surface water (see Section 4 below). In addition, as a result of remediation activities, background has been achieved in the pond, and the Northern and Southern Channels (see Section 4.5.2). Background has however not been achieved and/or approached in the Upper Brook and wetlands.

For all Class A-2, A-3, and A-4 RAOs, the MCP (310 CMR 40.0861(2)(g)) requires an evaluation of the feasibility of reducing the concentrations of OHM to levels that achieve or approach background concentrations. In accordance with DEP guidance for evaluating the feasibility of achieving or approaching background, the benefits of the remedial actions to achieve or approach background must justify the costs or associated risks with those actions.

With regard to the Central Brook and associated wetland area as a whole, achieving background would require excavation of the remaining section of the Upper Channel and the entire three-acre wetland. The feasibility evaluation using the "Benchmark Comparison" approach involves comparing the cost of remediating to levels of No Significant Risk (already achieved) to the cost of additional remediation to achieve background. As presented in Table 5-1 of the 2002 Phase III RAP Addendum, the cost to excavate the remaining section of the Upper Channel and the entire wetland would exceed 500% that of the recently-performed comprehensive remedial action. Therefore, remediation to achieve background is considered infeasible in this case.

Furthermore, if a Site Specific Benefit-Cost Evaluation (310 CMR 40.0860(5)(c)) indicates that an alternative which could achieve background would destroy more than 5,000 square feet of wetlands or would result in substantial deleterious impact to the environment and: 1) another Permanent Solution exists, 2) OHM is located in resources

that do not bio-accumulate and is not likely to migrate, and 3) the damage resulting from the alternative would be permanent and irreparable; the alternative can also be considered infeasible to achieve or approach background.

Based on a Site Specific Benefit-Cost analysis, the only alternative that would achieve background for the entire Central Brook and associated wetlands area would destroy significantly more than 5,000 square feet of wetlands (approximately three acres). In addition: 1) a Permanent Solution has been achieved, 2) there is a high certainty that OHM will not migrate, and 3) the destruction of three acres of wetlands would be permanent and require long-term restoration. Therefore, remediation to achieve background is infeasible for the site under the Site Specific Benefit-Cost Evaluation.

As stated previously, background was achieved in the pond, and the Northern and Southern Channels, where the majority of the contaminant mass had been located.

## 3.9 Upper Concentration Limits

There are no UCL exceedances at the site nor the Central Brook and associated wetland area. An evaluation of the feasibility of achieving UCL concentrations at locations with UCL exceedances is therefore not applicable.

## 3.10 AUL Opinion

This partial-RAO is not based on the implementation of an activity and use limitation (AUL). A condition of No Significant Risk exists without the need for an AUL.

## 3.11 Ongoing O&M

No ongoing operation, maintenance and/or monitoring activities are necessary to maintain a condition of no significant risk at portions/media of the site addressed by this partial-RAO.

## 3.12 Permanent Solution

A permanent solution (i.e. Class A-2 partial-RAO) has been achieved for the portion/media of the site addressed by the RAO.

# 4 RISK CHARACTERIZATION

## 4.1 Introduction

The purpose of this risk characterization is to support the partial-RAO for the Central Brook Area, as delineated in previous sections. It relies on and supplements the Phase II Risk Characterization (EMCON 1997) conducted for the site as a whole. This Risk Characterization has been conducted in accordance with the MCP (310 CMR 40.0900), and related guidance (MADEP 1995, 1996).

### 4.1.1 Background

A risk characterization for the site was conducted in 1999 and was included in the Phase II Comprehensive Site Assessment (CSA) report. This report concluded that a condition of No Significant Risk to the Environment did not exist in the Central Brook wetlands and stream sediment. As a result, additional investigation activities and remedial activities were conducted as part of the Phase IV, including removal of sediment in the stream beds, as described in Section 2.2.

This report evaluates whether response actions conducted have achieved a condition of No Significant Risk in the Central Brook sediments.

### 4.1.2 Scope and Organization of the Risk Characterization

The scope of this assessment is environmental risk associated with the Central Brook and wetlands sediment. As discussed below, other potential risks in the area addressed by this area were found to be insignificant in the Phase II.

## 4.2 Summary of Phase II Risk Characterization

### 4.2.1 Human Health

Potential human exposures to surface water and sediment at the site, including the Central Brook area, were evaluated in Appendix J of the Phase II (EMCON 1997). As a conservative approach, maximum sediment concentrations in Central Brook wetlands and streams were compared to MCP Method 1 Soil Standards for Direct Exposure (S-1). All

maximum concentrations in Central Brook wetlands were below these standards, except for chromium and lead, whose maximum concentrations of 2,800 and 390 mg/kg respectively, were above the standards at locations ESD-6 and ESD-31 respectively. However, the average concentrations of these two metals were well below the standards. In the 1997 Phase II CSA, it was concluded that No Significant Risk of harm to human health exists to exposure to sediments from Central Brook. No changes in Method 1 Soil Standards have occurred since the completion of the Phase II CSA that would change this conclusion and a significant portion of sediment has since been removed, including the sediment associated with sample location ESD-6.

### 4.2.2 Public Welfare

The risk to public welfare was evaluated for the site as a whole in Section 6.5 of the Phase II CSA (EMCON 1997). This evaluation considered the MCP criteria in effect at the time of the report, (e.g., compared site concentrations to Upper Concentration Limits (UCLs)). In the 1997 Phase II CSA, it was concluded that a condition of No Significant Risk to public welfare exists at the site. No changes in the MCP Upper Concentration Limits have occurred since the completion of the Phase II that would change this conclusion.

### 4.2.3 Safety

The risk to safety was also evaluated for the site as a whole in the Phase II Report (EMCON 1997). It was concluded that a condition of No Significant Risk to safety exists at the site.

### 4.2.4 Environment

The risk to the environment in the Central Brook area was evaluated in the Phase II CSA (EMCON 1997) using a Stage II Risk Characterization and a Weight of Evidence Approach. The assessment endpoint chosen for the evaluation was the effect of metals concentrations on populations or subpopulations of benthic organisms, such that their function as a prey base is substantially diminished. Of particular concern, based on the Stage I Screening, were concentrations of copper, chromium, lead, and silver. Measurement endpoints included: benchmark comparisons; acid volatile sulfide/simultaneously extracted metals (AVS/SEM) data; a qualitative survey of benthic invertebrates; and sediment toxicity testing. The conclusion of this evaluation was that, given the Weight of Evidence, a significant risk of harm to the environment exists in Central Brook and the associated wetlands.

## 4.3 Summary of Revised Risk Characterization in Phase III Addendum

Additional site data were collected from the Central Brook area after the completion of the Phase II CSA and Phase III RSP Reports. These data are summarized in the Phase III RAP Addendum (Shaw 2002). Sediment samples were collected and analyzed via the sequential extraction procedure (SEP). This analysis provided information on the environmental mobility, metal solubility, and bioavailability of chromium, copper, silver and lead. The results showed that the these metals are largely present in inert fractions and not normally bioavailable. Copper was found to be the most mobile and bioavailable of the four metals tested.

The Phase III RAP Addendum also included a summary of a predator study conducted in the Central Brook area in April 1999. The purpose of this study was to determine whether a quantitative evaluation of predators was feasible at the site. Such a study would be useful in evaluating whether the receptors of concern had actually been impacted by possible effects on benthic populations. This study concluded the following:

- Amphibian and aquatic bird species were identified at the site, and none exhibited overt adverse effects. All life stages of some frogs were identified, indicating that amphibians are successfully breeding and living at the site;

- The site, in general, is a relatively poor breeding and feeding habitat for aquatic birds due to the lack of dense wetland vegetation present at this site. This is due to the man-made nature of the pond, and not the presence of contamination; and

- Fish were observed in the stream connecting the culvert at Network Drive with the pond, as well as the pond. Because fish are important predators of amphibian larvae, these locations are likely poor habitat for amphibians.

These conclusions were based on a qualitative evaluation. Quantitative evaluation was not conducted since the site represented a relatively poor habitat for the species of interest, and no reference locations could be identified that were comparable to the site.

Based on the information gained in the predator study, the Weight of Evidence evaluation contained in the 1997 Phase II CSA was revised. Table 4-1 shows the revised Weight of Evidence evaluation incorporating the new data. This table shows that the weight of evidence for the predator study was high, as it is direct evidence of the species of interest. For both Central Brook (Stream/Pond/Channels) and the Central Brook Wetlands, there is moderate evidence of no significant effect on vertebrate species. This rating is based on the observation of all life stages of amphibians, as well as the conclusion that the site is a relatively poor habitat for amphibians and aquatic birds (the predators most likely to be impacted by reduction in populations of benthic invertebrates). Because the

observations are qualitative in nature, the evidence is considered moderate instead of strong.

Based on the Weight of Evidence Evaluation shown in Table 4-1, it can be concluded that a condition of No Significant Risk exists for Central Brook Wetlands. Based on the 1997 Phase II CSA analysis, the benchmark comparison and the qualitative benthic survey showed moderate indication of toxicity with a medium weight. The toxicity test showed no indication of mortality associated with sediment from the wetland location. No additional information on concentrations in wetlands sediments or sediment toxicity has been collected since the completion of the Phase II CSA. The qualitative predator study described above had a moderate indication of no significant effect on vertebrate predator species, with a high weight of evidence. The two measurement endpoints with the high weight of evidence are consistent for the wetlands; the toxicity testing showed no indication of mortality, and the qualitative predator evaluation showed no significant effect on vertebrate species. The strong evidence of sub-lethal effects from the toxicity test does not weigh heavily in this analysis since mortality is more likely to result in secondary effects on predator species.

The analysis in the Phase III RAP Addendum, and shown in Table 4-1 indicated that a condition of No Significant Risk, however, did not exist for Central Brook sediments in the streams, pond, and channels. The strong indication of toxicity (mortality and sub-lethal effects) from samples from the stream and pond sediment outweighs the conclusions of the qualitative predator study. Therefore, the conclusions regarding this portion of the site (stream and pond sediment) remained the same as that presented in the 1997 Phase II CSA Report, that metals concentrations in these locations posed a significant risk to environmental receptors.

## 4.4 Central Brook Remedial Objectives

Remedial objectives for the Central Brook streams and pond were developed in the Phase III RAP Addendum (Shaw 2002). Concentrations to be used in risk reduction alternatives were developed for these locations using the sediment toxicity testing results provided in the Phase II CSA Report (EMCON 1997). The remedial objectives represented concentrations that would achieve a Permanent Solution and a condition of No Significant Risk.

A statistical evaluation was conducted to determine the correlation between sediment concentrations and toxicity for the species *Hyalella azteca*. This evaluation is provided in Appendix C of the Phase III Addendum (Shaw 2002). The purpose of conducting these correlations was to determine, if possible, which metal(s) were responsible for the observed toxicity, and to determine if predictions could be made regarding laboratory toxicity and sediment concentrations.

The statistical evaluation is provided in Appendix C of the Phase III Addendum (Shaw 2002). The analysis considered the contribution of the three metals (chromium, copper, and lead) to toxicity. Silver was not included in this analysis since concentrations in the sediment toxicity samples was low (ranging from 3 to 9 mg/kg), with little variation. The evaluation showed that the concentration of lead had negligible effect on toxicity compared to chromium and copper, which were strongly correlated with toxicity.

An equation representing the fitted curve of the survival probability as a function of copper and chromium concentrations was developed using the toxicity test results. This equation was used to develop copper and chromium concentrations that would achieve a condition of No Significant Risk using an "acceptable" survival probability.

A value of 50% mortality/survival of *Hyalella azteca* in the laboratory sediment toxicity test was selected as the basis of the cleanup concentrations. It is assumed that 50 % survival of this species, as measured in laboratory toxicity tests would be protective of vertebrate predators for the following reasons:

- Laboratory-raised organisms of this species are likely to be more sensitive than site organisms.

- This species is considered a sensitive species. Toxicity tests were also performed for a few locations on *Chironomus tentans*, a less sensitive species. Survival for this species was greater than the *Hyalella azteca* in the same samples. For example, in the pond sample, survival of *Hyalella azteca* was 13.75%, and for *Chironomus tentans* was 77.5%. Therefore, a benthic ecosystem exposed to a concentration that results in 50% survival of *Hyalella azteca* is likely to show greater survival as a whole, as many species would not be affected at these concentrations.

- The effect on the benthic ecosystem would need to be substantial in order for the prey base to be reduced such that predators have insufficient food supply. Based on the toxicity testing results, concentrations that result in 50% survival of *Hyalella azteca* are unlikely to reduce benthic populations sufficiently to affect predator populations.

In support of this criterion, the qualitative predator survey showed a lack of significant effect on the vertebrate predator populations at locations where survival of invertebrates (*Hyalella azteca*) was found to be as low as 13.75% in the laboratory. This may indicate that laboratory mortality overestimates field mortality due to the use of a sensitive species of laboratory-raised organisms in the toxicity test (as opposed to site-specific organisms which may be less sensitive since they have adapted to site conditions). It also may be that the nature of the habitat is limiting vertebrate predator populations

independent of sediment contamination. As discussed above, vertebrate predator populations may be limited due to physical characteristics of the habitat.

Using the derived relationship, a table was developed showing combinations of concentrations of these two metals that would result in survival of less than 50% of the sensitive laboratory-raised benthic organisms (*Hyalella azteca*). Table 4-2 shows in bold combinations of copper and chromium concentrations that were predicted to result in survival of 50% or greater and that would achieve a condition of No Significant Risk.

## 4.5 Characterization of Risk to the Environment - Post-Remediation

As discussed in Section 2.2, a comprehensive response action was performed in the Central Brook area in the fall of 2002. The primary objectives of this comprehensive response action (CRA) included reducing sediment concentrations (primarily copper and chromium), via sediment removal in selected stream and pond sediments to the remedial objectives described above. The locations where sediments were removed, which included the lower half of the Upper Brook, the entire pond, the entire Northern Channel, and the lower section of the Southern Channel, are shown on Figure 2-1.

### 4.5.1 Derivation of the Revised Exposure Point Concentrations

After remediation was complete, the highest concentrations of metals remaining were 780 mg/kg chromium at SD-21 and 640 mg/kg copper at ESD-44B. Exposure point concentrations were derived for the four areas evaluated in the Phase II CSA (EMCON 1997) using historical data that represented sediments still remaining at the site and confirmatory samples from the excavation (see Table 2-3). Silver was not detected in any of the confirmatory sediment samples, and was therefore, not considered in this evaluation. Lead was detected in 9 of 35 confirmatory samples, but since the toxicity testing results described above indicated that lead concentrations did not contribute significantly to toxicity, this metal was not included in the evaluation. Based on the copper and chromium data, the resulting average exposure point concentrations (EPCs) in each of the four areas (Upper Brook, pond, Northern Channel and Southern Channel) are presented in Table 4-3. This table shows the exposure point concentrations prior to remediation, and those achieved after remediation.

### 4.5.2 Comparison of EPCs to Remedial Objectives

Figure 4-1 shows a comparison of the exposure point concentrations for copper and chromium in each of the four areas before and after remediation; the solid line represents

the remedial objective concentrations. As shown in this figure, the concentrations achieved were much lower than necessary to meet the remedial objectives. The predicted survival of *Hyalella azteca* in the laboratory to the concentrations at these four locations ranged from 66% to 87%, with the pond and the north and south channels ranging from 86% to 87%. These last three locations are effectively equivalent to the 91% survival observed in the control sample in the sediment toxicity test. Based on these comparisons, the remedial objectives have been achieved in all locations, and background has been achieved in the pond, and the north and south channels.

### 4.5.3 Evaluation of Applicable or Suitably Analogous Environmental Standards

Applicable standards for the Central Brook area are Massachusetts Surface Water Standards (314 CMR 4.00). Surface water sampling in the Central Brook pond and streams was conducted in December 2002 and January 2003, as discussed in Section 2.3.2. Samples were analyzed for total and dissolved copper, chromium, lead and silver. Lead and silver were not detected in any location. Dissolved copper and chromium were detected in the pond, but were not detected in any of the stream sampling locations. Table 4-4 shows a comparison of the measured concentrations to the Massachusetts Surface Water Standards. These standards are Ambient Water Quality Criteria developed by the US Environmental Protection Agency. In the case of copper and chromium, these criteria are dependent on hardness. Table 4-4 shows the average hardness for the two pond locations over the two rounds of sampling. This value was used to derive the standards shown in the table, in accordance with US EPA (2002). As this Table indicates, surface water concentrations in the pond do not exceed the applicable standards.

## 4.6 Risk Characterization Summary and Conclusions

The 1997 Phase II CSA concluded that a condition of No Significant Risk to health, safety and public welfare existed in the Central Brook area, but that a condition of No Significant Risk to the environment did not exist due to metals concentrations in sediment. The metals of concern were copper, chromium, lead and silver. Subsequent sampling and re-evaluation resulted in the conclusion that a condition of No Significant Risk to the environment did exist in the Central Brook wetlands, but not in the streams and pond. As a result, remedial objectives were developed in order to achieve a condition of No Significant Risk for these locations. These objectives were interdependent concentrations of copper and chromium based on the criteria of laboratory survival of 50% or greater of *Hyalella azteca*. This criteria was determined to be protective of the predator species of concern.

The remediation of the stream and ponds was evaluated through confirmatory sediment samples. A comparison of exposure point concentrations for the pond and three distinct stream areas showed that remedial objectives were met. In fact, in the pond and the north and south channel, background conditions were met, as measured by projected survival similar to that seen in control samples from the sediment toxicity test.

Post-remedial surface water sampling of the Central Brook streams and pond was conducted to ensure that applicable standards were met post-remediation. None of the four metals were detected in any of the stream samples. Copper and chromium were detected in the pond, however, concentrations were below applicable standards.

Based on the risk characterization provided in the 1997 Phase II CSA, and the supplemental evaluation provided in this report, it can be concluded that a condition of No Significant Risk to health, safety, public welfare, and the environment has been achieved in the Central Brook and associated wetland area. This conclusion is not based on any restrictions to use of this area.

# 5 RAO SUMMARY AND CONCLUSIONS

Extensive site characterization and comprehensive remediation activities have been performed in the Central Brook and associated wetlands area at the subject site since 1985. The results of these activities have been considered during a combined Method 2 and Method 3 Risk Characterization which was prepared for the Central Brook and associated wetlands portion of this site as shown on Figure 1-2. Method 1 standards were used where available and Method 2 was used to derive standards for OHM of concern for which no standards exist. Method 3 was used to evaluate the risk of harm to public welfare, safety and the environment. The risk characterization concluded that a condition of No Significant Risk exists for the areas and media addressed by this partial-RAO.

Therefore, a Class A-2 RAO is applicable to the Central Brook and associated wetlands portion of site, as described in the text and shown on Figure 1-2, because:

- Comprehensive response actions were conducted and a condition of no significant risk has been achieved; no active operation and maintenance of a remedial action is required;
- No continuing sources exist;
- A Permanent Solution has been achieved;
- OHM in the environment were not reduced to background however, background was approached; and
- One or more Activity and Use Limitations are not required to maintain a Level of No Significant Risk.

# 6 PUBLIC INVOLVEMENT ACTIVITIES

The following public involvement activities will be conducted in support of the partial-Response Action Outcome Statement in accordance with the Public Involvement Plan (EMCON 1998) and 310 CMR 40.1403:

- A four-page newsletter was mailed to the PIP Mailing List on March 7, 2003 announcing a public meeting. Announcements were also made in the local papers and via a press release;

- A public meeting will be held on March 20, 2003 at the Burlington School Committee Room, School Administration Building, Burlington High School, 123 Cambridge Street at 7:00 P.M. (EST). The purpose of the public meeting is to discuss this partial-RAO;

- The draft partial-Response Action Outcome Statement will be made available for review. A complete hard-copy will be available at DEP's NERO office and the Burlington Town Library. Several copies will also be available at the public meeting (March 20, 2003); and

- The public comment period will be from March 20, 2003 through April 10, 2003.

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# 8 LIST OF ACRONYMS

| | |
|---|---|
| ACOE | Army Corps of Engineers |
| AUL | Activity and Use Limitations |
| BCC | Burlington Conservation Commission |
| BOL | Bill of Lading |
| BRP WW | Bureau of Resource Protection – Wetlands and Waterways |
| BVW | Bordering Vegetated Wetland |
| BWSC | Bureau of Waste Site Clean-up |
| CMR | Code of Massachusetts Regulations |
| COCs | Contaminants of Concern |
| CRA | Comprehensive Remedial Action |
| CSA | Comprehensive Site Assessment |
| CWA | Clean Water Act |
| CY | Cubic Yards |
| DEP | Department of Environmental Protection |
| ENF | Environmental Notification Form |
| EOEA | Executive Office of Environmental Affairs |
| EPA | Environmental Protection Agency |
| EPC | Exposure Point Concentration |
| EPH | Extractable Petroleum Hydrocarbons |
| ERM | Effects Range-Median |
| HASP | Health and Safety Plan |
| IRA | Immediate Response Action |
| LSP | Licensed Site Professional |
| MNA | Monitored Natural Attenuation |
| MCP | Massachusetts Contingency Plan |
| NOI | Notice of Intent |
| NPDES | National Pollution Discharge Elimination System |
| NTU | NEPHELOMETRIC Turbidity Units |
| OHM | Oil and/or Hazardous Materials |
| OOC | Order of Conditions |
| PAHs | Polynuclear Aromatic Hydrocarbons |

| | |
|---|---|
| PCBs | Polychlorinated Biphenyls |
| PID | Photo ionization Detector |
| PIP | Public Involvement Plan |
| PPE | Personnel Protective Equipment |
| PRP | Potentially Responsible Party |
| RAMs | Release Abatement Measures |
| RAO | Response Action Outcome |
| RAA | Remedial Action Alternative |
| RAP | Remedial Action Plan |
| RCRA | Resource Conservation and Recovery Act |
| RfC | Reference Concentrations |
| RfDs | Reference Doses |
| RIP | Remedy Implementation Plan |
| SEP | Sequential extraction procedure |
| SVOCs | Semivolatile Organic Compounds |
| TAC | Target Air Concentrations |
| TCLP | Toxicity characteristic leaching parameter |
| TPH | Total Petroleum Hydrocarbons |
| TSS | Total Suspended Solids |
| UCLs | Upper Concentration Limits |
| USTs | Underground Storage Tanks |
| VOCs | Volatile Organic Compounds |
| WQC | Water Quality Certification |

# TABLES

# FIGURES

# APPENDIX A

# LABORATORY ANALYTICAL REPORTS

## COPIES OF APPENDICES ARE AVAILABLE AT THE BURLINGTON PUBLIC LIBRARY IN THE LOCKHEED MARTIN REPOSITORY

# APPENDIX B

# MANN-KENDALL TREND TESTS

# APPENDIX C

# DATA GRAPHS

# APPENDIX D

# CONTROL CHARTS

# APPENDIX E

# COPY OF COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM BWSC-104

**Table 2-1**
**Summary of Surface Water Field Chemistry Parameters**
**Partial-RAO for Central Brook**
**Former RCA Facility**
**Burlington, MA**

| Surface Water Field Chemistry Parameters | | | | | | |
|---|---|---|---|---|---|---|
| Surface Water Location | Sample Depth (inches) | Water Column Thickness (inches) | Temperature ($^{o}$F) | pH (standard units) | Turbidity (NTU) | Date Collected |
| CVB-01 | 12 | 26 | 0.7 | 6.28 | 15 | 12/13/03 |
| CVB-02 | 12 | 38 | 1.5 | 6.11 | 33 | 12/13/03 |
| CVB-03 | 12 | 36 | 0.5 | 6.04 | 19 | 12/13/03 |
| CVB-04 | 12 | 43 | 0.6 | 5.83 | 40 | 12/13/03 |
| CVB-05 | 12 | 58 | 0.5 | 6.51 | 12 | 12/13/03 |
| CVB-06 | 2 (1) | 9 | 9.3 | 6.24 | 29 | 12/13/03 |
| SD-09 | 12 | 46 (2) | 1.9 | 6.90 | 10 | 12/13/03 |
| SD-09 | 12 | 40 (4) | 2.0 | 7.60 | 16 | 1/14/03 |
| SD-16 | 12 | 35 (3) | 1.9 | 6.10 | 49 | 12/13/03 |
| SD-16 | 12 | 43 (5) | 1.0 | 7.20 | 19 | 1/14/03 |

Notes:
(1) Sample collected at 2 inches depth due to the shallow water column
(2) Sample collected under 5 inches of ice (thickness of ice included in water column thickness)
(3) Sample collected under 3 inches of ice (thickness of ice included in water column thickness)
(4) Sample collected under 7 inches of ice (thickness of ice included in water column thickness)
(5) Sample collected under 9 inches of ice (thickness of ice included in water column thickness)

**Table 2-2**
**Summary of Surface Water Sampling Results for Metals**
**Partial-RAO for Central Brook**
**Former RCA Burlington, MA Facility**

| Sample Location Description | Sample Location Identifier | Date Sampled | Total Chromium (mg/l) | Dissolved Chromium (mg/l) | Total Copper (mg/l) | Dissolved Copper (mg/l) | Total Lead (mg/l) | Dissolved Lead (mg/l) | Total Silver (mg/l) | Dissolved Silver (mg/l) | Hardness as CaCO3 (mg/l) | Dissolved Hardness as CaCO3 (mg/l) | Turbidity (ntu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vine Brook Upstream | CVB-01 | 03/22/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 62 | 62 | 1.2 |
| | CVB-01 | 05/24/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 62 | 53 | 2.19 |
| | CVB-01 | 10/01/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 65.2 | 61 | |
| | CVB-01 | 12/07/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00159 | <0.001 | <0.0005 | <0.0005 | 63.1 | 51.5 | 1.74 |
| | CVB-01 ( Turbidity Dup) | 12/07/1999 | | | | | | | | | | | 1.74 |
| | CVB-01 | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.0016J | 0.001 | <0.0005 | <0.0001 | | | |
| | CVB-01 | 05/11/2000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 53.2 | 56 | 0.98 |
| | CVB-01 ( Turbidity Dup) | 05/11/2000 | | | | | | | | | | | 0.98 |
| | CVB-01 | 09/13/2000 | <0.0013 U | (0.0016) J | (0.0032) J | (0.0019) J | <0.0011 UJ | <0.001 | <0.0005 | <0.0005 | 44 | 39 | 6.66 J |
| | CVB-01 | 11/15/2000 | (0.0031) J | <0.003 U | <0.0026 U | (0.0017) J | <0.00097 U | <0.00075 UJ | <0.000026 U | <0.001 J | 55 | 49 | 2.03 |
| | CVB-01 (Dup) | 11/15/2000 | (0.0033) J | <0.0036 U | <0.0028 U | (0.0018) J | <0.00084 U | <0.00073 UJ | <0.000044 U | <0.001 J | 56 | 47 | 2.05 |
| | CVB-01 | 02/15/2001 | <0.004 | <0.004 | (0.0016) J | (0.0012) J | <0.00049 U | (0.00030) J | (0.000094) J | <0.001 | 83 | 81 | 1.8 |
| | CVB-01 | 02/11/2002 | 0.0024 | (0.00085) J | 0.0035 | (0.0016) J | <0.0014 U | <0.00014 | <0.00009 | <0.00018 | 89 | 85 | 2.1 |
| | CVB-01 | 12/13/2002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.001 | <0.001 | <0.0005 | <0.0005 | 79 | 79 | 2.7 |
| Central Brook - Downstream end of Southern Channel | CVB-02 | 03/22/1999 | <0.005 | <0.005 | <0.005 | 0.005 | 0.00117 | <0.001 | <0.001 | <0.001 | 67 | 59 | 29 |
| | CVB-02 | 05/24/1999 | 0.034 | 0.02 | 0.067 | 0.04 | 0.00317 | 0.00106 | 0.00083 | 0.00044 | 63 | 54 | 2.61 |
| | CVB-02 | 10/01/1999 | 0.017 | 0.021 | 0.049 | 0.06 | 0.00574 | 0.0024 | 0.00044 | 0.00046 | 70.6 | 75.6 | |
| | CVB-02 | 12/07/1999 | 0.008 | 0.0062 | 0.024 | 0.023 | 0.00168 | 0.00123 | <0.0005 | <0.0005 | 49 | 43.2 | 1.88 |
| | CVB-02 | 02/29/2000 | 0.0115 | <0.005 | 0.0064 | <0.005 | 0.0044J | 0.0011 | <0.0005 | <0.0001 | | | |
| | CVB-02 | 05/11/2000 | 0.0061 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 65.7 | 64.4 | 0.98 |
| | CVB-02 | 11/15/2000 | (0.0018) J | <0.0011 U | 0.013 | 0.008 J | <0.0015 U | <0.0011 UJ | <0.000037 U | <0.000066 UJ | 52 | 48 | 6.58 |
| | CVB-02 | 02/15/2001 | <0.00049 U | <0.004 | (0.0020) J | (0.0028) J | (0.00084) J | (0.00095) J | (0.00011) J | <0.001 | 78 | 82 | 1.8 |
| | CVB-02 | 02/11/2002 | <0.00057 U | <0.00032 | <0.002 U | (0.0017) J | <0.0011 U | (0.00019) J | <0.00009 | <0.00018 | 86 | 89 | 2.1 |
| | CVB-02 | 12/13/2002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.001 | <0.001 | <0.0005 | <0.0005 | 82 | 81 | 2.7 |
| Central Brook - Downstream end of Northern Channel | CVB-03 | 03/22/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.001 | <0.001 | 62 | 58 | 1.1 |
| | CVB-03 | 05/24/1999 | <0.005 | <0.005 | 0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 62 | 56 | 2.35 |
| | CVB-03 | 10/01/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00231 | <0.001 | <0.0001 | <0.0001 | 61 | 58.5 | |
| | CVB-03 | 12/07/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00131 | <0.001 | <0.0005 | <0.0005 | 59.8 | 50.6 | 1.37 |
| | CVB-03 | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.0016J | 0.0011 | <0.0005 | <0.0001 | | | |
| | CVB-03 | 05/11/2000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 64.4 | 58.8 | 1.05 |
| | CVB-03 | 11/15/2000 | (0.00075) J | <0.00092 U | <0.0026 U | <0.0011 UJ | <0.00078 U | <0.00046 UJ | <0.000031 U | <0.001 J | 53 | 48 | 1.85 |
| | CVB-03 | 02/15/2001 | <0.0018 U | (0.00046) J | 0.0048 | (0.0029) J | <0.00056 U | (0.00021) J | (0.000060) J | <0.001 | 75 | 80 | 1.9 |
| | CVB-03 | 02/11/2002 | <0.0016 U | (0.00044) J | 0.0036 | (0.0035) J | <0.0013 U | (0.00023) J | <0.00009 | <0.00018 | 90 | 84 | 2.3 |
| | CVB-03 | 12/13/2002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.001 | <0.001 | <0.0005 | <0.0005 | 77 | 80 | 2.7 |

**Table 2-2**
**Summary of Surface Water Sampling Results for Metals**
**Partial-RAO for Central Brook**
**Former RCA Burlington, MA Facility**

| Sample Location Description | Sample Location Identifier | Date Sampled | Total Chromium (mg/l) | Dissolved Chromium (mg/l) | Total Copper (mg/l) | Dissolved Copper (mg/l) | Total Lead (mg/l) | Dissolved Lead (mg/l) | Total Silver (mg/l) | Dissolved Silver (mg/l) | Hardness as CaCO3 (mg/l) | Dissolved Hardness as CaCO3 (mg/l) | Turbidity (ntu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vine Brook - Downstream of Central Brook | CVB-04 | 03/22/1999 | <0.005 | <0.005 | <0.005 | 0.018 | <0.001 | <0.001 | <0.001 | <0.001 | 62 | 56 | 1.2 |
| | CVB-04 (Dup) | 03/22/1999 | <0.005 | <0.005 | <0.005 | 0.007 | <0.001 | <0.001 | <0.001 | <0.001 | 65 | 59 | 1.2 |
| | CVB-04 | 05/24/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 62 | 53 | 1.88 |
| | CVB-04 (Dup) | 05/24/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 56 | 55 | 2.3 |
| | CVB-04 | 10/01/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 67.3 | 58.5 | |
| | CVB-04 (Dup) | 10/01/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 64.8 | 61 | |
| | CVB-04 | 12/07/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00223 | 0.001 | <0.0005 | <0.0005 | 62.3 | 53.5 | 2.08 |
| | CVB-04 (Dup) | 12/07/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00205 | 0.00148 | <0.0005 | <0.0005 | 65.6 | 53.5 | 1.13 |
| | CVB-04 | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.0056J | 0.0011 | <0.0005 | <0.0001 | | | |
| | CVB-04 (Dup) | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.0015J | 0.001 | <0.0005 | <0.0001 | | | |
| | CVB-04 | 05/11/2000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 64.8 | 66.6 | 1.07 |
| | CVB-04 (Dup) | 05/11/2000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 64.3 | 70.1 | 1.2 |
| | CVB-04 | 09/13/2000 | <0.0019 UJ | (0.00088) J | (0.00073) J | (0.0028) J | <0.00049 UJ | <0.001 | <0.0005 | <0.0005 | 69 | 62 | 16.3 J |
| | CVB-04 (Dup) | 09/13/2000 | 0.0054 | (0.0016) J | 0.0066 J | (0.0013) J | 0.0087 J | (0.0003) J | (0.00014) J | <0.0005 | 80 | 63 | 4.67 J |
| | CVB-04 | 11/15/2000 | 0.0055 | <0.0019 U | 0.0059 | (0.0023) J | 0.0028 | <0.00084 UJ | <0.000091 U | <0.001 J | 51 | 44 | 3.01 |
| | CVB-04 | 02/15/2001 | <0.004 | <0.004 | (0.0017) J | (0.0015) J | <0.00046 U | (0.00023) J | (0.000038) J | <0.001 | 80 | 79 | 1.6 |
| | CVB-04 (Dup) | 02/15/2001 | <0.00053 U | <0.004 | (0.0019) J | (0.0017) J | <0.00068 U | (0.00026) J | <0.00002 | <0.001 | 79 | 81 | 1.6 |
| | CVB-04 | 02/11/2002 | <0.00087 U | <0.00032 | <0.0027 U | (0.002) J | <0.0012 U | (0.00021) J | <0.00009 | <0.00018 | 92 | 89 | 2.1 |
| | CVB-04(Dup) | 02/11/2002 | <0.0015 U | <0.00032 U | <0.0024 U | (0.0024) J | <0.0012 U | (0.00025) J | <0.00009 U | <0.00018 U | 90 | 94 | 2.2 |
| | CVB-04 | 12/13/2002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.001 | <0.001 | <0.0005 | <0.0005 | 83 | 80 | 2.9 |
| Vine Brook - Further Downstream of Central Brook | CVB-05 | 03/22/1999 | <0.005 | <0.005 | <0.005 | 0.011 | <0.001 | <0.001 | <0.001 | <0.001 | 61 | 57 | 1.4 |
| | CVB-05 | 05/24/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 62 | 53 | 1.37 |
| | CVB-05 | 10/01/1999 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0001 | <0.0001 | 65.6 | 61.4 | |
| | CVB-05 | 12/07/1999 | <0.005 | <0.005 | <0.005 | <0.005 | 0.00493 | <0.001 | <0.0005 | <0.0005 | 63.1 | 53.5 | 1.33 |
| | CVB-05 | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.0019J | <0.001 | <0.0005 | <0.0001 | | | |
| | CVB-05 | 05/11/2000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 65.1 | 69.4 | 1.57 |
| | CVB-05 | 09/13/2000 | <0.0011 UJ | <0.005 | <0.005 | (0.0025) J | <0.001 J | <0.001 | <0.0005 | <0.0005 | 71 | 65 | 1.01 J |
| | CVB-05 | 11/15/2000 | (0.0012) J | <0.00078 U | <0.0028 U | <0.0013 UJ | <0.0016 U | <0.00063 UJ | <0.001 | <0.001 J | 52 | 44 | 1.8 |
| | CVB-05 | 02/15/2001 | <0.004 | <0.004 | (0.0018) J | (0.0016) J | <0.00063 U | (0.00025) J | (0.000035) J | <0.001 | 79 | 83 | 1.6 |
| | CVB-05 | 02/11/2002 | <0.00074 U | <0.00032 | <0.0025 U | (0.002) J | <0.0011 U | (0.00059) J | <0.00009 | <0.00018 | 91 | 91 | 1.9 |
| | CVB-05 (Turbidity Dup) | 02/11/2002 | | | | | | | | | | | 1.9 |
| | CVB-05 | 12/13/2002 | <0.002 | <0.002 | 0.015 | <0.002 | 0.0018 | <0.001 | <0.0005 | <0.0005 | 80 | 79 | 4.2 |

**Table 2-2**
**Summary of Surface Water Sampling Results for Metals**
**Partial-RAO for Central Brook**
**Former RCA Burlington, MA Facility**

| Sample Location Description | Sample Location Identifier | Date Sampled | Total Chromium (mg/l) | Dissolved Chromium (mg/l) | Total Copper (mg/l) | Dissolved Copper (mg/l) | Total Lead (mg/l) | Dissolved Lead (mg/l) | Total Silver (mg/l) | Dissolved Silver (mg/l) | Hardness as CaCO3 (mg/l) | Dissolved Hardness as CaCO3 (mg/l) | Turbidity (ntu) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central Brook - Upstream | CVB-06 | 03/22/1999 | 0.043 | <0.005 | 0.092 | <0.005 | 0.0402 | <0.001 | 0.00112 | <0.001 | 79 | 79 | 15 |
| | CVB-06 | 05/24/1999 | 0.014 | <0.005 | 0.018 | <0.005 | 0.00587 | <0.001 | 0.00057 | <0.0001 | 52 | 50 | 4.76 |
| | CVB-06 | 10/01/1999 | 0.01 | <0.005 | 0.03 | 0.007 | 0.00406 | <0.001 | 0.00023 | <0.0001 | 96.8 | 91 | |
| | CVB-06 | 12/07/1999 | <0.005 | <0.005 | 0.0102 | 0.0067 | 0.0018 | 0.001 | <0.0005 | <0.0005 | 29.8 | 26.2 | 2.55 |
| | CVB-06 | 02/29/2000 | <0.005 | <0.005 | <0.005 | <0.005 | 0.001J | <0.001 | <0.0005 | <0.0001 | | | |
| | CVB-06 | 05/11/2000 | <0.025 | <0.005 | 0.32 | <0.005 | <0.001 | <0.001 | <0.0005 | <0.0005 | 168 | 41.7 | 62.8 |
| | CVB-06 | 09/13/2000 | <0.0024 UJ | <0.005 | (0.0038) J | 0.0069 | <0.00058 UJ | <0.001 | <0.0005 | <0.0005 | 190 | 170 | 35.9 J |
| | CVB-06 | 11/15/2000 | 0.024 J | 0.027 | 0.24 | 0.041 J | 0.063 | 0.028 J | 0.007 | <0.001 J | 82 | 58 | 300 |
| | CVB-06 | 02/15/2001 | (0.0031) J | <0.004 | 0.0047 | (0.0036) J | (0.0013) J | (0.00022) J | (0.000041) J | <0.001 | 71 | 72 | 8.6 |
| | CVB-06 | 02/11/2002 | <0.00088 U | <0.00032 | 0.0052 | 0.0033 | <0.0012 U | <0.00014 | <0.00009 | <0.00018 | 59 | 58 | 6.8 |
| | CVB-06 | 12/13/2002 | <0.002 | <0.002 | 0.0022 | <0.002 | <0.001 | <0.001 | <0.0005 | <0.0005 | 180 | 180 | 2.9 |
| Central Brook - Pond (North) | SD-09 | 12/13/2002 | 0.0046 | 0.0025 | 0.013 | 0.0069 | 0.0011 | <0.001 | <0.0005 | <0.0005 | 95 | 93 | 4 |
| | SD-09(Dup) | 12/13/2002 | 0.0047 | 0.0036 | 0.011 | 0.0084 | 0.001 | <0.001 | <0.0005 | <0.0005 | 75 | 78 | 3.6 |
| | SD-09 | 01/14/2003 | NA | NA | 0.011 | 0.011 | NA | NA | NA | NA | 150 | 150 | NA |
| Central Brook - Pond (South) | SD-16 | 12/13/2002 | 0.0071 | 0.0028 | 0.013 | 0.0081 | <0.001 | <0.001 | <0.0005 | <0.0005 | 81 | 80 | 1.9 |
| | SD-16 | 01/14/2003 | NA | NA | 0.011 | 0.0099 | NA | NA | NA | NA | 150 | 160 | NA |

Notes:
< = Less than reporting limit. Concentration is the reporting limit.
J = Estimated Concentration.
NA = Not Analyzed or Not Applicable
() = Detected at less than the reporting limit.

**Table 2-3**
**Summary of Sediment Sampling Results**
**Partial-RAO for Central Brook**
**Former RCA Facility Site**
**Burlington, MA**

| Sample Location Description | Sample Location Identifier | Date Sampled | Chromium (mg/kg) | Copper (mg/kg) | Lead (mg/kg) | Silver (mg/kg) | Total Solids (%) |
|---|---|---|---|---|---|---|---|
| Vine Brook - Upstream | SED-A | 11/18/1999 | 28.9 J | 58.5 | 97.0 | 2.4 J | 28.9 |
| | SED-A | 02/29/2000 | 31.7 J | 55.8 | 88.1 J | 2.99 | 32.5 |
| | SED-A | 05/02/2000 | 4.18 | 4.03 | 7.62 | <0.0265 J | 68.5 |
| | SED-A | 08/18/2000 | 12 | 13.6 | 50.4 | <1.117 | 28.2 |
| | SED-A | 11/14/2000 | 16 | 26 J | 66 J | <3.9 | 41.0 |
| | SED-A | 02/14/2001 | 19 J | 52 | 95 J | <5.3 | 23.0 |
| | SED-A | 05/09/2001 | 11 J | 14 | <46 U | <2.6 | 48.3 |
| | SED-A (1) | 08/29/2001 | 9.1 J | 3.1 | 18 J | <1.8 | 71.0 |
| | SED-A (2) | 08/29/2001 | 5.5 J | 5.3 | 14 J | <1.7 | 74.0 |
| | SED-A (1) | 11/13/2001 | 5 J | 2.7 J | 15 J | 1.9 J | 71.9 |
| | SED-A (2) | 11/13/2001 | 6.1 J | 3.4 J | 18 J | 2.2 J | 70.8 |
| | SED-A1 | 02/20/2002 | 7.7 | 5.6 | 14 | 0.14 J | 61.4 |
| | SED-A2 | 02/20/2002 | 4.6 | 1.7 J | 9 | 0.097 J | 73.3 |
| | SED-A1 | 05/16/2002 | 20 J | 25 J | 65 J | 0.62 J | 33.7 |
| | SED-A2 | 05/16/2002 | 16 J | 17 J | 46 J | 0.53 J | 41.1 |
| | SED-A1 | 08/29/2002 | 15 | 14 | 28 | 1.2 | 45.7 |
| | *SED-A* | *11/19/2002* | *14* | *16* | *36* | *<2.0* | *49.7J* |
| | *SED-A (DUP)* | *11/19/2002* | *20* | *22* | *58* | *<0.92* | *41.4J* |
| | *SED-A* | *12/13/2002* | *11* | *17* | *42* | *<0.83* | *59.9* |
| Central Brook - Downstream end of Southern Channel | SED-B | 11/18/1999 | 425J | 404 | 141 | 3.2J | 17.9 |
| | SED-B | 05/02/2000 | 20,400 | 15,000 | 450 | 93.2J | 10.3 |
| | SED-B | 08/18/2000 | 1,290 | 1,960 | 208 | 16.8 | 15.7 |
| | SED-B | 11/14/2000 | 490 | 350 J | 200 J | <11 | 14.3 |
| | SED-B | 02/14/2001 | 700 | 420 | 150 J | 8.0 J | 17.0 |
| | SED-B | 05/09/2001 | 28,000 | 8,000 | 730 | 120 | 18.1 |
| | SED-B | 08/29/2001 | 2,600 | 1,100 | 230 | 19 | 16.1 |
| | SED-B | 11/13/2001 | 110 | 96 | 130 | 6.9 J | 22.6 |
| | SED-B | 02/20/2002 | 86 | 7 | 92 | 0.61 J | 19.7 |
| | SED-B | 05/16/2002 | 380 J | 190 J | 70 J | 1.6 J | 17.1 |
| | *SED-B* | 08/29/2002 | 86 | 50 | 130 | 0.45 J | 13.8 |
| | *SED-B* | *11/21/2002* | *<54* | *<110* | *<54* | *<27* | *19* |
| Central Brook - Downstream end of Northern Channel | SED-C | 11/18/1999 | 2,280 J | 1,960 | 216 | 21J | 10.8 |
| | SED-C (Dup) | 11/18/1999 | 5,350 J | 3,170 | 340 | 40J | 10.7 |
| | SED-C | 05/02/2000 | 5,980 | 3,140 | 354 | 65.5J | 10.1 |
| | SED-C (Dup) | 05/02/2000 | 6,360 | 2,830 | 363 | 63.3J | 12.3 |
| | SED-C | 08/18/2000 | 4,190 | 2,090 | 294 | 44.9 | 10.4 |
| | SED-C | 11/14/2000 | 5,600 | 2700 J | 370 J | 53 | 10.3 |
| | SED-C | 02/14/2001 | 6,400 | 3,000 | 360 | 63 | 10.0 |
| | SED-C | 05/09/2001 | 7,800 | 3,500 | 540 | 80 | 20.7 |
| | SED-C | 08/29/2001 | 5,800 | 2,600 | 370 | 46 | 19.1 |
| | SED-C | 11/13/2001 | 3,000 | 1,800 | 260 | 43 | 20.9 |
| | SED-C | 02/20/2002 | 9,200 | 5,500 | 480 | 95 | 23.7 |
| | SED-C | 05/16/2002 | 110 J | 62 J | 23 J | 1 J | 20.6 |
| | SED-C | 08/29/2002 | 9,000 | 3,600 | 450 | 81 | 12.2 |
| | *SED-C* | *11/16/2002* | *21* | *<28* | *<14* | *<7* | *68* |
| Vine Brook - Between Southern and Northern Central Brook Channels | SED-D | 11/18/1999 | 102 J | 41.5 | 21.7 | 0.51 J | 45.7 |
| | SED-D | 02/29/2000 | 80.9 J | 78.5 | 35.8J | 0.807 | 43.7 |
| | SED-D (Dup) | 02/29/2000 | 166 J | 101 | 61.1 J | 1.1 | 29.9 |
| | SED-D | 05/02/2000 | 21.7 | 7.98 | 8.58 | <0.0265 J | 59.9 |
| | SED-D | 08/18/2000 | 227 | 98.3 | 47.2 | 2.74 | 28.6 |
| | SED-D | 11/14/2000 | 31 | 14 J | <18 | <2.2 | 73.6 |
| | SED-D | 02/14/2001 | 260 | 160 | 130 | <3.8 | 33.0 |
| | SED-D (Dup) | 02/14/2001 | 190 | 130 | 98 | <3.5 | 36.0 |
| | SED-D | 05/09/2001 | 83 | 34 | <28 U | <2.7 | 45.6 |
| | SED-D (1) | 08/29/2001 | 15 | 10 | 13 J | <1.9 | 64.9 |
| | SED-D (2) | 08/29/2001 | 28 | 16 | 13 J | <1.8 | 68.1 |
| | SED-D (2)(Dup) | 08/29/2001 | 21 | 17 | 14 J | <1.9 | 66.6 |
| | SED-D (1) | 11/13/2001 | 160 | 76 | 20 J | 2.8 J | 67.6 |
| | SED-D (2) | 11/13/2001 | 6.2 J | 4.7 J | <9.5 | 2.4 J | 78.8 |
| | SED-D1 | 02/20/2002 | 39 | 2 | 20 | 0.11 J | 57.9 |
| | SED-D2 | 02/20/2002 | 20 | 17 | 18 | 0.23 J | 70.2 |
| | SED-D1 | 05/16/2002 | 31 J | 18 J | 9.6 J | 0.3 J | 66.7 |
| | SED-D2 | 05/16/2002 | 59 J | 40 J | 19 J | 0.42 J | 56.2 |
| | SED-D1 | 08/29/2002 | 55 | 38 | 33 | 0.44 J | 49 |
| | *SED-D1* | *11/19/2002* | *43* | *23* | *12 J* | *<1.7* | *60.7J* |
| | *SED-D2* | *11/19/2002* | *120* | *110* | *27* | ***1.7*** | *59.4J* |
| | *SED-D* | *12/13/2002* | *69* | *47* | *20* | *<0.92* | *31.3* |

**Table 2-3**
**Summary of Sediment Sampling Results**
**Partial-RAO for Central Brook**
**Former RCA Facility Site**
**Burlington, MA**

| Sample Location Description | Sample Location Identifier | Date Sampled | Chromium (mg/kg) | Copper (mg/kg) | Lead (mg/kg) | Silver (mg/kg) | Total Solids (%) |
|---|---|---|---|---|---|---|---|
| Vine Brook - Downstream of Central Brook | SED-E | 11/18/1999 | 3.39 J | <0.12 | <1.945 | <0.0265 J | 75.7 |
| | SED-E | 02/29/2000 | 227 J | 180 | 254 J | 3.89 | 33.5 |
| | SED-E (TOC Dup) | 02/29/2000 | NA | NA | NA | NA | NA |
| | SED-E | 05/02/2000 | 2.95 | <0.135 | <2.52 | <0.0265 J | 76.9 |
| | SED-E | 08/18/2000 | 3.85 | <0.174 | <3.252 | <0.406 | 77.5 |
| | SED-E | 11/14/2000 | <1.5 | <0.92 | <18 | <2.2 | 74.2 |
| | SED-E | 02/14/2001 | 61 | 32 | 67 | <2.4 | 53.0 |
| | SED-E | 03/29/2001 | 36 | 94 | <23 | 7 J | 32.8 |
| | SED-E | 05/09/2001 | 41 | 20 | <38 U | 2.9 J | 53.7 |
| | SED-E (Dup) | 05/09/2001 | 13 | 7.5 J | <21 U | <1.8 | 70.7 |
| | SED-E (1) | 08/29/2001 | 13 | 6.3 | 17 J | <1.9 | 65.1 |
| | SED-E (2) | 08/29/2001 | 11 | 5.3 | 14 J | <1.8 | 70.1 |
| | SED-E (1) | 11/13/2001 | 10 | 4.0 J | 10 J | 2.5 J | 73.9 |
| | SED-E (2) | 11/13/2001 | 8.7 J | 4.7 J | 18 J | 2.8 J | 68.4 |
| | SED-E (1) | 02/20/2002 | 14 | 7.6 | 10 | <0.066 | 64.9 |
| | SED-E (2) | 02/20/2002 | 35 | 18 | 33 | <0.062 | 69 |
| | SED-E (1) | 05/16/2002 | 13 J | 7.2 J | 8.8 J | 0.096 J | 59.7 |
| | SED-E (1) (Dup) | 05/16/2002 | 15 J | 6.1 J | 7.4 J | 0.12 J | 63.9 |
| | SED-E (2) | 05/16/2002 | 22 J | 14 J | 18 J | 0.18 J | 49 |
| | SED-E1 | 08/29/2002 | 29 | 19 | 20 | 0.25 J | 51.2 |
| | SED-E2 | 08/29/2002 | 32 | 17 | 17 | 0.21 J | 58.3 |
| | *SED-E* | *11/19/2002* | *9.7* | *4.1* | *4.8 J* | *<1.4* | *69.3J* |
| | *SED-E* | *12/13/2002* | *24* | *15* | *14* | *<1.6* | *65.8* |
| | *SED-E (DUP)* | *12/13/2002* | *12* | *8.6* | *8.7* | *<0.83* | *60.1* |
| Vine Brook - Further Downstream of Central Brook | SED-F | 11/18/1999 | 5.85 J | 3.51 | 4.11 | <0.0265 J | 70.1 |
| | SED-F | 02/29/2000 | 7.61 J | 5.58 | 7.78 J | <0.125 | 64.9 |
| | SED-F | 05/02/2000 | 2.91 | 1.51 | <2.52 | <0.0265 J | 76.3 |
| | SED-F (TOC Dup) | 05/02/2000 | NA | NA | NA | NA | NA |
| | SED-F | 08/18/2000 | 4.98 | 2.47 | <3.433 | <0.429 | 73.4 |
| | SED-F (Dup) | 08/18/2000 | 3.97 | 1.89 J | <8.936 | <1.117 | 75.8 |
| | SED-F | 11/14/2000 | 41 | 30 J | <32 | <4 | 40.4 |
| | SED-F (Dup) | 11/14/2000 | 28 | 6.8 J | 91 J | <2.3 | 69.6 |
| | SED-F | 01/11/2001 | 4.9 | 2.9 | <7.5 | NA | 74.4 |
| | SED-F | 02/14/2001 | 11 J | 7.7 J | <11 | <1.9 | 65.0 |
| | SED-F | 05/09/2001 | 23 | 13 | <33 U | <2.2 | 56.8 |
| | SED-F (1) | 08/29/2001 | 43 | 24 | 23 J | <2.7 | 46.8 |
| | SED-F (2) | 08/29/2001 | 30 | 13 | 24 J | <2.9 | 43.5 |
| | SED-F (1) | 11/13/2001 | 11 | 7.4 J | 13 J | 2.0 J | 69.4 |
| | SED-F (2) | 11/13/2001 | 27 | 19 | 19 J | 3.1 J | 59.2 |
| | SED-F (2) (Dup) | 11/13/2001 | 43 | 27 | 33 J | 3.7 J | 43 |
| | SED-F1 | 02/20/2002 | 14 | 5.3 | <6.9 | 0.31 J | 31.8 |
| | SED-F (1) (DUP) | 02/20/2002 | 19 | 8.1 | 6.2 J | <0.11 U | 40.7 |
| | SED-F (2) | 02/20/2002 | 23 | 2.6 J | <6.8 | <0.13 | 32.5 |
| | SED-F1 | 05/16/2002 | 20 J | 12 J | 12 J | 0.12 J | 49.6 |
| | SED-F2 | 05/16/2002 | 19 J | 13 J | 13 J | 0.17 J | 55.3 |
| | SED-F1 | 08/29/2002 | 17 | 22 | 8 | <0.082 | 52.3 |
| | SED-F1 (DUP) | 08/29/2002 | 20 | 10 | 9 | <0.075 | 57.6 |
| | *SED-F* | *11/19/2002* | *11* | *6* | *5.1 J* | *<1.9* | *52.7J* |
| | *SED-F1* | *12/13/2002* | *14* | *9.5* | *9.5* | *<0.83* | *54.2* |
| | *SED-F2* | *12/13/2002* | *17* | *14* | *11* | *<0.76* | *60.6* |

Notes:
< = Less than Method Detection Limit (MDL).
J = Estimated Concentration or reporting limit
U = Estimated Concentration qualified by data validator
NA - Not Analyzed or Not Applicable
Italics represents the most recent data in Vine Brook

## Table 2-4

## Summary of Sediment Depth Measurements
## Partial-RAO for Central Brook
## Former RCA Facility
## Burlington, MA

| Sampling Location | Depth to Sediment from Top of Staff Gauge (inches) | | | |
|---|---|---|---|---|
| | May 16, 2002 | August 28, 2002 | November 19, 2002 | December 13, 2002 |
| SED-A | 31 | 27 | 35 | 38 |
| SED-B | 20 | 21 | NM | NM |
| SED-C | 33 | 32 | NM | NM |
| SED-D | 39 | 18 | 19 | 21 |
| SED-E | 35 | 27 | 30 | 24 |
| SED-F | 42 | 27 | 31 | 25 |

NM = Not Measured (Stream segment remediated or in the process of being remediated.)
NS = Not Sampled

## TABLE 4-1

## Stage II Environmental Risk Characterization - Weight of Evidence Evaluation
## Partial-RAO for Central Brook
## Former RCA Facility
## Burlington, MA

| Measurement Endpoint | Measurement Result - Central Brook (stream and pond sediments) | Measurement Result - Central Brook Wetlands | Weight of Evidence | | |
|---|---|---|---|---|---|
| | | | High | Medium | Low |
| Benchmark Comparison | Strong indication of toxicity | Moderate indication of toxicity | | ✓ | |
| AVS/SEM Data | Indeterminate - no sulfides detected | Indeterminate - no sulfides detected | | ✓ | |
| Benthic Qualitative Survey | Moderate indication of toxicity (fewer species at impacted locations), however evidence of survival | Moderate indication of toxicity (fewer species at impacted locations), however evidence of survival | | | ✓ |
| Toxicity Testing | Strong indication of toxicity and sublethal effects | No indication of mortality, strong indication of sublethal effects | ✓ | | |
| Predator Survey | Moderate indication of no significant effect on vertebrate predator species | Moderate indication of no significant effect on vertebrate predator species | ✓ | | |

Notes: Table originally presented in the Phase II Report (EMCON 1997) as Table 6-24, excluding information on the predator survey

**Predicted Survival of *Hyalella azteca* in Central Brook Sediments Based on Copper and Chromium Concentrations**
**Partial-RAO for Central Brook**
**Former RCA Facility**
**Burlington, MA**

| Copper Concentration (mg/kg) | Chromium Concentration (mg/kg) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 |
| 0 | **0.909** | **0.893** | **0.875** | **0.854** | **0.830** | **0.803** | **0.772** | **0.739** | **0.703** | **0.664** | **0.623** | **0.579** | **0.535** | *0.490* |
| 50 | **0.890** | **0.871** | **0.849** | **0.824** | **0.797** | **0.766** | **0.732** | **0.695** | **0.655** | **0.614** | **0.570** | **0.525** | *0.480* | *0.436* |
| 100 | **0.866** | **0.844** | **0.819** | **0.790** | **0.759** | **0.724** | **0.687** | **0.647** | **0.605** | **0.561** | **0.516** | *0.471* | *0.426* | *0.383* |
| 150 | **0.839** | **0.813** | **0.784** | **0.752** | **0.717** | **0.679** | **0.638** | **0.595** | **0.551** | **0.506** | *0.461* | *0.417* | *0.374* | *0.333* |
| 200 | **0.807** | **0.777** | **0.745** | **0.709** | **0.670** | **0.629** | **0.586** | **0.542** | *0.497* | *0.452* | *0.408* | *0.365* | *0.324* | *0.286* |
| 250 | **0.771** | **0.737** | **0.701** | **0.662** | **0.620** | **0.577** | **0.532** | *0.487* | *0.442* | *0.399* | *0.356* | *0.316* | *0.278* | *0.244* |
| 300 | **0.730** | **0.693** | **0.653** | **0.611** | **0.568** | **0.523** | *0.478* | *0.433* | *0.389* | *0.347* | *0.308* | *0.271* | *0.237* | *0.206* |
| 350 | **0.685** | **0.645** | **0.602** | **0.558** | **0.513** | *0.468* | *0.424* | *0.380* | *0.339* | *0.300* | *0.263* | *0.230* | *0.199* | *0.172* |
| 400 | **0.636** | **0.593** | **0.549** | **0.504** | *0.459* | *0.415* | *0.372* | *0.330* | *0.292* | *0.256* | *0.223* | *0.193* | *0.167* | *0.143* |
| 450 | **0.584** | **0.539** | *0.494* | *0.449* | *0.405* | *0.363* | *0.322* | *0.284* | *0.249* | *0.217* | *0.188* | *0.162* | *0.139* | *0.118* |
| 500 | **0.530** | *0.485* | *0.440* | *0.396* | *0.354* | *0.314* | *0.276* | *0.242* | *0.210* | *0.182* | *0.156* | *0.134* | *0.115* | *0.097* |
| 550 | *0.475* | *0.431* | *0.387* | *0.345* | *0.306* | *0.269* | *0.235* | *0.204* | *0.176* | *0.152* | *0.130* | *0.111* | *0.094* | *0.080* |
| 600 | *0.421* | *0.378* | *0.337* | *0.298* | *0.261* | *0.228* | *0.198* | *0.171* | *0.147* | *0.126* | *0.107* | *0.091* | *0.077* | *0.065* |
| 650 | *0.369* | *0.328* | *0.290* | *0.254* | *0.221* | *0.192* | *0.165* | *0.142* | *0.121* | *0.103* | *0.088* | *0.074* | *0.063* | *0.053* |
| 700 | *0.320* | *0.282* | *0.247* | *0.215* | *0.186* | *0.160* | *0.137* | *0.117* | *0.100* | *0.085* | *0.072* | *0.061* | *0.051* | *0.043* |

Notes:

Toxicity test performed in November 1996 by EnviroSystems, Inc. According to the ASTM (1991) protocol. Also Appendix C of Phase III Addendum (Shaw 2002)

Bold represents copper and chromium concentrations corresponding to a survival rate of 50% or greater (no significant risk)

Italics represent copper and chromium concentrations corresponding to a survival rate of less than 50% (significant risk)

To use table, find copper and chromium concentrations to predict survival rate of *Hyalella azteca*, for example:

100 mg/kg copper and 700 mg/kg chromium = 65% survival rate or no significant risk

600 mg/kg copper and 100 mg/kg chromium = 38% survival rate or significant risk

**Table 4-3**
**Post-Remediation Sediment Exposure Point Concentrations**
**Partial-RAO for Central Brook**
**Former RCA Facility**
**Burlington, MA**

| SAMPLE RESULTS PRIOR TO REMEDIATION | | | | SAMPLE RESULTS POST-REMEDIATION | | | |
|---|---|---|---|---|---|---|---|
| SITE LOCATION | DATE | CONCENTRATION (mg/kg) | | SITE LOCATION REMEDIATED? | DATE OF POST-EX SAMPLE | CONCENTRATION (mg/kg) | |
| | | CHROMIUM | COPPER | | | CHROMIUM | COPPER |
| **UPPER BROOK** | | | | | | | |
| SD-19 | 09/07/2001 | 28 | 41 | ✓ | 11/15/2002 | **13** | 54 |
| ESD-29 | 10/17/1996 | 45 | 75 | | | 45 | 75 |
| ESD-5 | 10/16/1996 | **2.5** | 270 | | | 2.5 | 270 |
| ESD-44 | 02/12/1997 | 330 | 340 | | | 330 | 340 |
| SD-20 | 09/07/2001 | 43 | 450 | ✓ | 11/10/2002 | 54 | 260 |
| ESD-48 | 02/12/1997 | 670 | 530 | | | 670 | 530 |
| ESD-44B | 02/12/1997 | 140 | 640 | | | 140 | 640 |
| SD-21 | 09/07/2001 | 1100 | 870 | ✓ | 11/10/2002 | 780 | 300 |
| ESD-51 | 02/12/1997 | 750 | 900 | ✓ | 11/15/2002 | 42 | 50 |
| | | | | | | | |
| **MEAN OF ALL SAMPLES IN UPPER BROOK BEFORE REMEDIATION** | | 345 | 457 | **MEAN OF SAMPLES AFTER REMEDIATION** | | 231 | 280 |
| | | | | | | | |
| **POND** | | | | | | | |
| SD-08 | 09/07/2001 | 50 | 230 | ✓ | 10/15/2002 | **7** | **13.5** |
| SD-10 | 09/07/2001 | 140 | 440 | ✓ | 10/25/2002 | 36 | 90 |
| ESD-54 | 02/12/1997 | 900 | 610 | ✓ | 10/31/2002 | **16** | **32** |
| SD-06 | 09/07/2001 | 360 | 620 | ✓ | 10/10/2002 | *50* | *46* |
| SD-16 | 09/06/2001 | 230 | 810 | ✓ | 11/06/2002 | **16.5** | **33** |
| ESD-55 | 02/12/1997 | 1700 | 850 | ✓ | see SD-14 | | |
| ESD-53 | 02/12/1997 | 330 | 870 | ✓ | see SD-9 | | |
| CB-3 | 11/21/1996 | 760 | 900 | ✓ | see SD-17 | | |
| SD-09 | 09/07/2001 | 1800 | 1600 | ✓ | 10/15/2002 | 22 | **13.5** |
| SD-11 | 09/07/2001 | 930 | 1900 | ✓ | 10/25/2002 | **15** | **29** |
| SD-18 | 09/06/2001 | 2000 | 2500 | ✓ | 11/10/2002 | 77 | 110 |
| SD-07 | 09/07/2001 | 3500 | 3100 | ✓ | 10/10/2002 | *180* | *210* |
| SD-12 | 09/06/2001 | 14000 | 3100 | ✓ | 11/04/2002 | **17** | **34** |
| SD-17 | 09/06/2001 | 7300 | 3400 | ✓ | 11/15/2002 | **19** | **38.5** |
| SD-13 | 09/06/2001 | 6200 | 5000 | ✓ | 11/04/2002 | **17** | **34** |
| SD-14 | 09/06/2001 | 3400 | 5700 | ✓ | 11/06/2002 | 40 | **36** |
| SD-15 | 09/06/2001 | 5000 | 7600 | ✓ | 11/06/2002 | 200 | 190 |
| | | | | | | | |
| **MEAN OF ALL SAMPLES IN POND BEFORE REMEDIATION** | | 2859 | 2308 | **MEAN OF SAMPLES AFTER REMEDIATION** | | 51 | 65 |
| | | | | | | | |

**Table 4-3**
**Post-Remediation Sediment Exposure Point Concentrations**
**Partial-RAO for Central Brook**
**Former RCA Facility**
**Burlington, MA**

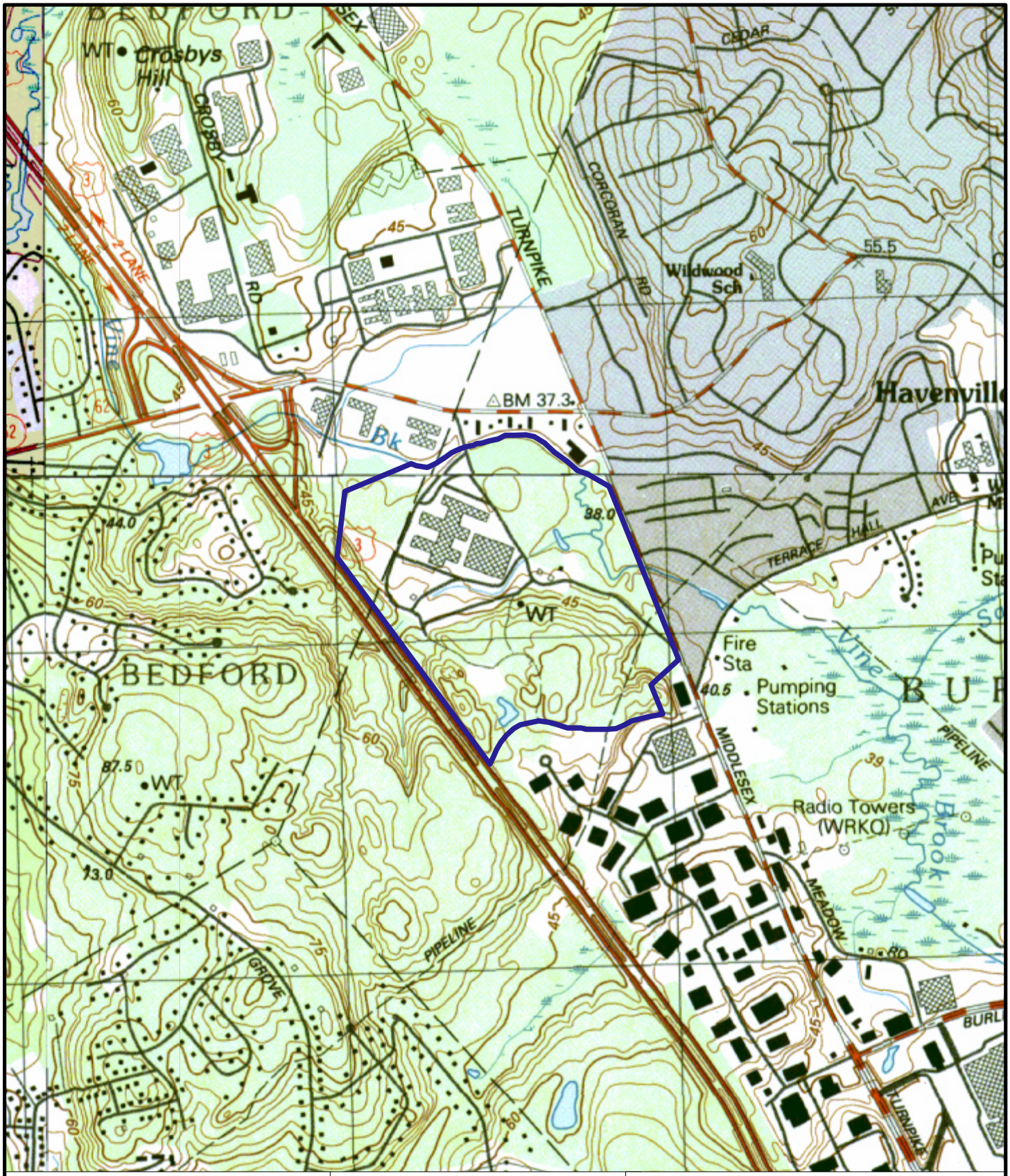
| SAMPLE RESULTS PRIOR TO REMEDIATION | | | | SAMPLE RESULTS POST-REMEDIATION | | | |
|---|---|---|---|---|---|---|---|
| SITE LOCATION | DATE | CONCENTRATION (mg/kg) | | SITE LOCATION REMEDIATED? | DATE OF POST-EX SAMPLE | CONCENTRATION (mg/kg) | |
| | | CHROMIUM | COPPER | | | CHROMIUM | COPPER |
| **NORTH CHANNEL** | | | | | | | |
| ESD-60 | 02/12/1997 | 140 | 92 | ✓ | 11/12/2002 | 280 | 370 |
| ESD-61 | 02/12/1997 | 190 | 530 | ✓ | 11/16/2002 | **8** | **16** |
| ESD-56 | 02/12/1997 | 900 | 890 | ✓ | 11/11/2002 | 44 | **39.5** |
| SD-04 | 09/07/2001 | 3400 | 2400 | ✓ | 11/16/2002 | **21** | **41.5** |
| SD-05 | 09/07/2001 | 6800 | 3800 | ✓ | 11/12/2002 | 40 | **36** |
| SED-C | Mean* | 4179 | 2330 | ✓ | 11/16/2002 | 21 | **14** |
| | | | | | | | |
| **MEAN OF ALL SAMPLES IN NORTH CHANNEL BEFORE REMEDIATION** | | 2602 | 1674 | **MEAN OF SAMPLES AFTER REMEDIATION** | | 69 | 86 |
| **SOUTH CHANNEL** | | | | | | | |
| ESD-66 | 02/12/1997 | 12 | 12 | | | 12 | 12 |
| ESD-62 | 02/12/1997 | 88 | 40 | | | 88 | 40 |
| ESD-58 | 02/12/1997 | 36 | 51 | | | 36 | 51 |
| ESD-63 | 02/12/1997 | 120 | 55 | ✓ | 11/24/2002 | 20 | **7.5** |
| SD-01 | 09/06/2001 | 250 | 490 | | | 250 | 490 |
| ESD-64 | 02/12/1997 | 1600 | 1600 | ✓ | 11/12/2002 | **29** | **60** |
| ESD-6 | 10/16/1996 | 2800 | 1600 | ✓ | see SED-B | | |
| SD-03 | 09/06/2001 | 1200 | 1900 | ✓ | 11/11/2002 | **10** | **20** |
| SD-02 | 09/06/2001 | 2000 | 10000 | ✓ | 11/11/2002 | 49 | **44.5** |
| SED-B | Mean* | 6945 | 3883 | ✓ | 11/21/2002 | **27** | **55** |
| | | | | | | | |
| **MEAN OF ALL SAMPLES IN SOUTH CHANNEL BEFORE REMEDIATION** | | 1505 | 1963 | **MEAN OF SAMPLES AFTER REMEDIATION** | | 58 | 87 |

Notes:
*Italics = estimated quantity due to data validation*
**Bold** data = metal not detected, concentration shown half the reporting limit
Shaded location = location addressed by remediation, post excavation sample shown in right hand column
* Mean of samples taken at location from 3/99 to 11/01

**Table 4-4**
**Comparison of Pond Surface Water Concentrations to Applicable Standards**
**Partial-RAO for Central Brook**
**Former RCA Facility**
**Burlington, MA**

| Sampling Location | Date | Hardness | Chromium Concentration | Copper Concentration |
|---|---|---|---|---|
| **SD-09** | 12/13/2002* | 95 | 0.0036 | 0.0084 |
| | 01/14/2003 | 150 | | 0.011 |
| **SD-16** | 12/13/2002 | 81 | 0.0028 | 0.0081 |
| | 01/14/2003 | 160 | | 0.0099 |
| **Pond Mean** | | 121.5 | 0.0032 | 0.00935 |
| **MA Surface Water Standard**** | | | 0.087 | 0.011 |

**Notes:**
All concentrations are dissolved mg/L
Lead and silver were not detected in surface water at any location
* concentrations shown are the higher of the sample and duplicate
** MA Surface Water Standard = EPA Ambient Water Quality Criteria based on average hardness




LEGEND

Site Location

Source: Scanned USGS topographic quadrangle dated 1987 supplied by Massachusetts Executive Office of Envrionmental Affairs, MassGIS.

500 0 500 1000 Feet

Scale 1:15840 Drawn: 05/28/2002

N

Site Coordinates:
x = 222002 m
y = 916312 m
MA State Plane NAD 83 Meters

FIGURE 1-1
SITE LOCATION MAP
LOCKHEED MARTIN CORPORATION
1 NETWORK DRIVE
BURLINGTON, MA

Shaw

P:\smallprojects\808170\Figure 1-1.lay


LEGEND

PORTION OF SITE ADDRESSED IN JANUARY 2002 PARTIAL–RAO WHICH APPLIES TO ALL MEDIA

PORTION OF SITE WHERE ROS WILL APPLY TO A WELL–DEFINED CHLORINATED VOC PLUME IN GROUNDWATER (SOIL ADDRESSED IN JANUARY 2002 PARTIAL–RAO)

PORTION OF SITE WHERE MARCH 2003 PARTIAL–RAO APPLIES TO SEDIMENT AND SURFACE WATER (SOIL AND GROUNDWATER ADDRESSED IN JANUARY 2002 PARTIAL–RAO)

PROPERTY BOUNDARY

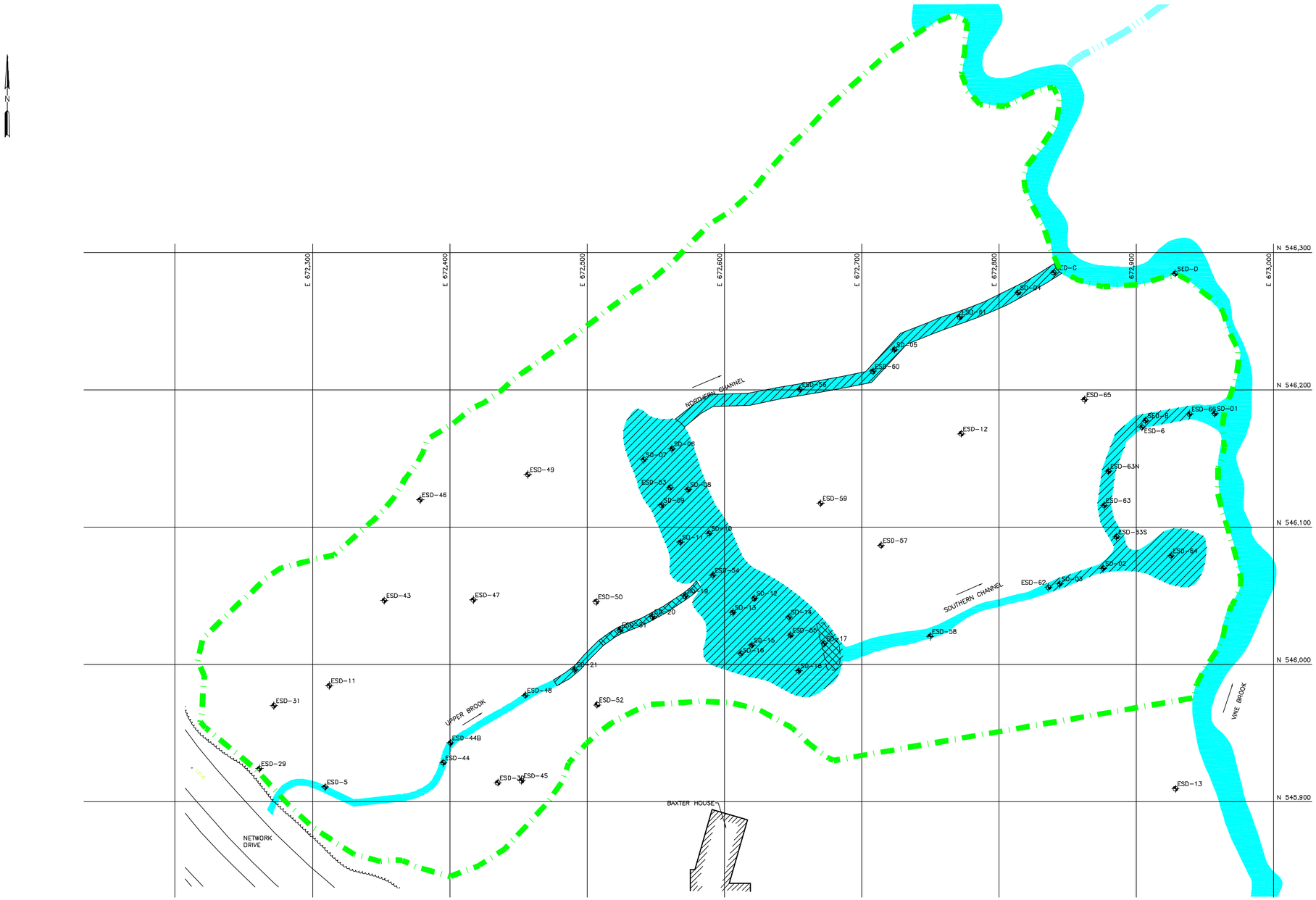
Shaw™
Shaw E & I, Inc.

DATE 1/31/03
DWN J.O'D.
APP
REV
PROJECT NO.
830835

**FIGURE 1-2**
LOCKHEED MARTIN CORP.
1 NETWORK DRIVE
BURLINGTON, MASSACHUSETTS
**SITE RAO MAP**

XREF Files: ANLMB-01 ANLMB-03 BLDG ANLMXR02 Animbd01 animxr01 animxr03 IMAGE Files:
File: N:\dwg\830835\11\fig 1-2\animf-01.dwg Layout: Site Features User: jodonnell Mar 10, 2003 – 2:00pm

1" 1/2" 0" 1"




LEGEND

SED-C SAMPLING LOCATION

AREA DREDGED TO A DEPTH OF ONE FOOT

AREA DREDGED TO A DEPTH GREATER THAN ONE FOOT

AREA NOT DREDGED

CENTRAL BROOK AND ASSOCIATED WETLANDS (AREA SUBJECT TO MARCH 2003 PARTIAL-RAO)

0 40 80
SCALE IN FEET

| REV | DATE | DESCRIPTION | DWN BY | DES BY | CHK BY | APP BY |
|---|---|---|---|---|---|---|
| | | | | | | |

DATE OF ISSUE 2/5/03
DWN BY J.O'D.
DES BY
CHK BY
APP BY

Shaw™
Shaw E & I, Inc.

LOCKHEED MARTIN CORP.
183 BEDFORD STREET
BURLINGTON, MASSACHUSETTS

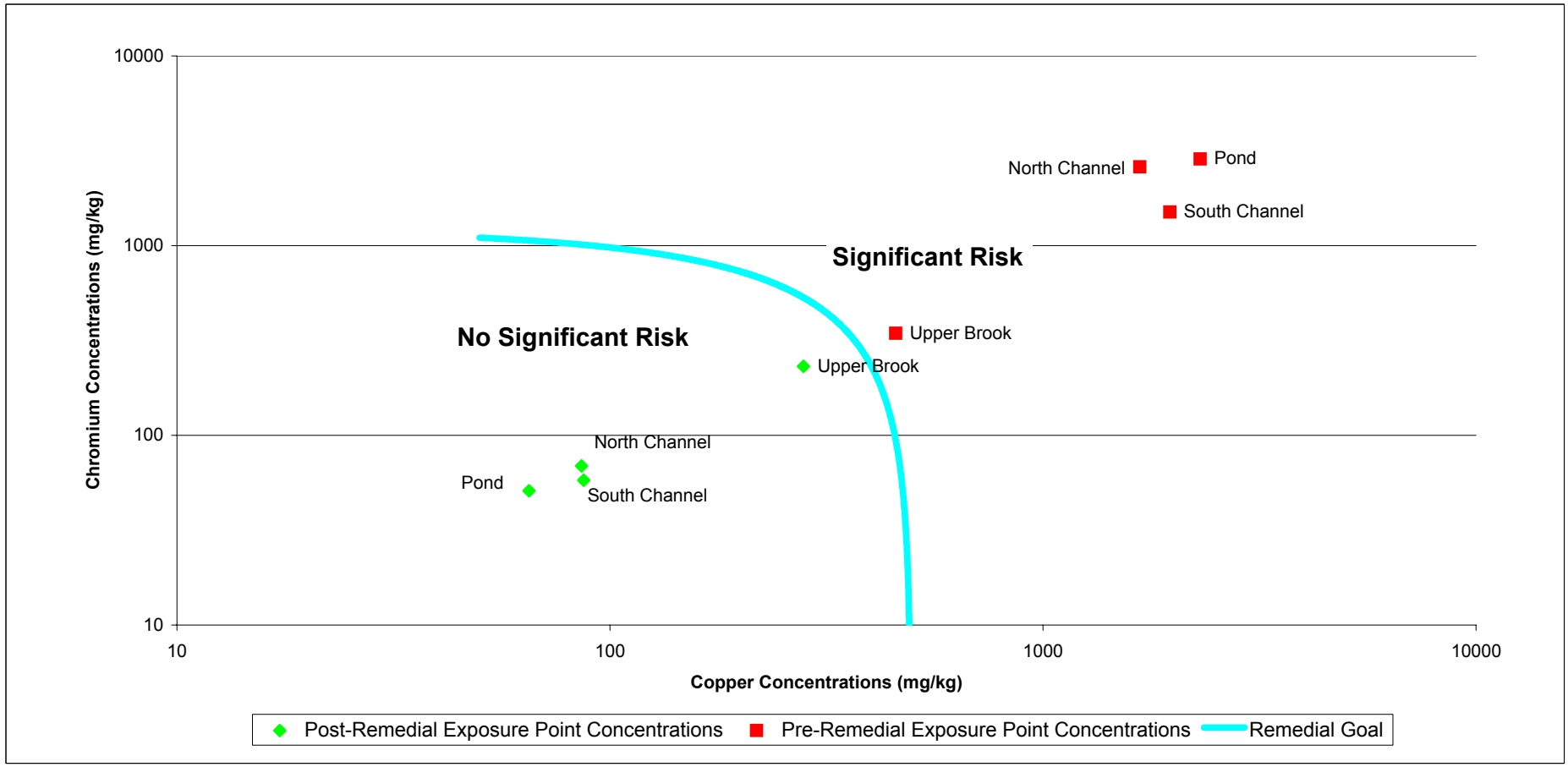
**PARTIAL RAO**
**SITE PLAN MAP**

FIGURE
**2-1**
PROJECT NO.
830835

1" 1/2" 0" 1"

XREF Files: pnlmb303 pnlmb-01 pnlmx01 pnlmx01 pnlmx01 pnlmx02 IMAGE Files:
File: N:\dwg\830835\11\pnlmap01.dwg Layout: RAO Users: jodonnell Mar 10, 2003 - 2:00pm

**Figure 4-1**
**Comparison of Central Brook Sediment Exposure Point Concentrations to Remedial Goals**
**Partial RAO - Central Brook Area**
**Former RCA Facility**
**Burlington, MA**



**Massachusetts Department of Environmental Protection** **BWSC-104**

*Bureau of Waste Site Cleanup*

# RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart I)

Release Tracking Number: 3 - 265

## A. SITE OR DOWNGRADIENT PROPERTY LOCATION:

Site Name: (optional) Former RCA Facility

Street: 183 Bedford Street Location Aid:

City/Town: Burlington ZIP Code: 01803-0000

☑ Check here if this Site location is Tier Classified. If a Tier I Permit has been issued, state the Permit Number: 102258

Related Release Tracking Numbers that this Form Addresses:

**If submitting an RAO Statement, you must document the location of the Site or the location and boundaries of the Disposal Site subject to this Statement. If submitting an RAO Statement for a PORTION of a Disposal Site, you must document the location and boundaries for both the portion subject to this submittal and, to the extent defined, the entire Disposal Site. If submitting a Downgradient Property Status Submittal, you must provide a site plan of the property subject to the submittal and, to the extent defined, the Disposal Site.**

## B. THIS FORM IS BEING USED TO: (check all that apply)

☑ Submit a **Response Action Outcome (RAO) Statement** (complete Sections A, B, C, D, E, F, H, I, J and L).

☐ Check here if this is a revised RAO Statement. Date of Prior Submittal:

☑ Check here if any Response Actions remain to be taken to address conditions associated with any of the Releases whose Release Tracking Numbers are listed above. This RAO Statement will record only an RAO-Partial Statement for those Release Tracking Numbers.

Specify Affected Release Tracking Numbers:

☐ Submit an optional **Phase I Completion Statement supporting an RAO Statement or Downgradient Property Status Submittal** (complete Sections A, B, H, I, J, and L).

☐ Submit a **Downgradient Property Status Submittal** (complete Sections A, B, G, H, I, J and K).

☐ Check here if this is a revised Downgradient Property Status Submittal. Date of Prior Submittal

☐ Submit a **Termination of a Downgradient Property Status Submittal** (complete Sections A, B, I, J and L).

☐ Submit a **Periodic Review Opinion evaluating the status of a Temporary Solution** (complete Sections A, B, H, I, J and L).

Specify one: ☐ For a Class C RAO ☐ For a Waiver Completion Statement indicating a Temporary Solution

Provide Submittal Date of RAO Statement or Waiver Completion Statement

**You must attach all supporting documentation required for each use of form indicated, including copies of any Legal Notices and Notices to Public Officials required by 310 CMR 40.1400.**

## C. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply)

☐ Assessment and/or Monitoring Only

☑ Removal of Contaminated Soils

- ☐ Re-use, Recycling or Treatment
  - ○ On Site ○ Off Site Est. Vol.: cubic yards
  - Describe:
- ☑ Landfill ○ Cover ◉ Disposal Est. Vol.: 491 tons cubic yards

☐ Removal of Drums, Tanks or Containers

Describe:

☑ Removal of Other Contaminated Media

Specify Type and Volume: Debris/Soil/Sediment, 83 tons

☐ Other Response Actions

Describe:

☐ Deployment of Absorbant or Containment Materials

☐ Temporary Covers or Caps

☐ Bioremediation

☐ Soil Vapor Extraction

☐ Structure Venting System

☐ Product or NAPL Recovery

☐ Groundwater Treatment Systems

☐ Air Sparging

☐ Temporary Water Supplies

☐ Temporary Evacuation or Relocation of Residents

☐ Fencing and Sign Posting

**SECTION C IS CONTINUED ON THE NEXT PAGE.**

# RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart I)

Release Tracking Number: 3 - 265

## C. DESCRIPTION OF RESPONSE ACTIONS: (continued)

☐ Check here if any Response Action(s) that serve as the basis for this RAO Statement involve the use of Innovative Technologies. (DEP is interested in using this information to create an Innovative Technologies Clearinghouse.)

Describe Technologies: _____

## D. TRANSPORT OF REMEDIATION WASTE: (if Remediation Waste was sent to an off-site facility, answer the following questions)

Name of Facility: Turnkey Recycling & Environmental Enterprise

Town and State: Rochester, New Hampshire

Quantity of Remediation Waste Transported to Date: 574 tons

## E. RESPONSE ACTION OUTCOME CLASS:

Specify the Class of Response Action Outcome that applies to the Site or Disposal Site. Select **ONLY** one Class:

☐ **Class A-1 RAO**: Specify one of the following:

◯ Contamination has been reduced to background levels. ◯ A Threat of Release has been eliminated.

☑ **Class A-2 RAO**: You **MUST** provide justification that reducing contamination to background levels is infeasible.

☐ **Class A-3 RAO**: You **MUST** provide both an implemented Activity and Use Limitation (AUL) and justification that reducing contamination to background levels is infeasible.

If applicable, provide the earlier of the AUL expiration date or date the design life of the remedy will end: _____

☐ **Class B-1 RAO**: Specify one of the following:

◯ Contamination is consistent with background levels ◯ Contamination is **NOT** consistent with background levels.

☐ **Class B-2 RAO**: You **MUST** provide an implemented AUL.

If applicable, provide the AUL expiration date : _____

☐ **Class C RAO**: ☐ Check here if you will conduct post-RAO Operation, Maintenance and Monitoring at the Site.

Specify One: ◯ Passive Operation and Maintenance ◯ Monitoring Only

◯ Active Operation and Maintenance (defined at 310 CMR 40.0006)

## F. RESPONSE ACTION OUTCOME INFORMATION:

☐ If an RAO Compliance Fee is required, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment.

☐ Check here if submitting one or more AULs. You must attach an AUL Transmittal Form (BWSC-113) and a copy of each implemented AUL related to this RAO Statement. Specify the type of AUL(s) below: (required for all Class A-3 RAOs and Class B-2 RAOs)

◯ Notice of Activity and Use Limitation ◯ Grant of Environmental Restriction Number of AULs attached: _____

Specify the Risk Characterization Method(s) used to achieve the RAO described above and all Soil and Groundwater Categories applicable to the Site.

**More than one Soil Category and more than one Groundwater Category may apply at a Site.**
**Be sure to check off all APPLICABLE categories, even if more stringent soil and groundwater standards were met.**

| | | | |
|---|---|---|---|
| Risk Characterization Method(s) Used: | ☐ Method 1 | ☑ Method 2 | ☑ Method 3 |
| Soil Category(ies) Applicable: | ☐ S-1 | ☑ S-2 | ☑ S-3 |
| Groundwater Category(ies) Applicable: | ☐ GW-1 | ☑ GW-2 | ☑ GW-3 |

**> When submitting any Class A-1 RAO or a Class B-1 RAO where contamination is consistent with background levels, do NOT specify a Risk Characterization Method.**

**> When submitting any Class A-2 RAO or a Class B-1 RAO where contamination is NOT consistent with background levels, you cannot use an AUL to maintain a level of no significant risk. Therefore, you must meet S-1 Soil Standards, if using Risk Characterization Method 1.**

**Massachusetts Department of Environmental Protection** **BWSC-104**

*Bureau of Waste Site Cleanup*

**RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM**

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart I)

Release Tracking Number

3 - 265

**G. DOWNGRADIENT PROPERTY STATUS SUBMITTAL:**

☐ If a Downgradient Property Status Submittal Compliance Fee is required, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment.

☐ Check here if a Release(s) of Oil or Hazardous Material(s), other than that which is the subject of this submittal, has occurred at this property.

Release Tracking Number(s) _____

◯ Check here if the Releases identified above require further Response Actions pursuant to 310 CMR 40.0000.

**Required documentation for a Downgradient Property Status Submittal includes, but is not limited to, copies of notices provided to owners and operators of both upgradient and downgradient abutting properties and of any known or suspected source properties.**

**H. LSP OPINION:**

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and (iii) the provisions of 309 CMR 4.03(5), to the best of my knowledge, information and belief,

> *if Section B indicates that a **Downgradient Property Status Submittal** is being provided,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in 310 CMR 40.0183(2)(b), and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B indicates that either an **RAO Statement, Phase I Completion Statement and/or Periodic Review Opinion** is being provided,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

☑ Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

LSP Name: Olaf Westphalen LSP #: 9982 Stamp:

Telephone: 978-691-2136 Ext.: _____

FAX: (optional) 978-975-2065

Signature: _____

Date: _____

**I. PERSON MAKING SUBMITTAL:**

Name of Organization: Lockheed Martin Corporation

Name of Contact: Ronald N. Helgerson Title: Senior Project Manager, EES&H

Street: 6801 Rockledge Drive DM315

City/Town: Bethesda State: MD ZIP Code: 20817-0000

Telephone: 301-214-9958 Ext.: _____ FAX: (optional) 301-214-9502

**J. RELATIONSHIP TO SITE OF PERSON MAKING SUBMITTAL:** (check one)

☑ RP or PRP Specify: ◯ Owner ◯ Operator ◯ Generator ◯ Transporter Other RP or PRP: Former owner/operator

☐ Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ Any Other Person Submitting This Form Specify Relationship: _____

## RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart I)

Release Tracking Number: 3 - 265

### K. CERTIFICATION OF PERSON SUBMITTING DOWNGRADIENT PROPERTY STATUS SUBMITTAL:

I, _____ , attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form; (ii) that, based on my inquiry of the/those individual(s) immediately responsible for obtaining the information, the material information contained herein is, to the best of my knowledge, information and belief, true, accurate and complete; (iii) that, to the best of my knowledge, information and belief, I/the person(s) or entity(ies) on whose behalf this submittal is made satisfy(ies) the criteria in 310 CMR 40.0183(2); (iv) that I/the person(s) or entity(ies) on whose behalf this submittal is made have provided notice in accordance with 310 CMR 40.0183(5); and (v) that I am duly authorized to make this attestation on behalf of the person(s) or entity(ies) legally responsible for this submittal. I/the person(s) or entity(ies) on whose behalf this submittal is made is/are aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: _____ Title: _____
(signature)

For: _____ Date: _____
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

### L. CERTIFICATION OF PERSON MAKING SUBMITTAL:

**If you are completing only a Downgradient Property Status Submittal, you do not need to complete this section of the form.**

I, Ronald N. Helgerson , attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: _____ Title: _____
(signature)

For: Lockheed Martin Corporation Date: _____
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

**YOU MUST COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE, AND YOU MAY INCUR ADDITIONAL COMPLIANCE FEES**

# ATTACHMENT TO SECTION H

## COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM

MCP Response actions at the 1 Network Drive (formerly 183 Bedford Street) site in Burlington, Massachusetts are being conducted under a Tier IB permit. This permit (No. 102258) was approved by the Department of Environmental Protection (DEP) on December 11, 1995. The permit authorized Martin Marietta Technologies, Inc. to perform comprehensive remedial response actions at the site. In a minor permit modification approved by DEP on September 5, 1996, the permittee name was formally changed to Lockheed Martin Corporation, and the Licensed Site Professional (LSP)-of-Record was changed to Donald W. Podsen of EMCON. In a minor permit modification submitted to DEP on May 12, 2000, the LSP-of Record was changed to Olaf Westphalen of IT Corporation (currently Shaw Environmental, Inc.). A Tier IB permit extension application was approved by DEP in March 2000; the current permit expires March 7, 2003. A second Tier IB permit extension application was submitted to DEP on January 30, 2002.

Note that a permanent solution was achieved over most of the site as documented in the partial-RAO submitted January 22, 2002. The partial-RAO did not include two areas: 1) Central Brook and associated wetlands, and 2) a well-defined chlorinated VOC plume. A Remedy Operation Status Statement is being filed concurrently for the well-defined chlorinated VOC plume where additional Phase V activities (monitored natural attenuation) are still warranted to reach a permanent solution. This partial RAO specifically addresses sediments and surface water in the Central Brook and associated wetlands area.